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VERSION 4

BUI 10

Beach Closings Beneficial Use Impairment Assessment Report

St. Lawrence River (Cornwall) Area of Concern

June 1, 2022

Acknowledgments

The content of this beneficial use impairment assessment report has been reviewed and approved by the St. Lawrence River (Cornwall) Area of Concern Water Quality Technical Working Group and Restoration Council. The following is a list of members of the two groups:

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Executive Summary

The St. Lawrence River (Cornwall) Area of Concern (AOC) Beach Closings beneficial use was originally identified as being 'impaired' in the 1997 Remedial Action Plan (RAP) Stage 2 Report due to persistent, on-going high fecal bacteria counts from industrial production and waste disposal practices, preventing the public from enjoying the river. Since then, considerable work has been undertaken in the AOC to reduce bacteria inputs from both point and non-point sources. Three delisting criteria were established to assess the status of the St. Lawrence River (Cornwall) AOC Beach Closings beneficial use impairment (BUI).

The assessment criteria are based on the Provincial Water Quality Objective (PWQO) for recreational water quality:

i) Geometric mean concentration (minimum of five samples): ≤ 200 *E. coli*/100 mL, or

ii) Single-sample maximum concentration: ≤ 400 *E. coli*/100 mL.

The assessment also took into consideration the following:

- The Impairments are due to current or past human activity; and
- Impairments are due to persistent, on-going high fecal bacteria counts, not sporadic high counts associated with rainfall events.

E. coli exceedances that are linked to rainfall events are not considered to be persistent, on-going sources of contaminants to the beaches, and are therefore not included in the final assessment.

The assessment of AOC beaches against the delisting criteria concluded the following:

Criterion #1: At public beaches, no more than 20% of weekly tests (i.e., five sample *E. coli* geometric means) exceed the Provincial Water Quality Objective during an annual swimming season. In addition, the main/predominant sources of fecal pollution are known; most of these exceedances are associated with local events, such as significant rainfall or high wind periods.

Assessment: During the annual swimming season at Akwesasne beaches, Charlottenburgh Park Beach and Glengarry Park Beach, less than 20% of weekly tests at each beach exceeded the Provincial Water Quality Objective for recreational water quality from 2012 – 2020, when eliminating exceedances associated with rainfall events (see Appendix A for report). Microbial source tracking was conducted in 2011 at Charlottenburgh Park and Glengarry Park beaches and found that bovine sources of fecal coliform were more prevalent than human sources (Ridal and Bramburger, 2012).

Recommendation: Criterion #1 has been met.

Criterion #2: The 'vast majority' of body contact water recreation areas in the Area of Concern, other than public beaches, must meet the Provincial Water Quality Objective during the swimming season. Body contact water recreation sites that do not meet these objectives are highly localized and exceedances occur only sporadically (i.e. the Area of Concern does not show widespread evidence of fecal pollution).

Assessment: Studies undertaken in 2002, 2003, 2007, 2008, and 2012-2019 show that *E. coli* levels in recreational areas other than regularly monitored public beaches were consistently below the Provincial Water Quality Objective for recreational water quality. In 2008, a sampling program was conducted and demonstrated that the impact of the tributaries seemed to be localized and that the area of Westleys Point was sporadically elevated due to the influence of the Westleys Creek.

Recommendation: Criterion #2 has been met.

Criterion #3: For body contact water recreation areas where water quality objective exceedances occur, the main sources of fecal pollution must be identified, pollution control plans must be developed, and these plans must be actively implemented.

Assessment:

i) Water samples were analyzed for *E. coli* at 28 Akwesasne beaches and Glengarry and Charlottenburgh Park beaches from 2012-2020 and assessed against the 20% exceedance criteria. The results show that, excluding outliers associated with rain events, water quality at beaches was consistently below the Provincial Water Quality Objective during annual swimming seasons.

ii) Microbial source tracking conducted in 2011 determined that bovine sources of *E. coli* were more prevalent than human sources at Charlottenburgh and Glengarry Park beaches in July and August. No assessment to determine the source of fecal pollution was undertaken at Akwesasne beaches.

iii) Plans have been developed and are being implemented to address fecal pollution stemming from agricultural practices and municipal sources. For example, the Raisin Region Conservation Authority (RRCA) runs a successful tributary restoration program, farm stewardship program and implements the Raisin-South Nation Source Protection Plan, all of which result in reduced *E. coli* loadings to waterways. Additionally, a number of farmers in the AOC have participated in the Canada-Ontario Environmental Farm Plan, which encourages actions to reduce nutrient runoff. The City of Cornwall is implementing a Pollution Control Plan, which ensures that *E. coli* loadings to waterways stays significantly below the Provincial Water Quality Objective for recreational water quality.

Recommendation: Criterion #3 has been met.

Based on these findings, the Beach Closing beneficial use can be considered restored, and the status of this beneficial use should be changed from 'impaired' to 'not impaired' for the St. Lawrence River (Cornwall) Area of Concern.

Acronyms and Abbreviations

AOC – Area of Concern

BUI – Beneficial Use Impairment

CFU – Colony Forming Units

ECCC – Environment and Climate Change Canada

EOHU – Eastern Ontario Health Unit

E. coli – *Escherichia coli*

GLWQA – Great Lakes Water Quality Agreement

IPZ – Intake Protection Zone

IJC – International Joint Commission

MCA – Mohawk Council of Akwesasne

MECP – Ontario Ministry of Environment, Conservation and Parks

OMHLTC - Ontario Ministry of Health and Long-Term Care

PWQO – Provincial Water Quality Objectives

RAP – Remedial Action Plan

RRCA – Raisin Region Conservation Authority

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1. Introduction

The St. Lawrence River at Cornwall was identified as an Area of Concern in 1986 under the Great Lakes Water Quality Agreement (GLWQA) (International Joint Commission, 1987) because the area had been severely degraded by human activities to the point that beneficial uses were impaired.

In the St. Lawrence River (Cornwall) AOC, high levels of bacteria at area beaches was identified as a 'condition for impaired use' in the Stage 1 Report (1992). An assessment completed in 1992 of the area's beaches concluded that there were many sources of bacterial pollution in the AOC, including sewage treatment plants, stormwater runoff, agricultural activity, and faulty septic systems (Pilon and Karl, 1992). In the Stage 2 Report, the Beach Closings beneficial use was identified as 'impaired' and actions to help remediate the BUI were identified. Throughout the years, actions have been completed to improve bacterial water quality in the AOC. As a result, bacterial water quality has vastly improved since the St. Lawrence River at Cornwall was designated an Area of Concern and the number of beach closings per year has decreased.

This report summarizes the environmental history that led to the Beach Closings beneficial use being identified as 'impaired', remedial actions that have been completed, the delisting criteria and an assessment of whether a 'not impaired' status can be applied to the Beach Closings BUI for this AOC. This consists of work undertaken by scientists and RAP partners who have been members of the St. Lawrence River (Cornwall) Area of Concern Restoration Council.

2. Targets and Criteria for Redesignating the Beach Closings Beneficial Use Impairment

Delisting criteria are measurable environmental conditions that need to be achieved before a BUI can be considered restored. The delisting criteria for the Beach Closings BUI have gone through a few iterations as scientists gained a better understanding of the St. Lawrence River (Cornwall) AOC bacterial sources and management options. Appendix 1 identifies the various iterations of the delisting criteria throughout the years, the dates these criteria were adopted and the rationale behind the changes.

The current delisting criteria were adopted in 2006, and they incorporate components that address the following:

- The International Blue Flag Program (www.blueflag.ca) benchmark whereby beaches should be closed for less than 20% of the swimming season due to unsafe levels of *E. coli* as determined by the local health authority;
- Impairments are due to current or past human activity;
- Impairments are due to persistent, on-going high fecal bacteria counts, not sporadic high counts associated with rainfall events; and
- The importance of distinguishing sources of fecal bacteria.

- Although, the delisting criteria and BUI refer to 'beach closings', we should note that they are actually referring to 'beach postings'. In 2003, the initial delisting guideline was amended to use the term 'beach postings' instead of 'beach closings' when referring to the status of the beaches, as per the OMHLTC guidelines (2014). Although a beach is now seldom closed, 'posting' a beach is a way to communicate swimming advisories due to high levels of *E. coli* or other issues.

The federal and Ontario Provincial Water Quality Objectives (PWQO) for the protection of recreational water users is:

i) Geometric mean concentration (minimum of five samples): ≤ 200 *E. coli*/100 mL, or

ii) Single-sample maximum concentration: ≤ 400 *E. coli*/100 mL.

Table 1 – Beach Closings BUI Delisting Criteria

Delisting Criteria
Criteria: 1. At public beaches, no more than 20% of weekly tests (i.e., five sample *E. coli* geometric means) exceed the Provincial Water Quality Objective during an annual swimming season. In addition, the main/predominant sources of fecal pollution are known; most exceedances are associated with local events, such as significant rainfall or high wind periods. 2. The 'vast majority' of body contact water recreation areas in the AOC, other than public beaches, must meet the Provincial Water Quality Objective during the swimming season. Body contact water recreation sites that do not meet these objectives are highly localized and exceedances occur only sporadically (i.e., the AOC does not show widespread evidence of fecal pollution). *Note 1: The interpretation of the 'vast majority' is left to the assessment of the committee, but should be a large percentage of the total number of the body contact recreation sites (i.e., 75% or more)"* 3. For body contact water recreation areas where water quality objective exceedances occur, the main sources of fecal pollution must be identified, pollution control plans must be developed and these plans must be actively implemented. *Note 2: Recent research on microbial indicators such as E. coli have shown that even pristine areas in the Great Lakes can be impacted by microbial loadings from wildlife feces, decaying life forms and pollution of human origin. These findings are closely associated with those local events (rainfall or high wind), mentioned in criterion #1. The microbial loadings from wildlife feces, decaying life forms and anthropogenic emissions are often triggered by rainfall events.*

3. Historical Impacts and Remedial Actions Undertaken

The RAP Stage 1 Report indicates that there were 'several beach closings during 1986, 1988, and 1989 and elevated bacteria levels downstream of Cornwall' (St. Lawrence Remedial Action Plan Team, 1992). Increased levels of bacteria were found to be from a variety of sources including industrial effluent, sewage

treatment plant discharges, combined sewer overflows from urban areas, private septic systems, and agricultural runoff.

Since then, there have been significant improvements in bacterial water quality in the St. Lawrence River (Cornwall) AOC. Many actions that have contributed to this have been implemented through the St. Lawrence River (Cornwall) RAP.

3.1. Industry

Cornwall, the largest urban centre in the AOC, has been a hub of industrial activity for more than 100 years. This legacy led to contamination issues in local waters affecting the aquatic environment.

Courtaulds/Domtar/ICI/Cornwall Chemicals: There were several industries in the area that directly discharged industrial wastewater and sewage containing fecal coliforms to the St. Lawrence River. Fecal coliform was the original metric for bacterial contamination. The largest source of fecal coliforms was determined to be the effluent from Courtaulds Fibres, Courtaulds Films, Domtar, ICI Forest Products and Cornwall Chemicals.

All of these industries are now closed, and there are no more industrial point-source inputs of bacteria to the waterways in the AOC. Courtaulds Films closed in 1989, Courtaulds Fibres closed in 1992, ICI Forest Products closed in 1995, Cornwall Chemicals closed in 1995 and Domtar closed in 2006.

Ships: Ships discharged untreated sewage directly into the St. Lawrence River in the early 1900s. In 1913, water samples identified high bacteria levels in the river from the Thousand Islands to Cornwall, the main contributing factor being discharges from ships (St. Lawrence Remedial Action Plan Team, 1992).

In 2001, marine vessels (i.e., ocean tankers and barges) in Canadian waters were prohibited from discharging untreated sewage into waterways. From 2012 onwards, all vessels including small watercraft in Canadian waters, fresh and salt, became covered by the same legislation regarding sewage discharge. Treated sewage is only allowed to be discharged into Canadian waters in rare instances, subject to specified limits of fecal coliforms per 100 ml of water (Canada Shipping Act, 2001).

3.2 Sewage Treatment Plant Discharges

There are three sewage treatment plants that discharge directly into the St. Lawrence River/Lake St. Francis within the AOC, and all were identified in the Remedial Action Plan Stage 1 or Stage 2 reports as being potential sources of fecal coliforms/*E. coli*.

i) City of Cornwall: The City of Cornwall Wastewater Treatment Plant was built in 1968 and was originally designed to provide only primary sewage treatment. Prior to that, raw sewage collected by the sewage system was discharged straight into the St. Lawrence River. The plant was expanded and updated between 1985 and 1988, and the Certificate of Approval issued by the Ministry of the Environment required effluent concentration limits for fecal coliform to be 35,000 *E. coli* CFU/100 mL. The city developed a comprehensive pollution control plan in 1993-1994 to improve the collection system capacity and Wastewater Treatment Plant operations. The pollution control plan included a detailed program for reducing combined sewer

overflows, controlling stormwater discharges, and improving the water quality of its treated and untreated discharges to its receiving streams and the St. Lawrence River.

In 2003, the City of Cornwall investigated options for upgrading their sewage treatment plant, which resulted in a Class Environmental Assessment being undertaken in 2005. After applying to the Ontario Ministry of the Environment to allow for modifications and upgrades to the existing sanitary collection system and primary sewage treatment plant to achieve a rated capacity of 54,432 m3/day, new limits were set out in a Certificate of Approval for the *E. coli* concentration in plant effluent, reducing it to 200 *E. coli* CFU/100 mL. In a study conducted by the City of Cornwall in 2009, it was determined that the plant was not able to meet these objectives (J. L. Richards & Associates Limited et al., 2010). Starting in 2012, a $55.5-million upgrade to the treatment plant was undertaken, resulting in the addition of secondary treatment and an increase in capacity, and the upgraded *E. coli* effluent objective was further reduced to 100 *E. coli* CFU/100 mL.

Annual reports from 2018-2021 show that the average *E. coli* annual geometric mean in plant effluent for the past four years has been 29 (2018), 44 (2019), 72 (2020) and 50 (2021) *E. coli* CFU/100 mL, well below the Provincial Water Quality Objective geometric mean concentration of ≤ 200 *E. coli*/100 mL for recreational water.

ii) Glen Walter (South Glengarry): This plant discharges directly into the St. Lawrence River. The sewage treatment plant was constructed in 1987/1988 and was identified in the Remedial Action Plan Stage 2 Report as a possible source of contaminants to the AOC. Subsequent upgrades to the system included upgrading the disinfection system from Sodium Hypochlorite to UV disinfection (2010) and the addition of Aluminum sulfate for the removal of phosphorus (2010). The current Certificate of Approval issued by the Ministry of the Environment contains effluent limits for *E. coli* of ≤ 200 *E. coli*/100 mL. Annual reports from 2018-2021 show that the average *E. coli* annual geometric mean in plant effluent for the past four years has been 7.3 (2018), 2.2 (2019), 2.7 (2020) and 1.6 (2021) *E. coli* CFU/100 mL, well below the Provincial Water Quality Objective geometric mean concentration of ≤ 200 *E. coli*/100 mL for recreational waters.

The council of South Glengarry approved a plan to move forward to the next stage of the Environmental Assessment (EA) process for the expansion of the Glen Walter core. The preferred option will allow the Township to have sufficient capacity in the municipal water and wastewater systems to support growth within the following areas: infill within the Glen Walter Core and Farlinger Point, Place St. Laurent, Country Club Estates and two other rural areas. Once the EA is completed, it will give the township a better understanding of how many private septic systems could be replaced in the future, providing further protection to the river from possible *E. coli* contamination.

iii) Lancaster Sewage Treatment Plant (South Glengarry): This plant discharges directly into Lake St. Francis. In 1992, it was identified that possible sources of bacteria for Glengarry Park included the South Lancaster sewage disposal system effluent (Pilon and Karl, 1992). During 2000-2002, the system was upgraded from two lagoons to include aeration and dosages of aluminum. Annual reports from 2018 - 2021 show that the *E. coli* average concentration in plant effluent for each year has been 55.18 (2018), 55.18 (2019), 21.4 (2020) and 21.4 (2021) *E. coli* CFU/100 mL, well below the Provincial Water Quality Objective Geometric mean concentration of ≤ 200 E. coli/100 mL and the single-sample maximum concentration of ≤ 400 E. coli/100 mL.

3.3 Combined Sewer Overflows

Combined sewer systems are sewers that were designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. During precipitation events, when there is a dramatic increase in rainwater, combined sewer can overflow discharging high concentrations of *E. coli* via untreated or partially treated sewage to local waterways. In 1989, the City of Cornwall undertook a review of all the Combined Sewer Overflows (CSOs) events and developed recommendations to reduce the number and volume of CSO discharges. As a result of this review, the City started to upgrade the system to reduce overflows and basement floodings by undertaking annual sewer separation projects. Although the original length of the combined sewers has been difficult to determine, in 2006 it was identified that there were 66.6 km of combined sewers in the city. Since then, upgrades have resulted in the separation of 11.9km of combined sewers, therefore as of the beginning of 2022 there are only 54.7km of combined sewers left to separate This on-going initiative will provide further protection of the river from possible *E. coli* contamination.

3.4 Stormwater Outfalls

In 1995, in the City of Cornwall, there were 17 stormwater outfalls discharging directly into three receiving streams: Fly Creek (which empties into Gray's Creek then into the St. Lawrence River), the south branch of the Raisin River (which empties into the St. Lawrence River), and the St. Lawrence River (CH2M Hill Engineering Ltd., 1995). A study of the 17 stormwater outfalls in 1993 determined that the geometric mean effluent concentration of *E. Coli* was 2,573 *E. coli* CFU/100 mL. Water quality samples were composite samples taken using by either an ISCO automatic sampler during both wet and dry weather events each hour, or grab samples. There were typically two sampling days for each outfall, between June and November.

The Cornwall Pollution Control Plan was developed in 1995 to address, in part, stormwater loadings. Work to reduce stormwater continued through the years, and the Cornwall Blueprint was produced in 2014 to consolidate the City's initiative to deal with issues such as basement flooding mitigation and environmental, water and infrastructure awareness. Implementation of the plan is ensuring reductions in sewer infiltration, the creation of stormwater ponds, implementation of low impact development options, and sewer separation projects. All of this is reducing the volume of outflow from the storm sewers as well as improving the quality of the outflow.

The 1995 Cornwall Pollution Control Plan identified that the stormwater discharge from the Fly Creek catchment area comprised up to 25% of the total stormwater discharge from the City of Cornwall to the St. Lawrence River via Gray's Creek, and was a significant source of contaminants, including bacteria. A 1980 sampling program in Gray's Creek showed levels of fecal coliforms/100 mL fluctuating throughout the summer, with levels ranging from 4 CFU/100 mL to 26,000 CFU/100 mL (Kauss et al., 1988). To address this, in 1997 the pond was retrofitted with three treatment cells and a pumping station to further improve water quality before it is discharged to surface water. These upgrades were very successful.

Gray's Creek is the outflow for the Fly Creek stormwater control system that had been constructed as part of the City of Cornwall's Pollution Control Plan. Monitoring of bacteria in 2002 at 5 stations in Grays Creek showed that the daily mean *E. coli* levels were at or below 10 *E. coli* CFU/100 mL even after a rain event (St. Lawrence River Institute of Environmental Sciences, 2003).

3.5 Campground Sewage Treatment Systems

Campground systems located along the river within the AOC had been originally identified as a possible source of bacteria. The local MOE district office carried out an assessment of campground sewage treatment systems in the summer of 2005. Only systems greater than 10,000 litres per day were inspected according to MOE's regulatory responsibilities under the provincial Environmental Protection Act, which included the following sites: Glengarry Park, Cameron's Point Campsite, Lancaster Park, and T&I Campground. None of these systems had any surface discharges, or discharges to water, as they used holding tanks or leaching beds. The results indicated that all systems at these campgrounds were in good working order, without any surface ponding or sewage break-out on the surface which would be indicative of a malfunctioning system. Additionally, all systems were sloped away from the beach areas, reducing any potential impact of a poorly functioning system on the beach.

3.6 Private Septic Systems

Another source of bacterial pollution in the AOC was faulty septic systems along the St. Lawrence River. In 1990/1991, the Raisin Region Conservation Authority recorded high levels of fecal coliforms in the nearshore area between Summerstown and Pilons Point, and attributed the high levels to malfunctioning private septic systems. In the same study, elevated levels were found in the Raisin River and Finney Creek, which was thought to be from agricultural run-off and faulty septic systems in Williamstown and Martintown.

A voluntary septic inspection program for shoreline owners was implemented from 2008-2013 by the Raisin Region Conservation Authority to mitigate inputs from faulty or overcharged septic sources leaking into the St. Lawrence River. It promoted voluntary care and maintenance of private residential septic systems. Throughout the program, 148 private septic systems were inspected and pumped out, and minor repairs were undertaken to reduce leakages.

Bacterial pollution from septic systems is also addressed in specific areas known as 'Intake Protection Zones' (IPZs) (see Appendix 4 for map). The Raisin-South Nation Source Protection Committee was required to develop a Source Protection Plan under the Clean Water Act, 2006. The Raisin-South Nation Source Protection Plan contains policies to address activities that are, or would be significant drinking water threats. To create this document an assessment of the potential risks to municipal drinking water was undertaken and highly vulnerable aquifers, groundwater recharge areas, wellheads and intake structures were mapped and potential threats, such as septic systems, were identified (Raisin Region Source Protection Area, 2012). Septic systems which are located within these vulnerable areas are subject to inspections every 5 years.

3.7 Agriculture

Agriculture is one of the main land uses in this AOC, and hence can be a potential contributor of bacteria to the streams and rivers. Local tributaries, such as the Raisin River, were historically found to have high fecal coliform counts. A 1992 study (Pilon and Karl, 1992) observed high *E. coli* concentrations at the mouths of Finney Creek (ranging up to 2,200 CFU/100 mL) and Raisin River (ranging up 1,730 CFU/100 mL) which could be associated with runoff from agricultural lands drained by these tributaries. Finney Creek showed high bacterial counts for most of the summer, only 3 times falling to levels below the provincial guidelines.

In 1994, *E. coli* and fecal streptococci concentrations greatly exceeded the PWQO in some areas along Sutherland Creek, and these areas were all situated downstream of farms where cattle either had access to, or were in close proximity of the creek (Richman et al, 1997). Concentrations ranged up to 2,700 CFU/100 mL.

To address these issues, a highly successful tributary restoration and farm stewardship program run by the Raisin Region Conservation Authority was undertaken from 1994-2012 and re-instated in 2019. Through the program, farm-based best management practices (BMPs) were implemented, resulting in habitat creation and nonpoint source pollution reduction. This program continues to provide financial assistance and technical guidance to farmers and landowners near AOC tributaries.

Between 1994-2012 and 2019-2020 the following BMPs were implemented, which all contributed to the reduction of non-point sources of *E. coli*:

- 89,920 m of vegetative buffers planted along the edge of fields
- 74,008 m of livestock fencing constructed to reduce or restrict access to water
- 68 manure storage upgrades
- 35 milkhouse washwater upgrades
- 104,500 trees and shrubs planted
- 26 ha of forest restored
- 153.4 kms of riparian habitat restored
- 0.8 ha of wetland habitat restored
- 25.6 ha of prairie/meadow habitat restored
- 1,400 m of shoreline softened using bioengineering techniques

The Canada-Ontario Environmental Farm Plan also focuses on reducing *E. coli* loadings. Farm Plans were developed for 511 properties in Stormont, Dundas and Glengarry counties between 1994-2021. The plan is a voluntary education and awareness tool that helps farmers identify the agri-environmental assets and risks to their operation. After the risks have been identified, an action plan is developed and possible BMPs are outlined.

Additionally, under the Nutrient Management Act, 2002 (NMA) some farms are required to develop nutrient management strategies (NMS) and/or nutrient management plans (NMP). An NMS documents nutrient management matters such as manure generation type and quantity, and ensures that the agricultural operation has adequate manure storage capacity and acceptable runoff management. An NMP deals with nutrient application on farm fields, crop rotation, tillage, projected yields and other management approaches to optimize the utilization of nutrients by crops. Under the NMA, the Ministry of the Environment, Conservation and Parks have specialized provincial officers with agricultural training known as Agricultural Environmental Officers (AEOs). AEOs are responsible for working with farmers to encourage compliance with the NMA. This is done through pro-active and re-active inspections and site visits. If there are concerns or NMA violations AEOs can require farmers to upgrade their facilities or implement BMPs to ensure compliance

with the NMA. AEOs also respond to spills, such as manure run-off events, and public complaints to ensure agricultural operation are operating in a manner that is protective of human health and the environment.

4. Assessment against delisting criteria

The assessment criteria are based on the Provincial Water Quality Objective for recreational water quality:

i) Geometric mean concentration (minimum of five samples): ≤ 200 *E. coli*/100 mL, and

ii) Single-sample maximum concentration: ≤ 400 *E. coli*/100 mL.

There are three delisting criteria used to assess the status of this BUI. As identified in Section 2, the delisting criteria are based on:

- The International Blue Flag Program (www.blueflag.ca) benchmark whereby beaches should be closed for less than 20% of the swimming season due to unsafe levels of *E. coli* as determined by the local health authority;
- Impairments which are due to current or past human activity;
- Impairments are due to persistent, on-going high fecal bacteria counts, not sporadic high counts associated with rainfall events; and
- The importance of distinguishing sources of fecal bacteria.

4.1 Criterion #1

Criterion #1: At public beaches, no more than 20% of weekly tests (i.e., five sample E. coli geometric means) exceed the Provincial Water Quality Objective during an annual swimming season. In addition, the main/predominant sources of fecal pollution are known; most of these exceedances are associated with local events, such as significant rainfall or high wind periods.

i) No more than 20% of weekly tests (i.e., five sample E. coli geometric means) exceed the Provincial Water Quality Objective during an annual swimming season; most of these exceedances are associated with local events, such as significant rainfall or high wind periods...

An assessment of criterion #1 was completed in 2021 (St. Lawrence River Institute of Environmental Sciences, 2022) using *E. coli* data collected between 2012 and 2020. The technical assessment report for criterion #1 is located in Appendix 1. Water was sampled for *E. coli* by the Eastern Ontario Health Unit at Charlottenburgh Park and Glengarry Park beaches and by the Mohawk Council of Akwesasne Health Department for 28 Akwesasne beaches. Data was assessed to determine whether there were any exceedances, and if exceedances were found, the underlying cause was determined. This was done by comparing dates when exceedances occurred with weather data to determine if significant rainfall or high wind events contributed to the exceedances.

Exceedances of *E. coli* at beaches due to rainfall events is a global phenomenon. Urban stormwater runoff from roads, lawns, and other impervious surfaces can pick up a variety of pollutants, including bacteria. The

bacteria may be from domestic animals, such as dogs and cats, and horses and cattle in more rural areas. Combined sewer overflows can also be a source of bacterial loading to the rivers.

Exceedances did not occur in more than 20% of weekly tests for Charlottenburgh Park Beach. Note this beach is deemed 'low risk' by the EOHU based on prior sampling results and therefore is sampled less frequently. At Glengarry Park Beach, there were some exceedances; however, the majority of them corresponded with intermittent high rainfall events. At Akwesasne beaches, two beaches exceeded the 20%; however, these exceedances also corresponded with high rainfall events (see Appendix 3 for a summary of the data).

ii) …the main/predominant sources of fecal pollution are known.

In 2011, a study was conducted to determine the source of fecal pollution at both Charlottenburgh Park and Glengarry Park beaches (Ridal and Bramburger, 2012). Water was analyzed for human and bovine specific *Bacteroides fragilis* markers, which are bacteria that grow in human and (some) animal guts and can be used as an indicator of pollution from wastewater treatment plants and agricultural operations. *Bacteroides* species are good indicators for differentiating livestock and human fecal contamination in water because of their high concentration in feces and host specificity.

At both parks it was determined that a mix of sources contributed to the *E. coli* levels, including both human and bovine specific *B. fragilis*. Incidences of *E. coli* from human sources only (the worst case scenario with respect to human health) were low. Note that *Bacteroides* pose a low risk to the health of humans and animals especially when found outside of the body, as they are an anaerobic species (Bacic and Smith, 2008 and Government of Canada, 2017).

Recommendation: Criterion #1 has been met.

4.2 Criterion #2

> **Criterion #2: The 'vast majority' of body contact water recreation areas in the Area of Concern, other than public beaches, must meet the Provincial Water Quality Objective (PWQO) during the swimming season. Body contact water recreation sites that do not meet these objectives are highly localized and exceedances occur only sporadically (i.e. the Area of Concern does not show widespread evidence of fecal pollution).**

In 2002, 27 recreation areas with the AOC were monitored for fecal coliforms and/or *E. coli* concentrations (St. Lawrence River Institute of Environmental Sciences, 2003) and in 2003, 35 sites were monitored (St. Lawrence River Institute of Environmental Sciences, 2004). These sites included both public and private beaches and areas where water recreation activities have been known to occur along the Cornwall waterfront, on Cornwall Island and in other smaller communities in the AOC. The report assessed the *E. coli* levels against the old PWQO of the geometric mean concentration ≤ 100 *E. coli* CFU/100 mL. The PWQO was changed in 2018 to a geometric mean concentration (minimum of five samples) of ≤ 200 *E. coli* CFU/100 mL, and a single-sample maximum concentration of ≤ 400 *E. coli* CFU/100 mL. The data have been reassessed based on the following: i) using a geometric mean concentration (minimum of five samples) of ≤ 200 *E. coli*

CFU/100 mL for the PWQO, ii) the water recreation area is not a public beach (this data is captured in criterion #1), and iii) the exceedance is not associated with a rain event.

Based on this, in 2002 the *E. coli* geometric mean was below the PWQO geometric mean of ≤ 200 *E. coli* CFU/100 mL. In 2003, there were only two exceedances of the PWQO geometric mean, both at Westleys Point (July 8, 2003 250 *E. coli* CFU/100 mL, and August 19, 2003 211 *E. coli* CFU/100 mL). Overall, the assessment concluded that the levels of *E. coli* within the Area of Concern were very low and trends were decreasing when compared to data from the 1990s.

Additional water sampling was conducted in 2007 at Westleys Point to investigate possible sources of higher *E. coli* levels in this area. Sampling focused on an agricultural drain and local cottages, it was found that 11% of the samples exceeded the PWQO, well within the delisting criteria of less than 20% exceedances.

In 2008, a sampling program of the shoreline to mid-stream area assessed the current impacts of tributary plumes impinging on swimming areas. Over all, the water quality was very good, 94% of 236 samples met the PWQO. This study noted that the impact of the tributaries seemed to be localised, the most consistent issues appeared to be Westleys Creek which appeared to be entrained upstream occasionally into the cottage area.

More recently, the River Institute conducted water samples at the Cornwall Canal annually from 2012 to 2019 as part of the preparations for the annual Cornwall Water Festival. Samples were collected on multiple days at 10 sites per year, none of these samples showed any exceedances of the PWQO.

Overall, the level of *E. coli* in waters used for recreation purposes within the AOC is very low, with only localized exceedances of the delisting criterion noted.

Recommendation: Criterion #2 has been met.

4.3 Criterion #3

Criterion #3: For body contact water recreation areas where water quality objective exceedances occur, the main sources of fecal pollution must be identified, pollution control plans must be developed, and these plans must be actively implemented.

Exceedances of PWQO in body contact water recreation areas occurred rarely. The main sources of fecal pollution are described in Section 3 and Section 4 Criteria # 1 ii. Plans have been, and are being, implemented to address fecal pollution stemming from agricultural practices and septic systems. The Canada-Ontario Environmental Farm Plan encourages actions on farms to reduce nutrient runoff. Nutrient management plans and strategies required by the Ontario Ministry of Agricultural, Food and Rural Affairs document livestock manure generation and usage, as well as ensuring that agricultural operation have adequate manure storage and runoff management in place. The implementation of agricultural best management practices (BMPs) and the Drinking Water Source Protection Plan (both implemented by the Raisin Region Conservation Authority) result in additional reductions of *E. coli* loading to waterways.

The Cornwall Pollution Control Plan was developed in 1995 to address, in part, urban stormwater loadings.

Work to reduce stormwater continued through the years, and the Cornwall Blueprint was produced in 2014 to consolidate the City's initiative to deal with issues such as basement flooding mitigation and environmental, water and infrastructure awareness. Implementation of the plan is ensuring reductions in sewer infiltration, the creation of stormwater ponds, implementation of low impact development options, and sewer separation projects. All of this will result in a reduction of *E. coli* from entering the St. Lawrence River.

Recommendation: Criterion #3 has been met.

5. Continued Monitoring

Continued monitoring of E. coli at the beaches of the St. Lawrence River (Cornwall) AOC is needed to protect the health of those using the water for recreation. Public safety is enhanced with routine monitoring for E. coli during the swimming season and posting of beaches when necessary. The EOHU is required under the Health Protection and Promotion Act (1990) to monitor public beaches on an annual basis; this includes Charlottenburgh Park and Glengarry Park beaches. Monitoring results are reported to the public for both beaches at theswimguide.org. The MCA Health Department will continue to annually monitor Akwesasne beaches, and provides updates to the community through social media. This monitoring will continue after the delisting of the St. Lawrence River (Cornwall) as an Area of Concern.

6. Conclusions and Recommendations

This assessment indicates that the three delisting criteria for the Beach Closings BUI have been met. Improved bacteriological water quality has been recorded at all beaches and swimming locations assessed in this report. The 'vast majority' of body contact water recreation areas have met the Provincial Water Quality Objective since 2012, and there are many programs and plans in place to ensure that water quality along the St. Lawrence River within the AOC continues to meet the Provincial Water Quality Objective for recreational use.

The recommendation based on this assessment is that the Beach Closings impaired beneficial use has been restored and should be redesignated from 'impaired' to 'not impaired'.

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Appendix 1: Beach Closings Criterion # 1 Assessment for the St. Lawrence River (Cornwall) Area of Concern

Report under separate cover.

Appendix 2: Changes to the BUI Delisting Criteria Over Time

The delisting criteria have gone through a few iterations as scientists gained a better understanding of the St. Lawrence River (Cornwall) AOC bacterial sources and management options. Table 1 identifies the various iterations of the delisting criteria throughout the years and the dates these criteria were adopted.

Table 1 – Various iterations of delisting criteria for 'Beach Closings' and dates.

Delisting Guidelines and Criteria	**Date**
Guideline: This use impairment will be delisted when there have been no beach closures in the AOC for two consecutive years and no reports of the of St. Lawrence River water in the AOC at concentrations exceeding Provincial Water Quality Objectives (100 *E. coli* per 100 ml in 1996), at locations where water is used for body contact recreation. (Dreier et al 1997)	1997
Criteria: This Beneficial Use Impairment will be delisted when beach postings indicating high concentrations of bacteria at public bathing beaches along the St. Lawrence River in the Area of Concern (AOC) do not exceed 5% (~5 days) of the swimming season (June 1st to Labour Day) for two consecutive years. Elsewhere in the AOC portion of the St. Lawrence there shall be no reports, for two consecutive years, of St. Lawrence River water at concentrations exceeding the Provincial Water Quality Objective (100 *E. coli* per 100 mL in 2003), at locations where water is used for body contact recreation. (Moore and Ridal, 2004)	2003
Criteria: 1. At public beaches, no more than 20% of weekly tests (i.e., five sample *E. coli* geometric means) exceed the Provincial Water Quality Objective during an annual swimming season. In addition, the main/predominant sources of fecal pollution are known; most exceedances are associated with local events, such as significant rainfall or high wind periods. 2. The 'vast majority' of body contact water recreation areas in the AOC, other than public beaches, must meet the Provincial Water Quality Objective during the swimming season. Body contact water recreation sites that do not meet these objectives are highly localized and exceedances occur only sporadically (i.e., the AOC does not show widespread evidence of fecal pollution). *Note 1: The interpretation of the 'vast majority' is left to the assessment of the committee, but should be a large percentage of the total number of the body contact recreation sites (i.e., 75% or more)"* 3. For body contact water recreation areas where water quality objective exceedances occur, the main sources of fecal pollution must be identified, pollution control plans must be developed and these plans must be actively implemented. *Note 2: Recent research on microbial indicators such as E. coli have shown that even pristine areas in the Great Lakes can be impacted by microbial loadings from wildlife feces, decaying life forms and pollution of human origin. These findings are closely associated with those local events (rainfall or high wind), mentioned in criterion #1. The microbial loadings from wildlife*	2006 (current)

feces, decaying life forms, and anthropogenic emissions, are often triggered by rainfall events.	

Rationale for Revisions for Delisting Criteria

Fecal Coliforms vs. *E.coli*: When the St. Lawrence River (Cornwall) was listed as an AOC in 1986, fecal coliform was used to assess water quality at beaches. This was changed shortly afterwards (early 1990s) from fecal coliform to *E. coli*. *E. coli* are considered to be the preferred indicator for fecal pollution because they "comprise about 97 percent of the coliform organisms in human feces" and are much easier to measure than many of the other health-related pathogens that may be associated with fecal matter (Federal-Provincial Working Group, 1992).

Beach Closings vs. Beach Postings: In 2003, the initial delisting guideline was amended to use the term 'beach postings' instead of 'beach closings' when referring to the status of the beaches, as per the OMHLTC guidelines (2014). Although a beach is now seldom closed, 'posting' a beach is a way to communicate swimming advisories due to high levels of *E. coli* or other issues. Thus, the beach is typically open but the local health unit advises against swimming through posting notices on websites, through media releases, or on signs at the swimming areas. This revised phrasing was deemed to be more consistent with current beach management practices when discussing the status of the beaches, although the title of this BUI remained 'Beach Closings' as per the Great Lakes Water Quality Agreement.

Blue Flag Swimming Season Targets: In 2006, the delisting criteria was changed to reflect the International Blue Flag Program (www.blueflag.ca) benchmark whereby beaches may be closed for less than 20% of the swimming season due to unsafe levels of *E. coli* as determined by the local health authority. It had been observed that *E. coli* sometimes exceeded the PWQO in nearshore and beach areas due to inputs from wildlife and by resuspension of *E. coli* that is already present in the sediment by onshore wave action (Whitman and Nevers, 2004). Therefore, high *E. coli* levels may not always originate from man-made sources or recent fecal inputs.

Provincial Water Quality Objectives: In 2018, the Ontario Ministry of Health replaced the provincial water quality objective for recreational water use at public beaches from a geometric mean of ≤ **100** *E. coli* colony forming units (CFU) per 100 mL to a geometric mean of ≤ **200** *E. coli* CFU/100 mL (MOHLTC, 2018). The guideline also introduced a single-sample maximum concentration of ≤ 400 *E. coli* / 100 mL. Although this did not result in the wording of the criteria being changed, a comparison of the 2012-2017 *E. coli* data against the new guideline demonstrated was undertaken which resulted in fewer exceedances, as expected.

Source Identification: The importance of distinguishing sources of fecal bacteria was also identified, as anthropogenic sources are more problematic for human health. In 2011, a study was conducted to determine the main sources of fecal bacteria at Charlottenburgh Park and Glengarry Park beaches. It was found that anthropogenic sources represented a minor source of *E. coli* at both beaches. Bovine sources were more closely related to increased *E. coli* concentrations.

Appendix 3: Summary of Exceedances of PQWO at AOC Beaches and Comparison of Those Exceedances to Rainfall Events

Charlottenburgh Park: 2012-2020

Year	# of Weekly Tests	# of Weekly Tests Exceeding PWQO	# Exceedances Coinciding with Rainfall Event (>2mm)	# Exceedances per Year not Associated with Rainfall Events	% Exceedances per year not Associated with Rainfall Events (must be below 20% to meet delisting criterion)
2012	15	0	0	0	0
2013	52	1	1	0	0
2014	15	0	0	0	0
2015	4	0	0	0	0
2016	4	0	0	0	0
2017	3	0	0	0	0
2018	5	0	0	0	0
2019	6	1	0	1	16.7%
2020	10	0	0	0	0

Glengarry Park: 2012-2020

Year	# of Weekly Tests	# of Weekly Tests Exceeding PWQO	# Exceedances Coinciding with Rainfall Event (>2mm)	# Exceedances per Year not Associated with Rainfall Events	% Exceedances per year not Associated with Rainfall Events (must be below 20% to meet delisting criterion)
2012	35	4	3	1	3%
2013	29	4	3	1	3%
2014	50	15	11	4	8%
2015	31	2	2	0	0
2016	25	1	1	0	0
2017	24	5	4	1	4%
2018	30	0	0	0	0
2019	16	2	2	0	0
2020	2	0	0	0	0

Akwesasne Beaches: 2012-2020

Year	# of Weekly Tests	# of Weekly Tests Exceeding PWQO	# Exceedances Coinciding with Rainfall Event (>2mm)	# Weekly Exceedances per Year not Associated with Rainfall Events	% Weekly Exceedances per year not Associated with Rainfall Events (must be below 20% to meet delisting criterion)
2012 - 2020	1207	25	21	4	<1%

Appendix 4: Map of Intake Protection Zones (IPZ) in the AOC