

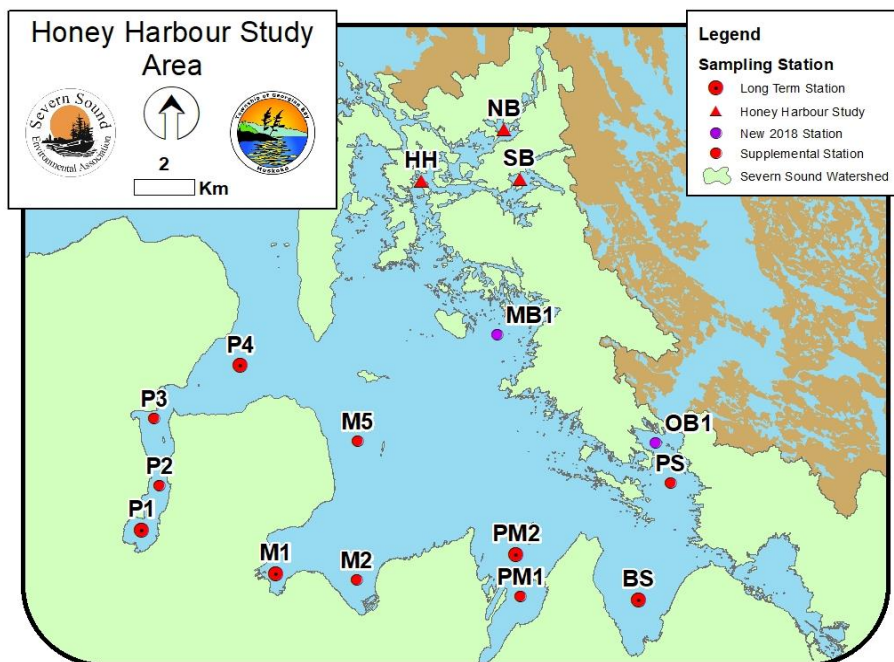
# UPDATE ON WATER QUALITY IN HONEY HARBOUR

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The Honey Harbour area of Georgian Bay is a special place with a beauty that draws seasonal and year-round residents, along with tourists, to its sparkling waters and rugged shorelines. Healthy water is as vital to the ecosystem in this corner of Georgian Bay as it is to the people who spend time enjoying it.

The Severn Sound Environmental Association (SSEA) has been monitoring water quality at three locations in the Honey Harbour area since 1998 (Figure 1), collecting biweekly samples over the ice-free season (12-15 samples per year). 2018 marks 11 years of continuous sampling at these sites. Samples are analyzed for water quality variables such as nutrients (e.g. phosphorus, nitrogen),



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Figure 1. Map showing sampling sites across Severn Sound, including sites sampled in North Bay, South Bay and Honey Harbour, and M5 which is used as a deep water reference site. Also shown are 2018 sampling locations in Macey's and Oak Bay (purple).

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metals (e.g. iron, manganese), and basic chemistry (e.g. conductivity, chloride), as well as the amount and type of algae present. Water column profiles of temperature, dissolved oxygen, conductivity and turbidity are also taken from the surface to just above the lakebed.

In 2018, SSEA also collected samples in Macey's Bay and Oak Bay in order to establish a baseline of water quality and algae community characteristics, and to compare conditions to other sampling sites in Severn Sound. Samples were collected once in spring, summer and fall in order to get a sense of seasonal variability.

### *Water Quality Trends at Long Term Sites*

There are many ways to look at water quality, both in terms of what indicators and timescales are used. Trends are assessed over the long term, usually with at least 5 years of data. The variables discussed below (Table 1) are commonly used to assess the nutrient or *trophic status* of a water body. Phosphorus and nitrogen are key nutrients for algae, with phosphorus being the limiting nutrient in most cases. Based on data from 2003-2018, there has been fluctuation but no significant steady increase or decrease in

Table 1. Summary of trophic status indicators using data up to 2018. Arrows with an asterisk indicate where 2018 data is not yet available. Trends were determined to be significantly increasing or decreasing based on a statistical method called the Mann Kendall trend test.

	North Bay	South Bay	Honey Harbour	Open Waters (M5)
Tot. Phosphorus (P)	↔	↑	↔	↔
Tot. Nitrogen (N)	↓	↓	↓	↓
Water Clarity	↔	↓	↓	↔
Chlorophyll a	↔	↔	(insuff. data)	↔
Algae Counts*	↔	↑	↑	↔
Min. DO at 1 MOB	↔	↔	↔	↔

↔ No change    ↑ Increase    ↓ Decrease

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**total phosphorus** at all monitoring locations except South Bay, where there has been an increase. **Total nitrogen** has been decreasing at all locations. Secchi depth, which is a measure of **water clarity**, has been decreasing at South Bay and Honey Harbour, meaning the water has become more turbid. Low water clarity can be attributed to suspended sediment or algae in the water column or high dissolved organic carbon content (tea colour).

**Chlorophyll a** is a pigment found in all plants, including algae. It is used as an estimate of the amount of algae in the water, but can also be influenced by physiological characteristics of the algae community since some species contain more chlorophyll a than others. While there has been no long term change observed in chlorophyll a concentration, the seasonal average **total amount of algae** as measured on a biomass basis has been increasing in South Bay and Honey Harbour. This is likely the cause of worsening water clarity at these locations. Algae identification shows that blooms of the blue-green algae *Planktothrix*, *Dolichospermum* and *Aphanizomenon* occur in deeper waters in South Bay (4-9 m). While these algae have the potential to produce toxins, they occur at a depth where human contact is unlikely. The golden algae *Peridinium wisconsinense* and *Chryso-sphaeralla brevispina* bloom at specific depths (4-5 m) for short periods over the season at North Bay. These algae are not harmful, although they can cause taste and odour problems in drinking water.



Total phosphorus sampling in South Bay.



Late fall sampling in North Bay.  
Photo courtesy of Armin Grigaitis.

**Dissolved oxygen** is important for the health of aquatic life, and in determining the chemical states and biological availability of nutrients and metals. The water column in North and South Bays becomes thermally stratified each year, meaning there is a strong

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temperature gradient that makes the surface waters much warmer than the bottom waters, preventing them from mixing. This lack of mixing isolates the bottom waters from the more oxygenated surface waters, and bottom water oxygen becomes depleted as decomposition of organic material on the lakebed occurs. Dissolved oxygen reaches anoxic levels ( $<2$  mg/L) by mid-summer each year in the bottom waters of North Bay and South Bay, and also at mid-water column in North Bay. Low oxygen causes phosphorus, ammonia and some metals (e.g. iron) to be released from lake sediments, causing them to accumulate in a narrow zone above the lakebed beginning in mid-summer. There is no long term trend in minimum seasonal dissolved oxygen at any of the monitoring sites.

### *Water Quality Conditions in 2018*

Another way to assess water quality conditions is to compare conditions at a particular point in time to a long term average value, or to compare with water quality targets or objectives. In order to put 2018 conditions into context, it is helpful to compare to long term average conditions for each location (Table 2), and to water quality targets set out in the Severn Sound Remedial Action Plan (RAP). RAP targets are as follows:

- Total Phosphorus:  $<15$   $\mu\text{g/L}$
- Water Clarity (as measured by Secchi depth):  $>3$  m
- Chlorophyll *a*:  $<5$   $\mu\text{g/L}$
- Minimum Bottom Dissolved Oxygen:  $>5$  mg/L

2018 results show that **total phosphorus** was below the RAP target of  $15$   $\mu\text{g/L}$  and was lower than the long term average at all locations except South Bay. **Total nitrogen** in 2018 was lower than the long term average at all locations. While there is no RAP target for total nitrogen, values are in a range considered typical of moderately enriched waters. RAP targets were not met for **water clarity** (3m) at any of the Honey Harbour locations, and clarity was worse in 2018 compared with the long term average at all locations. **Chlorophyll a** in 2018 was lower than the long term average at all locations, and values met the RAP target. The minimum seasonal **dissolved oxygen** concentration was lower than the long term average at all locations except South Bay. Only the Honey Harbour station met the RAP target for dissolved oxygen.

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Table 2. Long term average values, 95% confidence limits (measures variability over the season), and 2018 averages for trophic status indicators. Long term average values include data going back to 1981 for North and South Bays, 1998 for Honey Harbour and 2003 for Severn Sound open waters (M5).

Location		Tot. Phosphorus (ug/L)	Tot. Nitrogen (ug/L)	Water Clarity (m)	Algae Counts* (mm <sup>3</sup> /m <sup>3</sup> )	Chlorophyll a (ug/L)	Min. Bottom DO (mg/L)
North Bay	LT Average	13.3	351	3.1	1467	3.2	0.35
	95% CL	0.7	17	0.2	319	0.4	0.19
	2018 avg	<b>13.1</b>	<b>303</b>	<b>2.7</b>		<b>2.3</b>	<b>0.23</b>
South Bay	LT Average	15.7	376	3.0	1056	3.6	0.21
	95% CL	1.2	17	0.3	400	0.6	0.05
	2018 avg	<b>17.6</b>	<b>344</b>	<b>2.3</b>		<b>3.2</b>	<b>0.23</b>
Honey Harbour	LT Average	10.0	337	2.7	809	2.1	6.32
	95% CL	0.3	17	0.2	200	0.7	0.69
	2018 avg	<b>9.3</b>	<b>289</b>	<b>2.3</b>		<b>1.9</b>	<b>6.16</b>
Open Waters	LT Average	10.3	376	3.5	553	1.7	4.20
	95% CL	0.4	20	0.2	86	0.3	0.76
	2018 avg	<b>9.6</b>	<b>323</b>	<b>3.3</b>		<b>1.6</b>	<b>3.17</b>

Better than long term average

Worse than long term average

 2018 data not yet available

\*Long term average not including 2018

### *Water Quality in Macey's Bay and Oak Bay*

Monitoring in Macey's and Oak Bays served to establish baseline water quality conditions, and allow for comparison of conditions to the rest of Severn Sound (Figure 2). Conductivity, a measure of how much material is dissolved in the water, is a good indicator to use in determining whether sites are being influenced by similar geological and hydrological factors. Conductivity at Macey's Bay was very similar to Midland Bay (station M2), as was Oak Bay to the Severn River mouth (station PS). For both Macey's and Oak Bays (as well as most other locations across Severn Sound), spring and fall water clarity were lower than in summer. The spring sampling visit was in early June, and the spring diatom algae bloom likely caused low water clarity, while the fall visit was in late September and could be reflecting higher blue-green algae abundance. Macey's Bay had slightly poorer clarity than M2, while clarity in Oak Bay and at PS was virtually the same. Total phosphorus in Macey's Bay was more similar to the open water M5 site, with relatively low values. Total phosphorus was also low in Oak Bay, which again was similar to PS, with the exception of

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higher spring values at PS. Chlorophyll a is sampled in fewer locations across Severn Sound, and the Midland Bay sites and PS are not among those sampled. Macey's Bay values were similar to outer Hogg Bay (station PM2), with the exception of a higher spring value in Macey's Bay. There are no nearby stations with which to compare chlorophyll a in Oak Bay. All chlorophyll a values in Macey's and Oak Bays were low.

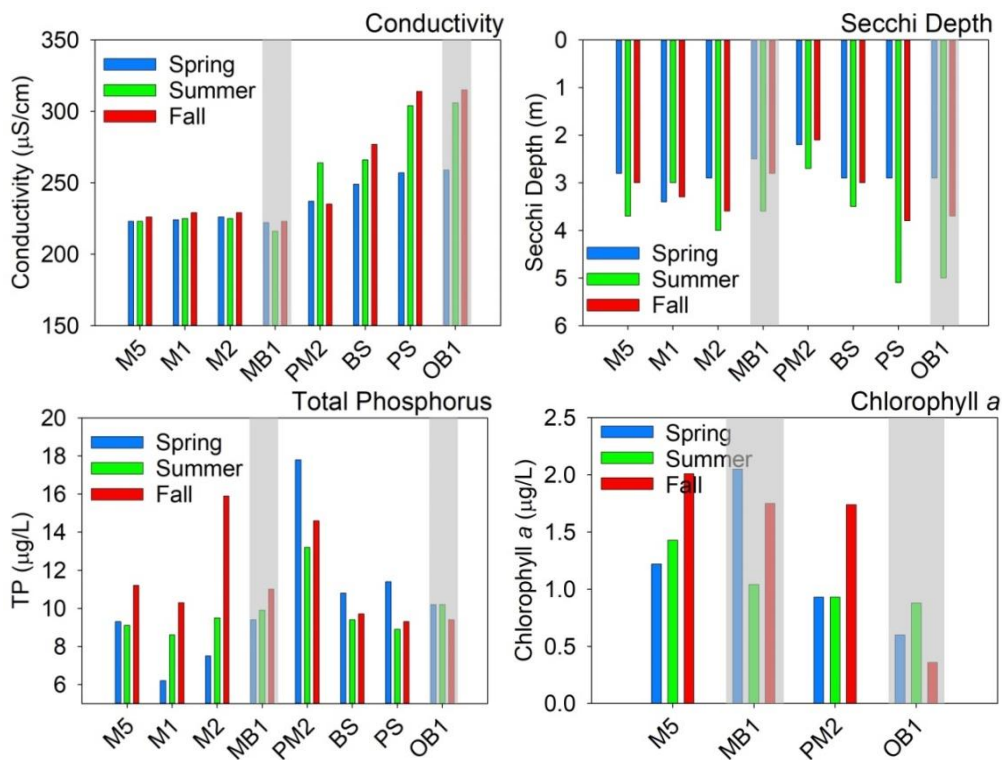


Figure 2. Water chemistry results for samples taken Jun 5, Aug 14 and Sept 25, 2018. Macey's Bay (MB1) and Oak Bay (OB1) marked by shaded grey bars.

### A Note on Sampling Location

There are several important questions to consider when deciding where to sample, including: *What do we want to know?* *What location is representative of the area in question?* and *How many sampling sites are needed to address the question at hand?* For instance, if we want to know about long term trends in an embayment, it is appropriate to sample somewhere that is representative of conditions in the open waters of that embayment, and won't be subjected to short term variability from highly localized

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inputs. It is important to keep in mind that gradients in water quality exist between offshore sampling sites and sites close to shore. Water quality tends to be better offshore where water is well mixed and not directly influenced by the immediate shoreline. In order to generally characterize the water quality of a particular embayment, it is standard practice to sample in the deepest location. This will give a complete picture of the water column, and highlight any unique temperature gradients or oxygen depletion issues. When a lake or embayment is classified as poorly, moderately or highly enriched with nutrients, it is based on sampling done from the deepest location. Water quality close to shore can be easily influenced by localized land-use practices, tributary and groundwater inputs, and generally does not represent basin-wide conditions. If the question at hand is to determine the impact of a particular land-use practice, then a localized sampling program with multiple sites must be designed with that question in mind.

### *Summary*

Overall, water quality in North Bay is holding steady, with deteriorating conditions in South Bay and Honey Harbour related to water clarity and algae growth. Phosphorus load reduction measures should be implemented, such as maintaining a natural shoreline, avoiding fertilizer use, and regularly inspecting and maintaining septic systems. Water quality in Macey's and Oak Bays can generally be classified as good and comparable with the rest of Severn Sound.

We look forward to continuing to work with the Township of Georgian Bay on common goals to monitor and protect water quality. For more information, visit our website, [www.severnsound.ca](http://www.severnsound.ca). To report a suspected algae bloom, call the Ministry of Environment, Conservation and Parks Spills Action Centre at 1-866-MOE-TIPS (663-8477) and our Port McNicoll office at (705) 534-7283. Funding from our municipal members, especially Township of Georgian Bay, and the Ministry of Environment, Conservation and Parks is gratefully acknowledged.