2023 Water System Assessment Report
Cornwallis Water Treatment Plant

Final Report

CBCL

County of Annapolis
Naturally Rooted

230822.00 • September 2023

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September 14th, 2023

Mr. Jim Young, P.Eng.
Director of Municipal Operations
Municipality of the County of Annapolis
752 St. George Street
Annapolis Royal, NS B0S 1A0

Dear Mr. Young:

RE: ***Cornwallis WTP 2023 Water System Assessment Report***

Please find enclosed the 2023 System Assessment Report (SAR) for the Cornwallis Water Treatment Plant (WTP) completed by CBCL Limited (CBCL) on behalf of the Municipality of the County of Annapolis (MCA). This report includes the specific requirements of a SAR as outlined in the Nova Scotia Environment and Climate Change (NSECC) *Approval to Operate* for a WTP.

Yours very truly,

CBCL Limited

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Project No: 230822.00

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1 Project

1.1 Introduction

The objective of this System Assessment Report (SAR) is to verify that the operation, supply, and distribution of water provided by the Cornwallis Water Treatment Plant (WTP) complies with the environmental standards for safe drinking water as outlined in the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems* (June 2022). This report follows the Terms of Reference provided by Nova Scotia Environment and Climate Change (NSECC). In addition to verifying the required performance, this report will identify any sources of concern and provide appropriate recommendations.

The overall study area includes the Cady Lake watershed source, treatment plant, storage and distribution facilities which are owned and operated by the Municipality of the County of Annapolis (MCA), to provide drinking water to residents of Cornwallis Park. Infrastructure included in the municipal drinking water system includes:

- Cady Lake and various water bodies in the Cady Lake Source Water Protection Area.
- Head Pond dam and raw water transmission main.
- Raw water reservoir.
- Cornwallis WTP.
- Treated water storage reservoir.
- Distribution watermains.

1.2 Purpose

CBCL Limited (CBCL) has been engaged to complete the 2023 SAR for the MCA to verify that the system meets the requirements to comply with the current standards outlined by NSECC. The previous SAR for the Cornwallis system was completed in April 2013.

This report, prepared by CBCL, verifies that the WTP can:

- Meet current environmental standards, which are frequently updated and enhanced for public health protection.
- Meet the minimum requirements set out in the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems.*
- Demonstrate performance with disinfection criteria.
- Demonstrate performance with turbidity criteria.

- Demonstrate that online equipment is in place and appropriately alarmed to continuously monitor chlorine residual, individual filter effluent, and all parameters related to other primary disinfectants.
- Confirm that waste streams generated by treatment facilities are adequately managed.

This report is organised into four sections as follows:

1. Characterization of the Water Source.
2. Treatment Processes, Facilities and Equipment.
3. Operations, Monitoring and Management.
4. Ability to Comply.

2 Characterization of the Water Source

This section of the SAR characterizes the source water for the Cornwallis WTP by outlining the source water and reporting on the following:

1. Microbial risks.
2. Chemical and physical risks.
   a. Lead and corrosion control.
   b. *Guidelines for Canadian Drinking Water Quality* (*GCDWQ*).
   c. *Guideline for Monitoring Public Drinking Water Supplies* (*GMPDWS*).
   d. Source Water Protection Plan (SWPP) monitoring.
3. Filter backwash waste.
4. Source quantity.
5. SWPP.

2.1 Source Description & Schematic

Throughout this report and in previous reports, Lake Cady is referenced as the primary source of drinking water supply for the Cornwallis WTP; however, the 2015 source water protection plan (SWPP) describes that the actual source of supply, a dammed head pond on the West Moose River, is typically replenished more from other sources within the watershed (including 2,260 hectares of catchment area which make up the headwaters of West Moose River as well as Potter Lake, Mud Lake, and Shell Camp Lake). The relative contributions to the head pond from Lake Cady versus other sources within the watershed are variable depending on rainfall and water levels. Water from the West Moose River dam flows by gravity to the raw water storage pond located off South Broadway Avenue in Cornwallis. The total raw water transmission main is reportedly 10.8 km in length, but complete details of the routing of the transmission main were not available to confirm. The approximate routing is north-northeast from the reservoir (assumed to be along Clementsport Road) in a 60-year-old steel pipe approximately 6.6 km to the Clementsport Dam, before connecting to a 2.9 km section of PVC watermain constructed in 1999/200, which connects to an existing main from an area near the municipal wastewater treatment facility to the raw water reservoir. The raw water reservoir itself has a capacity of 27,000 m^3.

2.1.1 Back-up Water Supplies

The Cornwallis WTP does not have a back-up water supply. Manual valves outside the WTP can be manipulated to bypass the raw water reservoir, feeding the WTP directly from the raw water transmission main, if there is a problem in the raw water reservoir itself.

2.2 Microbial Risks

The microbial treatment requirements for municipal water treatment systems supplied with surface water, such as Lake Cady, include the following:

- 3.0-log reduction in protozoa (e.g., *Cryptosporidium* oocysts and *Giardia* cysts).
- 4.0-log reduction in viruses.

Log reductions of microbial agents must be achieved by a combination of engineered filtration and disinfection. Disinfection must provide a minimum of 0.5-log inactivation of *Giardia*.

2.2.1 Surface Water Sources

The raw water supply originates from a surface water source and is required to meet a minimum 3.0-log reduction for protozoa (e.g., *Cryptosporidium* oocysts and *Giardia* cysts) and a minimum of 4.0-log reduction of viruses according to the outlined requirements in *the Nova Scotia Treatment Standards for Municipal Drinking Water Systems* (2022).

The Cornwallis WTP utilizes an engineered filtration and disinfection process consisting of coagulation, flocculation, dissolved air flotation (DAF), multimedia gravity filters, and chlorine disinfection to achieve the required log reductions. The *Nova Scotia Treatment Standards for Municipal Drinking Water Systems* assigns conventional filtration facilities with a 3.0-log removal credits for protozoa (e.g., *Cryptosporidium* oocysts and *Giardia* cysts), and 2.0-log removals for viruses. Remaining log reductions for *Giardia* and viruses are met using free chlorine (sodium hypochlorite). Table 2.1 provides the minimum pathogen reduction credits achieved at the Cornwallis WTP by unit process.

Table 2.1: Minimum Pathogen Reduction Credits Achieved at the Cornwallis WTP

Treatment Technology	Protozoa		Virus	Individual Filter Turbidity Limit
	Cryptosporidium	*Giardia*		
Conventional Filtration	3.0-log	3.0-log	2.0-log	▸ Shall be less than 0.2 NTU 95% of the time in each calendar month. ▸ Shall not exceed 1.0 NTU at any time. ▸ Filter-to-waste until below 0.2 NTU.
Chlorination		0.5-log	2.0-log	

Minimum Total Reduction	3.0-log	3.0-log	4.0-log	

2.2.1.1 Bacterial Quality

The existing *Approval to Operate* (Schedule A) does not require raw water bacteriological testing for total coliforms and *E. coli* at the Cornwallis WTP, and as such, no raw water quality data is available to review. As the plant treats surface water, it is assumed that colony-forming bacteria is regularly present in the source water.

2.2.1.2 Protozoa Water Quality

Schedule A within the existing *Approval to Operate* document prescribes that the minimum sampling frequency requirements to test for the presence of protozoa (*Cryptosporidium* oocysts and *Giardia* cysts) in the raw water is at the request of NSECC. To date, no raw water protozoa quality testing has been requested. The prevalence of protozoa in the source water is unknown, the plant is designed to treat surface water and as such the assumption is that protozoa may be present at any given time.

2.2.1.3 Viral Water Quality

Schedule A within the existing *Approval to Operate* document outlines that the minimum sampling frequency requirements to test for the presence of viruses in the raw water is at the request of NSECC. To date, no raw water virus testing has been requested. No information on viral water quality is available; it is assumed that viruses may be present in the source water at any given time.

2.2.2 Groundwater Sources

There are no groundwater sources utilized by the Cornwallis WTP.

2.3 Chemical & Physical Risks

2.3.1 Disinfection By-Products

Trihalomethanes (THMs) and Haloacetic Acids (HAAs) levels are currently monitored on a quarterly basis at three different locations within the distribution system to establish Locational Running Annual Averages (LRAAs). The sample locations are as follows:

- Site A: Cornwallis Wastewater Treatment Plant (WWTP).
- Site B: Annapolis Basin Maintenance.
- Site C: 490 South Broadway Ave (Water storage tank).

Site C represents the entry point to the distribution system. Site A was selected due to its long retention time at the distal end of the system . Site C was selected to represent the

central part of the distribution system. The number of sampling locations is adequate for the Cornwallis WTP. The mapped locations of the Disinfection By-Product (DBP) sampling points are presented in Appendix C.

Site A does not adequately represent the distal end of the distribution system. MCA should switch this sampling location to ZURI Canada located on Burns Hill Road, where distribution turbidity, chlorine residual and bacteria are currently sampled. This is the farthest area served by the WTP and would, therefore, have the longest retention time.

2.3.1.1 Trihalomethanes

THM concentration results for 2022 are provided in Table A.3 (Appendix A). THM levels observed in the distribution system complied with the LRAA maximum of 100 µg/L.

2.3.1.2 Haloacetic Acids

HAA5 concentration results for 2022 are provided in Table A.3 (Appendix A). HAA5 levels observed in the distribution system complied with the LRAA maximum of 80 µg/L.

2.3.1.3 Other Disinfectant By-Products

Other DBPs listed in the NSECC Terms of Reference include Bromate, Chlorate, Chlorite, and N-Nitroso dimethylamine (NDMA). The Cornwallis WTP utilizes sodium hypochlorite for primary and secondary disinfection, therefore, monitoring for these other DBPs is not required since sodium hypochlorite is not stored for more than three months.

2.3.2 Lead & Corrosion Control

2.3.2.1 Lead

MCA has established a Lead and Copper Sampling Program. The purpose of this program is to implement consistent sampling of lead in residential buildings to assess public exposure to lead, as well as to evaluate the WTP's Corrosion Control Program.

The Lead Sampling Program outlines the sample locations and provides the following sections:

- Collecting Samples for Lead and Copper.
  - Sample Protocol and Number of Samples.
  - Sample Information.
- Notification and Investigation Procedures.
- Taking Action.
- Public Information and Communication Plan.

The *Guidelines for Canadian Drinking Water Quality* (*GCDWQ)* sets the Maximum Acceptable Concentration (MAC) of 0.005 mg/L for total lead. According to the *Requirements for Lead*

and Copper Management, the minimum number of sample locations is determined by the current serviced population. Table 2.2 displays the ranges for the minimum number of sample locations based on serviced population.

Table 2.2: Minimum Number of Sample Locations for Lead and Copper Sampling

Number of People Served	Number of Sample Locations (Annual)
≤500	5
501-3,300	10
3,301-10,000	20
10,001-100,000	30
>100,000	50

As of 2022, the Cornwallis system serves approximately 750 people, therefore, 10 locations are required to comply with the Lead and Copper Sampling Program. MCA sampled four residential locations for lead, which is not in compliance with the minimum number of sample locations required.

Sampling occurred in June 2022 for both lead and copper. Copper was re-tested in July 2022. 1L Random Daytime Samples (RDT) were collected from the kitchen of residences and sent to a third-party lab for analysis. Sample locations, dates, and results for 2022 are provided in Table 2.3 and Table 2.4.

Table 2.3: Lead & Copper Sampling Locations & Results

Sample Date	Address	Lead Results (µg/L)	Copper Results (µg/L)
06/14/2022	90 Hillside Drive	<0.5	9
06/14/2022	406 Dingle Rd.	<0.5	5
06/14/2022	149 Topsail Ave.	<0.5	19
06/14/2022	108 Old School Hill.	<0.5	7

Table 2.4: Copper Sampling Locations & Results

Sample Date	Address	Copper Results (µg/L)
07/06/2022	90 Hillside Drive	4
07/06/2022	406 Dingle Rd.	2
07/06/2022	149 Topsail Ave.	17
07/06/2022	108 Old School Hill.	3

The 2022 Lead and Copper Sampling Program results all indicate lead concentrations are below the MAC limit of 5 µg/L, and copper concentrations are below the MAC limit of 2,000 µg/L.

Residents were notified about potential lead and copper testing by word of mouth, and as a note on their water bills in 2022. The information on the water bill notice did not meet the minimum requirements set by section 3 in the NSECC *Requirements for Lead and Copper Management* and MCA was unable to obtain 10 residential spots to sample. Due to this, MCA is not in compliance with the current *Approval to Operate.*

Moving forward, MCA should ensure information communicated to residents for participation in the program meets the minimum requirements set in section 3 of the *Requirements for Lead and Copper Management.* Clarification from NSECC on lead and copper sampling requirements should be requested and an updated Approval to Operate with current sampling requirements should be provided.

2.3.2.2 Corrosion Control

Corrosion control inhibitors in the form of a zinc orthophosphate blend, are injected into the process stream prior to distribution.

The Cornwallis WTP's *Approval to Operate* (Schedule A) includes requirements for a Corrosion Control Monitoring Program, including sampling for various parameters on a quarterly basis for two consecutive years. Sampling parameters include the following:

- pH.
- Alkalinity.
- Conductivity.
- Temperature.
- Dissolved oxygen.
- Chlorine residual.
- Corrosion inhibitor residual

The sampling locations and frequency outlined in the *Approval to Operate* indicates that a total of three sampling sites are required (one leaving the WTP and two in the distribution system). MCA's 2022 Annual Sampling Plan included these parameters (with the exception of corrosion inhibitor residual) under Section 2.1.7 – Corrosion Monitoring Program, but no results were included in the 2022 Annual Report.

Currently no comprehensive document outlining the Corrosion Control Plan has been developed. No sampling results for the parameters identified in the Approval to Operate and the Annual Sampling Plan were available for review. A Corrosion Control Plan should be developed and should include a detailed sampling plan, action limits for corrosion monitoring parameters, and description of follow-up actions. If water is deemed non-corrosive from sampling results, a request to NSECC for a reduction in sampling frequency can be made.

2.3.3 Guidelines for Canadian Drinking Water Quality

All parameters with associated MACs listed in the *GCDWQ* are required to be analyzed from a raw and treated water sample every five years. The most recent rounds of *GCDWQ* compliance sampling were completed on the following dates:

- Sample Date#1: August 30, 2016.
- Sample Date #2: July 27, 2021.

The last round of provided sampling results, are provided in Appendix E. All raw and treated water samples were in compliance with the MACs for health-related parameters of the *GCDWQ* in 2021, with the exception of manganese. Raw and treated water parameters including total iron, pH, and turbidity exceeded the Aesthetic Objective (AO) values as presented in Table 2.5.

Table 2.5: Parameters Exceeding *GCDWQ* Guidelines.

Parameter	*GCDWQ* Sample Date/Result	Guideline
	July 2021	
Total Iron (Raw Water)	1.0 mg/L	AO: 0.3 mg/L
Total Manganese (Raw Water)	**0.153 mg/L**	AO: 0.02 mg/L
True Color (Raw Water)	92.1 TCU	AO: 15 TCU
pH (Raw Water)	6.67	AO: 7.0-10.5
Turbidity (Finished Water)	1.1	AO: 1 NTU
Turbidity (Raw Water)	2.0	AO: 1 NTU

The Cornwallis WTP has commenced remedial measures to ensure exceedances are identified and investigated. The next round of sampling will be completed in 2027 to meet the minimum requirement of one sampling event every five years.

2.3.4 Guidelines for Monitoring Public Drinking Water Supplies

The *Nova Scotia Treatment Standards Municipal Drinking Water Systems* requires that municipal water utilities monitor water quality for the parameters listed in the *GMPDWS*. As per the *Approval to Operate*, the *GMPDWS* samples should be collected and tested annually in raw and treated water. The last round of sampling results from July 2022 are provided in Appendix F.

All raw and treated water samples were in compliance with the MACs for health-related parameters of the *GCDWQ* in 2022, with the exception of manganese. Raw and treated water parameters including total iron, pH, and turbidity exceeded the Aesthetic Objective (AO) values as presented in Table 2.6.

Table 2.6: Parameters Exceeding *GMPDWS* Guidelines

Parameter	*GMPDWS* Sample Date/Result	Guideline
	July 2022	
Total Iron (Finished Water)	0.65 mg/L	AO: 0.3 mg/L
Total Manganese (Finished Water)	**0.133 mg/L**	AO: 0.02 mg/L
pH (Raw Water)	6.41	AO: 7.0-10.5
Turbidity (Finished Water)	2.3	AO: 1 NTU
Turbidity (Raw Water)	4.2	AO: 1 NTU

The Cornwallis WTP has commenced remedial measures to ensure exceedances are identified and investigated. The next round of compliance testing is scheduled to occur in July 2023.

Health Canada added a health-based maximum for total manganese of 120 µg/L in 2019. NSECC updated the *GMPDWS* to reflect this change and requires monitoring of total manganese in raw, treated, and distribution system samples. As per the *Approval to Operate*, manganese is sampled quarterly. No documentation of quarterly manganese sampling was provided. As per the 2022 Annual Report the treated water sample for manganese exceeded the *GCDWQ* MAC of 120 µg/L.

MCA should begin sampling for manganese on a quarterly basis for both raw and treated samples to be in compliance with the current *Approval to Operate.*

2.3.5 Source Water Protection Plan Monitoring

The Lake Cady SWPP outlines the recommended monitoring plan and possible sources of contaminants as point sources and non-point sources. A list of the parameters, sample locations, and the associated sampling schedule is provided in Table 2.7.

Table 2.7 Cornwallis Monitoring Stations & Sampling Schedule

Parameter	Locations		
	Outlet of Cady Lake (low-density residential area)	Outlets of Potter Lake, Shell Camp Lake, & Mud Lake	Raw water before treatment
Turbidity	Quarterly	Semi-annual	Daily
Conductivity	Quarterly	Quarterly	Annual
pH	Quarterly	Quarterly	Daily
Total Coliform and ***E. coli***	Semi-annual	Semi-annual	Weekly
Nitrate	Semi-annual	Semi-annual	Annual
Chloride	Semi-annual	Semi-annual	Semi-annual
Total Dissolved Solids (TDS)	Annual	Annual	Annual

Pesticides	Annual	Annual	Annual
Polychlorinated Biphenyls (PCBs)	Annual	Annual	Annual
Volatile Organic Compounds (VOCs)	Annual	N/A	Annual
Total Petroleum Hydrocarbons	Annual	N/A	Annual

The sampling protocols for the active watersheds provides sufficient data and information needed to constantly evaluate the effectiveness of the SWPP. The sampling network provides MCA with a strong early warning system for potential contamination or changes in source water quality.

Currently MCA has not implemented these parameters into regular sampling procedures. As per the Annual Sampling Plan and Annual report, no sampling occurs at the outlets of Potter Lake, Shell Camp Lake and Mud Lake. These watersheds all contribute to the dammed head pond on West Moose River and would have significant impact on source water quality. MCA should begin sampling all parameters listed at all locations to be in compliance with current *Approval to Operate*. The SWPP monitoring program locations should also be reviewed and updated to select sites that may better reflect the active watersheds that are contributing to the source water.

2.3.6 Cyanobacteria

A monitoring and protection program against the risk of cyanobacteria is required as per the *Approval to Operate*. Currently no cyanobacteria monitoring is implemented at the plant.

In the event of a bloom, the conventional water treatment process will remove the majority of cyanobacterial biomass through the DAF and filtration processes. Any intracellular toxins (contained within the biomass) will be removed, however, dissolved cyanotoxins (extracellular) are not readily reduced in conventional surface water treatment processes. Free chlorine is moderately effective for the oxidation of microcystin and is in use at the facility. As a result, the WTP does have the capability to reduce total microcystin to some extent should a bloom occur. The primary challenge for microcystin removal is the lack of online monitoring or established criteria for chemical dosing and operating parameters when treating for this toxin. MCA should visually monitor for algal blooms on a weekly basis. Should MCA desire a proactive approach to cyanobacteria monitoring, rapid cyanotoxin strip tests or algal monitoring sondes could be implemented into the existing monitoring plan.

MCA should implement a monitoring and protection program against the risk of cyanobacteria. If algal blooms are suspected, response triggers for cyanotoxin testing (microcystin-LR) should be conducted.

2.4 Filter Backwash Water

Filter backwash water from the treatment process is fed directly into the wastewater collection system. This system flows to the Cornwallis WWTP located on Billy Bishop Road. After treatment, the wastewater is released into the Bay of Fundy. Consequently, the filter backwash water has no impact on the source water quality. Filters continue to divert effluent to filter to waste until turbidity levels return to 0.2 NTU. This setpoint should be documented in the filtration SOP.

2.5 Source Quantity

Water withdrawal permits are issued by NSECC in order to document the allowable withdrawals from the source water. The Water Withdrawal Approval Number is 2014-090991 with an expiry date of October 1, 2025. The Approval is attached in Appendix H.

The Approval authorizes the following withdrawal rates:

- Average rate of withdrawal: 700,000 litres per day (L/day) (averaged over 30 days).
- Maximum rate of withdrawal: 1,125,000 L/day (averaged over 3 days).

Raw water flow data for 2022 is provided in Table A.6 (Appendix A) and summarized in Figure 2.1. A copy of the *Approval for Storage of Water/Water Withdrawal for the Purpose of Municipal Water Systems* is provided in Appendix H. The average daily rate of withdrawal of the Cornwallis WTP in 2022 was 538.9 m^3/d, with a maximum rate of withdrawal of 1,190 m^3/d occurring in August. The water withdrawal limit is based on the maximum 3-day average withdrawal. Daily flows from August 2022 were analyzed to confirm water withdrawal limits were not exceeded over a 3-day average period. Therefore, MCA is in compliance with the current Approval to Operate.

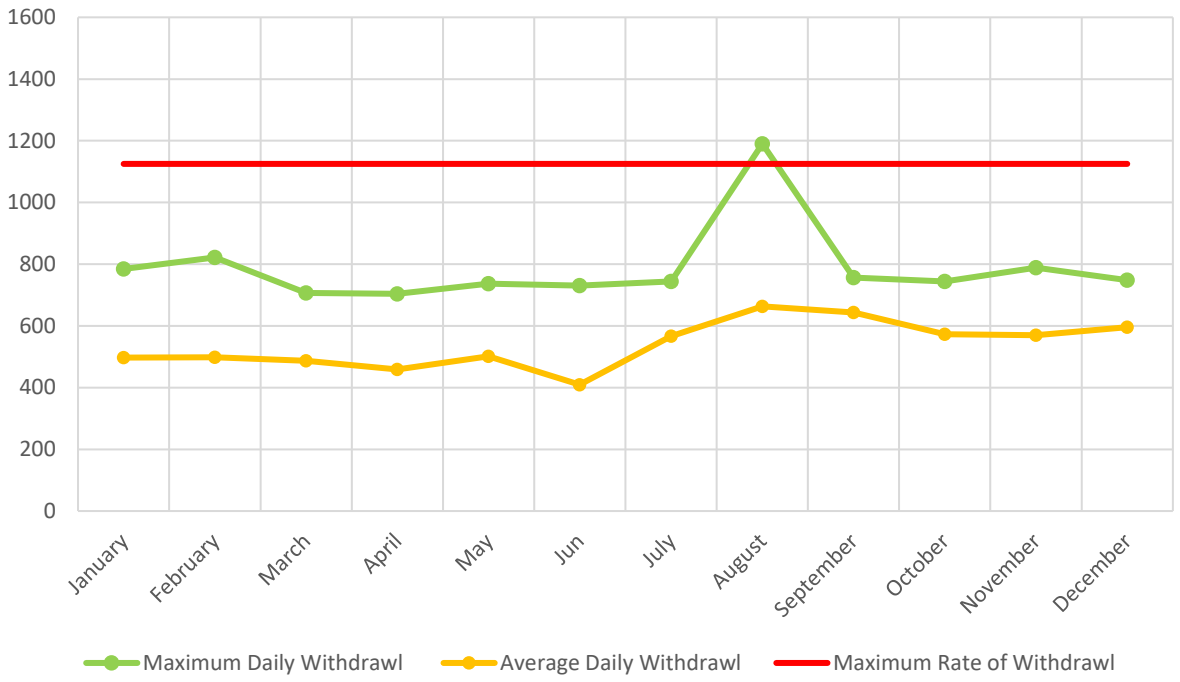


Figure 2.1: 2022 Withdrawal Data by Month

2.5.1 Demand Growth

The approximate population of Cornwallis Park is 750. Given the current production rate of the system, demand growth is expected to be met by the current drinking water system for the foreseeable future.

2.6 Source Water Protection Plan

The current SWPA was designated in 1965. Unfortunately, this designation does not follow the topographic divides very well and most significantly omits the area surrounding Shell Camp Lake. The SWPP recommends that a new Provincial Water Area designation be created. This would allow MCA to oversee regulated activities that may impair water quality within the Lake Cady Source Water Supply Area.

The objective of the Cady Lake SWPP is to promote stewardship within the watershed and protect the drinking water supplied to the Cornwallis WTP. The original SWPP was adopted in 2015. The main risks that have been identified and established within the watershed were ranked and listed below:

1. Fuel spills.
2. Sedimentation.
3. Herbicides and pesticides.
4. Residential fuel storage.
5. Road salt.
6. Septic systems.

7 Forest fires.
8 NSPI infrastructure.
9 Wildlife and vegetation.

The six primary management strategies adopted in the SWPP are described below:

1 **Acquisition of Land** - Typically the most expensive option, but also the most effective, as it provides direct control over the land usage and development.
2 **Best Management Practices (BMPs)** - Methodologies used by residents and industry to define practical and effective means of protecting source water areas.
3 **By-Laws** - By-laws are enacted under Municipal Planning Strategies and allow the Municipality to restrict land usage and activities in sensitive areas.
4 **Contingency Planning** - Not all risks to a Protected Water Area can be mitigated. Contingency Planning defines emergency response protocols, in case of a dangerous contamination occurrence within the Source Water Protection Area.
5 **Designation** - Regulations enacted under the Nova Scotia Environment Act, Section 106. The Source Water Protection Area can be formally designated as Protected Water Area under this legislation. Regulations can be drafted that would enable the Water Utility to define allowable activities within the protected area.
6 **Education and Stewardship** – educating people and communities on the importance of source water protection creates a sense of ownership and shared responsibility of the water resource and the need for its protection.

MCA indicated that an active Source Water Protection Advisory Committee (SWPAC) has not been held for an extended period of time. As such, the meeting minutes from the previous two SWPAC meetings are not attached as an Appendix. The date of the next SWPAC meeting has not been scheduled.

MCA should recommence annual meetings of the SWPAC and determine the status of updating the SWPA under NSECC.

2.7 Conclusion & Recommendations

2.7.1 Treatment Requirements to Protect Against Pathogenic Organisms

The Cornwallis WTP draws water from Cady Lake. As per the *Nova Scotia Treatment Standards for Municipal Drinking Systems*, surface water sources require a 3.0-log reduction for protozoa and 4.0-log reduction for viruses. Using DAF, filtration, and chlorination, the Cornwallis WTP meets the treatment requirements to protect against *Giardia*, *Cryptosporidium,* and viruses.

2.7.2 Disinfection By-Products

The Cornwallis WTP monitors THMs and HAAs at three different locations throughout the distribution system. Site C represents the entry point to the distribution system, Site A represents the distal end of the system, and Site B represents the central part of the distribution system. THM and HAA5 levels observed in the distribution system comply with the LRAA maximum of 100 µg/L and 80 µg/L respectively.

Site A does not adequately represent the distal end of the distribution system. MCA should switch this sampling location to ZURI Canada located on Burns Hill Road, where distribution turbidity, chlorine residual and bacteria are currently sampled. This is the farthest area served by the WTP and would, therefore, have the longest retention time.

2.7.3 Lead & Corrosion Control

The Cornwallis WTP does not adequately monitor lead concentrations in the distribution system. In 2022, four residential locations were sampled, and the *Approval to Operate* requires a minimum of 10. Residents were notified about potential testing by word of mouth, and as a note on their water bills. The information on the water bill notice did not meet the minimum requirements set by section 3 in the NSECC *Requirements for Lead and Copper Management*. All four samples were under the MAC of 0.005 mg/L for lead. In 2023, MCA will sample 10 residential locations for lead and copper as per their Lead and Copper Sampling Program.

Moving forward, MCA should ensure information communicated to residents for participation in the program meets the minimum requirements set in section 3 of the *Requirements for Lead and Copper Management.* Clarification from NSECC on lead and copper sampling requirements should be requested and an updated Approval to Operate with current sampling requirements should be provided.

The Annual Report did not include results for corrosion monitoring parameters at any sampling locations in the distribution system, which is not in compliance with the *Approval to Operate*. **MCA should begin sampling in accordance with its Annual Sampling Plan and Approval to Operate for corrosion control parameters.**

Currently no comprehensive document outlining the Corrosion Control Plan has been developed. This should include a detailed sampling plan, action limits for corrosion monitoring parameters, and description of follow-up actions. If water is deemed non-corrosive from sampling results, a request to NSECC for a reduction in sampling frequency can be made.

2.7.4 Guidelines for Canadian Drinking Water Quality

The last round of provided sampling results, are provided in Appendix E. The last round of sampling, completed in July 2021, was partially in compliance with the NSECC sampling requirements of the *GCDWQ*. The raw water sample for manganese exceeded the MAC of 0.12 mg/L. The Cornwallis WTP has commenced remedial measures to ensure exceedances are identified and investigated. The next round of sampling will be completed in 2027 to meet the minimum requirement of one sampling event every five years.

2.7.5 Guidelines for Monitoring Public Drinking Water Supplies

As per the *Approval to Operate,* the *GMPDWS* samples are collected annually and sent for analysis. The last round of sampling, completed in July 2022, was partially in compliance with the NSECC sampling requirements of the *GMPDWS*. The raw water sample for manganese exceeded the *GCDWQ* MAC of 0.12 mg/L. The Cornwallis WTP has commenced remedial measures to ensure exceedances are identified and investigated. The next round of compliance testing is scheduled to occur in July 2023.

MCA should begin sampling for manganese on a quarterly basis to be in compliance with the current *Approval to Operate.*

2.7.6 Source Water Protection Plan Monitoring

The sampling protocols for the active watersheds provide sufficient data and information needed to constantly evaluate the effectiveness of the SWPP. The sampling network provides MCA with a strong early warning system for potential contamination or changes in source water quality.

Currently MCA has not implemented these parameters into regular sampling procedures. As per the Annual Sampling Plan and Annual report, no sampling occurs at the outlets of Potter Lake, Shell Camp Lake and Mud Lake. These watersheds all contribute to the dammed head pond on West Moose River and would have significant impact on source water quality. MCA should begin sampling all parameters listed at all locations to be in compliance with current *Approval to Operate*. The SWPP monitoring program locations should also be reviewed and updated to select sites that may better reflect the active watersheds that are contributing to the source water.

2.7.7 Filter Backwash Water Discharge

Filter backwash water from the treatment process is fed directly into the wastewater collection system. This system flows to the Cornwallis WWTP located on Billy Bishop Road. After treatment, the wastewater is released into the Bay of Fundy. Consequently, the filter backwash water has no impact on the source water quality. Filters continue to divert

effluent to filter to waste until turbidity levels return to 0.2 NTU. This setpoint should be documented in the filtration SOP.

2.7.8 Source Quantity

In 2022, the WTP did not exceeded the maximum rate of withdrawal averaged over a 3-day average period, therefore, the Cornwallis WTP is in compliance with it's withdrawal limits in 2022.

2.7.9 Source Water Protection Plan

Appendix B identifies the boundaries of the Cady Lake Source Water Protection Area. The SWPP proposed updating the current SWPA to better represent all source water areas that contribute to the Cornwallis WTP influent. The last two SWPAC meetings were not included as they have not been held for an extended length of time.

MCA should recommence annual meetings of the SWPAC and determine the status of updating the SWPA under NSECC.

3 Treatment Processes, Facilities, & Equipment

3.1 Treatment Process

The *Approval to Operate* classifies the system as a Class III Water Treatment Facility and a Class II Water Distribution Facility. The *Approval to Operate* is attached in Appendix G, and the details are as follows:

- Approval Holder: Municipality of the County of Annapolis.
- Approval No: 2009-065804-02.
- Expiry Date: June 1, 2029.

3.1.1 Treatment Process Schematic

The WTP is a conventional DAF system followed by filtration , and consists of the following process units.

- Aluminum Sulfate (Alum) Feed.
- Sodium Carbonate (Soda Ash) Feed.
- Coagulation.
- Flocculation.
- Clarification – DAF.
- Multimedia Filtration.
- Sodium hypochlorite feed (primary disinfection).
- Filtered Water Sodium Carbonate (Soda Ash) Feed.
- Corrosion Inhibitor Feed.

A schematic of the treatment process is presented below in Figure 3.1 and in Appendix I.

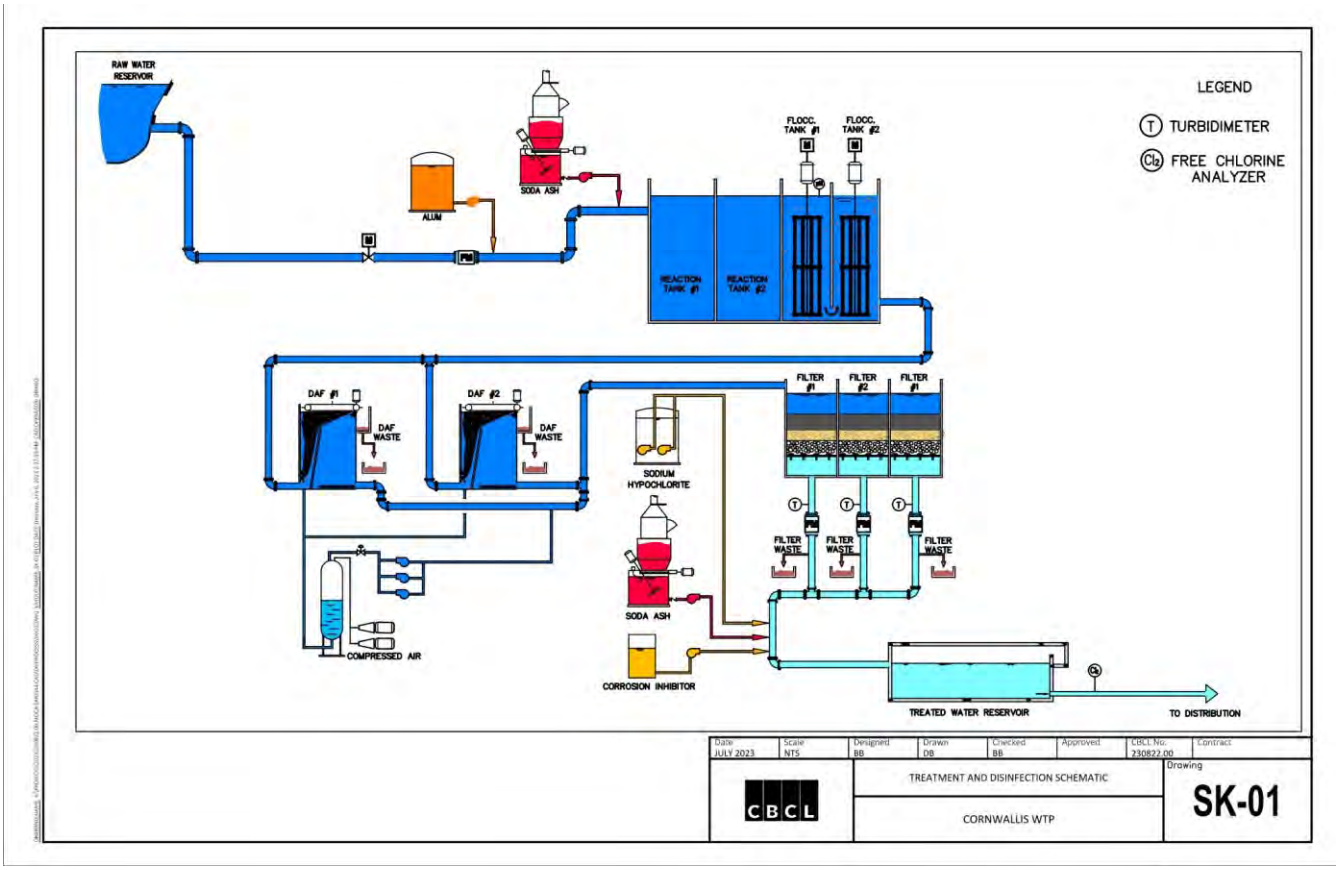


Figure 3.1: Treatment Process Schematic

3.1.2 Turbidity Levels & Associated Criteria

3.1.2.1 Surface Water

Table 3 of the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems* outlines the prescribed filter turbidity levels. The individual filter turbidity limits for conventional filtration systems, such as Cornwallis WTP, are as follows:

- Shall be less than or equal to 0.2 NTU in at least 95% of the measurements made or at least 95% of the time each calendar month.
- Shall not exceed 1.0 NTU at any time.
- Filter-to-waste filters shall be capable of directing filtered water to waste or recycle immediately following a backwash for a period of time until the filtrate turbidity is below 0.2 NTU.

Verification of Filter #1, Filter #2, and Filter #3 to continuously achieve the minimum 3.0-log removal credits for protozoa and 2.0-log removal credits for viruses was evaluated using Option 1 as outlined in the NSECC *Terms of Reference for Municipal Drinking Water Systems*. The Cornwallis WTP utilizes SCADA to provide individual filter effluent turbidity data.

Table 3.1, Table 3.2, and Table 3.3, illustrate the 2022 turbidity level breakdown for Filters 1, 2, and 3 respectively.

Table 3.1: Percentile of Turbidity Readings below 0.2 NTU in 2022 (Filter #1)

2022	Filter #1		
Month	Total Readings	Readings Below 0.2 NTU	Percentile
January	6,308	5,018	**79.55%**
February	5,454	4,716	**86.47%**
March	6,051	5,107	**84.40%**
April	5,422	3,910	**72.11%**
May	6,212	4,639	**74.68%**
June	5,095	4,739	**93.01%**
July	6,867	6,867	100.00%
August	8,025	8,025	100.00%
September	7,217	7,217	100.00%
October	7,132	7,132	100.00%
November	6,511	6,054	**92.98%**
December	7,201	6,632	**92.10%**

Table 3.2: Percentile of Turbidity Readings below 0.2 NTU in 2022 (Filter #2)

2021	Filter #2		
Month	Total Readings	Readings Below 0.2 NTU	Percentile
January	6,270	4,150	**66.19%**
February	5,491	5,447	99.20%
March	6,073	6,070	99.95%
April	5,397	5,382	99.72%
May	6,137	5,951	96.97%
June	5,155	4,429	**85.92%**
July	6,834	6,086	**89.05%**
August	8,030	7,488	**93.25%**
September	7,176	7,176	100.00%
October	7,058	7,058	100.00%
November	6,630	5,175	**78.05%**
December	7,222	6,603	**91.43%**

Table 3.3: Percentile of Turbidity Readings below 0.2 NTU in 2022 (Filter #3)

2022	Filter #3		
Month	Total Readings	Readings Below 0.2 NTU	Percentile
January	6,273	5,888	**93.86%**
February	5,473	5,434	99.29%
March	6,050	6,047	99.95%
April	5,392	5,377	99.72%
May	6,235	6,016	96.49%

June	5,125	4,363	**85.13%**
July	6,826	6,084	**89.13%**
August	7,982	7,440	**93.21%**
September	7,199	7,176	99.68%
October	7,104	7,104	100.00%
November	6,605	5,078	**76.88%**
December	7,158	5,506	**76.92%**

The data presented in the above tables shows that all three filter units were not able to produce filtered water to comply with turbidity limits at all times in 2022. As such, the Cornwallis WTP does not meet the requirements to receive the removal credits as per *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*. **Control strategies such as more frequent backwashing and updating PLC programing should be implemented to mitigate exceedances. If exceedances remain an issue after operational changes have been made, a comprehensive filter evaluation could also be completed. This would be done to examine and evaluate the condition of the filters and if appropriate, provide filter optimization options and recommendations.**

The 2022 Annual Report only reported exceedances in October, which does not match the interval data provided. Daily grab sample readings were not provided and therefore could not be compared to interval or annual report data. **Exceedances may not have been identified at the plant due to the high setpoint within the SCADA programming being set to 1.2 NTU, instead of 0.2 NTU. Due to this, the Cornwallis WTP is not operating in compliance with the current Approval to Operate. This programming has since been adjusted and the high alarm setpoint at the plant has been set to 0.2 NTU, and an automatic shutdown is initiated when filter turbidity levels exceed 1.0 NTU**.

All documented exceedances in the Annual Report were reported to NSE. The 2022 annual sampling plan outlines potential causes and action measures that should be followed when continuous turbidity monitoring of filtered water indicates turbidity levels exceeding 1.0 NTU at any time, or 0.2 NTU more than 5% of the time each calendar month. These potential causes and action measures are summarized in Table 3.4 below.

Table 3.4: Cornwallis Park WTP Potential Sources of Elevated Turbidity and Action Measures

Potential Cause of Elevated Turbidity	Identify Issue	Remedial Measures	Preventative Measures
Elevated Iron and Manganese	Red or black sediments in water, elevated sample concentrations.	Increased water quality monitoring.	Iron and manganese treatment.
Increased Plant Flow Rate	Review water use.	Reduce plant flow rate.	Operate within the approved design flow.

Improper Cleaning of Filters	High turbidity after filtration.	Backwash filters.	Establish protocol for filter cleaning and maintenance.
Online Turbidity Meter Error	Quality control with handheld turbidity meter.	Calibrate the turbidity meter.	Establish QA/QC protocol.

3.1.2.2 GUDI Wells

This section is not applicable for this system.

3.1.2.3 Non-GUDI Wells

This section is not applicable for this system.

3.1.2.4 Review of the Standard Operating Procedure for Filtration Process

MCA currently does not have a Stand Operating Procedure (SOP) for standard filtration processes.

MCA should create a comprehensive SOP for filtration process that includes daily operations procedures for filtration as well as clear procedures for notification, action items, plant shutdown, backwashing procedures, and bringing the WTP online after a process upset in the WTP filter effluent.

3.1.2.5 Inspection of Turbidity Meters

Online monitoring of filter effluent turbidity is conducted using a HACH 1720E series turbidimeter. These meters meet and exceed the *USEPA Method 180.1* rules for measuring turbidity for drinking water compliance. The analysis method is based upon the comparison of light scattering by the sample under defined conditions with the intensity of light scattered by a standard reference suspension. These units are capable of measuring turbidity levels with an accuracy of ±2% of the reading or ±0.02 NTU (whichever is greater) from 0 to 40 NTU. These readings are double checked using a bench model HACH 2100 turbidimeter.

MCAs Operations and Maintenance Manual does not include a detailed quality assurance and calibration program. Turbidimeters are inspected on a weekly basis by operators and calibrated as needed.

MCA should update the Quality Assurance/Quality Control (QA/QC) Standard Operating Procedure (SOP) to better reflect the operation, maintenance, and calibration of the online monitoring equipment. The updated SOP should include sections on equipment start-up, calibration, maintenance, and troubleshooting.

3.1.2.6 Filter Redundancy & Compliance

The rated design capacity of the Cornwallis WTP packaged treatment system is 2,100 m^3/day (2.1 MLD) with one filter out of service. The plant runs at an average of 546 m^3/day, which can be adequately met by running only one filter. Filter capacity has been deemed to not be an issue as the Cornwallis WTP operates at a fraction of the design capacity.

3.1.3 Membrane Filtration

This section is not applicable for this system.

3.1.4 Primary Disinfection

Under the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*, treatment processes using surface water as their source water are required to have the ability to achieve:

- 3.0-log reduction for *Giardia* and *Cryptosporidium.*
- 4.0-log reduction for viruses.
- A minimum of 0.5-log inactivation for *Giardia* with primary disinfection (chlorine) when used in conjunction with filtration.

The filtration drinking water technology facility located in Cornwallis can receive a 3.0-log removal credit for protozoa (*Cryptosporidium* oocysts and *Giardia* cysts), and a 2.0-log credit for viruses, based on obtaining the individual filter turbidity limits described in the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*. Sodium hypochlorite is used to achieve primary chemical disinfection at the Cornwallis WTP. A schematic of the primary disinfection system is provided in Appendix K.

In 2022 the system was not able to meet individual filter turbidity limits and necessary log reductions were not met.

3.1.4.1 CT Calculations (CT Concept)

Calculations are based on various operational, treatment, and system design parameters. Operational parameters including maximum flowrate, chlorine residual and contact volume will affect the time that primary disinfection occurs and the efficiency of disinfection. Furthermore, environmental conditions such as pH and temperature affect the efficiency of disinfection and are included in CT calculations. Calculations reflect the worst-case scenario to ensure that adequate disinfection will always occur in a given water disinfection system.

Primary disinfection occurs in the treated water storage tank at the WTP and in the transmission line from the treated water storage to the first customer. The treated water storage is designed to hold a maximum volume of 2,045 m^3 with a single unbaffled inlet

and outlet, so a baffling factor of 0.3 is assigned. The transmission main acts as a plug flow and has an assigned baffling factor of 1.0. While additional CT is achieved in the transmission main as calculated below, it should not be used in calculation of CT compliance for the purposes of conservatism. All design parameters used to calculate the CT ratio for the WTP are listed below in Table 3.4 and Table 3.5.

Table 3.4: CT Design Parameters

CT Design Parameters	Values
Maximum Flow (m^3/day)	1227
Maximum pH	8.0
Minimum Temperature (˚C)	0.5 ˚C
Minimum Free Chlorine Residual (mg/L)	0.6 mg/L *(Actual 2022 min. = 0.9 mg/L)*

Table 3.5: Treated Water Storage & Transmission Line Design Parameters for CT Calculations

Clearwell Design Parameters	Values
Treated Water Storage Volume (m^3)	2,045 m^3
Minimum Water level in the Tank	20%
Baffling Factor (Tank)	0.3
Transmission Line Length (300 mm diameter)	140 m
Transmission Line Volume (300 mm diameter)	9.9 m^3
Transmission Line Length (200 mm diameter)	50 m
Transmission Line Volume (200 mm diameter)	1.6 m^3
Baffling Factor (Transmission Line)	1.0

$$Contact\ Time_{Storage\ Tank}\ (min) = \frac{Volume\ (m^3) * \ volume\ \%}{Max\ Flow\ (\frac{m^3}{day})} = \frac{(2045\ m^3) * \ 20\%}{1{,}227\ \frac{m^3}{day}} = 480\ min$$

$$Contact\ Time\ _{Transmission\ Line}\ (min) = \frac{Volume\ (m^3)}{Max\ Flow\ (\frac{m^3}{day})} = \frac{11.5\ m^3}{1{,}227\ \frac{m^3}{day}} = 13.5\ \text{min}\ \ (not\ used)$$

$$CT_{actual}\ (mg * min/L) = Chlorine\ Residual\ \left(\frac{mg}{L}\right) * Contact\ Time\ (\text{min}) * \text{Baffling Factor}$$

$$CT_{actual}\ (mg * min/L) = 0.6\frac{mg}{L} * 480 * 0.3 = \ 86.4\ mg * min/L$$

$CT_{req} = 46\ mg * min/L\ (for\ 0.5\ log\ Giardia\ at\ Temp\ =\ 0.5°C,\ pH\ =\ 8.0, Free\ Chlorine\ =< 0.4\ mg/L)$

$$\frac{CT_{actual}}{CT_{req}} = \frac{86.4\ mg * min/L}{46\ mg * min/L} = 1.9$$

The CT calculation above for the 0.5-log inactivation of *Giardia* confirms that the Cornwallis WTP is meeting the minimum CT required. This is the case as the ratio of $CT_{actual}/CT_{required}$ is greater than one and confirms proper disinfection. In 2022, there were no instances where operational conditions for adequate CT were not met.

3.1.4.2 UV Disinfection (IT Concept)

This section is not applicable for this system.

3.1.4.3 Redundancy, Monitoring, & Alerting

Online monitoring of chlorine residual is accomplished using a HACH CL17 chlorine analysers at the outlet of the treated water reservoir that continuously take primary disinfection residual readings and transmits this data to the SCADA system for monitoring and alarming, as required. Control limits within the SCADA system are set to alarm and notify operators when the primary disinfection system is operating incorrectly.

A portable chlorine residual analyzer (HACH DR2000 Spectrophotometer) is used to confirm chlorine residual. This unit can measure free chlorine residual from a range of 0.1–2.0 mg/L (±0.2 mg/L). The device is in good working order and is maintained by operations staff. The device is calibrated when required to ensure accuracy and functionality.

3.1.4.4 Standing Operating Procedures

There is no formal SOP for the disinfection process. A general SOP describes how the CT concept of disinfection may be applied.

MCA should update the current disinfection SOP to formally outline operational setpoints, worst case scenario CT values, response procedures, and operation/maintenance of the disinfection equipment.

3.1.5 Secondary Disinfection

Secondary disinfection is achieved by maintaining a minimum free chlorine residual of 0.2 mg/L at all points within the distribution system. Grab samples are collected weekly at two designated sample locations. It should be noted that sampling locations for January and February occurred at the mall and at Annapolis Basin Maintenance. Samples for the remainder of the year were taken from ZURI Canada and Annapolis Basin Maintenance. All samples collected in 2022 met the required chlorine residual, though sampling locations were not in compliance with the *Approval to Operate* as a full year of weekly results is needed for each sampling location.

The requirement to maintain an adequate secondary disinfectant residual throughout the distribution system drives the dose applied at the primary chlorination point.

3.1.6 Other Critical Processes

Other critical processes include chemical injection systems for coagulation, pH adjustment, and corrosion control.

3.1.6.1 Coagulation

Aluminum sulfate (alum) is used as a coagulating chemical at the WTP. The coagulant causes the particles to become destabilized and begin to clump together in the raw water to form floc. Dissolved organics are precipitated and/or adsorbed to the floc. The floc floats to the surface of the DAF tank for skimming and is filtered out, resulting in the reduction of turbidity and dissolved organic material in the process water. Liquid alum from the alum storage tank is injected into the process stream before reaction tank 1.

3.1.6.2 pH Adjustment

Sodium carbonate (soda ash) solution is mixed in a chemical solution tank from dry powdered soda ash. This is injected into the process stream before reaction tank 1, to adjust the pH of the pretreated water to be within the optimal range for alum coagulation.

3.1.6.3 Orthophosphate Feed

Injection of orthophosphates into the treatment process provides corrosion control. The plant utilizes a zinc-orthophosphate product to protect the distribution system from corrosion. Orthophosphate is injected into the water stream prior to entering the treated water reservoir.

3.1.7 Waste Streams

3.1.7.1 Filter-to-Waste

Upon completion of a successful backwash sequence, filter backwash water from the treatment process is fed into a holding tank, which feeds directly into the wastewater collection system. The filter backwash does not come in contact with the source water. The required range should be documented in the filter SOP.

Filter backwash water is subsequently pumped into a municipal sewer and is treated at the Cornwallis WWTP. As a result, water quality measurements (Total Suspended Solids (TSS), [Al], [Cl], pH, and fish toxicity) are not measured and the backwash water has no effect on the surrounding surface water quality.

3.1.7.2 Filter Backwash Water - Discharging into a Freshwater Watercourse

This section is not applicable for this system.

3.1.7.3 Filter Backwash Water - Discharge to Land or Soil

This section is not applicable for this system.

3.1.7.4 Filter Backwash Water – Discharge to a Marine or Brackish Environment

This section is not applicable for this system.

3.1.7.5 Other Waste Streams

MCA did not report where DAF float waste streams were directed or treated.

3.2 Distribution Water Quality

Distribution system water quality samples are collected from the locations listed below. The Distribution Map is presented in Appendix C.

Site A	Cornwallis Wastewater Treatment Plant, Billy Bishop Road
Site B	Annapolis Maintenance, Corvette Drive
Site C	Zuri Canada, 1051 Waldeck Line Road (a.k.a. Burns Hill Rd)
Site D	Water Treatment Plant

It should be noted that samples in January and February were collected at the local mall. The county sold the mall and public works are no longer allowed to sample there. Sampling locations were switched from the mall to Zuri Canada in March 2022.

3.2.1 Chlorine Residual Levels

Samples from the distribution system for chlorine residual were collected weekly at two sample locations using grab samples as per the *Approval to Operate* conditions. Samples were collected at Sites B and C from March to December. In January and February samples were taken from the local mall, therefore sampling results for Site C are incomplete. Results indicate the chlorine residuals did not fall below 0.2 mg/L or exceed 4.0 mg/L.

3.2.2 Microbial Water Quality

Schedule A in the existing Cornwallis WTP *Approval to Operate* requires samples to be collected on a weekly basis to monitor for total coliforms and *E. coli*. Samples were collected at Sites B and C from March to December. In January and February samples were taken from the local mall, therefore sampling results for Site C are incomplete. All test results were absent for the presence of *E. coli* and total coliforms in 2022.

The number of samples taken in 2022 exceeds the minimum number of samples required for a population of 750 residents. The sampling locations represent the center and the distal end of the distribution system. As a result, the distribution system microbial water quality for the WTP is within compliance.

3.2.3 Turbidity

The distribution system was monitored for turbidity on a weekly basis at two sampling locations (Sites B and C) from March to December. Samples in January and February were only taken at the mall; therefore, sampling results are incomplete.

Schedule A in the *Approval to Operate* requires turbidity samples to be collected on a weekly basis to monitor for distribution turbidity to ensure values are maintained below 5.0 NTU. The sampling records for 2022 distribution turbidity levels for all locations were below the limit but are incomplete as a full year of sampling results was not provided.

3.2.4 Cross Connection Control Program

MCA has developed a Cross Connection Control Program to comply with NSECC requirements. The Cross Connection Control Program requires all multi residential units (greater than four units), industrial, commercial, and institutional buildings to install a Backflow Prevention Device (BFD) on their water service lateral. The devices are installed to provide premises isolation at the entrance to the building for new sprinkler services, and on the customer's side of the water meter for domestic services.

Currently the plan does not meet the minimum requirements outlined in *A Guide to Assist Nova Scotia Municipal Water Works Develop a Cross Connection Control Program.* **MCA should update the cross-connection control program to include a detailed project scope, budget, authority, and timelines.**

3.2.5 Other Distribution System Monitoring Programs

MCA conducts the following distribution system monitoring:

- Annual flushing program with inspection of hydrants and system gate valves.
- Ongoing leak detection program in development, includes both flow monitoring and correlation and acoustic leak detection equipment.

There is currently no formal reservoir inspection program in place at the Cornwallis reservoir. It is recommended that a program be established to conduct interior inspection in the reservoir on a regular basis.

3.3 On-Site Inspection

An on-site inspection was conducted on June 7, 2023, by Ben Bickerton, M.A.Sc., P.Eng. and Meghan Lea, M.A.Sc., EIT.

3.4 Conclusion & Recommendations

3.4.1 Filtration

All three filter units were not able to produce filtered water with turbidity less than or equal to 0.2 NTU in at least 95% of the measurements made. As such, the Cornwallis WTP does not meet all the requirements to receive the removal credits as per *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*. **Control strategies such as more frequent backwashing and updating PLC programing should be implemented to mitigate exceedances. If exceedances remain an issue after operational changes have been made, a comprehensive filter evaluation could also be completed. This would be done to examine and evaluate the condition of the filters and if appropriate, provide filter optimization options and recommendations**

The plant can meet the maximum design flow of the WTP while only operating one filter, providing the necessary redundancy.

3.4.2 Membranes

This section is not applicable for this system.

3.4.3 Primary Disinfection

The WTP uses sodium hypochlorite as primary disinfection. Calculations for CT confirm that primary disinfection adequately attains a 2.0-log reduction of viruses and 0.5-log reduction of *Giardia* prior to entering the distribution system.

MCA should update the current disinfection SOP to formally outline operational setpoints, worst case scenario CT values, response procedures, and operation/maintenance of the disinfection equipment.

3.4.4 Secondary Disinfection

Secondary disinfection is achieved by maintaining a minimum free chlorine residual of 0.2 mg/L at all points within the distribution system. Grab samples are collected weekly at designated sample locations and online chlorine analyzers continuously monitor free chlorine residual levels leaving the WTP and water storage tank reservoir.

3.4.5 Other Critical Processes

Other critical processes include chemical injection systems for coagulation, pH adjustment, and corrosion control.

3.4.6 Waste Streams

3.4.6.1 Filter-to-Waste

The existing filter-to-waste sequence meets the requirements of the *Nova Scotia Treatment Standards for Municipal Drinking Water*. Filters direct water to waste holding tank when measured turbidity at the filter outlet exceeds 0.2 NTU. This required range should be documented in the filter SOP.

3.4.6.2 Filter Backwash Water

Filter backwash water is discharged into a municipal sewer and treated at the WWTP. Consequently, it has no effect on the water quality of surrounding surface water.

3.4.7 Distribution Water Quality

3.4.7.1 Chlorine Residual Levels

Samples from the distribution system for chlorine residual were collected weekly at two sample locations using grab samples as per the *Approval to Operate* conditions. Samples were collected at a different site in January and February. Sampling results for one site are incomplete. Results indicate the chlorine residuals did not fall below 0.2 mg/L or exceed 4.0 mg/L.

3.4.7.2 Microbial Water Quality

Samples from the distribution system for chlorine residual were collected weekly at two sample locations using grab samples as per the *Approval to Operate* conditions. Samples were collected at a different site in January and February. Sampling results for one site are incomplete. All test results were absent for the presence of *E. coli* and total coliforms in 2022.

3.4.7.3 Turbidity

The distribution system was monitored for turbidity on a weekly basis at two sampling locations from March to December and one alternate location in January and February; therefore, sampling results are incomplete.

Schedule A in the *Approval to Operate* requires the Cornwallis WTP to collect turbidity samples on a weekly basis to monitor for distribution turbidity to ensure values are maintained below 5.0 NTU. The sampling records for 2022 distribution turbidity levels for all locations were below the limit but are incomplete as a full year of sampling results was not provided.

3.4.7.4 Cross Connection Control Program

MCA has developed a Cross Connection Control Program to partially comply with NSECC requirements. The Cross Connection Control Program requires all multi residential units (greater than four units), industrial, commercial, and institutional buildings to install a Backflow Prevention Device (BFD) on their water service lateral. The devices are installed to

provide premises isolation at the entrance to the building for new sprinkler services, and on the customer's side of the water meter for domestic services.

Currently the plan does not meet the minimum requirements outlined in *A Guide to Assist Nova Scotia Municipal Water Works Develop a Cross Connection Control Program*. **MCA should update the cross-connection control program to include a detailed project scope, budget, authority, and timelines.**

3.4.7.5 Other Distribution System Monitoring Programs

MCA conducts the following distribution system monitoring:

- Annual flushing program with inspection of hydrants and system gate valves.
- Ongoing leak detection program in development, includes both flow monitoring and correlation and acoustic leak detection equipment.

There is currently no formal reservoir inspection program in place at the Cornwallis reservoir. It is recommended that a program be established to conduct interior inspection in the reservoir on a regular basis.

3.4.8 On-Site Inspection

An on-site inspection was conducted on June 7, 2023. The WTP appeared to be in good working order. Discussions were held regarding manganese exceedances and corrective measures to implement.

4 Operations, Monitoring, & Management

4.1 Operations & Maintenance

As required by the *Approval to Operate*, MCA has a limited Operations and Maintenance Manual which outlines the characteristics of the system and includes emergency actions and limited SOPs for normal operations. Copies of the Operations and Maintenance Manual are available digitally, and operations staff have access to these documents and are aware of their contents.

All certified operators make process adjustments such as chemical dosing changes, perform equipment and instrument maintenance as required based on experience, and continuous evaluation of the system performance. The Operator in Direct Responsible Charge (ODRC) is ultimately responsible for changes, and significant changes beyond routine adjustments are discussed with the ODRC prior to implementing the change. The Operations and Maintenance Manual lacks detailed SOPs for the operations staff to follow. The maintenance plan was reviewed and is not adequate to ensure the long-term viability of the Municipal Public Drinking Water Supply, including distribution system components.

MCA should update the Operation and Maintenance Manual to include detailed SOPs in accordance with the NSECC document *A Guide to Assist Nova Scotia Municipal Water Works Develop a Comprehensive Operations Manual.*

4.2 Monitoring & Reporting

The approved monitoring program was submitted to NSECC in 2022. The program includes quality assurance programs and training, water quality compliance limits, sampling sites, and monitoring plans. Compliance monitoring is required to ensure that the water adheres to the quality standards outlined in the *GCWDQ/GMPDWS*. A summary of the raw, treated, and SWPP sampling programs are provided in Table 4.1, Table 4.2, and Table 4.3 respectively.

Table 4.1: Raw Water Sampling Program

Summary of Raw Water Requirements			
Parameter	***Approval to Operate* Sampling Requirements**		**Cornwallis Water System Sampling Program**
	Location	**Frequency**	**Frequency**
Turbidity	Raw Water	Continuous	Continuous
Water Volume	Flow Meter	Continuous	Continuous
All *GMPDWS*	Raw Water	Annually	Annually
All *GCDWQ*	Raw Water	Every 5 years	Every 5 years
Viruses	Raw Water	As Requested	As Requested
Manganese	Raw Water	Quarterly	Quarterly
Giardia and *Cryptosporidum*	Raw Water	As Requested	As Requested
Cyanobacteria	Raw Water	Visual monitoring weekly – May to October	Not required*
Cyanobacterial Toxins – Total Microcystins	Raw Water	During a bloom and along with 5-year*GCDWQ* testing	Not required*

* No documentation provided for these parameters to be excluded. Operations staff had no knowledge on NSECC approval for sampling reductions/omissions.

Table 4.2: Distribution Water Sampling Program

Summary of Treated Water and Distribution Monitoring Requirements			
Parameter	***Approval to Operate* Sampling Requirements**		**Cornwallis Water System Sampling Program**
	Location	**Frequency**	**Frequency**
Turbidity	Individual Filter Effluent	Continuous	Continuous
	Distribution Sample Points	Weekly Grab	Weekly Grab
Temperature	CT Control Point	Continuous	Continuous
pH	CT Control Point	Continuous	Continuous
Free Chlorine	CT Control Point	Continuous	Continuous
	Storage Structure Outlet	Continuous	Continuous
	Distribution Sample Points	Weekly Grab	Weekly Grab
Total Coliform & *E. coli* (P/A)	Distribution Sample Points	Weekly Grab	Weekly Grab
Parameters per Corrosion Monitoring Program	Distribution Sample Points	Quarterly	Annual as per NSECC approval*
Aluminium	Water entering distribution	Monthly	No longer required
	Distribution Sample Points	Monthly	No longer required
Manganese	Entering Distribution	Quarterly	Quarterly
Lead – Flushed Samples	Representative Locations in Distribution System	Annually (Warmest Month)	Annually (Warmest Month)
Lead (Health Canada)	See Lead Sampling Plan	Annually (May to October)	Annually (May to October)
THM's	Distribution Sample Points	Quarterly	Quarterly
HAA's	Distribution Sample Points	Quarterly	Quarterly
All *GMPDWS*	Entering Distribution	Annually	Annually
All health-related parameters of *GCDWQ*	Entering Distribution	Every 5 years	Every 5 years
Viruses	Water entering distribution	As requested	As requested
Giardia and *Cryptosporidium*	Water entering distribution	As requested	As requested
Cyanobacterial Toxins	Storage Tank Outlet	During a bloom and along with 5-year *GCDWQ* testing	During a bloom and along with 5-year *GCDWQ* testing

* No documentation provided for these parameters to be excluded. Operations staff had no knowledge on NSECC approval for sampling reductions/omissions.

Table 4.3: Source Water Protection Plan Sampling Program

	Locations		
Parameter	**Outlet of Cady Lake (low-density residential area)**	**Outlets of Potter Lake, Shell Camp Lake, & Mud Lake**	**Raw water before treatment**
Turbidity	Quarterly	Semi-annual	Daily
Conductivity	Quarterly	Quarterly	Annual
pH	Quarterly	Quarterly	Daily
Total Coliform and *E. coli*	Semi-annual	Semi-annual	Weekly
Nitrate	Semi-annual	Semi-annual	Annual
Chloride	Semi-annual	Semi-annual	Semi-annual
Total Dissolved Solids (TDS)	Annual	Annual	Annual
Pesticides	Annual	Annual	Annual
Polychlorinated Biphenyls (PCBs)	Annual	Annual	Annual
Volatile Organic Compounds (VOCs)	Annual	N/A	Annual
Total Petroleum Hydrocarbons	Annual	N/A	Annual

All samples collected for the various monitoring programs are sent to AGAT Laboratories in Dartmouth, NS for analysis. AGAT is an accredited laboratory as per the *Policy on Acceptable Certification of Laboratories*.

4.2.1 Review of Recent Submitted Annual Report

The 2022 Annual Report was reviewed. Not all sections were completed; most notably, distribution system corrosion control parameters, manganese and lead/copper sampling results were not included.

MCA should ensure that each section of the Annual Report where applicable to the Cornwallis system is completed in its entirety each year. The document can be modified from the basic template provided by NSECC.

4.3 Management

The Cornwallis system has been classified as a Class III Water Treatment Facility and a Class II Water Distribution Facility. James Jenner, Chief Operator is the Operator in Direct Responsible Charge (ODRC) of the WTP. A summary of plant staffing information is provided as:

- James Jenner (ODRC) - Level III Water Treatment.
- John Webber - Level III Water Treatment.
- Andrew Cranton – Level II Water Treatment.
- Charles Grant – Level I Water Treatment.
- Amy Brown – Level I Water Treatment.
- Matt Leonard – Level I Water Treatment.

The ODRC protocol information is provided in Appendix A.

4.4 Conclusion & Recommendations

4.4.1 Operation & Maintenance

The system has a limited Operations and Maintenance Manual. It is recommended that a comprehensive manual be created that elaborates on protocols and procedures.

MCA should update the Operations and Maintenance Manual to include detailed SOPs on daily operations.

4.4.2 Monitoring & Reporting

Results from all sampling listed in the approved Annual Sampling Plan was not available for review. The 2022 Annual Report did not include reporting on all parameters (e.g. corrosion control parameters).

MCA should ensure that each section of the Annual Report where applicable to the Cornwallis system is completed in its entirety each year. The document can be modified from the basic template provided by NSECC.

4.4.3 Management

The ODRC is James Jenner. All operators are adequately certified and there is a sufficient number of operators as well as back-up personnel available. The procedure for when the ODRC is absent is outlined in Appendix A.

5 Ability to Comply

This section will provide a summary of conclusions as outlined in the NSECC Terms of Reference.

5.1 Summary

5.1.1 Source Water Characterization

5.1.1.1 Treatment Process

Water is supplied from surface water from the Cady Lake Watershed and surrounding watersheds within the Municipal boundaries of the MCA. The treatment process consists of coagulation, flocculation, DAF, filtration, and chlorine disinfection. The *Approval to Operate* is valid until June 1, 2029.

5.1.1.2 Turbidity Levels & Associated Criteria

The turbidity of filtered water leaving the filtration units must be less than or equal to 0.2 NTU in at least 95% of the measurements made or at least 95% of the time each calendar month. All three filters at the Cornwallis WTP were not able to meet this criterion at all times in 2022. As such, all three filters were not compliant with the turbidity level criteria outlined in the *Approval to Operate*.

5.1.1.3 Primary Disinfection

All municipal drinking water systems in Nova Scotia are required to meet the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems* to achieve:

- 3.0-log removal for *Giardia* and *Cryptosporidium*.
- 4.0-log removal credits for viruses.

The filtration drinking water technology facility located in Cornwallis can receive a 3.0-log removal credit for protozoa (*Cryptosporidium* oocysts and *Giardia* cysts), and a 2.0-log credit for viruses, based on obtaining the individual filter turbidity limits described in the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*. Due to the turbidity exceedances, the system was not able to achieve the necessary levels to qualify for these removal credits at all times. As such, the 0.5-log removal of *Giardia* and 2.0-log removal of viruses is not completed using chlorine disinfection.

CT calculations for the "worst case scenario" confirm that chlorine disinfection is adequate to always achieve both the 0.5-log reduction of *Giardia* and a 2.0-log reduction of viruses. As such, the combination of filtration and chlorine inactivation is able to remove and inactivate protozoa (*Giardia* and *Cryptosporidium*) and viruses to NSECC's *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*.

Based on calculation of the primary disinfection system, CT is achieved using sodium hypochlorite with contact in the treated water storage reservoir.

5.1.1.4 Secondary Disinfection

Secondary disinfection is achieved by maintaining a minimum free chlorine residual of 0.2 mg/L at all points within the distribution system. Weekly grab samples within the distribution system are used to ensure that the minimum chlorine residual is met.

5.1.1.5 Other Critical Processes

There are no other critical processes at the WTP.

5.1.1.6 Process Waste Streams

Filters are backwashed until effluent achieves a critical turbidity value within a specified range. All process waste from filter backwash and the DAF clarifier are directed to an on-site wastewater tank which feeds directly to the Cornwallis WWTP.

5.1.2 Distribution System Water Quality

5.1.2.1 Chlorine Residuals

Chlorine residuals in the distribution system are acceptable and met a minimum concentration of 0.2 mg/L. Weekly samples were performed on the treated water at two locations, though only one location had results for an entire year. Online continuous monitoring was also conducted at the outlet of the water storage reservoirs in the distribution system.

5.1.2.2 Microbial Water Quality

Microbiological samples for *E. coli* and total coliforms were collected at two distribution locations weekly, though only one location had results for an entire year. All results for each location tested absent for *E. coli* and total coliforms in 2022.

5.1.2.3 Turbidity

Grab samples are collected weekly from two distribution sample points from March to December. Sampling occurred at a single alternate location in January and February. All samples collected were below 5.0 NTU though results were incomplete.

5.1.2.4 Cross Connection Control Program

MCA has implemented an approved Cross Connection Control Program to partially comply with NSECC requirements.

MCA should update the cross-connection control program to include a detailed project scope, budget, authority and timelines.

5.1.2.5 Other Distribution Monitoring System

No other distribution system monitoring programs are in place for the system.

5.1.3 Operations, Monitoring, & Management

5.1.3.1 Operations & Maintenance

The Cornwallis WTP has an Operations and Maintenance Manual. **It is recommended that the manual be updated to better outline the characteristics of the system and include emergency actions and SOPs for normal facility operation.**

5.1.3.2 Monitoring & Reporting

The 2022-2023 monitoring program and 2022 Annual Report appear to address all requirements, with minor exceptions including lead/copper, manganese, and corrosion control sampling results.

All chemical analyses are carried out at the AGAT Laboratories in Dartmouth. AGAT Laboratories is an accredited laboratory as per the *Policy on Acceptable Certification of Laboratories*.

5.1.3.3 Management

The Cornwallis WTP has been classified a Class III Water Treatment Facility and a Class II Water Distribution Facility. James Jenner, Chief Operator is the ODRC of the WTP.

5.1.4 Recommendations

Table 5.1 summarizes the recommendations to problems identified throughout this report.

Table 5.1: Recommendations

Category	Problem/ Challenge Area	Recommended Action	Time Frame to Complete	Opinion of Cost
SWPP	Annual SWPP Meeting	Commence annual SWPAC meeting.	2023	$0
Treatment	Filtration Exceedances	Comprehensive filter evaluation to determine any filter deficiencies.	1 year	$10,000
Management	Operations and Maintenance Manual and SOPs limited	Develop a comprehensive Operations and Maintenance manual with SOPs in accordance with the NSECC guidance manual.	1 year	No cost if done in-house
Water Quality	SWPP and Manganese Monitoring	Complete monitoring proposed in the SWPP, including water quality sampling and watershed inspections.	1 year	$10,000/year
Water Quality	Corrosion Control Monitoring	Formalize a comprehensive Corrosion Control Plan with action limits/responses that align with the current *Approval to Operate*, aiming to reduce lead and copper, to correspond to existing sampling plan.	6 months	No cost if done in-house
Monitoring	Cyanobacteria monitoring	Establishing key water quality parameters for testing the occurrence of cyanobacteria	3 months	No cost if done in-house
Monitoring	Copper and Lead Monitoring	Copper and Lead sampling frequency and number of locations should be clarified with NSECC, approval should be updated to reflect any changes.	1 year	No cost if done in-house

Category	Problem/ Challenge Area	Recommended Action	Time Frame to Complete	Opinion of Cost
Monitoring	DBP Sampling	DBPs should be sampled at ZURI Canada, since this site represents the longest retention time in the distribution system.	3 months	$400/year
Monitoring	Copper and Lead Sampling	Information to residents about the lead and copper sampling should follow lead and copper management guidelines.	1 year	No cost if done in-house
Treatment	Disinfection SOP	Update disinfection SOP to include notification and response procedures in the event of CT parameters falling outside of design ranges.	Immediate	No cost if done in-house
Management	Limited Cross Connection Control Plan	Update Cross Connection Control Plan to comply with minimum requirements set by NSECC.	3 months	No cost if done in-house

5.2 Report Preparation

5.2.1 Engineer's Declaration

I, the undersigned, hereby declare that to the best of my knowledge, the information contained herein and the information in support of this submission, as completed by me, is complete and accurate in accordance with my obligations under the Engineering Profession Act and its regulations. I further declare that this submission has been prepared in accordance with the published standard for this submission.

Ben Bickerton, M.A.Sc., P.Eng.
Process Engineer

APPENDIX A

Tables Required by the Terms of References

Table A.1: Groundwater Under the Direct Influence of Surface Water: MPA Test Results
Table not required for this system as it is a surface water system.

Table A.2: Annual Trihalomethanes Concentrations by Sample Location

Sampling Period/Month		Site A	Site B	Site C
		THM total (mg/L)	THM total (mg/L)	THM total (mg/L)
Q1	January	-	-	-
	February	0.043	0.032	0.022
	March	-	-	-
Q2	April	-	-	-
	May	0.082	0.061	0.037
	June	-	-	-
Q3	July	0.154	0.153	0.110
	August	-	-	-
	September	-	-	-
Q4	October	0.043	0.043	0.052
	November	-	-	-
	December	-	-	-
LRAA (mg/L)		**0.080**	**0.072**	**0.055**
Meets MAC of 0.1 mg/L (100 µg/L)		**Yes**	**Yes**	**Yes**

Table A.3: Annual Haloacetic Acid Concentrations by Sample Location

Sampling Period/Month		Site A	Site B	Site C
		HAA (5) mg/L	HAA (5) mg/L	HAA (5) mg/L
Q1	January	-	-	-
	February	0.033	0.036	0.029
	March	-	-	-
Q2	April	-	-	-
	May	0.041	0.050	0.041
	June	-	-	-
Q3	July	0.058	0.067	0.085
	August	-	-	-
	September	-	-	-
Q4	October	0.051	0.081	0.075
	November	-	-	-
	December	-	-	-
LRAA (mg/L)		**0.046**	**0.058**	**0.057**
Meets MAC of 0.08 mg/L (80 µg/L)		**Yes**	**Yes**	**Yes**

Table A.4: Health-Related Parameters in the Guidelines for Canadian Drinking Water Quality

Parameter	MAC (mg/L)	Raw Water			Treated Water		
		Sampling Period			Sampling Period		
		August 30 ,2016	2022	2027	August 30 ,2016	2022	2027
Bacteria		-	-	-	-	-	-
Total Coliforms	None per 100 mL	-	-	-	-	-	-
E. coli	None per 100 mL						
Aluminum	2.9	-	-	-	<0.01	-	-
Antimony	0.006	-	-	-	<0.02	-	-
Arsenic	0.01	-	-	-	<0.02	-	-
Atrazine	0.005	-	-	-	<0.0005	-	-
Barium	2	-	-	-	0.112	-	-
Benzene	0.005	-	-	-	<0.001	-	-
Benzo[*a*]pyrene	0.00004	-	-	-	-	-	-
Boron	5	-	-	-	0.09	-	-
Bromate	0.01	-	-	-	<0.01	-	-
Bromoxynil	0.03	-	-	-	<0.0003	-	-
Cadmium	0.007	-	-	-	<0.0003	-	-
Carbon tetrachloride	0.002	-	-	-	<0.00056	-	-
Chlorate	1	-	-	-	0.24	-	-
Chlorite	1	-	-	-	<0.02	-	-
Chlorpyrifos	0.09	-	-	-	<0.001	-	-
Chromium	0.05	-	-	-	<0.02	-	-
Copper	2	-	-	-	<0.02	-	-
Cyanide	0.2	-	-	-	-	-	-
Cyanobacterial toxins	0.0015	-	-	-	-	-	-
Dicamba	0.11	-	-	-	<0.005	-	-
1,4-Dichlorobenzene	0.005	-	-	-	<0.001	-	-
1,2-Dichloroethane	0.005	-	-	-	<0.002	-	-
1,1-Dichloroethylene	0.014	-	-	-	<0.002	-	-
Dichloromethane	0.05	-	-	-	-	-	-
2,4-Dichlorophenoxy acetic acid (2,4-D)	0.1	-	-	-	-	-	-
Dimethoate	0.02	-	-	-	-	-	-
1,4-Dioxane	0.05	-	-	-	-	-	-
Diquat	0.05	-	-	-	<0.05	-	-
Ethylbenzene	0.14	-	-	-	<0.02	-	-
Fluoride	1.5	-	-	-	-	-	-
Glyphosate	0.28	-	-	-	<0.15	-	-
Haloacetic acids - Total (HAAs)	0.08	-	-	-	0.045	-	-
Lead	0.005	-	-	-	<0.005	-	-
Malathion	0.19	-	-	-	<0.005	-	-
Manganese	0.12	-	-	-	<0.02	-	-
Mercury	0.001	-	-	-	<0.00005	-	-
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	0.35	-	-	-	-	-	-

Parameter	MAC (mg/L)	Raw Water			Treated Water		
		Sampling Period			Sampling Period		
		August 30 ,2016	2022	2027	August 30 ,2016	2022	2027
Metribuzin	0.08	-	-	-	<0.00025	-	-
Nitrate-Nitrogen	10	-	-	-	1.63	-	-
Nitrilotriacetic acid (NTA)	0.4	-	-	-	-	-	-
Nitrite-Nitrogen	1	-	-	-	-	-	-
N-Nitroso dimethylamine (NDMA)	0.00004	-	-	-	-	-	-
Pentachlorophenol	0.06	-	-	-	<0.001	-	-
Perfluorooctane Sulfonate (PFOS)	0.0006	-	-	-	-	-	-
Perfluorooactanoic Acid (PFOA)	0.0002	-	-	-	-	-	-
Selenium	0.05	-	-	-	<0.002	-	-
Strontium	7	-	-	-	0.032	-	-
Tetrachloroethylene	0.01	-	-	-	<0.001	-	-
Toluene	0.06	-	-	-	<0.002	-	-
Trichloroethylene	0.005	-	-	-	<0.001	-	-
2,4,6-Trichlorophenol	0.005	-	-	-	<0.0005	-	-
Trihalomethanes (THM)	0.1	-	-	-	0.075	-	-
Turbidity	See Approval	-	-	-	0.9	-	-
Uranium	0.02	-	-	-	<0.0014	-	-
Vinyl chloride	0.002	-	-	-	<0.0006	-	-
Xylenes (total)	0.09	-	-	-	<0.04	-	-

Table A.5: Guidelines for Monitoring Public Drinking Water Supplies

Parameter	MAC (mg/L)	AO (mg/L)	Raw (2022)	Treated (2022)
Alkalinity			6	55
Aluminium	0.1/0.2		.211	.070
Ammonia			<.00003	<.00003
Antimony	0.006		<.002	<.002
Arsenic	0.01		<.002	<.002
Barium	1		<.005	<.005
Boron	5		<.005	.006
Cadmium	0.005		<.00009	<.00009
Calcium			.0014	.0016
Chloride		≤250	.006	.010
Chromium	0.05		<.001	<.001
Colour		≤ 15 TCU	<5	<5
Conductivity			36	207
Copper		≤1.0	.650	<.050
Fluoride	1.5		.00014	<.00012
Hardness			3.5	4
Iron		≤0.3	<.005	**.650**
Lead	0.01		.0008	<.0005
Magnesium			<.0008	<.0008
Manganese	0.12	≤0.02	**.087**	**.133**
Nitrate-nitrogen	10		<.00005	.00008
pH		6.5-8.5	6.41	7.96
Potassium			.0004	.0004
Selenium	0.01		<.001	<.001
Sodium		≤200	4	43
Sulphate		≤500	<.002	.039
Total Dissolved Solids		≤500	16	128
Total Organic Carbon			9	1.9
Turbidity			4.2	2.3
Uranium	0.05		<.0002	<.0002
Zinc		≤5	<.005	.083

Table A.6.a – Water Withdrawal Data

Raw Water Flow				
Month	**Monthly Maximum Daily Rate (m^3/d)**	**Monthly Average Daily Rate (m^3/d)**	**Monthly Withdrawal Volume (m^3)**	**Annual Withdrawal Volume (m^3)**
January	785	498	15,428	-
February	822	498	13,950	-
March	707	487	15,082	-
April	704	458	13,753	-
May	737	501	15,532	-
June	731	410	12,286	-
July	744	567	17,582	-
August	1190	663	20,562	-
September	757	643	19,295	-
October	744	573	17,771	-
November	789	570	17,096	-
December	748	596	18,475	-
Total Annual Withdrawal				196,812

Table A.6.b – Water Withdrawal Data Comparison to Approved Limits

Source – Cady Lake		
Specify Approved Withdrawal Limits		**Exceeds (Yes/No)**
Maximum Daily Rate (m^3/day)	1125	No
Average Daily Rate (m^3/day)	700	No
Volume (30 days) (m^3)	-	-
Volume (Annual) (m^3)	-	-

Table B.1: Membrane Filtration Direct Results
Not required for this system.

Table B.2 - Filter Backwash Water – Discharges to A Freshwater Watercourse
Not required for this system.

Table B.3: Filter Backwash Water – Discharge to Land or Soil
Not required for this system.

Table B.4 - Filter Backwash Water – Discharge to A Marine Or Brackish Environment
Not required for this system.

Table C.1: Operator in Direct Responsible Charge

The operator in overall direct responsible charge (ODRC) is:
James Jenner

Signature of Operator: _____
Date: June 30, 2023

Protocols in place during the absence of the operator in ODRC include:

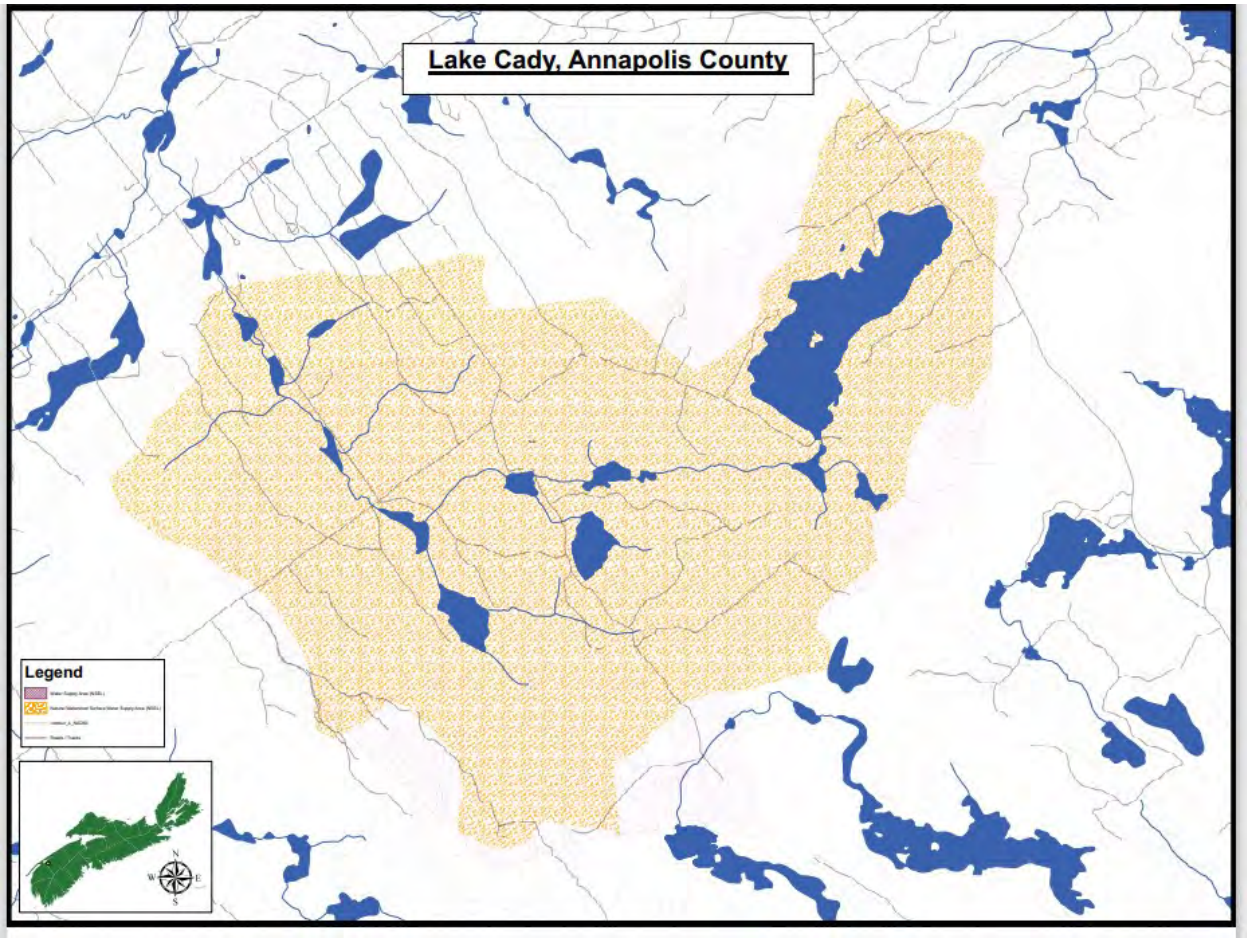
When on vacation:
There will be no changes made to any treatment process in the water treatment plants. Relief operators will maintain and monitor the treatment process and record all information.

When ill:
There will be no changes made to any treatment process in the water treatment plants. Relief operators will maintain and monitor the treatment process and record all information.

Other (specify):
There will be no changes made to any treatment process in the water treatment plants. Relief operators will maintain and monitor the treatment process and record all information.

APPENDIX B

Watershed Boundary Plan


Lake Cady, Annapolis County
Legend
N
W
E
S

APPENDIX C

Distribution Map


Sample Point A:
Wastewater Treatment
Plant (Billy Bishop Road)
Sample Point B:
Maintenance Depot
(Corvette Drive)
Water Treatment
Plant & Treated
Water Reservoir
Raw Water Reservoir
Sample Point C:
1051 Waldeck Line Road
Marine Drive
Sherman Street
Bean Street
Atlantic Avenue
Corvette Drive
Highway 1
Hillside Drive
Old School Hill Road
Harbour View Crescent
South Broadway Avenue
Normandy Road
Burns Hill Road
The Dingle
Waldeck Line
Perry Jane Riley

APPENDIX D

Corrosion Control Program Results

AGAT Laboratories

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Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
PO Box 100
Annapolis Royal, NS B0S1A0
(902) 532-3141
ATTENTION TO: James Jenner
PROJECT: Cornwallis Lead & Copper
AGAT WORK ORDER: 22X909305
WATER ANALYSIS REVIEWED BY: Sara Knox, Data Reviewer
DATE REPORTED: Jun 22, 2022
PAGES (INCLUDING COVER): 5
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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Certificate of Analysis

AGAT WORK ORDER: 22X909305
PROJECT: Cornwallis Lead & Copper

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Health Canada Lead & Copper Sampling - Drinking Water

DATE RECEIVED: 2022-06-17 **DATE REPORTED: 2022-06-22**

		SAMPLE DESCRIPTION:		90 Hillside Drive	406 Dingle	149 Topsail	108 Old School
		SAMPLE TYPE:		Water	Water	Water	Water
		DATE SAMPLED:		2022-06-14	2022-06-14	2022-06-14	2022-06-14
Parameter	Unit	G / S	RDL	3990464	3990465	3990466	3990467
Total Copper	ug/L	2000, 1000	2	9	5	19	7
Total Lead - Health Canada	ug/L	5	0.5	<0.5	<0.5	<0.5	<0.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By: Sara Knox

AGAT Laboratories

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Dartmouth, Nova Scotia
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FAX (902)468-8924
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
AGAT WORK ORDER: 22X909305
PROJECT: Cornwallis Lead & Copper
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Water Analysis

RPT Date: Jun 22, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Health Canada Lead & Copper Sampling - Drinking Water															
Total Copper	3984157		420	433	3.2%	< 2	108%	80%	120%	108%	80%	120%	NA	70%	130%
Total Lead - Health Canada	3984157		2.2	2.3	NA	< 0.5	101%	80%	120%	107%	80%	120%	92%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Certified By: Lara Knox

AGAT Laboratories

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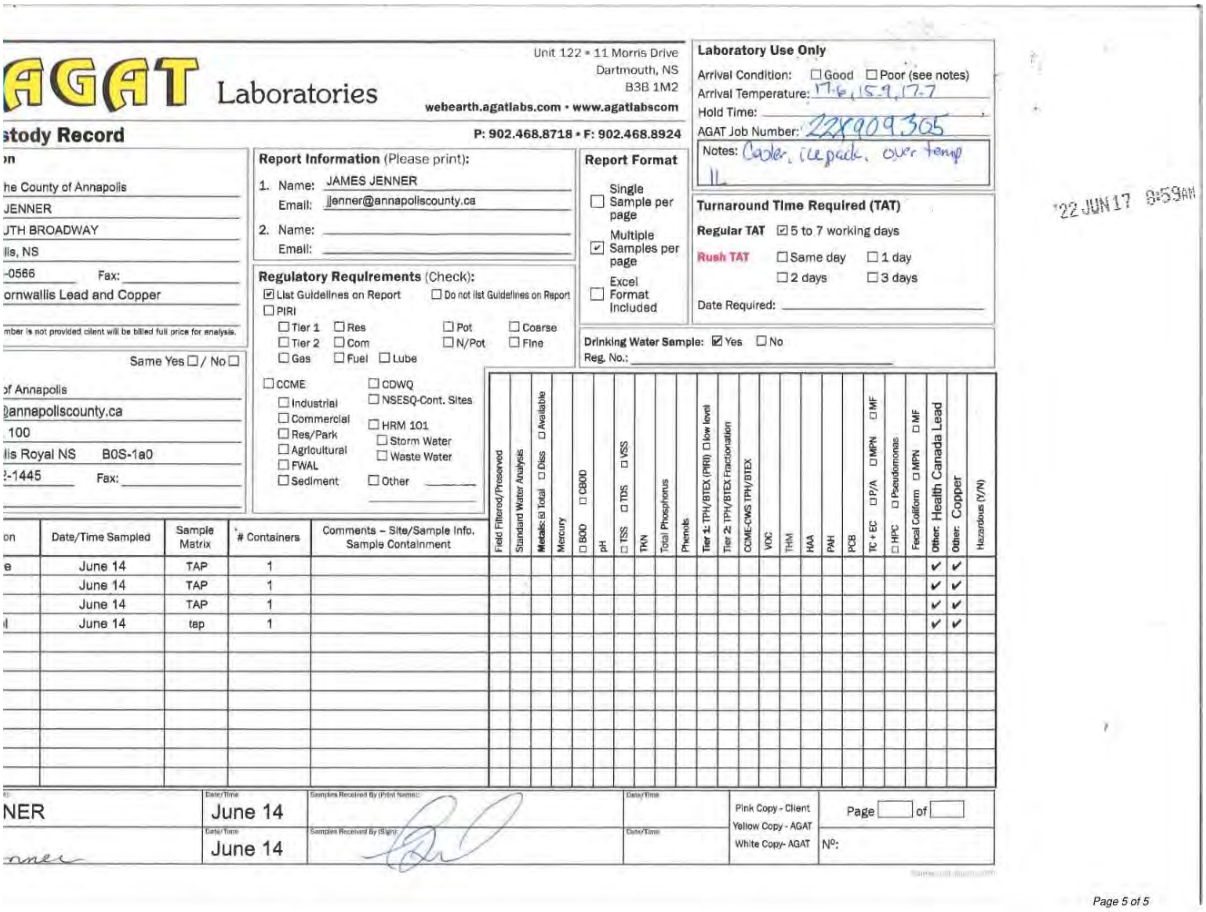
Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY **AGAT WORK ORDER: 22X909305**

PROJECT: Cornwallis Lead & Copper **ATTENTION TO: James Jenner**

SAMPLING SITE: **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Copper	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Lead - Health Canada	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS



AGAT Laboratories

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Dartmouth, NS
B3B 1M2
webearth.agatlabs.com • www.agatlabscom
P: 902.468.8718 • F: 902.468.8924

stody Record

Laboratory Use Only
Arrival Condition: ☐ Good ☐ Poor (see notes)
Arrival Temperature: 17.6, 15.9, 17.7
Hold Time:
AGAT Job Number: 22X909.305
Notes: Cooler, icepack, over temp
11

'22 JUN 17 8:59AM

on
he County of Annapolis
JENNER
UTH BROADWAY
lis, NS
-0566 Fax:
ornwallis Lead and Copper
mber is not provided client will be billed full price for analysis.

Same Yes ☐ / No ☐
f Annapolis
@annapoliscounty.ca
100
lis Royal NS B0S-1a0
2-1445 Fax:

Report Information (Please print):
1. Name: JAMES JENNER
Email: jjenner@annapoliscounty.ca
2. Name:
Email:

Report Format
☐ Single Sample per page
☑ Multiple Samples per page
☐ Excel Format Included

Turnaround Time Required (TAT)
Regular TAT ☑ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days
Date Required:

Regulatory Requirements (Check):
☑ List Guidelines on Report ☐ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ NSESQ-Cont. Sites
☐ Commercial ☐ HRM 101
☐ Res/Park ☐ Storm Water
☐ Agricultural ☐ Waste Water
☐ FWAL
☐ Sediment ☐ Other

Drinking Water Sample: ☑ Yes ☐ No
Reg. No.:

on	Date/Time Sampled	Sample Matrix	# Containers	Comments – Site/Sample Info. Sample Containment	Field Filtered/Preserved	Standard Water Analysis	Metals: ☐ Total ☐ Diss ☐ Available	Mercury	☐ BOD ☐ CBOD	pH	☐ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PHB) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ P/A ☐ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Fecal Coliform ☐ MPN ☐ MF	Other: Health Canada Lead	Other: Copper	Hazardous (Y/N)
e	June 14	TAP	1																						✓	✓	
	June 14	TAP	1																						✓	✓	
	June 14	TAP	1																						✓	✓	
l	June 14	tap	1																						✓	✓	

NER
June 14
June 14

Samples Received By (Print Name):
Samples Received By (Sign):
Date/Time
Date/Time

Pink Copy - Client
Yellow Copy - AGAT
White Copy- AGAT

Page ☐ of ☐
№:

Page 5 of 5

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
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http://www.agatlabs.com

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
PO Box 100
Annapolis Royal, NS B0S1A0
(902) 532-3141
ATTENTION TO: James Jenner
PROJECT: Cornwallis Thm's, Haa's Copper, SWA
AGAT WORK ORDER: 22X917864
TRACE ORGANICS REVIEWED BY: Wendy Rose, Trace Organics Lab Technician
WATER ANALYSIS REVIEWED BY: Sara Knox, Data Reviewer
DATE REPORTED: Jul 19, 2022
PAGES (INCLUDING COVER): 16
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
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- *The test results reported herewith relate only to the samples as received by the laboratory.*
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- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22X917864

PROJECT: Cornwallis Thm's, Haa's Copper, SWA

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Halifax - Metals - Copper (µg/L)

DATE RECEIVED: 2022-07-08

DATE REPORTED: 2022-07-19

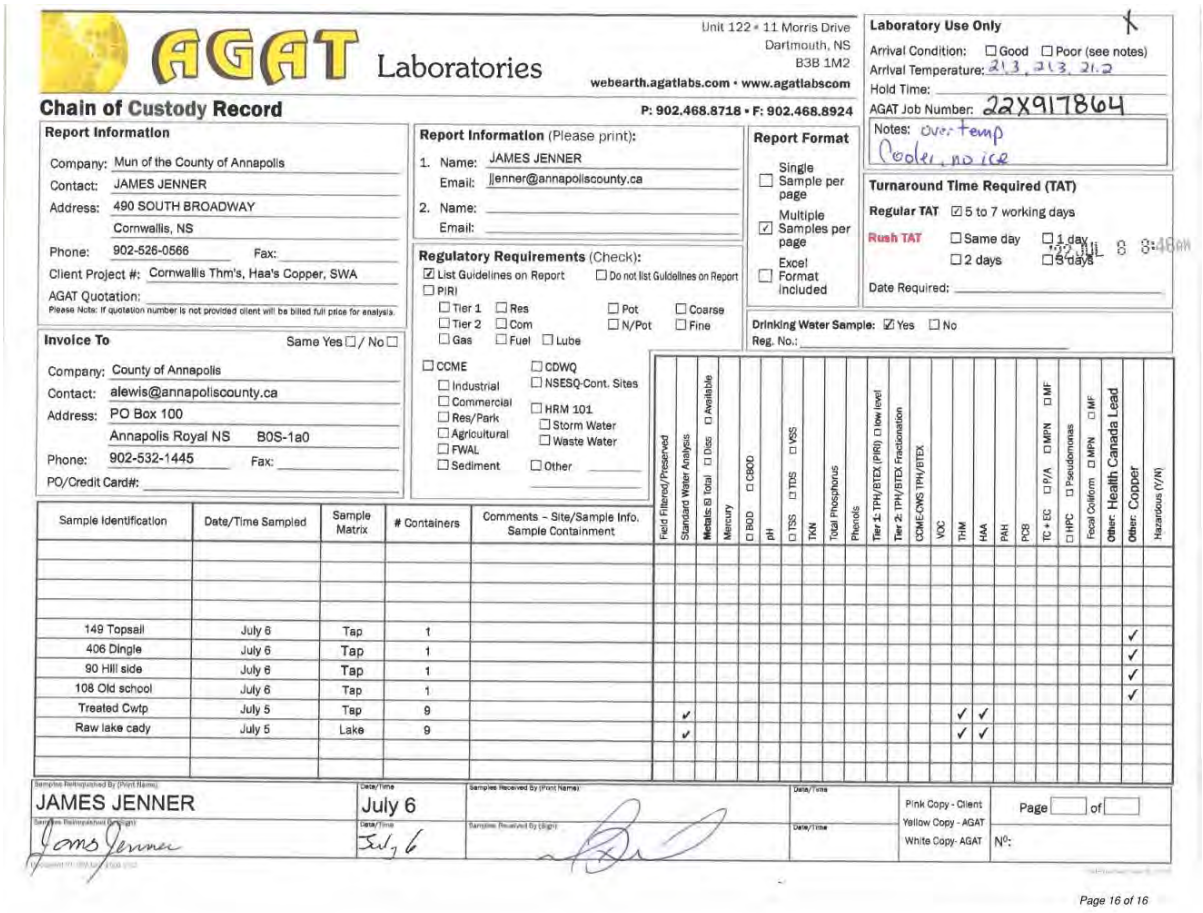
		SAMPLE DESCRIPTION:		149 Topsail	406 Dingle	90 Hillside	108 Old School
		SAMPLE TYPE:		Water	Water	Water	Water
		DATE SAMPLED:		2022-07-06	2022-07-06	2022-07-06	2022-07-06
Parameter	Unit	G / S	RDL	4065920	4065922	4065923	4065924
Total Copper	ug/L	2000, 1000	1	4	2	17	3

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4065920-4065924 < - Values refer to Report Detection Limits.

Analysis performed at AGAT Edmonton (unless marked by *)

Certified By: Sara Knox



AGAT Laboratories

Unit 122 - 11 Morris Drive
Dartmouth, NS
B3B 1M2
webearth.agatlabs.com • www.agatlabs.com
P: 902.468.8718 • F: 902.468.8924

Chain of Custody Record

Laboratory Use Only
Arrival Condition: ☐ Good ☐ Poor (see notes)
Arrival Temperature: 21.3, 21.3, 21.2
Hold Time:
AGAT Job Number: 22X917864
Notes: over temp
Cooler, no ice

Report Information
Company: Mun of the County of Annapolis
Contact: JAMES JENNER
Address: 490 SOUTH BROADWAY
Cornwallis, NS
Phone: 902-526-0566 Fax:
Client Project #: Cornwallis Thm's, Haa's Copper, SWA
AGAT Quotation:
Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):
1. Name: JAMES JENNER
Email: jjenner@annapoliscounty.ca
2. Name:
Email:

Report Format
☐ Single Sample per page
☑ Multiple Samples per page
☐ Excel Format included

Turnaround Time Required (TAT)
Regular TAT ☑ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days
Date Required:

Regulatory Requirements (Check):
☑ List Guidelines on Report ☐ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ NSESQ-Cont. Sites
☐ Commercial
☐ Res/Park ☐ HRM 101
☐ Agricultural ☐ Storm Water
☐ FWAL ☐ Waste Water
☐ Sediment ☐ Other

Drinking Water Sample: ☑ Yes ☐ No
Reg. No.:

Invoice To Same Yes ☐ / No ☐
Company: County of Annapolis
Contact: alewis@annapoliscounty.ca
Address: PO Box 100
Annapolis Royal NS B0S-1a0
Phone: 902-532-1445 Fax:
PO/Credit Card#:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments - Site/Sample Info. Sample Containment
149 Topsail	July 6	Tap	1	
406 Dingle	July 6	Tap	1	
90 Hill side	July 6	Tap	1	
108 Old school	July 6	Tap	1	
Treated Cwtp	July 5	Tap	9	
Raw lake cady	July 5	Lake	9	

Field Filtered/Preserved; Standard Water Analysis; Metals: ☐ Total ☐ Diss ☐ Available; Mercury; ☐ BOD ☐ CBOD; pH; ☐ TSS ☐ TDS ☐ VSS; TKN; Total Phosphorus; Phenols; Tier 1: TPH/BTEX (PIRI) ☐ low level; Tier 2: TPH/BTEX Fractionation; CCME-CWS TPH/BTEX; VOC; THM; HAA; PAH; PCB; TC + EC ☐ P/A ☐ MPN ☐ MF; ☐ HPC ☐ Pseudomonas; Fecal Coliform ☐ MPN ☐ MF; Other: Health Canada Lead; Other: Copper; Hazardous (Y/N)

Samples Relinquished By (Print Name): JAMES JENNER	Date/Time: July 6	Samples Received By (Print Name):	Date/Time:
Samples Relinquished By (Sign): James Jenner	Date/Time: July 6	Samples Received By (Sign):	Date/Time:

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page ☐ of ☐
N°:

Page 16 of 16

APPENDIX E

Last Round of Sampling Data for *GCDWQ*

AGAT Laboratories

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CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
PO Box 100
Annapolis Royal, NS B0S1A0
(902) 532-3141
ATTENTION TO: James Jenner
PROJECT: IMAC
AGAT WORK ORDER: 16X119322
FOOD CHEMISTRY REVIEWED BY: Philippe Morneau, chimiste
TRACE ORGANICS REVIEWED BY: Jennifer Patterson, Organics Supervisor
WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Operation Manager
DATE REPORTED: Aug 30, 2016
PAGES (INCLUDING COVER): 19
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
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Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Glyphosate (Montreal) (ug/L)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

			SAMPLE DESCRIPTION:	Cornwallis Treated
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2016-07-25
Parameter	Unit	G / S	RDL	7729604
Glyphosate	ug/L		15	<15

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Montreal (unless marked by *)

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Canadian Drinking Water MAC Package (Carb./Urea Pest)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

			SAMPLE DESCRIPTION:	Cornwallis Treated
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2016-07-25
Parameter	Unit	G / S	RDL	7729604
Aldicarb	µg/L		0.15	<0.15
Bendiocarb	µg/L		2	<2
Carbofuran	µg/L		5	<5
Carbaryl	µg/L		5	<5
Diuron	µg/L		10	<10

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2023-01
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

7729604 Analysis performed within AGAT's internal laboratory network.

Certified By: J. Patterson

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Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Canadian Drinking Water MAC Package (Diq./Paraq.)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

				SAMPLE DESCRIPTION:	Cornwallis Treated
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2016-07-25
Parameter	Unit	G / S	RDL	7729604	
Diquat	µg/L	70	5	<5	
Paraquat	µg/L		1	<1	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2023-01
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

7729604 Analysis performed within AGAT's internal laboratory network.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: J. Patterson

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Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Canadian Drinking Water MAC Package (HAAs, Herbicides, OC Pest, Triaz. Pest, OP Pest., VOCs)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

		SAMPLE DESCRIPTION:		Cornwallis Treated
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2016-07-25
Parameter	Unit	G / S	RDL	7729604
Chloroacetic Acid	ug/L		1.7	<1.7
Bromoacetic Acid	ug/L		0.3	<0.3
Dichloroacetic Acid	ug/L		0.2	23.6
Trichloroacetic Acid	ug/L		0.2	12.5
Bromochloroacetic Acid	ug/L		0.2	3.1
Dibromoacetic Acid	ug/L		0.1	<0.1
Haloacetic Acids	ug/L	80	4.0	39.2
Bromoxynil	µg/L	5	0.5	<0.5
Dicamba	µg/L	120	0.05	<0.05
2,4-Dichlorophenol	µg/L		0.3	<0.3
2,4-Dichlorophenoxyacetic acid (2,4-D)	µg/L	100	0.05	<0.05
Diclofop Methyl	µg/L	9	0.05	<0.05
Dinoseb	µg/L		1	<1
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	µg/L	100	5	<5
Pentachlorophenol	µg/L	60, 30 AO	0.5	<0.5
Picloram	µg/L		0.05	<0.05
2,3,4,6-Tetrachlorophenol	µg/L		0.5	<0.5
2,4,6-Trichlorophenol	µg/L	5, 2 AO	0.5	<0.5
Aldrin	ug/L		0.05	<0.05
Dieldrin	ug/L		0.05	<0.05
Aldrin + Dieldrin	ug/L		0.05	<0.05
Methoxychlor	µg/L		0.1	<0.1
Phorate	µg/L		0.5	<0.5
Dimethoate	µg/L	20	1.5	<1.5
Terbufos	µg/L		0.7	<0.7
Chlorpyrifos	µg/L	90	1	<1
Diazinon	µg/L		1	<1
Malathion	µg/L	290	1	<1

Certified By: J. Patterson

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Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Canadian Drinking Water MAC Package (HAAs, Herbicides, OC Pest, Triaz. Pest, OP Pest., VOCs)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

Parameter	Unit	SAMPLE DESCRIPTION: / SAMPLE TYPE: / DATE SAMPLED: G / S	RDL	Cornwallis Treated Water 2016-07-25 7729604
Parathion	µg/L		1	<1
Azinophos	µg/L	20	2	<2
Benzo(a)pyrene	mg/L	0.00004	0.00001	<0.00001
Trifluralin	µg/L		1	<1
Simazine	µg/L		1	<1
Atrazine	µg/L		0.5	<0.5
Atrazine + N-dealkylated metabolites	µg/L	5	1	<1
Metribuzin	µg/L	80	0.25	<0.25
Cyanazine	µg/L		1	<1
Metolachlor	µg/L		1	<1
Vinyl Chloride	ug/L	2	0.6	<0.6
Chloroethane	ug/L		5	<5
1,1-Dichloroethylene	ug/L	14	2	<2
Methylene Chloride (Dichloromethane)	ug/L	50	2	<2
Methyl-t-Butyl-Ether (MTBE)	ug/L	15 AO	2	<2
Chloroform	ug/L		1	55
1,2-Dichloroethane	ug/L	5	2	<2
Carbon Tetrachloride	ug/L	2	1	<1
Benzene	ug/L	5	1	<1
Trichloroethylene	ug/L	5	1	<1
Bromodichloromethane	ug/L		1	9
Toluene	ug/L	60, 24 AO	2	<2
Dibromochloromethane	ug/L		1	<1
Tetrachloroethylene	µg/L		1	<1
Chlorobenzene	ug/L	80, 30 AO	1	<1
Ethylbenzene	ug/L	140,1.6 AO	2	<2
Bromoform	ug/L		1	<1
Xylenes (Total)	ug/L	300 AO	4	<4

Certified By: J. Patterson

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Canadian Drinking Water MAC Package (HAAs, Herbicides, OC Pest, Triaz. Pest, OP Pest., VOCs)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

		SAMPLE DESCRIPTION:		Cornwallis Treated
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2016-07-25
Parameter	**Unit**	**G / S**	**RDL**	**7729604**
1,4-Dichlorobenzene	ug/L	5, 1 AO	1	<1
1,2-Dichlorobenzene	ug/L		1	<1
Total Trihalomethanes	ug/L	100	1	64
Surrogate	**Unit**	**Acceptable Limits**		
2-Bromobutanoic acid	%	50-130		103
Toluene-d8	%	60-130		94
4-Bromofluorobenzene	%	60-130		91

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2023-01
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
Analysis performed at AGAT Halifax (unless marked by *)

Certified By: J. Patterson

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CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Canadian Drinking Water MAC Package (Metals, Hg & Inorganics)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

		SAMPLE DESCRIPTION:		Cornwallis Treated Water
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2016-07-25
Parameter	Unit	G / S	RDL	7729604
Total Aluminum	ug/L	2900, 100	10	83
Total Antimony	ug/L	6	2	<2
Total Arsenic	ug/L	10	2	<2
Total Barium	ug/L	2000	5	<5
Total Boron	ug/L	5000	5	<5
Total Cadmium	ug/L	7	0.3	<0.3
Total Chromium	ug/L	50	2	<2
Total Copper	ug/L	2000, 1000	2	<2
Total Iron	ug/L	300 AO	50	<50
Total Lead	ug/L	5	0.5	<0.5
Total Manganese	ug/L	120, 20 AO	2	17
Total Selenium	ug/L	50	2	<2
Total Uranium	ug/L	20	0.1	<0.1
Total Zinc	ug/L	5000 AO	5	38
Total Sodium	mg/L	200 AO	0.1	63.4
Mercury	ug/L	1	0.05	<0.05
pH		7.0-10.5		8.13
Turbidity	NTU	1.0	0.1	0.6
True Color	TCU	15 AO	5	10
Chloride	mg/L	250 AO	1	23
Fluoride	mg/L	1.5	0.1	<0.1
Nitrate as N	mg/L	10	0.05	0.06
Sulphate	mg/L	500 AO	2	36
Total Dissolved Solids	mg/L	500 AO	5	204
Bromate	mg/L	0.01	0.01	<0.01
Chlorine, Free	mg/L		0.50	1.45
Chlorate	mg/L	1	0.02	0.07
Chlorite	mg/L	1	0.02	<0.02
Chloramines - Total	mg/L		0.1	0.1

Certified By: Jason Coughlan

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CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Canadian Drinking Water MAC Package (Metals, Hg & Inorganics)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

				SAMPLE DESCRIPTION:	Cornwallis Treated
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2016-07-25
Parameter	Unit	G / S	RDL		7729604
Sulphide	mg/L	0.05 AO	0.05		<0.05
Cyanide, Free	mg/L		0.002		<0.002

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2023-01
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

7729604 Sulphide and Cyanide were analysed at AGAT Mississauga.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:

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11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
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TEL (902)468-8718
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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Canadian Drinking Water MAC Package (Radiochemistry)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

				SAMPLE DESCRIPTION:	Cornwallis Treated
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2016-07-25
Parameter	Unit	G / S	RDL		7729604
Radionuclides - Gross Alpha	Bq/L	0.5	0.08		<0.08
Radionuclides - Gross Beta	Bq/L	1.0	0.01		0.05

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2023-01
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

7729604 *Analysis performed at subcontracted laboratory.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By: Jason Coughlan

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Certificate of Analysis

AGAT WORK ORDER: 16X119322
PROJECT: IMAC

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Canadian Drinking Water MAC Package (Subcontracted)

DATE RECEIVED: 2016-07-25 **DATE REPORTED: 2016-08-30**

				SAMPLE DESCRIPTION:	Cornwallis Treated
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2016-07-25
Parameter	Unit	G / S	RDL		7729604
Nitriloacetic Acid (NTA)	mg/L	0.4	0.03		<0.03
Microcystin - LR	ug/L	1.5	0.05		<0.05
N-Nitrosodimethylamine (NDMA)	ug/L	0.04	0.0008		<0.0008

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2023-01
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
7729604 *Analysis performed at subcontracted laboratory.
Analysis performed at AGAT Halifax (unless marked by *)

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Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
AGAT WORK ORDER: 16X119322
PROJECT: IMAC
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Food Chemistry Analysis

RPT Date: Aug 30, 2016			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Glyphosate (Montreal) (ug/L)															
Glyphosate	727	NA	< 15	< 15	0.0%	< 15	106%	70%	130%	106%	70%	130%	99%	70%	130%

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Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY | **AGAT WORK ORDER: 16X119322**

PROJECT: IMAC | **ATTENTION TO: James Jenner**

SAMPLING SITE: | **SAMPLED BY:**

Trace Organics Analysis

RPT Date: Aug 30, 2016

PARAMETER	Batch	Sample Id	DUPLICATE Dup #1	DUPLICATE Dup #2	DUPLICATE RPD	Method Blank	REFERENCE MATERIAL Measured Value	REFERENCE MATERIAL Acceptable Limits Lower	REFERENCE MATERIAL Acceptable Limits Upper	METHOD BLANK SPIKE Recovery	METHOD BLANK SPIKE Acceptable Limits Lower	METHOD BLANK SPIKE Acceptable Limits Upper	MATRIX SPIKE Recovery	MATRIX SPIKE Acceptable Limits Lower	MATRIX SPIKE Acceptable Limits Upper
Canadian Drinking Water MAC Package (Carb./Urea Pest)															
Aldicarb	7734830		< 0.15	< 0.15	NA	< 0.15	113%	60%	140%	99%	60%	140%	101%	60%	140%
Bendiocarb	7734830		< 2	< 2	NA	< 2	97%	60%	140%	84%	60%	140%	82%	60%	140%
Carbofuran	7734830		< 5	< 5	NA	< 5	97%	60%	140%	84%	40%	130%	82%	30%	150%
Carbaryl	7734830		< 5	< 5	NA	< 5	105%	60%	140%	112%	40%	130%	101%	30%	150%
Diuron	7734830		< 10	< 10	NA	< 10	107%	60%	140%	114%	60%	140%	101%	30%	150%
Canadian Drinking Water MAC Package (Diq./Paraq.)															
Diquat	7728844		< 5	< 5	NA	< 5	98%	60%	140%	85%	60%	140%	87%	60%	140%
Paraquat	7728844		< 1	< 1	NA	< 1	98%	60%	140%	83%	60%	140%	83%	60%	140%
Canadian Drinking Water MAC Package (HAAs, Herbicides, OC Pest, Triaz. Pest, OP Pest., VOCs)															
Chloroacetic Acid	1	7735938	< 1.7	< 1.7	0.0%	< 1.7	85%	70%	130%	96%	60%	130%	105%	70%	130%
Bromoacetic Acid	1	7735938	< 0.3	< 0.3	0.0%	< 0.3	80%	70%	130%	97%	60%	130%	112%	70%	130%
Dichloroacetic Acid	1	7735938	69.8	64.2	8.4%	< 0.2	87%	70%	130%	109%	60%	130%	79%	70%	130%
Trichloroacetic Acid	1	7735938	56.0	52.6	6.3%	< 0.2	77%	70%	130%	73%	60%	130%	115%	70%	130%
Bromochloroacetic Acid	1	7735938	4.6	4.2	9.1%	< 0.2	90%	70%	130%	90%	60%	130%	105%	70%	130%
Dibromoacetic Acid	1	7735938	< 0.1	< 0.1	0.0%	< 0.1	100%	70%	130%	72%	60%	130%	115%	70%	130%
Bromoxynil	1	7728940	< 0.5	< 0.5	0.0%	< 0.5	101%	70%	130%	74%	60%	130%	NA	60%	130%
Dicamba	1	7728940	< 0.05	< 0.05	0.0%	< 0.05	110%	70%	130%	81%	60%	130%	NA	60%	130%
2,4-Dichlorophenol	1	7728940	< 0.3	< 0.3	0.0%	< 0.3	106%	70%	130%	76%	60%	130%	NA	60%	130%
2,4-Dichlorophenoxyacetic acid (2,4-D)	1	7728940	< 0.05	< 0.05	0.0%	< 0.05	95%	70%	130%	87%	60%	130%	NA	60%	130%
Diclofop Methyl	1	7728940	< 0.05	< 0.05	0.0%	< 0.05	117%	70%	130%	76%	60%	130%	NA	60%	130%
Dinoseb	1	7728940	< 1	< 1	0.0%	< 1	115%	70%	130%	86%	60%	130%	NA	60%	130%
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	1	7728940	< 5	< 5	0.0%	< 5	120%	70%	130%	83%	60%	130%	NA	60%	130%
Pentachlorophenol	1	7728940	< 0.5	< 0.5	0.0%	< 0.5	98%	70%	130%	88%	60%	130%	NA	60%	130%
Picloram	1	7728940	< 0.05	< 0.05	0.0%	< 0.05	106%	70%	130%	83%	60%	130%	NA	60%	130%
2,3,4,6-Tetrachlorophenol	1	7728940	< 0.5	< 0.5	0.0%	< 0.5	114%	70%	130%	113%	60%	130%	NA	60%	130%
2,4,6-Trichlorophenol	1	7728940	< 0.5	< 0.5	0.0%	< 0.5	86%	70%	130%	103%	60%	130%	NA	60%	130%
Aldrin	1	7764178	< 0.05	< 0.05	0.0%	< 0.05	100%	70%	130%	104%	60%	130%	102%	60%	130%
Dieldrin	1	7764178	< 0.05	< 0.05	0.0%	< 0.05	94%	70%	130%	115%	60%	130%	114%	60%	130%
Methoxychlor	1	7764178	< 0.1	< 0.1	0.0%	< 0.1	92%	60%	130%	96%	70%	130%	91%	60%	130%
Phorate	1	7728844	< 0.5	< 0.5	0.0%	< 0.5	99%	70%	130%	95%	40%	130%	NA	40%	130%
Dimethoate	1	7728844	< 1.5	< 1.5	0.0%	< 1.5	101%	70%	130%	82%	40%	130%	NA	40%	130%
Terbufos	1	7728844	< 0.7	< 0.7	0.0%	< 0.7	101%	70%	130%	91%	40%	130%	NA	40%	130%
Chlorpyrifos	1	7728844	< 1	< 1	0.0%	< 1	103%	70%	130%	93%	40%	130%	NA	40%	130%
Diazinon	1	7728844	< 1	< 1	0.0%	< 1	101%	70%	130%	104%	40%	130%	NA	40%	130%
Malathion	1	7728844	< 1	< 1	0.0%	< 1	95%	70%	130%	92%	40%	130%	NA	40%	130%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

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Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY | **AGAT WORK ORDER: 16X119322**

PROJECT: IMAC | **ATTENTION TO: James Jenner**

SAMPLING SITE: | **SAMPLED BY:**

Trace Organics Analysis (Continued)

RPT Date: Aug 30, 2016			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Parathion	1	7728844	< 1	< 1	0.0%	< 1	82%	70%	130%	90%	40%	130%	NA	40%	130%
Azinophos	1	7728844	< 2	< 2	0.0%	< 2	92%	70%	130%	123%	40%	130%	NA	40%	130%
Benzo(a)pyrene	1	7733106	< 0.00001	< 0.00001	0.0%	< 0.00001	87%	50%	140%	80%	50%	140%	61%	50%	140%
Trifluralin	1	7729134	< 1	< 1	0.0%	< 1	105%	50%	140%	107%	50%	140%	NA	50%	140%
Simazine	1	7729134	< 1	< 1	0.0%	< 1	92%	50%	140%	112%	50%	140%	NA	50%	140%
Atrazine	1	7729134	< 0.5	< 0.5	0.0%	< 0.5	98%	50%	140%	106%	50%	140%	NA	50%	140%
Atrazine + N-dealkylated metabolites	1	7729134	< 1	< 1	0.0%	< 1	102%	50%	140%	102%	50%	140%	NA	50%	140%
Metribuzin	1	7729134	< 0.25	< 0.25	0.0%	< 0.25	90%	50%	140%	107%	50%	140%	NA	50%	140%
Cyanazine	1	7729134	< 1	< 1	0.0%	< 1	88%	50%	140%	75%	50%	140%	NA	50%	140%
Metolachlor	1	7729134	< 1	< 1	0.0%	< 1	93%	50%	140%	106%	50%	140%	NA	50%	140%
Vinyl Chloride	1	7733101	< 0.6	< 0.6	0.0%	< 0.6	97%	70%	130%	126%	60%	140%	114%	60%	140%
Chloroethane	1	7733101	< 5	< 5	0.0%	< 5	110%	70%	130%	102%	60%	140%	110%	60%	140%
1,1-Dichloroethylene	1	7733101	< 2	< 2	0.0%	< 2	98%	70%	130%	107%	60%	140%	109%	60%	140%
Methylene Chloride (Dichloromethane)	1	7733101	< 2	< 2	0.0%	< 2	105%	70%	130%	109%	60%	140%	111%	60%	140%
Methyl-t-Butyl-Ether (MTBE)	1	7733101	< 2	< 2	0.0%	< 2	95%	60%	140%	97%	60%	140%	99%	60%	140%
Chloroform	1	7733101	< 1	< 1	0.0%	< 1	102%	70%	130%	107%	60%	140%	110%	60%	140%
1,2-Dichloroethane	1	7733101	< 2	< 2	0.0%	< 2	101%	70%	130%	107%	60%	140%	114%	60%	140%
Carbon Tetrachloride	1	7733101	< 1	< 1	0.0%	< 1	100%	70%	130%	109%	60%	140%	109%	60%	140%
Benzene	1	7733101	< 1	< 1	0.0%	< 1	101%	70%	130%	111%	70%	130%	115%	70%	130%
Trichloroethylene	1	7733101	< 1	< 1	0.0%	< 1	100%	60%	130%	111%	60%	140%	114%	60%	140%
Bromodichloromethane	1	7733101	< 1	< 1	0.0%	< 1	100%	70%	130%	100%	60%	140%	103%	60%	140%
Toluene	1	7733101	< 2	< 2	0.0%	< 2	103%	70%	130%	110%	60%	140%	112%	60%	140%
Dibromochloromethane	1	7733101	< 1	< 1	0.0%	< 1	118%	70%	130%	99%	60%	140%	104%	60%	140%
Tetrachloroethylene	1	7733101	< 1	< 1	0.0%	< 1	101%	70%	130%	108%	60%	140%	109%	60%	140%
Chlorobenzene	1	7733101	< 1	< 1	0.0%	< 1	103%	70%	130%	106%	60%	140%	111%	60%	140%
Ethylbenzene	1	7733101	< 2	< 2	0.0%	< 2	101%	70%	130%	107%	60%	140%	111%	60%	140%
Bromoform	1	7733101	< 1	< 1	0.0%	< 1	101%	70%	130%	104%	60%	140%	111%	60%	140%
Xylenes (Total)	1	7733101	< 4	< 4	0.0%	< 4	103%	60%	140%	108%	60%	140%	113%	60%	140%
1,4-Dichlorobenzene	1	7733101	< 1	< 1	0.0%	< 1	107%	70%	130%	104%	60%	140%	117%	60%	140%
1,2-Dichlorobenzene	1	7733101	< 1	< 1	0.0%	< 1	113%	70%	130%	117%	60%	140%	124%	60%	140%

Certified By: J. Patterson

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Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 16X119322

PROJECT: IMAC

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Aug 30, 2016			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Canadian Drinking Water MAC Package (Metals, Hg & Inorganics)															
Total Aluminum	7262016		18	26	NA	< 10	91%	80%	120%	120%	80%	120%	124%	70%	130%
Total Antimony	7262016		< 2	< 2	NA	< 2	80%	80%	120%	107%	80%	120%	94%	70%	130%
Total Arsenic	7262016		< 2	< 2	NA	< 2	86%	80%	120%	99%	80%	120%	86%	70%	130%
Total Barium	7262016		94	98	4.2%	< 5	96%	80%	120%	95%	80%	120%	110%	70%	130%
Total Boron	7262016		10	8	NA	< 5	113%	80%	120%	119%	80%	120%	105%	70%	130%
Total Cadmium	7262016		< 0.017	< 0.017	NA	< 0.3	100%	80%	120%	103%	80%	120%	100%	70%	130%
Total Chromium	7262016		< 1	< 1	NA	< 2	80%	80%	120%	83%	80%	120%	71%	70%	130%
Total Copper	7262016		< 1	< 1	NA	< 2	80%	80%	120%	95%	80%	120%	103%	70%	130%
Total Iron	7262016		452	451	0.2%	< 50	106%	80%	120%	90%	80%	120%	73%	70%	130%
Total Lead	7262016		< 0.5	< 0.5	NA	< 0.5	110%	80%	120%	113%	80%	120%	114%	70%	130%
Total Manganese	7262016		90	94	4.3%	< 2	104%	80%	120%	104%	80%	120%	117%	70%	130%
Total Selenium	7262016		< 1	< 1	NA	< 2	98%	80%	120%	97%	80%	120%	92%	70%	130%
Total Uranium	7262016		< 0.1	< 0.1	NA	< 0.1	112%	80%	120%	113%	80%	120%	122%	70%	130%
Total Zinc	7262016		< 5	< 5	NA	< 5	107%	80%	120%	99%	80%	120%	114%	70%	130%
Total Sodium	7262016		2.4	2.4	0.0%	< 0.1	102%	80%	120%	88%	80%	120%	85%	70%	130%
pH	7729136		7.45	7.41	0.5%	<	102%	80%	120%	NA	80%	120%	NA	80%	120%
Turbidity	1	7733940	1.5	1.4	6.9%	< 0.1	102%	80%	120%		80%	120%		80%	120%
True Color	1	7733740	17	15	NA	< 5	120%	80%	120%		80%	120%		80%	120%
Chloride	7730562		15	16	6.5%	< 1	94%	80%	120%	NA	80%	120%	NA	80%	120%
Fluoride	7730562		<0.1	<0.1	NA	< 0.1	113%	80%	120%	NA	80%	120%	114%	80%	120%
Nitrate as N	7730562		<0.05	<0.05	NA	< 0.05	95%	80%	120%	NA	80%	120%	117%	80%	120%
Sulphate	7730562		3	3	NA	< 2	100%	80%	120%	NA	80%	120%	92%	80%	120%
Total Dissolved Solids	1	4122	998	982	1.6%	< 5	114%	80%	120%		80%	120%		80%	120%
Bromate	7728940		<0.01	<0.01	NA	< 0.01	106%	70%	130%	NA	70%	130%	103%	70%	130%
Chlorine, Free	1	7729342	<0.50	<0.50	NA	< 0.50	117%	70%	130%		130%	130%		70%	130%
Chlorate	7728940		<0.02	<0.02	NA	< 0.02	109%	70%	130%	NA	70%	130%	102%	70%	130%
Chlorite	7728940		<0.02	<0.02	NA	< 0.02	113%	70%	130%	NA	70%	130%	109%	70%	130%
Sulphide	7730858		<0.05	<0.05	NA	< 0.05	100%	80%	120%	99%	85%	115%	99%	70%	130%
Cyanide, Free	7736889		<0.002	<0.002	NA	< 0.002	104%	90%	110%	103%	90%	110%	85%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Certified By:

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Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY **AGAT WORK ORDER: 16X119322**

PROJECT: IMAC **ATTENTION TO: James Jenner**

SAMPLING SITE: **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Food Chemistry Analysis			
Glyphosate	ORG-100-5115F	MA.403-GLYAMP 1.0 Modifée	HPLC

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Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY **AGAT WORK ORDER: 16X119322**

PROJECT: IMAC **ATTENTION TO: James Jenner**

SAMPLING SITE: **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Aldicarb	ORG-91- 5101	EPA SW-632 531.1 & MOE E3389	HPLC
Bendiocarb	ORG-91- 5101	EPA SW-632 531.1 & MOE E3389	HPLC
Carbofuran	ORG-91-5101	EPA SW-632 531.1 & MOE E3389	HPLC
Carbaryl	ORG-91-5101	EPA SW-632 531.1 & MOE E3389	HPLC
Diuron	ORG-91- 5101	EPA SW-632 531.1 & MOE E3389	HPLC
Diquat	ORG-91-5102	EPA 549.1	HPLC
Paraquat	ORG-91-5102	EPA 549.1	HPLC
Chloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Bromoacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Dichloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Trichloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Bromochloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Dibromoacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Haloacetic Acids	ORG-120-5110	EPA 552.3	GC/ECD
2-Bromobutanoic acid	ORG-120-5110	EPA 552.3	GC/ECD
Bromoxynil	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
Dicamba	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
2,4-Dichlorophenol	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
2,4-Dichlorophenoxyacetic acid (2,4-D)	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
Diclofop Methyl	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
Dinoseb	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
Pentachlorophenol	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
Picloram	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
2,3,4,6-Tetrachlorophenol	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
2,4,6-Trichlorophenol	ORG-120-6111	modified from EPA SW846 8151A & EPA 515.1	GC/ECD
Aldrin	ORG-120-5108	Based on EPA SW-846/6510 C-8080-8081 A	GC/ECD
Dieldrin	ORG-120-5108	Based on EPA SW-846/6510 C-8080-8081 A	GC/ECD
Aldrin + Dieldrin	ORG-120-5108	Based on EPA SW-846/6510 C-8080-8081 A	GC/ECD
Methoxychlor	ORG-120-5108	Based on EPA SW-846/6510 C-8080-8081 A	GC/ECD
Phorate	ORG-120-6112	modified from EPA SW-846 3510C/8141A/8270C	GC/MS
Dimethoate	ORG-120-6112	modified from EPA SW-846 3510C/8141A/8270C	GC/MS
Terbufos	ORG-120-6112	modified from EPA SW-846 3510C/8141A/8270C	GC/MS
Chlorpyrifos	ORG-120-6112	modified from EPA SW-846 3510C/8141A/8270C	GC/MS

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Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY **AGAT WORK ORDER: 16X119322**

PROJECT: IMAC **ATTENTION TO: James Jenner**

SAMPLING SITE: **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Diazinon	ORG-120-6112	modified from EPA SW-846 3510C/8141A/8270C	GC/MS
Malathion	ORG-120-6112	modified from EPA SW-846 3510C/8141A/8270C	GC/MS
Parathion	ORG-120-6112	modified from EPA SW-846 3510C/8141A/8270C	GC/MS
Azinophos	ORG-120-6112	modified from EPA SW-846 3510C/8141A/8270C	GC/MS
Benzo(a)pyrene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Trifluralin	ORG-120-6113	EPA SW-846 3510C/8270C and MOE E3121	GC/MS
Simazine	ORG-120-6113	EPA SW-846 3510C/8270C and MOE E3121	GC/MS
Atrazine	ORG-120-6113	EPA SW-846 3510C/8270C and MOE E3121	GC/MS
Atrazine + N-dealkylated metabolites	ORG-120-6113	EPA SW-846 3510C/8270C and MOE E3121	GC/MS
Metribuzin	ORG-120-6113	EPA SW-846 3510C/8270C and MOE E3121	GC/MS
Cyanazine	ORG-120-6113	EPA SW-846 3510C/8270C and MOE E3121	GC/MS
Metolachlor	ORG-120-6113	EPA SW-846 3510C/8270C and MOE E3121	GC/MS
Vinyl Chloride	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Chloroethane	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
1,1-Dichloroethylene	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Methylene Chloride (Dichloromethane)	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Methyl-t-Butyl-Ether (MTBE)	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Chloroform	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
1,2-Dichloroethane	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Carbon Tetrachloride	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Benzene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Trichloroethylene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Bromodichloromethane	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Toluene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Dibromochloromethane	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Tetrachloroethylene	VOL-120-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chlorobenzene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Ethylbenzene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Bromoform	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Xylenes (Total)	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
1,4-Dichlorobenzene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
1,2-Dichlorobenzene	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Total Trihalomethanes	VOL-120-5001	EPA SW846 5230/8260	GC/MS
Toluene-d8	VOL-120-5001	EPA SW846 5030B/8260B	GC/MS
4-Bromofluorobenzene	VOL-120-5001	EPA SW846 5030B/8260B	GC/MS

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Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY | **AGAT WORK ORDER: 16X119322**

PROJECT: IMAC | **ATTENTION TO: James Jenner**

SAMPLING SITE: | **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Aluminum	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Antimony	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Arsenic	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Barium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Boron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Cadmium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Chromium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Copper	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Iron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Lead	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Manganese	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Selenium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Uranium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Zinc	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Sodium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Mercury	INOR-121-6100 & INOR-121-6107	SM 3112 B	CV/AA
pH	INOR-121-6001	SM 4500 H+B	PC-TITRATE
Turbidity	INORG-121-6022	SM 2130 B	NEPHELOMETER
True Color	INORG-121-6014	EPA 110.2	NEPHELOMETER
Chloride	INORG-121-6005	SM 4110 B	IC
Fluoride	INOR-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INORG-121-6005	SM 4110 B	IC
Sulphate	INORG-121-6005	SM 4110 B	IC
Total Dissolved Solids	INOR-121-6024, 6025	SM 2540C, D	GRAVIMETRIC
Bromate	INOR-121-6005	SM 4110 B	IC
Chlorine, Free	INOR-121-6037	SM 4500-Cl F	TITRATION
Chlorate	INOR-121-6005	SM 4110 B	IC
Chlorite	INOR-121-6005	SM 4110 B	IC
Chloramines - Total			Calculated
Sulphide	INOR-93-6054	SM 4500 S2- D	SPECTROPHOTOMETER
Cyanide, Free	INOR-93-6052	MOE CN-3015 & SM 4500 CN- I	TECHNICON AUTO ANALYZER
Radionuclides - Gross Alpha			
Radionuclides - Gross Beta			
Nitriloacetic Acid (NTA)			
Microcystin - LR			
N-Nitrosodimethylamine (NDMA)		EPA SW846-8270	GC/MS

APPENDIX F

Last Round of Sampling Data for *GMPDWS*

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CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
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Annapolis Royal, NS B0S1A0
(902) 532-3141
ATTENTION TO: James Jenner
PROJECT: Cornwallis Thm's, Haa's Copper, SWA
AGAT WORK ORDER: 22X917864
TRACE ORGANICS REVIEWED BY: Wendy Rose, Trace Organics Lab Technician
WATER ANALYSIS REVIEWED BY: Sara Knox, Data Reviewer
DATE REPORTED: Jul 19, 2022
PAGES (INCLUDING COVER): 16
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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Certificate of Analysis

AGAT WORK ORDER: 22X917864

PROJECT: Cornwallis Thm's, Haa's Copper, SWA

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Haloacetic Acids (water)

DATE RECEIVED: 2022-07-08

DATE REPORTED: 2022-07-19

		SAMPLE DESCRIPTION:		Treated Cwtp	Raw lake cady
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2022-07-05	2022-07-05
Parameter	Unit	G / S	RDL	4065939	4065952
Chloroacetic Acid	ug/L		0.5	0.7	<0.5
Bromoacetic Acid	ug/L		0.5	<0.5	<0.5
Dichloroacetic Acid	ug/L		0.5	16.5	<0.5
Trichloroacetic Acid	ug/L		0.5	14.4	<0.5
Bromochloroacetic Acid	ug/L		0.5	2.3	<0.5
Dibromoacetic Acid	ug/L		0.5	<0.5	<0.5
Total Haloacetic Acids	ug/L	80	4.0	33.9	<4.0
HAA5	ug/L	80	4.0	31.8	<4.0
Surrogate	**Unit**	**Acceptable Limits**			
2-Bromobutanoic acid	%	70-130		110	118

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4065939-4065952 HAA5 is a calculated parameter. The calculated parameter is non-accredited. The component parameters of the calculation are accredited.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By: JROSS

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Certificate of Analysis

AGAT WORK ORDER: 22X917864

PROJECT: Cornwallis Thm's, Haa's Copper, SWA

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Trihalomethanes in Water

DATE RECEIVED: 2022-07-08

DATE REPORTED: 2022-07-19

		SAMPLE DESCRIPTION:		Treated Cwtp	Raw lake cady
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2022-07-05	2022-07-05
Parameter	Unit	G / S	RDL	4065939	4065952
Chloroform	ug/L		1	46	<1
Bromodichloromethane	ug/L		1	7	<1
Dibromochloromethane	ug/L		1	<1	<1
Bromoform	ug/L		1	<1	<1
Total Trihalomethanes	ug/L	100	1	53	<1
Surrogate	**Unit**	**Acceptable Limits**			
Toluene-d8	%	60-140		98	98
4-Bromofluorobenzene	%	60-140		101	107

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Halifax (unless marked by *)

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Certificate of Analysis

AGAT WORK ORDER: 22X917864

PROJECT: Cornwallis Thm's, Haa's Copper, SWA

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Halifax - Metals - Copper (µg/L)

DATE RECEIVED: 2022-07-08

DATE REPORTED: 2022-07-19

		SAMPLE DESCRIPTION:		149 Topsail	406 Dingle	90 Hillside	108 Old School
		SAMPLE TYPE:		Water	Water	Water	Water
		DATE SAMPLED:		2022-07-06	2022-07-06	2022-07-06	2022-07-06
Parameter	Unit	G / S	RDL	4065920	4065922	4065923	4065924
Total Copper	ug/L	2000, 1000	1	4	2	17	3

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4065920-4065924 <- Values refer to Report Detection Limits.

Analysis performed at AGAT Edmonton (unless marked by *)

Certified By: Sara Knox

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Certificate of Analysis

AGAT WORK ORDER: 22X917864

PROJECT: Cornwallis Thm's, Haa's Copper, SWA

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Halifax - Metals - Total (µg/L)

DATE RECEIVED: 2022-07-08

DATE REPORTED: 2022-07-19

Parameter	Unit	SAMPLE DESCRIPTION: / SAMPLE TYPE: / DATE SAMPLED: G / S	RDL	Treated Cwtp Water 2022-07-05 4065939	Raw lake cady Water 2022-07-05 4065952
Total Aluminum	ug/L	2900, 100	4	70	211
Total Antimony	ug/L	6	2	<2	<2
Total Arsenic	ug/L	10	2	<2	<2
Total Barium	ug/L	2000	5	<5	<5
Total Beryllium	ug/L		2	<2	<2
Total Bismuth	ug/L		2	<2	<2
Total Boron	ug/L	5000	5	6	<5
Total Cadmium	ug/L	7	0.09	<0.09	<0.09
Total Chromium	ug/L	50	1	<1	<1
Total Cobalt	ug/L		1	<1	<1
Total Copper	ug/L	2000, 1000	1	<1	14
Total Iron	ug/L	300 AO	50	**650**	<50
Total Lead	ug/L	5	0.5	<0.5	0.8
Total Manganese	ug/L	120, 20 AO	3	**133**	87
Total Molybdenum	ug/L		2	<2	<2
Total Nickel	ug/L		2	<2	<2
Total Selenium	ug/L	50	1.0	<1.0	<1.0
Total Silver	ug/L		0.1	<0.1	<0.1
Total Strontium	ug/L	7000	5	10	10
Total Thallium	ug/L		0.2	<0.2	<0.2
Total Tin	ug/L		3	<3	<3
Total Titanium	ug/L		3	<3	<3
Total Uranium	ug/L	20	0.2	<0.2	<0.2
Total Vanadium	ug/L		2	<2	<2
Total Zinc	ug/L	5000 AO	5	83	<5
Total Phosphorus	ug/L		50	62	239

Certified By: Sara Knox

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Certificate of Analysis

AGAT WORK ORDER: 22X917864
PROJECT: Cornwallis Thm's, Haa's Copper, SWA

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Halifax - Metals - Total (µg/L)

DATE RECEIVED: 2022-07-08 **DATE REPORTED: 2022-07-19**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4065939-4065952 < - Values refer to Report Detection Limits.
Analysis performed at AGAT Edmonton (unless marked by *)

Certified By: Sara Knox

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Certificate of Analysis

AGAT WORK ORDER: 22X917864

PROJECT: Cornwallis Thm's, Haa's Copper, SWA

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Total Metals

DATE RECEIVED: 2022-07-08

DATE REPORTED: 2022-07-19

		SAMPLE DESCRIPTION:		Treated Cwtp	Raw lake cady
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2022-07-05	2022-07-05
Parameter	Unit	G / S	RDL	4065939	4065952
pH		7.0-10.5		7.96	**6.41**
Reactive Silica as SiO2	mg/L		0.5	15.4	8.5
Chloride	mg/L	250 AO	1	10	6
Fluoride	mg/L	1.5	0.12	<0.12	0.14
Sulphate	mg/L	500 AO	2	39	<2
Alkalinity	mg/L		5	55	6
True Color	TCU	15 AO	5.00	<5.00	<5.00
Turbidity	NTU	1.0	0.5	**2.3**	**4.2**
Electrical Conductivity	umho/cm		1	207	36
Nitrate + Nitrite as N	mg/L		0.05	0.08	<0.05
Nitrate as N	mg/L	10	0.05	0.08	<0.05
Nitrite as N	mg/L	1.0	0.05	<0.05	<0.05
Ammonia as N	mg/L		0.03	<0.03	<0.03
Total Organic Carbon	mg/L		0.5	1.9	9.0
Ortho-Phosphate as P	mg/L		0.01	0.12	0.012
Total Sodium	mg/L	200 AO	1	43	4
Total Potassium	mg/L		0.1	0.4	0.4
Total Calcium	mg/L		0.8	1.6	1.4
Total Magnesium	mg/L		0.8	<0.8	<0.8
Bicarb. Alkalinity (as CaCO3)	mg/L		5	55	6
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10
Hydroxide	mg/L		5	<5	<5
Calculated TDS	mg/L	500 AO	1	128	16
Hardness	mg/L			4.0	3.5
Langelier Index (@20C)	NA			-1.69	-4.17
Langelier Index (@ 4C)	NA			-2.01	-4.49
Saturation pH (@ 20C)	NA			9.65	10.6
Saturation pH (@ 4C)	NA			9.97	10.9
Anion Sum	me/L			2.20	0.29
Cation sum	me/L			2.00	0.29

Certified By: Sara Knox

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Certificate of Analysis

AGAT WORK ORDER: 22X917864

PROJECT: Cornwallis Thm's, Haa's Copper, SWA

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Total Metals

DATE RECEIVED: 2022-07-08

DATE REPORTED: 2022-07-19

		SAMPLE DESCRIPTION:		Treated Cwtp	Raw lake cady
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2022-07-05	2022-07-05
Parameter	Unit	G / S	RDL	4065939	4065952
% Difference/ Ion Balance	%			4.8	0.1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4065939-4065952 % Difference / Ion Balance, Hardness, Langelier Index, Nitrate + Nitrite, Hydroxide and Saturation pH are calculated parameters. The calculated parameters are non-accredited. The component parameters of the calculations are accredited.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By: Sara Knox

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Exceedance Summary

AGAT WORK ORDER: 22X917864

PROJECT: Cornwallis Thm's, Haa's Copper, SWA

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
4065939	Treated Cwtp	NS-CDWQ incl [AO]	Halifax - Metals - Total (µg/L)	Total Iron	ug/L	300 AO	650
4065939	Treated Cwtp	NS-CDWQ incl [AO]	Halifax - Metals - Total (µg/L)	Total Manganese	ug/L	120, 20 AO	133
4065939	Treated Cwtp	NS-CDWQ incl [AO]	Standard Water Analysis + Total Metals	Total Iron	ug/L	300 AO	650
4065939	Treated Cwtp	NS-CDWQ incl [AO]	Standard Water Analysis + Total Metals	Total Manganese	ug/L	120, 20 AO	133
4065939	Treated Cwtp	NS-CDWQ incl [AO]	Standard Water Analysis + Total Metals	Turbidity	NTU	1.0	2.3
4065952	Raw lake cady	NS-CDWQ incl [AO]	Standard Water Analysis + Total Metals	Turbidity	NTU	1.0	4.2
4065952	Raw lake cady	NS-CDWQ incl [AO]	Standard Water Analysis + Total Metals	pH		7.0-10.5 OG	6.41

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Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
AGAT WORK ORDER: 22X917864
PROJECT: Cornwallis Thm's, Haa's Copper, SWA
ATTENTION TO: James Jenner
SAMPLING SITE:
SAMPLED BY:

Trace Organics Analysis

RPT Date: Jul 19, 2022

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Trihalomethanes in Water															
Chloroform	1	4059710	2	2	NA	< 1	99%	50%	140%	88%	60%	130%	94%	50%	140%
Bromodichloromethane	1	4059710	< 1	< 1	NA	< 1	92%	50%	140%	81%	60%	130%	89%	50%	140%
Dibromochloromethane	1	4059710	< 1	< 1	NA	< 1	95%	50%	140%	87%	60%	130%	73%	50%	140%
Bromoform	1	4059710	< 1	< 1	NA	< 1	88%	50%	140%	80%	60%	130%	89%	50%	140%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution. Matrix spike performed on a different sample than the duplicate.
If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Haloacetic Acids (water)															
Chloroacetic Acid	1	4065939	0.7	0.7	NA	< 0.5	99%	70%	130%	74%	60%	130%	73%	60%	130%
Bromoacetic Acid	1	4065939	< 0.5	< 0.5	NA	< 0.5	96%	70%	130%	84%	60%	130%	92%	60%	130%
Dichloroacetic Acid	1	4065939	16.5	16.6	0.6%	< 0.5	94%	70%	130%	105%	60%	130%	113%	60%	130%
Trichloroacetic Acid	1	4065939	14.4	14.5	0.7%	< 0.5	87%	70%	130%	103%	60%	130%	113%	60%	130%
Bromochloroacetic Acid	1	4065939	2.3	2.3	NA	< 0.5	82%	70%	130%	102%	60%	130%	113%	60%	130%
Dibromoacetic Acid	1	4065939	< 0.5	< 0.5	NA	< 0.5	85%	70%	130%	120%	60%	130%	128%	60%	130%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Certified By: JROSS

AGAT Laboratories
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Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY | **AGAT WORK ORDER: 22X917864**

PROJECT: Cornwallis Thm's, Haa's Copper, SWA | **ATTENTION TO: James Jenner**

SAMPLING SITE: | **SAMPLED BY:**

Water Analysis

RPT Date: Jul 19, 2022

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis + Total Metals															
pH		4073506	7.71	7.97	3.3%	<	100%	80%	120%						
Reactive Silica as SiO2	4068611		5.9	6.4	7.1%	< 0.5	103%	80%	120%	105%	80%	120%	110%	80%	120%
Chloride	4052126		11	11	2.5%	< 1	109%	80%	120%	NA	80%	120%	NA	70%	130%
Fluoride	4052126		<0.12	<0.12	NA	< 0.12	107%	80%	120%	NA	80%	120%	109%	70%	130%
Sulphate	4052126		8	8	NA	< 2	104%	80%	120%	NA	80%	120%	88%	70%	130%
Alkalinity		4073506	54	53	1.9%	< 5	97%	80%	120%						
True Color	4068611		<5.00	<5.00	NA	< 5	83%	80%	120%	107%	80%	120%	NA		
Turbidity	4076312		10.0	11.6	15.3%	< 0.5	100%	80%	120%	NA			NA		
Electrical Conductivity		4073506	141	137	2.9%	< 1	103%	90%	110%						
Nitrate as N	4052126		2.43	2.46	1.4%	< 0.05	116%	80%	120%	NA	80%	120%	NA	70%	130%
Nitrite as N	4052126		<0.05	<0.05	NA	< 0.05	92%	80%	120%	NA	80%	120%	113%	70%	130%
Ammonia as N	4062196		<0.03	<0.03	NA	< 0.03	100%	80%	120%	85%	80%	120%	96%	70%	130%
Total Organic Carbon	4068605		2.9	2.9	1.3%	< 0.5	100%	80%	120%	NA	80%	120%	98%	80%	120%
Ortho-Phosphate as P			0.02	0.02	NA	< 0.01	83%	80%	120%		80%	120%		80%	120%
Total Sodium	4106494		65	66	1.9%	< 0.1	103%	80%	120%	108%	80%	120%	NA	70%	130%
Total Potassium	4106494		<0.1	<0.1	NA	< 0.1	102%	80%	120%	106%	80%	120%	107%	70%	130%
Total Calcium	4106494		<0.1	<0.1	NA	< 0.1	102%	80%	120%	102%	80%	120%	103%	70%	130%
Total Magnesium	4106494		<0.1	<0.1	NA	< 0.1	101%	80%	120%	105%	80%	120%	105%	70%	130%
Bicarb. Alkalinity (as CaCO3)		4073506	54	53	1.9%	< 5	NA	80%	120%						
Carb. Alkalinity (as CaCO3)		4073506	< 10	< 10	0.0%	< 10	NA	80%	120%						
Hydroxide		4073506	< 5	< 5	0.0%	< 5	NA	80%	120%						

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Halifax - Metals - Copper (µg/L)															
Total Copper	195	4065952	14	14	2.9%	< 1	101%	70%	130%	105%	80%	120%	81%	70%	130%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.
If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.

Halifax - Metals - Total (µg/L)															
Total Aluminum	195	4065952	211	224	6.0%	< 4	101%	70%	130%	106%	80%	120%	73%	70%	130%
Total Antimony	195	4065952	<2	<2	NA	< 2	104%	70%	130%	105%	80%	120%	83%	70%	130%
Total Arsenic	195	4065952	<2	<2	NA	< 2	98%	70%	130%	108%	80%	120%	94%	70%	130%
Total Barium	195	4065952	<5	6	NA	< 5	103%	70%	130%	101%	80%	120%	87%	70%	130%
Total Beryllium	195	4065952	<2	<2	NA	< 2	94%	70%	130%	97%	80%	120%	77%	70%	130%
Total Bismuth	195	4065952	<2	<2	NA	< 2	104%	70%	130%	97%	80%	120%	NA	70%	130%
Total Boron	195	4065952	<5	<5	NA	< 5	98%	70%	130%	85%	80%	120%	74%	70%	130%
Total Cadmium	195	4065952	<0.09	<0.09	NA	< 0.09	98%	70%	130%	112%	80%	120%	91%	70%	130%
Total Chromium	195	4065952	<1	<1	NA	< 1	101%	70%	130%	97%	80%	120%	83%	70%	130%

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Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY | **AGAT WORK ORDER: 22X917864**

PROJECT: Cornwallis Thm's, Haa's Copper, SWA | **ATTENTION TO: James Jenner**

SAMPLING SITE: | **SAMPLED BY:**

Water Analysis (Continued)

RPT Date: Jul 19, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Cobalt	195	4065952	<1	<1	NA	< 1	102%	70%	130%	107%	80%	120%	83%	70%	130%
Total Copper	195	4065952	14	14	0.0%	< 1	101%	70%	130%	105%	80%	120%	81%	70%	130%
Total Iron	196	4065939	650	574	12.4%	< 50	97%	70%	130%	104%	80%	120%	109%	70%	130%
Total Lead	195	4065952	0.8	1.0	NA	< 0.5	104%	70%	130%	92%	80%	120%	91%	70%	130%
Total Manganese	196	4065939	133	118	12.0%	< 3	99%	70%	130%	103%	80%	120%	109%	70%	130%
Total Molybdenum	195	4065952	<2	<2	NA	< 2	115%	70%	130%	96%	80%	120%	96%	70%	130%
Total Nickel	195	4065952	<2	<2	NA	< 2	95%	70%	130%	98%	80%	120%	81%	70%	130%
Total Selenium	195	4065952	<1.0	<1.0	NA	2.0	94%	70%	130%	98%	80%	120%	105%	70%	130%
Total Silver	195	4065952	<0.1	<0.1	NA	< 0.1	102%	70%	130%	107%	80%	120%	90%	70%	130%
Total Strontium	196	4065939	10	9	NA	< 5	96%	70%	130%	97%	80%	120%	105%	70%	130%
Total Thallium	195	4065952	<0.2	<0.2	NA	< 0.1	102%	70%	130%	92%	80%	120%	90%	70%	130%
Total Tin	195	4065952	<3	<3	NA	< 2	106%	70%	130%	99%	80%	120%	82%	70%	130%
Total Titanium	195	4065952	<3	9	NA	< 2	120%	70%	130%	NA	80%	120%	75%	70%	130%
Total Uranium	195	4065952	<0.2	<0.2	NA	< 0.2	103%	70%	130%	94%	80%	120%	90%	70%	130%
Total Vanadium	195	4065952	<2	<2	NA	< 2	95%	70%	130%	95%	80%	120%	83%	70%	130%
Total Zinc	195	4065952	<5	<5	NA	< 5	106%	70%	130%	119%	80%	120%	98%	70%	130%
Total Phosphorus	196	4065939	62	<50	NA	< 50	88%	70%	130%	95%	80%	120%	80%	70%	130%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.
If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.

For a multi-element scan up to 10% of analytes may exceed the quoted limits by up to 10% absolute.

Certified By: Lara Knox

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Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY **AGAT WORK ORDER: 22X917864**

PROJECT: Cornwallis Thm's, Haa's Copper, SWA **ATTENTION TO: James Jenner**

SAMPLING SITE: **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Chloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Bromoacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Dichloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Trichloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Bromochloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Dibromoacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
2-Bromobutanoic acid	ORG-120-5110	EPA 552.3	GC/ECD
Total Haloacetic Acids	ORG-120-5110	EPA 552.3	GC/ECD
HAA5	ORG-120-5110	EPA 552.3	GC/ECD
Chloroform	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Bromodichloromethane	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Dibromochloromethane	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Bromoform	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Total Trihalomethanes	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Toluene-d8	VOL-120-5001	EPA SW846 5030B/8260B	GC/MS
4-Bromofluorobenzene	VOL-120-5001	EPA SW846 5030B/8260B	GC/MS

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Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY | **AGAT WORK ORDER: 22X917864**

PROJECT: Cornwallis Thm's, Haa's Copper, SWA | **ATTENTION TO: James Jenner**

SAMPLING SITE: | **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Copper	INOR-171-6100, -6202	SM 3030 E; SM 3125 B	ICP-MS
Total Aluminum	INOR-171-6201, INOR-171-6100	SM 3030 E; SM 3125 B	ICP-MS
Total Antimony	INOR-171-6201, INOR-171-6100	SM 3030 E; SM 3125 B	ICP-MS
Total Arsenic	INOR-171-6201	SM 3030 E; SM 3125 B	ICP-MS
Total Barium	INOR-171-6201	SM 3030 E; SM 3125 B	ICP-MS
Total Beryllium	INOR-171-6100, -6202	SM 3030 E; SM 3125 B	ICP-MS
Total Bismuth	INOR-171-6201	SM 3030 E; SM 3125 B	ICP/MS
Total Boron	INOR-171-6201	SM 3030 E; SM 3125 B	ICP-MS
Total Cadmium	INOR-171-6201	SM 3030 E; SM 3125 B	ICP/MS
Total Chromium	INOR-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Cobalt	INOR-171-6100, -6202	SM 3030 E; SM 3125 B	ICP-MS
Total Iron	INOR-171-6100, 171-6201	SM 3030 E; SM 3120 B	ICP/OES
Total Lead	INOR-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Manganese	INOR-171-6201	SM 3030 E; SM 3120 B	ICP/OES
Total Molybdenum	INOR-171-6202	SM 3030 E; SM 3125 B	ICP/MS
Total Nickel	INOR-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Selenium	INOR-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Silver	INO-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Strontium	INOR-171-6201	SM 3030 E; SM 3120 B	ICP/OES
Total Thallium	INOR-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Tin	INOR-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Titanium	INOR-171-6100, -6202	SM 3030 E; SM 3125 B	ICP/MS
Total Uranium	INOR-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Vanadium	INORG-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Zinc	INORG-171-6202	SM 3030 E; SM 3125 B	ICP-MS
Total Phosphorus	INOR-171-6100, 171-6201	SM 3030 E; SM 3120 B	ICP/OES
pH	INOR-121-6001	SM 4500 H+B	PC TITRATE
Reactive Silica as SiO2	INOR-121-6027	SM 4500-SiO2 F	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Alkalinity	INOR-121-6001	SM 2320 B	
True Color	INOR-121-6008	SM 2120 B	LACHAT FIA
Turbidity	INOR-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	CALCULATION
Nitrate as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-121-6047	SM 4500-NH3 H	COLORIMETER
Total Organic Carbon	INOR-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INOR-121-6012	SM 4500-P G	COLORIMETER
Total Sodium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Potassium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Calcium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS

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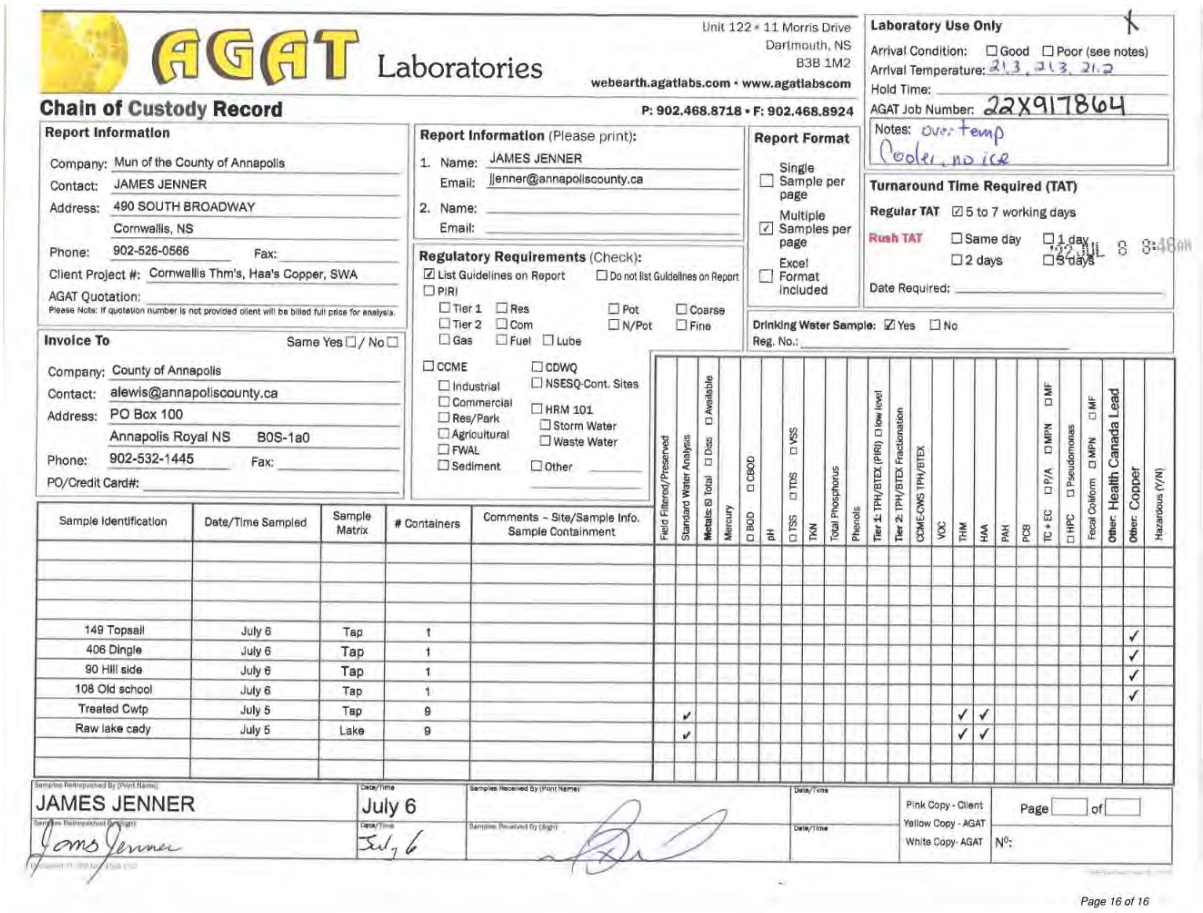
Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY **AGAT WORK ORDER: 22X917864**

PROJECT: Cornwallis Thm's, Haa's Copper, SWA **ATTENTION TO: James Jenner**

SAMPLING SITE: **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Magnesium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS	CALCULATION	SM 1030E	CALCULATION
Hardness	CALCULATION	SM 2340B	CALCULATION
Langelier Index (@20C)	CALCULATION	CALCULATION	CALCULATION
Langelier Index (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 20C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Anion Sum	CALCULATION	SM 1030E	CALCULATION
Cation sum	CALCULATION	SM 1030E	CALCULATION
% Difference/ Ion Balance	CALCULATION	SM 1030E	CALCULATION



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Chain of Custody Record

P: 902.468.8718 • F: 902.468.8924

Report Information
Company: Mun of the County of Annapolis
Contact: JAMES JENNER
Address: 490 SOUTH BROADWAY
Cornwallis, NS
Phone: 902-526-0566 Fax:
Client Project #: Cornwallis Thm's, Haa's Copper, SWA
AGAT Quotation:
Please Note: If quotation number is not provided client will be billed full price for analysis.

Invoice To Same Yes ☐ / No ☐
Company: County of Annapolis
Contact: alewis@annapoliscounty.ca
Address: PO Box 100
Annapolis Royal NS B0S-1a0
Phone: 902-532-1445 Fax:
PO/Credit Card#:

Report Information (Please print):
1. Name: JAMES JENNER
Email: jjenner@annapoliscounty.ca
2. Name:
Email:

Regulatory Requirements (Check):
☑ List Guidelines on Report ☐ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ NSESQ-Cont. Sites
☐ Commercial ☐ HRM 101
☐ Res/Park ☐ Storm Water
☐ Agricultural ☐ Waste Water
☐ FWAL
☐ Sediment ☐ Other

Report Format
☐ Single Sample per page
☑ Multiple Samples per page
☐ Excel Format included

Laboratory Use Only
Arrival Condition: ☐ Good ☐ Poor (see notes)
Arrival Temperature: 21.3, 21.3, 21.2
Hold Time:
AGAT Job Number: 22X917864
Notes: over temp
Cooler, no ice

Turnaround Time Required (TAT)
Regular TAT ☑ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day
☐ 2 days ☐ 3 days
Date Required:

Drinking Water Sample: ☑ Yes ☐ No
Reg. No.:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments - Site/Sample Info. Sample Containment	Field Filtered/Preserved	Standard Water Analysis	Metals ☐ Total ☐ Diss ☐ Available	Mercury	☐ BOD ☐ CBOD	pH	☐ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ F/A ☐ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Focal Coliform ☐ MPN ☐ MF	Other: Health Canada Lead	Other: Copper	Hazardous (Y/N)
149 Topsail	July 6	Tap	1																							✓		
406 Dingle	July 6	Tap	1																							✓		
90 Hill side	July 6	Tap	1																							✓		
108 Old school	July 6	Tap	1																							✓		
Treated Cwtp	July 5	Tap	9			✓													✓	✓								
Raw lake cady	July 5	Lake	9			✓													✓	✓								

Samples Relinquished By (Print Name): JAMES JENNER
Samples Relinquished By (Sign): James Jenner
Date/Time: July 6
Date/Time: July 6
Samples Received By (Print Name):
Samples Received By (Sign):
Date/Time:
Date/Time:

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page ☐ of ☐
N°:

Page 16 of 16

APPENDIX G

Approval to Operate

NOVA SCOTIA

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Canada B5A 2T2

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902-742-7796 F
www.novascotia.ca

APPROVAL

Province of Nova Scotia
Environment Act, S.N.S. 1994-95, c.1 s.1

APPROVAL HOLDER: MUNICIPALITY OF THE COUNTY OF ANNAPOLIS

SITE PID: 05213756

APPROVAL NO: 2009-065804-02

EXPIRY DATE: June 1, 2029

Pursuant to Part V of the *Environment Act*, S.N.S. 1994-95, c.1 s.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Municipal - Water Works - Water Treatment Facility

Paddy-joe MacMillan

Administrator: Paddy-joe MacMillan

Effective Date: June 1, 2019

The Minister's powers and responsibilities under the Act with respect to this Approval have been delegated to the Administrator named above. Therefore, any information or notifications required to be provided to the Minister under this Approval can be provided to the Administrator unless otherwise advised in writing.

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder: MUNICIPALITY OF THE COUNTY OF ANNAPOLIS

Project: Cornwallis Park WTP at Cady Lake

Site:

PID	Civic #	Street Name	Street Type	Community	County
05213756	490	SOUTH BROADWAY	AVE.	CORNWALLIS PARK	ANNAPOLIS COUNTY

Approval No: 2009-065804-02

File No: 94600-30-YAR-2009-065804

Reference Documents

- Application submitted March 8, 2018 and attachments.

1. Definitions

a. Act means Environment Act. 1994-95, c.1, s.1 , and includes, unless the context otherwise requires, the regulations made pursuant to the Act, as amended from time to time.

b. Administrator means a person appointed by the Minister for the purpose of the Act, and includes an acting administrator.

c. CT means disinfectant residual in mg/l multiplied by the contact time in minutes.

d. Contact Time denoted as T10 is an effective contact time for disinfection in minutes and represents the time when 10% of the water passes the contact unit; that is 90% of the water remains in the unit and will be exposed to longer disinfection within the unit. T10 can be established by tracer studies or calculated using theoretical hydraulic detention times multiplied by an appropriate baffling factor listed in the "Nova Scotia Treatment Standards for Municipal Drinking Water Systems" as amended from time to time.

e. Continuous monitoring is sampling of flow through analysis equipment that creates an output signal a minimum of once every five minutes.

f. Department means the Department of Environment, and the contact for the Department for this approval is:

Nova Scotia Environment
Western Region, Yarmouth Office
55 Starrs Road, Unit 9
Yarmouth, NS, B5A 2T2

Phone: 902-742-8985
Fax: 902-742- 7796

g. Grab sample means an individual sample collected in less than 30 minutes and which is representative of the substance sampled.

h. Inadequate Primary Disinfection means water that does meet the required CT/IT.

i. Inadequate Secondary Disinfection means water that does not meet the required disinfectant residual in the distribution system.

j. Log reduction means a negative of the base 10 logarithm of the fraction of pathogens remaining after the treatment process.

log reduction = log removal by physical treatment + log inactivation by disinfection

where log removal by physical treatment is equal to the credit assigned to the filtration technology indicated in the Department's "Nova Scotia Treatment Standards for Municipal Drinking Water Systems", as amended from time to time; and

log inactivation by disinfection is equal to the inactivation which shall be calculated as defined by the Department's "Nova Scotia Treatment Standards for Municipal Drinking Water Systems", as amended from time to time.

k. Minister means the Minister of Environment and includes any person delegated the authority of the Minister.

l. QA/QC means quality assurance and quality control.

m. Quarterly sampling means samples taken once per quarter with no less than a 45 day interval between sampling events.

n. Site means a place where a designated activity and/or undertaking is occurring or may occur.

2. Scope

a. This Approval (the "Approval") relates to the Approval Holder(s) and their

application and all documentation submitted to the Department prior to the issuance of this approval for the Municipal Water Treatment Facility situated at or near Cornwallis, NS (the "Site").

b. This Approval supersedes previous Approval number 2009-065804-R01 which is now null and void.

3. General

a. The Approval Holder(s) shall conduct the Designated Activity in accordance with the following provisions:

i. The Act, as amended from time to time;

ii. Any standard adopted by the Department, as amended from time to time, which includes but is not limited to the following:

(a) The Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution and Operation of Drinking Water Supply Systems (2004), as amended from time to time;

(b) By January 1, 2020, the Nova Scotia Treatment Standards for Municipal Drinking Water Systems (2012), as amended from time to time;

(c) the Guidelines for Monitoring Public Drinking Water Supplies, as amended from time to time;

(d) Health Canada's Guidelines for Canadian Drinking Water Quality, as amended from time to time;

(e) Facility Classification Standards (2009), as amended from time to time.

b. Nothing in this Approval relieves the Approval Holder(s) of the responsibility for obtaining and paying for all licenses, permits, approvals or authorizations necessary for carrying out the work authorized to be performed by this Approval which may be required by municipal by-laws or provincial or federal legislation. The Minister does not warrant that such licenses, permits, approvals or other authorizations will be issued.

c. If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.

d. Any request for renewal or extension of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.

e. If the Minister cancels or suspends this Approval, the Approval Holder(s) remains subject to the penalty provisions of the Act.

f. The Approval Holder(s) shall advise the Department in writing prior to any proposed extensions or modifications to the Site. An amendment to this Approval may be required before implementing any extension or modification.

g. The Approval Holder(s) shall immediately notify the Department of any incidents of non-compliance with this Approval.

h. The Approval Holder(s) shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.

i. All sampling and analysis must be performed in accordance with the following as amended from time to time: Standard Methods for the Examination of Water and Wastewater, or the analytical methods section of Health Canada's guideline technical document for the parameter of concern. All samples shall be collected by persons trained in appropriate sample collection procedures.

j. Unless written authorization is received otherwise from the Minister, all samples required by this Approval shall be analyzed by a laboratory that meets the requirements of the Department's "Policy on Acceptable Certification of Laboratories" as amended from time to time.

k. Notwithstanding the above item, the following parameters may be analyzed at the Site or a laboratory that is not certified.

   Alkalinity*, Aluminium Residual*, Chloramines, Chlorine Dioxide Residual, Chlorine Residual, Colour, Conductivity*, Fluoride Residual*, Hardness*, Iron*, Manganese*, Methane*, Free Ammonia (as N)*, Ozone Residual, pH, Temperature, Total Organic Carbon, Turbidity and UV Absorbance.

   * These parameters must have a Quality Assurance/Quality Control component that includes quarterly confirmation by an accredited laboratory.

l. The Approval Holder(s) shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel directly involved in the designated activity are made fully aware of the terms and conditions which pertain to this Approval.

m. Upon any changes to the Registry of Joint Stock Companies information, the Approval Holder(s) shall provide a copy to the Department within five business days.

4. Releases

a. Releases shall be reported in accordance with the Act.

b. Releases shall be cleaned up in accordance with the Act.

5. Residuals Management

a. All residuals generated at the Site shall be managed in accordance with a Residuals Management Plan deemed acceptable by the Department.

b. Changes to the Residuals Management Plan must be submitted in writing for review and be deemed acceptable by the Department prior to implementation.

   i. type of residual;

   ii. processing method;

   iii. expected annual volume of residuals to be generated by the activity.

c. The Approval Holder(s) shall record the following information each time residuals are removed from the facility and make the records available to the Department immediately upon request:

   i. the type of residual;

   ii. the volume of each residual transported, expressed as cubic metres or kilograms;

   iii. hauler, if applicable;

   iv. date of transport;

   v. final destination of residuals.

6. Operation

a. The Municipal Public Drinking Water Supply has been classified as a Class III water treatment facility and a Class II water distribution facility.

b. When it is necessary to use a by-pass to divert water around one or more unit processes, the Approval Holder(s) shall immediately notify the Department and identify the anticipated period of time that the by-pass will be in service.

c. When it is necessary to use a by-pass to divert water around one or more unit processes, the Approval Holder(s) shall immediately initiate a Boil Water Advisory. The Approval Holder(s) shall maintain the boil advisory until otherwise advised by the Department.

d. The Approval Holder(s) shall ensure the development and implementation of a cross-connection control program to protect the Municipal Public Drinking Water Supply from contamination due to cross-connections from commercial, institutional, industrial, multi-unit residential, and agricultural facilities, at a minimum, and avoid any cross-connections within the drinking water treatment facility. The program shall be submitted to the Department for review on or before

June 1 , 2020. Upon review, the Department may require changes to the cross-connection control program.

e. The Approval Holder(s) shall demonstrate that any water supply system component in contact with treated water has been disinfected after construction, repair or maintenance in accordance with ANSI(American National Standards Institute)/AWWA (American Water Works Association) C651 - Disinfection of Water Mains, ANSI/AWWA-C653 - Disinfection of Water Treatment Plant, and ANSI/AWWA C652 - Disinfection of Water Storage Facilities or the latest revisions.

f. The Approval Holder(s) shall ensure that all chemicals used in the treatment process and all materials contacting the water are of “food grade” quality and meet both the AWWA quality criteria as set out in AWWA standards and the ANSI safety criteria as set out in ANSI standard NSF/60 (for chemical additives) or NSF/61 (for materials). A copy of the appropriate NSF certification is to be kept on Site and is to be available for review immediately upon request by the Department.

g. The Approval Holder(s) shall discontinue use of any chemical found to have adverse effects on finished water quality limits as prescribed in this Approval.

h. Emergency Notification Procedures:

    i. The Approval Holder(s) shall ensure that the emergency notification procedures are reviewed and updated on a yearly basis. The Approval Holder(s) shall document in the annual report what modifications were made to the emergency notification procedures and how the procedures were communicated to their staff.

    ii. A copy of the emergency notification procedures are to be maintained on Site at all times and are to be available for review immediately upon request by the Department.

    iii. All employees shall be apprised of the emergency notification procedures.

i. Operations Manual:

    i. A copy of the operations manual is to be kept on Site at all times and is to be available for review immediately upon request by the Department.

    ii. The Approval Holder(s) shall ensure that all employees are trained in accordance with the operations manual and shall keep a record of training at the facility for a minimum period of five (5) years.

j. A set of drawings, incorporating any amendments made from time to time, shall be retained on Site by the Approval Holder(s) for as long as the Municipal Public Drinking Water Supply is kept in operation and are to be available for inspection

or review by departmental staff immediately upon request.

k. The Approval Holder(s) shall establish procedures for receiving and responding to complaints including a reporting system that records and documents what steps were taken to determine the cause of complaint and the corrective measures taken to alleviate the cause and prevent its recurrence.

l. The Approval Holder(s) shall establish security measures to assure the safety of the Municipal Public Drinking Water Supply.

m. The Approval Holder(s) shall maintain a written list of the name of each laboratory utilized, and the parameters analyzed by each laboratory, and shall submit this list to the Department immediately upon request.

7. System Assessment Report

a. The Approval Holder(s) shall submit a “System Assessment Report" to the Department by April 1, 2023, to verify that the Municipal Public Drinking Water Supply complies with the Act and standards.

b. The System Assessment Report shall be in accordance with the Department's "Terms of Reference for System Assessment Reports for Water Works" as amended from time to time.

c. The Approval Holder(s) shall provide the Department with their corrective action plan to address deficiencies identified by the “System Assessment Report” by October 1, 2023. Any changes to the corrective action plan shall be submitted to and deemed acceptable by the Department.

8. Source Water Protection

a. The Approval Holder(s) shall implement the accepted Source Water Protection Plan in accordance with the accepted schedule.

b. The Approval Holder(s) shall ensure that the Source Water Protection Plan is reviewed and updated on a yearly basis. The Approval Holder(s) shall ensure that any changes are documented in the annual report.

c. The Approval Holder(s) shall modify the Source Water Protection Plan including updates, if so directed by the Department.

9. Water Quality Requirements - Performance and Limits

General Requirements

a. Utilizing both the engineered filtration and disinfection processes, the treatment facility shall meet the following treatment efficiencies:

i. Treatment shall be sufficient to ensure 3-log reduction (99.9%) of Giardia

and Cryptosporidium, and

ii. Treatment shall be sufficient to ensure 4 log reduction (99.99%) of viruses.

b. Primary disinfection though the use of UV, chlorine, and/or Department approved alternate disinfectant shall address a minimum of 0.5-log inactivation for Giardia when used in conjunction with filtration. The disinfection log inactivation shall be based on CT/IT values as described in "Nova Scotia Treatment Standards for Municipal Drinking Water Systems". CT values shall be calculated as defined by the Department's "Nova Scotia Treatment Standards for Municipal Drinking Water Systems". A minimum UV dose (IT) of 40mJ/cm2 is required.

c. The treated water shall be minimize corrosion of the water distribution and/or plumbing systems.

Primary Disinfection Requirements

d. The facility shall have a minimum of two primary disinfection units to ensure that inadequately disinfected water is not distributed. Each disinfection unit shall be capable of meeting the maximum day demand flow. Where more than two disinfection units are provided , the maximum day demand flow shall be met when the largest unit is out of service.

e. Continuous on-line monitoring of the primary disinfection process is required at each treatment facility with measurements taken at a minimum of once every five minutes to ensure that inadequately disinfected water does not enter the distribution system. Water systems shall be equipped with alarm capabilities to notify operations staff if the disinfection process fails to operate properly to prevent inadequately disinfected water from being distributed.

f. In the event of an emergency situation where water enters the water distribution system that does not meet the water quality limits as prescribed in this Approval, the Approval Holder(s) shall issue a boil water advisory, do-not-consume, or do-not-use advisory as described in the Guidelines for Monitoring Public Drinking Water Supplies and immediately notify the Department.

g. Standard operational procedures (SOPs) for the disinfection process shall be developed, implemented and communicated to all operations staff and documented in the operations manual required herein. The procedures and a log indicating the date and method of communication to staff shall be made available to the Department immediately upon request.

i. The standard operational procedures shall indicate the design ranges for achieving CT (e.g. minimum temperature and chlorine residual; maximum flow and pH) and/or IT (e.g. min UV intensity, min UV transmittance, and max water flow).

ii. When operational conditions are outside the design ranges for achieving

CT/IT, the Approval Holder shall notify the Department as soon as the Approval Holder becomes aware, investigate the cause and take necessary corrective action. CT/IT shall be calculated during every such event.

Filtration Requirements

General Requirements:

h. A minimum of two filters (redundancy) is required. Where two filters or membrane units are provided, each shall be capable of supplying maximum daily demands with the largest filter out of service. Where more than two filters or membrane units are provided, the maximum day demand shall be met with the largest filter out of service.

i. Filters shall be capable of directing filtered water to waste immediately following a backwash for a period of time until the filtrate turbidity value is below 0.2 NTU.

Individual Filter Turbidity Values:

j. For chemically-assisted filtration, turbidity levels from the combined or individual filter effluent:

   i. shall be less than or equal to 0.2 NTU in at least 95% of the measurements made, or at least 95% of the time each calendar month;

   ii. shall not exceed 1.0 NTU at any time.

k. The filtration process shall be operated in such a manner as to remove an individual filter from service if the turbidity exceeds the values specified herein.

l. Filtration processes for pathogen reduction are required to be continuously monitored, with measurements taken at a minimum frequency of once every five minutes. Filtration processes shall have a shut off feature and alarm when turbidity criteria are not achieved . The Approval Holder shall notify the Department as soon as they become aware of turbidity values that do not meet the requirements of this Approval.

m. Standard operational procedures for the filtration process shall be developed, implemented and communicated to all operations staff and documented in the operations manual required herein. The procedures shall be made available to the Department immediately upon request.

Distribution Turbidity Values:

n. A turbidity value of 5.0 NTU or less shall be achieved on water distribution system sampling.

o. Unless specified otherwise in this approval, sampling and testing frequency is the same as for bacteriological sampling requirements as stated in the “Guidelines

for Monitoring Public Drinking Water Supplies".

p. Where turbidity values of greater than 5.0 NTU are observed in the water distribution system, the Approval Holder(s) shall investigate the cause and take corrective action as necessary and notify the Department immediately.

Turbidity Monitoring Requirement:

q. Continuous monitoring, with measurements taken at no more than five minute intervals, is required for individual filter effluent.

r. Continuous or grab sample monitoring at least once a day is required for raw water prior to pre-treatment.

s. Continuous or grab sample monitoring of the water distribution system is required. Unless specified otherwise in this approval, sampling and testing frequency is the same as for bacteriological sampling requirements as stated in the "Guidelines for Monitoring Public Drinking Water Supplies".

t. Continuous or grab sample monitoring of the filter-to-waste product is required. Unless specified otherwise in this Approval, sampling and testing shall be completed prior to returning the filter to operation.

Secondary Disinfection and Residual Monitoring Requirements

u. Secondary disinfection through the use of Free Chlorine shall be used to maintain a chlorine residual in the water distribution system.

v. The disinfection process shall be operated in such a manner as to ensure that the following minimum chlorine residual value is achieved throughout the water distribution system at all times:

   i. 0.20 mg/L free chlorine residual.

w. The disinfection process shall be operated in such a manner as to ensure that the maximum chlorine residual delivered to consumers does not exceed the following value:

   i. 4.0 mg/L free chlorine residual.

x. Continuous monitoring of the chlorine residual is required for the water leaving any water storage structure within the water distribution system, with measurements taken at no more than five minute intervals.

y. Monitoring of the water distribution system for chlorine residual is required. Unless specified otherwise in this Approval, sampling and testing frequency is the same as for bacteriological sampling requirements as stated in the "Guidelines for Monitoring Public Drinking Water Supplies".

Aluminum Residual Values:

z. Based upon a running annual average of monthly samples, reduce residual aluminum levels to the lowest extent possible with a maximum operational value of 0.1 mg/L for conventional treatment or 0.2 mg/L when utilizing other treatment types.

10. Backup Water Systems

a. Prior to the use of a backup water system, the Approval Holder(s)shall immediately notify the Department and identify the anticipated period of time that the backup system will be in service.

b. For backup systems that do not meet the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, the Approval Holder(s) shall immediately initiate a Boil Water Advisory as stated in the "Guidelines for Monitoring Public Drinking Water Supplies" prior to the use of the backup system. The Approval Holder(s) shall maintain the boil advisory until otherwise advised by the Department.

c. For backup systems that meet the Nova Scotia Treatment Standards for Municipal Drinking Water Systems , the backup water system may continue to operate until the main water system is put back into service or as otherwise directed by the Department.

11. Laboratory Reports and Water Quality Results

a. The Approval Holder shall submit copies of the laboratory certificate of analysis to the Department immediately upon request.

b. The Approval Holder(s) will authorize and work with laboratories to electronically report water quality results to the Department upon implementation of an on-line drinking water quality surveillance program.

c. Electronic reporting shall not replace the Approval Holder(s)'s responsibility to notify the Department immediately, by telephone, of the presence of bacteria or an exceedance of a maximum acceptable concentration for a health-related parameter listed in the "Guidelines for Canadian Drinking Water Quality".

12. Treatment Backwash - Performance and Limits

a. Backwash water from the treatment process shall be discharged to a location deemed acceptable by the Department.

b. Backwash water discharged from the treatment process shall go to a municipal wastewater collection system.

13. Monitoring and Recording

a. The Approval Holder(s) shall monitor and sample the municipal public drinking water supply system in accordance with a monitoring program deemed acceptable by the Department and which meets the minimum requirements of Schedule A, attached. In the case of a discrepancy between Schedule A and the accepted monitoring program, the accepted monitoring program shall apply.

b. All required monitoring data must be collected and submitted in the units of measure indicated in the standard(s).

c. Sampling shall be representative of the water distribution system.

d. On or before October 1 of each year, the Approval Holder(s) shall recommend to the Department the monitoring program for the municipal public drinking water supply for the following calendar year, highlighting any proposed changes and the reason for the changes. Any existing monitoring program shall remain in place until the recommended monitoring program is deemed acceptable by the Department.

e. The monitoring program shall meet the minimum requirements of the Department's "A Guide to Assist Nova Scotia Municipal Water Works Prepare Annual Sampling Plans", as amended from time to time.

f. The monitoring program shall be acceptable to the Department.

g. The Approval Holder(s) is responsible for implementing, on an annual basis, the monitoring program and subsequent revisions as deemed acceptable by the Department.

h. The Approval Holder(s) shall not move, relocate or otherwise alter the location of the sampling locations indicated in the approved monitoring program without written permission from the Department.

i. Following a review of any of the analytical results required by this Approval, the Department may alter the frequencies, location, and parameters for analyses required for this Approval or require other remedial action.

j. Any flow measuring devices and continuous water quality analysers and indicators with alarm systems shall be installed, maintained and calibrated as specified by the instrument manufacturer's instructions. Calibration logs for each instrument shall be maintained at the site and be available for inspection immediately upon request by the Department.

k. The Approval Holder(s) shall establish a QA/QC program to validate the measurements obtained from continuous monitoring equipment and for all analysis conducted at the Site or a non-certified laboratory.

l. The Approval Holder(s) shall establish and conduct process control testing and sampling and record the results. Results are to be made available for inspection

or review by departmental staff immediately upon request.

m. The Approval Holder(s) shall establish and conduct source water protection testing and sampling and record the results. Results are to be made available for inspection or review by departmental staff immediately upon request.

14. Reporting

Reporting Upon Request

a. The Approval Holder(s) shall keep records continually updated in such a way, that weekly and/or monthly reporting of monitoring and sampling results can be immediately sent to the Department upon request.

Annual Reporting

b. The Approval Holder(s) shall prepare and submit to the Department, an annual report for the municipal public drinking water supply.

c. The annual report shall be submitted on or before April 1 following the completion of the calendar year being reported upon.

d. The annual report shall contain, but not be limited to, the following information:

i. a summary and discussion of the quantity of water supplied during the reporting period on a per month basis showing design values, maximum daily flow and average daily flow for each month and any other parameters or conditions specified in the Water Withdrawal Approval.

ii. a summary and interpretation of analytical results obtained in accordance with the monitoring and recording section of this Approval, including an explanation for any exceedance of the maximum acceptable concentration (MAC) of health-related parameters listed in the “Guidelines for Canadian Drinking Water Quality”, latest edition and the actions taken to address the exceedance;

iii. a summary and interpretation of analytical results obtained in accordance with the corrosion assessment/control monitoring program including but not limited to residential lead sampling results;

iv. annual trend graphs for parameters that are continuously monitored;

v. date and description of any emergency or upset conditions which occurred during the period being reported upon and action taken to correct them;

vi. any modifications to the contingency plan or emergency notification procedures including a description of how the information was communicated to staff;

vii. a list of the names of each laboratory utilized by the Approval Holder(s) and the parameters analyzed by each laboratory;

viii. an update on the status of the source water protection plan, including any modifications to the plan or implementation schedule, and a summary of activities taken to achieve the goals and objectives of the plan;

ix. all incidents of free chlorine residual below 0.20 mg/L in the water distribution system shall be detailed with a description of any actions taken;

x. mathematical verification that the operational conditions remained within the design range for achieving CT/IT; if operational conditions went outside the design ranges, provide CT/IT calculations and a summary of corrective actions taken;

xi. mathematical verification that the individual filter turbidity values are less than or equal to 0.2 NTU in at least 95% of the measurements made, or at least 95% of the time each calendar month;

xii. incidents of non-compliance with this Approval, the date it was reported to the Department, and corrective actions taken by the Approval Holder(s);

xiii. any complaints received and the steps taken to determine the cause of the complaint and the corrective measures taken to alleviate the cause and prevent its recurrence;

xiv. a review of the QA/QC program to validate the measurements obtained from continuous monitoring equipment and for all analysis conducted at the facility or a non-certified laboratory;

xv. a list of each certified operator and their level of certification.

Emergency Reporting on Operation

e. The Approval Holder(s) shall notify the Department immediately of an incident that may adversely affect the quality of the water within the municipal public drinking water supply. Notification shall be made to a live person by phone or in person and followed by fax or email. These incidents shall include but not be limited to: the presence of bacteria; inadequately disinfected water being directed to the water distribution system; sewage or other releases in the source municipal public drinking water supply area; line breakage that may result in cross contamination; exceedance of turbidity values required by this approval; if using membrane filtration, failure of direct integrity test, etc.

f. The Approval Holder(s) shall notify the Department immediately of any analytical results that exceed the maximum acceptable concentration (MAC) of health-related parameters listed in the “Guidelines for Canadian Drinking Water Quality”, latest edition. Notification shall be made to a live person by phone or in person

and followed by fax or email.

g. When bacteria are detected at the municipal public drinking water supply, the Approval Holder(s) shall notify the Department immediately of the presence of bacteria and take corrective action as outlined in the latest edition of the "Guidelines for Monitoring Public Drinking Water Supplies" as amended from time to time. Notification shall be made to a live person by phone or in person and followed by fax or email.

h. If the chlorine residual in the water distribution system is less than 0.20 mg/L free chlorine, the Approval Holder(s) shall notify the Department immediately of the low chlorine residual and take corrective action to obtain the required residual. Notification shall be made to a live person by phone or in person and followed by fax or email.

15. Contingency Plan

a. The contingency plan is to meet the minimum requirements of the Department's "A Guide to Assist Nova Scotia Municipal Water Works Develop a Comprehensive Operations Manual" and "Contingency Planning Guidelines" as amended from time to time.

b. The Approval Holder(s) shall ensure that the contingency plan for the Municipal Public Drinking Water Supply is reviewed and updated on a yearly basis. The Approval Holder(s) shall document in the annual report what modifications were made to the plan and how the plan was communicated to their staff.

c. The Approval Holder(s) shall ensure that all employees are trained in accordance with the contingency plan and shall keep a record of training at the facility for a minimum period of five (5) years.

d. A copy of the contingency plan is to be maintained on Site at all times and is to be available for review immediately upon request by the department.

16. Records

a. The Approval Holder(s) shall keep the following records and water quality analyses:

   i. All incidents of suspected and/or confirmed disease outbreaks attributed to the water system shall be documented and kept for a minimum of ten years.

   ii. Bacteriological, chlorine residual and turbidity analyses shall be kept for two years.

   iii. Chemical analysis shall be kept for 10 years.

   iv. Annual water withdrawal records shall be kept for 10 years.

b. The Approval Holder(s) shall retain the following information for a period of five (5) years:

   i. Calibration and maintenance records.

   ii. Continuous monitoring data.

c. A copy of project reports, construction documents and drawings, inspection reports, shall be kept for the life of the Water Supply System.

Schedule A Surface Water		
Water Quality Parameters	Sample Location	Minimum Frequency
Turbidity		
Turbidity	Raw water	Continuous at no more than 5 minute intervals or daily grab
	Individual filter effluent	Continuous at no more than 5 minute intervals
	Filtered water directed to waste	Continuous at no more than 5 minute intervals or grab sample during filter-to-waste
	Distribution system sample points	Weekly grab sample
Primary Disinfection (Parameters to be monitored depend on the disinfection method used)		
Free Chlorine		
Fee Chlorine Residual	CT control point (water entering distribution system)	Continuous at no more than 5 minute intervals – must meet CT design criteria
Temperature	CT control point	Continuous at no more than 5 minute intervals or daily grab – must meet CT design criteria
pH	CT control point	Continuous at no more than 5 minute intervals - must meet CT design criteria
Secondary Disinfection (Parameters to be monitored depend on the disinfection method used)		
Free Chlorine		
Free Chlorine Residual	Storage structure outlet	Continuous at no more than 5 minute intervals
	Distribution system sample points	Weekly grab sample
Microbial Quality		
Total Coliforms and *E. coli* (present/absent)	Water entering the distribution system	Weekly grab sample
	Distribution system sample points	Weekly grab sample

<table>
<tr><th colspan="3">Schedule A
Surface Water</th></tr>
<tr><th>Water Quality Parameters</th><th>Sample Location</th><th>Minimum Frequency</th></tr>
<tr><td rowspan="2">Viruses</td><td>Raw water</td><td>As requested by the Department</td></tr>
<tr><td>Water distribution system</td><td>As requested by the Department</td></tr>
<tr><td rowspan="2">Giardia and Cryptosporidium</td><td>Raw water</td><td>As requested by the Department</td></tr>
<tr><td>Water distribution system</td><td>As requested by the Department</td></tr>
<tr><td>Cyanobacteria</td><td>Raw water</td><td>Visual monitoring at least weekly for evidence of bloom formation from May to October.</td></tr>
<tr><td rowspan="2">Cyanobacterial toxins - Total Microcystins</td><td>Raw water</td><td>During a bloom

Minimum of every 5 years as part of full health-related parameter suite (during warmest month)</td></tr>
<tr><td>Treated water</td><td>During a bloom

Minimum of every 5 years as part of full health-related parameter suite (during warmest month)</td></tr>
<tr><th colspan="3">Corrosion Monitoring Program</th></tr>
<tr><td>• pH
• Alkalinity
• Conductivity
• Temperature
• Dissolved oxygen
• Chlorine or chloramine residual
• Corrosion inhibitor residual (if used)

These parameters will assist the utility determine the corrosivity of the water and type of corrosion control the system should install, if needed.</td><td>Point of entry and representative locations within the distribution system based on population served:

<table><tr><th>Population</th><th># of distribution samples</th></tr><tr><td><100</td><td>1</td></tr><tr><td>101-500</td><td>2</td></tr><tr><td>501-3,300</td><td>3</td></tr><tr><td>3,301-10,000</td><td>4</td></tr><tr><td>10,001-100,000</td><td>6</td></tr><tr><td>>100, 000</td><td>10</td></tr></table></td><td>Quarterly grab sample for two consecutive years*

* An owner may submit a request to NSE for a reduction in the frequency of point-of-entry and distribution monitoring requirements from quarterly to annually between May and October if the water is not corrosive as evidenced by point of entry and distribution sample results for key parameters in conjunction with residential lead levels (e.g. the 90th percentile</td></tr>
</table>

Schedule A Surface Water		
Water Quality Parameters	Sample Location	Minimum Frequency
		lead concentrations are below the lead action level for a period of two consecutive years). *If the water is corrosive as evidenced by point-of-entry and distribution sample results for key parameters in conjunction with residential lead levels (e.g. the 90th percentile lead concentrations are above the lead action level in any given year), the utility shall implement a corrosion control program or optimize their existing program. The utility shall submit a corrosion control program to NSE for review and acceptance. Once accepted by NSE, the utility shall follow the corrosion control monitoring parameters, location(s) and frequency included in their program.
Lead – flushed sample(s)	Representative locations within the distribution system based on population served – see table above.	Annually – during the warmest month* * An owner may submit a request to NSE to stop collecting flushed samples for lead from the distribution system, if samples collected from the distribution system during the warmest month for a period of two consecutive years show the utility does not have lead present in fittings or other components in the distribution system.

<table>
<tr><th colspan="3">Schedule A
Surface Water</th></tr>
<tr><th>Water Quality Parameters</th><th>Sample Location</th><th>Minimum Frequency</th></tr>
<tr><td rowspan="2">Lead – Stagnated Sampling
(as per Health Canada's Guidance for Controlling Corrosion in Drinking Water Distribution Systems, as amended from time to time)

Tier 1 Sampling
• Minimum 6-hour stagnation period
• Collect first draw 1 litre sample. May collect 4 1-litre samples in case Tier 2 sampling is required.</td><td>Where possible, sites shall be selected to include: 1/ at least 50% of sites with lead service lines (where present); 2/ locations that contain copper pipes with lead solders or lead pipes; and 3/ locations with lead containing brass fittings.</td><td>Annually between May to October to assess corrosivity of water to lead release.

If < 10% (defined as 90th percentile) of initial sample results are above the lead action limit for a period of two consecutive years, submit request to NSE to sample once per year (reduced annual).

If > 10% (defined as 90th percentile) of initial sample results are above the lead action limit, proceed to Tier 2 sampling.</td></tr>
<tr><td colspan="2">Number of monitoring sites is based on the population served as shown in the following table:

<table><tr><th>Population</th><th># of sites (Routine annual)</th><th># of sites (Reduced annual)</th></tr><tr><td><100</td><td>5</td><td>5</td></tr><tr><td>101-500</td><td>10</td><td>5</td></tr><tr><td>501-3,300</td><td>20</td><td>10</td></tr><tr><td>3,301-10,000</td><td>40</td><td>20</td></tr><tr><td>10,001-100,000</td><td>60</td><td>30</td></tr><tr><td>>100, 000</td><td>100</td><td>50</td></tr></table>
*An owner may submit a request to NSE for a reduction in the number of residential samples if the 90th percentile lead concentrations are below the lead action level for a period of two consecutive years.</td></tr>
<tr><td>Tier 2 Sampling
• Minimum 6-hour stagnation period
• Collect first draw 4* x 1</td><td>Sample at 10% of sites sampled in Tier 1 (sites with the highest lead concentration). For</td><td>Only required when >10% (defined as 90th percentile) of Tier 1 samples exceed the lead action limit.</td></tr>
</table>

Schedule A Surface Water		
Water Quality Parameters	Sample Location	Minimum Frequency
litre samples (or additional 3 x 1 litre samples from Tier 1) * More than 4 samples may be required to identify the source of lead, depending on several factors including the length and diameter of piping, etc.	systems serving 500 or fewer people a minimum of two sites are required. Each 1 liter sample is analyzed to obtain a profile of lead contribution from the: -Faucet -Plumbing (leaded solder, brass and bronze fittings, brass water meter, etc.) -Lead service line	
Process Control		
Water Volume	Raw water entering facility	Continuous at no more than 5 minute intervals - must meet CT design criteria
Aluminum – for facilities that add aluminum-based coagulants	Water entering the distribution system	Monthly
	Select distribution system sample point(s)	Monthly
Disinfection By-products		
Total Trihalomethanes (THMs)	Select distribution system sample point(s) – representative of highest level. Areas in the distribution system with the longest disinfectant retention time.	Quarterly - locational running annual average (lraa) based on a minimum of 4 quarterly samples.
Haloacetic Acids (HAAs)	Select distribution system sample point(s) – where historical data show the highest concentration. Where historical data is not available concentrations shall be monitored in the middle and extremities of the distribution system.	Quarterly - locational running annual average (lraa) based on a minimum of 4 quarterly samples.
Chlorate – if storing sodium hypochlorite	Water entering distribution system	Quarterly

Schedule A Surface Water		
Water Quality Parameters	Sample Location	Minimum Frequency
more than 3 months		
Bromate – if storing sodium hypochlorite more than 3 months	Water entering distribution system	Quarterly
Treatment Process -Backwash Wastewater		
Treatment process backwash wastewater- parameter(s), location(s), and frequency in accordance with this approval and the accepted annual monitoring program.		
General Chemical and Physical Quality		
General chemical and physical parameters listed in the Guidelines for Monitoring Pubic Drinking Water Supplies	Raw and treated water	Minimum annually
Manganese	• Raw water (prior to treatment) • Entering the distribution system • Distribution system	Quarterly * The Approval Holder may request a reduction in sample frequency if it is determined that manganese is not a parameter of concern for the water supply.
Guidelines for Canadian Drinking Water Quality		
All health-related parameters in the Guidelines for Canadian Drinking Water Quality	Raw and treated water	Every 5 years unless system assessment report or source water protection plan requires more frequent monitoring.
Source Water Protection		
Parameters as per the source water protection monitoring program	Locations and frequencies in accordance with the source water protection monitoring program.	

APPENDIX H

Approval to Withdrawal

NOVA SCOTIA
Environment
Environmental Monitoring and Compliance

2nd Floor
136 Exhibition Street
Kentville, Nova Scotia
Canada B4N 4E5

902 679-6086 t
902 679-6186 f
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Our File Number: 95100-30KEN-2014-090991

October 9, 2015

Municipality of the County of Annapolis
Attn.: James Jenner
P.O. Box 100
Annapolis Royal, NS
B0S 1A0

RE: Approval for Water Withdrawal/Storage of Water - Reservoir and Lake Cady
Municipality of the County of Annapolis
Application No. 2014-090991
PID # 05049655, Clementsvale, Annapolis County, Nova Scotia

Enclosed please find Approval Number 2014-090991 for the withdrawal and storage of surface water from the watercourse known as; "reservoir" and Lake Cady, located at or near Clementsvale, Annapolis County, Nova Scotia.

Based on the projected withdrawal volumes, you will be invoiced an annual user fee. You will also be invoiced for an Annual Approval Administration Fee. These fees are subject to review and adjustment by the Minister and you will be invoiced annually.

This approval or a copy is to be kept on-site at all times. All personnel involved in the project must be made fully aware of the terms and conditions of this approval. The terms and conditions are shown as attached and it is your responsibility to ensure that they are followed. Failure to comply with the terms and conditions is an offence.

It is your duty to advise the Department of any new and relevant information respecting any adverse effect that results or may result from the approved Activity, which comes to your attention after the issuance of the approval. This is required under Section 60 of the *Environment Act*.

If the Activity is altered, extended or modified beyond the description given in this approval, please reapply as a new approval may be required.

Despite the issuance of this Approval, the Approval Holder is still responsible for obtaining any other authorization which may be required to carry out the Activity, including those which may be necessary under provincial, federal or municipal law.

Should you have any questions, please contact Lynsey Crowell at Western Region, Kentville Office at (902) 679-6086.

Yours truly,

Jennifer Lonergan
District Manager

cc Pauline Herron, Environment, Kentville Office
Lisa Paon, DFO

NOVA SCOTIA
Environment

APPROVAL

Province of Nova Scotia
***Environment Act*, S.N.S. 1994-95, c.1, s.1**

APPROVAL HOLDER:	**Municipality of the County of Annapolis.**
APPLICATION NO:	**2014-090991**
EXPIRY DATE:	**October 1, 2025**

Pursuant to Part V of the *Environment Act*, S.N.S. 1994-95, c.1, s.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following Activity:

Water withdrawal/storage of water at the watercourse known as Lake Cady (PID 05196050) and Reservoir (PID 05049655) at or near Clementsvale, Annapolis County, in the Province of Nova Scotia.

Administrator Jennifer Spreng

Effective Date October 9th 2015

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder:	Municipality of the County of Annapolis
Project:	Margaretsville Municipal Water Supply Water withdrawal/storage of water Lake Cady & Reservoir
Site:	Clementsport Road Clementsvale, Annapolis County
PID:	05049655 & 05196050
Application No:	2014-090991
File No:	95100-30-KEN-2014-090991

Average rate of withdrawal: 700,000 litres per day (averaged over 30 days)

Maximum rate of withdrawal: 1,125,000 litres per day (over a 3 day period)

Reference Documents:

- Application and supporting documentation received September 4, 2014
- Report entitled "Water Withdrawal Report for Community of Cornwallis Lake Cady, Annapolis County, Nova Scotia" received July 27, 2015.
- Various communication in file dated up to October 7, 2015.

1. Definitions

a. "Act" means the *Environment Act* S.N.S. 1994-1995, c.1 and includes all regulations made pursuant to the Act.

b. "Department" means the Western Region, Kentville Office, of Nova Scotia Environment.

c. "Facility" means the water withdrawal and associated works.

d. "Minister" means the Minister of Nova Scotia Environment.

e. "Qualified person" means, for the purposes of this Approval, a registered professional engineer licensed to practice in Nova Scotia or a person with hydrology training and experience.

2. Scope of Approval

a. This Approval (the "Approval") relates to the Approval Holder and their application and supporting documentation, as listed in the reference documents above, to withdraw and store water from Lake Cady and Reservoir at or near Clementsvale, Annapolis County, Nova Scotia.

b. The Facility shall be operated as outlined in the application for approval dated September 4, 2014 and supporting documentation.

3. General

a. The Approval Holder shall withdraw water in accordance with provisions of the:

i. *Environment Act* S.N.S. 1994-1995, c.1; s.1 (the "Act") as amended from time to time
ii. Regulations, as amended from time to time, pursuant to the above Act;
iii. Nova Scotia Watercourse Alteration Specifications (1997) Legal, General,
iv. Standards, Policies, or Guidelines as amended from time to time issued by Nova Scotia Environment;

b. The Activity shall be conducted in accordance with the details and specifications in the Application and attached appendices and the reference documents. **If there is a discrepancy between the reference documents and these terms and conditions, the terms and conditions of this approval shall apply.**

c. Any request for renewal or extension of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.

d. The Minister or Administrator may modify, amend or add conditions to this Approval at anytime pursuant to Section 58 of the Act.

e. This Approval is not transferable without the consent of the Minister or Administrator.

f. (i) If the Minister or Administrator determines that there has been non-compliance with any or all of the terms and conditions contained in this Approval, the Minister or Administrator may cancel or suspend the Approval pursuant to subsections 58(2)(b) and 58(4) of the Act, until such time as the Minister or Administrator is satisfied that all terms and conditions have been met.

(ii) Despite a cancellation or suspension of this Approval, the Approval Holder is at all times subject to the penalty provisions of the Act and regulations.

g. The Approval Holder shall notify the Department prior to any proposed extensions or modifications of the Activity including, but not limited to, an increase in withdrawal rates or the addition of production wells. The Approval holder shall obtain written authorization or amendment from the Administrator before implementing any change that would not comply with the Terms and Conditions of this Approval.

h. The Approval Holder shall immediately notify the Department of any incidents of non-compliance with this Approval.

i. Pursuant to Section 60 of the Act, the Approval Holder shall submit to the Administrator any new and relevant information respecting any adverse effect that actually results, or may potentially result, from any activity to which the Approval relates and that comes to the attention of the Approval Holder after the issuance of the Approval.

j. The Approval Holder shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.

k. Unless written approval is received otherwise from the Administrator, all samples required by this Approval shall be analysed by a laboratory that meets the requirements of the Department's "Policy on Acceptable Certification of Laboratories" as amended from time to time.

l. The Approval Holder shall submit any monitoring results or reports required by this Approval to the Department. Unless specified otherwise in this Approval, all monitoring results shall be submitted within 30 days following the month of monitoring.

m. The Approval Holder shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel directly involved in the Activity are made fully aware of the terms and conditions which pertain to this Approval.

n. Within one month of the issuance of this Approval, the Approval Holder shall designate in writing, to the Department, a contact for this Approval. If the contact should change, the Approval Holder shall immediately notify the Department in writing.

o. The Approval Holder shall, upon receipt of an invoice from the Minister of Nova Scotia Environment stating the amount owing, pay to the Minister of Finance the amount stipulated in said invoice. Said amount shall be in accordance with the schedule of fees established by the Minister of Nova Scotia Environment, as may be revised from time to time.

p. The failure of the Minister to insist upon a strict performance of a Term and Condition contained in this Approval shall not be deemed a waiver of any rights or remedies that the Minister may have and shall not be deemed a waiver of any subsequent breach of the Terms and Conditions of this Approval.

q. This Approval does not give sole or exclusive rights to any watercourse or water resource, and the Minister reserves the right to use and to allow others to use the watercourse or water resource and the water therein.

r. The Approval Holder may not alter or use the watercourse or water resource so as to:

   i. prejudice any riparian or other rights, should any such rights exist, of a person lawfully in possession lands abutting the watercourse or water resource;

   ii. cause damage or nuisance to adjacent or abutting lands.

s. The Approval Holder shall not place a pecuniary value on or claim any pecuniary value for the rights granted by this Approval, over and above the amounts, if any, paid to the Minister by the Approval Holder for the rights.

t. The Approval Holder shall maintain a culvert, bridge, dam, sluice, flume, conduit, well or other structure built or used in or on the watercourse or water resources so that it does not cause an adverse effect. This conditions survives the expiry or cancellation of this Approval.

u. The Approval Holder shall conform to a direction of the Minister or an Administrator concerning the maintenance or rehabilitation of a

watercourse or water resource or the maintenance, rehabilitation or removal of a culvert, bridge, dam, sluice, flume, conduit, or structure used or maintained in and on the watercourse or water resource. The Approval Holder shall, pursuant to an Approval where required, remove a culvert, bridge, dam, sluice, flume, conduit, pump or other structure and any equipment or personal property built, used or maintained in and on the watercourse or water resource at the end of the useful life of the culvert, bridge, dam, sluice, flume, conduit or structure. In the event the Approval Holder fails to remove a culvert, bridge, dam, sluice, flume, conduit or other structure or equipment or personal property, the Minister may, without any liability, remove or demolish the same in whatever manner the Minister deems necessary and the Approval Holder shall reimburse the Minister for all expenses and costs of such removal or demolition. This condition survives the expiry or cancellation of this Approval.

v. The Approval Holder shall indemnify and save harmless the Minister and an employee, servant or agent of the Department against any loss, cost or damage resulting from the activities performed pursuant to this Approval. Such indemnity shall include, but not be restricted to, all losses, costs or damages occasioned by the improper or faulty relocation of a watercourse or water resource or the improper or faulty construction of, repair, alteration or addition to any culvert, bridge, dam, sluice, flume, conduit or other structure in or on the watercourse or water resource, or by any trespass, negligence or wilful act of the Approval Holder or any employees, agents, contractors or guests of the Approval Holder.

w. This Approval shall enure to the benefit of and be binding upon the Minister, the Minister's successors, assigns and authorized representatives and upon the Approval Holder, and the heirs, administrators, executors and assigns of the Approval Holder.

x. The Minister and all persons designated as Inspectors pursuant to the *Environment Act* shall have free access at all times to the Activity and to land under control of the Approval Holder to ensure these Terms and Conditions are being fulfilled.

4. Site Specific Terms and Conditions

a. The average water withdrawal rate from the "Reservoir" shall not exceed 700,000 litres per day (averaged over 365 days).

b. The maximum withdrawal rate shall not exceed 1,125,000 litres per day (averaged over 3 days).

c. A water flow metre shall be installed, maintained, and monitored separately for each withdrawal location.

d. The approval holder shall keep daily withdrawal records for each withdrawal location. Data is to be tabulated and also available in electronic format. Records should be available upon request by the Department.

e. Nova Scotia Environment shall not be held responsible for any water quality or quantity problems that may be encountered by the proponent.

f. If production causes interference problems with any existing supplies or water resource, the Department shall be notified immediately, and the withdrawal rate shall be reduced and/or the problem rectified to the satisfaction of the Department.

g. Based on DFO letter dated September 14, 2015, the following terms and conditions apply:

i. The Approval Holder shall ensure that an ecological maintenance flow of 0.05 cubic meters per second (m3/s) during the summer low flow period (July through September) and 0.34 m3/s during the remainder of the year are required immediately downstream of the outlet of the "Reservoir".

ii. By **July 1, 2016** the Approval Holder shall install a gauge in the channel immediately downstream of the Reservoir outlet.

iii. The Approval Holder shall develop a stage discharge curve to establish the relationship between the level of the watercourse and the rate of flow. The stage discharge curve shall be submitted to NSE and DFO for review by **November 30, 2016.** If additional information is required to better define the relationship between water level and rate of flow, the Approval Holder will be notified by March 31, 2017.

iv. The Approval Holder shall determine the watercourse level that corresponds to the ecological maintenance flows based on the stage discharge curve. These watercourse levels shall be used to establish two benchmarks at each gauging sites: one for summer low flow and one for the remainder of the year. These benchmarks should accurately reflect the ecological maintenance flows and may need to be recalibrated if site conditions change.

v. The Approval Holder shall monitor and record the watercourse levels **twice a week** to ensure that water withdrawals do not reduce flow levels below the benchmarks. Monitoring frequency should be increased as the water level approaches the

benchmarks. The records shall be made available to NSE upon request and shall be maintained for the duration of the Approval.

vi. If the watercourse levels falls below the benchmark NSE and DFO must be contacted immediately to discuss options.

vii. The water intake shall be screened to ensure fish are not impinged or entrained.

For questions related to the above terms and conditions please contact DFO at (902)426-3909 and quote file # 15-W-312.

h. This approval does not allow for the Approval Holder to withdrawal or divert water out of Lake Cady via the underwater pipe. In the event that the valve that controls the outlet of Lake Cady needs to be turned on the Department must be notified as this approval may have to be amended.

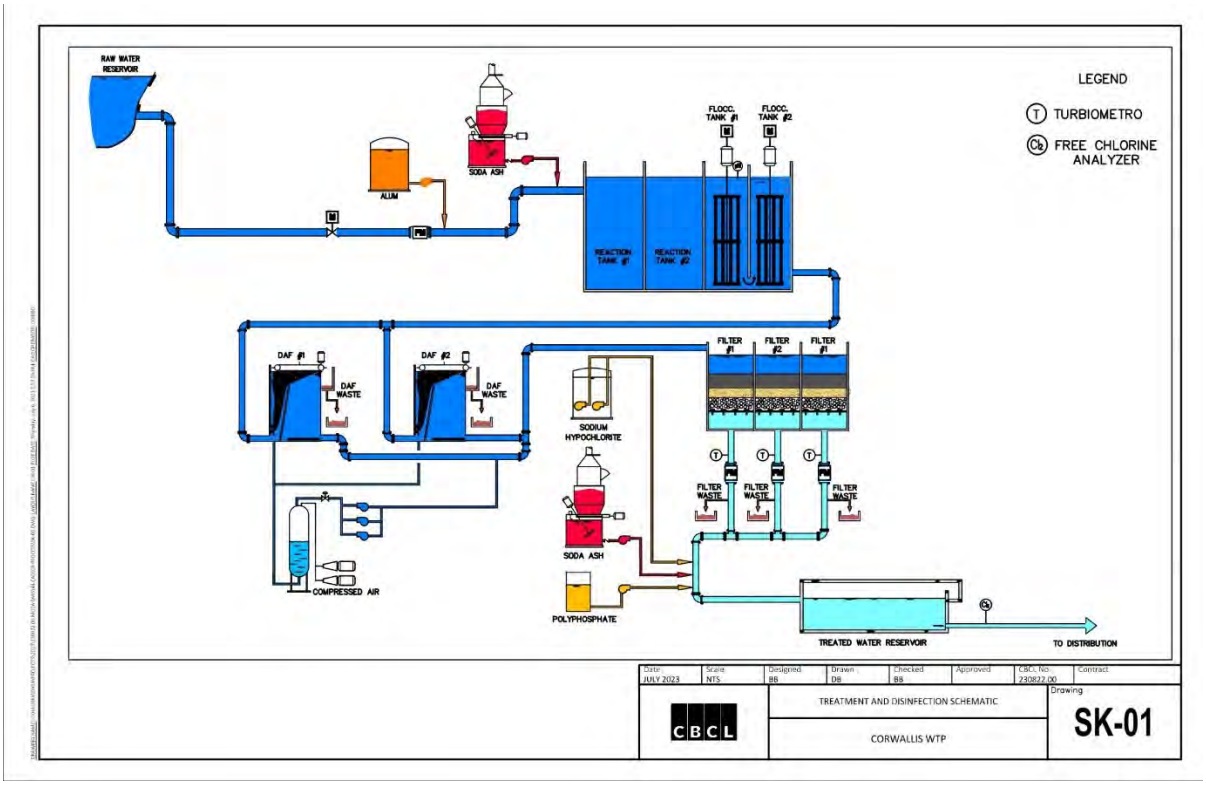
I. The Approval holder shall maintain all structures in accordance with the Canadian Dam Association Guidelines.

i) The Approval holder shall retain the services of a qualified consulting engineering firm to oversee compliance with the Canadian Dam Association Guidelines.

ii) The Approval holder shall update Emergency Preparedness Plans on a regular basis. The Emergency Preparedness Plan must at a minimum be reviewed annually to ensure that the procedures, contacts and notification process are still valid.

APPENDIX I

Schematic of the Treatment & Disinfection Process



APPENDIX J

Water Protection Zone Mapping in GIS Format for NSECC

To be provided separately.

APPENDIX K

Terms of Reference Checklist

Nova Scotia Environment & Climate Change

System Assessment Report
Terms of Reference Checklist

NOVA SCOTIA

PART I
Introduction

This checklist was prepared as a companion document to the Terms of Reference for System Assessment Reports for Municipal Drinking Water Systems, 2022. For detailed information on each of the submission requirements below, please consult the source document. For ease of reference, reports should follow the format and sequence of the checklist below. Where possible, section references should follow section and sub-section numbering conventions used in the checklist.

Where data is required to be submitted for "the most recent calendar year", Approval Holders may submit 12 consecutive months of data within a 2-year period from the date the system assessment report is due.

PART II
Characterization of the Water Source

2.0 Source Water Characterization

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.1 Source Description and Schematic*				
i. Describe the water source(s) used to meet water consumption demand.	☑	☐	2.1	3
ii. Describe any sources that are used as back-up supplies.	☐	☑	2.1.1	4
iii. Identify sources on a map.	☑	☐	App.B	App.B
iv. Document what precautions are required for back-up supplies.	☐	☑	-	-
v. If a back-up supply is intended to be used without precautions, verify that it meets the Nova Scotia Treatment Standards for Municipal Drinking Water Systems or if the back-up supply is connected to an adjoining municipality, document the name of the Municipal Public Drinking Water Supply to which it is connected.	☐	☑	-	-
vi. For Municipal Public Drinking Water Supplies that purchase water from an adjoining system, identify system connections on a map.	☐	☑	-	-
vii. Document the name of the municipal public drinking water supply(s) that water is purchased from and proceed to section 2.3.	☐	☑	-	-

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.2 Microbial Risks				
2.2.1 Surface Water Sources				
i. Summarize microbial risks and water quality variability of the surface water source(s).	☐	☑	2.2.1	4
ii. Submit raw water quality data for total coliforms and E. coli, as well as Cryptosporidium and Giardia if available, for the most recent calendar year as an Appendix.	☐	☑	2.2.1	4
2.2.2 Groundwater Sources				
i. Verify that all individual wells have been classified in accordance with the Protocol for Determining Groundwater Under the Direct Influence of Surface Water.	☐	☑	-	-
ii. Summarize the GUDI status by individual well and identify at which step in the GUDI Protocol the well was categorized as GUDI or non-GUDI.	☐	☑	-	-
iii. For wells that are no longer in use, identify if the well has been properly decommissioned or is being maintained as a back-up well or monitoring well.	☐	☑	-	-
iv. For GUDI wells, complete Table A.1 and verify that the GUDI classification has not changed based on the results of microscopic particulate analysis (MPA) testing required every two years.	☐	☑	-	-
v. Verify that MPA samples were taken following a rainfall event in accordance with Step 3 of the GUDI Protocol (e.g., if there is a 15-day time-of-travel, then the well shall be sampled 15 days after a surface water event).	☐	☑	-	-
vi. Inspect the site(s) to verify that there are no changes to the surrounding area to warrant re-classification of the well(s).	☐	☑	-	-

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
vii. Recommend corrective action for wells: • For which MPA test results indicate a change in GUDI classification. • Where changes to the surrounding area have occurred to warrant re-classification of the well per the GUDI Protocol. • Where any other concerns are identified.	☐	☑	-	-
viii. Submit raw water quality data for total coliforms and E. coli bacteria for the most recent calendar year as an Appendix.	☐	☑	-	-
ix. For GUDI wells, submit any raw water quality data for Cryptosporidium or Giardia (if available) for the most recent calendar year as an Appendix.	☐	☑	-	-

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.3 Chemical Risks				
2.3.1 Disinfection By-Products				
a) Trihalomethanes (THMs)				
i. Complete Table A.2 to summarize quarterly THM concentrations by sampling location.	☑	☐	App.A	App.A
ii. For non-GUDI systems that have had quarterly sampling reduced to annual sampling: • Note the acceptance date for this reduction in sampling frequency. • Modify Table A.2 to summarize annual results, including sampling date.	☐	☑	-	-
iii. If the locational running annual average for any sampling location exceeds the maximum acceptable concentration, recommend corrective actions.	☐	☑	2.3.1.1	6
iv. Verify that sampling locations are appropriate as follows: • Are samples collected at the point(s) in the distribution system with the highest potential THM concentrations? • Are an adequate number of sites sampled to represent exposure levels system-wide?	☑	☐	2.3.1.1	6
v. Identify THM sampling locations on a map of the distribution system.	☑	☐	App,C	App.C
vi. Recommend sampling location/frequency changes if necessary.	☐	☑	2.3.1.1	6
b) Haloacetic Acids (HAA5)				

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
i. Complete Table A.3 to summarize HAA5 concentrations by sampling location.	☑	☐	App.A	App.A
ii. For non-GUDI systems that have had quarterly sampling reduced to annual sampling: • Note the acceptance date for this reduction in sampling frequency. • Modify Table A.3 to summarize annual results, including sampling date.	☐	☑	-	-
iii. If the locational running annual average for any sampling location exceeds the maximum acceptable concentration, recommend corrective actions.	☐	☑	2.3.1.2	6
iv. Verify that sampling locations are appropriate as follows: • Are samples collected at the location(s) where historical data show the highest HAA5 concentrations? If historical data are not available, are HAA5 concentrations monitored in the middle and extremities of the distribution system to determine the highest concentrations? • Are samples collected in areas where disinfectant residuals are significantly lower than the system average because of long residence time? • In systems with booster chlorination stations and water tanks/reservoirs, are HAA5 concentrations monitored downstream of these components? • Are an adequate number of sites sampled to represent system-wide exposure levels?	☑	☐	2.3.1.2	6
v. Identify HAA5 sampling locations on a map of the distribution system.	☑	☐	App.C	App.C
vi. Recommend sampling location/ frequency changes if necessary.	☐	☑	2.3.1.2	6

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
c) Other Disinfection By-Products (DBPs)				
i. Identify which other DBPs are required to be monitored and compare this to existing monitoring (see Table 1 in the Terms of Reference).	☐	☑	2.3.1.3	6
ii. Verify that sampling locations are appropriate.	☐	☑	2.3.1.3	6
iii. Identify sampling locations on a map of the distribution system.	☐	☑	2.3.1.3	6
iv. Recommend sampling location/frequency changes if necessary.	☐	☑	2.3.1.3	6
v. Summarize concentrations for the most recent calendar year as an Appendix.	☐	☑	2.3.1.3	6
vi. Recommend corrective actions if any maximum acceptable concentration is exceeded.	☐	☑	2.3.1.3	6
2.3.2 Lead and Corrosion Control				
a) Lead and Copper				

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
i. Verify that sampling locations and frequencies for lead are appropriate as follows: • Does the residential sampling program meet the minimum requirements as outlined in the Lead and Copper Management Requirements – Municipal Public Drinking Water Supplies or as otherwise accepted by the Department? • Are residences suspected to be at the highest risk for lead targeted in the residential sampling program?	☑	☐	2.3.2.1	6
ii. Recommend sampling location/ frequency changes if necessary.	☑	☐	2.3.2.1	6
iii. Summarize and append lead and copper concentrations by sampling location and sample protocol used for the most recent calendar year.	☑	☐	2.3.2.1	6
iv. Summarize corrective actions taken when residential sample results exceeded the maximum acceptable concentration, as outlined in the Lead and Copper Management Requirements – Municipal Public Drinking Water Supplies. • Are the corrective actions taken in line with the minimum requirements outlined in the Lead and Copper Management Requirements – Municipal Public Drinking Water Supplies or as otherwise accepted by the Department?	☑	☐	2.3.2.1	7
v. Recommend program improvements, where applicable.	☑	☐	2.3.2.1	7
b) Corrosion Control				
i. Review the corrosion control program: • Does one exist?	☐	☑	2.3.2.2	8
• Does it include the minimum monitoring requirements as outlined in the Guidelines for Monitoring Public Drinking Water Supplies – Part 1?	☐	☑	2.3.2.2	8

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
• Does it include action limits for the corrosion monitoring parameters that trigger follow-up?	☐	☑	2.3.2.2	8
ii. Summarize the water quality results of the corrosion control program for the most recent calendar year as an Appendix.	☐	☑	App.D	App.D
iii. Recommend corrective actions if concerns are identified from the review of the corrosion control program.	☑	☐	2.3.2.2	8
iv. If a corrosion control program does not exist, document why, including water quality results that demonstrate non-corrosivity of the water, or recommend the need for a more comprehensive corrosion control program. Note: The Langelier Index is no longer considered an adequate measure of corrosivity. The submission of water quality results based solely on a positive Langelier Index will not be accepted as justification for not having a corrosion control program. Note: The Engineer is not required to develop a corrosion control program as part of the System Assessment Report.	☐	☑	2.3.2.2	8
2.3.3 Guidelines for Canadian Drinking Water Quality* *Municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply may obtain water quality results from the Approval Holder of the Municipal Public Drinking Water Supply that treats the water.				
i. Verify that the full suite of health-related parameters (see Table A.4 in the Terms of Reference) has been analyzed a minimum of once every five years for all raw water sources and treated water and document sampling dates.	☑	☐	App.A	App.A
ii. Review the data to: • Verify that sampling locations and frequencies are appropriate for cyanobacterial toxins and pesticides. • Identify if any maximum acceptable concentrations (MACs) have been exceeded. • Identify parameters with detectable concentrations.	☑	☐	2.3.3	8

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iii. Discuss any trends for parameters with detectable concentrations.	☑	☐	2.3.3	8
iv. Include laboratory results from the last round of sampling as an Appendix.	☑	☐	App.E	App,E
v. Identify when the next round of sampling is scheduled to occur.	☑	☐	2.3.3	8
vi. Recommend corrective actions if any MACs are exceeded.	☐	☑	2.3.3	8
vii. Recommend any changes to the monitoring program (frequency/location) if sampling is inappropriate for cyanobacterial toxins, pesticides or other parameters with enhanced monitoring that was recommended for parameters with detectable concentrations.	☑	☐	2.3.3	8
2.3.4 Guidelines for Monitoring Public Drinking Water Supplies				
i. Verify that the parameters in the Guidelines for Monitoring Public Drinking Water Supplies (see Table A.5) have been analyzed as required in all raw water sources and treated water and document the sampling dates.	☑	☐	App.A	App.A
ii. Review the data to: • Verify that sampling locations and frequencies are appropriate. • Identify if any maximum acceptable concentrations (MACs) have been exceeded. • Identify any aesthetic parameters that may compromise disinfection or other critical processes.	☑	☐	2.3.4	9
iii. Discuss any water quality trends.	☑	☐	2.3.4	9

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iv. Include laboratory results from the last round of sampling as an Appendix.	☑	☐	App.F	App.F
v. Identify when the next round of sampling is scheduled to occur.	☑	☐	2.3.4	9
vi. If any MACs are exceeded, recommend corrective actions.	☐	☑	2.3.4	9
vii. Recommend any changes to the monitoring program, sampling location/ frequencies if necessary.	☑	☐	2.3.4	9
2.3.5 Source Water Protection Plan Monitoring* *This section is not applicable for municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply.				
i. For Approval Holders monitoring any other chemical parameters for source water protection purposes, summarize the parameters, their sampling frequency, and their measured concentrations.	☑	☐	2.3.5	10
ii. Recommend corrective actions if concentrations are detectable or increasing.	☐	☑	2.3.5	10
iii. Review the source water protection plan monitoring program: • Does one exist? • Does it include monitoring of parameters that provide the information that is needed to evaluate the effectiveness of the source water protection plan?	☑	☐	2.3.5	10

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.3.6 Cyanobacteria* *This section is only applicable to surface water sources.				
i. Identify whether the source of supply has been impacted by cyanobacterial blooms.	☐	☑	2.3.6	10
ii. Summarize and append any results for cyanobacterial blooms through visual observation and/or confirmation from laboratory results including dates.	☐	☑	2.3.6	10
iii. Discuss any corrective actions taken when cyanobacteria have been detected in the source water.	☐	☑	2.3.6	10
iv. Discuss the treatment capability of the facility to remove microcystin toxins and identify any vulnerabilities.	☐	☑	2.3.6	10
v. Provide recommendations if necessary.	☑	☐	2.3.6	10

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.4 Filter Backwash Water* *Not applicable for municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply				
i. Document the impact on the raw water source if water from the filter backwash treatment system is discharged upstream of the raw water intake.	☐	☑	2.4	11
ii. Provide recommendations if this discharge impacts the source.	☐	☑	2.4	11
2.5 Source Quantity* *Not applicable for municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply				
i. Compile existing Water Withdrawal Approvals and include copies of these as an Appendix.	☑	☐	2.5	11
ii. Complete Table A.6.a and A.6.b to compare water withdrawals to approved limits.	☑	☐	App.A	App.A
iii. Recommend corrective actions, including water conservation measures, if water withdrawals are greater than approved limits.	☑	☐	2.5	11
iv. Recommend corrective actions if water withdrawals are approaching approved limits and growth is forecast to increase withdrawals beyond approved limits.	☑	☐	2.5	11

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.6 Source Water Protection Plan* *Not applicable for municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply.				
i. Identify the source water protection zone(s) on a map.	☑	☐	App.C	App.C
ii. Submit the source water protection zone(s) in GIS format to the Department. If zones are not available in GIS format, contact the Watershed Planner for your supply.	☐	☑	App. J	App. J
iii. Summarize the status of the source water protection plan and implementation schedule.	☑	☐	2.6	12
iv. Document the dates of the last two SWPP meetings.	☐	☑	2.6	12
v. Note the status of meeting actions and/or SWPP deliverables.	☐	☑	2.6	12
vi. Make recommendations to address any concerns identified by the advisory committee or the source water protection planning process.	☑	☐	2.6	12
2.7 Conclusions and Recommendations				
i. Refer to the Terms of Reference.	☑	☐	2.7	13

PART III
Treatment Processes, Facilities and Equipment

3.0 Evaluation of Treatment Processes, Facilities and Equipment

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.1 Treatment Processes				
i. Compile existing Approval(s) to Operate and include copies of these as an Appendix. For Approval Holders that only distribute water purchased from another Municipal Public Drinking Water Supply, document the name of the treatment facility, and proceed to section 3.2.	☑	☐	3.1	16
3.1.1 Treatment Process Schematic				
i. Provide a schematic of the treatment process from the source to treated water entering the distribution system.	☑	☐	3.1	16
3.1.2 Turbidity Levels and Associated Criteria				
a) Surface Water				
i. Verify that filtration technologies are meeting specified turbidity limits to receive the assigned log removal credits outlined in Table C2 of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems by either Option 1 or Option 2.	☐	☑	3.1.2.1	17
ii. Submit individual filter effluent turbidity values for the most recent calendar year by month (Option 1) or by the time interval graphed (Option 2).	☐	☑	3.1.2.1	18
iii. Recommend corrective actions if the supply does not meet stipulated turbidity limits.	☑	☐	3.1.2.1	18

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iv. For Municipal Public Drinking Water Supplies with cartridge filters assigned log reduction credits for protozoa, provide the highest recorded individual filter differential pressure reading for each month of the most recent calendar year.	☐	☑	-	-
v. Review the standard operating procedures (SOPs) for the filtration process: • Have control limits been set to alarm and notify operators of issues related to the filtration process? • Have procedures been developed to remove a filter or membrane unit from service before turbidity or differential pressure (i.e., for cartridge filters assigned log reduction credits) exceeds stipulated values? • Have procedures been implemented and communicated to all operations staff? • Have procedures been documented in the operations manual?	☐	☑	-	-
vi. Inspect the filtration process to verify that continuous on-line turbidity measurements are taken and recorded for each individual filter at a minimum of once every five minutes.	☑	☐	3.1.2.1	18

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
vii. Inspect the on-line turbidimeters: • Do they have the required range and accuracy to measure turbidity levels? • Are they in good working order? • Do they have a maintenance and quality assurance/calibration program?	☑	☐	3.1.2.5	19
viii. Inspect the filtration process to verify that there are a minimum of two filters.	☑	☐	3.1.2.6	19
ix. Document if the maximum day flow can be met with the largest filter out of service. Note: If the facility is unable to meet maximum day flows with the largest filter out of service, improvements to meet the Treatment Standards may be deferred to a future expansion provided SOPs are in place to minimize filter rate changes and spikes in turbidity which can result in filter breakthrough.	☑	☐	3.1.2.6	19
x. Make recommendations to address any concerns identified by the review of the filtration SOPs, inspection of on-line turbidimeters, and filter redundancy.	☑	☐	3.1.2	18

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
b) GUDI Wells				
i. Verify that natural filtration is achieving specified turbidity limits to receive the assigned log removal credits outlined in Table C2 of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems by either Option 1 or Option 2.	☐	☑	-	-
ii. Submit individual GUDI well turbidity values for the most recent calendar year by month (Option 1) or by the time interval graphed (Option 2).	☐	☑	-	-
iii. For GUDI wells that do not meet stipulated turbidity limits, contact the Department to determine what requirements shall apply.	☐	☑	-	-
iv. Inspect the site(s) to verify that continuous on-line turbidity measurements are taken for each individual GUDI wellhead at a minimum of once every five minutes.	☐	☑	-	-
v. Inspect the on-line turbidimeters: • Do they have the required range and accuracy to measure turbidity levels? • Are they in good working order? • Do they have a maintenance and quality assurance/calibration program?	☐	☑	-	-
vi. Make recommendations to address any concerns identified by the inspection of the on-line turbidimeters.	☐	☑	-	-

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
c) Non-GUDI Wells				
i. Summarize turbidity levels in non-GUDI wells by either Option 1 or Option 2.	☐	☑	-	-
ii. Note if measurements are by daily grab samples or continuous on-line turbidimeters.	☐	☑	-	-
iii. Submit non-GUDI system turbidity for individual wells or combined flow for the most recent calendar year by month (Option 1) or by the time interval graphed (Option 2).	☐	☑	-	-
iv. For non-GUDI wells that do not meet stipulated turbidity limits, contact the Department to determine what requirements shall apply.	☐	☑	-	-
v. Where continuous measurements are taken, inspect the on-line turbidimeters: • Do they have the required range and accuracy to measure turbidity levels? • Are they in good working order? • Do they have a maintenance and quality assurance/calibration program?	☐	☑	-	-
vi. Where grab samples are taken, inspect the monitoring equipment, SOPs, maintenance, and quality assurance/calibration program to ensure equipment is in good working order and measurements are appropriate.	☐	☑	-	-
vii. Make recommendations to address any concerns identified by the inspection of on-line turbidimeters or grab sample protocols.	☐	☑	-	-

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.1.3 Membrane Filtration – Additional Requirements				
i. Complete Table B.1 to verify that each individual membrane treatment unit that is used for pathogen reduction credits is free of any integrity breaches and determine its log removal value using pressure-based testing.	☐	☑	-	-
ii. Make recommendations to address any concerns identified.	☐	☑	-	-
iii. For Municipal Public Drinking Water Supplies with integrated membrane systems, summarize the process used to verify the rejection rate remains adequate for organics removal.	☐	☑	-	-
iv. Make recommendations to address any concerns identified.	☐	☑	-	-
3.1.4 Primary Disinfection				
i. Document how many inactivation log credits are required by the disinfection process for each target microorganism (e.g., protozoa and/or viruses).	☑	☐	3.1.4	20
ii. Discuss how disinfection is achieved (e.g., chemical disinfectants, UV or both).	☑	☐	3.1.4	20

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
a) Chemical Disinfection (CT Concept)				
i. Where chemical disinfectants are used, provide a schematic of the primary disinfection process including, but not limited to: • Tank(s) dimensions. • Baffling configuration and assumed baffling factor. • Water level operating range, highlighting the low level. • Disinfection type (e.g., free chlorine, chlorine dioxide, ozone). • Minimum disinfectant concentration at the CT control point. • Minimum water temperature. • Maximum pH of the water for free chlorine or optimum pH for chlorine dioxide or ozone. • Maximum flow and minimum retention time - if the tank used to achieve CT is subject to water level fluctuations, verify if the inflow/outflow represents the maximum flow condition.	☑	☐	3.1.4.1	20
ii. Calculate the design CT.	☑	☐	3.1.4.1	21
iii. Verify that operational conditions remained within the design range for achieving CT at all times during the most recent calendar year.	☑	☐	3.1.4.1	21
iv. Where operational conditions went outside the design range, identify the cause, document the corrective actions taken and verify that CT was calculated during every such event.	☐	☑	3.1.4.1	21
v. Make recommendations to address any concerns identified.	☐	☑	3.1.4.1	21
b) UV Disinfection (IT Concept)				

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
i. Where UV disinfection is used, provide a schematic of the primary disinfection process including, but not limited to: • Unit manufacturer and model. • Validation standard. • Maximum flow. • Minimum intensity at the end of lamp life. • Minimum transmittance at the end of lamp life. • Correction for water temperature. • Maximum concentrations for water quality parameters that promote fouling (e.g., iron, manganese, hardness). • Sleeve cleaning method.	☐	☑	3.1.4.2	21
ii. Verify that the unit has been designed to deliver a UV dose of 40 mJ/cm^2 or Department accepted alternate dose. Specify the alternate dose, if applicable.	☐	☑	3.1.4.2	21

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iii. Verify that the following conditions were met at all times during the most recent calendar year: • Was the intensity above the minimum required? • Was the flow below the maximum allowed? • Was the transmittance above the minimum required?	☐	☑	3.1.4.2	21
iv. Where operational conditions went outside the design range, identify the cause, document the corrective actions taken and verify that IT was calculated during every such event.	☐	☑	3.1.4.2	21
v. Provide recommendations to address any concerns identified.	☐	☑	3.1.4.2	21
c) Redundancy, Continuous Monitoring and Alerting				
i. Inspect the primary disinfection process to verify the following: • Are there a minimum of two primary disinfection units? • Are the primary disinfection units sized to meet maximum day demand with one unit out of service? • Is on-line monitoring of the primary disinfection process in place with measurements taken and recorded at least once every five minutes? • Have control limits been set to alarm and notify operators that the primary disinfection process is not working properly? • Are protocols in place to prevent inadequately disinfected water from entering the distribution system?	☑	☐	3.1.4.3	21
ii. Inspect the on-line instrumentation: • Do they have the required range and accuracy to measure chlorine concentrations?	☑	☐	3.1.4.3	21

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
• Are they in good working order? • Do they have a maintenance and quality assurance/calibration program?				
iii. Provide recommendations to address any concerns identified.	☐	☑	3.1.4.3	21
d) Standard Operating Procedures				
i. Review the standard operating procedures for the disinfection process: • Do they specify the design ranges for achieving CT (e.g., temperature, disinfectant residual, flow, pH) or IT (e.g., intensity, flow, transmittance)? • Do they include notification and response procedures when operational conditions are outside CT or IT design ranges? • Do they include procedures to ensure the disinfection process is working properly? • Do they include response procedures when the disinfection process is not working properly? • Have they been implemented and communicated to all operations staff? • Have they been documented in the operations manual?	☑	☐	3.1.4.4 3.1.4.4	22 22
ii. Provide recommendations to address any concerns identified.	☑	☐	3.1.4.4	22
3.1.5 Secondary Disinfection				
i. Describe the secondary disinfection process.	☑	☐	3.1.5	22
ii. Inspect the secondary disinfection process to verify the following:	☑	☐	3.1.5	22

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
• Are on-line continuous chlorine residual monitors in place to measure chlorine residual entering the distribution system at least once every five minutes? • Are the on-line chlorine residual monitors in good working order? • Is there a maintenance and quality assurance/calibration program in place?				
iii. Where free chlorine is used for both primary and secondary disinfection, refer to Section 3.1.4 and note if the chlorine dose is controlled by CT (primary disinfection) or distribution system residual maintenance (secondary disinfection).	☑	☐	3.1.5	22
iv. Where UV light is used for primary disinfection to receive protozoa inactivation credits, calculate the design CT for virus inactivation credits.	☐	☑	-	-
v. Where UV light is used for primary disinfection to receive protozoa inactivation credits, verify that operational conditions remained within the design range for achieving CT for virus inactivation at all times during the most recent calendar year.	☐	☑	-	-

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
vi. Where operational conditions went outside the design range, identify the cause, document the corrective actions taken and verify that CT was calculated during every such event.	☐	☑	3.1.5	22
vii. Provide recommendations to address any concerns identified.	☐	☑	3.1.5	22
3.1.6 Other Critical Processes				
i. Evaluate and inspect other critical processes against established standards and guidelines.	☐	☑	3.1.6	22
ii. Recommend corrective actions where necessary.	☐	☑	3.1.6	22
3.1.7 Waste Streams				
a) Filter-to-Waste				
i. Describe the filter-to-waste process.	☐	☑	3.1.7	22
ii. For chemically assisted filtration, verify that turbidity is less than or equal to 0.2 NTU before returning a filter to service.	☐	☑	3.1.7	22
iii. Identify recommendations, if necessary, to meet the Nova Scotia Treatment Standards for Municipal Drinking Water Systems.	☐	☑	3.1.7	22
b) Filter Backwash Water – Discharge Into A Freshwater Watercourse				
i. Summarize treatment of the filter backwash water, if applicable, and identify the watercourse it is discharging into.	☐	☑	3.1.7.1	22
ii. Identify any discharge criteria specified in the Approval to Operate.	☐	☑	3.1.7.1	22

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iii. Complete Table B.2. • Does sampling meet the minimum requirements as outlined in the Nova Scotia Treatment Standards for Municipal Drinking Water Systems? • Does effluent quality meet the discharge criteria stipulated in the Approval to Operate?	☐	☑	3.1.7.1	22
iv. If the water quality does not meet the discharge criteria stipulated in the Approval to Operate or if there are no discharge criteria stipulated in the Approval to Operate, identify recommendations to meet the requirements specified in Part V – Management of Waste Streams of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems.	☐	☑	3.1.7.1	22
v. Recommend corrective actions where necessary to address any concerns identified.	☐	☑	3.1.7.1	22

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.		Yes	N/A	Section	Page #
c) Filter Backwash Water – Discharge To Land Or Soil					
i.	Summarize treatment of the filter backwash water, if applicable, and identify the location of discharge.	☐	☑	3.1.7.2	23
ii.	Identify whether the municipal public drinking water supply has a Discharge Management Plan in accordance with Part V – Management of Waste Streams of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, as amended from time to time.	☐	☑	3.1.7.2	23
iii.	Identify the effluent discharge criteria specified in the Approval to Operate, or the Department accepted Discharge Management Plan.	☐	☑	3.1.7.2	23
iv.	Complete Table B.3. • Does effluent quality meet the discharge criteria stipulated in the Approval to Operate, or the Department accepted Discharge Management Plan?	☐	☑	3.1.7.2	23
v.	If the water quality does not meet the discharge criteria stipulated in the Approval to Operate, or the Department accepted Discharge Management Plan, identify recommendations to meet the minimum requirements for a plan specified in Part V – Management of Waste Streams of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, as amended from time to time.	☐	☑	3.1.7.2	23
vi.	Identify operational, maintenance, and monitoring procedures in the Discharge Management Plan that do not meet the minimum requirements for a plan as specified in Part V – Management of Waste Streams of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, as amended from time to time.	☐	☑	3.1.7.2	23
vii.	Recommend corrective actions where necessary to address any concerns identified.	☐	☑	3.1.7.2	23

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
d) Filter Backwash Water – Discharge To A Marine Or Brackish Environment				
i. Summarize treatment of the filter backwash water, if applicable, and identify the watercourse it is discharging into.	☐	☑	3.1.7.3	23
ii. Identify any discharge criteria specified in the Approval to Operate.	☐	☑	3.1.7.3	23
iii. Complete Table B.4. • Does effluent quality meet the discharge criteria stipulated in the Approval to Operate?	☐	☑	3.1.7.3	23
iv. Recommend corrective actions where necessary to address any concerns identified.	☐	☑	3.1.7.3	23
e) Other Waste Streams				
i. Review other waste streams and verify that they are being managed appropriately.	☐	☑	3.1.7.4	23
ii. Provide recommendations to address any concerns identified.	☐	☑	3.1.7.4	23

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.2 Distribution Water Quality				
3.2.1 Chlorine Residual Levels				
i. Review distribution system chlorine residuals for the most recent calendar year available.	☑	☐	3.2.1	23
ii. Recommend corrective actions where residuals are routinely less than 0.20 mg/L or 0.40 mg/L (depending on the concentration specified in the Municipal Public Drinking Water Supply's Approval to Operate) where free chlorine is used (or less than 1.0 mg/L combined chlorine for chloraminated systems).	☐	☑	3.2.1	23
iii. Inspect all distribution water storage tanks to verify that on-line continuous chlorine residual monitors are in place to measure chlorine residual at the storage tank outlet at least once every five minutes.	☑	☐	3.2.1	23
iv. Inspect the on-line chlorine residual monitors to ensure that they are in good working order and that a maintenance and quality assurance/calibration program is in place.	☑	☐	3.2.1	23
v. Recommend corrective actions where necessary.	☐	☑	3.2.1	23

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.2.2 Microbiological Water Quality				
i. Review total coliforms and E. coli results for the most recent calendar year available.	☑	☐	3.2.2	23
ii. Discuss any presence of bacteria in the distribution system and identify recommendations where necessary.	☐	☑	3.2.2	23
iii. Verify that sampling locations and frequencies meet the requirements of the Guidelines for Monitoring Public Drinking Water Supplies Part I, including any re-sampling required after the presence of bacteria is detected.	☑	☐	3.2.2	23
iv. Identify sampling locations on a map of the distribution system.	☑	☐	App.C	App.C
v. Recommend sampling location/frequency changes if necessary.	☐	☑	3.2.2	23

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.2.3 Turbidity				
i. Review distribution system turbidity results for the most recent calendar year available.	☑	☐	3.2.3	24
ii. Verify that a protocol exists for investigating the cause of turbidity values above 5 NTU.	☑	☐	3.2.3	24
iii. Discuss any values above 5 NTU and identify recommendations identified where necessary.	☐	☑	3.2.3	24

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.2.4 Cross Connection Control Program				
i. Review the cross connection control program. • Does it meet the minimum requirements as outlined in A Guide to Assist Nova Scotia Municipal Water Works Develop a Cross Connection Control Program, as amended from time to time. • Are implementation timelines being met in accordance with the accepted plan? Provide an update on the status of the Cross Connection Control Program, including any modifications to the plan or implementation schedule, and a summary of the activities taken to achieve the goals and objectives of the program.	☑	☐	3.2.4	24
ii. Provide recommend where necessary.	☑	☐	3.2.4	24
3.2.5 Other Distribution System Monitoring/Programs				
i. Review any other distribution system monitoring or programs that are in place to deal with threats to distribution system integrity, including but not limited to infrastructure age, watermain breaks, leak detection, pressure transients, etc.	☐	☑	3.2.5	24
ii. Provide recommendations where necessary.	☐	☑	3.2.5	24

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.3 Site Inspection				
i. Conduct a site inspection to evaluate treatment processes, as well as other facilities and equipment as per the requirements outlined in section 3.3 of the Terms of Reference.	☑	☐	3.3	24
3.4 Conclusions and Recommendations				
i. Refer to section 3.4 of the Terms of Reference.	☑	☐	3.4	24

PART IV
Operations, Monitoring and Management

4.0 Review of Operations, Maintenance, Monitoring and Management

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
4.1 Operations and Maintenance				
i. Review the comprehensive operations manual: • Does one exist? • Is it current and up to date? • Does it include SOPs, emergency notification procedures and contingency plans? • Is it available on site or an alternate location accepted by the Department? • Are operations staff aware of its contents?	☑	☐	4.1	28
ii. Evaluate the procedures an operator follows to identify any problem(s) with the water treatment and distribution process, determine the changes needed to correct the problem(s) and how adjustments to the processes are approved and performed as needed.	☑	☐	4.1	28
iii. Verify that a maintenance program exists and is adequate to ensure the long-term viability of the Municipal Public Drinking Water Supply, including distribution system components.	☑	☐	4.1	28
iv. Identify recommendations where necessary.	☑	☐	4.1	28
4.2 Monitoring and Reporting				

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
i. Review the annual monitoring program to: • Does one exist? • Is it current and up to date? • Does it meet the minimum requirements as outlined in the Nova Scotia Treatment Standards for Municipal Drinking Water Systems and A Guide to Assist Nova Scotia Municipal Water Works Prepare Annual Sampling Plans? • Are operations staff aware of its contents?	☑	☐	4.2	29
ii. Identify the laboratories being used for water quality analyses.	☑	☐	4.2	31
iii. Verify that the Municipal Public Drinking Water Supply is operating in accordance with the Policy on Acceptable Certification of Laboratories.	☑	☐	4.2	31
iv. Review reporting requirements and verify that the Approval Holder has complied with the immediate, annual and ad hoc reporting requirements outlined in the Nova Scotia Treatment Standards for Municipal Drinking Water Systems.	☑	☐	4.2	31
v. Review the most recent annual report and identify any concerns in the System Assessment Report.	☑	☐	4.2.1	31
vi. Identify recommendations where necessary.	☑	☐	4.2.1	31

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
4.3 Management				
i. Review the number of certified operators and back-up personnel to verify that the municipal public drinking water supply is operating in accordance with Part I of the Water and Wastewater Facilities and Public Drinking Water Supplies Regulations.	☑	☐	4.3	31
ii. Complete Table C.1 to identify the operator(s) in overall direct responsible charge (ODRC) and summarize what protocols are in place during the absence of the operator(s) in ODRC. Note: The ODRC operator(s) must sign Table C.1.	☑	☐	App.A	App.A
iii. Review the water quality goals that the Municipal Public Drinking Water Supply has and evaluate their plan(s) to accomplish or maintain these goals.	☑	☐	4.3	31
iv. Identify recommendations where necessary.	☐	☑	4.3	31
4.4 Conclusions and Recommendations				
i. Refer to section 4.4. of the Terms of Reference.	☑	☐	4.4	31

PART V
REPORT SUBMISSION

5.0 Ability to Comply

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
5.1 Summary				
i. Summarize conclusions and identify all recommendations necessary to meet the Nova Scotia Treatment Standards for Municipal Drinking Water Systems.	☑	☐	5.1	33
ii. Include preliminary cost estimates and an implementation schedule to address the above requirements. Costs shall be presented and prioritized with respect to public health risks. Note: If the corrective action plan submitted to the Department varies from the risk-based approach documented in the System Assessment Report, written justification shall be included in the corrective action plan for varying the priority.	☑	☐	5.1	36
iii. Highlight any obvious problems associated with the Municipal Public Drinking Water Supply that jeopardize treated water quality to the point that it no longer meets the health protection standards adopted by the Department.	☑	☐	5.1	37

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
5.2 Report Preparation				
i. Submit three (3) copies of the System Assessment Report to the Department and include a copy of this completed checklist.	☑	☐	5.2	
ii. Engineer's Declaration (refer to section 1.4 of the Terms of Reference)	☑	☐	5.2	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