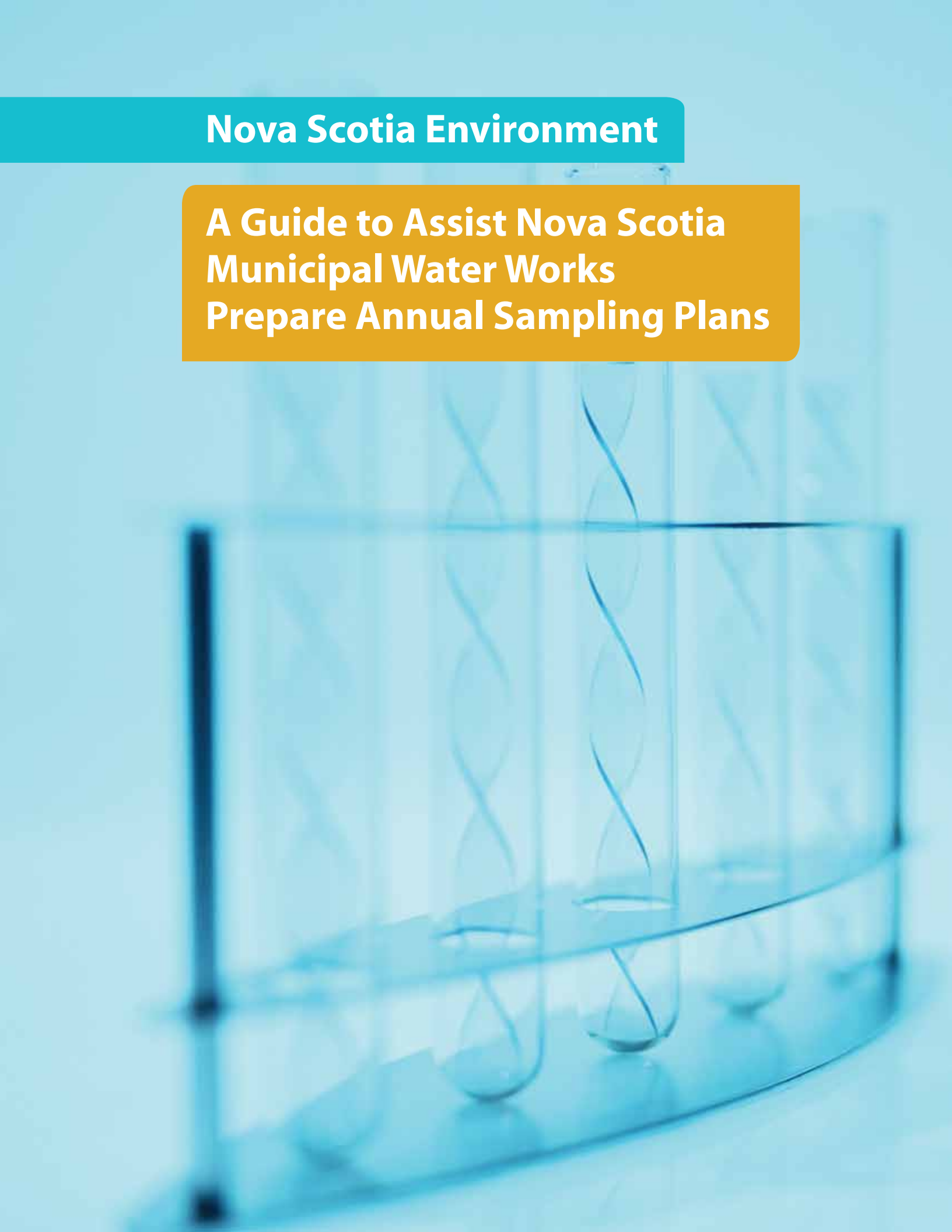
Nova Scotia Environment

A Guide to Assist Nova Scotia Municipal Water Works Prepare Annual Sampling Plans



Nova Scotia Environment

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Contents

The main purpose of this document is to provide guidance to managers and operators regarding the development of an annual sampling plan for water treatment and water distribution facilities in Nova Scotia.

Drinking water facilities in Nova Scotia

Municipal public drinking water supplies in Nova Scotia are operated under an approval from Nova Scotia Environment (NSE). Typically, an approved system will be classified as either a:

1 Water Treatment (WT) facility; or
2 Water Distribution (WD) facility.

Depending upon the source of the drinking water supply—groundwater (well) or surface water (spring, lake or river)—the facility must meet specific standards for water quality and operations, as well as apply best management practices. Owners of approved water treatment and water distribution systems in Nova Scotia are required to develop, maintain, and submit a comprehensive annual sampling plan to NSE for approval.

What is an annual sampling plan?

The annual sampling plan is a document that describes the approach that the municipal water utility will follow for all water quality monitoring. This document details how a utility will collect and monitor samples in a consistent manner during the year. Sampling plans should be developed to address compliance, process control and response monitoring, as well as monitoring recommended in the source water protection plan. In some cases, special process characterization and optimization monitoring may also be included.

Why is an annual sampling plan required?

Recognizing that safe drinking water is a core public health issue, the Nova Scotia government adopted the health-related *Guidelines for Canadian Drinking Water Quality* (GCDWQ) as legally binding standards in October 2000. The GCDWQ set out the basic parameters that every municipal water system should strive to achieve in order to provide the cleanest, safest and most reliable drinking water possible. By developing an annual sampling plan, the municipal water utility demonstrates that they are meeting regulatory requirements.

What should be included in an annual sampling plan?

Annual sampling plans will be unique for every facility in Nova Scotia. The number and type of water quality parameters analysed at a water treatment facility and in a water distribution system will be based on the type of treatment provided, the size of the facility, source water characteristics and requirements of the facility's Approval to Operate. An effective sampling plan should, at a minimum, include the following elements:

- Division of sampling activities into categories
- Description of the inter-relationship between the categories
- Parameters to be analysed and frequency of sampling
- Sampling site locations
- Standard operating procedures for the sampling program
- Quality assurance/quality control program
- Operator training for the sampling program
- Definition of water quality compliance and "in-plant" action limits
- Approaches for data evaluation and interpretation
- Reporting requirements

Who develops the annual sampling plan?

Developing an annual sampling plan is an important step for any facility. The annual sampling plan organizes all the required water quality monitoring.

The owner of the facility should dedicate a competent individual to lead the development of the annual sampling plan. However, it basically comes down to deciding if the manual will be created by either:

1 internal staff (managers, operators, etc.); or
2 an external service provider (consultant).

A third option may be to utilize internal staff to draft the plan while using an external service provider to do the word processing and printing.

If the decision is made to hire a consultant then the company will have their own method to create and layout the plan. The facility owner may want to review examples of other plans the consultant has developed to ensure that the final product will be acceptable to staff.

Staff at the facility will likely be asked to provide information to the consultant during the development process. They may be asked to provide the consultant with process details such as water quality parameters, sampling location, frequency, etc. It is critical that staff provide the consultant with credible and verified information in order for the plan to be effective for the facility.

What are the different types of sampling categories that need to be considered?

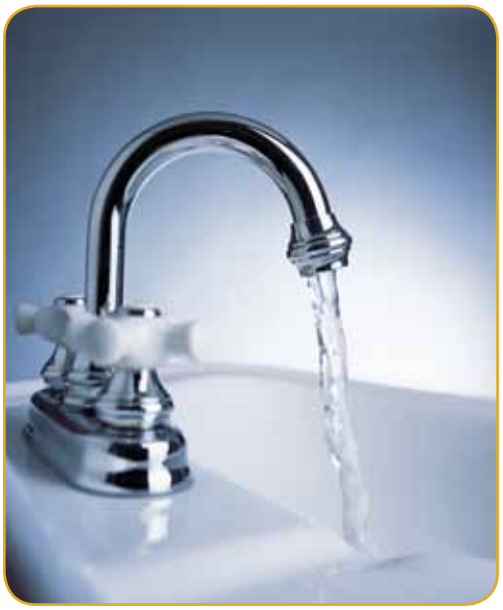
There are a number of different sampling categories that must be considered when operating a water treatment or water distribution facility. The sampling categories should attempt to provide information on all potential operational scenarios that could be encountered. At a minimum, the sampling plan should include the following categories:

- Compliance monitoring
- Process control monitoring
- Response monitoring
- Source water characterization and protection

In addition, some facilities may require special process characterization and optimization to improve or enhance a process or overall water quality.

Compliance monitoring

This category of sampling includes identifying all the parameters, as well as location and frequency, which are required by regulation. These samples are required in order for the facility to be in compliance with the regulatory regime in Nova Scotia.



In particular, sampling in accordance with the *Guidelines for Monitoring Public Drinking Water Supplies* (GMPDWS) is required every year for surface water and groundwater under the direct influence of surface water (GUDI) or once every two years for secure groundwater (non-GUDI).

The health-related parameters in the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) are required to be measured every five years for untreated and treated water to ensure that the microbiological, physical and chemical characteristics of a supply do not exceed maximum acceptable concentrations or interim maximum acceptable concentrations; the sampling frequency should be enhanced for parameters that have detectable levels.

Some process and source water characterization parameters are also required for compliance monitoring (e.g., turbidity, parameters to calculate disinfection efficacy, chlorine residual, etc.).

The facility owner is responsible for ensuring that water quality testing is completed by approved laboratories in accordance with the *Policy on Acceptable Certification of Laboratories* www.gov.ns.ca/nse/airlandwater/docs/Policy-AcceptableCertificationOfLabs.pdf.

Process control monitoring

There are a number of critical water quality parameters that are adjusted or monitored throughout the treatment process to ensure water of the highest quality is produced and to optimize operations and processes. It is important to monitor these parameters (e.g., pH, temperature, turbidity, etc.) such that specific unit processes (e.g., coagulation, filtration, disinfection) are working as designed to produce safe water.

Response monitoring

On occasion, there may be an event such as a chemical spill in the source water protection area or a water main break that requires response monitoring. In some cases, response monitoring will verify that a parameter is not present (e.g., chemical spill); in other cases, it verifies that a problem has been fixed (e.g., water main break). This monitoring may need to be conducted more frequently and/or for an extended period of time. The annual sampling plan must include monitoring for the operational contingencies identified by the utility.

Source water characterization

With the development of a source water protection plan there may be a number of water quality parameters that have been identified as a concern. Additional water quality monitoring identified during Step 5 of the source water protection planning process should be included in the annual sampling plan.

Special process characterization and optimization monitoring

Periodically, the water utility may choose to make modifications to specific unit processes (e.g., enhanced coagulation for total organic carbon removal, corrosion control, etc.). These modifications, with the intent to improve water quality, may require additional monitoring during the process change or optimization. For example, when optimizing corrosion control, weekly sampling is recommended.

What parameters should be sampled?

Microbiological quality must be monitored to ensure there is minimal risk of exposure to disease-causing organisms in drinking water. The *Guidelines for Canadian Drinking Water Quality* set health-related limits for total coliforms and *E. coli*; these parameters must be monitored on a weekly basis at a minimum.

Parameters to calculate disinfection efficacy (known as CT)must be monitored to ensure that the minimum design criteria are being met during primary disinfection (e.g., flow, temperature, disinfectant residual, pH).

Flow must be measured since it is required for the water withdrawal approval.

Chlorine residual must be monitored to ensure disinfection objections are achieved and to minimize the risk of exposure to disease-causing organisms in drinking water.

Turbidity, while not a microbiological parameter per se, is considered an important surrogate measure of microbiological quality for surface water and groundwater under the direct influence of surface water. Increased turbidity may be associated with a contamination episode or may interfere with disinfection. Continuous turbidity monitoring is required for surface water (individual filter effluent) and groundwater under the direct influence of surface water (at the wellhead).

Disinfection by-products (DBPs) are important parameters because utilities must balance effective disinfection for microbiological protection against the creation of DBPs. Minimising DBPs to meet regulatory requirements will often restrict treatment process selection, and must be taken into account when new plants/upgrades/improvements are being considered.

DBPs must be monitored on a quarterly basis with the exception of bromate, which must be monitored on a monthly basis. An increased sampling frequency may be required for facilities using surface water or groundwater under the direct influence of surface water during peak by-product formation periods.

Trihalomethanes (THMs) and haloacetic acids (HAA5) form from the use of chlorine.

Chlorite and chlorate form from the use of chlorine dioxide.

Chlorate forms when utilities store fresh sodium hypochlorite solutions for more than three months.

Bromate forms from the use of ozone; bromate also forms when utilities store fresh sodium hypochlorite solutions for more than three months.

N-Nitrosodimethylamine (NDMA) forms from the use of chloramines, as well as chlorine in supplies with high humic concentrations.

Municipal water utilities should make every effort to maintain DBP concentrations as low as reasonably achievable without compromising the effectiveness of disinfection.

Guidelines for Monitoring Public Drinking Water Supplies—Section 33 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* requires an owner of a public drinking water supply to sample for the chemical and physical parameters listed in the *Guidelines for Monitoring Public Drinking Water Supplies* (see Appendix C). The minimum sampling frequency is every year for surface water and groundwater under the direct influence of surface water or every two years for secure groundwater. These parameters must be included in the annual sampling plan.

Guidelines for Canadian Drinking Water Quality — Section 35 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* requires an owner of a public drinking water supply to ensure that the microbiological, physical and chemical characteristics of a supply do not exceed the maximum acceptable concentration (MAC) or interim maximum acceptable concentration (IMAC) for substances listed in the *Guidelines for Canadian Drinking Water Quality*. As such, the health-related parameters (see Appendix D) are legally enforceable standards that require corrective action. These parameters must be included in the annual sampling plan.

Non-health-related parameters that have an aesthetic objective (AO) or operational guideline (OG) are generally not legally enforceable unless they compromise disinfection or another treatment process.

Corrosion control parameters and lead release must be included in the annual sampling plan. The collection of baseline or historical data is important in order to have a good understanding of water quality prior to developing a corrosion control program. The corrosion control program should be reviewed and assessed for improvement if elevated concentrations of lead are observed or if treatment process changes are proposed (e.g., switching to chloramines for secondary disinfection, etc.).

Source water protection parameters that are recommended in the source water protection plan must be included in the annual sampling plan. The source water protection plan should be reviewed and assessed for improvement every five years, or whenever significant changes to the municipal water system or risks to its source occur.

Maximum acceptable concentration (MAC) — is a level that has been established for certain substances in the *Guidelines for Canadian Drinking Water Quality* that are known or suspected to cause adverse health effects.

Interim maximum acceptable concentration (IMAC) — is a level that has been established for certain substances in the *Guidelines for Canadian Drinking Water Quality* that may cause adverse health effects but there is insufficient data to set a maximum acceptable concentration.

Aesthetic objective (AO) — is a level that has been established for certain substances in the *Guidelines for Canadian Drinking Water Quality* that may impair the taste, odour or colour of water or which may interfere with good water quality control practices.

Operational guideline (OG) — is a level that has been established for certain substances in the *Guidelines for Canadian Drinking Water Quality* that may negatively affect the efficient and effective treatment, disinfection, and distribution of water.

Where should the sample be taken?

The sampling location depends on the type of sample and water quality parameters being measured. Many parameters have locations specified within the GCDWQ. There are five regions within the facility where samples can be taken. These include:

1 **Source water** samples are collected from untreated surface water or groundwater sources. These samples may be used as an indicator of changes in source water quality. Samples may be collected at a set interval for trending or after known activities in the watershed have occurred (e.g., manure application, pesticide spraying, heavy rainfall, etc.).

2 **Raw water** sampling is located at the front end of the facility prior to treatment (e.g., pH, temperature, turbidity, etc.).

3 **Unit processes** sampling (e.g., pH after coagulation, turbidity after filtration, etc.).

4 **Finished water** sampling is located after the water has been treated, but prior to distribution of the water (e.g., disinfectant residual leaving the plant, clearwell turbidity, etc.).

5 **Distribution system** sampling must be performed to ensure that the finished water quality is maintained within the distribution system (e.g., coliform bacteria, chlorine residual, turbidity, DBPs, lead, etc.).

Sample locations are **not** to be changed without approval from Nova Scotia Environment with the exception of response monitoring; response monitoring may be required at any location depending on the nature of the problem.

How often should a parameter be sampled?

Parameters and frequency of sampling are dependent on many contributing factors including water source, historical results, population served, and local conditions. Routine monitoring should be performed to yield an overall understanding of the drinking water quality and evaluate performance of treatment, protect consumers, and increase acceptance and confidence in the water supply. Routine monitoring results serve as background data and can be used to compare water quality from one year to the next.

The frequency of sampling depends on the water quality parameter being measured and the role that parameter plays in controlling water quality. Continuous monitoring must be planned for water quality parameters that are used to indicate an immediate risk to public health, such as disinfectant residual and turbidity for surface water and groundwater under the direct influence of surface water.

Parameters to be tested and their sampling frequency are enforceable per Section 33 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations*. Many utilities voluntarily choose to collect more than the required minimum number of samples. The benefits are:

- high customer confidence and satisfaction;
- strong working relationships and trust between the utility and the regulatory agencies;
- timely identification and response to water quality issues; and
- cost savings on treatment chemicals and process maintenance.

Many parameters have specified sampling frequencies. Refer to Tables B1–B3 in Appendix B for more information on water quality parameters, sampling frequency and location.

What's the difference between compliance and "in-plant" action limits?

Compliance monitoring ensures that the water leaving the facility and within the distribution system meets the established requirements — the *Guidelines for Canadian Drinking Water Quality*. Facilities may also establish "in-plant" action limits for water quality. These action limits are set to be better than what is required by the *Guidelines for Canadian Drinking Water Quality*. "In-plant" action limits provide the opportunity for corrective action to take place before the water quality reaches non-compliance levels.

FOR EXAMPLE

The regulatory limit for turbidity for a conventional surface water treatment facility is 0.2 NTU in at least 95% of the measurements made, or at least 95% of the time each calendar month. Many utilities set 0.1 NTU, 99% of the time as their "in-plant" action limit.

Where more stringent "in-plant" action levels are applied these should be noted in the annual sampling plan to convey that added protection is in place.

What standard operating procedures should be included in the sampling plan?

The plan should include a list of the methods/procedures that are used for:

- quality control/quality assurance protocols for on-line instrumentation and monitoring equipment, as well as "in-plant" lab testing;
- "in-plant" samples;
- samples analysed by an accredited laboratory;
- procedures on next steps when water quality limits are exceeded; and
- maintenance and calibration of in-plant equipment and instrumentation.

If the standard operating procedures are included in the utility's operations manual there is no need to duplicate the procedures in the annual sampling plan. The annual sampling plan can simply refer to the operations manual for the list of standard operating procedures.

What methods should be used for "in-plant" samples?

For all in-plant testing, the annual sampling plan should include a list of methods that are used for measuring water quality parameters. These methods should be based on recognized and established methods (e.g., HACH, manufacturer's method, etc.).

What should be done for maintaining "in-plant" instruments?

Maintenance must be performed on all "in-plant" instruments. The protocols and scheduled maintenance plans must be included in the annual sampling plan. This will ensure that water quality results from in-plant analytical instruments are measuring within their design specifications. Maintenance should be performed on a regular basis and as recommended by the manufacturer.

How are "in-plant" samples verified?

All in-plant equipment should be routinely calibrated using the manufacturer's method. Results should be verified using standard calibration solutions with known concentrations and/or the utility's quality assurance/quality control program.

What is QA/QC?

Quality assurance/quality control (QA/QC) refers to an approach that verifies that sampling and monitoring are being performed correctly. QA/QC samples include duplicate, travel blanks and lab blanks, as well as internal standards. If there is a significant variation in the samples in the QA/QC program then efforts should be taken to improve analytical methods and/or sampling techniques, including sample preparation, so that there can be a high level of confidence in the water quality results. The QA/QC approach should be documented in the annual sampling plan.

QA/QC is especially important for "in-plant" equipment and continuous monitoring instruments. A QA/QC program is necessary to ensure that they are accurate and provide a high level of confidence in the water quality results. In this case, QA/QC may also involve regularly verifying results using an accredited laboratory www.gov.ns.ca/nse/water/waterlabs.asp.

Which lab should be used to analyse samples?

When testing and analysing water samples for compliance purposes, municipal water utilities must follow the *Policy on Acceptable Certification of Laboratories* www.gov.ns.ca/nse/airlandwater/docs/Policy-AcceptableCertificationOfLabs.pdf.

How do I calculate an annual locational running average for THMs and HAAs?

Trihalomethanes (THMs) are sampled at points in the distribution system with the highest potential THM concentrations. These points generally represent the areas in the distribution system with the longest retention time and are typically at the end of the distribution system farthest from the source.

Haloacetic acids (HAAs) are disinfectant by-products that form when chlorine reacts with organic carbon in drinking water. Unlike THMs, HAA concentrations may not peak at the end of the distribution system. Every distribution system will have a critical point where the HAA peak concentration will be found. It is the responsibility of the municipal water utility to sample for HAAs and determine the peak location.

Sample locations for THMs and HAAs are not to be changed without approval from Nova Scotia Environment.

FOR EXAMPLE

THMs at the end of the distribution system had the following concentrations at that specified location:

March	34 micrograms per litre
June	61 micrograms per litre
September	94 micrograms per litre
December	42 micrograms per litre
Average	**58 micrograms per litre**

As the locational running annual average is less than 100 micrograms per litre — the guideline limit — the utility is compliant.

HAAs peak at point "a" in the distribution system and had the following concentrations at that specified location:

March	65 micrograms per litre
June	100 micrograms per litre
September	120 micrograms per litre
December	95 micrograms per litre
Average	**95 micrograms per litre**

As the locational running annual average is greater than 80 micrograms per litre — the guideline limit — the utility is not compliant and corrective action is necessary.

THMs and HAAs are sampled on a quarterly basis. Quarterly sampling means samples are taken once per quarter with no less than 45 days interval between sampling events. Once four quarterly samples are collected at each location, the locational running average can be determined by averaging the four samples taken within the year at a specified location.

Utilities should make every effort to maintain THM and HAA concentrations as low as reasonably possible without compromising the effectiveness of disinfection.

How do I calculate the 95th/99th percentile for turbidity?

Turbidity must be measured at a minimum frequency of once every five minutes for surface water (individual filter effluent) and groundwater under the direct influence of surface water (at the wellhead). Where turbidimeters are polled more frequently than every five minutes, the "five minute value" should be the average of the set of data taken at the smaller intervals. Any two consecutive measurements that exceed the turbidity limit for the technology used must be documented. Any measurements that exceed the maximum allowable value for the technology used must be reported to Nova Scotia Environment.

The 95th/99th percentile is calculated as follows:

Number of turbidity readings in a month = MTT
Number of turbidity readings in a month below or equal to the turbidity limit = MTBL

Percentile = (MTBL/MTT) x 100

FOR EXAMPLE

Technology Type:
Conventional Treatment (Turbidity Limit = 0.2 NTU, 95% of the time each calendar month)
Month: January (31 days)
Number of turbidity readings in January = 8,923
Number of turbidity readings in January below or equal to the turbidity limit of 0.2 NTU = 8,645
Percentile = (8645/8923) x 100 = 96.8%

As this is greater than 95%, the utility is compliant.

Should future training be included in the sampling plan?

As part of the annual sampling plan, training opportunities for operators at the facility should be identified. The training should ensure that operators are proficient in sample collection, analysis, and interpretation of water quality results. It is important that operators understand proper sampling techniques for "in plant" analysis and those analysed by an accredited laboratory.

How should data be evaluated and interpreted?

The water quality results must be reported to Nova Scotia Environment in the annual report. The water quality results must be summarized and interpreted by staff or by a qualified water quality professional. All water quality exceedences must be clearly identified, as well as reasons for the exceedences and corrective actions taken by the water utility.

If there has been a noticeable change in water quality, this should be noted with possible reasons for the change. Actions that will be taken to ensure high quality drinking water is provided should also be noted.

What should be done to respond to or report exceedences?

In the case of water quality exceedences, the municipal water utility must be prepared to respond immediately to ensure that the public is protected. All utilities must have established contingency plans and emergency notification procedures to contact Nova Scotia Environment, the Medical Officer of Health and the community. These should be located in the facility's operations manual.

Water quality exceedences must be immediately reported to Nova Scotia Environment upon receipt of results that indicate a maximum acceptable concentration or interim maximum acceptable concentration has been exceeded; other water quality results also trigger immediate reporting requirements (e.g., whenever the presence of bacteria is detected, low chlorine residual, etc.).

When an exceedence is observed, water quality must be re-sampled according to the *Guidelines for Monitoring Public Drinking Water Supplies*. If the exceedence is confirmed, corrective action is necessary per Section 34 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations*.

Why should water quality results be reported?

The reporting of water quality results is important for a number of reasons:

- Provides a historical record of the water quality results. This can be helpful for trouble-shooting, determining seasonal variations in water quality at the facility and in the source.
- Demonstrates that the municipality is providing safe water as required by Sections 33 and 35 of the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations*.
- Provides the public with water quality results and builds trust in municipal water supplies.

Summary

This document provides an overview of the components required in an annual sampling plan. Every drinking water facility in Nova Scotia is unique; therefore every municipal water utility must develop an annual sampling plan acceptable to Nova Scotia Environment. The annual sampling plan is not only important for regulatory purposes; it's an important way for the utility to organize sampling at the facility throughout the year.

Additional information can be found in the following appendices:

Appendix A — Submission Check List for Annual Sampling Plan

- Lists the minimum items that should be included in the annual sampling plan. The check list should be submitted with the annual sampling plan.

Appendix B — Example Sampling Plans for Best Practices

- Table B.1: Water Quality Parameters and Sampling Frequency Requirements for Surface Water and High Risk GUDI
- Table B.2: Water Quality Parameters and Sampling Frequency Requirements for Medium Risk GUDI with Natural Filtration Log Credit
- Table B.3: Water Quality Parameters and Sampling Frequency Requirements for Secure Groundwater (Non-GUDI)

Appendix C — Guidelines for Monitoring Public Drinking Water Supplies

- Table C.1: Chemical/Physical Parameters in the *Guidelines for Monitoring Public Drinking Water Supplies*

Appendix D — Guidelines for Canadian Drinking Water Quality

- Table D.1: Health-related Parameters in the *Guidelines for Canadian Drinking Water Quality*

Appendix E — Example Table of Contents for an Annual Sampling Plan

Concluding Remarks

For more information, visit our website at www.gov.ns.ca/nse/water or contact:

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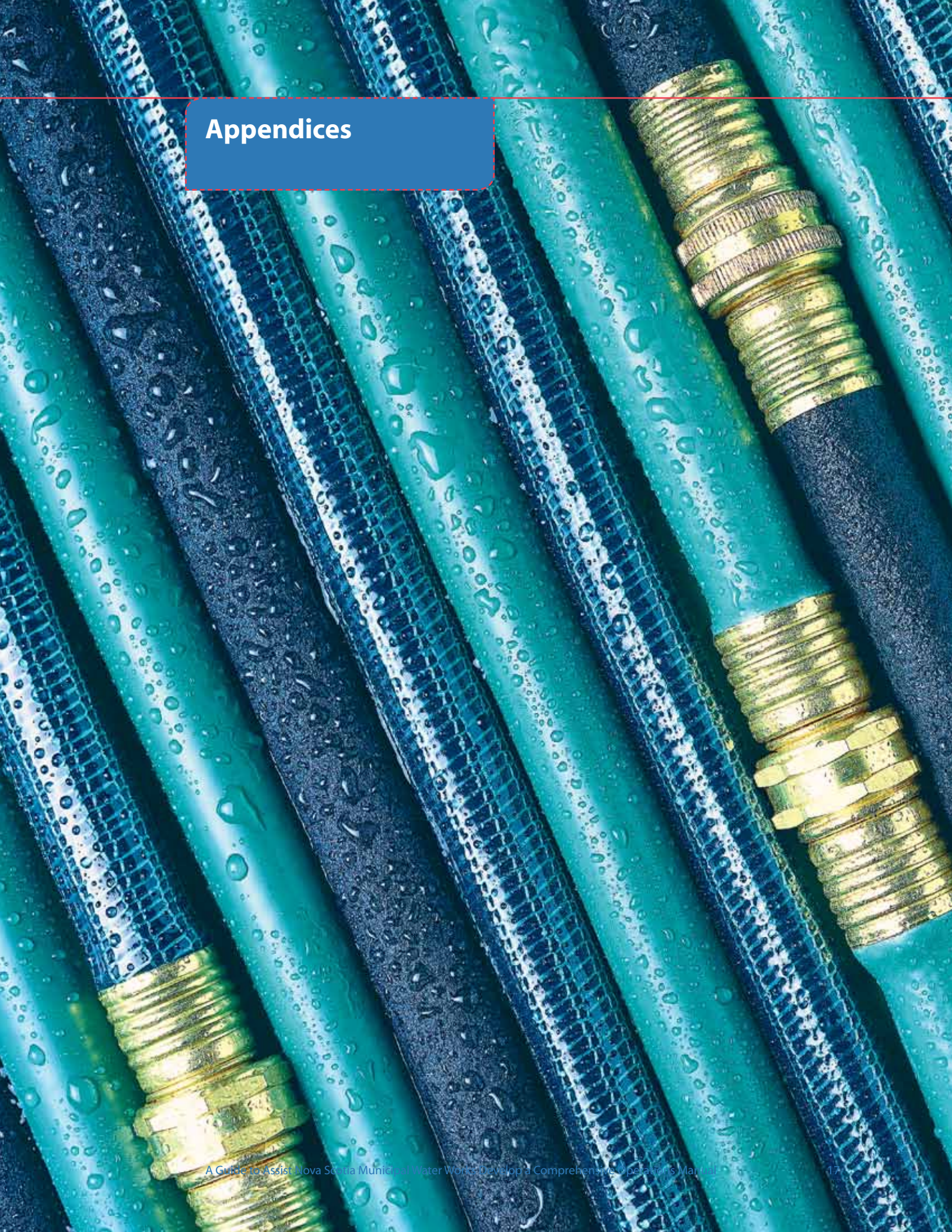
Appendices



Appendix A
Submission Check List for Annual Sampling Plan

Minimum requirements for the annual sampling plan

	✔
Water parameters have been identified by category of sample	
Compliance monitoring	
Process control monitoring	
Response monitoring	
Special process characterization and optimization monitoring	
Source water characterization	
Sampling frequency for each parameter has been identified	
Sampling site locations have been determined, including rationale for site selection	
Established standard operating procedures for analysing water parameters	
Identified all training that will be taken by staff to ensure proper sampling and water quality analysis	
Established quality assurance/quality control program for facility sampling and in-plant monitoring and devices, as well as in-plant testing (e.g., "in-plant" pH probes, turbiditimeters, chlorine residual analysers, etc.)	
Established a clear process for reviewing and evaluating water quality monitoring results, including source water protection plan monitoring	
Provided detailed description of how the utility plans to address MAC/IMAC exceedences or concentrations that are of concern	
Established deadline to submit annual sampling plan to Nova Scotia Environment	

Date of Submission

Appendix B
Example Sampling Plans for Best Practices

Table B.1 Water Quality Parameters and Sampling Frequency Requirements for Surface Water and High Risk GUDI

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Turbidity			
Turbidity	Raw water just prior to coagulation chemical addition point	Continuous or grab sample at least once per day	
	Individual filters	Continuous at no more than 5 minute intervals	**Conventional and direct filtration** • ≤ 0.2 NTU in at least 95% of the measurements or at least 95% of the time based on each calendar month • shall never exceed 1.0 NTU **Slow sand and diatomaceous earth filtration** • ≤ 1.0 NTU in at least 95% of the measurements or at least 95% of the time based on each calendar month • shall never exceed 3.0 NTU **Membrane filtration** • ≤ 0.1 NTU in at least 99% of the measurements or at least 99% of the time based on each calendar month • shall never exceed 0.3 NTU
	Filtered water directed to waste	Continuous or grab sample during filter-to-waste step	Filter-to-waste until the filtrate turbidity is below 0.2 NTU (conventional and direct filtration)
	Distribution system sample points	Weekly	Aesthetic objective ≤ 5.0 NTU

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Primary and Secondary Disinfection			
Chlorine Residual	Entering distribution system	Continuous at no more than 5 minute intervals	Must meet disinfection objectives
	Storage structure outlet	Continuous at no more than 5 minute intervals	See limits for distribution system sample points
	Distribution system sample points	Weekly	**Free Chlorine** • ≥ 0.2 mg/L free chlorine throughout the water distribution system • ≤ 4.0 mg/L free chlorine throughout the water distribution system **Chloramines** • ≥ 1.0 mg/L combined chlorine residual throughout the water distribution system • ≤ 3.0 mg/L combined chlorine residual throughout the water distribution system
UV transmissivity	Influent water to UV chamber	Continuous at no more than 4 hour intervals	As per IT design criteria
UV intensity	Influent water to UV chamber	Continuous at no more than 4 hour intervals	As per IT design criteria
UV monitoring parameters	As per manufacturer's specifications or Nova Scotia Environment requirements	As per manufacturer's specifications or Nova Scotia Environment requirements	As per IT design criteria
Chlorine Dioxide	CT control point	Continuous at no more than 5 minute intervals	As per CT design criteria; maximum feed dose of 1.2 mg/L
	Secondary disinfection point	Continuous at no more than 5 minute intervals	Minimize chlorine dioxide residual to minimize chlorate formation

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Ozone	CT control point	Continuous at no more than 5 minute intervals	As per CT design criteria; maximum residual range 0.5–1.0 mg/L
	Air quality (off-gas destruct unit)	Continuous at no more than 5 minute intervals* * Should be interlocked with the ozone generator controls to shut down system if excess ozone is detected	1.0 mg/L of ozone by volume
	As per manufacturer's specifications or Nova Scotia Environment requirements	As per manufacturer's specifications or Nova Scotia Environment requirements	
Microbial Quality			
Total Coliforms and *E. coli* (present/absent)	Water entering the distribution system	Weekly	None detectable per 100 mL
	Distribution system sample points	Weekly	None detectable per 100 mL
If total coliforms present; *E. coli* absent	As required by the GMPDWS	Grab sample; re-sample immediately at sites where total coliforms are present	None detectable per 100 mL
If total coliforms present; *E. coli* present	As required by the GMPDWS	Grab sample; re-sample immediately and **BOIL WATER ADVISORY**	None detectable per 100 mL
Viruses	Raw water	As requested by NSE	
	Water distribution system	As requested by NSE	Treatment must provide 4-log reduction unless the source water quality requires a higher level of treatment
Giardia* and *Cryptosporidium	Raw water	As requested by NSE	
	Water distribution system	As requested by NSE	Treatment must provide 3-log reduction unless the source water quality requires a higher level of treatment

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Cyanobacterial toxins (surface water only)	Raw water	Annually during warmest month unless previous algal blooms require more frequent sampling	
	Treated water	Annually during warmest month unless previous algal blooms require more frequent sampling	0.0015 mg/L
Corrosion Control			
pH	Water entering the distribution system	Continuous or grab sample at least once per day	6.5–8.5 but will depend on corrosion control strategy; can be as high as 10
	As required by process monitoring if pH control/ adjustment is practiced	Grab sample at least once per day	6.5–8.5 but will depend on corrosion control strategy; can be as high as 10
Corrosion control program parameters Examples include: • pH • alkalinity • dissolved inorganic carbonate • hardness • dissolved oxygen • disinfectant (type and concentration) • corrosion inhibitor residual • lead concentration • iron, zinc, copper concentrations • chloride and sulfate concentrations • corrosion coupons • etc.	Select distribution system sample point(s)	As per process control needs* * When optimizing corrosion control, weekly sampling is recommended	Chloride to sulfate mass ratio should be < 0.58
Lead — flushed sample	Select distribution system sample point(s)	Annual grab sample — during warmest month	0.01 mg/L (10 µg/L)

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Lead — stagnated sample			
Lead — Tier 1 Sampling • Minimum 6 hour stagnation period • First draw 1 litre sampling protocol	Preferably at homes with lead service lines	Number of monitoring sites based on population served and whether quality limits are met for a minimum of two consecutive periods of testing Sample once per year during warmest months if quality limits are met or twice a year if lead concentration exceeds 0.015 mg/L in more than 10% of samples	If lead concentration exceeds 0.015 mg/L in more than 10% of the samples (90th percentile value), implement Tier 2 sampling to determine the best corrective measures for the system
Lead — Tier 2 Sampling • Minimum 6 hour stagnation period • First draw 4 x 1 litre sampling protocol (or additional 3 x 1 litre samples from Tier 1 site)	At sites with the highest lead concentrations from Tier 1 samples	Number of monitoring sites based on population served and whether quality limits are met for a minimum of two consecutive periods of testing Sample once per year during warmest months if quality limits are met or twice a year if lead concentration exceeds 0.015 mg/L in more than 10% of samples	Each 1 litre sample is analysed to obtain a profile of lead contributions from the: • faucet • plumbing (leaded solder, brass and bronze fittings, brass water meters, etc.) • lead service line
Process Control			
Turbidity	Raw water just prior to coagulation chemical addition point	Continuous or grab sample at least once per day	
Water Volume	Raw water entering facility	Continuous	Must meet CT design criteria
	As requested by NSE	Continuous	
Temperature	CT control point	Continuous or daily grab	Must meet CT design criteria
TOC/DOC/UV254	As per process control needs	As per process control needs	
pH	Disinfection contact chamber	Continuous	Must meet CT design criteria
	Clarifier/flocculation tank	Continuous	Ensuring optimal range for coagulation
	As required by process monitoring if pH control/ adjustment is practiced	Grab sample at least once per day	6.5–8.5 but will depend on pH control/adjustment strategy; can be as high as 10

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Free ammonia (as N) — for facilities using chloramination	Select distribution system sample point(s)* * Sampling points should include distribution system storage and dead ends	Weekly	
Nitrate/nitrite (as N) — for facilities using chloramination	Distribution system sample point(s)* * Sampling points should include distribution system storage and dead ends	Weekly	10.0 mg/L for nitrate-nitrogen and 1.0 mg/L for nitrite-nitrogen if measured separately "In-plant" action limits should be set lower so that water quality results can be assessed for nitrification potential
Fluoride — if fluoridating	Water entering the distribution system	Daily	0.7 mg/L optimal
Aluminum — for facilities that add aluminum-based coagulants	Water entering the distribution system	Monthly	**Direct Filtration**: ≤ 0.2 mg/L (average of 12 monthly samples) **Conventional Filtration**: ≤ 0.1 mg/L (average of 12 monthly samples)
	Select distribution system sample point(s)	Monthly	
Disinfection By-products			
Total Trihalomethanes (THMs)	Select distribution system sample point(s) — representative of highest level	Quarterly	0.1 mg/L (100 µg/L) running locational annual average based on a minimum of 4 quarterly samples
Haloacetic Acids (HAA5)	Select distribution system sample point(s) — representative of highest level	Quarterly	0.08 mg/L (80 µg/L) running locational annual average based on a minimum of 4 quarterly samples
Chlorate and chlorite — if using chlorine dioxide	Select distribution system sample point(s) — mid-system and end locations	Monthly	1.0 mg/L — chlorate 1.0 mg/L — chlorite

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Chlorate — if storing fresh sodium hypochlorite more than 3 months	Water entering the distribution system	Quarterly	1.0 mg/L
Bromate — if using ozone	Select distribution system sample point(s) — representative of highest level	Monthly	0.01 mg/L (10 µg/L)
Bromate — if storing fresh sodium hypochlorite more than 3 months	Water entering the distribution system	Quarterly	0.01 mg/L (10 µg/L)
Guidelines for Monitoring Public Drinking Water Supplies			
Refer to Table C.1 for parameters	Raw and treated water	Minimum annually for surface water and high risk GUDI	Refer to Table C.1 for limits
Guidelines for Canadian Drinking Water Quality			
Refer to Table D.1 for parameters	Raw and treated water	Every 5 years unless system assessment report or source water protection plan states otherwise	Refer to Table D.1 for all health-related limits
Source Water Protection			
Parameters as per the source water protection monitoring plan	In accordance with Step 5 of the source water protection planning process		
Quality Assurance/Quality Control			
Parameters as per the QA/QC program	In accordance with QA/QC program		

Table B.2 Water Quality Parameters and Sampling Frequency Requirements for Groundwater Medium Risk GUDI with Natural Filtration Log Credit

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Turbidity			
Turbidity	Individual GUDI wells (at wellhead)	Continuous at no more than 5 minute intervals	≤ 1.0 NTU in at least 95% of the measurements or at least 95% of the time based on each calendar month
	Distribution system sample points	Weekly	Aesthetic objective ≤ 5.0 NTU
Primary and Secondary Disinfection			
Chlorine Residual	Individual GUDI wells or combined	Continuous at no more than 5 minute intervals	Must meet disinfection objectives
	Storage structure outlet	Continuous at no more than 5 minute intervals	See limits for distribution system sample points
	Distribution system sample points	Weekly	**Free Chlorine** • ≥ 0.2 mg/L free chlorine throughout the water distribution system • ≤ 4.0 mg/L free chlorine throughout the water distribution system **Chloramines** • ≥ 1.0 mg/L combined chlorine residual throughout the water distribution system • ≤ 3.0 mg/L combined chlorine residual throughout the water distribution system
UV transmissivity	Influent water to UV chamber	Continuous at no more than 4 hour intervals	As per IT design criteria
UV intensity	Influent water to UV chamber	Continuous at no more than 4 hour intervals	As per IT design criteria
UV monitoring parameters	As per manufacturer's specifications or Nova Scotia Environment requirements	As per manufacturer's specifications or Nova Scotia Environment requirements	As per IT design criteria

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Chlorine Dioxide	CT control point	Continuous at no more than 5 minute intervals	As per CT design criteria; maximum feed dose of 1.2 mg/L
	Secondary disinfection point	Continuous at no more than 5 minute intervals	Minimize chlorine dioxide residual to minimize chlorate formation
Ozone	CT control point	Continuous at no more than 5 minute intervals	As per CT design criteria; maximum residual range 0.5–1.0 mg/L
	Air quality (off-gas destruct unit)	Continuous at no more than 5 minute intervals* * Should be interlocked with the ozone generator controls to shut down system if excess ozone is detected	1.0 mg/L of ozone by volume
	As per manufacturer's specifications or Nova Scotia Environment requirements	As per manufacturer's specifications or Nova Scotia Environment requirements	
Microbial Quality			
Total Coliforms and *E. coli* (present/absent)	Water entering the distribution system	Weekly	None detectable per 100 mL
	Distribution system sample points	Weekly	None detectable per 100 mL
If total coliforms present; *E. coli* absent	As required by the GMPDWS	Grab sample; re-sample immediately at sites where total coliforms are present	None detectable per 100 mL
If total coliforms present; *E. coli* present	As required by the GMPDWS	Grab sample; re-sample immediately and **BOIL WATER ADVISORY**	None detectable per 100 mL
Viruses	Raw water	As requested by NSE	
	Water distribution system	As requested by NSE	Treatment must provide 4-log reduction unless the source water quality requires a higher level of treatment

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Giardia* and *Cryptosporidium	Raw water	As requested by NSE	
	Water distribution system	As requested by NSE	Treatment must provide 3-log reduction unless the source water quality requires a higher level of treatment; partial reduction may be obtained by natural filtration
Microbial Particulate Analysis (MPA) testing	Raw water from each individual GUDI well	Every two years in spring following rainfall	A change in GUDI risk status must be immediately reported to NSE
Corrosion Control			
pH	Water entering the distribution system	Continuous or grab sample at least once per day	6.5–8.5 but will depend on corrosion control strategy; can be as high as 10
	As required by process monitoring if pH control/ adjustment is practiced	Grab sample at least once per day	6.5–8.5 but will depend on corrosion control strategy; can be as high as 10
Corrosion control program parameters Examples include: • pH • alkalinity • dissolved inorganic carbonate • hardness • dissolved oxygen • disinfectant (type and concentration) • corrosion inhibitor residual • lead concentration • iron, zinc, copper concentrations • chloride and sulfate concentrations • corrosion coupons • etc.	Select distribution system sample point(s)	As per process control needs* * When optimizing corrosion control, weekly sampling is recommended	Chloride to sulfate mass ratio should be < 0.58
Lead — flushed sample	Select distribution system sample point(s)	Annual grab sample — during warmest month	0.01 mg/L (10 µg/L)

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Lead — stagnated sample			
Lead — Tier 1 Sampling • Minimum 6 hour stagnation period • First draw 1 litre sampling protocol	Preferably at homes with lead service lines	Number of monitoring sites based on population served and whether quality limits are met for a minimum of two consecutive periods of testing Sample once per year during warmest months if quality limits are met or twice a year if lead concentration exceeds 0.015 mg/L in more than 10% of samples	If lead concentration exceeds 0.015 mg/L in more than 10% of the samples (90th percentile value), implement Tier 2 sampling to determine the best corrective measures for the system
Lead — Tier 2 Sampling • Minimum 6 hour stagnation period • First draw 4 x 1 litre sampling protocol (or additional 3 x 1 litre samples from Tier 1 site)	At sites with the highest lead concentrations from Tier 1 samples	Number of monitoring sites based on population served and whether quality limits are met for a minimum of two consecutive periods of testing Sample once per year during warmest months if quality limits are met or twice a year if lead concentration exceeds 0.015 mg/L in more than 10% of samples	Each 1 litre sample is analysed to obtain a profile of lead contributions from the: • faucet • plumbing (leaded solder, brass and bronze fittings, brass water meters, etc.) • lead service line
Process Control			
Water Volume	Each individual well	Continuous	
	As requested by NSE	Continuous	
Temperature	CT control point	Continuous or daily grab	Must meet CT design criteria
pH	Disinfection contact chamber	Grab sample at least once per day	Must meet CT design criteria
	As required by process monitoring if pH control/ adjustment is practiced	Grab sample at least once per day	6.5–8.5 but will depend on pH control/adjustment strategy; can be as high as 10
Free ammonia (as N) — for facilities using chloramination	Select distribution system sample point(s)* * Sampling points should include distribution system storage and dead ends	Weekly	

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Nitrate/nitrite (as N) — for facilities using chloramination	Distribution system sample point(s)* * Sampling points should include distribution system storage and dead ends	Weekly	10 mg/L for nitrate-nitrogen and 1.0 mg/L for nitrite-nitrogen if measured separately "In-plant" action limits should be set lower so that water quality results can be assessed for nitrification potential
Fluoride — if fluoridating	Water entering the distribution system	Daily	0.7 mg/L optimal
Disinfection By-products			
Total Trihalomethanes (THMs)	Select distribution system sample point(s) — representative of highest level	Quarterly	0.1 mg/L (100 µg/L) running locational annual average based on a minimum of 4 quarterly samples
Haloacetic Acids (HAA5)	Select distribution system sample point(s) — representative of highest level	Quarterly	0.08 mg/L (80 µg/L) running locational annual average based on a minimum of 4 quarterly samples
Chlorate and chlorite — if using chlorine dioxide	Select distribution system sample point(s) — mid-system and end locations	Monthly	1.0 mg/L — chlorate 1.0 mg/L — chlorite
Chlorate — if storing fresh sodium hypochlorite more than 3 months	Water entering the distribution system	Quarterly	1.0 mg/L
Bromate — if using ozone	Select distribution system sample point(s) — representative of highest level	Monthly	0.01 mg/L (10 µg/L)
Bromate — if storing fresh sodium hypochlorite more than 3 months	Water entering the distribution system	Quarterly	0.01 mg/L (10 µg/L)

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Guidelines for Monitoring Public Drinking Water Supplies			
Refer to Table C.1 for parameters	Raw and treated water	Minimum every year for medium risk GUDI	Refer to Table C.1 for limits
Guidelines for Canadian Drinking Water Quality			
Refer to Table D.1 for parameters	Raw and treated water	Every 5 years unless system assessment report or source water protection plan states otherwise	Refer to Table D.1 for all health-related limits
Source Water Protection			
Parameters as per the source water protection monitoring plan	In accordance with Step 5 of the source water protection planning process		
Quality Assurance/Quality Control			
Parameters as per the QA/QC program	In accordance with QA/QC program		

Table B.3 Water Quality Parameters and Sampling Frequency Requirements for Secure Groundwater (Non-GUDI)

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Turbidity			
Turbidity	At well heads or can be combined flow	Daily grab or continuous	≤ 1.0 NTU in at least 95% of the measurements or at least 95% of the time based on each calendar month
	Distribution system sample points	Weekly	Aesthetic objective < 5.0 NTU
Primary and Secondary Disinfection			
Chlorine Residual	Entering distribution system	Continuous at no more than 5 minute intervals	Must meet disinfection objectives
	Storage structure outlet	Continuous at no more than 5 minute intervals	See limits for distribution system sample points
	Distribution system sample points	Weekly	**Free Chlorine** • ≥ 0.2 mg/L free chlorine throughout the water distribution system • ≤ 4.0 mg/L free chlorine throughout the water distribution system **Chloramines** • ≥ 1.0 mg/L combined chlorine residual throughout the water distribution system • ≤ 3.0 mg/L combined chlorine residual throughout the water distribution system
Microbial Quality			
Total Coliforms and *E. coli* (present/absent)	Distribution system sample points	Weekly	None detectable per 100 mL
If total coliforms present; *E. coli* absent	As required by the GMPDWS	Grab sample; re-sample immediately at sites where total coliforms are present	None detectable per 100 mL
If total coliforms present; *E. coli* present	As required by the GMPDWS	Grab sample; re-sample immediately and **BOIL WATER ADVISORY**	None detectable per 100 mL

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Viruses	Raw water	As requested by NSE	
	Water distribution system	As requested by NSE	Treatment must provide 4-log reduction
Corrosion Control			
pH	Water entering the distribution system	Continuous or grab sample at least once per day	6.5–8.5 but will depend on corrosion control strategy; can be as high as 10
	As required by process monitoring if pH control/ adjustment is practiced	Grab sample at least once per day	6.5–8.5 but will depend on corrosion control strategy; can be as high as 10
Corrosion control program parameters Examples include: • pH • alkalinity • dissolved inorganic carbonate • hardness • dissolved oxygen • disinfectant (type and concentration) • corrosion inhibitor residual • lead concentration • iron, zinc, copper concentrations • chloride and sulfate concentrations • corrosion coupons • etc.	Select distribution system sample point(s)	As per process control needs* * When optimizing corrosion control, weekly sampling is recommended	Chloride to sulfate mass ratio should be < 0.58
Lead — flushed sample	Select distribution system sample point(s)	Annual grab sample — during warmest month	0.01 mg/L (10 µg/L)

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Lead — stagnated sample			
Lead — Tier 1 Sampling • Minimum 6 hour stagnation period • First draw 1 litre sampling protocol	Preferably at homes with lead service lines	Number of monitoring sites based on population served and whether quality limits are met for a minimum of two consecutive periods of testing Sample once per year during warmest months if quality limits are met or twice a year if lead concentration exceeds 0.015 mg/L in more than 10% of samples	If lead concentration exceeds 0.015 mg/L in more than 10% of the samples (90th-percentile value), implement Tier 2 sampling to determine the best corrective measures for the system
Lead — Tier 2 Sampling • Minimum 6 hour stagnation period • First draw 4 x 1 litre sampling protocol (or additional 3 x 1 litre samples from Tier 1 site)	At sites with the highest lead concentrations from Tier 1 samples	Number of monitoring sites based on population served and whether quality limits are met for a minimum of two consecutive periods of testing Sample once per year during warmest months if quality limits are met or twice a year if lead concentration exceeds 0.015 mg/L in more than 10% of samples	Each 1 litre sample is analysed to obtain a profile of lead contributions from the: • faucet • plumbing (leaded solder, brass and bronze fittings, brass water meters, etc.) • lead service line
Process Control			
Water Volume	Each individual well	Continuous	Must meet CT design criteria
	As requested by NSE	Continuous	
Temperature	CT control point	Continuous or daily grab	Must meet CT design criteria
pH	Disinfection contact chamber	Continuous or daily grab	Must meet CT design criteria
	As required by process monitoring if pH control/ adjustment is practiced	Grab sample at least once per day	6.5–8.5 but will depend on pH control/adjustment strategy; can be as high as 10
Free ammonia (as N) — for facilities using chloramination	Select distribution system sample point(s)* * Sampling points should include distribution system storage and dead ends	Weekly	

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Nitrate/nitrite (as N) — for facilities using chloramination	Distribution system sample point(s)* * Sampling points should include distribution system storage and dead ends	Weekly	10.0 mg/L for nitrate-nitrogen and 1.0 mg/L for nitrite-nitrogen if measured separately "In-plant" action limits should be set lower so that water quality results can be assessed for nitrification potential
Fluoride — if fluoridating	Water entering the distribution system	Daily	0.7 mg/L optimal
Disinfection By-products			
Total Trihalomethanes (THMs)	Select distribution system sample point(s) — representative of highest level	Quarterly — sampling frequency may be reduced to annual based on historical results	0.1 mg/L (100 µg/L) running locational annual average based on a minimum of 4 quarterly samples
Haloacetic Acids (HAA5)	Select distribution system sample point(s) — representative of highest level	Quarterly — sampling may be reduced to annual based on historical results	0.08 mg/L (80 µg/L) running locational annual average based on a minimum of 4 quarterly samples
Chlorate and chlorite — if using chlorine dioxide	Select distribution system sample point(s) — mid-system and end locations	Monthly	1.0 mg/L — chlorate 1.0 mg/L — chlorite
Chlorate — if storing fresh sodium hypochlorite more than 3 months	Water entering the distribution system	Quarterly	1.0 mg/L
Bromate — if using ozone	Select distribution system sample point(s) — representative of highest level	Monthly	0.01 mg/L (10 µg/L)
Bromate — if storing fresh sodium hypochlorite more than 3 months	Water entering the distribution system	Quarterly	0.01 mg/L (10 µg/L)

Water Quality Parameter	Sample Location	Frequency of Water Quality Testing	Quality Limits
Guidelines for Monitoring Public Drinking Water Supplies			
Refer to Table C.1 for parameters	Raw and treated water	Minimum every two years for groundwater	Refer to Table C.1 for limits
Guidelines for Canadian Drinking Water Quality			
Refer to Table D.1 for parameters	Raw and treated water	Every 5 years unless system assessment report or source water protection plan states otherwise	Refer to Table D.1 for all health-related limits
Source Water Protection			
Parameters as per the source water protection monitoring plan	In accordance with Step 5 of the source water protection planning process		
Quality Assurance/Quality Control			
Parameters as per the QA/QC program	In accordance with QA/QC program		

Appendix C
Guidelines for Monitoring Public Drinking Water Supplies

Table C.1 Chemical/Physical Parameters in the Guidelines for Monitoring Public Drinking Water Supplies[1]

Water Quality Parameter	Maximum Acceptable Concentration MAC (mg/L)	Aesthetic Objective AO (mg/L)
Alkalinity	–	–
Aluminum[2]	0.1/0.2	–
Ammonia	–	–
*Antimony[3]	0.006	–
Arsenic	0.010	–
Barium	1	–
*Boron	5	–
Cadmium	0.005	–
Calcium	–	–
Chloride	–	≤ 250
Chromium	0.05	–
Colour	–	≤ 15 TCU
Conductivity	–	–
Copper	–	≤ 1.0
Fluoride[4]	1.5	–
Hardness	–	–
Iron	–	≤ 0.3
Lead[3]	0.01	–
Magnesium	–	–
Manganese	–	≤ 0.05
Nitrate — nitrogen[5]	10	–
pH (no units)	–	6.5–8.5[6]
Potassium	–	–
Selenium	0.01	–
Sodium	–	≤ 200

Water Quality Parameter	Maximum Acceptable Concentration MAC (mg/L)	Aesthetic Objective AO (mg/L)
Sulphate	–	≤ 500
Total Dissolved Solids	–	≤ 500
Total Organic Carbon	–	–
Turbidity	See Approval	–
*Uranium	0.02	–
Zinc	–	≤ 5.0

* Denotes parameters for which the health-related guideline was developed as an interim maximum acceptable concentration.

Notes

1 As of February 2010. Update information if parameters are added or limits change.

2 Until a health-related standard for aluminum is set, municipal water approvals require water treatment plants using aluminum-based coagulants to reduce residual aluminium levels in treated water to the lowest extent possible as a precautionary measure. Values of less than 0.1 mg/L total aluminium for conventional treatment plants and less than 0.2 mg/L total aluminium for other types of treatment systems have been set. Any attempt to minimize aluminum residuals must not compromise the effectiveness of the disinfection process or interfere with the removal of disinfection by-product precursors.

3 Because first-drawn water may contain higher concentrations of metals than are found in running water after flushing, faucets should be thoroughly flushed before water is taken for consumption or analysis.

4 The maximum acceptable concentration for naturally occurring fluoride is 1.5 mg/L. Where fluoride is added for the control of dental caries, it is recommended that the concentration of fluoride be adjusted to the optimum range of 0.7 mg/L.

5 The Health Canada documentation indicates that the maximum acceptable concentration for nitrate is 45 mg/L. This is equivalent to 10 mg/L as nitrate-nitrogen. Concentrations of nitrate and nitrite in drinking water are often expressed in the literature in units of nitrate-nitrogen and nitrite-nitrogen respectively, as follows: 1 mg nitrate-nitrogen/L = 4.43 mg nitrate/L and 1 mg nitrite-nitrogen/L = 3.29 mg nitrite/L. As such, the 10 mg/L as nitrate-nitrogen is specified in this document. Where nitrate and nitrite are determined separately, levels of nitrite should not exceed 3.2 mg/L or 1.0 mg/L as nitrite-nitrogen. Where both nitrate and nitrite are present, the total of the two should not exceed 10 mg/L (as nitrogen).

6 Dependent on the corrosion control strategy; can be as high as 10.

Appendix D
Guidelines for Canadian Drinking Water Quality

Table D.1 Health-related Guidelines from the Guidelines for Canadian Drinking Water Quality[1]

Water Quality Parameter	Maximum Acceptable Concentration MAC (mg/L)
Bacteria	
Total Coliforms	None per 100 mL
E. coli	None per 100 mL
Aldicarb	0.009
Aldrin + dieldrin	0.0007
Aluminum[2]	0.1 or 0.2
*Antimony[3]	0.006
Arsenic	0.010
*Atrazine + metabolites	0.005
Azinphos-methyl	0.02
Barium	1
Bendiocarb	0.04
Benzene	0.005
Benzo[a]pyrene	0.00001
*Boron	5
*Bromate	0.01
*Bromoxynil	0.005
Cadmium	0.005
Carbaryl	0.09
Carbofuran	0.09
Carbon tetrachloride	0.005
Chloramines (total)	3.0
Chlorate	1.0
Chlorite	1.0
Chlorpyrifos	0.09
Chromium	0.05

Water Quality Parameter	Maximum Acceptable Concentration MAC (mg/L)
*Cyanazine	0.01
Cyanide	0.2
Cyanobacterial toxins (as microcystin-LR)[4]	0.0015
Diazinon	0.02
Dicamba	0.12
1,2-Dichlorobenzene[5]	0.2
1,4-Dichlorobenzene[5]	0.005
*1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.014
Dichloromethane	0.05
2,4-Dichlorophenol	0.9
*2,4-Dichlorophenoxyacetic acid (2,4-D)	0.1
Diclofop-methyl	0.009
*Dimethoate	0.02
Dinoseb	0.01
Diquat	0.07
Diuron	0.15
Fluoride[6]	1.5
*Glyphosate	0.28
Haloacetic Acids (HAAs)	0.080
Lead[3]	0.01
Malathion	0.19
Mercury	0.001
Methoxychlor	0.9

Water Quality Parameter	Maximum Acceptable Concentration MAC (mg/L)
*Metolachlor	0.05
Metribuzin	0.08
Monochlorobenzene	0.08
Nitrate- nitrogen[7]	10
Nitrilotriacetic acid (NTA)	0.4
*Paraquat (as dichloride)[8]	0.01
Parathion	0.05
Pentachlorophenol	0.06
Phorate	0.002
*Picloram	0.19
Selenium	0.01
*Simazine	0.01
*Terbufos	0.001

Water Quality Parameter	Maximum Acceptable Concentration MAC (mg/L)
Tetrachloroethylene	0.03
2,3,4,6-Tetrachlorophenol	0.1
Trichloroethylene	0.005
2,4,6-Trichlorophenol	0.005
*Trifluralin	0.045
Trihalomethanes (THMs)	0.100
Turbidity	See Approval
*Uranium	0.02
Vinyl chloride	0.002
Radionuclides	
Gross Alpha	0.5 Bq/L
Gross Beta	1 Bq/L
Lead 210	0.2 Bq/L

* Denotes parameters for which the health-related guideline was developed as an interim maximum acceptable concentration.

Notes

1 As of February, 2010. Update information if parameters are added or limits change.

2 Until a health-related standard for aluminum is set, municipal water approvals require water treatment plants using aluminum-based coagulants to reduce residual aluminium levels in treated water to the lowest extent possible as a precautionary measure. Values of less than 0.1 mg/L total aluminium for conventional treatment plants and less than 0.2 mg/L total aluminium for other types of treatment systems have been set. Any attempt to minimize aluminum residuals must not compromise the effectiveness of the disinfection process or interfere with the removal of disinfection by-product precursors.

3 Because first-drawn water may contain higher concentrations of metals than are found in running water after flushing, faucets should be thoroughly flushed before water is taken for consumption or analysis.

4 The guideline is considered protective of human health against exposure to all microcystins that may be present.

5 In cases where total dichlorobenzenes are measured and concentrations exceed the most stringent value (0.005 mg/L), the concentrations of individual isomers should be established.

6 The maximum acceptable concentration for naturally occurring fluoride is 1.5 mg/L. Where fluoride is added for the control of dental caries, it is recommended that the concentration of fluoride be adjusted to the optimum range of 0.7 mg/L.

7 The Health Canada documentation indicates that the maximum acceptable concentration for nitrate is 45 mg/L. This is equivalent to 10 mg/L as nitrate-nitrogen. Concentrations of nitrate and nitrite in drinking water are often expressed in the literature in units of nitrate-nitrogen and nitrite-nitrogen respectively, as follows: 1 mg nitrate-nitrogen/L = 4.43 mg nitrate/L and 1 mg nitrite-nitrogen/L = 3.29 mg nitrite/L. As such, the 10 mg/L as nitrate-nitrogen is specified in this document. Where nitrate and nitrite are determined separately, levels of nitrite should not exceed 3.2 mg/L or 1.0 mg/L as nitrite-nitrogen. Where both nitrate and nitrite are present, the total of the two should not exceed 10 mg/L (as nitrogen).

8 Equivalent to 0.007 mg/L for paraquat ion.

Appendix E
Example Table of Contents for an Annual Sampling Plan

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Notes

Notes

NOVA SCOTIA

Environment

2010