

# Halifax Beach Water Quality Monitoring Protocol Summer 2023

## Beach Management

The Municipality's supervised outdoor swim (beaches) program is offered as a public service during the summer months of every year. The program runs annually from July 1 through August 31. This service, offered at 19 locations throughout HRM in 2023 (see Appendix A), is highly valued by our residents, and is one of the signature recreational services available during summer months. Public services offered in natural environments can only be offered when an adequate measure of public safety can be assured. Both freshwater and marine aquatic environments pose potential risks to human health and safety, due to the possibility of contact with various chemicals or biological materials, and physical hazards.

The primary hazard posed by water quality is the potential for contact with microorganisms associated with fecal contamination. An emerging hazard to beach water quality in Halifax is harmful algal blooms and mats (cyanobacteria), and the potential for these blooms and mats to produce toxins harmful to humans and other animals. The best way to manage these risks is through the effective operation of a water quality monitoring program, including the use of risk awareness measures, appropriate guidelines and standards for collection, handling, analysis, and reporting. The Municipality's program is operated in partnership with contracted laboratory services, provided in 2023 by Bureau Veritas Laboratories (BV Labs).

### *Beach Operation*

Supervised beaches are open to the public except in the following circumstances:

- The [geometric mean](#) (geomean) of five test results for a given beach is above the acceptable concentration for the appropriate indicator bacteria;
- Beach personnel suspect water quality concerns; and
- Visual observation of algal blooms or mats

Staff responses to circumstances triggering beach closures are described starting on page 4 of this protocol.

Due to different indicator limits for fecal bacteria and cyanobacteria, the protocols guiding beach openings, closures, and advisories are different for each, as reflected in the details presented below.

2023 is the sixth year the municipality has a planned response to cyanobacteria. The Municipality's response is to use a risk-based approach based on species identification and toxin testing due to multiple factors such as uncertainty in appearance, toxicity, number and location of blooms or mats, and current testing limitations. Water sample handling guidelines are similar for fecal bacteria and cyanobacteria testing practices and are addressed below.

## Water Quality Results

The municipality's beach water quality monitoring protocol conforms to Health Canada's Guidelines for Canadian Recreational Water Quality. The third and most recent edition of these guidelines was published in 2012.

As per these guidelines, Halifax uses *E. coli* as indicator of water quality for freshwater beaches, and enterococci as the indicator of water quality for marine and brackish beaches. Kinap Beach is a supervised brackish beach and is managed based on enterococci results. All other supervised beaches are exclusively managed based on *E. coli* results.

### *Municipal Response to Water Quality Results*

Lab results are received by the Water Quality Coordinator, Water Resources Specialist, and Aquatic Specialist. For supervised beaches, where bacteriological results exceed guideline limits, beaches will be closed, and Beach Supervisors will arrange to retest the affected beach as soon as possible and follow the steps outlined in *Table 1*.

*Table 1: Action Items for Bacteria Exceedances & Algae Blooms at Supervised Beaches*

<b>Step</b>	<b>Action</b>	<b>Person(s) Responsible</b>
1	Laboratory contact to notify Manager of Aquatic & Inclusion Services	Aquatic Specialist or Beach Supervisor on Office duty
2	Notify lifeguard(s) on affected beach(es)	Beach Staff
3	Place appropriate signage at site	Lifeguard(s) on site
4	Notify Public Affairs Office to publish PSA Email: <a href="mailto:mediarelations@halifax.ca">mediarelations@halifax.ca</a>	Water Resources Specialist
5	Remain on station for at least 7 days for public relations	Lifeguard(s) on site
6	Direct all media questions to the Public Affairs Office for redirection to Water Resources Specialist or designate. Staff to maintain "no comment" unless otherwise directed.	All staff
7	Notify NSECC: 1) Primary Contact - Environmental Health Consultant, Rodney Lahey, 902.565.9881, <a href="mailto:rodney.lahey@novascotia.ca">rodney.lahey@novascotia.ca</a> ; if Rodney is unavailable, contact Manager of Environmental Health Programs, Colin Poirier, 902.943.9842, <a href="mailto:colin.poirier@novascotia.ca">colin.poirier@novascotia.ca</a> 2) NS Inspection, Compliance & Enforcement Division, Central Region (Bedford Office) a. 902-424-7773 or <a href="mailto:Bedford.Office@novascotia.ca">Bedford.Office@novascotia.ca</a> (M - F 08:30-16:30); or b. Environmental Emergencies Hotline: 1-800-565-1633 between 16:30 and 08:30 M-F and weekends	Water Resources Specialist

## Fecal Bacteria Overview

Beaches remain open as long as water quality indicators are below acceptable limits. Halifax beach program staff collect, handle, and deliver water samples and associated documentation to Bureau Veritas Labs (BV Labs). BV Labs is responsible for confirming documentation and analytical procedures, conducting analytical procedures, and reporting analytical results to Halifax staff. Halifax and lab staff responsibilities are described separately below.

### *Water Quality – Sample Collection, Handling, Delivery & Documentation*

Sample collection is the process of obtaining uncompromised water samples across the supervised beach area. Samples are collected across the entire length of the beach, at knee-depth. Five samples are collected weekly at each beach.

Each sample is assigned a unique label, A through E, representing their relative location within the beach area. From the perspective of a lifeguard standing on the beach facing the water, Sample A is on the far left, Sample E is on the far right, and Samples B-D are arranged equidistant from all other sample stations in sequential order.

At each sampling location, the open bottle should be submerged below the water surface with the open end facing downwards, turning the bottle upright to fill it at a depth of roughly 30cm. Take care to avoid contaminating the sample by touching the mouth of the bottle with your hand or another surface. Human skin naturally harbors several varieties of microorganisms, including bacteria, even when freshly washed. If a hand touches the inside of the bottle or the inside of the lid, these bacteria could be transferred to the water sample, potentially causing false-positive test results. False-positive results could lead to unnecessary beach closures, further testing requirements, and unnecessary expense. Sample collectors should wear nitrile gloves.

The municipality's beach program conforms to water quality standards set in the [Canadian Recreational Water Quality Guidelines](#) (Health Canada, 2012). This protocol has been developed in consultation with Nova Scotia Environment & Climate Change (NSECC), including Environmental Health, the division representing the interests of the district Medical Officer of Health.

Each beach is sampled once weekly, with all samples submitted by end of day Wednesday. Five samples will be collected during each monitoring event, one at each of five stations (A-E.). The [geomean](#), an average of all samples, will be calculated from the five sample results.

In 2023, Halifax has supervised beaches in both freshwater and brackish environments. Water quality indicators for each are described in *Table 2*:

*Table 2: Beach Monitoring Indicators and Maximum Concentrations*

Beach Type	Indicator Bacteria	Maximum Allowable Concentration (CFU*)	
		Geomean of five samples**	Individual sample
Freshwater	<i>E. coli</i>	200/100mL	400/100 mL
Marine & Brackish	enterococci	35/100mL	70/100 mL

\* CFU = Colony Forming Unit

\*\* Beach closures and re-openings are based on the geomean unless one individual sample exceeds the threshold listed in this table.

A summary of monitoring requirements at all beaches is provided in Appendix B.

Beach Supervisors are trained on proper sample collection procedures by HRM's Water Resources Specialist at the start of each beach season. Only Beach Supervisors should collect water samples from supervised beaches. Support can be provided by HRM Environment & Climate Change (ECC) In extenuating circumstances.

Handling procedures for water samples are intended to ensure safe, secure, and controlled collection of samples from the time they are collected until delivery at BV Labs. This includes proper bottle labelling and storage – including refrigeration. Bottles must be labelled with the following information:

- Date and Time of sample collection
- Sample ID: Beach Name, Station Name
- Sample Type: FW (Fresh Water) **or** SW (Salt Water)
- Analysis: *E. coli* (FW) **or** enterococci (SW)

The lab requires water samples to arrive at 10°C or cooler. Samples should be immediately placed into a cooler filled with ice upon collection. Samples being held overnight should be stored in a refrigerator.

The same type of bottle is used for all bacteria samples. This bottle contains sodium thiosulphate ( $\text{Na}_2\text{S}_2\text{O}_3$ ) in powder form. Sodium thiosulfate is used as a de-chlorination agent for treated drinking water and is not necessary to stabilize surface water samples. While caution should be taken not to pollute, it is acceptable if the powder escapes the bottle upon sample collection. This material will not contact staff using the safe handling procedure. If the material does get onto someone's skin, wash thoroughly with soap and water. The Material Safety Data Sheet (MSDS) for sodium thiosulphate can be found in Appendix C.

Documentation of water samples is critical because incomplete, inaccurate, or missing paperwork can lead to confusing, misleading, or useless sample results, or samples being rejected by BV Labs.

In addition to labeling the individual bottles, all water samples must be submitted with a correctly completed Chain of Custody (COC) form. The municipality has forms customized for the beaches program and supplied by BV Labs (Appendix D). To complete this form, staff must provide the following information:

- Field Sample Identification (i.e., Beach name & Station #)
- Date of sample collection
- Time of sample collection
- # and Type of Bottles (per site) – report each sampling station on its own line (row) \*
- Matrix (i.e., Fresh Water or Salt Water)
- Identification of Analysis Required (check *E. coli*, enterococci, or microcystin)
- Name (of HRM staff delivering samples), plus date and time of delivery

Water samples collected for bacteriological analysis are only valid if analytical testing begins within 24 hours of sample collection. **Staff must ensure the delivery of all samples to the lab as soon as possible after they are collected.** Samples being held overnight should be stored in a refrigerator and must be delivered to the lab first thing the following morning. Samples delivered more than 24 hours after collection will be rejected by the lab and will need to be

recollected.

BV Labs has implemented a non-contact sample receipt protocol. All samples should be left in the building lobby, accompanied by completed COC forms. These forms should be completed before leaving samples in the lobby to minimize traffic in the drop-off area.

*Table 3: Sample Drop-off Times for Bureau Veritas Laboratories*

<b>Drop-Off Day</b>	<b>Parameter</b>	<b>Preferred Drop Time (same day)</b>	<b>Latest Acceptable Drop Time</b>	<b>Results Availability</b>
Monday – Thursday	<i>E. coli</i>	4pm	10am (day after sample collected)	Noon on Day 2
Monday-Thursday	enterococci	4pm	10am (day after sample collected)	Noon on Day 3
Monday - Friday	Microcystin	n/a	n/a	Standard: 7 Business Days; Rush: 3 or 5
Friday	<i>E. coli</i> & enterococci	n/a	2pm (same day)	Noon on following Monday
The tests for <i>E. coli</i> and enterococci must run for 24 hours and 48 hours, respectively. If samples are received in the afternoon the results will not be ready by noon the following day; they will be reported by noon on the second day. (i.e., if sample dropped off Monday at 3pm the results will be reported on Wednesday by noon).				
<b>Notice for sample drop-off beyond regular cut-off times should be given as early as possible.</b> During business hours, please contact Preeti Kapadia (Project Manager, at 902.420.0203 ext. 252) or as backup Maryann Comeau (Supervisor ext. 298, cell 902.229.2201). After business hours, please contact Suzanne Rogers (Lab Manager, 902.209.4055) or Jason Wang (Lab Supervisor, 902.448.4337).				

BV Labs sends analytical results to the following staff via email: Elizabeth Montgomery, Josh Weagle, and Pat McGrath.

*Water Quality – Documentation Confirmation, Analysis & Reporting*

Halifax contracts with only accredited and certified laboratories for the testing of water samples. These labs apply thorough quality control and assurance programs at all stages of their work, which begins with sample reception. Reception staff are responsible for confirming that the number and type of bottles received match those reported on the COC form, and for following up on any inconsistencies, errors, or uncertainties with the client.

Upon satisfactory receipt and confirmation of all samples, the lab conducts the appropriate analysis as requested on the COC. BV Labs conducts all *E. coli* and enterococci analyses on-site.

To restate, samples remain viable for analysis only when received and initially processed by the laboratory within 24 hours of sample collection. With a lag of up to 3 hours between receipt and processing, samples need to be delivered within 21 hours of collection. It is therefore critical to accurately observe and record the collection time, and to deliver samples less than 21 hours

later. *Table 2* identifies the key drop times and corresponding reporting periods for all parameters on a weekly basis. BV Labs will notify the Water Resources Specialist and the Aquatics Specialist in the event of holiday closures with updated sample drop-off times.

### *Beach Retesting in Case of Closure*

When bacterial analysis results lead to closures of any municipal beach, affected beaches are re-sampled as soon as practical, typically the following weekday. Beaches will remain closed until the geometric mean of five samples is equal to or less than the guideline limits.

If a wastewater system overflow occurs near a supervised beach, the beach will be closed to swimming as a precaution. Water samples (*E. coli* or enterococci) should be collected on the next weekday after the overflow. Beaches will remain closed until the geometric mean of five samples is equal to or less than guideline limits.

During retesting conditions, Beach Supervisors should consider documenting the following conditions to assist in interpreting water results as necessary:

- Was it raining at the time of collection or at any time during the previous 24-hour period?
- How clear or turbid was the water?
- Were ducks, geese, or other birds present? How many?
- Did you see any other signs of potential water contamination, or plausible causes for such contamination?

## Cyanobacteria Overview

Cyanobacteria, also called blue-green algae, are a group of bacteria that naturally occur in the same freshwater environments as true algae, occasionally forming blooms or benthic mats if the right conditions are present.

Cyanobacteria produce toxins when they bloom or form mats, but toxin production does not always occur. As the organisms die and decay, any toxins produced will be released into the water. People who make physical contact with blooms or mats may experience negative health symptoms, including skin irritations/rashes, sore throat, red eyes, swollen lips, and hay-fever-like symptoms. People and other animals who drink affected water or eat the mat material may be at risk of headaches, fever, diarrhea, vomiting, cramps, muscle, and joint pain, and even liver damage. Ingestion of mat material in particular can be fatal to humans and animals.

It is difficult to predict if blooms will form, and if blooms, when formed, will produce and subsequently release toxins. The municipality's cyanobacteria protocol is triggered by the observation of blooms or mats.

Cyanobacteria may vary considerably in colour, consistency, and overall appearance. Staff will assess blooms and mats observed directly and as reported by the public.

To streamline, document, and enable the assessment of public reports, ECC has initiated a review process in consultation with staff from the Parks division. This review includes the collection of caller name and contact info, and the date, location, and description of the suspected bloom. For reported blooms or mats in lakes associated with supervised municipal beaches, staff will conduct a site visit. Other reports are forwarded to NSECC. The purpose of this visit is to visually assess the environment of the bloom and reach one of two conclusions: 1) verify its presence; or 2) determine that the alleged bloom or mat is, in effect, a "false report" – i.e., staff observations are not consistent with algae blooms or mats.

This protocol adopts the approach that Halifax should only issue closure notices at the 19 supervised beaches, and the Shubie Park Dog Beach, where Halifax currently conducts water quality monitoring to protect public safety. For all other watercourses, Halifax maintains that the Province of Nova Scotia has jurisdiction, and Halifax will duly notify staff at NSECC ((1) Environmental Health & (2) Bedford Office, Inspection, Compliance, & Enforcement Division) to enable their own risk assessment, risk management, and, if necessary, public communications procedures.

Once staff suspect the presence of blooms or mats near municipal supervised beaches and the Shubie Park Dog Beach. Public Affairs will issue public risk advisory notifications via Public Service Announcement (PSA) and Twitter, advising the public of possible cyanobacteria presence, to avoid swimming, allowing pets to enter the water, and to take any additional recommended precautions. Municipal beaches will be closed until the bloom or mat is determined not to pose a risk to public safety.

Following the initial risk advisory notification, staff will initiate the following three-step risk assessment process:

1. Taxonomic identification;
2. Toxin analysis through accredited laboratory services; and
3. Toxin level assessment through test-strips.

### *1. Taxonomic Identification*

The first step is to identify what species are present, and whether they are potentially toxin-producing cyanobacteria. Staff will collect samples from blooms or mats, label the sample containers, and bring them to Bio-Limno Research & Consulting (BLRC) - a laboratory in Halifax specializing in this work. Taxonomic identification is the process of recognizing the identity of organisms, in this case to the species level. BLRC staff identify which species are forms of cyanobacteria, and of those, which can produce toxins (microcystin, anatoxin, saxitoxin, nodularin, or cylindrospermopsin). Results are available within 48 hours of sample submission.

If this assessment determines the bloom does not contain cyanobacteria, or that those cyanobacteria present do not produce toxins, staff will reopen the affected beach. If the assessment confirms that the cyanobacteria species present may produce toxins, the beach will remain closed, and staff will begin regular visual observations. These observations will continue until the cyanobacteria is no longer visible and remains undetected for a period of seven consecutive days after its last confirmed observation.

After seven consecutive days with no cyanobacteria observed, staff will conduct a toxin assessment, described below.

### *2. Toxin Analysis by BV Labs*

Cyanobacteria are the most common toxin-producing harmful algal blooms in Canadian freshwater environments. Microcystin is the most frequently observed form of toxin produced by the toxin-producing species of cyanobacteria, and it is the only toxin for which Health Canada has published guideline values to protect public health. Consequently, microcystin is the form of toxin that will be assessed. It is also the only toxin for which accredited analyses are available via BV Labs.

Seven days after a potentially toxin-producing bloom has dissipated, samples for toxin analysis will be collected by ECC staff and submitted to BV Labs. Although the health risks to personnel collecting samples for assessment are minimal, to further reduce the risk of exposure, staff will wear rubber boots or waders and nitrile gloves. For each location sampled, five discrete water samples will be collected and mixed in a clean container, from which a composite will be collected. This single composite sample is submitted to BV Labs for analysis.

*Table 2* identifies the key drop times and corresponding reporting periods for all parameters on a weekly basis for BV Labs. For toxin analysis, staff will request a “rush” turnaround time of 3 days. Microcystin samples received by BV Labs’ Bedford office will be shipped to an accredited affiliate in Mississauga for analysis.

If toxin levels are acceptable ( $\leq 20 \mu\text{g/L}$ ), and no new blooms appear in the area, staff will use test-strips to confirm current toxin levels.

### *3. Toxin level assessment by test strip*

This secondary assessment is performed to ensure microcystin concentrations have not increased above safe levels since the date that samples were collected for analysis. ECC staff collect water samples for immediate subsequent assessment using a microcystin test strip, specifically designed to indicate whether the concentration of microcystin in fresh water are present in a concentration under or over the guideline value as stated in Health Canada’s

Guidelines for Recreational Water Quality ( $\leq 20\mu\text{g/L}$ ). The sampling procedure used is in accordance with the Manufacturer's User Guidelines for the Microcystin Test Strip in Recreational Waters (Appendix E).

This analysis will be completed within 2 hours of return to the office following sample collection. Test results are available immediately upon completion of analysis.

If test strip results indicate toxin concentrations are below the guideline level, staff will open the affected beaches. If results indicate toxin levels are above the guideline level, affected beaches will remain closed, and ECC staff will repeat Step 2 in this risk assessment process. Steps 2 and 3 will be repeated until toxin levels are confirmed to remain below the guideline value. At that time, beaches will be reopened, and cyanobacteria signage removed.

Beginning in 2020, Halifax added additional protocols for lakes with multiple beaches and public access points such as Lake Banook and Lake Micmac. In instances where blooms are contained to one portion of the lake, additional testing will take place to ensure that blooms and toxins have not spread to other portions of the lake.

The authority to issue, revise, and lift closures lies with Water Resources Specialist Elizabeth Montgomery. In Elizabeth's absence, that authority resides with Environment & Climate Change's Environment Manager, Emma Wattie. Staff will advise the Directors of Environment & Climate Change and Parks and Recreation of forthcoming risk advisories prior to their publication.

**Halifax Beach Program Contacts:**

Water Resources Specialist	Elizabeth Montgomery Environment & Climate Change, Property, Fleet & Environment 902.943.1954 <a href="mailto:elizabeth.montgomery@halifax.ca">elizabeth.montgomery@halifax.ca</a>
Manager, Aquatic & Inclusion Services	Pat McGrath Beaches – Parks & Recreation 902.220.6329 <a href="mailto:mcgratjo@halifax.ca">mcgratjo@halifax.ca</a>
Aquatic Specialist	Josh Weagle Beaches – Parks & Recreation 902.818.0396 <a href="mailto:weaglejo@halifax.ca">weaglejo@halifax.ca</a>
Beach Office	Beaches – Parks and Recreation 902.490.5458 (ext. 3)
Beach Supervisor	Beaches – Parks & Recreation
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**List of Appendices:**

- Appendix A: Beach Locations 2023
- Appendix B: Beach Monitoring Summary 2021
- Appendix C: MSDS Sodium Thiosulphate Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>
- Appendix D: Sample Customized Chain of Custody Form 2023
- Appendix E: Microcystin Test Strip User Guide

**Director Approvals:**

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Director, Environment & Climate Change

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Date

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Director, Recreation

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Date