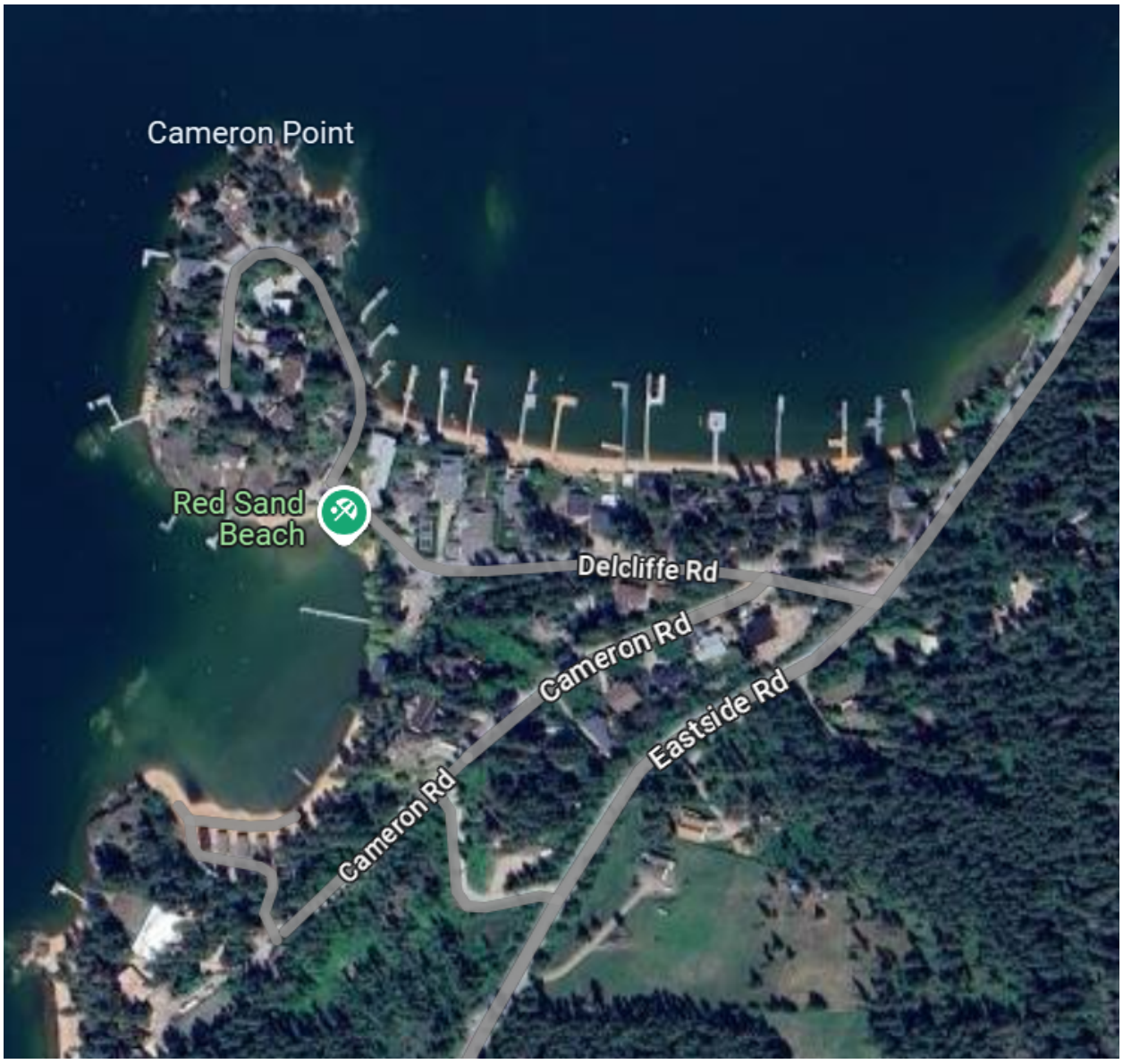
Delcliffe Water Utility
2024 Annual Report



Regional District of North Okanagan
9848 Aberdeen Road
Coldstream, BC V1B 2K9

Prepared for: Interior Health & RDNO
Prepared by: RDNO Utility Department
April 2025

1.0 INTRODUCTION 1
2.0 WATER SYSTEM OVERVIEW 1
2.1. SYSTEM OVERVIEW 1
2.2. WATER SOURCE 3
2.3. TREATMENT REQUIREMENTS 3
3.0 OPERATIONS 4
3.1. MANAGEMENT 4
3.2. EOCP CLASSIFICATION 4
3.3. OPERATIONS PROGRAMS 4
3.3.1. FLUSHING AND STANDPIPE MAINTENANCE 4
3.3.2. CROSS CONNECTION CONTROL PROGRAM 4
3.3.3. SYSTEM CONTROL - SCADA SOFTWARE 5
4.0 SOURCE ASSESSMENT AND WATERSHED PROTECTION PLANNING 5
5.0 WATER QUALITY MONITORING 5
5.1. PROGRAM AND SCHEDULE 5
5.2. SOURCE WATER QUALITY MONITORING 6
5.2.1. BACTERIA 6
5.2.2. TURBIDITY 7
5.2.3. ULTRA-VIOLET TRANSMISSIVITY 7
5.2.4. TOTAL ORGANIC CARBON 8
5.2.5. ALGAE DENSITY 8
5.2.6. FIELD PARAMETERS 9
5.2.7. ANNUAL COMPREHENSIVE 9

5.3. TREATMENT PROCESS 9

5.3.1. CHLORINE 9

5.4. DISTRIBUTION 10

5.4.1. BACTERIA 10

5.4.2. TURBIDITY 10

5.4.3. CHLORINE 11

5.4.4. OTHER FIELD PARAMETERS 11

6.0 WATER CONSUMPTION 11

7.0 EMERGENCY RESPONSE PLANNING 12

7.1. THE EMERGENCY RESPONSE PLAN 12

7.2. INCIDENTS AND NOTIFICATIONS 13

8.0 REPORTING REQUIREMENTS 14

9.0 WORKS COMPLETED 14

10.0 PLANNED WORKS 14

11.0 CLOSING 15

TABLES

Table 1 RDNO Utilities Department....16
Table 2: RDNO Water Operators EOCP Certifications....17
Table 3: CoV Water Operators EOCP Certifications....17
Table 4 2024 Source Water Bacterial Summary....18
Table 5 2024 Source Water – SCADA Turbidity Daily Average Summary....19
Table 6 2024 Source Water Field Parameters and RDNO Lab Results....19
Table 7 2024 Source Water - Total and Dissolved Organic Carbon Summary....19
Table 8 2024 Treated Water – SCADA Chlorine Daily Average Summary....20
Table 9 2024 Distribution Water Bacterial Summary....20
Table 10 2024 Distribution Water - Field Parameter Summary....20
Table 11 Monthly Water Consumption....21
Table 12 2024 Incident Summary....21

FIGURES

Figure 1 2024 Source Water E.Coil Resuls....23
Figure 2 2024 Source Water Total Coliforms Results....23
Figure 3 Historical Source Water - SCADA Daily Average Turbidity (2018-2024)....24
Figure 4 2024 Source Water - SCADA Turbidity Daily Average....24
Figure 5 Historical Source Water - UVT Filtered and Unfiltered....25
Figure 6 2024 Source Wate - UVT Unfiltered....25
Figure 7 2024 Source Water – SCADA Turbidity Daily Average vs UVT Unfiltered....26
Figure 8 Historical Source Water - Total Organic Carbon (2018-2024)....27
Figure 9 2024 Source Water - Total Organic Carbon....27
Figure 10 Historical Water Consumption - Daily Average Consumption between 2018-2023 vs 2024 Daily Consumption....28
Figure 11 Historical Water Consumption - Daily Consumption (2018 - 2024)....28
Figure 12 Photo of new reservoir liner....29
Figure 13 Photos of replumbed lake station (left before photo and right after photo)....29

APPENDICES

Appendix A Water System Map

Appendix B Operating Permit

Appendix C 2024 Sampling Program and Schedules

Appendix D 2024 Source Water Comprehensive Analysis

ACRONYMS

AO	Aesthetic Objectives
BWN	Boil Water Notice
CARO	CARO Analytical Services
CCCO	Cross Connection Control Officer
CCCP	Cross Connection Control Program
CFU	Colony Forming Units
COP	Conditions on Permit
CoV	City of Vernon
CT	Contact Time
DBP	Disinfection By-Products
DOC	Dissolved Organic Carbon
DRP	Deviation Response Plan
DTRT	Decision Tree for Responding to Turbidity Event in Unfiltered Drinking Water
DWPA	*Drinking Water Protection Act*
DWPR	*Drinking Water Protection Regulation*
DWO	Drinking Water Officer
DWU	Delcliffe Water Utility
DWTO	Drinking Water Treatment Objectives (Microbiologial) for Surface Water Supplies
E.coli	Escherichia coli
ENKI	Internet based data software system with centralized information management
EOCP	Environmental Operators Certification Program
ERP	Emergency Response Plan
GCDWQ	Guidelines for Canadian Drinking Water Quality
GVW	Greater Vernon Water
HAA	Haloacetic Acids
IHA	Interior Health Authority
MAC	Maximum Acceptable Concentrations
MoE	Ministry of Environment
MPN	Most Probable Number
NTU	Nephelometric Turbidity Units
OBWB	Okanagan Basin Water Board
OCCP	Okanagan Collaborative Conservation Program
OP	Operating Permit

PS	Pump Station
RDL	Read Detection Limit
RDNO	Regional District of North Okanagan
RDNO Lab	Regional District of North Okanagan Laboratory
SCADA	Supervisory Control and Data Acquisition software
SS	Sample Station
SDWQG	Source Drinking Water Quality Guidelines
THAA	Total Haloacetic Acids
THM	Trihalomethane
TTHM	Total Trihalomethane
TOC	Total Organic Carbon
UVT	Ultra-violet Transmissivity
VOC	Volatile Organic Compounds
WQA	Water Quality Advisory
WQG-01	British Columbia Source Drinking Water Quality Guidelines
WQI	Water Quality Indicators

1.0 INTRODUCTION

As required by the *Drinking Water Protection Act* (DWPA) *of BC*, the Regional District of North Okanagan (RDNO) provides the following annual report in accordance with the Conditions on Permit (COP) issued by Interior Health Authority (IHA) for the Delcliffe Water Utility (DWU).

This report provides an overview of the following:

- the DWU water system,
- the operations of the water utility including the management, Environmental Operator Certification Program (EOCP) classification, and operations programs,
- source assessment and watershed protection,
- the annual water quality monitoring program and a summary of water quality analysis,
- water consumption,
- emergency response,
- reporting requirements,
- annual completed works, and
- long-term plans.

The annual report is available to the public on the RDNO website.

2.0 WATER SYSTEM OVERVIEW

2.1. SYSTEM OVERVIEW

The DWU system is located within the Greater Vernon Water (GVW) service area however it is a self-contained water system separated from the GVW system and is classified as a small water system in its Permit to Operate, facility #0411809. The water quality monitoring program is coordinated and maintained by RDNO water quality staff. The system supplies water to 32 residential connections around Delcliffe Road and Cameron Road in Vernon, BC. Appendix A provides the water service boundary and properties serviced by DWU. RDNO manages the supply and treatment system and are required to respond to emergencies 24 hours a day, 7 days a week. RDNO contracts out to the City of Vernon (CoV) operators to operate and maintain the DWU water distribution system.

The source water of DWU is Okanagan Lake. The Delcliffe distribution system has 1.2 km of pipeline, 1 lake pump station, 1 reservoir booster station and 1 enclosed reservoir.. There is 1

pressure zone at an elevation 370 meters (1214 feet) above sea level controlled by the reservoir booster pump station.

The DWU system is comprised of the following:

- Lake Intake
    - Has a fisheries approved screen located approximately 160 m offshore.
    - Pipe is 100 mm combination of PVC and irrigation grade HDPE pipe.
    - Depth ranges from 3.4 m to 6.4 m depending on lake level.
- Lake Pump Station
    - Buried concrete chamber with two 7.5 HP pumps connected in parallel for redundancy.
    - Pumps water 28 meters from the intake in Okanagan Lake to the reservoir.
- Reservoir
    - Reservoir is in-ground and located at the end of Cameron Road.
    - Material is a concrete tank lined with a liner and
    - Covered with a wood truss roof, aluminum sheeting, wood siding, and rodent resistant screening.
    - Reservoir level is monitored by a pressure sensor connected to a low-level alarm located at the lake pump station.
- Reservoir Booser Pump Station
    - Is a wood frame and concrete building located near the reservoir at the end of Cameron Road.
    - Has 2 – 5 Hp booster pumps connected in parallel for redundancy
    - The pumps boost the water pressure from the reservoir into the distribution system.
    - The pumps are set to maintain a system pressure of about 45 psi to the highest customer right next to the reservoir.
    - The electrical controls and panel and chlorination equipment are located within the building.
    - Building is heated, vented and secured against rodents.
- System Piping
    - Main pipe (supply line) material from the lake pump station to the reservoir booster pump station is 150 mm C900 PVC.
    - Distribution pipe material type throughout the system is unknown.

2.2. WATER SOURCE

DWU draws water from Okanagan Lake through the intake located 160 meters from shore at an approximate depth of between 3.4 and 6.4 meters (due to lake level fluctuations). The intake was upgraded in 2012 with two stainless steel screens to meet the provincial requirements for fish and was raised off the bottom of the lake by 1 meter to improve water quality.

2.3. TREATMENT REQUIREMENTS

The treated water quality objectives for all BC water systems using a surface water source need to meet the Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies (DWTO) in BC which include the following:

- 4-log removal or inactivation for viruses,
- 3-log removal or inactivation for protozoa (*Giardia* and *Cryptosporidium*),
- 2 treatment processes for surface water,
- 1 Nephelometric turbidity units (NTU) maximum turbidity, and
- 0 *Escherichia coli* (*E.coli*).

Currently DWU source water is treated with only chlorination at the booster station. Chlorination of the water is completed to ensure sufficient contact time (CT) to provide 4 log inactivation of viruses, to meet the 0 *E.coli* condition, and to inhibit microbial growth in the distribution system by achieving a minimum of 0.2 mg/L free chlorine throughout the system.

Currently, DWU does not meet the 3-log removal/inactivation for protozoa nor have 2 treatment processes and is therefore not compliant with these DWTP standards.

Various options have been explored to bring DWU up to standards, but funding constraints have prevented their implementation. The long-term goal is to connect DWU to either the GVW system or the Outback water system as development progresses in the area.

Turbidity is continuously measured with online turbidity using Supervisory Control and Data Acquisition software (SCADA). A comparison with a hand-held turbidity meter is completed weekly at the site to ensure the SCADA monitored meter is reading correctly. If turbidity increases above 1 NTU based on a 24-hour average, a Water Quality Advisory (WQA) will be issued.

See Table 1 for the water quality objectives established for DWU, as well as an assessment of weather each objective was achieved.

3.0 OPERATIONS

3.1. MANAGEMENT

The DWU is a function and owned by the RDNO and managed by the RDNO Utilities department (Table 2). Operations and maintenance of the water supply and water treatment is completed by EOCP certified RDNO operators (Table 3). The distribution system is contracted under an agreement with CoV to operate and maintain the water distribution system (Table 4). The water quality monitoring program is coordinated and monitored by the water quality staff of the RDNO.

IHA is the regulator of water utilities and is responsible for ensuring compliance with legislation and Provincial standards. IHA issues the Operating Permit (OP) (Appendix B) and associated COP. The IHA representative is a Drinking Water Officer (DWO) who works closely with the water utility to ensure the COP are met.

3.2. EOCP CLASSIFICATION

Section 12 of the *Drinking Water Protection Regulations* (DWPR) refers to qualification standards for persons operating water supply systems. In this section, the operators of a water system are required to have EOCP certification. With this certification, a person is qualified to operate, maintain, or repair a water supply system for the classification stated under the EOCP.

Operators with EOCP certification and employed by the RDNO and CoV can be found in Tables 3 and 4. The RDNO operators are responsible for operating and maintaining the source, reservoir and chlorination facility. The CoV operators are contracted by the RDNO to operate and maintain the DWU water distribution system and any after hours issues with the distribution system, such as leaks, customers should call the CoV after hours number.

3.3. OPERATIONS PROGRAMS

3.3.1. FLUSHING AND STANDPIPE MAINTENANCE

Annual water main flushing and standpipe maintenance are completed by CoV operators.

3.3.2. CROSS CONNECTION CONTROL PROGRAM

The RDNO has a Cross Connection Control Program (CCCP) for all water utilities owned by RDNO, including DWU. The Cross Connection Control Program is managed by the Utilities

Department as outlined in the RDNO *Cross Connection Control Regulation Bylaw No. 2651, 2014* available at: www.rdno.ca/ccc. As all connections are residential, they are considered low risk.

3.3.3. SYSTEM CONTROL - SCADA SOFTWARE

The operation, maintenance, monitoring of reservoir water levels, operating pumps, monitoring quality control equipment and maintaining a historical data file of the water systems operations is made easier by SCADA, a comprehensive monitoring software program used by RDNO. Connected by wireless links, the automated SCADA software monitors sensors at all RDNO owned reservoirs and pump stations. When a problem is detected within the system, the SCADA system issues alarms and RDNO operators respond.

4.0 SOURCE ASSESSMENT AND WATERSHED PROTECTION PLANNING

Currently, the immediate watershed area surrounding DWU is minimally developed. With respect to activities on Okanagan Lake. RDNO participates in the Okanagan Collaborative Conservation Program (OCCP) projects around Okanagan Lake and the Okanagan Basin Water Board (OBWB).

5.0 WATER QUALITY MONITORING

The goal of the water quality program is to monitor the quality of the source water and treated water within the distribution system to detect the presence of microorganisms and monitor the water for anything that can degrade drinking water quality. As issues are found, operations and staff can respond to correct any issues or appropriately notify customers as required.

5.1. PROGRAM AND SCHEDULE

The Water Quality Program is based on the requirements of the following legislation, regulations and guidelines:

- Guidelines for Canadian Drinking Water Quality (GCDWQ),
- *British Columbia Drinking Water Protection Act (*DWPA),
- *British Columbia Regulation* (DWPR),
    - *Schedules A and B*
- British Columbia Source Drinking Water Quality Guidelines (WQG-01),

- Drinking Water Treatment Objectives (microbiological) for Surface Water in BC (DWTO), (BC. MOH, 2012) and
- Decision Tree for Responding to Turbidity Event in Unfiltered Drinking Water (DTRT), (BC Ministry of Health, 2013).

The program is reviewed and updated annually in the fall for implementation of the following year. The sampling program and schedules are provided in Appendix D. RDNO provides the Water Quality Monitoring Program (WQ Program) to IHA at the beginning of each year after the program is developed. Included in the WQ Program submitted is the monitoring schedule, parameters, and frequency of samples taken at different times of the year.

To meet Schedule B in the DWPR for populations less than 5,000, a minimum of 4 distribution microbiological samples are required per month. In 2024, DWU met this requirement by taking one sample weekly. The sample is dropped off at the RDNO Laboratory and water quality staff process for shipment to CARO Analytical Services (CARO), where samples are analyzed, the results go to IHA and RDNO.

5.2. SOURCE WATER QUALITY MONITORING

This section outlines the bacterial, turbidity, ultra-violet transmissivity (UVT), pH, temperature, and annual comprehensive results for source water at DWU.

5.2.1. BACTERIA

The DWTO states source water must meet the following:

- the number of *E.coli* in source water does not exceed 20/100 mL, or
- if *E.coli* data are not available (less than 100/100 mL of TC) in at least 90% of the weekly samples from the previous six (6) months.

In 2024, DWU met the requirements for E. coli and Total Coliform in source water (Tables 1 and 5, and Figures 1 and 2).

RDNO submits monthly reports to IHA, summarizing bacterial results which are available on the RDNO website: https://www.rdno.ca/dwu/waterquality.

5.2.2. TURBIDITY

Turbidity measurements relate to the optical properties of water. Turbidity is caused by suspended matter such as clay, silt, finely divided organic and inorganic matter, soluble coloured organic compounds, plankton, and other microscopic organisms. Excessively high turbidity can have a negative effect on disinfection techniques. A provincial guidance document issued in April 2013, *the Decision Tree for Responding to a Turbidity Event in Unfiltered Drinking Water (DTRT)* (BC Ministry of Health, 2013) assists RDNO during turbidity events and communication with the water customers.

Turbidity at DWU intake has historically been below 1 NTU during most of the year except during freshet, as seen in Figure 3. If turbidity is >1 NTU, the utility issues a WQA. If the turbidity increases >5 NTU the utility issues a Boil Water Notice (BWN).

See Table 6 and Figure 4 for the 2024 DWU source water SCADA daily average turbidity results. In 2024, turbidity SCADA daily averages of the source water never exceeded 1 NTU.

Monthly water quality reports and the GVW Water Quality Deviation Response Plan, provide further details regarding turbidity events and/or trigger levels for response and notification. When turbidity trends above 1 NTU on a 24-hour average, a Water Quality Advisory (WQA) is issued.

5.2.3. ULTRA-VIOLET TRANSMISSIVITY

RDNO water quality staff monitor UVT throughout the year. The samples are taken monthly and analysed at the RDNO Lab. See Appendix D for the UVT sampling schedule. UVT represents the percentage of light transmitted through the water. The purpose of this monitoring is for future planning to determine if UV disinfection is a viable option to install on-site. Table 7 summarizes the source water UVT unfiltered results for 2024. The sample for UVT filtered is taken during the comprehensive testing annually.

When observing historic UVT since 2014, no trend was evident (Figure 5).

The UVT is measured using Standard Methods 10054 as an unfiltered sample (staff analyze unfiltered UVT in-house). UVT unfiltered results ranged from 84.6% to 86.7%, with an average of 85.7% (Table 7 and Figure 6), meaning UV would be an effective disinfection method for this source.

The UVT was plotted graphically with turbidity (Figure 7) which demonstrates the relationship between turbidity and UVT. Like previous years, the turbidity in 2024 increases during freshet and remains slightly elevated until the end of July while UVT drops during that same time period and increases again after freshet. This demonstrates that the type of turbidity at the indicate could potentially impact the efficiency of secondary UVT disinfection if used directly on the source water without including filtration.

5.2.4. TOTAL ORGANIC CARBON

Total Organic Carbon (TOC) is a measure of suspended carbon bound in organic molecules and organisms and Dissolved Organic Carbon (DOC) refers to organic matter that is able to pass through a filter which removed material between 0.70 and 0.22 mm in size. The SDWQG MAC for TOC is 4.0 mg/L. There are no current health standards/guidelines for DOC but RDNO monitors to assess if there are changes which may impact the formation of Disinfection By-Products (DBP) as higher levels of organic carbon increase the likelihood of DBP formation when there is no pretreatment to remove the carbon prior to chlorination of the water.

Since 2018 the DWU source water has a historical TOC range from 3.80 mg/L and 5.80 mg/L and an average of 4.60 mg/L (Figure 8). The historical average TOC for this site is above the SDWQG MAC of 4.0 mg/L.

The source water is sampled monthly for TOC. In 2024, the TOC results ranged from 3.90 mg/L to 5.18 mg/L with an average of 4.54 mg/L (Table 8). The TOC is likely higher than Outback as the intake is considered fairly shallow. When compared to historical TOC data, the 2024 results are normal for this site. Based on the sampling results, TOC is above the SDWQG MAC guideline (Figure 9). TOC will continue to be monitored at DWU as it is above the SDWQG MAC.

5.2.5. ALGAE DENSITY

Algae density is routinely monitored at the source monthly from May to November. This monitoring is important, as algae contribute to organic loading in the system and certain species can impact water quality by causing taste and odor concerns. Routine monitoring is done to detect algae blooms early, allowing for timely intervention, with public notification is triggered based on IHA requirements. In 2024, the algae density monitoring showed that the algae was low.

5.2.6. FIELD PARAMETERS

Field parameters are taken at each site sampled. The parameters reported are turbidity, pH, and temperature. Turbidity is discussed in section 5.2.2. The Canadian Drinking water guideline for source (GCDWQ) for pH and temperature are:

- Temperature - Aesthetic Objective (AO) 15°C
- pH - range of 7.0-10.5 to maximize treatment effectiveness.

Table 7 summarizes the field temperature and pH for the source water in 2024. Temperature results range from 5.2°C to 22.6°C and is strongly related to season air temperatures. There were four temperature readings above the AO. The four temperature readings above the AO were between June and September, with range of 17.6°C to 22.6°C. These exceedances are not a health concern.

pH results range from 6.9 to 8.0 with an average of 7.5, therefore within guidelines.

5.2.7. ANNUAL COMPREHENSIVE

Comprehensive sampling is completed annually in July or August each year. The 2024 comprehensive samples were taken on July 22nd and all parameters were well within the GCDWQ limits (Appendix E).

5.3. TREATMENT PROCESS

5.3.1. CHLORINE

Under normal operations, the target free residual after chlorine injection is normally between 1.50 to 2.00 mg/L to achieve the minimum target chlorine residual of 0.20 mg/L at the end of the distribution system.

Chlorine is injected at the reservoir booster station on the reservoir inlet line. Continuous online free chlorine monitoring is completed with an analyzer that is located off the sample line from the reservoir outlet to allow for sufficient contact time (CT) for virus reduction. In the event of a low-level chlorine alarm, the system is programed through SCADA to shut off the lake pumps automatically to ensure that source water is not pumped into the distribution system and to notify the operator via an alarm. An operator would respond to the alarm, assess the issue, analyze the cause, and implement the solution.

The average monthly SCADA free chlorine range was 1.15 mg/L to 3.05 mg/L with an average of 1.67 mg/L (Table 9).

5.4. DISTRIBUTION

Distribution sampling follows the specifications outlined in the COP and as directed by IHA, see Sections 2.3. Additional parameters and monitoring can occur for individual projects or during incidents. There are 2 sample sites within the distribution system: the Delcliffe Hill Pumpstation (PS) and Delcliffe Road Sample Station (SS). See Appendix D for the detailed schedule.

5.4.1. BACTERIA

The Guidelines for Canadian Drinking Water Quality and the *BC Drinking Water Protection Act Regulations* have established the following microbiological criteria for drinking water distribution systems. Schedule A of the DWPR requires the following criteria to be met for potable water:

1. **No detectable Escherichia coli (*E.coli*) per 100 mL.**

   In 2024, there were 53 samples analyzed using the CFU/100mL method and 31 samples analyzed using the MPN/100mL method. All samples were non-detect for *E.coli* in the DWU distribution system (Table 10).

2. **At least 90% of samples have no detectable Total Coliform bacteria per 100 ml.**

   In 2024, there were 53 samples analyzed using the CFU/100mL method and 31 samples analyzed using the MPN/100mL method. All samples were non-detect for Total Coliform in the DWU distribution system (Table 10) with 100% of samples being non detect for the year.

3. **No sample has more than 10 Total Coliform per 100 ml.**

   In 2024, there were no detectable Total Coliform in and of these samples therefore, DWU met this requirement (Table 10).

5.4.2. TURBIDITY

Turbidity is monitored with a handheld turbidity meter at two distribution sites based on the monitoring program schedule. Field parameters are recorded on the submitted requisition sheets and water quality staff enter the data into RDNO's internet-based database (ENKI).

In 2024, 102 turbidity grab samples were taken within the distribution system. The turbidity results ranged from 0.16 NTU to 0.89 NTU with an average of 0.52 NTU (Table 11).

5.4.3. CHLORINE

Total and free chlorine is monitored with a handheld chlorine meter concurrently with the turbidity readings.

In 2024, the free chlorine of the distribution sites ranged from 0.78 to 2.18 mg/L. The average distribution free chlorine for all sites (102 samples) was 1.65 mg/L (Table 11).

5.4.4. OTHER FIELD PARAMETERS

Along with turbidity and chlorine, other field parameters such as pH, temperature and conductivity are monitored with handheld meters which are recorded on a worksheet.

The pH readings of all distribution sites ranged from 7.21 to 8.21, with an average of 7.79 The conductivity readings of all distribution sites ranged from 296 µS/cm to 395 µS/cm, with an average of 327 µS/cm. The temperature readings of all distribution sites ranged from 4.2 °C to 24.6 °C with an average of 13.2^{o}C (Table 11). In 2024, 40 samples had a temperature greater than the GCDWQ AO of 15°C, which occurred between June through October. Water temperature is strongly related to season air temperatures, a factor beyond RDNO's control. It is important to note that this is an aesthetic objective and not a health guideline and as such does not affect the quality of the water.

6.0 WATER CONSUMPTION

Table 12 provides the monthly consumption in 2024 while Figure 10 provides a graph of the daily consumption and the previous years' daily average from 2018-2023. Figure 11 provides daily water consumption trend data from 2018 to 2024.

DWU's water consumption follows a consistent annual trend, remaining relatively low for most of the year. Usage begins to rise in April or May, reaching its peak in July and August. In September, the trend shifts as monthly flows start to decline, continuing a gradual decrease thereafter. Greater Vernon Water called a drought in 2024 which corresponds with the water us drop in May, although water use did rise through the summer season.

In 2024, the total consumption for 2024 was 28,880 m^3 with a monthly average of 2,407 m^3. Water use comparisons can be made based on the DWU servicing 32 houses and using an average of 2.5 person/household. The following results are in litres per day per person (L/d/p):

- Winter water use was approximately 741 L/d/p in 2024. This is considered to represent indoor domestic water use only. This water use is considered high for 2024, as statistics indicate that average Canadian water use is 223 L/d/p (Government of Canada, 2021).
- Peak water use in August was 1,517 L/d/p This is very high water use. For reference, Greater Vernon Water metered customer's average summer residential water use is 407 L/d/p.
- The average annual water use in 2024 was 1,003 L/d/p, which is considered high compared to Greater Vernon Water metered customer's which is 268 L/d/p. The water use for DWU is considered high compared to metered water utilities even with the outdoor water restrictions that were in effect in 2024.

7.0 EMERGENCY RESPONSE PLANNING

7.1. THE EMERGENCY RESPONSE PLAN

The Emergency Response Plan (ERP) is reviewed and updated annually. The ERP has the GVW Water Quality Deviation Response Plan (DRP) that provides guidelines to actions during times of water quality changes or emergencies. Sampling methodology and RDNO small utility ERP training for the operators also occurs annually.

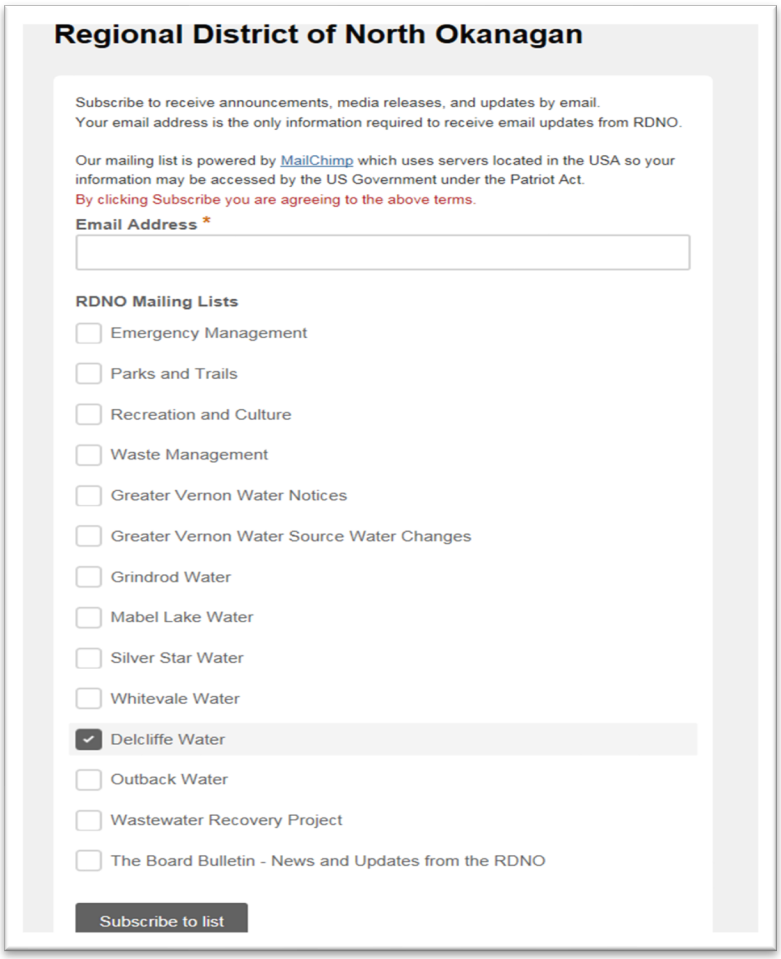
RDNO Utilities staff, as well as the operators are all instructed on how to use the following supporting documents in times of water quality changes or emergencies:

1. RDNO Emergency Response Plan
2. RDNO Water Quality Deviation Response Plan

The above documents contain the contacts, criteria, and procedures necessary to assist operators and staff to make timely, informed decisions.

GVW must inform customers when their drinking water does not meet standards with the appropriate notifications based on risk. A WQA is released when the water poses a modest health risk. A BWN is released when there is a known or higher risk of a possible health impact to the customer.

An advisory or notice is delivered as quickly and efficiently as possible. Notification may include WQA or BWN road signs, radio, email, and/or media releases. Under specific circumstances notification is hand-delivered. Customers are advised to subscribe to the Delcliffe Water Mailing List for advisories and updates by going to www.rdno.ca/subscribe (shown below):



7.2. INCIDENTS AND NOTIFICATIONS

The DWPA mandates public notification regarding monitoring results, information related to the water supply, potential hazards to drinking water, and instances where the system does not meet regulatory requirements.

RDNO Emergency Response Procedures require that incidents are reported. Incidents are defined when there is a deviation from normal operating procedure or there is a demonstrated water quality issue.

Public notifications are usually related to water infrastructure upgrades and are in localized areas where the work is occurring. These notifications are usually to make customers aware of planned work and advise them to store water for household use during the work. The notifications are usually hand delivered to the affected customers.

In 2024, there were two incidents. One was related to short term system changes due to an improvement project to line the reservoir that required 5 public notifications. Table 13 provides a summary of the incidents and notifications.

8.0 REPORTING REQUIREMENTS

Monthly and annual reports are submitted to IHA as per the COP and are available to the public on the RDNO website at (www.rdno.ca). Monthly reports for the last 12 months are available on the website and if historical reports are wanted, please contact the RDNO at 250-550-3700.

9.0 WORKS COMPLETED

Operational changes and improvement projects have been completed to increase the safety and reliability of the DWU system. Works in 2024 include:

- **New reservoir liner.** A flexible polypropylene membrane was anchored to the existing inground concrete reservoir and spray coated with a NSF 61 certified aromatic polyurea coating. See figure 12 for a photo of the new reservoir liner.
- **Replumbed lake station pumphouse** and switched to vertical stack pumps from end suction centrifugal pumps. See figure 13 for photos of the replumbed lake station (before and after photos).

10.0 PLANNED WORKS

Over the long term, improvements to the DWU are necessary, and multiple options are available. Each option presents both advantages and disadvantages. One possibility is maintaining the DWU as a stand-alone system while improving treatment and intake conditions. Alternatively, connecting the DWU to the larger GVW system could be considered. Both options involve significant costs and must be evaluated based on their individual merits, though external development pressures beyond GVW's control may influence decision-making. Currently, a definitive course for system improvements has not been established.

11.0 CLOSING

RDNO continues to make strides in fulfilling the RDNO program objectives, meeting Provincial Standards and requirements outlined by IHA, and in implementing BC's DWPA and DWPR at DWU. RDNO will continue to move forward on implementation of system improvements within the constraints of the DWU budget.

RDNO is pleased to present the 2024 DWU Annual Report. If you have any questions about this report or want more information, please contact RDNO at 250-550-3700 or email utilities@rdno.ca.

TABLES

Table 1 2024 Water Quality Objectives

Objective	Standard	Objective Met
Treatment - removal / inactivation for viruses	4-log reduction	✅ Yes
Treatment - protozoa Removal/Inactivation (Giardia & Cryptosporidium)	3-log reduction	❌ No
Treatment Processes for Surface Water	Minimum of 2 processes	❌ No
Treatment - Turbidity Limit	≤ 1 NTU (max)	✅ Yes
Treatment - E. coli Limit (Drinking Water)	0 detectable per 100 mL	✅ Yes
Treatment - Chlorine Residual	1.00–2.50 mg/L after injection	✅ Yes
Number of distribution samples for populations less than 5,000	4 distribution samples per month	✅ Yes
E. coli in Source Water	≤ 20 per 100 mL in at least 90% of weekly samples from previous 6 months	✅ Yes
Total Coliform in Source Water	≤ 100 per 100 mL in at least 90% of weekly samples from previous 6 months	✅ Yes
Total Organic Carbon (TOC) Limit	≤ 4.0 mg/L	❌ No (DWU normally exceeds this)
pH in Source Water	7.0–10.5	✅ Yes
Escherichia coli (E.coli) in distribution	No detectable Escherichia coli (E.coli) per 100 mL	✅ Yes
Total Coliform in distribution	At least 90% of samples have no detectable Total Coliform bacteria per 100 mL	✅ Yes
Total Coliform per sample	no sample has more than 10 total coliform per 10 mL	✅ Yes
pH in distribution	7.0–10.5	✅ Yes

Table 2 RDNO Utilities Department

RDNO Utilities	
Zee Marcolin, P.Eng	General Manager, Utilities
John Lord, P.Eng	Manager, Water Distribution
Tricia Brett, MSc., PAg	Manager, Water Quality
Connie Hewitt, AScT	Water Quality Technologist
Jamie Ferris	Water Quality Technician
Chris Cannon	Water Quality Technician
Kimberly Berndt	Engineering Technician
Mike Philips, AScT	Engineering Technologist / Bylaw Officer
Skyler Ganz, AScT	Engineering Technologist
Alec Busby, EIT	Assistant Utilities Engineer
Keiko Parker, AScT	Manager, Small Utilities
Sandy Edwards, AScT	Manager, Projects
Jonathn McLuskie	Utilities Quality Assurance Inspector

Table 3: RDNO Water Operators EOCP Certifications

RDNO Operators			
Last Name	**First Name**	**Certification #**	**Certification Held**
Heidt	Dustin	4498	WDIII, WTIV
Hartwig	Corey	9378	WTI
Mykytuk	Becky	9086	WTIII
Beckett	Jemma	1001610	WTI
Cimon	Caroline	1001075	WTII
Lockwood	Ryan	1000755	WDI, WTII
Tucker	Chris	6489	WTIV, WDII
Radu	David	1002040	WTII

Table 4: CoV Water Operators EOCP Certifications

City of Vernon Operators			
Last Name	**First Name**	**Certification #**	**Certification Held**
Austin	Mercedes	1001060	WDI
Briggs	Geordie	6495	WDIII, WWCII
Becraft	Spencer	1001538	WWCI
Bouchard	Martin	1000696	WDI, WWCII
Browne	Ryan	8176	WDII, WWCll

Callbeck	Brad	1001930	WWCI
Cleverly	Curtis	7193	WDIII, WWCI
Cruz-Santos	Edwin	1001325	WDII, WWCI
Dobson	Scott	100438	WDII, WWCII
Gaythorpe	Glen	7271	WDII, WWCII
Greenan	Craig	1001795	WWCI
Holloway	Ryan	8876	WDII, WWCI, SWS
Holtz	Colin	9158	WDI, WWCII
Irwin	Sean	8610	WDII,WWCII
Jacob	Mason	1000333	WDI, WWCI
Johannson	Iain	9427	WDII, WWCI
Knight	Jessie	1000335	WDII, WWCI
Martin	Derek	1001431	WDI, WWCI
Novakowski	Dan	1001106	WDII, WWCI
Parker	Ryan	6988	WDIV, WWCII
Price	Eric	9215	WDII, WWCI
Rempel	Chris	7192	WDI
Rempel	Cory		
Rennie	Dylan	100532	WDI, WWCI
Roberts	Alex	1001050	WDI, WWCI
Rowan	Jared	1001263	WDII, WWCI
Stowards	Blaine	8247	WDII, WCII
Thomas	Jamie	7550	WDI, WWCI

Table 5 2024 Source Water Bacterial Summary

2024 Source Water Bacterial Summary						
	Lab	Min	Max	Average	# Samples	# Deviations[1]
E. coli (MPN/100 mL)	Caro	<1	4.0	0.8	10	0
E. coli (MPN/100 mL)	RDNO	<1	5.2	0.4	24	0

Total Coliform (MPN/100 mL)	Caro	<1	304	47.2	10	0
Total Coliform (MPN/100 mL)	RDNO	<1	201.4	30.0	24	0

[1]*Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in BC (2024): at least 90% of the samples in the past six months should not exceed 20 E. coli bacteria per 100 mL.*

Table 6 2024 Source Water – SCADA Turbidity Daily Average Summary

2024 Source Water SCADA Turbidity Daily Average Summary	
	Turbidity (NTU)
Minimum	0.16
Maximum	0.67
Average	0.36
# of days	366
Counts <1 NTU	366
Counts >1 NTU	0
Counts >5 NTU	0

Table 7 2024 Source Water Field Parameters and RDNO Lab Results

2024 Source Water Field Parameters and RDNO Lab Results				
	Min	Max	Average	# Samples
pH	6.9	8.0	7.5	12
Temperature (°C)	5.2	22.6	12.3	12
UVT – unfiltered (%)	84.6	86.7	85.7	11
Conductivity (µS/cm)	296	320	305	12

Table 8 2024 Source Water - Total and Dissolved Organic Carbon Summary

2024 Source Water Total and Dissolved Organic Carbon					
	Min	Max	Average	# Samples	# of Deviations[1]
Dissolved Organic Carbon (mg/L)	3.77	5.34	4.35	11	-----

Total Organic Carbon (mg/L)	3.90	5.18	4.54	12	10

[1]Drinking Water Treatment Objectives for Source Water Supplies in BC (2020); MAC Total Organic Carbon is 4.0 mg/L.

Table 9 2024 Treated Water – SCADA Chlorine Daily Average Summary

2024 Treated Water SCADA Chlorine Daily Average Summary	
	Free Chlorine (mg/L)
Minimum	1.15
Maximum	3.05
Average	1.67
# of days	366
# of Deviations[1]	0

[1]WQ Deviation Response Plan triggered when Free Chlorine < 0.20 mg/L in the distribution

Table 10 2024 Distribution Water Bacterial Summary

2024 Distribution Water Bacterial Summary					
	Min	Max	Average	# Samples	# Deviations[1]
E. coli (CFU/100 mL)	<1	<1	<1	53	0
E. coli (MPN/100 mL)	<1	<1	<1	31	0
Total Coliform (CFU/100 mL)	<1	<1	<1	53	0
Total Coliform (MPN/100 mL)	<1	<1	<1	31	0

[1]Drinking Water Treatment Objectives (Microbiological) for Source Water Supplies in BC (2020) (Sec 1.31): Potable drinking water must meet the drinking water treatment objectives for surface water and groundwater of no detectable E. coli.
WQ Deviation Response Plan triggered when Total Coliform > 10/100mL. At least 90% of samples have no detectable Total Coliform bacteria per 100ml and no single sample has >10 Total Coliform per 100mL.

Table 11 2024 Distribution Water - Field Parameter Summary

2024 Distribution Water Field Parameter Summary								
	Min	Max	Average	# Samples	Chlorine <0.2 mg/L	Turbidity >1 NTU but <5 NTU	Turbidity >5 NTU	Temperature >15 °C

Free Chlorine (mg/L)[1]	0.78	2.18	1.65	102	0	-----	-----	-----
Total Chlorine (mg/L)	0.97	2.4	1.84	102	-----	-----	-----	-----
Turbidity (NTU)[1]	0.16	0.89	0.52	102	-----	0	0	-----
pH	7.21	8.21	7.79	100	-----	-----	-----	-----
Temperature (°C)	4.2	24.6	13.2	102	-----	-----	-----	40
Conductivity (µS/cm)	296	395	327	100	-----	-----	-----	-----

[1]WQ Deviation Response Plan triggered when Free Chlorine <0.20 mg/L; Turbidity > 1.0 NTU – unfiltered

Table 12 Monthly Water Consumption

2024 Monthly Water Consumption		
Month	Average Daily Consumption (m^3)	Total Monthly Consumption (m^3)
January	80	2470
February	80	2190
March	80	2360
April	90	2750
May	110	3210
June	90	2600
July	110	3330
August	120	3640
September	90	2570
October	40	1280
November	40	1210
December	40	1270
Monthly Min	**40**	**1210**
Monthly Max	**120**	**3640**
Monthly Average	**81**	**2407**
Annual Total (m^3)	**28880**	

Table 13 2024 Incident Summary

2024 Incident Summary		
Cause	Date Reported	Actions Completed

Air Locking issue on one of the pumps caused an increase in chlorine residual in the reservoir	March 14	Hand dipped samples reading as high as 5.2 mg/L Free Chlorine. The air lock was removed, and residual chlorine levels returned to normal by the end of the day.
Reservoir Upgrades	September 20	On September 20, 2024, a notice was sent to customers stating that starting September 24, 2024, residents on the Delcliffe water system would be put on a temporary reservoir while upgrades were being completed on the existing reservoir. Upgrades include changing the lining on the reservoir as well as repair of some of the concrete within the reservoir. On September 23, 2024, this notice was upgraded to a WQA. Work was expected to be completed October 30, 2024.
Reservoir Upgrades	September 24	WQA for the Delcliffe area that treated water will be supplied by a temporary reservoir while upgrades are being completed on the existing reservoir
Reservoir Upgrades	October 28	On October 28, 2024, a notice was sent to customers stating that the WQA for the Delcliffe water system was being extended due to additional work being required one the existing reservoir was drained. The new WQA was expected to last until November 22, 2024.
Reservoir Upgrades	November 22	On November 22, 2024, a notice was sent to customers stating that the WQA for the Delcliffe water system was being extended due to the continuing repair work to the existing reservoir. The new WQA was expected to last until December 20, 2024.
Reservoir Upgrades	December 6	On December 6, 2024, a notice was sent to customers stating that the WQA for the Delcliffe water system that was first issued on September 23, 2024 was rescinded.

FIGURES

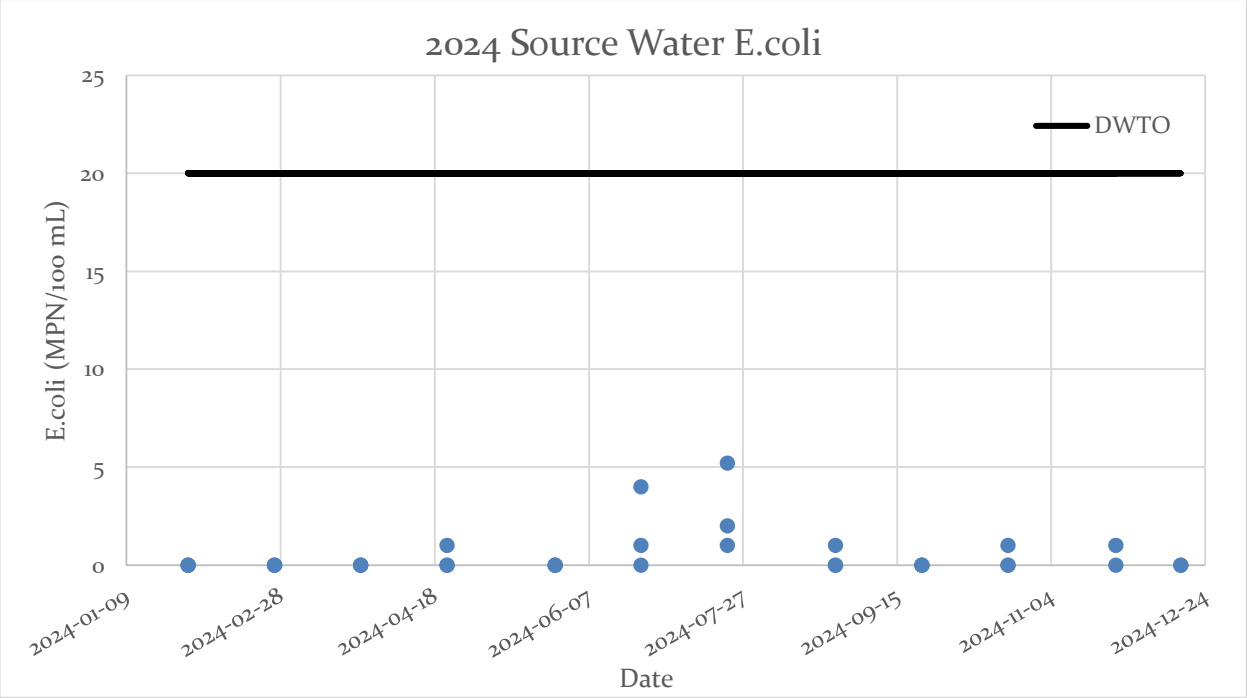


Figure 1 2024 Source Water E.Coil Resuls

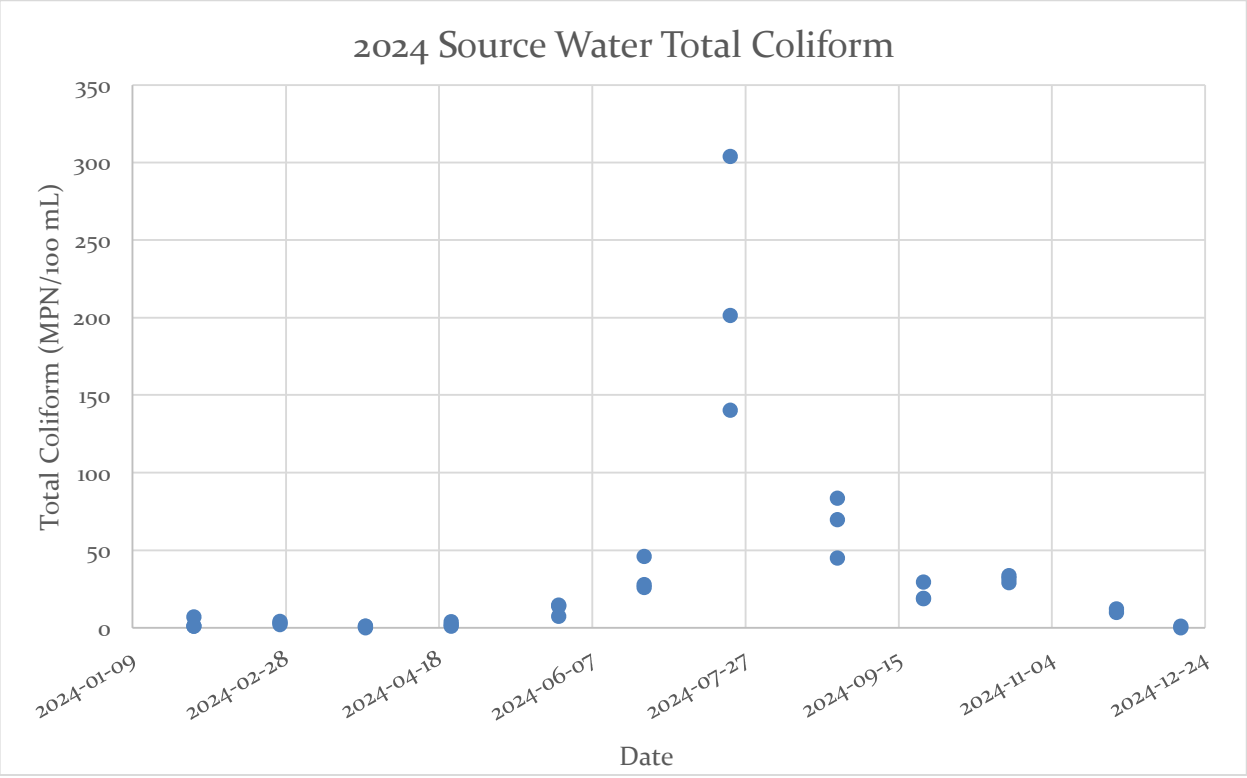
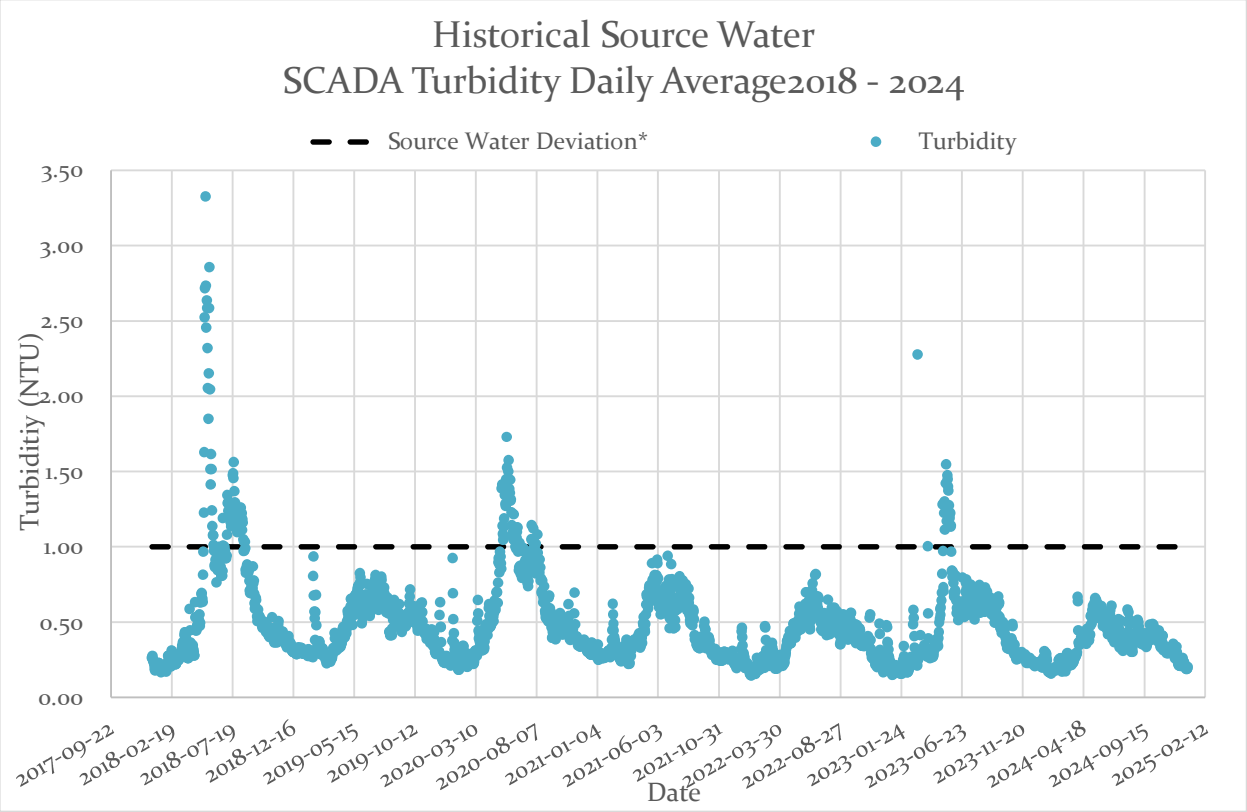
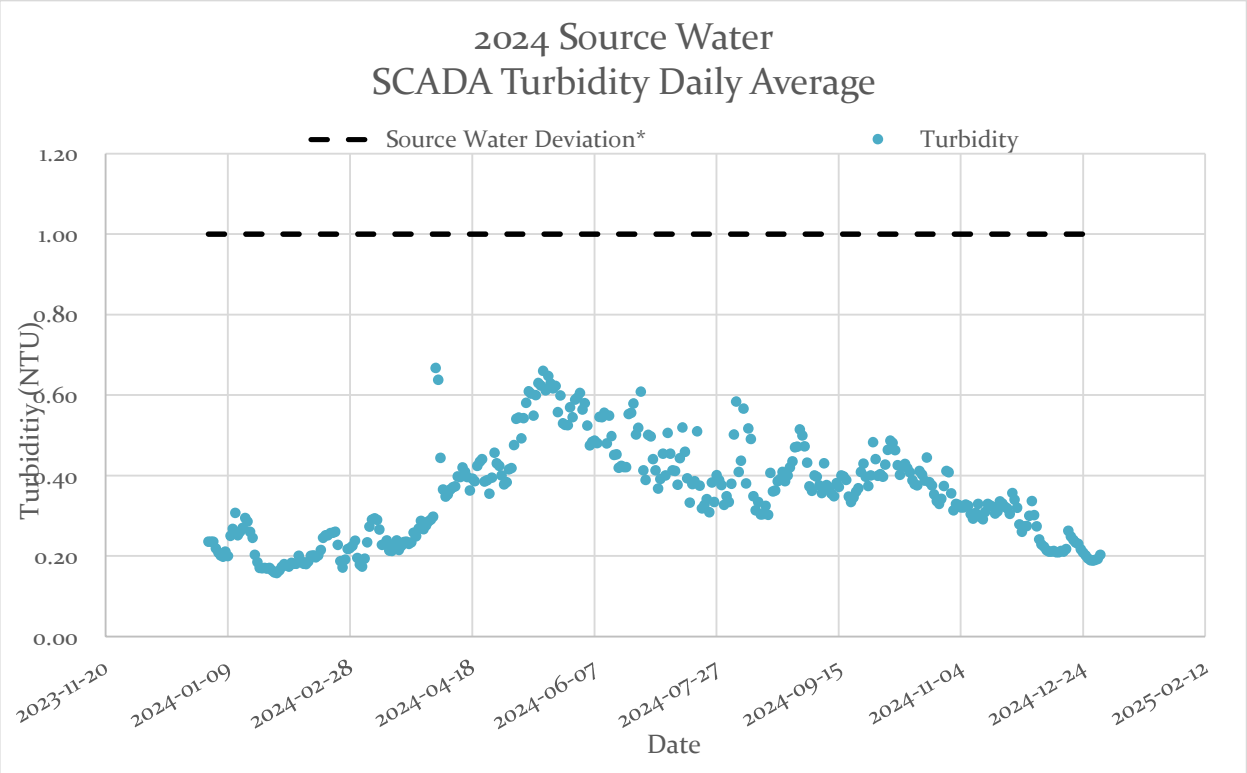


Figure 2 2024 Source Water Total Coliforms Results



*Source Water Quality Deviation Response Plan: Turbidity <1.0 NTU

Figure 3 Historical Source Water - SCADA Daily Average Turbidity (2018-2024)



*Source Water Quality Deviation Response Plan: Turbidity <1.0 NTU

Figure 4 2024 Source Water - SCADA Turbidity Daily Average

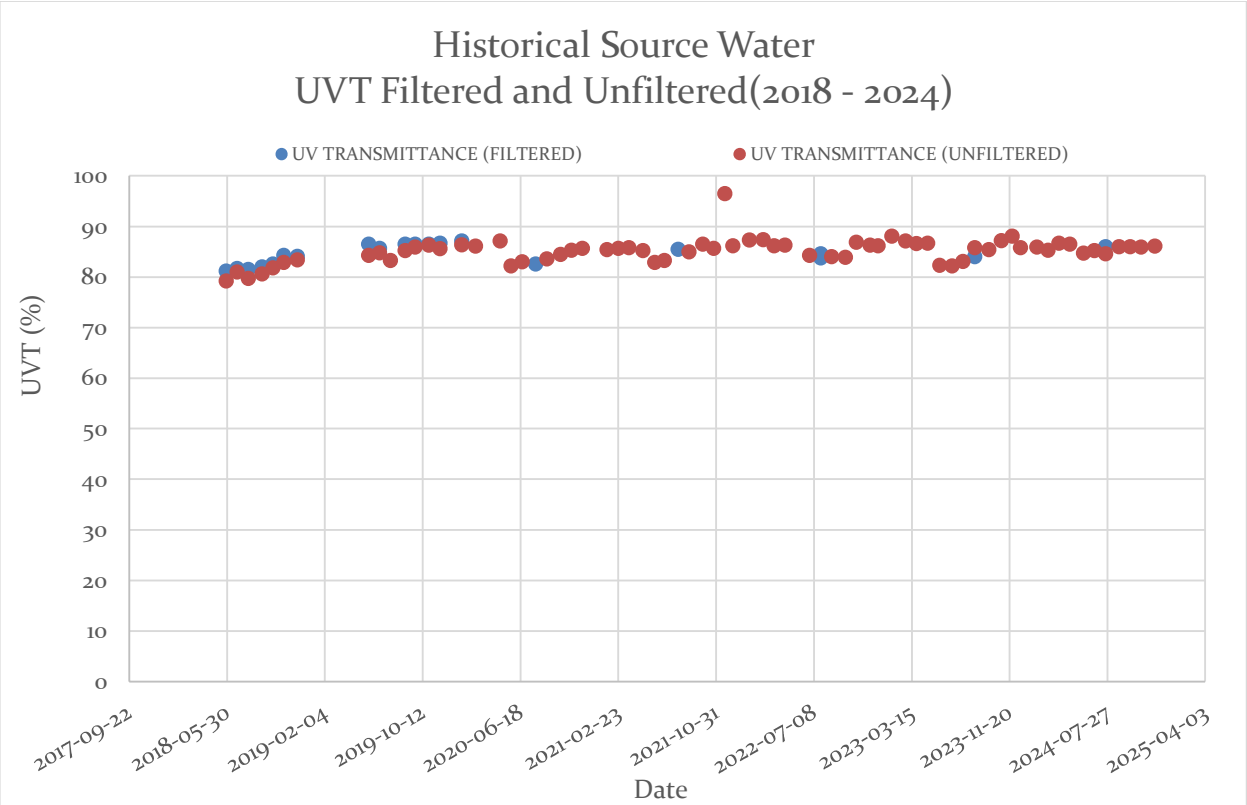


Figure 5 Historical Source Water - UVT Filtered and Unfiltered

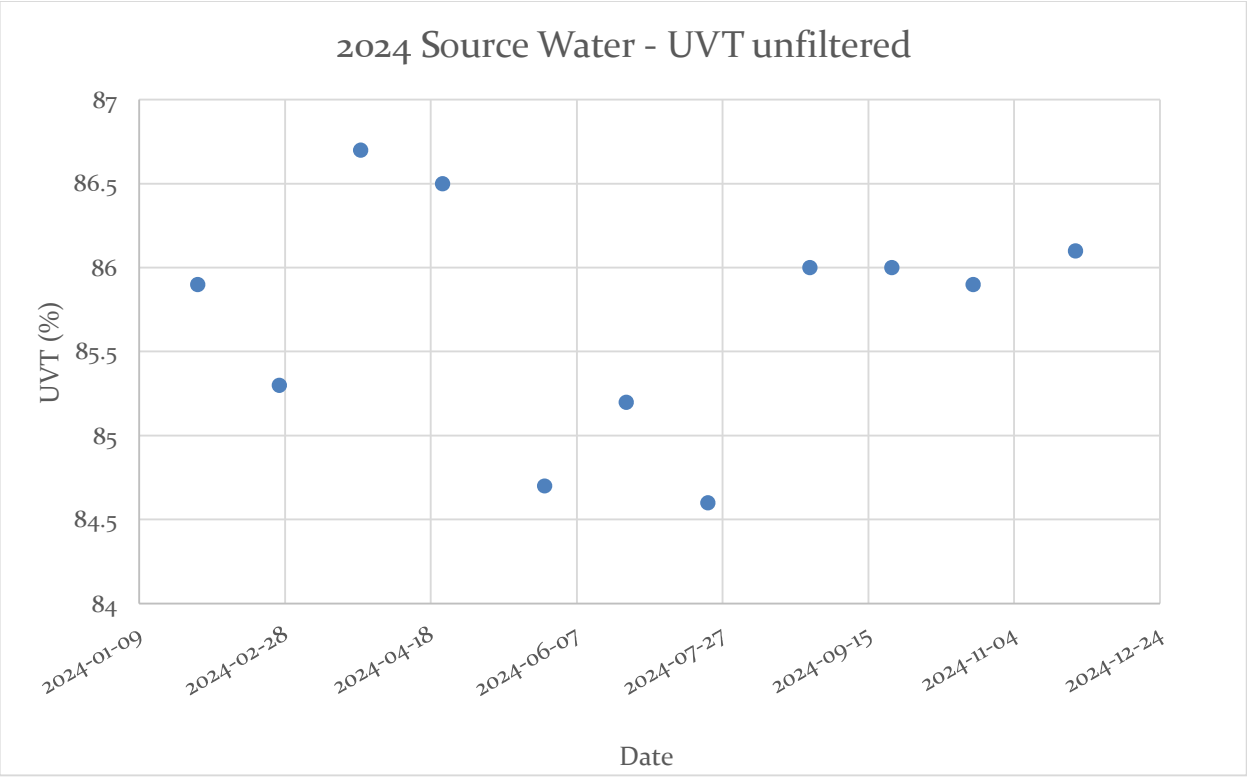


Figure 6 2024 Source Wate - UVT Unfiltered

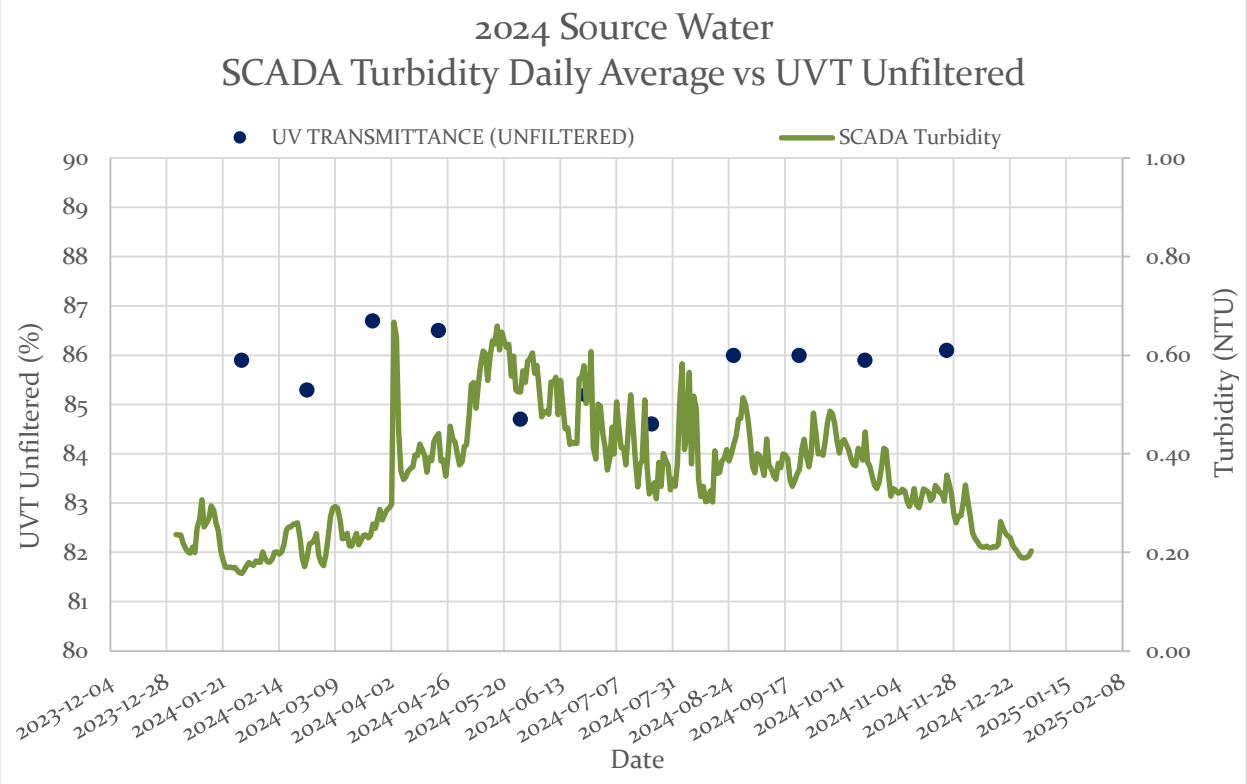


Figure 7 2024 Source Water – SCADA Turbidity Daily Average vs UVT Unfiltered

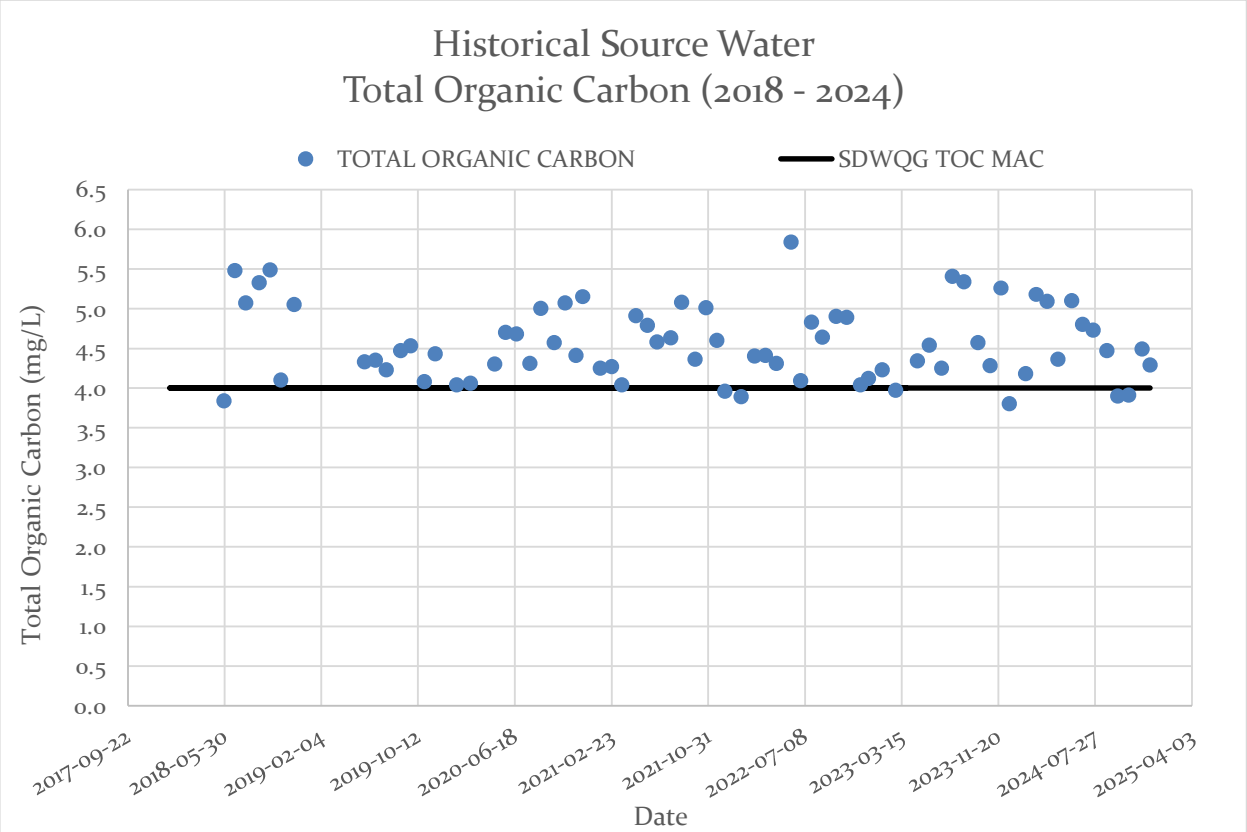
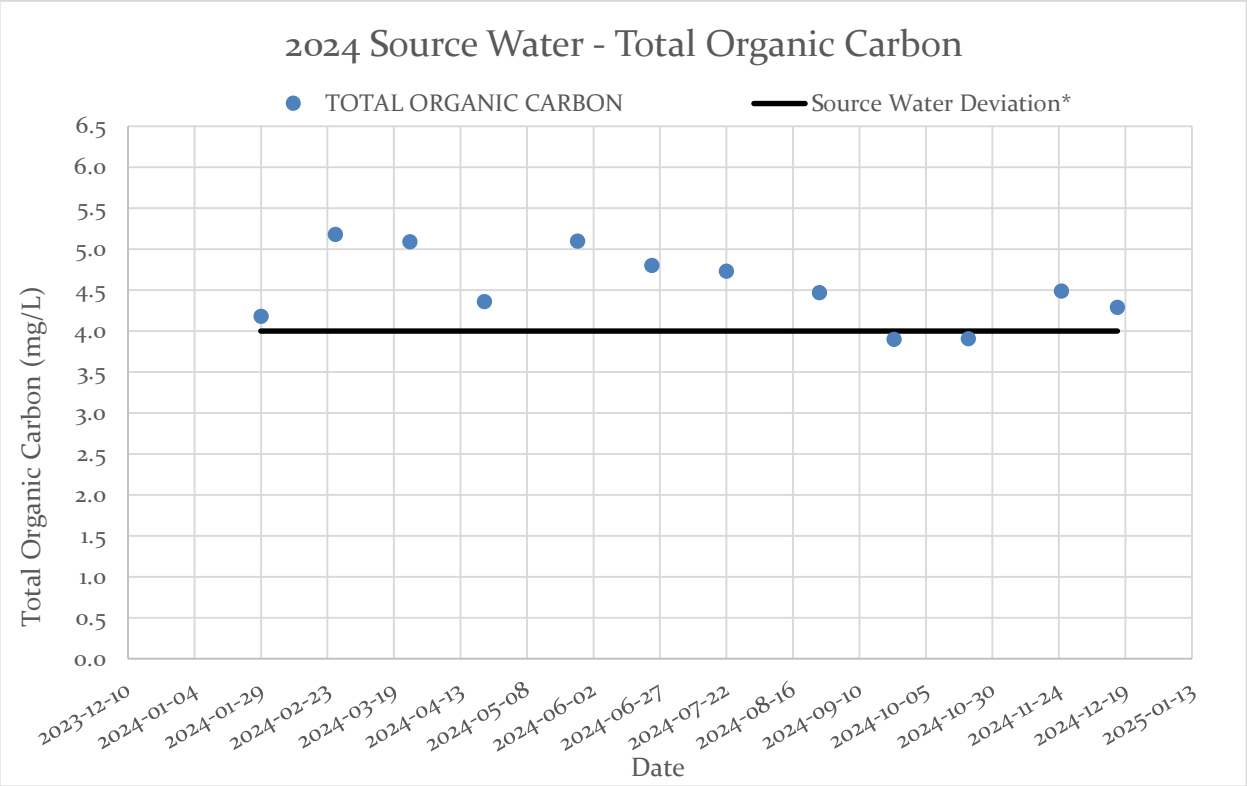


Figure 8 Historical Source Water - Total Organic Carbon (2018-2024)



*Drinking Water Treatment Objectives for Source Water Supplies in BC (2020): MAC Total Organic Carbon is 4.0 mg/L

Figure 9 2024 Source Water - Total Organic Carbon

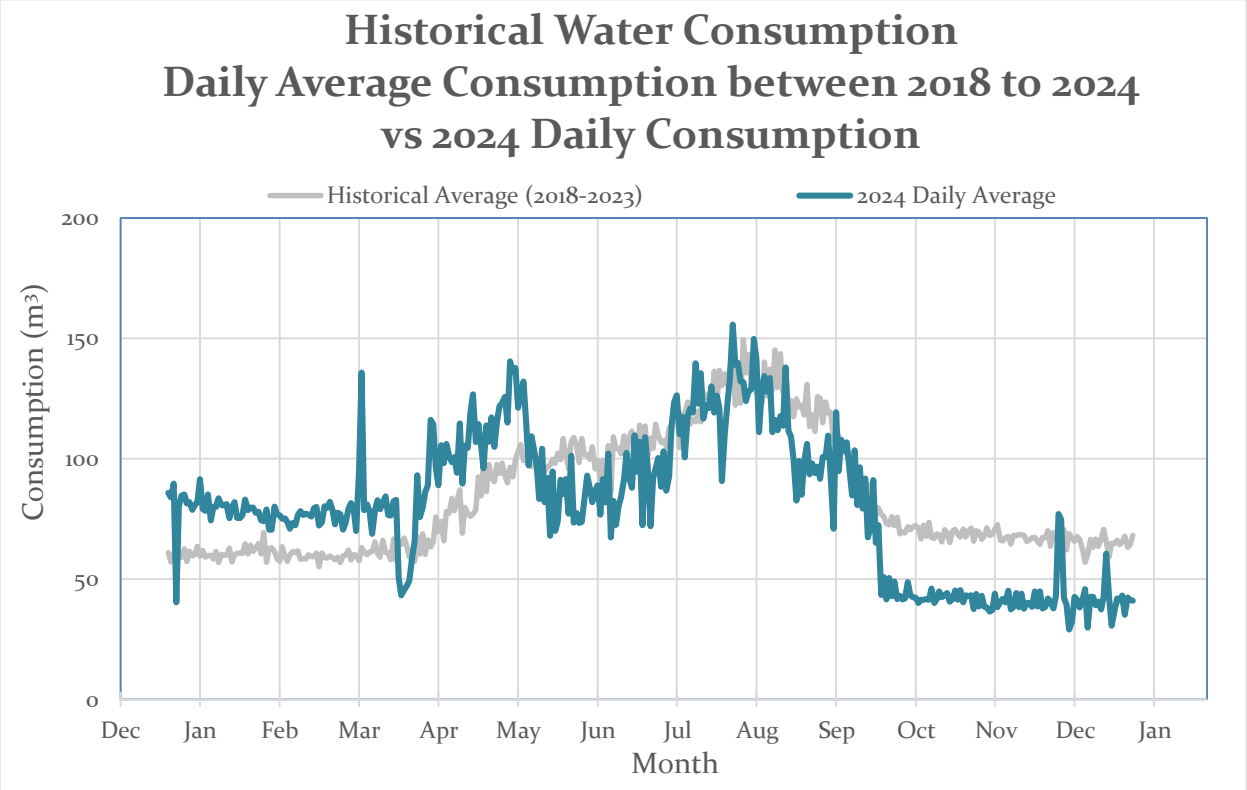


Figure 10 Historical Water Consumption - Daily Average Consumption between 2018-2023 vs 2024 Daily Consumption

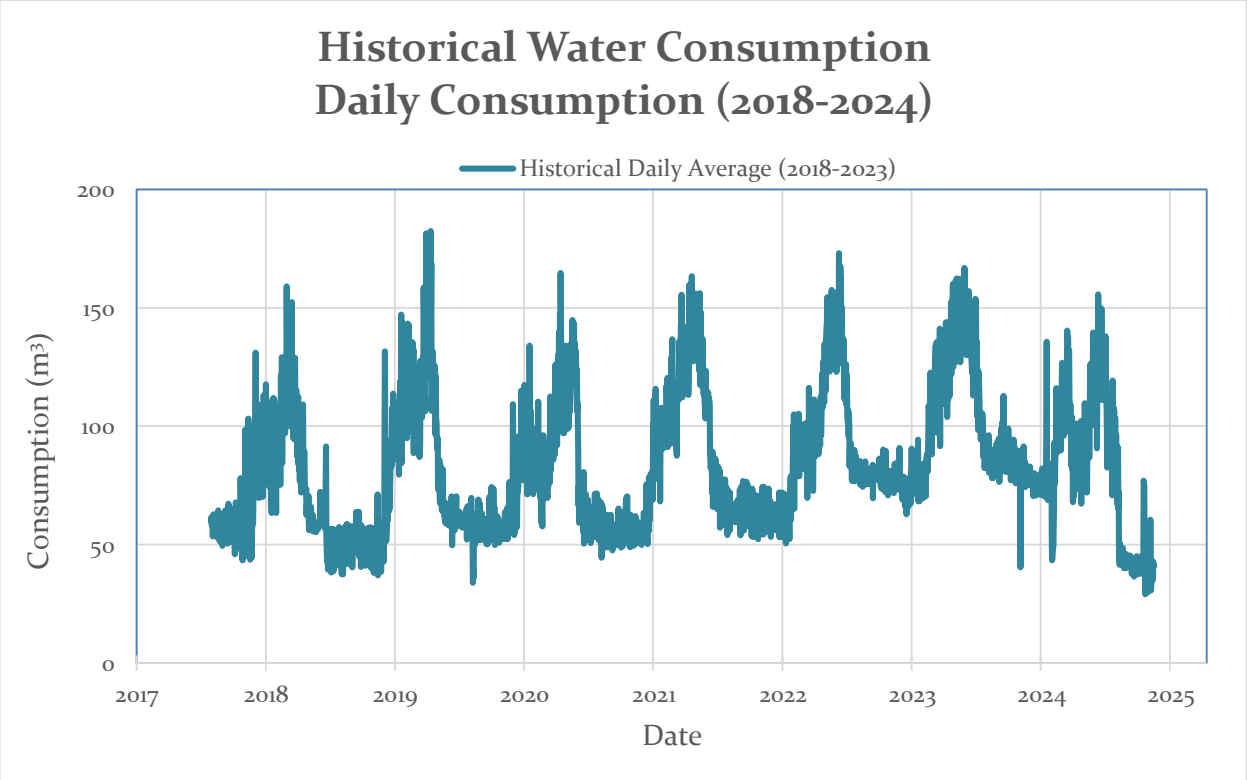


Figure 11 Historical Water Consumption - Daily Consumption (2018 - 2024)

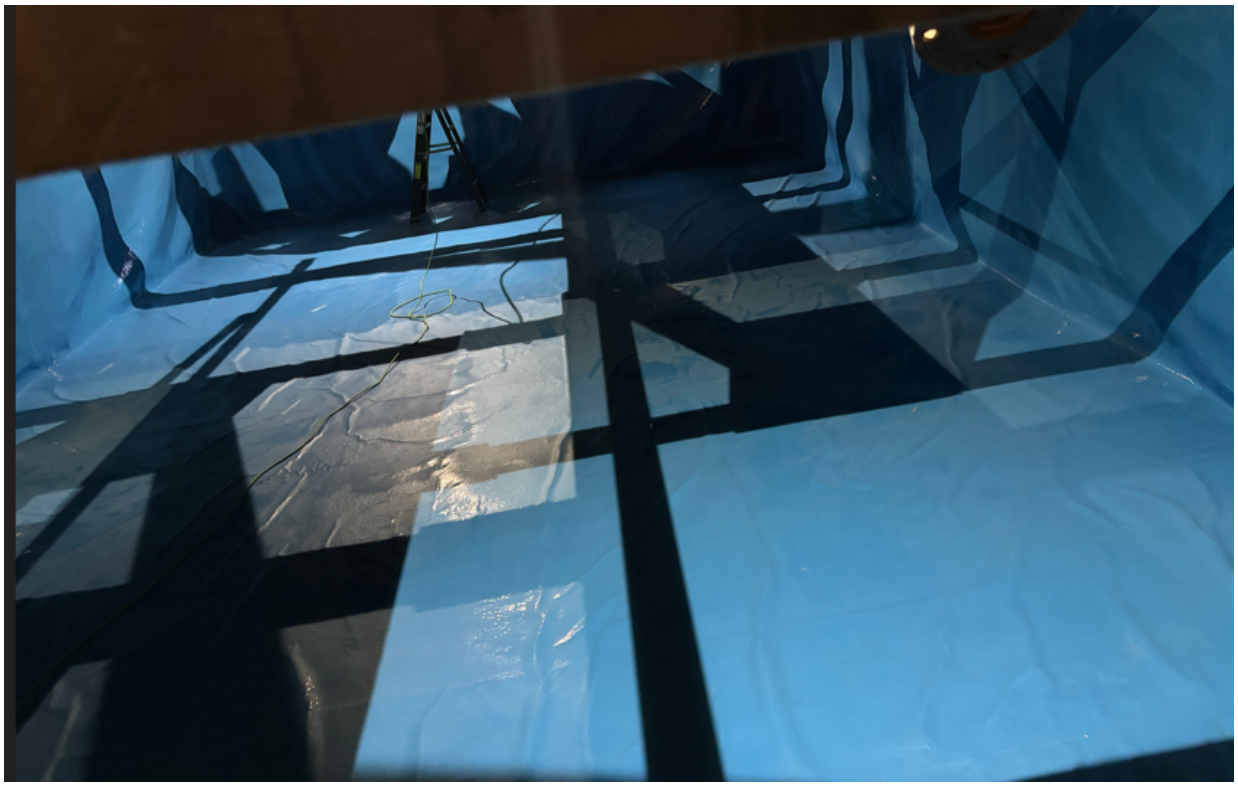


Figure 12 Photo of new reservoir liner

Figure 13 Photos of replumbed lake station (left before photo and right after photo)

REFERENCES

British Columbia Ministry of Environment. 2017. B.C. Source Drinking Water Quality Guidelines: Guideline Summary. Water Quality Guideline Series, WQG-01. Prov. B.C., Victoria B.C. Accessed on-line at:

www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/source_drinking_water_quality_guidelines_bcenv.pdf

British Columbia Ministry of Health. 2013. Decision Tree for Responding to Turbidity Event in Unfiltered Drinking Water, Accessed online from:

www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/how-drinking-water-is-protected-in-bc/1078529_dwog_part_b_-_9_turbidity_decision_tree.pdf

British Columbia Ministry of Health. 2012. Drinking Water Treatment Objectives (Microbiological) for Surface Water in British Columbia. Version 1.1 Accessed online from:

www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/how-drinking-water-is-protected-in-bc/part_b_-_5_surface_water_treatment_objectives.pdf

Bryan, J. E. and Jensen, E. V. 1999. Water Quality Trends in Mara, Mabel, and Sugar Lakes 1971-1998. Prepared for Ministry of Environment, Lands and Parks.

Government of British Columbia. 2003. *Drinking Water Protection Regulation*. Accessed on-line at:

www.bclaws.ca/civix/document/id/crbc/crbc/200_2003

Government of Canada. 2011. Statistics Canada Environmental Indicators – Residential Water Use. Accessed on-line at:

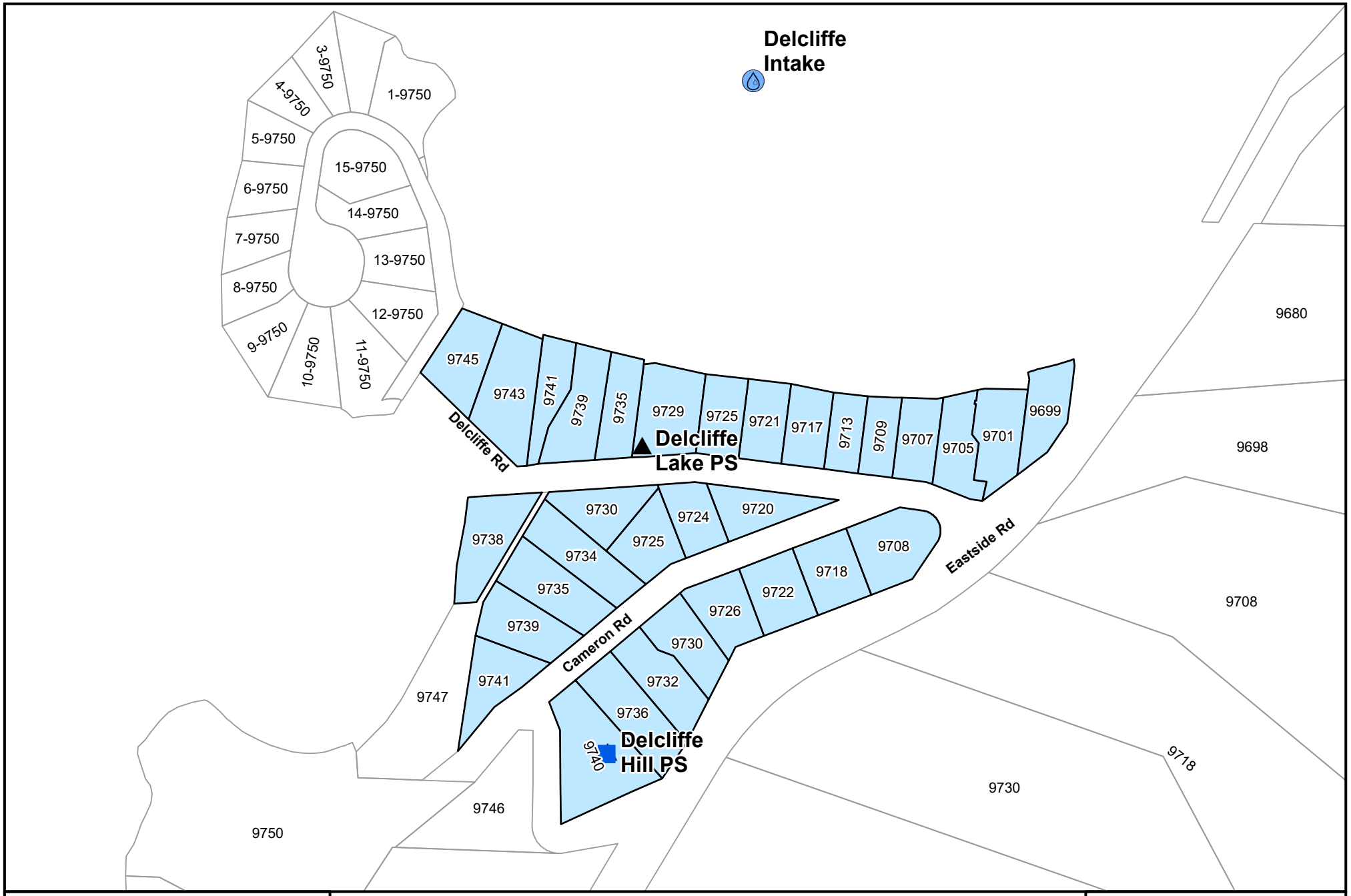
www.canada.ca/en/environment-climate-change/services/environmental-indicators/residential-water-use.html

Health Canada (2017). Guidelines for Canadian Drinking Water Quality—Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario. Accessed on-line at:

www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf

APPENDIX A

WATER SYSTEM MAP



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.

Delciffe

REGIONAL DISTRICT NORTH OKANAGAN

N

Date: Jun 02, 2025

Scale: 1:2,679
Size: 11" x 8.5"

0 65 130 260 Meters

Folder: \\nord\rdno\Maps\GIS\ArcGIS_Pro\Aprx_MasterMaps\Utilities\Master_WQ\

APPENDIX B

OPERATING PERMIT

PERMIT VALIDATION

Interior Health

ACCOUNTS RECEIVABLE
12-945 Columbia St W, Kamloops, BC V2C 1L5
Toll Free: 1-844-868-5200 ext. 10365 – Local Calls: 778-362-6810 ext. 10365
Email: hp.billing@interiorhealth.ca

TO VALIDATE your operating permit, immediately affix this decal in the designated location on the permit. The Health Act Fees Regulation states that an operation permit is valid only if it bears an unexpired decal.

Regional District of North Okanagan
Delcliffe Waterworks
9848 Aberdeen Road
Vernon BC V1B 2K9
Canada

Permit Number:	**005238**
Issue Date:	06-Mar-2024
Expiry Date:	31-Mar-2025
Facility Number:	0411809
Facility Name:	Delcliffe Waterworks

Drinking Water System 15 - 300 Connections

APPENDIX C

2024 SAMPLING PROGRAM AND SCHEDULES

RDNO Operator Schedule 2024		
Week	**RDNO Water Quality Sampling (Monday)**	**RDNO Operator Sampling (Tuesday)**
Jan 1 - 5		Outback Reservoir SS, Delcliffe Road SS
Jan 8 - 12		Outback Reservoir SS, Delcliffe Hill PS
Jan 15 - 19		Outback Reservoir SS, Delcliffe Road SS
Jan 22 - 26	Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Hill PS
Jan 29 - Feb 2		Outback Reservoir SS, Delcliffe Road SS
Feb 5 - 9		Outback Reservoir SS, Delcliffe Hill PS
Feb 12 - 16		Outback Reservoir SS, Delcliffe Road SS
Feb 19 - 23		Outback Reservoir SS, Delcliffe Hill PS
Feb 26 - Mar 1	Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Road SS
Mar 4 - 8		Outback Reservoir SS, Delcliffe Hill PS
Mar 11 - 15		Outback Reservoir SS, Delcliffe Road SS
Mar 18 - 22		Outback Reservoir SS, Delcliffe Hill PS
Mar 25 - 29	Outback Reservoir, Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Road SS
Apr 1 - 5		Outback Reservoir SS, Delcliffe Hill PS
Apr 8 - 12		Outback Reservoir SS, Delcliffe Road SS
Apr 15 - 19		Outback Reservoir SS, Delcliffe Hill PS
Apr 22 - 26	Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Road SS
Apr 29 - May 3		Outback Reservoir SS, Delcliffe Hill PS
May 6 - 10		Outback Reservoir SS, Delcliffe Road SS
May 13 - 17		Outback Reservoir SS, Delcliffe Hill PS
May 20 - 24		Outback Reservoir SS, Delcliffe Road SS
May 27 - 31	Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Hill PS
Jun 3 - 7		Outback Reservoir SS, Delcliffe Road SS
Jun 10 - 14		Outback Reservoir SS, Delcliffe Hill PS
Jun 17 - 21		Outback Reservoir SS, Delcliffe Road SS
Jun 24 - 28	Outback Reservoir, Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Hill PS
Jul 1 - 5		Outback Reservoir SS, Delcliffe Road SS
Jul 8 - 12		Outback Reservoir SS, Delcliffe Hill PS
Jul 15 - 19		Outback Reservoir SS, Delcliffe Road SS
Jul 22 - 26	Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Hill PS

RDNO Operator Schedule 2024		
Week	**RDNO Water Quality Sampling (Monday)**	**RDNO Operator Sampling (Tuesday)**
Jul 29 - Aug 2		Outback Reservoir SS, Delcliffe Road SS
Aug 5 - 9		Outback Reservoir SS, Delcliffe Hill PS
Aug 12 - 16		Outback Reservoir SS, Delcliffe Road SS
Aug 19 - 23		Outback Reservoir SS, Delcliffe Hill PS
Aug 26 - 30	Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Road SS
Sep 2 - 6		Outback Reservoir SS, Delcliffe Hill PS
Sep 9 - 13		Outback Reservoir SS, Delcliffe Road SS
Sep 16 - 20		Outback Reservoir SS, Delcliffe Hill PS
Sep 23 - 27	Outback Reservoir, Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Road SS
Sep 30 - Oct 4		Outback Reservoir SS, Delcliffe Hill PS
Oct 7 - 11		Outback Reservoir SS, Delcliffe Road SS
Oct 14 - 18		Outback Reservoir SS, Delcliffe Hill PS
Oct 21 - 25	Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Road SS
Oct 28 - Nov 1		Outback Reservoir SS, Delcliffe Hill PS
Nov 4 - 8		Outback Reservoir SS, Delcliffe Road SS
Nov 11 - 15		Outback Reservoir SS, Delcliffe Hill PS
Nov 18 - 22		Outback Reservoir SS, Delcliffe Road SS
Nov 25 - 29	Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Hill PS
Dec 2 - 6		Outback Reservoir SS, Delcliffe Road SS
Dec 9 - 13		Outback Reservoir SS, Delcliffe Hill PS
Dec 16 - 20	Outback Reservoir, Outback Intake, Delcliffe Intake	Outback Reservoir SS, Delcliffe Road SS
Dec 23 - 27		Outback Reservoir SS, Delcliffe Hill PS

July and August - Pump runs frequently so meeting is not required

DELCLIFFE - BOTTLES AND PARAMETERS

Weekly Sampling by RDNO Operators (alternate weekly)

Sample Site	Bottles	Parameters
Delcliffe Road SS	1 - Caro Bacterial	Total Coliform, E.Coli
Delcliffe Hill PS	1 - Caro Bacterial	Total Coliform, E.Coli

Monthly Sampling

Sample Site	Bottles	Parameters
Delcliffe Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 200 mL PA Bacterial	Bacterial (Most Probable Number)
	1 - 125 mL Caro	TP
	1 - 250 mL Caro	DOC, TN
	1 - TOC Caro	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)

Annual Sampling (July)

Sample Site	Bottles	Parameters
Delcliffe Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 200 mL PA Bacterial	Bacterial (Most Probable Number)
	1 - 125 mL Metals Caro	
	1 - 40 mL mercury glass metals	
	1 - 125 mL Caro	TP
	1 - Cyanide	Cyanide
	1 - TOC	TOC
	1 - 1 L Caro	
	1 - 1 L in house	Algae Density
	1 - 4 L Caro	Chlorophyll a

APPENDIX D

2024 SOURCE WATER COMPREHENSIVE ANALYSIS

Delcliffe Intake Water Quality 2024

Water System: Greater Vernon Water
Source: Okanagan Lake

Sampling Point: Delcliffe Intake
Date of Sample: July 22, 2024

Parameter	Result	Guideline	Unit
ALKALINITY (BICARBONATE, AS CACO3)	119	N/A	mg/L
ALKALINITY (CARBONATE, AS CACO3)	<1.0	N/A	mg/L
ALKALINITY (HYDROXIDE, AS CACO3)	<1.0	N/A	mg/L
ALKALINITY (PHENOLPHTHALEIN, AS CACO3)	<1.0	N/A	mg/L
ALKALINITY (TOTAL, AS CACO3)	119	N/A	mg/L
ALUMINUM (TOTAL)	0.0132	OG < 0.1, MAC = 2.9	mg/L
ANTIMONY (TOTAL)	<0.0002	MAC = 0.006	mg/L
ARSENIC (TOTAL)	0.0005	MAC = 0.01	mg/L
BARIUM (TOTAL)	0.0226	MAC = 2	mg/L
BERYLLIUM (TOTAL)	<0.0001	N/A	mg/L
BISMUTH (TOTAL)	<0.0001	N/A	mg/L
BORON (TOTAL)	<0.05	MAC = 5	mg/L
CADMIUM (TOTAL)	<0.00001	MAC = 0.007	mg/L
CALCIUM (TOTAL)	35.7	N/A	mg/L
CHLORIDE	5.97	N/A	mg/L
CHLOROPHYLL A	<1.0	N/A	µg/L
CHROMIUM (TOTAL)	<0.0005	MAC = 0.05	mg/L
COBALT (TOTAL)	<0.0001	N/A	mg/L
COLOUR (TRUE)	<5.0	AO ≤ 15	TCU
CONDUCTIVITY	299	N/A	µS/cm
COPPER (TOTAL)	0.00152	MAC = 2	mg/L
CYANIDE (TOTAL)	<0.002	MAC = 0.2	mg/L
DISSOLVED ORGANIC CARBON	4.68	N/A	mg/L
FLUORIDE	0.32	MAC=1.5	mg/L
HARDNESS (TOTAL, AS CACO3)	131	N/A	mg/L
IRON (TOTAL)	0.013	AO ≤ 0.3	mg/L
LEAD (TOTAL)	<0.0002	MAC = 0.005	mg/L
LITHIUM (TOTAL)	0.00312	N/A	mg/L
MAGNESIUM (TOTAL)	10	N/A	mg/L
MANGANESE (TOTAL)	0.00095	MAC = 0.12	mg/L
MERCURY (TOTAL)	<0.00001	MAC = 0.001	mg/L
MOLYBDENUM (TOTAL)	0.00354	N/A	mg/L
NICKEL (TOTAL)	0.00049	N/A	mg/L
NITRATE + NITRITE	<0.01	N/A	mg N/L
NITRATE	<0.01	N/A	mg N/L
NITRITE	<0.01	N/A	mg N/L
NITROGEN (TOTAL)	0.213	N/A	mg/L
PHOSPHORUS (TOTAL DISSOLVED)	<0.005	N/A	mg/L
PHOSPHORUS (TOTAL)	<0.05	N/A	mg/L
PH	7.19	OG = 7.0-10.5	pH units
POTASSIUM (TOTAL)	2.52	N/A	mg/L
SELENIUM (TOTAL)	<0.0005	MAC = 0.05	mg/L
SILICON (TOTAL, AS SI)	2.9	N/A	mg/L
SILVER (TOTAL)	<0.00005	N/A	mg/L
SODIUM (TOTAL)	12.2	AO ≤ 200	mg/L

STRONTIUM (TOTAL)	0.282	MAC = 7	mg/L
SULFUR (TOTAL)	10.7	N/A	mg/L
TELLURIUM (TOTAL)	<0.0005	N/A	mg/L
THALLIUM (TOTAL)	<0.00002	N/A	mg/L
THORIUM (TOTAL)	<0.0001	N/A	mg/L
TIN (TOTAL)	<0.0002	N/A	mg/L
TITANIUM (TOTAL)	<0.005	N/A	mg/L
TOTAL DISSOLVED SOLIDS	169	AO ≤ 500	mg/L
TOTAL KJELDAHL NITROGEN	0.213	N/A	mg/L
TOTAL ORGANIC CARBON	4.73	N/A	mg/L
TUNGSTEN (TOTAL)	<0.001	N/A	mg/L
TURBIDITY	0.46	OG < 1	NTU
URANIUM (TOTAL)	0.00241	MAC = 0.02	mg/L
UV TRANSMITTANCE (FILTERED)	86	N/A	% T
VANADIUM (TOTAL)	<0.005	N/A	mg/L
ZINC (TOTAL)	<0.004	AO ≤ 5	mg/L
ZIRCONIUM (TOTAL)	<0.0001	N/A	mg/L

"<" = Less than the detection limit shown

N/A = No current guideline

OG = Operational Guideline

MAC = Maximum Acceptable Concentration Guideline

AO = Aesthetic Objective Guideline

Guidelines are for treated drinking water - these samples are untreated water