Wollaston Lake Home & Cottage Association

Wollaston Lake: Environmental Health Score Card Addendums

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Wollaston Lake – Background Information

DEVELOPMENT

Total lots/properties within 300m of lake: 338

Permanent: 51

Seasonal: 224

Vacant lots: 63

Tourist Establishments: 2

(Source: Hastings County, 2012, from zoning classification of parcels within 300 m of lake)

Hastings County Plan Designation

Wollaston Lake is:

1) **A Cold water Lake** - considered by the Ministry of Natural Resources and Ministry of the Environment to be critical habitat for the maintenance of a healthy cold water fishery (i.e. lake trout).
2) **"At Capacity"** - no new development permitted within 300 metres except for the development of existing lots of record in accordance with existing zoning.

Acid Rain Rating

Wollaston Lake is considered 'not sensitive' to acid rain, and has an MNR Acid Sensitivity Rating of 5, which is the best rating provided by MNR.

Background Information on Monitoring Programs

In the late 1990's the association's executive began to test the lake for phosphorus and E Coli. This was in response to emerging concerns about the water quality in the lake.

Over the years, this program has been improved and refined to ensure scientific rigour and for consistency with government programs.

In recent years we have been sampling the lake for Phosphorous and E Coli at the following five locations around the lake:

- Kendon Bay
- Deer River Mouth (where the river enters the lake
- Main Lake (at the deepest spot)
- Second Lake

- Third Lake

After a review of the program by the Lake Steward in 2010, the following improvements were made:

1. Filtering of all phosphorous samples to be consistent with the method used by the Lake Partner Program.
2. Taking one extra duplicate phosphorous sample (typically in Kendon Bay), as a quality control check for good sampling technique and accurate laboratory analysis.

A further review in 2015 resulted in some additional changes. Phosphorus sample locations were restricted to the center of the three lake basins (Main, Second, and Third – with one duplicate sample), to eliminate the excessive variability resulting from nearshore sampling. Phosphorus analysis was switched to another laboratory which is able to measure down to much lower levels. This improves our ability to monitor trends.

From time to time, we have also conducted dissolved oxygen (D.O.) and temperature depth profile readings in the deepest part of the main lake, where the lake trout inhabit. Adequate dissolved oxygen is essential to survival of lake trout.

D.O. readings are conducted in September, when the oxygen levels are typically at their lowest. These readings were taken using equipment borrowed from the MNR office in Bancroft. Unfortunately, since 2010, MNR stopped lending out their D.O. meters. Since then we have relied on MOE to take D.O. profiles as part of their 5-yearly comprehensive lake monitoring program (this was last done in 2013).

E Coli was added to the sampling program in 2007, at the same locations as were sampled for total phosphorus. E Coli is an indicator of contamination with fecal matter from warm blooded animals. In 2015, Sampling dates were changed to July and August (as opposed to September), to reflect the summer swimming season. Sample locations were also changed to four spots where swimming is thought to be most prevalent – off the two camp grounds, jumping rock, and Anson Bay

MOE: Lake Partner Program: Links

Lake Partner Program (Dorset Environmental Science Centre): http://desc.ca/programs/lpp

Guide to Interpreting Total Phosphorus and Secchi Depth data from the Lake Partner Program (pdf file):
http://desc.ca/sites/default/files/Guide%20to%20Interpreting%20TP%20and%20Secchi%20Data.pdf

Water quality in local lakes:

https://www.ontario.ca/environment-and-energy/water-quality-local-lakes

Lake Partner Program (MOE web site):

https://www.ontario.ca/environment-and-energy/water-sampling-and-testing-inland-lakes

FOCA: Lake Partner Program – Overview:

http://foca.on.ca/lake-partner-program-overview/

Public Beach Monitoring Program

Hastings and Prince Edward County Public Health Unit – Link:

http://hpepublichealth.ca/home/water-safety - See under "Beach Water Quality Safety"

Ontario's Invasive Species Awareness Program (OFAH):

Link: http://www.invadingspecies.com/

Detailed information on each contaminant

Total Phosphorus

Where does phosphorus come from?

There are many sources of phosphorus, both natural and human. These include soil and rocks, runoff from fertilized lawns, failing septic systems, disturbed land areas, and commercial cleaning products.

Lakes have a naturally-occurring background level of phosphorus. In our lake, these arise mainly from rainfall deposition and leaching from the soil. The natural background levels are augmented by man-made sources. For Wollaston Lake, it is likely that the majority of man-made phosphorus comes from the treatment of human waste and cleaning products in septic tanks systems, as well as run-off from fertilized lawns and gardens.

Why is phosphorus important?

Both phosphorus and nitrogen are essential nutrients for the plants and animals that make up the aquatic food web. Since phosphorus is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals.

What are the government guidelines?

Guidelines: The Provincial Water Quality Objective… For comparison, the MOE's objective for phosphorus for our lake is 10 ug/L.

How do we measure nutrient status?

Total phosphorus concentrations are used to assess nutrient status of a lake since phosphorus is the critical nutrient element that controls the growth of algae in most Ontario lakes. Increases in phosphorus will decrease water clarity by stimulating algal growth. In extreme cases, algal blooms will affect the aesthetics of the lake and/or cause taste and odour problems in the water.

Scientists categorize lakes into three broad nutrient status categories. Lakes with less that 10 µg/L TP are considered oligotrophic. These are dilute, unproductive lakes that rarely experience nuisance algal blooms. Lakes with TP between 10 and 20 µg/L are termed mesotrophic and are in the middle with respect to trophic status. These lakes can range from clear and unproductive to susceptible to moderate algal blooms at concentrations near 20 µg/L. Lakes over 20 µg/L are classed as eutrophic and may exhibit persistent, nuisance algal blooms.

(adapted from "Interpretation of TP and Secchi Results," MOE-Lake Partner Program, 2005)

Note that Wollaston Lake would be classified as oligotrophic, since the spring TP levels are generally below 10 ug/L.

What monitoring programs are there?

The Lake Partner program uses volunteers to take phosphorus samples from lakes in early May, This is the best way to assess year-to-year trends, in the main part of the lake, since the water is unstratified (i.e. uniformly mixed) due to the "spring turnover."

Our own sampling program measures phosphorus levels at various locations around the lake in midsummer (July) and in the fall (September). The program is designed to:

- Understand what is happening in our lake over the years by tracking key water quality indicators.
- Assess whether there is a change in the phosphorus level from the spring turnover in May to the rest of the summer season.
- Assess whether there is a variation in phosphorus levels compared to the "deep spot" in the main lake, for example in the shallower bays.
- Assess whether phosphorus loading is causing an increase in algae or weed growth with a corresponding decrease in water clarity.

What is the status of phosphorus in Wollaston Lake?

Historically, the phosphorus levels in our lake (as measured by the Lake Partner Program in early May) are very consistent from year to year, with a range from 6.0 to 8.5 in the 12 years since 2003, when the program started to use filtered samples.

Historically our own data do not show such a consistent pattern for various reasons, notably:

- We cannot measure down to levels lower than 9 ug/L, so we would miss any trends below this level
- We take samples in some of the shallower bays of the lake, which tend to show a greater variability in phosphorus levels
- We take samples in the middle and end of the summer season, when the lake has become stratified, which may lead to higher phorphorus in the biologically active (photic) upper layer.

As well MOE undertakes comprehensive monitoring of water chemistry (and dissolved oxygen), about one every five years. Wollaston Lake was last sampled in 2013.

Water Clarity (Secchi disk depth)

What is water clarity?

Clarity measures how clear the water is. It can be measured using a Secchi disk, which results in a depth measurement (the depth at which the disk can no longer be seen. Clarity may be influenced by nutrient levels (causing increasing in algae growth, and decreasing in clarity). Broadly speaking the relationship between trophic status, phosphorus and clarity is typically as follows:

Trophic Status	Phosphorus level	Secchi Depth (metres)
Oligotrophic (unenriched, with few nutrients)	Less than 10 ug/L	> 5 m.
(moderately enriched, with some nutrients)	11 to 20 ug/L	3 to 4.9 m.
Eutrophic (enriched, with higher levels of nutrients)	21 ug/L or more	Less than 2.9 metres

What monitoring programs are there?

Clarity (Secchi depth) is measure twice monthly by volunteers as part of the Lake Partner Program. For more information see the LPP fact sheet – "Gude to interpreting…."

http://desc.ca/system/files/users/user26/Guide%20to%20Interpreting%20TP%20and%20Secchi%20Data%20%28Complete%29.pdf

Results are available on the MOE's Lake Partner Web site web site at: http://desc.ca/programs/LPP

What is the status of water clarity in Wollaston Lake?

Because Wollaston Lake is generally oligotrophic, with phosphorus levels below 10 ug/L, the Secchi depth readings are usually at or about 5 metres. The mean annual Secchi depth since 1997 is 5.14 metres, with annual averages ranging from 4.0 to 6.2 metres.

E Coli

Where does E Coli come from?

E Coli are bacteria which derive from the gut of warm blooded animals and therefore can be used to flag the presence of fecal waste from these animals. E Coli and other bacteria can be harmful when ingested by humans during exposure to contaminated water.

Why is E Coli important?

The E Coli test is useful as an "indicator" organism, as it has been found that where E Coli are present, then there is an increased likelihood of other potentially harmful organisms being present. It is used to determine whether a water body is safe for recreational use (e.g. swimming).

What are the government guidelines?

The Ministry guideline for recreational use is 100 CFUs (Colony Forming Units) per 100 ml, based on an geometric average of 5 samples taken over a one week period in a month. This procedure is used by health units for testing public beaches to determine whether they are safe for swimming. If tests show an average E Coli level above the guideline, then the health unit posts a closure sign to warn people not to swim. It should be noted that meeting the recreational (swimming) guideline does not mean that the water is safe for drinking without further treatment.

What monitoring programs are there?

As part of the WLHCA summer monitoring program, we test the lake for the E Coli bacteria at the same sample locations as for phosphorus

Note: While we do compare our lake samples against the government guideline for E Coli, this guideline was intended primarily for the use of Medical Officers of Health to assess the suitability of beaches for swimming and bathing (see below). The guideline requires a calculation of the geometric mean of at least 5 samples to be taken within a one month period. This number is then assessed against the maximum guideline level of 100 cfu. We only take one sample at each location.

Wollaston Lake Beach Monitoring:

The Hastings/Prince Edward County Public Health Unit takes monthly E Coli samples at public beaches and other swimming areas during the swimming season. An average of 5 samples is taken over a one week period in each month (June, July and August), to determine whether the government's recreational standard is being met. (If not, the beach is "posted" as unsafe for swimming).

The health unit's sample data can be found at:

http://forms.hpechu.on.ca/web/index.php/beach-reports/local-beach-reports

What is the status of E Coli in Wollaston Lake?

For the WLHCA monitoring in July and September, in all locations, since September 2007, the levels of these bacteria have consistently been well below the government guideline for recreational use (100 Colony Forming Units - cfu - per 100 ml). The highest level we have recorded for lake samples was 13 cfu, with a high of 38 cfu recorded at the Deer River mouth in 2008. The most recent samples in 2014 reflect the historical pattern, all samples being below 6 cfu.

For the Wollaston Lake Beach program in 2014, the Health Unit has found no exceedances of the government guideline at our beach since 2008, and therefore no beach closures have been posted in that time. For 2014, all 3 sample series at the beach were recorded at an average of 10 CFUs, well below the Ministry guideline of 100 cfu.

Calcium

Where does Calcium come from?

Calcium is a natural inorganic element that derives mainly from the weathering of rocks and soil, as well as from atmospheric deposition. Weathering can be accelerated by acid rain, resulting in increased calcium leaching into lakes. The bedrock of many lakes on the Canadian Shield is resistant to weathering and these lakes tend to have lower calcium levels and less ability to neutralize or "buffer" acid rain; these are considered to be "more sensitive" to acid rain

Why is Calcium important?

Calcium is an important element in the aquatic environment which is needed for the growth of the shells and exoskeletons of zooplankton organisms such as daphnia (water fleas), as well as aquatic animals, such as snail and crayfish. These animals are, in turn, food for fish and larger aquatic animals, and so form a key part of the lake's food chain. Unlike many other contaminants, we are looking for high levels of calcium to maintain a healthy population of these organisms.

Many lakes on the Precambrian Shield in Ontario are suffering from severe calcium depletion. Key factors are the recent reduction in acid rain deposition (which lowers weathering) and re-growth of trees following forest harvesting (which increases calcium removal). Climate change is also thought to be a factor; lower water flow results in a reduction in calcium being flushed into lakes from the watershed.

What are the government guidelines?

According to MOE, the critical lowest survival threshold is 1.5 milligrams per litre (mg/L). "Many (Precambrian shield) lakes are nearing or have recently crossed (below) this important threshold…. 35% of 770 Ontario lakes are below it." (MOE)

Fortunately as discussed below, Wollaston is not one of those lakes, as it has plenty of calcium.

What monitoring programs are there?

Calcium in the main lake is measured in early May, as part of the Lake Partner program. Calcium sampling has been part of this program since 2008. Results are available on the MOE's Lake Partner Web site web site at: http://desc.ca/programs/LPP

What is the status of calcium in Wollaston Lake?

Historically we have been fortunate to have abundant calcium levels – averaging 27.2 mg/L from 2008 to 2013. The Lake is therefore highly unlikely to suffer from depletion of daphnia or other crustaceans. This is probably partly due to the fact that Wollaston Lake is considered by MOE to be 'not sensitive' to acid rain and is ranked as a '5' – the least sensitive rating. Lakes sensitive to acid rain are more likely to have calcium depletion due to the excess historical leaching of calcium from nearby soils.

For more information on Calcium, check out the following MOE backgrounder:

http://desc.ca/sites/default/files/Calcium%20Decline%20Factsheet%20FINAL%2016June2016%20.pdf

Dissolved Oxygen

Where does dissolved oxygen come from?

Oxygen enters the water from the atmosphere by surface aeration, especially with wave, current and wind action. Oxygen is also produced through photosynthesis of aquatic plants and algae during sunlight hours.

Dissolved oxygen can exhibit daily variation where higher levels may be present during daylight hours due to photosynthesis, and lower levels at night, when plants are consuming oxygen.

There can also be seasonal variation where, in a stratified lake, dissolved oxygen is typically at its lowest level at end of summer season (mid-late September) due to plant/algae decomposition. This is especially so at the lower depths which can be critical for lake trout

Why is dissolved oxygen important?

Oxygen is needed at sufficient levels to support fish and zooplankton populations. The deepest part of Wollaston Lake has lake trout, which are especially sensitive to oxygen levels.

What are the government guidelines?

MOE has separate objectives for cold water biota versus warm water biota. Cold water objective requires slightly higher levels. Since colder water holds more dissolved oxygen, the objectives vary with temperature: higher temperature have a lower DO objective. For cold water biota the minimum recommended level ranges from 5 mg/L at 25˚C, to 8 mg/L at 0˚C. For warm water biota, the equivalent range is 4 to 7 mg/L. (MOECC's provincial water quality objectives document, can be downloaded here: https://www.ontario.ca/document/water-management-policies-guidelines-provincial-water-quality-objectives (see page 17).

MOECC also has a separate guideline for lake trout: a minimum weighted average volume-weighted hypolimnetic dissolved oxygen of 7 mg/L (hypolimnetic refers to the hypolimnion, or the deeper, colder part of a lake below the thermocline.

What monitoring programs are there?

MNR and MOE both conduct dissolved oxygen/temperature profiles from time to time. The most recent MOE survey was in September 2013.

WLHCA conducted late summer DO / temperature profiles in the years 2008-2010, using borrowed MNR equipment.

What is the status of Dissolved Oxygen in Wollaston Lake?

Our lake almost always shows a "negative heterograde oxygen profile" in late summer, where oxygen levels drop (often to critically low levels) at the thermocline, then recover to higher levels at lower depths

The most recent profile by MOE (Sept 2013) yielded a weighted average volume-weighted hypolimnetic dissolved oxygen of 6.85 mg/L, just below the minimum criterion level of 7 mg/L recommended by the Ontario government for lake trout.