

BEACH CLOSINGS (BUI #10)



BACKGROUND

Swimming is a fun and healthy way for people to enjoy the waters of the Great Lakes and is considered one of the Great Lakes' beneficial water uses. However, it is sometimes unsafe for people to swim at certain beaches. There are various natural and human-induced factors that can lead to the waters of a beach being unsafe for swimming, including large numbers of swimmers, wind and waves, large number of birds, heavy rainfall, algal blooms, stormwater outflows, sewer overflows, and runoff from the land. Swimming in waters that have bacterial pollution from these various sources could cause infections of the ear, eye, nose, throat, and skin and may cause diarrhea if that water is ingested. Waterborne illnesses can be caused by different viruses, protozoa or bacteria pathogens. Enteric and fecal coliform bacteria (normally found in human/animal feces) such as *Escherichia coli* (*E. coli*) are the most common indicator of fecal pollution such as sewage contamination.

In the Niagara region, the Niagara Region Public Health Unit (NRPHU), regularly monitors 23 designated public swimming beaches from May (Victoria Day) to September (Labour Day) annually to prevent and reduce the occurrence of waterborne illnesses in recreational water users. The determination for whether a beach is a public swimming beach is made by the local municipality. The NRPHU advises the public a location is safe or unsafe for swimming through signage at the beach location and web-site announcements. Effective January 2018, under the Recreational Water Protocol, the Ontario Ministry of Health and Long-Term Care (MOHLTC) changed part of the provincial guideline for recreational water use at public beaches from a geometric mean of ≤ 100 *E. coli* colony forming units (CFU) per 100 mL to ≤ 200 *E. coli* CFU/100 mL (MOHLTC, 2018). This change aligns with the national guideline established by Health Canada. In the Niagara Region, beaches are considered safe for swimming when the geometric mean *E. coli* levels are ≤ 200 CFU/100mL and there are no severe hazards to human health (e.g., algae, chemical spill, etc.). If water samples do not meet these requirements, a beach can be posted or closed. A posting means the beach is unsafe for swimming due to poor water quality and/or potential hazards to human health (e.g., algae in the water) as it may cause illness or infections. A beach is closed when there is a high risk of impacting human health due to poor water quality or immediate health hazards that make it unsafe for recreational body contact (e.g., blue-green algae, chemical spill, oil). To date, no Niagara Region beaches have ever been 'closed' due to water quality and/or severe health hazards (A. Habjan, personal communication, May 2019).

Beaches are reviewed by the NRPHU every few years. As popularity and municipal resources (e.g., change rooms, parking, garbage removal, beach raking/maintenance) are added at a beach it can be added to the sampling schedule and those decreasing in popularity can be removed from the sampling schedule. Locations that are removed from the sampling schedule are no longer considered public swimming beaches and are not 'closed' in the water quality context described above. Historically, there were six beaches located in the Niagara River (King's Bridge Park Beach, Dufferin Islands Beach, Bowen Road Beach, Princess Street Beach, and Ball Street Beach, and Queen's Royal Beach). Only the Queen's Royal Beach (QRB), located in the Town of Niagara-on-the-Lake (NOTL), is still considered a public swimming beach within the Ontario waters of the Niagara River AOC. The first four locations were located on Niagara Parks Commission property and are no longer considered public swimming beaches due to reasons unrelated to water quality (NRRAP 2009). The Ball Street beach, located approx. 500 meters upstream of QRB on the Niagara River, was removed from the NRPHU sampling schedule in 2009 and is no longer monitored as it did not have obvious sources of contamination and was not a priority for the NRPHU (NRRAP 2009; A. Habjan, personal communication, June 2019). Two other beaches, located in the Niagara River watershed (Binbrook Conservation Beach, Chippawa Creek Conservation Beach), were part of a 2007 technical review and were shown to be likely impacted by waterfowl and agricultural sources based on mass-balance modelling, not human sewage sources. Furthermore, these two conservation area beaches are located within man-made lakes in the Upper Welland River watershed and are not likely to impact the Niagara River's water quality (NRRAP 2009). For the purposes of the RAP, only the QRB is applicable to assessing the *Beach Closings* Beneficial Use Impairment (BUI).

The QRB is located near the mouth of the Niagara River as it meets Lake Ontario. Its iconic gazebo and scenic views make this beach a popular location for weddings, sightseeing by tourists, as well as a location for wading, stand-up paddle boarding, and as a launching point for kayaks. Every few years, the NRPHU assesses the popularity and municipal resources (i.e., changing rooms, parking, garbage removal, beach maintenance). In 2017, the NRPHU determined that several beaches (including QRB) would be removed from their sampling schedule to allow for increased sampling and data accuracy at the most popular beaches (A. Habjan, personal communication, May 2019). To fulfill the RAP goals and the Town of NOTL's desire to maintain the QRB as a public swimming beach, partner organizations involved in the Niagara River RAP worked together to ensure the beach would be monitored in 2018 and 2019. The Town of NOTL, with funding support from Environment and Climate Change Canada (ECCC) & Ontario Ministry of Environment, Conservation and Parks (MECP) and technical support from NRPHU and the Niagara Peninsula Conservation Authority, is presently monitoring water quality at Queen's Royal Beach three times per week during the swimming season. The NRPHU provides training for Town of NOTL water quality staff and conducts sample analysis to ensure adherence to the sample collection and analysis protocols for quality assurance and for comparison to previous sampling. Future monitoring at Beach Closings BUI

Queen's Royal Beach, as for any public beach, will be contingent on municipal/Regional funding and support.

Since the completion of the Niagara River RAP Stage 2 Update (2009), research and monitoring activities have been a priority for understanding and addressing issues at the QRB in the Niagara River. A 2007 technical review of beaches indicated that only QRB had a potential human source of bacterial contamination (NRRAP 2009) likely from the stormwater outfall near the beach. A microbial source tracking approach was undertaken in 2010 to investigate the potential source(s) of fecal contamination at 15 Niagara Region beaches, including QRB. Microbial source tracking techniques compare the similarity of microorganisms from fecal pollution sources and water samples to make inferences about the source of water contamination (Edge et al. 2011). The 2010 study revealed that *E. coli* concentrations were higher at QRB than any other Niagara Region beach, particularly after rainfall. In addition, a microbial DNA marker indicating human sewage contamination was most frequently detected at QRB. Therefore, more focused water sampling efforts were undertaken in the vicinity of the QRB and lower Niagara River from 2011-2014. The main findings of the microbial source tracking studies were:

- Water quality at most of the 15 Niagara Region beaches studied in 2010 were relatively clean and usually below 100 *E. coli* CFU/100 mL;
- *E. coli* concentrations were higher at QRB than any other Niagara Region beach, particularly after rainfall;
- *E. coli* concentrations at QRB were highly correlated with the stormwater outfall at the beach;
- A microbial DNA marker indicating human sewage contamination was detected more often at QRB than any other Niagara Region beach;
- The Niagara River proper delivers low concentrations of *E. coli* to QRB. The characterization of the *E. coli* shows it to be more frequently associated with a human source rather than a wildlife source;
- A stormwater outfall at QRB delivers high concentrations of *E. coli* which is frequently impacted by human sewage sources associated with rain events.

Overall, the microbial source tracking studies indicated that the stormwater outfall at QRB was likely a critical source location that required further investigation and remediation. In 2017, the Town of NOTL received funding from ECCO to investigate the King Street Storm Sewer Outlet (KSSO), which discharges east of the QRB and was noted as the potential source location for contamination at the beach. A consulting firm (GM BluePlan Engineering) was retained by the Town of NOTL to conduct a detailed investigation of the KSSO catchment area which identified prominent sources of *E. coli* to the outfall at QRB, including improper sewer connections, abandoned infrastructure, low flow cross-connections, and stormwater infrastructure in poor condition. In May 2019, GMBluePlan completed a draft report outlining its findings and recommendations for infrastructure improvements in the Town of NOTL to reduce bacterial loadings to the storm sewer, and ultimately, to QRB. The report is awaiting final approval and

will be used by NOTL with input from the RAP Team to prioritize remedial actions toward improving water quality at the QRB.

History of BUI Status Over Time

The RAP Stage 1 Report (1993), which provided a description of environmental conditions and identified problems in the AOC, noted that the *Beach Closings* BUI was 'Impaired'. The report indicated that there are beaches along the Niagara River in small, quiescent areas away from the river's high velocity but did not list the beaches nor whether they were regularly monitored. The RAP Stage 1 Report also indicated that beach closings "had occurred fairly routinely over a decade and that issues were related to combined sewer overflows, slow moving waters in nearshore swimming areas, and plentiful waterfowl". The BUI status remained 'Impaired' in the RAP Stage 2 Report (1995) and in the subsequent 2009 RAP Stage 2 Update Report due to bacterial indicators not meeting the water quality goals at QRB, particularly in 2009. The RAP Stage 2 Update Report (2009) indicated that the source of contamination at QRB may be from the nearby storm sewer outfall and recommended further studies to determine whether the contamination was anthropogenic and if the source could be remediated.

The Binational Connection

There are separate RAPs on the U.S. and Canadian sides of the Niagara River resulting in different status designations for the same BUIs, depending on local issues and inputs. On the U.S. side of the Niagara River, the *Beach Closings* BUI is listed as 'Not Impaired'. There is one public bathing beach on the U.S. side of the Niagara River, located in Beaver Island State Park at the southern tip of Grand Island, NY. In New York, a beach is considered safe if water quality samples ≤ 235 *E. coli* CFU/100 mL. The 1994 RAP Stage 1/Stage 2 Report indicates that the beach has never been closed due to water quality problems (NYSDEC 1994). Using historical water quality data, New York State Parks has assigned the Beaver Island State Park Beach as a 'category 1' beach meaning it is a location with low rates of exceedance, satisfactory resample results within 24 hours, and/or wet sampling results. The beach continues to be monitored weekly for bacterial indicators of water quality (*E. coli*) by New York State Parks and reported online within 24 hours of the sample being collected (New York State Parks 2019). Results are shared online by New York State Parks every week during the summer months. For the latest beach water quality information, visit their website: <https://parks.ny.gov/recreation/swimming/beach-results/>

DELISTING CRITERIA REVIEW & RECOMMENDATIONS

The delisting criteria are locally-developed, AOC-specific goals used to measure progress and assess the condition of each of the BUIs of an AOC. The delisting criteria should be specific, measurable, achievable/feasible, realistic, and time-bound. All of the Niagara River's BUI delisting criteria were last formally reviewed and updated as part of the Niagara River RAP Stage 2 Update (2009). However, a more recent review by staff from ECCC and MECP (as part of a COA Task Team, 2017) indicated that the *Beach Closings* BUI's delisting criteria needed to be updated to consider changes to the MOHLTC Recreational Water Quality Guideline, as noted in the *Overview* section above. As a result, in November 2018, the NRRAP Implementation Committee agreed to create technical working groups to review the delisting criteria for three of the remaining BUIs, including the *Beach Closings* BUI. As with other BUIs, the criteria apply to the waters of the Niagara River Area of Concern (as per the GLWQA 2012). This beneficial use impairment (BUI) refers to the impacts of anthropogenic sources of bacterial pollution on recreational water quality. According to the IJC (2018), this BUI applies "when bacterial concentrations in water commonly used for total-body contact or partial-body contact recreation exceed applicable standards. Typically, this impairment applies to beaches and other locations where swimming and other water sports are a primary use".

In February 2019, a technical working group was formed to review the existing delisting criteria (as listed in the 2009 RAP Stage 2 Update) and to provide recommendations for their revision, if necessary. The working group consists of one representative from each of the following: Niagara Region Public Health, McMaster University, Town of Niagara-on-the-Lake, ECCC, MECP as well as the RAP Project Manager. Representatives were selected based on their technical knowledge, expertise, experience with the RAP, management responsibilities related to beaches, and involvement in previous QRB studies.

The working group reviewed and discussed previous RAP information (i.e., past reports, delisting criteria), established criteria in other places (e.g., other AOCs and the Blue Flag Beach Criteria for Canada), and current monitoring protocols and health guidelines. The main reasons for recommending revisions to the 2009 delisting criteria were because of recent changes to the MOHLTC guidelines for recreational waters (MOHLTC 2018) and to clearly link the criteria to remedial actions and local problems impacting the only public swimming beach on the Canadian side of the Niagara River. The technical review resulted in several revisions to the 2009 delisting criteria (rationale for specific changes are noted in the following section). Below are the recommended *Beach Closings* BUI delisting criteria (as of May 2019) as well as the previous criteria from the RAP Stage 2 Update.

The *Beach Closings* BUI will no longer be impaired when...

	Recommended Delisting Criteria (2019)	RAP Stage 2 Update Report (2009)
1a	Prominent sources of fecal pollution that could contaminate the beach or recreational waters are known; <u>and</u>	Prominent sources of fecal pollution that could contaminate beach or recreational waters are known;
1b	Remedial actions to address known sources are identified and completed.	
2	At least 80% of the geometric mean results of recreational water samples (when sampled at least once per week) meet the Ontario Ministry of Health Recreational Water Quality Guideline (≤ 200 CFU/100 mL) each swimming season for a minimum of three years.	Less than 20% of the geometric means of water samples collected over the swimming season exceed the Provincial Water Quality Objectives (100 <i>E. coli</i> /100ml), or is similar to a suitable non-AOC reference site, when assessed over a period of at least three to five years;
3	Risk management actions (e.g., postings, signage, education, rain rule) are in place to protect human health.	Any severe exceedance of Provincial Water Quality Objectives is rare and predictably associated with local events such as significant rainfall events.

Rationale for delisting criteria revisions

This section highlights the Technical Working Group’s rationale for revisions made to the *Beach Closings* BUI delisting criteria.

Criterion 1

Sub-part (1b) was added to ensure a course of action is identified and completed should any significant sources of fecal pollution be found. Remedial actions noted in criterion 1b should target locally-controllable (within the Niagara River AOC), anthropogenic sources (e.g., human sewage rather than waterfowl fecal waste) as these are tied to the legacy concerns of the AOC and RAP program.

Criterion 2

The main revision is that the water quality target (# *E. coli* CFU/100 mL) was updated to reflect the recent change to the MOHLTC guideline effective January 2018 from ≤ 100 CFU/100 mL to ≤ 200 CFU/100 mL. The revision is consistent with the approach and guidelines used by the NRPHU for local beach monitoring. The local health unit uses the geometric mean of five samples against the MOHLTC guidelines to determine whether a beach is safe or unsafe for swimming.

The same numeric target related to percentage of results to be achieved is identified, ie. 80% being met rather than 20% not met, so the change is in wording only. The 80% target and wording is consistent with the draft 2018 Lake Ontario Lakewide Management and Action Plan which states that if a beach is open 80% of the time or more it is considered in ‘good’ condition, 70-79.9% is considered ‘fair’, and <70%

is considered poor (ECCC/USEPA 2018). The 80% target and wording is also similar to language used in the Blue Flag Canada beach criteria (80% of geometric mean results are below the limit value). The Blue Flag designation is an internationally-recognized eco-label for beaches that meet strict criteria in four categories (one being water quality) (Environmental Defence 2018). Given the dynamic nature of beach environments and natural influences, it is unlikely for a beach to be entirely free of bacteria above thresholds 100% of the time (ECCC/USEPA 2018).

The revision also clarifies the minimum monitoring required and provides a context for subsequent interpretation of results. The monitoring is clearly outlined as at least a minimum of one weekly sample. This clarification is important since it provides context around the potential accuracy of the assessment. A beach sampled weekly could remain posted for the entire week despite potentially having good water quality the next day. Alternatively, a beach may have good water quality on the sampling day and reported as open the entire week despite potential poor results later in the week. Reporting the percentage of days open/posted when the frequency of sampling is less than daily may at times not provide an accurate representation of the beach conditions and could over or underestimate actual conditions.

The NRPHU samples the most popular beaches 6 days per week while less popular, less maintained beaches are sampled 1-5 days per week. Since sampling at QRB is no longer conducted by the NRPHU, it was important to indicate the minimum frequency of sample collection to meet the criterion. The frequency of sampling should be at least once per week but could be more often, if resources allow. For 2018 and 2019, the beach was sampled 3 times per week.

Last, the language related to a reference site was removed. The technical working group noted that identifying a suitable non-AOC reference site for a beach is challenging as the water quality at a beach is unique and reflective of its immediate surroundings. Even two locations that are side-by-side can be completely different with respect to water quality depending on local conditions, wind direction, bather load, etc.

Overall, criterion 2 is meant to provide scientific evidence about the quality of the water and measurable information about the efficacy of remedial actions completed through criterion 1. If an assessment shows criterion 2 is not met even after prominent sources of human sewage contamination are addressed, then experts should provide evidence-based reasons for exceedances that may not be anthropogenic (i.e., rainfall events, bather load, wildlife).

Criterion 3

Measuring the level of *E. coli* in recreational waters is not the only tool to protect human health from waterborne illness. The criterion was replaced to ensure there are management actions in place for the protection of human health when there are potential exceedances of water quality guidelines. The recommended revised criterion is meant to ensure that long-term management actions are in place to

reduce and communicate the risk of waterborne illness related to recreational water users at the public beach. Risk management actions can include (but are not limited to): website announcements, on-site postings at public beaches, media releases, automated phones/hotlines, public health unit disclosure systems, automatic rain posting rules, etc. This language is linked to the Operational Approaches for Recreational Water Guideline (MOHLTC 2018).

The 2009 criterion attempted to link the explanation for guideline exceedances to associated rainfall, which is better suited for use in an assessment rather than a delisting goal. Heavy rainfall can be linked to increased levels of contamination as rain can carry pollutants from urban and agricultural runoff into lakes and beach areas. Implementing a rain rule (i.e., communication to the public about avoiding contact with the water for at least 48 hours after a heavy rain event) as a risk management action would be more appropriate and can help protect human health. Precipitation information is still considered important and should also be used in the assessment of criterion 2.

ASSESSMENT FRAMEWORK

To facilitate the interpretation of the delisting criteria and to assess the status of the BUI, the following assessment framework will be used (Figure 1). The framework uses a series of binary (yes/no) questions that relate to specific parts of the delisting criteria leading to an 'Impaired' or 'Not Impaired' decision. Should the assessment lead to an 'Impaired' result, then the RAP will need to revisit the issues and continue to implement the remedial action plan and/or review other options regarding the beach with the municipality. If the result is 'Not Impaired', then the RAP should continue to the BUI re-designation process (i.e., prepare assessment report, public consultation, U.S. consultation, etc.).

The QRB, located in the Town of NOTL, is the only public swimming beach located within the Ontario waters of the Niagara River. For the purposes of the RAP, only the QRB should be used to assess the *Beach Closings* BUI.

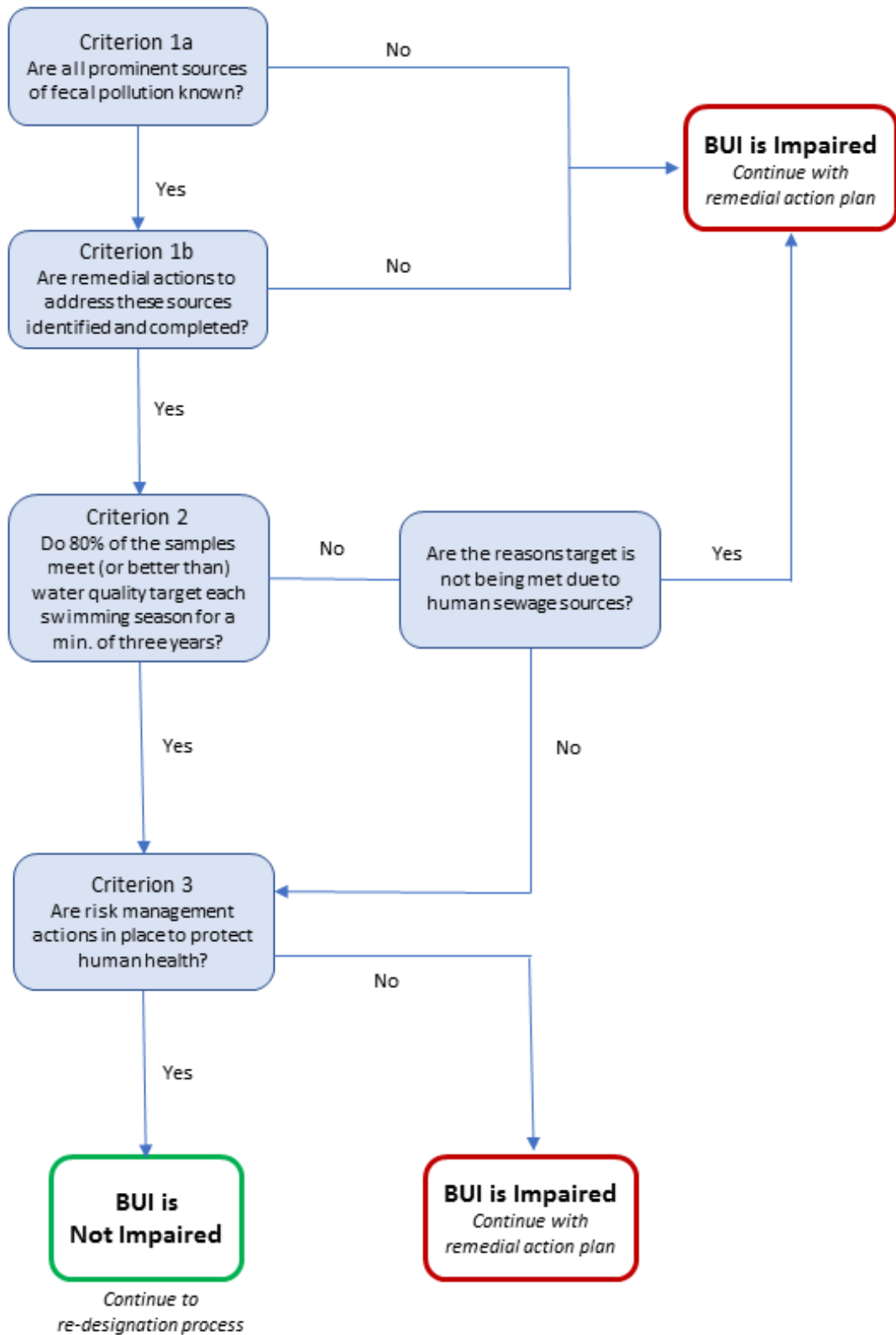


Figure 1. Framework to assess the *Beach Closings* BUI and to determine its status.

REFERENCES

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REVIEW/DECISION-MAKING PROCESS RECORDKEEPING

Oct. 31, 2019	Accepted by NRRAP Implementation Committee & Public Advisory Committee
Dec. 17/19 to Jan. 31/20	Public review period. Social media views (4,008), engagements (120), website views (57), newsletter clicks (4). Received one supportive comment.
Feb. 5/20	Finalized: recommended delisting criteria supersede the 2009 version and will be applied to future BUI assessment(s).