

Hamilton Public Health Services 2021 Beach Monitoring Report

Background

This is an annual update regarding Hamilton Public Health Services' (PHS) recreational water quality monitoring at Hamilton's public beaches. The Ontario Public Health Standards (OPHS) specify the public health programs and services Boards of Health must deliver. Program and topic-specific protocols under the OPHS further define the minimum responsibilities every Board of Health in Ontario is accountable to provide. To assist in the prevention and reduction of water-borne illness and injury related to recreational water use at a public beach, Boards of Health are directed by the Recreational Water Protocol (2019) and the Operational Approaches for Recreational Water Guideline (2018). Both documents guide the delivery of the local Beach Water Quality Monitoring Program in Hamilton.

In 2021 Hamilton PHS conducted routine beach surveillance at seven public beaches in Hamilton. A public beach is "any public bathing area owned and operated by a municipality where the public has access and there is reason to believe that there is recreational use of the water" (MOHLTC, 2019). The seven monitored beaches in Hamilton were Beach Boulevard, Van Wagner's and Confederation Park Beaches along Lake Ontario; Binbrook, Christie and Valens Conservation Area beaches, and Pier 4 Park Beach in Hamilton Harbour. Bayfront Park Beach remained closed to users due to a history of poor water quality. Routine beach inspections are conducted before the swimming season begins and throughout the summer, to monitor the safety of the public swimming areas and to establish strategies for the management of health hazards.

Beach Water Quality Monitoring

Hamilton PHS monitors the safety of public beaches by collecting and testing the beach water for *E. coli* bacteria during the swimming season, typically between the Victoria Day long weekend in May and the Labour Day long weekend in September. Public beaches were closed to the public at the beginning of the season in 2021 due to the COVID-19 pandemic and Ontario's Declaration of Emergency. However, beach water quality monitoring began just prior to the May long weekend, in anticipation of when beaches would be permitted to open. The data used in this report encompasses all water quality data retrieved, not just when beaches were permitted to open to users. Water quality monitoring continued at all beaches in Hamilton until the last week of August 2020. Beach water quality is monitored for both *E. coli* bacteria and blue-green algae (BGA) blooms.

E. coli

E. coli are naturally found in the intestines of humans and warm-blooded animals. High numbers of *E. coli* in the water indicates the presence of faecal contamination and the potential presence of

other harmful microorganisms such as *Cryptosporidium*, *Giardia*, *Shigella*, norovirus and *E. coli* 0157:H7 (CDC, 2017). These organisms have the potential to cause a variety of infections including gastrointestinal, skin, ear, respiratory, eye, neurologic and wound infections (CDC, 2017). The maximum acceptable concentration of *E. coli* at a beach is 200 *E. coli* colony-forming units (CFUs) per 100 ml of water (MOHLTC, 2018). *E. coli* concentrations above this level could represent an increased risk of infection to swimmers.

The Operational Approaches for Recreational Water Guideline (2018) states that a minimum of five samples must be collected at each beach and the geometric mean of *E. coli* concentrations must be used to assess recreational water quality and guide public health action. When the geometric mean (GM) of *E. coli* concentrations is above 200 CFUs per 100 ml of water, warning signs are posted at the affected beach to advise potential users that the water may pose a health risk and the beach is deemed as unsafe for swimming. The beach will also be posted as unsafe for swimming if any single point sample taken has a test result above 400 CFUs per 100 ml of water (MOHLTC, 2018). In addition to posting warning signs at the affected beaches, PHS updates the City of Hamilton's Beach Water Quality Website (www.hamilton.ca/beaches) and the Safe Water Information Line outgoing phone message (905-546-2189) to reflect the current beach water quality status.

Cyanobacteria (Blue-Green Algae)

Cyanobacteria or blue-green algae (BGA) are microorganisms which occur naturally in aquatic environments and flourish in warmer, slow-moving or still waters with high nutrient levels and sufficient levels of sunlight (Miller and Russell, 2017). Some cyanobacteria produce microcystin toxins which are the most commonly produced toxin of the cyanobacterial toxins. Microcystin toxins are tasteless, colourless and odourless, and are toxic to both humans and animals. Typical exposure routes are through skin contact or through ingestion and/or inhalation while swimming. Short-term exposure can cause skin irritation, rash, vomiting and fever while long-term exposure (mostly through drinking contaminated water) can lead to tumour formation with microcystin-LR being a possible human carcinogen (Miller and Russell, 2017).

Hamilton PHS monitors public beaches for the presence of microcystin toxins throughout the swimming season. The Health Canada Guidelines for Canadian Recreational Water Quality Cyanobacteria and their Toxins (2020) proposes the guideline value for total microcystins in recreational water be a maximum concentration of 10 µg/L. When potential toxin-producing cyanobacterial blooms are observed at a public beach, Hamilton PHS uses Abraxis™ test strips to measure the concentration of microcystin toxins in the water. When the concentration of microcystins is detected above 10 µg/L, the beach is closed, and a swimming advisory is issued. Hamilton PHS issues a media release and posts closure signs at the affected beach. The City of Hamilton's Beach Water Quality website and the Safe Water Information Line's outgoing phone message are also updated. PHS does not routinely monitor for *E. coli* bacteria when a beach has been closed due to microcystin toxins.

2021 Beach Water Quality Monitoring Results

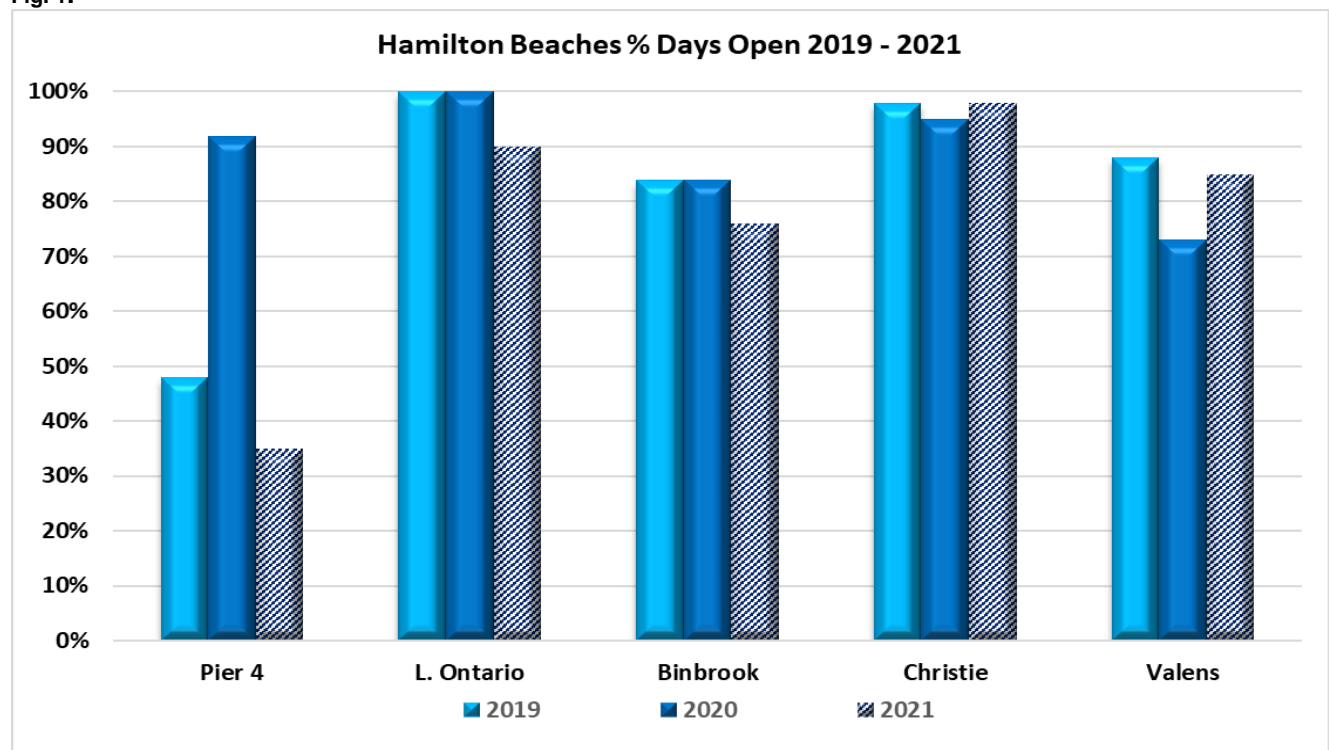
The 2021 beach monitoring program took place over an approximate 15-week period beginning May 25th, 2021 and ending the last week of August prior to the Labour Day long weekend. Table 1 on the following page summarizes the data for the 2021 swimming season at each public beach.

The far-right column indicates the total percentage of days the beach was open for swimming. In Hamilton Harbour, Pier 4 Beach's water quality was acceptable for swimming 35% of the time. Lake Ontario beaches were open between 87 and 93% of the season in 2021, while Binbrook, Christie and Valens Conservation Area Beaches were open 76%, 98% and 85% respectively.

Table 1: 2021 Beach Monitoring Program Summary

Name of Beach	Total # of Days in Bathing Season	# of Days Beach Posted due to <i>E. coli</i>	# of Days Beach Closed due to BGA	Total # of Days Beach Closed	Total # of Days Beach Open	% of Days Beach Open
Hamilton Harbour						
Pier 4 Beach	105	25	43	68	37	35%
Lake Ontario Beaches						
Beach Boulevard	105	7	0	7	98	93%
Van Wagner's	105	9	0	9	96	91%
Confederation Park	105	14	0	14	91	87%
Conservation Area Beaches						
Binbrook Conservation	105	25	0	25	80	76%
Christie Conservation	105	2	0	2	103	98%
Valens Conservation	105	16	0	16	89	85%

Fig. 1.

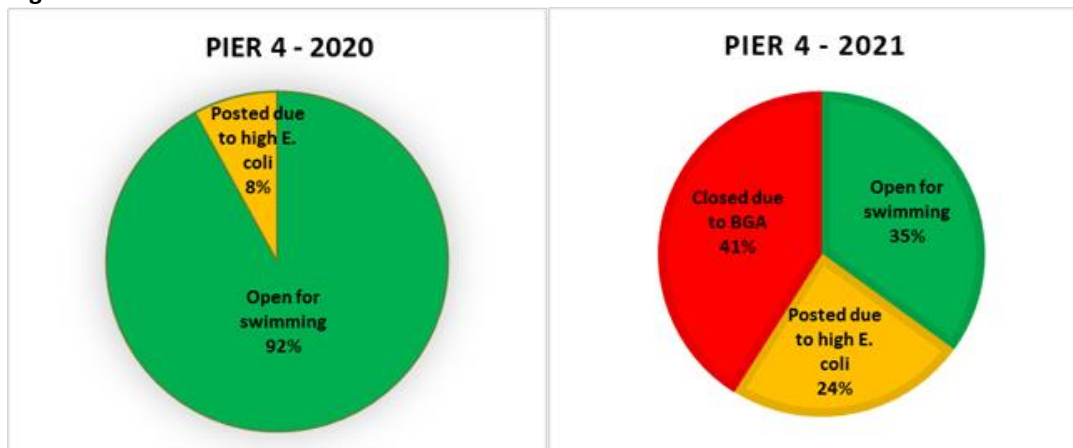


Pier 4 Park Beach

Pier 4 Park Beach was open for swimming for 35% of the season in 2021. The beach was posted as either unsafe for swimming due to high levels of *E. coli* bacteria or closed due to toxin-producing BGA for the remaining 65% of the season. This is a significant decrease from 2020, when the beach remained open for 92% of the season (Fig. 1).

The percentage of days open at Pier 4 Beach decreased significantly from 92% in 2020 to 35% in 2021 (Fig. 1). This decrease can be attributed to two factors: cyanobacteria (blue-green algae or BGA) and high levels of *E. coli* bacteria. While there was a complete absence of BGA at Pier 4 Beach in 2020, toxin-producing cyanobacteria (BGA) returned in 2021 and was first observed and confirmed at Pier 4 Beach on July 26, 2021, prompting the beach to be closed to users. Pier 4 beach was closed for the remainder of the season, with the BGA closure accounting for 41% of the entire season (Fig. 2).

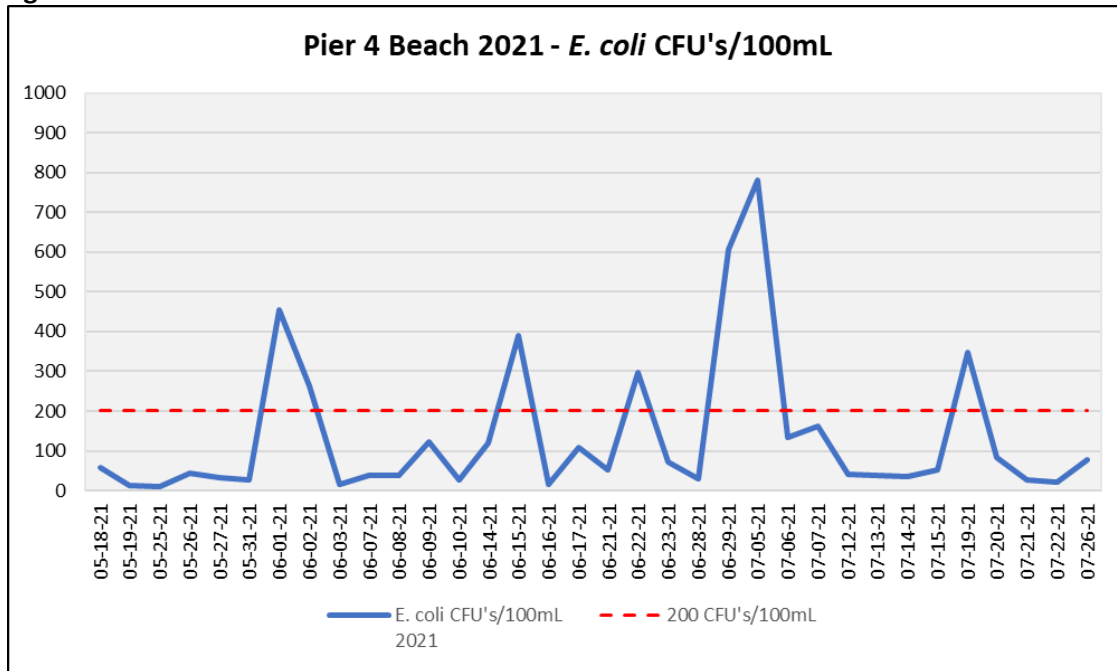
Fig. 2



Prior to the closure due to BGA, Pier 4 also experienced an increase in days posted as unsafe for swimming due to high levels of *E. coli* bacteria. Of the 62 days in the swimming season prior to the closure due to BGA, Pier 4 Beach was posted as unsafe for 25 of those days, or 40% of the time period in which bacteriological samples were collected (Fig. 3).

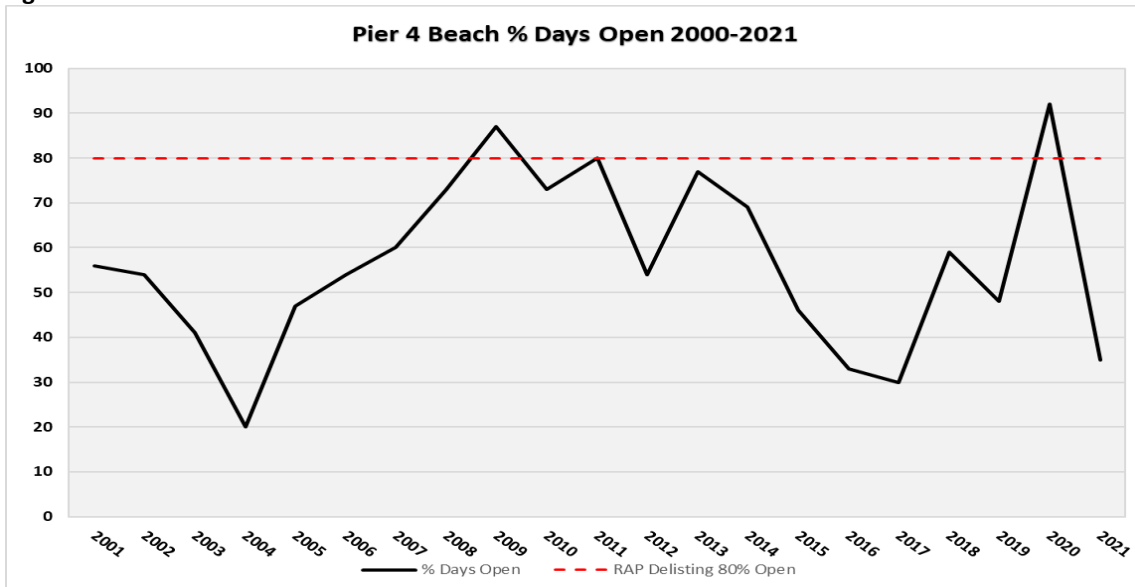
As Hamilton Public Health Services does not monitor for *E. coli* concentrations while BGA, it is unknown how many further days the beach would have been posted due to high *E. coli* concentrations had the beach not been closed due to BGA.

Fig. 3



The percentage of days that public beaches are open during the swimming season is an indicator of the recreational quality of the water at Hamilton’s public beaches. Hamilton Harbour remains on the Great Lakes Areas of Concern (AOC) List. As a result, stakeholders have developed a Remedial Action Plan (RAP) for Hamilton Harbour to identify the challenges in the harbour and how they may be addressed. One criterion that needs to be satisfied before the Hamilton Harbour can be delisted from the AOC List, is that harbour beaches must be open for swimming 80% of the time during the swimming season. **Fig. 4** below illustrates the percentage of days open at Pier 4 beach from the years 2000-2021 related to the 80% criterion.

Fig. 4



Pier 4 Beach reached a record low of only 20% days open in 2004 which prompted additional research on the issue of bacteriological water quality at Pier 4 Beach and the introduction of bird

exclusion measures in 2005. After the introduction of bird exclusion measures the water quality increased each year and percentages of days open continued to increase. Bird exclusion measures have continued to effectively evolve, and over the last several years, bacteriological levels have continued to decrease. However, BGA has resulted in lengthy closures of the beach and has significantly decreased the percentage of days open.

Increased Efforts to Control Waterfowl Population

Research has shown that high levels of bacteria are introduced to the water by waterfowl faecal droppings. These droppings can contaminate the beach water directly or indirectly through storm water runoff and beach sand. At Pier 4 Beach several measures designed to deter the waterfowl population from using the beach as suitable habitat have been put into place. These measures include the installation of a buoy line and habitat modification including the planting of shrubs around the perimeter of the beach. In 2018-19, strobe lighting was also used to discourage waterfowl migration to the beach area at night. Because of these efforts, City of Hamilton Parks North reported fewer geese or faecal matter on the beach after installation of these deterrents. The wildlife management contractor for the City of Hamilton also reported a decrease in the number of waterfowl population seen near Pier 4 Park Beach.

Lake Ontario Beaches

Lake Ontario beaches were open an average of 90% of the season in 2021 (**Fig. 1**). The water quality at Beach Boulevard, Van Wagner's and Confederation Park Beaches is historically very good, with beaches consistently open between 90-100% of the time during each swimming season. Swimming advisories are generally rare at Lake Ontario beaches and when they do occur, they are of very short duration, usually lasting only one or two days. Additionally, *E. coli* concentrations are consistently very low, often reported at the minimum reporting level of < 10 *E. coli* CFUs per 100 mL of water. As Public Health Ontario's minimum reporting level is < 10 *E. coli* CFUs per 100 mL of water, the actual geometric means may be even lower than what is listed below. Lake Ontario also does not typically have water quality problems related to BGA, allowing for a consistent and lengthy swimming season.

Due to the historically excellent water quality results at Lake Ontario beaches, Hamilton Public Health Services reduced the sampling frequency to once monthly in 2020, as per the Ontario Ministry of Health and Long-Term Care's Recreational Water Protocol (2019) which states "*sampling frequency may be reduced to once per month where historical data of the geometric mean and environmental surveys indicate water quality was consistently within the water quality threshold for the previous bathing season and confirmed through the pre-season sampling results*". However, on June 15, 2021 both Van Wagner's and Confederation Park beaches had single samples test greater than 400 CFU's / 100 mL (890 and 870 CFU's / 100 mL, respectively) following a heavy precipitation event and prompting the beaches to be posted as unsafe for swimming. Hamilton Public Health services decided to resume weekly monitoring following these test results.

Hamilton Public Health services will resume beach water quality monitoring in 2022 immediately following the Victoria Day long weekend (subject to provincial restrictions due to the COVID-19 pandemic) and continuing to the Labour Day long weekend in September.

References

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