

Hamilton Public Health Services 2019 Beach Monitoring Report

Background

This is an annual update regarding Hamilton Public Health Services' (PHS) recreational water quality monitoring at Hamilton's public beaches and the activities undertaken by stakeholders to improve the water quality at these 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 2019 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 at least once per week 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 at least once per week during the swimming season, which typically begins after the Victoria Day long weekend in May and ends on Labour Day weekend in September. *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* O157: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) when the geometric mean is greater than 100 CFUs. 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 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 possibly a 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 (2012) recommends the microcystin concentration in recreational water should be less than 20 parts per billion (ppb). 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 elevated concentrations of microcystins are detected, 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.

2019 Beach Water Quality Monitoring Results

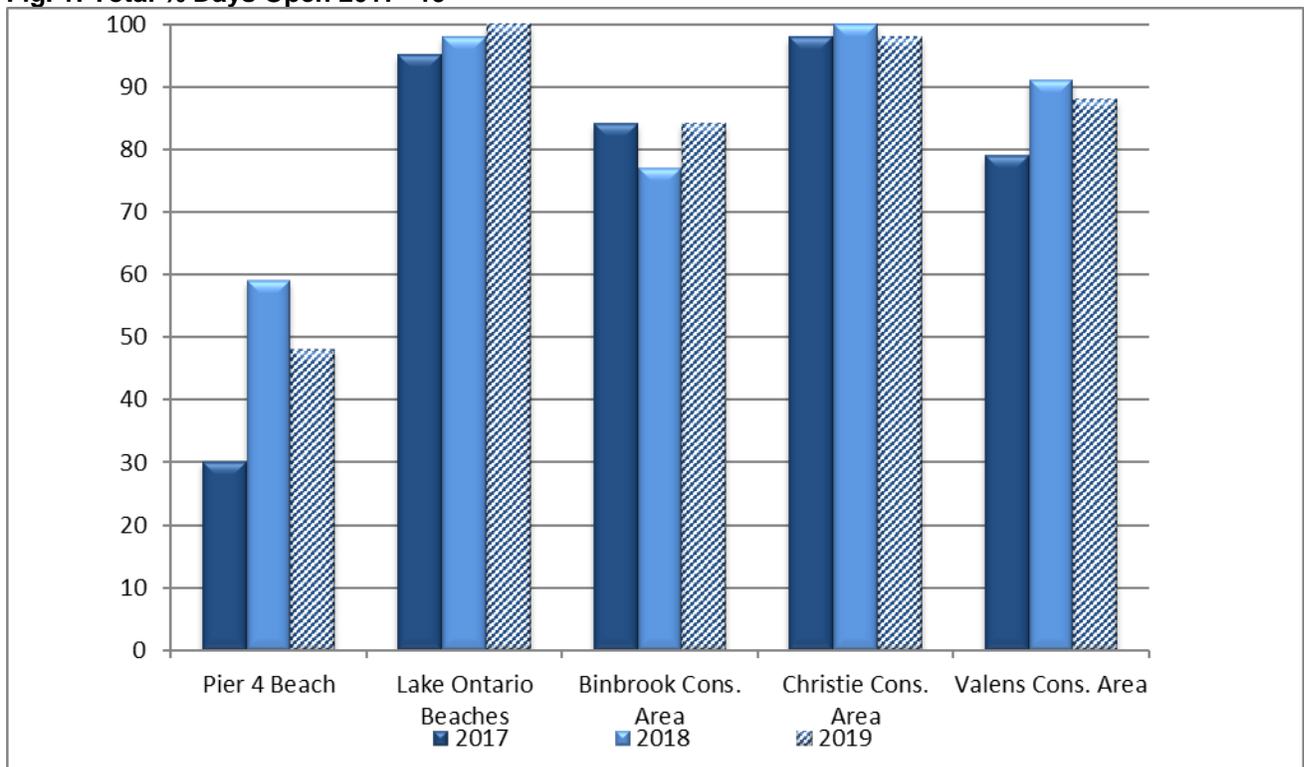
The 2019 beach monitoring program took place over a 15-week period beginning the week of May 21st and ending the last week of August. Table 1 on the following page summarizes the data for the 2019 swimming season at each public beach. The far-right column indicates the total percentage of days the beach was open for swimming. In Hamilton Harbour, Pier 4 Beach's water quality was acceptable for swimming 48% of the time, although the beach was closed to users for the season due to high water levels. Lake Ontario beaches were open for 100% of the season in 2019, while Binbrook, Christie and Valens Conservation Area Beaches were open 84%, 98% and 88% respectively.

Table 1: 2019 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	0	55	55	50	48%*
Lake Ontario Beaches						
Beach Boulevard	105	0	0	0	105	100%
Van Wagner's	105	0	0	0	105	100%
Confederation Park	105	0	0	0	105	100%
Conservation Area Beaches						
Binbrook Conservation	105	17	0	17	88	84%
Christie Conservation	105	2	0	2	103	98%
Valens Conservation	105	13	0	13	92	88%

*Although closed due to high water levels in 2019, water quality at Pier 4 would have been acceptable 48% of the season.

Fig. 1: Total % Days Open 2017*-19



Pier 4 Park Beach

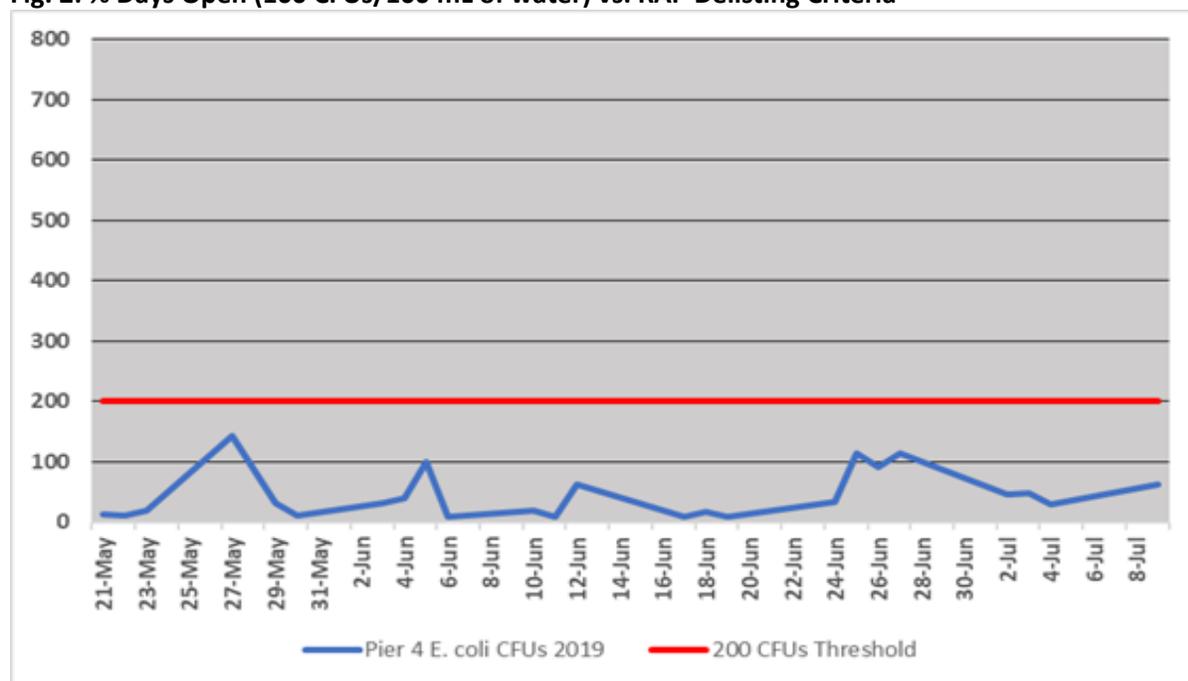
Although Pier 4 Beach was closed to users in 2019 due to high water levels, it would have been open 48% of the season (Table 1).

The total days Pier 4 was open in 2019 is down from 59% in 2018 (Fig. 1), however the beach was not once posted as unsafe for swimming due to high levels of *E. coli* bacteria and was open 100% of the season prior to the arrival of blue-green algae in early August (Fig 2). This is a considerable achievement for the water quality at Pier 4 beach. The decrease in total percentage of days open in 2019 can be attributed to an earlier arrival of blue-green algae which prompted a beach closure for the remainder of the season. Increased efforts to control the waterfowl population around the beach continued in 2019 and has likely contributed to the increase in water quality at this beach.

Hamilton Harbour Beach Management Group (HHBMG) meets at least twice per year to share research and discuss issues, projects and activities that are being conducted to improve the recreational water quality of the harbour beaches. Members of the group include staff from City of Hamilton Public Health Services (PHS), Hamilton Harbour Remedial Action Plan (HHRAP), Environment and Climate Change Canada (ECCC), City of Hamilton Public Works Department, Bay Area Restoration Council (BARC), and the Hamilton Waterfront Trust (HWT).

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. 2 illustrates the water quality results at Pier 4 beach from 1999 to 2019 related to the 80% criterion.

Fig. 2: % Days Open (100 CFUs/100 mL of water) vs. RAP Delisting Criteria



Lake Ontario beaches were open 100% of the season in 2019 (Fig 1). The water quality at Beach Boulevard, Van Wagner’s and Confederation Park Beaches is historically excellent, with beaches consistently open nearly 100% during each swimming season. Swimming advisories are 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 tend to be very low and are often reported at the minimum reporting level of < 10 *E. coli* CFUs per 100 mL of water. Lake Ontario also does not typically have water quality problems related to cyanobacteria, allowing for a consistent and lengthy swimming season.

Arrival of Cyanobacteria (Blue-green algae)

Cyanobacteria or blue-green algae have a significant impact on total percentage of days open for Hamilton harbour beaches. Microcystin toxin concentrations from cyanobacteria were detected and exceeded warning levels at Pier 4 Park Beach on July 10, 2019. Cyanobacteria persisted in Hamilton Harbour for the remainder of the season and accounted for a prolonged beach closure of 52% of the season (Table 2). In 2018 microcystin toxins were not confirmed at Pier 4 beach until early August, allowing a longer swimming season with the beach closed 30% of the time due to cyanobacteria. Table 2 below shows the percentage of days Pier 4 beach is open prior to the arrival of cyanobacteria has been increasing steadily from 82% in 2017 to 100% in 2019.

Table 2: Pier 4 % Days Open Prior to Cyanobacteria

	% of season closed due to cyanobacteria	% of days open prior to cyanobacteria
2017	52%	82%*
2018	30%	85%
2019	52%	100%

*Using the 2018 threshold of 200 CFU’s of *E. coli*/100 mL of water for data comparison purposes.

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 very few geese or faecal matter on the beach these years. 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.

In conclusion, conservation area and Lake Ontario beaches did not experience significant changes in water quality in 2019, when compared with historical data. Pier 4 Beach water quality was affected by the earlier arrival of cyanobacteria. However, increased efforts to control the waterfowl population around the beach has reduced the *E. coli* contamination from faecal matter in and around the beach. Hamilton Public Health services will resume beach water quality monitoring in 2020 and will continue to monitor and assess the impact of water quality improvement projects at Pier 4 Beach.

References

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