

Hamilton Public Health Services 2018 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 (2018) 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 2018 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 general public has access and there is reason to believe that there is recreational use of the water. Beach Boulevard, Van Wagner's and Confederation Park Beaches were monitored along Lake Ontario, while the beaches at Binbrook, Christie and Valens Conservation Areas were also monitored. In Hamilton Harbour, Pier 4 Park Beach was monitored while 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 the last week of August. *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 at or 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 at or above 200 CFUs per 100 ml of water, warning signs are posted at the affected beach to advise potential bathers 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 at or above 400 CFUs per 100 ml of water (MOHLTC, 2018) when the geometric mean is at or 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.

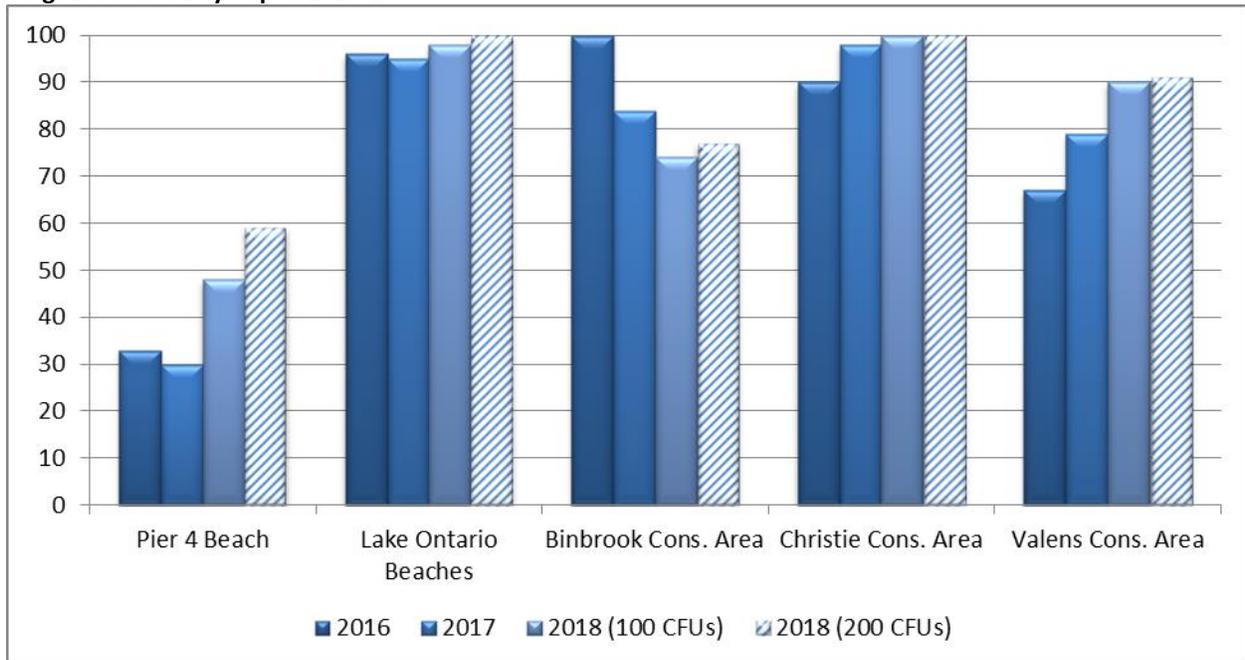
2018 Beach Water Quality Monitoring Results

The 2018 beach monitoring program took place over a 15-week period beginning the week of May 22nd, and ending the last week of August. Table 1 on the following page summarizes the data for the 2018 swimming season at each public beach. The far right 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 59% of the time, while Bayfront Beach remained closed to users due to a history of poor water quality and was not monitored in 2018. Lake Ontario beaches were open 99% to 100% of the time, while Binbrook, Christie and Valens Conservation Area Beaches were open 77%, 100% and 91% respectively.

Table 1: 2018 Beach Monitoring Program Summary

	Total # of Days in Bathing Season	# of Days Beach Posted due to <i>E. coli</i>	# of Days Beach Closed due to Cyano-bacteria	Total # of Days Beach Closed	Total # of Days Beach Open	Total % of Days Beach Open (100 <i>E. coli</i> / 100 mL)	Total % of Days Beach Open (200 <i>E. coli</i> / 100 mL)
Hamilton Harbour Beaches							
Bayfront Beach	Bayfront Beach Closed – Not Monitored in 2018						
Pier 4 Beach	105	11	32	43	62	48%	59%
Lake Ontario Beaches							
Beach Boulevard	105	1	0	1	104	99%	99%
Van Wagner's	105	0	0	0	105	100%	100%
Confederation Park	105	0	0	0	105	95%	100%
Conservation Area Beaches							
Binbrook Conservation	105	24	0	24	81	74%	77%
Christie Conservation	105	0	0	0	105	100%	100%
Valens Conservation	105	9	0	9	96	90%	91%

Fig. 1: Total % Days Open 2016-18



In 2018 the recreational water quality guideline in Ontario was increased from 100 to 200 *E. coli* CFUs per 100 mL of water. Table 1 also indicates the total percentage of days the beach would have been open for swimming using the old threshold of 100 CFUs. Using the new 2018 threshold of 200 CFUs, Pier 4 Beach was open a total of 59% of the season. Had the previous threshold of 100 CFUs still been in place, Pier 4 Beach would have been open for 48% of the season. This comparison is presented in Fig. 1: Total % Days Open 2016-18. This figure still represents a considerable increase in total percentage of days open at Pier 4, when compared with the water quality being acceptable only 30% of the time in 2017 and 33% in 2016.

Lake Ontario Beaches

Lake Ontario beaches were open between 99% and 100% of the swimming season in 2018. The water quality at Beach Boulevard, Van Wagner's and Confederation Park Beaches is historically very good, with beaches consistently open nearly 100% during each swimming season (Fig. 1). Swimming advisories are rare at Lake Ontario beaches and when they do occur they are of short duration, usually lasting only one or two days. Additionally, *E. coli* concentrations tend to be very low often reported at the minimum reporting level of < 10 *E. coli* CFUs per 100 mL of water. Lake Ontario does not typically have water quality problems related to cyanobacteria, allowing for a consistent and lengthy swimming season.

Hamilton Harbour Beaches

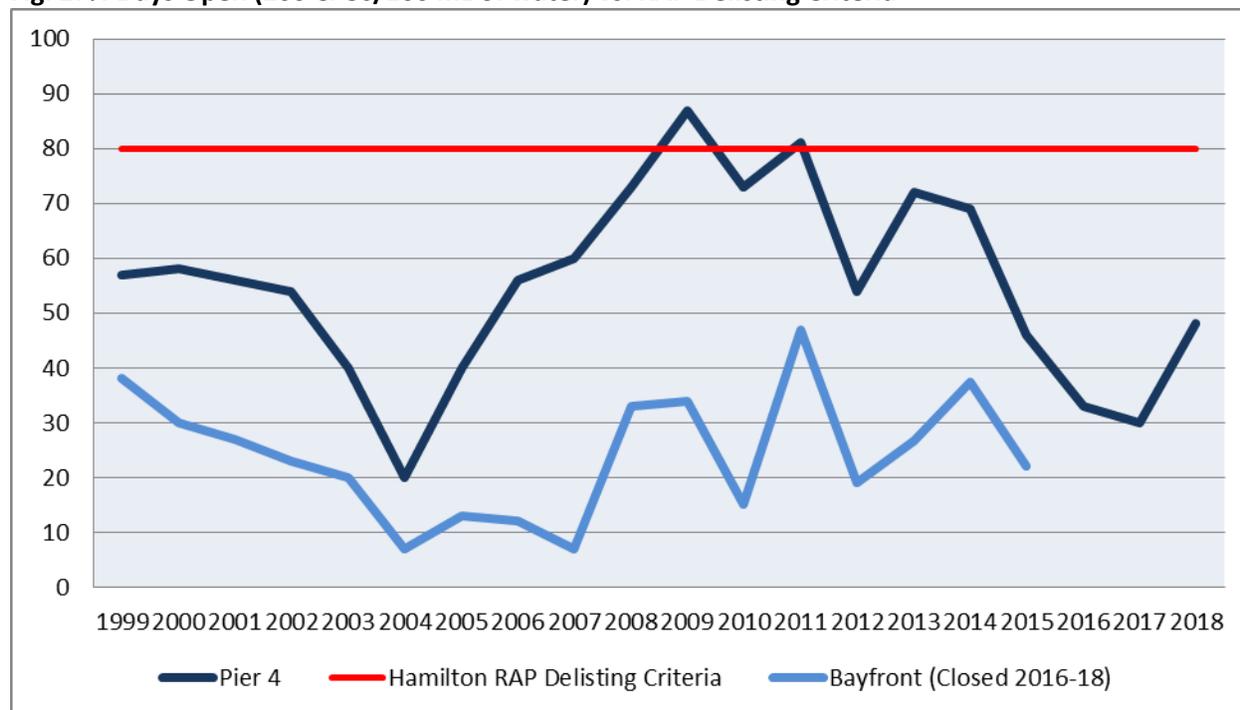
Hamilton Harbour Beach Management Group (HHBMG) meets at least twice per year to share research and discuss issues, projects and activities that are being conducted to improve the recreational water quality of the harbour beaches. Members of the group include staff from City of Hamilton Public Health 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 in order 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 and Bayfront Beaches from 1999 to 2018 related to the 80% criterion.

Pier 4 Park Beach

Pier 4 Park Beach showed improvement in 2018, increasing from 30% open in 2017 to 59% open in 2018. Contributing factors for the improved water quality at Pier 4 Beach in 2018 are; an increased *E. coli* threshold for posting a beach as unsafe for swimming, the later arrival of cyanobacteria, and increased efforts to control the waterfowl population around the beach..

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



Increased *E. coli* Concentration Threshold for Posting a Beach

In 2018, PHS began applying the new threshold of 200 *E. coli* / 100 mL of water as directed in the *Operational Approaches for Recreational Water Guideline, 2018* by the Ministry of Health and Long-Term Care (MOHLTC). A beach is posted as unsafe for swimming when water sample results reach or exceed this guideline. This value was adopted from the *Guidelines for Canadian Recreational Water Quality, 2012* by Health Canada and corresponds to the “epidemiological evidence relating *E. coli* concentrations in fresh recreational waters to the incidence of swimming-associated gastrointestinal illness observed among swimmers”.

Applying the current guideline value for posting the beach, Pier 4 Park Beach was open to users 59% of the time (Fig. 1). The beach would have been open 48% of the time, had the old threshold of 100 CFUs been applied, versus 30% in 2017 (Figs. 1 and 2). Without the influence of the threshold change, the beach would have been open 18% more often than in 2017.

Delayed Arrival of Cyanobacteria

Microcystin toxin concentrations from cyanobacteria were detected and exceeded warning levels at Pier 4 Park Beach on Aug. 3, 2018. Cyanobacteria persisted in Hamilton Harbour for the remainder of the season and accounted for a beach closure of 30% of the season. Cyanobacteria arrived almost three weeks earlier in 2017, on July 12th, prompting a prolonged closure of 52% of the 2017 season (Table 2). When compared with a 52% closure due to cyanobacteria in 2017, it can be seen how the later arrival allowed for a longer beach season and an increase in total percentage of days open for swimming. In 2018 Public Health Services did not monitor water for *E. coli* concentrations after the beach was closed due to the presence of cyanobacteria. Pier 4 Beach was open 85% of the time prior to the arrival of cyanobacteria using a 200 CFU threshold, or 68% of the time at a 100

CFU threshold (Table 2 and Fig. 3). This value is comparable to a 2017 value of 67% open prior to the arrival of cyanobacteria.

Table 2: Pier 4 % Days Open Prior to Cyanobacteria

	% of Season Closed due to BGA	% Days Open Prior to Cyanobacteria
2017	52%	67%
2018 (100 CFUs)	30%	68%
2018 (200 CFUs)	30%	85%

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, strobe lighting was also used to discourage waterfowl migration to the beach area at night. As a result of these efforts, City of Hamilton Parks North reported very few geese or faecal matter on the beach this year. 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.

Fig. 3: Pier 4 *E. coli* CFUs in 2018

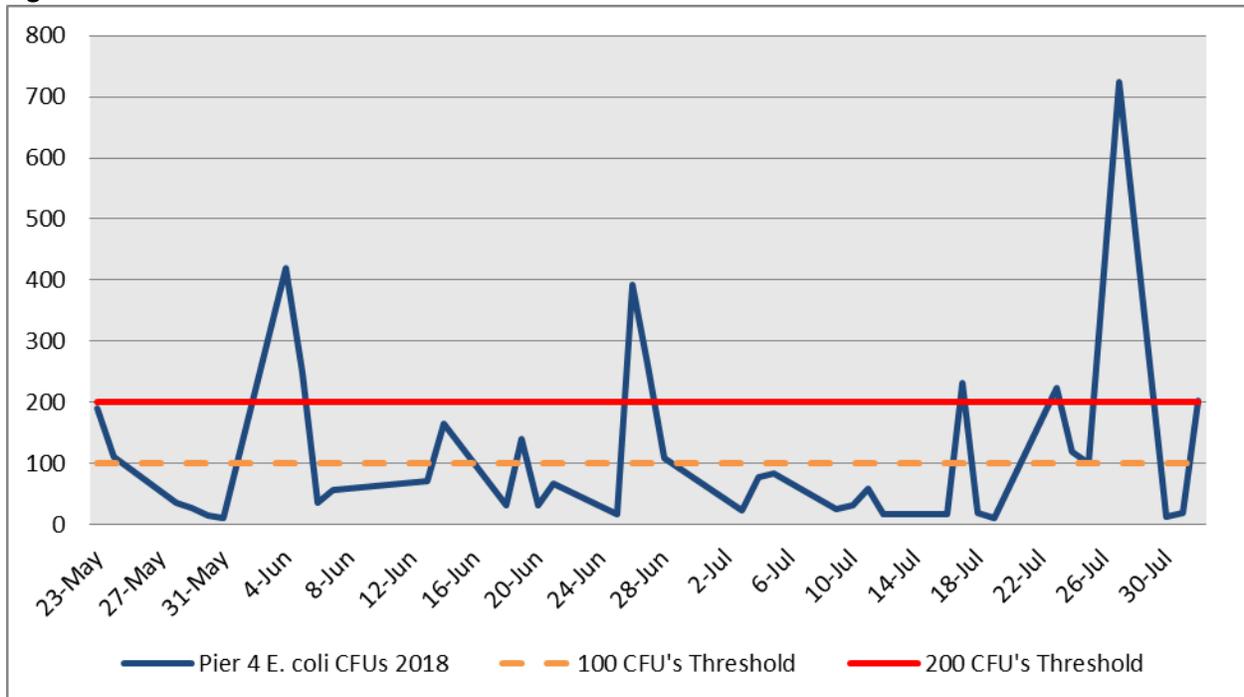
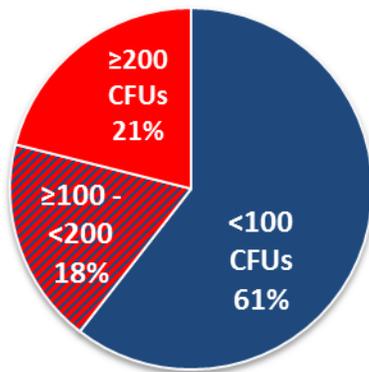


Fig. 4: % *E. coli* CFUs in 2018



Pier 4 Park Beach was sampled on 38 days in 2018. The *E. coli* concentration was found to be below the previous threshold of 100 CFUs 23/38 days or 61% of the days sampled (Figs. 3 and 4). On 7/38 days, the *E. coli* concentration was between 100 and 200 CFUs or 18% of the swimming season. The water quality was found to be above the 200 CFU threshold 8 times, or 21% of all days sampled (Figs. 3 and 4).

Conclusion

Conservation Area and Lake Ontario beaches did not experience significant changes in water quality in 2018, when compared with historical data. A considerable change to the beach monitoring program in Hamilton was the change to the MOHLTC recreational water quality guideline of a maximum acceptable *E. coli* concentration from 100 to 200 CFUs per 100 mL of water. The increased *E. coli* concentration threshold increased the number of days Pier 4 Beach is open by 11% VS the previous threshold of 100 CFUs. Pier 4 Beach water quality was improved by the late arrival of cyanobacteria and the increased efforts to control the waterfowl population which reduced the *E. coli* contamination from faecal matter in and around the beach. Although there was a delayed arrival of toxin-producing cyanobacteria in 2018, it continued to account for a considerable closure of 30% of the swimming season at Pier 4 Beach. Hamilton Public Health services will resume beach water quality monitoring in 2019 and will continue to monitor and assess the impact of water quality improvement projects at Pier 4 Beach.

References

Centers for Disease Control and Prevention (CDC). (2017). *Recreational Water Illnesses*. Retrieved from: <https://www.cdc.gov/healthywater/swimming/swimmers/rwi.html>

Health Canada. Guidelines for Canadian recreational water quality. 3rd ed. Ottawa, ON: Her Majesty the Queen in Right of Canada, represented by the Minister of Health; 2012. Available from: <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-recreational-water-quality-third-edition.html>

Miller, A and Russell, C. National Collaborating Centre for Environmental Health. (2017). *Cyanobacteria in Freshwater*. Retrieved from: http://www.ncceh.ca/sites/default/files/Cyanobacteria_in_Freshwater-May_2017.pdf

Ontario Ministry of Health and Long-Term Care (MOHLTC). (2018). *Operational Approaches for Recreational Water Guideline*. Retrieved from: http://health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/protocols_guidelines/Operational_Approaches_to_Rec_Water_Guideline_2018_en.pdf

Ontario Ministry of Health and Long-Term Care (MOHLTC). (2018). *Recreational Water Protocol*. Retrieved from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/protocols_guidelines/Recreational_Water%20Protocol_2018_en.pdf