Healthy Lakes, Healthy Communities!

Kawartha Lake Stewards Association
2017 Annual Lake Water Quality Report

KLSA

May 2018

Kawartha Lake Stewards Association
Lake Water Quality Report 2017

Lovesick Lake Reflection

Cover photo by Patricia Moffat

Please Note: To obtain copies of our report or to find out more about KLSA please contact:

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klsa.wordpress.com

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Healthy Lakes, Healthy Communities!

The Kawartha Lake Stewards Association (KLSA) is a volunteer-driven, non-profit organization of cottagers, year-round residents and local business owners in the Kawartha Lakes region.The Association's programs include the testing of lake water for phosphorus, clarity and *E.coli* bacteria and research and public education about water quality issues. KLSA has formed valuable partnerships with universities, colleges and governmental agencies to conduct research studies and produce publications. This year's report, *Healthy Lakes, Healthy Communities!*, highlights the many contributions that volunteers and non-profit organizations make to stewardship of the Kawartha lakes. KLSA is led by a 12-member Board of Directors, chaired by William A. Napier. A list of the members of the Board is provided in Appendix A. A summary of articles contained in the 2017 KLSA Annual Water Quality Report follows.

KLSA's *E. coli* Testing Program: Analysis of Results 2001 – 2017

KLSA Director Mike Dolbey conducted an analysis of 17 years of testing for *E. coli* bacteria in 20 Kawartha lakes. Lake water samples have been collected by KLSA volunteers at 258 different sites, from four to six times each year. Public beaches are posted as unsafe for swimming when levels reach 100 *E. coli* cfu/100 mL of water. KLSA believes that counts in the Kawartha Lakes should not exceed 50 *E. coli* cfu/100 mL. The vast majority of test sites have been clean and most of the sites with high levels have returned to normal when they were retested. The presence of wildlife, particularly wildfowl, appeared to be the most frequent source of contamination.

Shoreline Stewardship and Monitoring

Kawartha Conservation has provided leadership in the development of management plans for many lakes within its watershed. These plans are community driven and arise from a desire to maintain a healthy lake environment and address such pressures as shoreline development, excessive aquatic plant growth, invasive species and loss of aquatic habitat. There are opportunities for cottagers and permanent residents to volunteer to participate in the creation of management plans for their lakes as well as in shoreline stewardship and monitoring.

Climate Change in Curve Lake First Nation

Kyle Chivers, the Curve Lake First Nation Community Adaptation Liaison for Climate Change, is creating an adaptation strategy to address the future effects of climate change. He spoke to community members and Elders about the changes that have occurred during their lifetimes that may be related to climate change. Some of these indicators include fish die-offs, toxic algal blooms, fewer turtle sightings, changes in bird populations and increased aquatic plant growth. Curve Lake is represented in Greater Peterborough and Kawartha Lakes Climate Change Working Groups that aim to better understand and minimize the effects of climate change.

Kawartha Land Trust

The Kawartha Land Trust is the only non-governmental land conservation organization working to protect the Kawartha Lakes and surrounding lands. KLT has secured 13 properties comprising 3,217 acres and is involved in partnerships for an additional 11 properties. The article highlights the extensive volunteer engagement and public events that contribute to KLT's success.

The Blue Lakes Project

The Blue Lakes Project is a collaborative initiative of The Land Between and Watersheds Canada to develop an interactive database that combines water quality data with fisheries information and shoreline development data. Lake associations that agree to adopt stewardship practices can be awarded the Blue Lakes Ecolabel and gain access to the use of the database and a companion app. In 2018, the project will be pilot tested in several Kawartha lakes. Details are available on The Land Between's website.

Update on Big Cedar Lake Eurasian Water Milfoil Control

In last year's KLSA Annual Report, the Big Cedar Lake Stewardship Association described their efforts to control the growth of Eurasian water milfoil (EWM). These efforts included stocking the weed beds with milfoil weevils and mechanical harvesting. While these methods had some success, EWM continued to be a problem. In 2016, working with scientists from Trent University, the Association began to experiment with biodegradable mats seeded with native plants to out-compete the EWM. KLSA Director Doug Colmer provides a progress report on the 2017 program.

Citizen Science on Lake Scugog

The Scugog Lake Stewards (SLS) is a charitable organization run by a group of dedicated volunteers with an interest in protecting the health of Lake Scugog. They are involved in monitoring starry stonewort (an invasive macroalga), conducting research on water chemistry in summer and winter and forming partnerships with government agencies and other non-profit organizations to monitor the walleye population and participate in the creation of a new engineered wetland on the Port Perry waterfront. KLSA Director Colleen Dempster, who works with SLS, provides an update on these projects.

Thorny Thieves: The Fight Against Invasive Buckthorn on the KLT's Dance Nature Sanctuary
Buckthorn is a resilient invasive small tree species which has a rapid growth rate and spreads widely by seed dispersal through tree fruit and sprouting from cut or broken stems. Buckthorn reduces biodiversity by crowding out and shading native species. Kawartha Land Trust volunteer Patricia Wilson describes efforts to remove buckthorn at the KLT's Dance Nature Sanctuary. Volunteers cut down trees so they would not produce berries and painted the stumps with herbicide to prevent regrowth.

2016 Kawartha Lakes Sewage Treatment Plants Report
Each year, KLSA monitors output from local sewage treatment plants that discharge effluent either directly into the Kawartha lakes or their watershed, or to water bodies that flow into the lakes. Data for 2016, the latest year available, is analyzed by KLSA Director Mike Dolbey. Phosphorus (P) output is a key indicator and a primary cause of increased plant and algae growth in our lakes. KLSA would like all STPs that discharge directly into the lakes to achieve a 99% P removal rate. The report includes results for Minden, Coboconk, Fenelon Falls, Lindsay, Bobcaygeon, Omemee, King's Bay and Port Perry. The total amount of P discharged from all these plants in 2016 was 465 kg, an increase from 407 kg in 2015 and well below the 99% P removal goal. Continued monitoring of all STPs is vital.

***E. coli* Bacteria Testing**
In 2017, KLSA volunteers tested 64 sites in 11 lakes for *E. coli* bacteria. Samples were analyzed by SGS Canada Inc. in Lakefield. Public beaches are posted as unsafe for swimming when levels reach 100 *E. coli* cfu/100 mL of water. KLSA believes that counts should not exceed 50 *E. coli* cfu/100 mL, given their high recreational use. In general, *E. coli* levels were low throughout the summer of 2017, consistent with other years, reflecting excellent recreational water quality. Of the total 352 tests conducted, 324 were in the 0 - 20 range, 16 were in the 21 - 50 range, six were in the 50 - 100 range and only six exceeded 100 *E. coli* cfu/100 mL.The sites with elevated counts were usually in places where wildfowl congregated or areas with low water circulation. Most returned to normal when retests were conducted. The lakes west of Pigeon Lake, which used the Centre for Alternative Wastewater Treatment (CAWT) laboratory at Fleming College in Lindsay, did not participate in 2017 since there was no one to coordinate sample drop-off. KLSA hopes to resume the program in 2018. Lake-by-lake 2017 results can be found in Appendix E.

Phosphorus Testing
In 2017, as part of the Ministry of the Environment and Climate Change's Lake Partner Program (LPP), KLSA volunteers collected water samples four to six times (monthly from May to October) at 44 sites on 14 lakes for phosphorus testing. Samples were analyzed by the Ministry laboratory. Volunteers also measured water clarity, using a Secchi disk. Overall in the summer of 2017, average total phosphorus levels were lower than in any other year since the program began in 2002. Differences among lakes were similar to previous years. Detailed results are provided in Appendix F.

Kawartha Lakes Paleolimnology Study: Status and Update
KLSA is collaborating with Queen's University on a paleolimnological study age-dating and analyzing the sediments in core samples collected in three lakes: Cameron, Pigeon and Stony. KLSA Chair William Napier provides a status report on the project. The analysis is nearing completion and preliminary results indicate that all three lakes show signs of eutrophication due to runoff from shoreline development, invasive species, particularly zebra mussels and proliferation of aquatic plants. The report on the study will be published in June, 2018.

KLSA Support and Public Meetings
KLSA relies on donations from individuals, businesses, municipalities and other government agencies. Please consider making a donation to support our work. KLSA holds two general meetings per year in the spring and fall. The fall meeting includes the Association's Annual General Meeting. In 2018, the spring meeting will be held at the Bobcaygeon Community Centre on Saturday, May 5 at 10 a.m.

Thank you
KLSA could not achieve its goals without the extraordinary support of the many volunteers who participate in our programs and those individuals and organizations that provide financial support. Thank you also to our scientific advisors and staff at the Ministry of the Environment and Climate Change Lake Partner Program and SGS Canada Inc.who assist with the water testing programs.Thank you also to John West of McColl Turner LLP for reviewing our financial records. We are also very grateful to Jessie Gordon who prepared the layout and the Lakefield Herald for arranging for the publication of this report. For further details, visit our website:http://klsa.wordpress.com.

KLSA Editorial Committee: Sheila Gordon-Dillane (Chair), Colleen Dempster, Janet Duval, Tom McAllister, Kathleen Mackenzie and Kimberly Ong.

Chair's Message

William A. Napier
Chair, Kawartha Lake Stewards Association

"No Water, No Life, No Blue, No Green" - Sylvia Earle

We in Canada are fortunate with Canadian rivers accounting for about 9% of the world's renewable water supply. Water is also highly visible in Canada: probably no country in the world has as much of its surface area covered by fresh water as does Canada.

As noted by The Land Between, here in the Kawartha Lakes district, we are never more than 500 metres from a waterbody.In contrast to many northern lakes of the Canadian Shield, such as the Muskokas, the shallower Kawartha Lakes are naturally more productive ecosystems. That is, they are full of life, and can support a greater number of organisms. Many native species of aquatic plants, and some non-natives, form mini-forests underwater where fish find shade, protection, food, and places to lay eggs or build nests. The early explorers noted that for generations,Indigenous peoples lived among these lakes and their many wetlands, using the area's vast resources of fish, game and abundance of plant food.

The Kawartha Lake Stewards Association continues to monitor and observe lake conditions. For example, in 2014, KLSA member Dr. Mike Dolbey compiled a review of the phosphorus concentrations and trends (see KLSA Annual Report 2014). This year Mike used the same rigour in the evaluation of *E. coli* samples collected by KLSA volunteers for the past decade and a half. Mike's article "KLSA's *E. coli* Testing Program: Analysis of Results 2001-2017" is found in this year's annual report. As Mike notes, the concentrations of bacteria found within our lakes appear to primarily hinge on wildlife habitat and the geomorphology of the lake. While still respecting monitoring site confidentiality, Mike was able to categorize certain physical and biological factors reflective of possible *E. coli* concentrations. As we 'shoo' Canada Geese from our yards, there is the need for monitoring aquatic *E. coli* concentrations in areas of water use such as swimming, boating and potable water intakes. As Mike noted, the number of monitoring results from Sturgeon Lake westward has dwindled with the lack of volunteers and coordinators.

During our May meeting in Bobcaygeon, Dr. Eric Sager, Professor, Trent University and Fleming College, presented *"Swimming with plants: a Kawartha Lakes tradition"*. Dr. Sager spoke about aquatic invasive plants, and various control techniques that are employed throughout the Kawartha Lakes, often with limited success. He illustrated this point by describing an experiment in controlling an ornamental plant escapee known as 'Water Soldier' (see the 2016 KLSA Annual Report). The speed and extent of its invasion is startling, early detection difficult, and complete eradication is quite a challenge. One successful approach in managing invasive aquatic plants, such as Eurasian water milfoil, is the use of benthic mats seeded with native plant seeds, essentially swapping an undesirable plant for a more desirable one. Dr. Sager observed that since we can't prevent invasive plants from invading, we may need to modify our attitude towards them. Dr. Sager is one of KLSA's Scientific Advisors and we are appreciative of the expertise and time he devotes to the organization.

The next speaker, Mr. Doug Kennedy of Green Side Up Environmental Services and Landscaping, provided a wonderful presentation entitled: *"Shorelines, Streams: their Function, Importance and Restoration of Waterfront Properties"*. Green Side Up is an ecological contractor specializing in landscape construction and natural resource management. He spoke about the impacts of 'manicured' waterfront properties on our ever-changing perception of 'nature'. He looked at the past to show a simpler way of cottage living, where fish and other wildlife were more abundant, water was clearer, and shorelines were more stable. He described the consequences of hardening shorelines, particularly with regards to soil erosion, and provided some restorative options that suit our desire for both good water quality and to be in close proximity to the lake. Mr. Kennedy used case studies to describe techniques such as the use of applicable foundation material and substrate, naturalized native plants and, where needed, integrating structures such as retaining walls.

During the September 2017 meeting in Lakehurst, we were pleased to have Dr. Brian Cumming provide an initial glimpse of some of the results of the sediment core sampling project. Dr. Cumming is a Professor of Paleolimnology and Aquatic Ecology at Queen's University. In his presentation entitled: *"Kawartha Lakes Paleolimnology Study (Collection, Analysis and Age-Dating of Sediment Cores) - Understanding our past to plan for the future",* Dr. Cumming provided an update on the initial results of the sediment core samples taken from Cameron Lake, Pigeon Lake and Stony Lake. For a description and study method used for the sediment core study, see the 2016 Annual Report or visit the KLSA website.

Based on the preliminary data, cores from all the lakes showed that under background conditions (over 200 years ago), the lakes were less productive than they are at present. Also, Pigeon Lake showed the largest amount of nutrient productivity when compared to the other two lakes. Changes to the plankton types over the last 30 to 50 years are similar to other studies and may be associated with the changing climate. As of early 2018, all the analyses have been completed and the final report is being prepared.

KLSA looks forward to rolling out the results in the upcoming months. This study could not have been completed without the support of Kawartha Conservation, the Stony Lake Heritage Foundation, the City of Kawartha Lakes and private donors.

KLSA relies on your support and interest. A big thank you to the people at McColl Turner LLP and the Lakefield Herald for their help. We are guided by our Scientific Advisors at Queen's University, Trent University and Fleming College and all of you who provide us with comments and insight.

I would also like to acknowledge and thank those in the business community, municipal and government agencies who continue to provide financial support for our work.

There were no changes to this year's KLSA Board of Directors. Each member of the Board provides insight and effort to make this organization work. Also the patience and professionalism of the KLSA Editorial Committee that prepares the Annual Report needs to be recognized.

The volunteers who test the water (see Appendix A), assist in the KLSA-sponsored studies and participate on the committees contribute to our success. However, we are always in need of volunteers. If you have an interest in the health of the Kawartha Lakes, please contact us – we welcome your participation.

Throughout the year, take a look at the KLSA website or Facebook page where we provide updates of our activities https://klsa.wordpress.com/.

Our Spring meeting is scheduled for 10:00 a.m. on Saturday, May 5, 2018 at the Bobcaygeon Community Centre/Arena. See you there.

Lovesick Lake Sunset *Photo by Pat Moffat*

KLSA's *E. coli* Testing Program: Analysis of Results 2001-2017

Mike Dolbey, Ph.D., P.Eng., KLSA Director

Summary and Conclusions
An analysis of the results of the Kawartha Lake Stewards Association's lake water *E. coli* testing program from 2001 to 2017 is presented. Over the past 17 years, samples from 258 different sites in 20 lakes have been tested. In 2017, 55 sites in 11 lakes were sampled of which 36 have been monitored continuously since the start of the program in 2001. The number of sites exceeding KLSA and Provincial thresholds has declined over the past 17 years but it is concluded that this is not because the lakes are cleaner but that fewer sites exhibiting frequent high *E. coli* levels are being tested.

Attempts to correlate the level of *E. coli* found at a site with characteristics of the test site resulted in general trends but the results were not statistically significant. Between 2001 and 2017 the results of approximately 1 test in 50 has exceeded the Provincial threshold of 100 *E. coli* cfu/100mL but most of these results appear to be outliers; that is, not repeatable on retest. Infrequent, non-repeatable outliers (results above Provincial threshold) are not believed to be of concern but sustained high values should be investigated. The *E. coli* results from 65 sites for which at least 10 years of data has been collected were graphed to look for seasonal and long-term trends. Four sites for which site characteristics were known were analysed concluding that wildfowl were the probable source of the low (i.e., below Provincial threshold) levels of *E. coli* contamination observed at three of those sites and domestic farm animals were the probable source of the high (i.e., above Provincial threshold) levels of *E. coli* contamination observed at the fourth. Volunteer testers, who have knowledge of the characteristics of the sites that they test, may find the graphed results helpful in determining probable sources of *E. coli* contamination at their sites.

A survey of the charted results shows that many sites tested are very clean and where mild contamination is found it is probably due to the presence of wildlife. It is recommended that KLSA's *E. coli* testing program be continued to maintain a long-term database. It would also be beneficial if the program could be expanded to again include Kawartha Lakes west of Pigeon Lake.

Introduction
Kawartha Lake Stewards Association (KLSA) was incorporated in 2001 by citizens who were concerned about the quality and safety of the water in our Kawartha Lakes.

In 2001 KLSA began a program to measure the *E. coli* levels in lake water samples. *E. coli* was the bacteria of choice because it indicates fecal contamination from warm-blooded animals, including humans. Its presence also indicates the possible presence of other disease-causing organisms found in fecal matter, such as those causing gastrointestinal and outer-ear infections. Most species of *E. coli* bacteria are harmless, but some can be dangerous such as that involved in the Walkerton tragedy. Because the basic quantitative analysis performed for KLSA cannot distinguish between the harmless and the deadly, all *E. coli* must be considered to be potentially harmful. Similarly, the analysis cannot tell whether any detected *E.coli* is associated with bird or animal fecal contamination or whether it is the result of human fecal contamination that might indicate a faulty septic system. Human fecal contamination is potentially more serious than that from other sources because humans are more susceptible to the disease-causing organisms associated with it. For these reasons, it is important to try to ascertain the cause of any ongoing high *E. coli* results. (Mackenzie, K., KLSA 2005 ALWQR, page 56)

In the summer of 2001, volunteers tested 115 sites throughout the Kawartha Lakes. To the extent possible, all sites were tested on the same days using accepted sampling techniques and all samples were analysed by an accredited laboratory, Lakefield Research (later SGS Canada Inc.). Provincial standards had established a level of <100 *E. coli* cfu (colony forming units)/100mL as a safe level for swimming. KLSA requested volunteers to perform one or more retests if a result equaled or exceeded 50 *E. coli* cfu/100mL.

Between 2001 and 2017 the program continued unchanged except for the addition of new test sites and the dropping of others. Over the years, *E. coli* analyses have been performed on samples collected from 258 different sites on the following lakes: Balsam, Big Bald, Big Cedar, Buckhorn, Cameron, Chemong, Clear, Julian, Katchewanooka, Lovesick, Lower Buckhorn, Pigeon, Sandy & Little Bald, Shadow, Silver, Stony, Sturgeon, Upper Stoney and White. In 2017, 55 test sites were sampled of which 36 have been monitored continuously since the start of the program in 2001.

Since 2001 the results of each year's *E. coli* tests have been published in KLSA's Annual Lake Water Quality

Report. The majority of readings have been very low. When occasional high readings have occurred, underlying causes have been investigated to the extent possible. The following causes are generally accepted as being responsible for most high *E. coli* readings: the presence of wildlife such as geese, inflows from streams, culverts or wetlands, low-circulation areas such as quiet bays or marshes and runoff after heavy rain. With 17 years of collected data it was thought desirable to review the results to assess long-term trends or correlations that might not be evident on an annual basis.

Method

• *E. coli* test results from all KLSA Annual Lake Water Quality Reports from 2001 to 2017 were collected in one Microsoft Excel spreadsheet table and summarized with graphs.

• Each site was identified by lake name and site ID. Exact site locations are confidential.

• Results for each site were assigned to the six prescribed test dates in each of the 17 years resulting in a total of 102 results for a continuously monitored site. If a sample was not collected on the prescribed date, its result was assigned to the closest prescribed date. If a high reading resulted in one or more supplementary tests, the highest reading of the group was assigned to the prescribed date. Result values of <2 were assigned a value of 1 (the < symbol interferes with spreadsheet analysis).

• Volunteer testers were asked to assign,for each site they tested, a number rating of its characteristics based on the following scale. If more than one characteristic applied the highest number rating was assigned:

1. Undeveloped shoreline with good circulation
2. Developed shoreline with good circulation
3. Undeveloped shoreline with poor circulation or adjacent to a wetland
4. Developed shoreline with poor circulation or adjacent to a wetland
5. Near wildfowl congregating habitat
6. Near the outlet of a stream or river

• The susceptibility of a site to have elevated *E. coli* readings was calculated as the percentage of all readings that equaled or exceeded a threshold value. Two thresholds were evaluated: 50 and 100 *E.coli* cfu/100mL.

• For sites with long-term data (10 or more years), graphs showing the variation in *E. coli* results over time and seasonally were plotted.

Results and Discussion

A chart summarizing the number of *E. coli* sites tested on the six sampling dates each year is shown in Figure 1. The percentage of test results on each test date equaling or exceeding the KLSA threshold, 50 *E. coli* cfu/100mL, and the Provincial threshold, 100 *E. coli* cfu/100mL, is shown in Figure 2.

Between 2001 and 2017, 258 different sites were tested but, as shown in Figure 1, no more than 130 were tested in any one year. The number of sites tested per year has decreased over time with only 55 sites being tested in 2017. Over this 17-year period, the number of sites with results exceeding the KLSA and Provincial thresholds has decreased somewhat. There are a number of reasons for these results.

• During the early years of testing a number of individuals, associations and businesses were interested in knowing the level of *E. coli* in the lake water adjacent to their properties. After a few years of generally consistent results, some were unwilling to pay the annual test fee to continue testing. As these sites were dropped, others were added but at a declining rate over the years.

• During the early years of testing some testers selected a number of sites with varying conditions such as in quiet bays, adjacent to stream inlets and places where wildfowl congregate in order to determine the type of locations that might be susceptible to high *E. coli* results. These sites were frequently undeveloped, often had higher than normal *E. coli* results and the cost of testing was born by the tester. Such sites were frequently dropped after a few years for economic reasons.

• Between 2001 and 2009, all water samples were tested for *E. coli* by SGS Laboratories in Lakefield. The increased time commitment to deliver samples from the western Kawartha Lakes resulted in few test sites on these lakes.

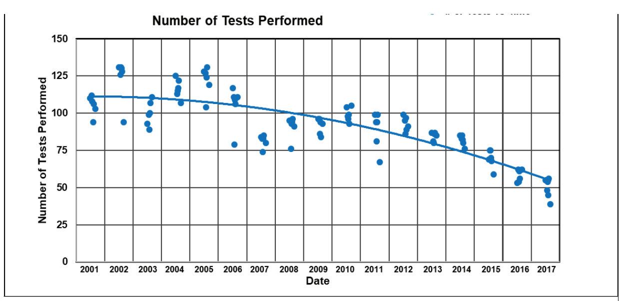


Figure 1. Number of KLSA *E. coli* tests performed each year

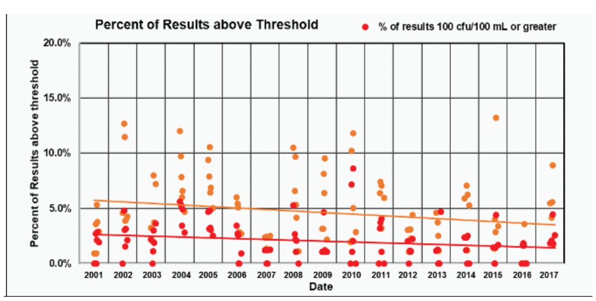


Figure 2. Percent of KLSA *E. coli* test results that exceed KLSA and Provincial threshold

KLSA's *E. coli* Testing Program

In 2010 arrangements were made for *E. coli* testing at a second laboratory, the Centre for Alternative Wastewater Treatment (CAWT) at Fleming College in Lindsay, resulting in an increase in test sites in the west, particularly on Balsam Lake. Unfortunately, after five years of testing, the cost of the tests and the lack of a coordinator for the west-end testing resulted in the discontinuation of the west-end laboratory for KLSA *E. coli* tests. At present there are no KLSA *E. coli* test sites on lakes to the west of Pigeon Lake.

Based on the above, it is probable that the reason that the number of sites exceeding KLSA and Provincial thresholds has declined over the past 17 years is not because the lakes are cleaner but that fewer sites exhibiting frequent high *E. coli* levels are being tested.

would be perfect correlation) indicating that the results cannot be considered to be statistically significant. It is probable that combinations of factors are influencing the results.

To better evaluate individual sites, the *E. coli* results for sites with at least 10 years of data were graphed over time and seasonally as illustrated in Figure 4 which shows results for the site that I have tested since 2006, Katchewanooka Lake Site 7. This test site is in front of my cottage which is in a bay and adjacent to a wetland and hence I characterize it as a category 4 site. Geese do nest in the local area and every year during spring and early summer there are usually flocks of 30 or more (four or more adults plus their goslings) that cruise around looking for lawns to feed (and defecate) on.

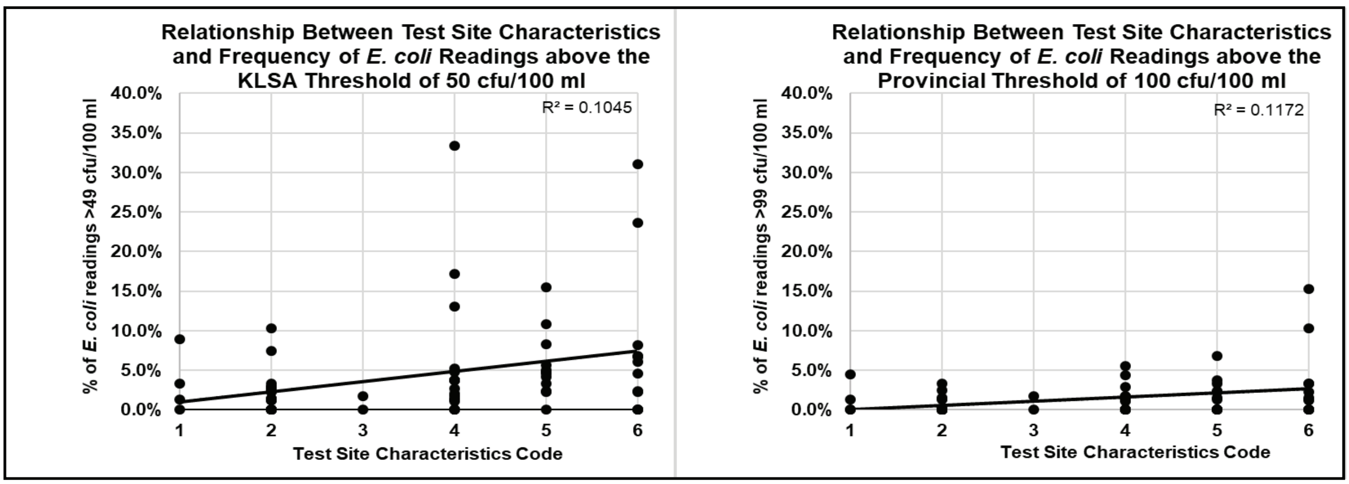


Figure 3. Relationship between test site characteristics and the frequency of *E. coli* results equaling or exceeding KLSA and Provincial thresholds.

The actual number of test results that equal or exceed KLSA and Provincial thresholds is very small. In 2017, typically 1 result in 25 (~4%) exceeded the KLSA threshold and 1 test in 70 (~1.5%) exceeded the Provincial threshold. In all results between 2001 and 2017, typically 1 test in 50 (~2%) exceeded the Provincial threshold.

An evaluation of the relationship between the characteristics of a test site and its susceptibility to have elevated *E. coli* levels is shown in Figure 3. Only sites for which testers provided a characteristic rating and for which at least 60 tests have been performed are included in the analysis. The trend line through the data indicates the least susceptibility of high *E. coli* results at sites on undeveloped shoreline with good circulation and an increased susceptibility of high *E. coli* results at sites with progressively less favourable characteristics. However, the considerable scatter in the data results in a very low correlation coefficient (R2) of only ~0.1 (1.0

Over the years I have taken measures to reduce the likelihood that geese will come on my lawn. These include planting tall grass and shrubs in front of the lawn along a portion of the shoreline, installing a motion-activated sprinkler near a small beach and positioning a number of large Muskoka chairs overlooking the lake, Figure 5. Geese prefer grazing in areas where they have a clear view of their escape route in case of danger so these measures have significantly reduced, but not eliminated, their visits to my lawn.

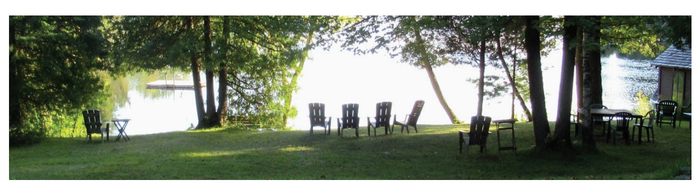


Figure 5. Waterfront showing tall grass, shrubs and large chairs to deter geese *Photo by Mike Dolbey*

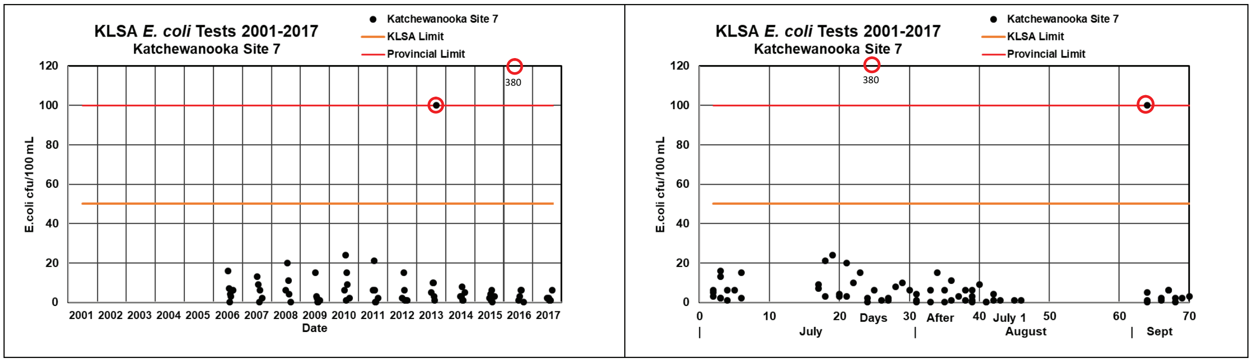


Figure 4. *E. coli* results for Katchewanooka Lake Site 7 over the years (left plot) and seasonally (right plot).

The results in Figure 4 show that between 2006 and 2012 before these measures were implemented, *E. coli* levels typically reached ~20 cfu/100mL whereas in later years *E. coli* levels typically reached only half this amount. As expected, the seasonal plot indicates that the higher readings were in the early summer when goslings cannot fly and adult geese are molting (renewing flight feathers). By mid-August they are all able to fly and usually move on to areas of better foraging. While it cannot be proven that the measures taken to deter geese are responsible for the reduction in *E. coli* levels in recent years it appears to be the most probable explanation.

During the 11 years of testing at this site, two unusually high readings occurred as indicated in Figure 4 by red circles - one of 100 cfu/100mL that occurred in September, 2013 and the other 380 cfu/100mL that occurred in late July, 2016. In both cases retesting resulted in normal very low *E. coli* values.These results are thus considered to be outliers. They may be due to sample contamination during or after collection or an unusual bit of detritus collected in the raw water sample. Unless elevated readings are frequent and repeatable it appears that they can be ignored. Outliers will be discussed further below.

Because the locations of sites are confidential (known only to the tester),a similar situational analysis for most sites is not possible. Nonetheless, it is possible to deduce some learning from the results at three other sites.

Katchewanooka Lake Site 2 has been tested continuously between 2001 and 2017 with *E. coli* results shown graphically in Figure 6. The site is located about 80m downstream from a rocky offshore shoal where gulls congregate throughout the summer and fall, Figure 7. *E. coli* readings have been variable between 0 and 100 cfu/100mL over the 17 years of testing with high readings occurring variably at all times of year. Again, it cannot be proven that gulls are responsible for the sustained elevated *E. coli* levels over the years but it appears to be the most probable explanation. It would probably be neither easy nor appropriate to attempt to interfere with this natural situation.

During the seventeen years of testing at this site only two unusually high readings occurred as indicated in Figure 6 by red circles - one of 125 cfu/100mL that occurred in September, 2005 and the other 261 cfu/100mL that occurred in July, 2013. These results are considered to be outliers.

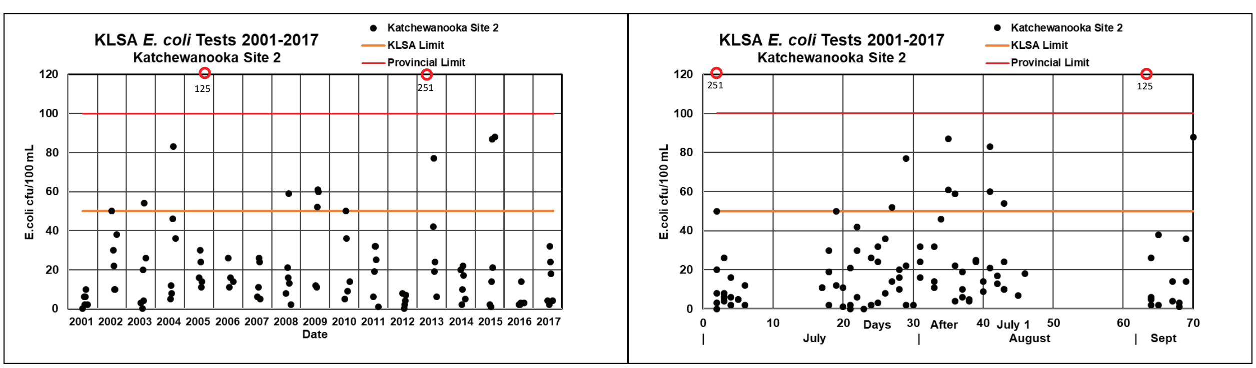


Figure 6. *E. coli* results for Katchewanooka Lake Site 2 over the years (left plot) and seasonally (right plot).

Figure 7. Gulls roosting on a rocky shoal upstream of Katchewanooka Lake Site 2

Photo by Mike Dolbey

The third example involves two sites in Pigeon Lake, NP5 and NP6 that are within 250m of one another in an area where geese congregate. The plots of *E. coli* results for NP5 and NP6 are shown in Figures 8 and 9 respectively. The seasonal plots for each site show higher results in early summer declining in late August and September which is characteristic of the presence of geese. However, at Site NP6, the high variable *E. coli* results in the early years dropped to very low values between 2007 and 2015 then climbed again to high values in the past two years.

It was discovered that in 2015 the owner of the property adjacent to Site NP6 was charged by the Ontario Provincial Police with killing goslings contrary to provisions of the Migratory Birds Convention Act. It was stated that "The man was angry that the geese were defecating on the grass and a beach area". It is surmised that the owner began deterring geese from entering his property about 2007 and continued until charged in 2015. Meanwhile, it appears that the geese were still active in the area as shown by the continued variably high results during this period at Site NP5 nearby. Once again it should be stated that without further investigation it cannot be proven that the significant reduction in *E. coli* at Site NP6 between 2007 and 2015 was due to the alleged illegal action, but it appears to be the most probable explanation.

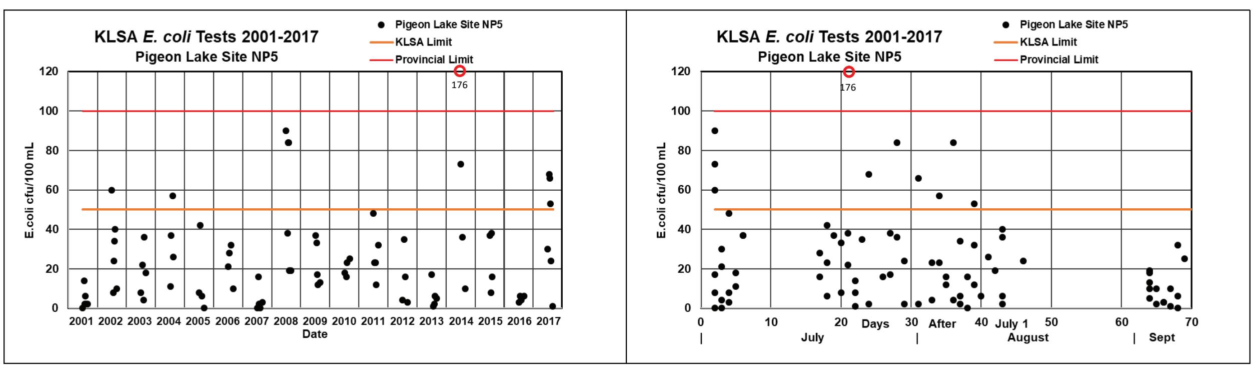


Figure 8. *E. coli* results for Pigeon Lake Site NP5 over the years (left plot) and seasonally (right plot).

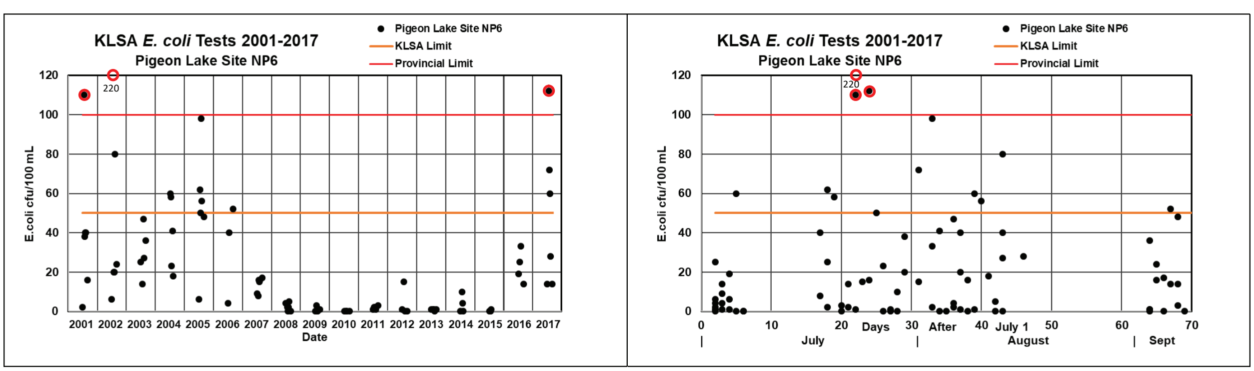


Figure 9. *E. coli* results for Pigeon Lake Site NP6 over the years (left plot) and seasonally (right plot)

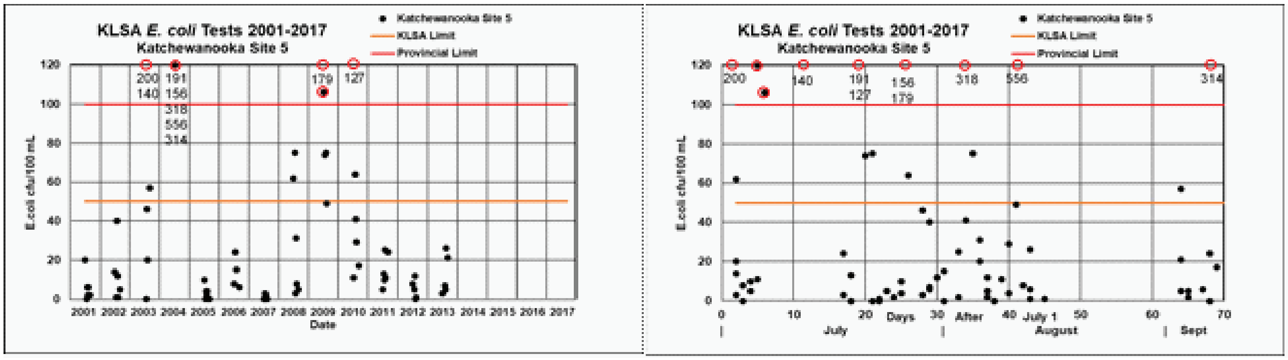


Figure 10. *E. coli* results for Katchewanooka Lake Site 5 over the years (left plot) and seasonally (right plot).

Outliers, or *E. coli* results greater than 100 cfu/100mL, occur infrequently for most sites; typically, about one for every 50 tests performed. When retests are requested and performed a few days later, the result is almost always a return to low values. This is not surprising. Healthy humans excrete about 100 million *E. coli* bacteria per ¼ teaspoon of fecal matter,(Mackenzie, K., KLSA 2005 ALWQR, page 56). Other mammals and birds that share our lakes also produce large amounts of *E. coli* and thus it is not surprising that high test results will occasionally occur. Only if they are frequent or repeatable should they be a cause for concern and investigation. An example of this occurred in 2004 at Katchewanooka Lake Site 5 as shown in Figure 10. This site is at the mouth of a creek that crosses many farms before emptying into Katchewanooka Lake. In early 2003 and throughout 2004 *E. coli* results were sustained above the Provincial threshold. It was concluded that a farmer was pasturing his cattle adjacent to the creek allowing their feces to contaminate the water.

During the next three years, 2005-07, *E. coli* results were low before rising again for the next three years. Unfortunately, testing was stopped in 2014 for financial reasons. This example illustrates that outliers cannot always be dismissed and that it is important to graph long-term data to see recurring patterns that aid in interpretation of the results.

The examples described above illustrate the value of graphical analysis of long-term data for observing trends and changes in *E. coli* results.When combined with knowledge of a site's characteristics, it may be possible to determine a probable source of contamination.Graphs of *E. coli* test results for 65 sites that have at least 10 years of data have been plotted.To conserve space, they are not presented in this report but are publicly available on the KLSA website, https://klsa.wordpress.com/resources/.

Volunteer testers are encouraged to review the charted data for the sites they test and to determine, to the extent possible, the sources of *E. coli* contamination. Where appropriate, results could be shared with waterfront property owners in the vicinity of test sites with information about how they may reduce the possible sources of *E. coli* contamination. Volunteers and waterfront property owners are encouraged to contact KLSA for assistance or advice in interpreting these charts.

A review of the graphs of all sites does not reveal any that are substantially different from the examples given above. Consequently, it is concluded that it is probable that wildlife is the primary source of *E. coli* measured at most KLSA test sites to date. Continued testing to maintain a long-term database is recommended. It would also be beneficial if the program could again be expanded to include Kawartha lakes west of Pigeon Lake. Anyone from these lakes interested in learning about becoming a water tester is encouraged to contact KLSA, 24 Charles Court, Lakefield ON K0L 2H0 or email: kawarthalakestewards@yahoo.ca.

Acknowledgements
KLSA thanks all its dedicated volunteer testers who faithfully collect samples and deliver them to the laboratory for analysis. We also thank our accredited laboratory, SGS Canada Inc. in Lakefield, Ontario, for providing us with excellent service at an affordable group testing rate that makes the *E. coli* test program possible.

It is Time for Proactive Shoreline Stewardship and Monitoring…Are You In?

Emily Johnston
Stewardship Outreach Technician, Kawartha Conservation

What is lake management planning and why do we need it?
These days our lakes are facing quite a few challenges. Things like intense shoreline development, excessive aquatic plant growth, invasive species, climate change, loss of aquatic habitat, water quality deterioration and other stressors are all causing changes to the lakes we enjoy. If not responsibly managed, all pose a legitimate threat to the future state of our lakes. In order to continue to benefit from the resources our lakes provide, we must do our part to stay informed and ensure we are in the best position possible to adapt to these changes in a positive way.

A Lake Management Plan can help with this. It's a document that outlines several recommendations that individuals and organizations can follow to benefit their lake. These Plans are community driven, and arise from a common resolve to maintain a healthy lake environment and address pressures that threaten the long-term sustainability of our most precious water resources. A priority recommendation from the recently completed Lake Management Plans identified the need for enhanced shoreline stewardship, shoreline inventory and water quality monitoring. Lakes that have management plans include:

- Canal and Mitchell Lakes
- Balsam and Cameron Lakes
- Four Mile Lake
- Lake Scugog
- Sturgeon Lake
- Head Lake (currently being developed)
- Shadow Lake (currently being developed)
- Pigeon Lake (currently being developed)

Why are shoreline stewardship, shoreline inventory and water quality monitoring important?
A generation ago, people were just starting to hear about invasive species like Eurasian water milfoil and water quality issues like *E.coli*. Awareness of these issues continues to grow and proactive shoreline management and lake monitoring have become necessary to address these issues. Our shorelines are now saturated with development, and there is a trend towards seasonal cottages changing to year round homes. We are spending more time at the lake and using the shoreline, which inherently leads to increased pressures on these resources.

Property "hardening" is often a consequence of shoreline development, when artificial materials (e.g., armourstone), usually in combination with grassy lawns, dominate the area around the water's edge. Although a hardened shoreline might look neat and tidy, and might make it easier to dock your boat or dive in for a swim, it means that the most important part of the lake/land connection, what scientists refer to as "The Ribbon of Life", has been degraded. It's called the Ribbon of Life because a very large percentage of life in and around the lake depends on the shoreline habitat for its overall health - fish spawn, turtles lay eggs, amphibians breed, mammals forage and birds nest in this area.

A healthy shoreline has living features like trees, shrubs and shoreline plants as well as non-living features like rocks, stumps and logs. These function not only as important fish and wildlife habitat, but also provide long-term shoreline stability by absorbing the energy from wind and wave action. Shoreline stability is also provided by living roots and vegetation that hold loose soils together, absorb nutrients that may otherwise stimulate algae, and help to cycle these nutrients back into the system.

When these features are removed, soil can be easily washed away, causing increased sedimentation into the lake and erosion of the land along the shoreline. Historically, shoreline hardening using concrete or armourstone has been a go-to solution to address this. Unfortunately, although these hardened surfaces can help with stability, the reality is that when natural features are removed, the nearshore areas of our lakes are exposed to additional nutrients and impurities in rainwater runoff, sewage from faulty septic systems, sediments and salt from roads, and other inputs at a much faster rate than normal. Data from lakes around the world have shown that nearshore populated areas are often more degraded than open waters of lakes.At this time, comprehensive datasets on nearshore health do not exist for Kawartha Lakes' shorelines. Monitoring to assess the problems and stewardship activities to improve or restore them arenow key areas where we need to focus our efforts.

How can lakeside property owners help?

To help better understand our impacts on the shoreline, Kawartha Conservation is empowering volunteer citizen scientists to help gather data on key nearshore parameters of lake health, such as nutrient concentrations (nitrogen and phosphorus), general water chemistry (water temperature, total suspended solids, and chloride), algal productivity (chlorophyll *a*) and bacteria concentrations (*E. coli*). These data, along with shoreline community engagement,let us know the types of stewardship activity that will best benefit the lake based on the individual pressures it is exposed to.

You can help by getting involved. Volunteer for shoreline monitoring and help gather the data needed to assess the threats your lake is faced with. Consider naturalizing your shoreline, even if it's just a small part of it. If you need help, consider attending a Kawartha Conservation workshop for shoreline property owners. You may also be eligible for a site visit with a stewardship technician, who can walk you through some of the steps toward a healthy shoreline property, including help with a naturalization plan.

Fig. 1: When planted along the shore, the strong, deep root systems of native plants help to anchor the soil, reducing the amount of material carried away by rain, waves, wind and snowmelt.
Photo by Kawartha Conservation

For more information on the Nearshore Monitoring Program, contact Debbie Balika: dbalika@KawarthaConservation.com, or visit KawarthaConservation.com/watershed/monitoring

For information and resources on shoreline stewardship, including upcoming workshops, please contact EmilyJohnston,ejohnston@KawarthaConservation.com, (705) 328-2271 x 242 or visit our website KawarthaConservation.com/stewardship/on-the-shore.

Fig. 2 (Before): Wooden structure holds the soil in place. *Photo by Kawartha Conservation*

Fig. 3 (After): Sloped rock and natural vegetation provide a healthy and stable shoreline.
Photo by Kawartha Conservation

Climate Change in Curve Lake

Climate Change in Curve Lake First Nation

Kyle Chivers,
Curve Lake First Nation Community Adaptation Liaison for Climate Change

Climate change is becoming more and more noticeable as the years pass. As the Community Adaptation Liaison for Climate Change, I am tasked with creating an adaptation strategy that looks towards the future effects of climate change. The great thing about this project is that it involves sitting down and meeting with people from the community. As someone not from Curve Lake, it is a daunting task to meet with community members and Elders, to ask of them to share and divulge their memories of days past, what the land was like, what changes have occurred during their lifetimes, and how it has all impacted their life.

Curve Lake First Nation sits on a peninsula between Chemong and Buckhorn Lakes, where water plays an important role in daily life. It was only 40 years ago you could drink freely from the lakes; now some are cautious about swimming at the beaches at Lance Woods Park and Henry's Gamiing.

What has changed?

Over the years there has been an increase in development and cottagers to the area. Although this is positive for the local economy, it does create stress on the natural ecosystems. Increased boating, shoreline development, shoreline clearing involving chemical use, and increased algae blooms all have quickly degraded the quality and accessibility to clean drinking water.

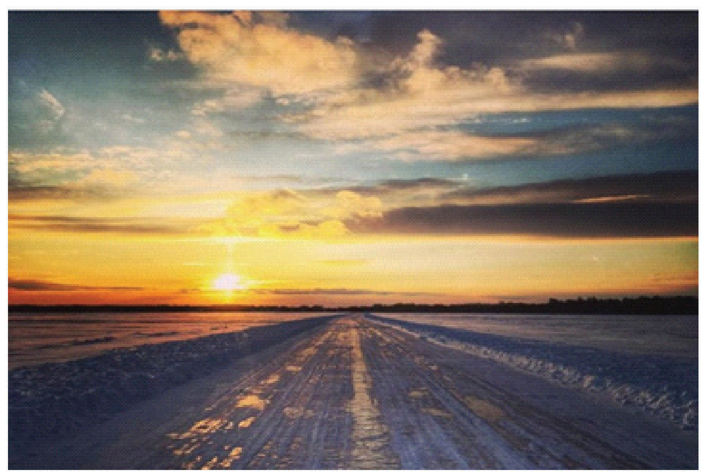
It is not uncommon for parts of Curve Lake to be under a Boil Water Advisory.

As a result of increased development, ecosystems are more vulnerable and susceptible to change. Elders and community have witnessed fish die-offs, especially with bass, and have noted fewer turtle sightings where there used to be many. Suitable habitat is diminishing, while encroachment of invasive species and increased algae blooms are taking their toll on the lakes' ecosystems. With rising surface and water temperatures, cool and cold water species of fish such as pickerel, muskie, and pike will have less habitat available to them as their numbers have already begun to diminish.

Some Elders have noticed that some birds are disappearing, with no or very few swallows and nighthawks spotted. There has also been an increase in sightings of bald eagles in the area thanks to conservation and protection efforts.

Over the years the amount of ginseng available has decreased, and few butternut trees remain. The lack of ginseng could be a result of harvesting and very few butternut trees as one community member noted that ginseng would typically be found near butternut trees.

In the last three years the ice road across Chemong Lake has been nearly non-existent. The two winters leading up to this winter, the ice road was not safe enough for travel. This year due to the lack of snow, the ice conditions were ideal and provided a short two-week period in late January and early February where the road could be travelled. While not integral, it does provide an alternate and shorter route into Buckhorn, Selwyn, and Bridgenorth with Curve Lake having only one land road in or out. The lack of ice also affects the ability for ice fishing. The ice road has acted as a good indicator for climate change, along with shorter winters, warmer weather, and increased freezing rain events.



Ice Road from Selwyn to Curve Lake winter 2018
Photo by Emma Taylor, Curve Lake First Nation

The loss of wild rice (Manoomin) to the lakes has had an impact to the degradation of the lakes ecosystem as a whole. As one community member mentioned, the rice beds provide food and habitat for the muskies, muskrats, various species of ducks and geese (all which have been noticed to be on a significant decline). In its place we are seeing algal blooms and the spreading of invasive Eurasian milfoil. Increased pollution from septic systems, spring runoff, and the

Climate Change in Curve Lake

Trent-Severn Waterway play a part in its loss. As part of a climate change adaptation strategy its continued re-emergence is integral for the health of the local ecosystems. Its protection will benefit all people who live and visit the Kawartha Lakes for with it comes healthy clean waters, wildlife, biodiversity, and an incredible food that is rooted in story and tradition for Anishinaabe people, providing a healthy lifestyle, and a local economy.

Seasonal changes with shorter winters, later snowfall, earlier springs, more extreme weather events whether it be extreme heat or extreme cold are all telltale signs of climate change and what's to come. Greater pressure and accountability is needed for larger industries contributing to climate change, but we also have to take on the responsibility of our lifestyle choices and our own surrounding environments.

Curve Lake is represented in the Greater Peterborough and Kawartha Lakes Climate Change Working Groups and continues to work with our neighbours towards a sustainable future. An Adaptation strategy will allow us to better understand the effects of climate change in our own territories and to create the kind of future we want to see.

Kyle is Chapleau Cree born, raised in Burlington, Ontario and a graduate from Fleming College and Trent University in Ecosystems Management and Indigenous Environmental Studies. Kyle is the Community Adaptation Liaison for Climate Change for Curve Lake First Nation and is a musician part-time with the band Elk the Moose.

Kawartha Land Trust

Kawartha Land Trust - Protecting the Land You Love!

Tara King
Development Coordinator, Kawartha Land Trust

The Kawartha Land Trust (KLT) is the only non-governmental land conservation organization working to protect this beautiful and diverse area we know as the Kawarthas. Since its formation in 2001, KLT has secured 13 properties (2 newly protected in 2017!) comprising 3,217 acres of diverse and significant landscapes with a donated land value of $6.9 million. We have also assisted our partners in protecting an additional 11 properties comprising more than 1,500 acres, largely additions to parks or conservation areas.

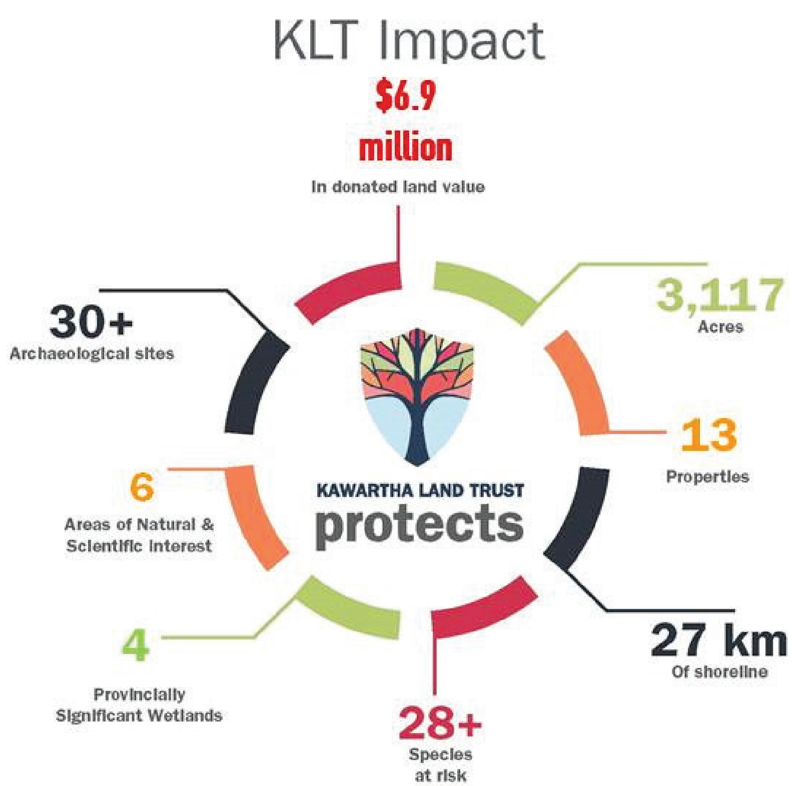
KLT is now a robust and dynamic organization with a strong regional presence. We've enhanced both our operating practices and our governance, with a renewed by-law and expansion of our organizational structure to include 30 Trustees (the members of the organization who will elect and support the Board of Directors). With several exciting and high-profile projects such as Big (Boyd/Chiminis) Island and the Stony Lake Trails network now complete, we believe we have the credibility, methods, team and resources to make a major impact on protecting more significant properties in this region.

Volunteers are a key part of our recipe for success and our current team includes 75 volunteers in a variety of formal capacities from Committees, our Board of Directors and the newly established Trustees of KLT, to an additional 25+ in an ad-hoc capacity.

We are also proud to report that in 2017 over 500 people participated in at least one of our events such as the 'Paddle & Babble Paddling Trips', 'Walk & Talk Tours', or the 'Volunteer Work Party', enhancing habitat for species at risk, removing invasive species, maintaining trails and exploring new places worth protecting. Many more visited our properties on their own or on one of our three hiking trail sites now available.

For more information about KLT, such as upcoming events, property profiles, trail maps, donation options or volunteer opportunities, visit www.kawarthalandtrust.org.

Kawartha Land Trust



31 km
recreational trails

supports **5** research projects

500+
participated in KLT events (2017)

18,500
trees planted (2017)

110+
amazing volunteers

7000
Volunteer hours in 2017

Paddle and Babble Paddling Trip
Photo by KLT

Cleanup of Stony Lake Trails
Photo by KLT

Leora Berman
Chief Operating Officer and Co-Founder,
The Land Between
William A. Napier, KLSA Chair

KLSA has been working with our partners to break the ‘data rich, information poor’ cycle where data is collected but remains elusive in its interpretation and utility. Our goal is to provide lake users and policy makers with information that can be used to ensure that water quality remains integral for ecosystem services including recreational uses. We believe that The Blue Lakes Project is a tool that can assist in achieving the compilation of data for use in determining if there are any lake changes which can cause adverse conditions.

The Blue Lakes Project (www.bluelakes.ca) is a collaborative initiative of The Land Between and Watersheds Canada. The Land Between is a registered charity that has spent seven years developing and testing a new interactive database that combines water quality data with fisheries information and shoreline development data. Watersheds Canada (https://watersheds.ca/) is a federally incorporated non-profit organization and registered Canadian charity committed to providing programs to communities across the country that work to engage and help shoreline owners enhance and protect the health of lakes and rivers. It works with landowners, communities and organizations to protect lakes and rivers through developing effective, transferable, long-term solutions.

The Blue Lakes database can accommodate other data sets such as Love Your Lake data or information on bacteria counts, etc. The database is a cooperative platform able to receive and instantly process new data entered from lake stewards, landowners, anglers, biologists and other scientists and partners to track historical and current lake status and trends. The Blue Lakes database can record data in areas of water quality, angling efforts or shoreline naturalization.

The Blue Lakes Project is an ecolabel initiative whereby lake associations agreeing to adopt stewardship practices are awarded the Blue Lakes Ecolabel and gain access to the use of this data base and companion app. Ecolabel programs allow the use of environmental logos by those whose stewardship actions include providing education to lake residents on best management practices, water quality monitoring, improving boating practices and advancing natural shorelines on their lakes through planting projects.

The Blue Lakes database and app feature data and trends related to water quality and fisheries using standard sampling data to derive trophic status, capacity levels, mean dissolved hypolimnion oxygen levels and the volume of areas of anoxia. Included are angler diaries and Fish on Line data from the Ontario Ministry of Natural Resources and Forestry (OMNRF) which helps to understand the state of the fishery related to the water quality. Unnatural shorelines have also been mapped using satellite imagery to estimate the percentage of the lake basin that has been altered. Individual landowner properties and profiles are protected and not identified. The database was developed with the support of Fleming College geomatics students using the best available science. It has been peer reviewed by a team of biologists from the OMNRF and the Ontario Ministry of Environment and Climate Change (OMOECC).

In 2018, The Blue Lakes Project (database and companion app) will be piloted in a number of lakes.The Project is seeking interested lake associations to participate. While the current focus is on lake trout lakes, the program is open to all lake associations that have organized and active or engaged boards of directors and/or lake stewards. The Project is also interested in participants who have existing lake water quality data and who have the capacity to sample water quality of Secchi depth, phosphorus, dissolved oxygen and temperatures.

Lake associations involved in the pilot phase will help refine existing features of the Project as well as identify gaps or needs to ensure the Project is effective and agile. Lake associations wishing to participate in this phase of the program will be asked to meet (in person or via the internet) with the collaborative team once a month to assist in the review and program development.

The questionnaire for determining if your lake could be a candidate for the pilot program is found at
https://bluelakes.ca/ or
https://www.surveymonkey.com/r/BlueLakes.

If your lake association is interested in being part of the pilot project or for more information, contact Leora Berman or Barb King by visiting www.bluelakes.ca.

Big Cedar Lake Eurasian Water Milfoil Control

Update on Big Cedar Lake Eurasian Water Milfoil Control

Doug Colmer
Big Cedar Lake Stewardship Association
KLSA Director

In last year's KLSA Annual Water Quality Report, the Big Cedar Lake Stewardship Association described their efforts to control the growth of Eurasian water milfoil (EWM) in their lake. Beginning in 2011, the Association began a five-year project of stocking milfoil weevils in EWM beds and monitoring the results. Some success was realized but EWM continued to be a problem so other control methods were tried.

In 2016, the Association tried removing milfoil with an extractor tool which was a pump with a vacuum head to withdraw weeds. This technique did not work out as well as we had hoped because it was difficult for the extractor to pull out the roots, particularly in deep water and rocky areas. We did, however, clear two areas with it and a team of scientists from Trent University put down biodegradable mats. They followed up in the summer of 2017 to see how much grew back. Approximately 10% of the EWM grew back. It was easily cleared because it had not rooted well. In one area where there was a lot of regrowth last year, they were able to finish the removal in 2017 and completely clear it. Putting down a mat temporarily was not required.

The Trent team of Amanda Cooper (Ecological Restoration Program) and four others then moved on to six new patches. They cleared areas and worked on patches that were in traffic lanes or swimming areas as well as locations where there were ideal conditions for working on the weed patches.

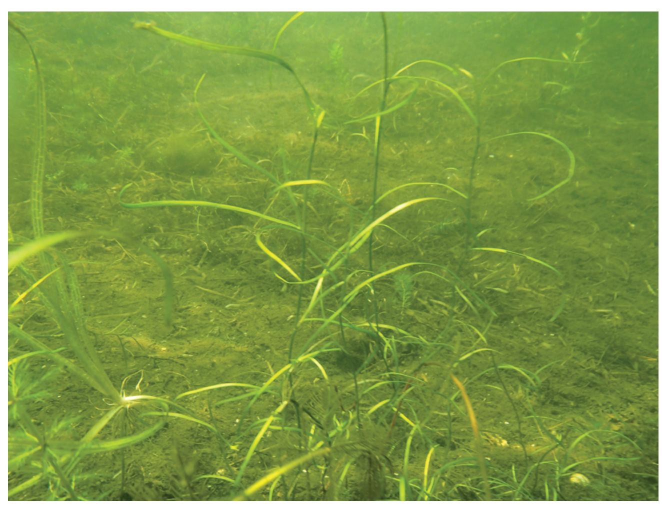
Biodegradable Mats

Biodegradable mats measuring four metres by ten metres were prepared using coir material made from coconut husk. Between mid-to-late July, six mats were submerged overnight at all treatment sites, where they were reinforced with heavy rocks to allow full saturation and prevent buoyant uplifting. Following this, four different species of native aquatic plants were planted into each of the mats. Native submersed plants that were used included: Robbins pondweed (*Potamogeton robbinsii*), broad-leaved pondweed (*Potamogeton amplifolius*), coontail (*Ceratophyllum demersum*) and tapegrass (*Vallisneria americana*).

Harvesting and replanting is very time-consuming. The divers did a very good job, persisting all year to clear all six areas.The Ministry of Natural Resources and Forestry (MNRF) cooperated with us, providing a weed-clearing permit for removing EWM in areas not immediately adjoining people's properties.In spite of the cool spring and slow start the weeds had a banner year and show that we are in a marathon not a sprint.

Big Cedar is one of the only lakes with an active program to try to control EWM. We hope the results are sufficient to encourage the effort to continue. Individuals' participation will still be necessary for people to improve their own swimming areas.

For more information on EWM removal, contact the author at dougcolmer@gmail.com or visit the Big Cedar Lake Stewardship Association website at bclsa.ca.



Biodegradable Mats in the Lake

Thorny Thieves: The Fight Against Invasive Buckthorn

Thorny Thieves: The Fight against Invasive Buckthorn on the Kawartha Land Trust's Dance Nature Sanctuary

Patricia Wilson
Kawartha Land Trust (KLT) Volunteer

European or Common Buckthorn (*Rhamnus cathartica*) is a non-native invasive small tree species that was introduced into North America in the 1880s as an attractive shrub that was planted on people's properties to be used as windbreaks or hedgerows along agricultural fields. Buckthorn trees have tiny black berries, oval leaves and several thorns on their twigs.

Like most invasive plant species, Buckthorn is a resilient species that can occupy several types of habitat and thrive in a variety of soil types, temperatures and is tolerant to both sun and shade. Buckthorn has a rapid growth rate and can spread widely using seed dispersal through tree fruit and sprouting from cut or broken stems. Due to their longer fruiting periods than most native species they have the advantage of dispersing for a longer period of time than native plants.

One of the biggest reasons removing buckthorn is important is because these tree species can decrease the biodiversity of an area. Buckthorn trees push native trees and shrubs out of habitats by crowding and shading other plants. Less diversity of plants means less real estate for small mammals, birds and insects to live in and fewer plants for wildlife to consume. The berries they produce are a laxative – meaning birds and other wildlife species get little to no nutritional value from these plants while also contributing to its dispersal.

Non-native plants also have limited associations with native insects – meaning the branches aren't crawling with this vital food source for birds. These species steal habitat for native species and threaten the biodiversity of any area they reside in – hence I call them *Thorny Thieves!*

While the presence of buckthorn on a property isn't the end of the world, removing it can increase the biodiversity on a property. Every year KLT removes these threatening species on our protected properties so that habitat for native species is optimized for future years. I was fortunate to have the opportunity to learn more about invasive species working with two groups of volunteers. Over two stewardship days in the spring and fall of 2017 we teamed-up to help fight the thorny thieves at KLT's Dance Nature Sanctuary.

Our first stewardship expedition was during a very rainy day in May. There were six volunteers working to help cut down buckthorn and plant native shrubs. We planted a variety of native shrubs - grey dogwood, chokecherry, nannyberry and service berry – all strong plants that provide food and refuge for several different species. Removing buckthorn was a very challenging, yet rewarding experience. I definitely did not expect the amount of effort and work that went into removing these pesky trees, not to mention at some points painful (thanks to their sharp thorns). Over the course of a few hours we managed to cut down several of the buckthorn plants in the field and plant more than 200 native species. It's safe to say we got a little muddy!

The second stewardship day was the complete opposite in terms of weather conditions – a high of 35 degrees and sunny skies. There were six volunteers and our task this time around was to cut down the buckthorn trees right to their stumps and apply herbicide to the stumps. This method is the most effective way of controlling the species. Due to the downpour on our first stewardship day we were unable to treat the stumps with herbicide but since it was a clear rain-free day we were able to do it this time.

Going into this project I was told that buckthorn trees grow rapidly but I was surprised to see that most of the buckthorn trees had grown back since our last removal in May. They weren't small either; some were almost two metres (five feet) tall!

Buckthorn removal at Dance Nature Sanctuary
Photo by KLT

Thorny Thieves: The Fight Against Invasive Buckthorn

Despite these resilent plants growing back, our method of cutting them to the stumps did slow down the berry production which we hope helped to delay the spread throughout the property. Even with this minor setback we were able to clear almost the entire field that we had worked on in May and a fair amount in another area of the property, successfully applying herbicides to each of the stumps. Fingers crossed that we were able to kill off most of the buckthorn in order for new native species to thrive.

Volunteering with Kawartha Land Trust is a constant learning experience for me. Prior to these stewardship days I had only a general knowledge about invasive plants.

Over the span of two days I was able to learn more about invasive plants and why they are a threat to our environment, how to identify buckthorn trees by leaf and branch physiology, and I gained experience in the management and removal of buckthorn.

Whenever I sign up for a volunteer day with the Kawartha Land Trust I always know it will be a fun time as well as a great learning experience for myself and the many other volunteers that work together to help protect and preserve the land. Special thanks to the Ministry of Natural Resources and Forestry, LSHRP grant, and the Ministry of the Environment and Climate Change EcoAction grant for making this project and other habitat stewardship projects possible for Kawartha Land Trust.

Right: Digging out buckthorn
Below: A KLT volunteer work party
Photos by KLT

Citizen Science on Lake Scugog

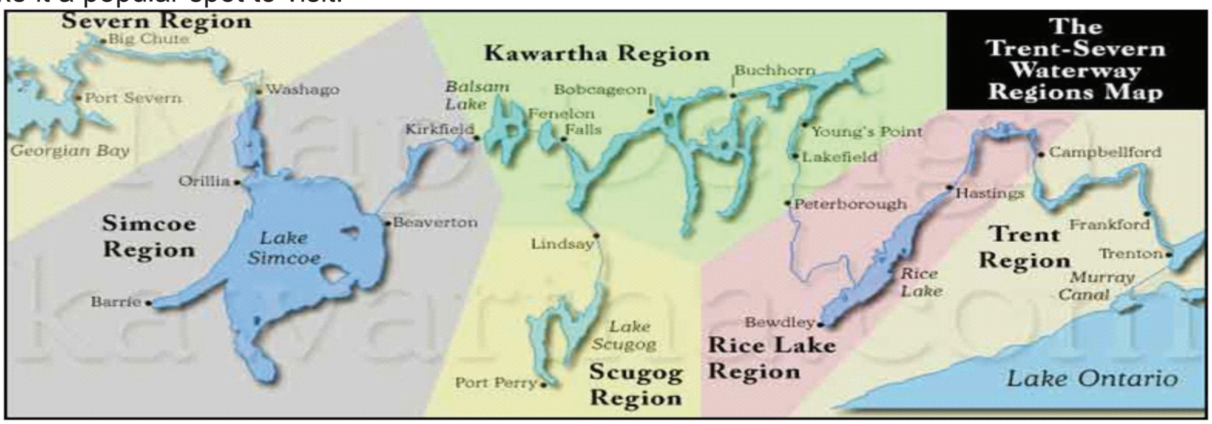
Colleen Dempster, KLSA Director and consultant to the Scugog Lake Stewards

Lake Scugog is located just south of Lindsay, and is around a one hour's drive northeast of Toronto with the town of Port Perry on its shoreline. It is shallow (average depth 1.4m) and eutrophic (average Total Phosphorus around 21 µg/L), with diverse wildlife and an active sport fishery. Its proximity to large urban centres, productivity of fish and wildlife, and its natural beauty make it a popular spot to visit!

Similarities in the ecology and the connectivity of the Kawartha Lakes means what happens in Lake Scugog could happen in other Kawartha Lakes too.

Therefore, it is worth checking in with each other to share information and resources, and to work together towards our common goals.

So, what's happening with Lake Scugog and what are the Scugog Lake Stewards (SLS) doing about it? There are a few big projects on the go which I would like to bring to your attention.



Lake Scugog is part of the Kawartha Lakes watershed, which means that, along with Balsam Lake, Mitchell Lake, Sturgeon Lake, and part of Pigeon Lake, it is under the jurisdiction of Kawartha Conservation. It also falls under Ontario Fisheries Management Zone 17, along with the rest of the Trent-Severn Waterway (TSW), which means it has fisheries characteristics and management strategies similar to the rest of the Kawartha Lakes. Finally, Lake Scugog is part of the TSW feeding a significant amount of water into the system through the Lindsay dam. Altogether, what happens in Lake Scugog could be a harbinger of things to come in the rest of the Kawartha Lakes. It is therefore critical that we communicate with our Scugog neighbours to the south.

Scugog Lake Stewards Inc.

Lake Scugog has been under the wise stewardship of the Scugog Lake Stewards (SLS) since 1999. The SLS is a volunteer-run, charitable organization composed of a group of highly dedicated individuals with an interest in protecting the health of their lake.

Monitoring starry stonewort

In our 2015 Annual Water Quality Report, Dr. Ron Porter and SLS President Barbara Karthein wrote an article about the abundance of the invasive macroalga "starry stonewort" which was newly discovered in Lake Scugog. Another two years of study have shown that populations of this plant-like alga are dynamic, sometimes dominating and sometimes disappearing, but have secured a foothold in Lake Scugog. Reports of starry stonewort have occurred in some other Kawartha Lakes, meaning it has inevitably made the move up the TSW. So, keep your eyes open for it on other lakes and report your sightings to us (and the Early Detection and Distribution Mapping System http://www.eddmaps.org/ontario)!

Citizen Science on Lake Scugog

Walleye research and rehabilitation

In January 2016, a moratorium was placed on the important walleye fishery due to dwindling walleye populations, especially of young walleye. It is hypothesized that many factors are contributing to poor walleye recruitment, including degraded spawning habitat, predation on walleye eggs/fry by invasive crappie, overfishing, changes in water clarity due to zebra mussels, and increasing water temperatures.The SLS have partnered with the University of Ontario Institute of Technology (UOIT), York University,Kawartha Conservation (KC), the Ministry of Natural Resources and Forestry (MNR-F) and Ontario Federation of Anglers and Hunters (OFAH) to conduct research and implement rehabilitation efforts for walleye.

Here's how it works. Dr. Andrea Kirkwood and MSc. candidate Tyler Harrow-Lyle from UOIT are monitoring water chemistry by boat offshore, and further studying plant community dynamics in the lake with a focus on the distribution and ecology of starry stonewort.

Throughout the summer, Debbie Balika from Kawartha Conservation is working with volunteers who live on Lake Scugog to gather data on water chemistry at their shorelines. In the winter, Dr. Joshua Thienpont and Dr. Jenny Korosi from York University, with the help of volunteers, continue to measure water chemistry, with focus on dissolved oxygen levels, through holes cut into the ice.

In spring, the SLS partners with the MNRF to conduct a citizen science program called "Walleye Watch", which asks volunteers living on the lake to peer into the water at night with a flashlight and count the number of walleye (by their shining eyes) at their shoreline. This will help determine walleye populations and spawning areas.All the information gained should facilitate the management of the walleye fishery and restoration measures. Permits pending, the SLS is partnering with OFAH to create new spawning beds for walleye rehabilitation in the lake.

With generous funding from the McLean Foundation, RBC Bluewater Project, the Ontario Trillium Foundation, and private donors, as well as knowledge, time and other resources from volunteers and partner organizations, the SLS and partners are conducting this important research for a total of four years!

All the while, efforts are being made to communicate findings with the public and the scientific community through informative videos, presentations, and annual roundtable events. You can watch the videos through the SLS's YouTube channel. I highly recommend that you subscribe to it. See https://www.youtube.com/channel/UCBwJ9rF6toXrKhReQ8fzT9A.

Lake Scugog Enhancement Project

This ambitious project will see the creation of a new engineered wetland on the Port Perry waterfront to improve the quality of stormwater entering the lake from the Port Perry urban area, which contributes approximately 20% of the yearly increased phosphorus load to the lake. The design will accomplish the removal of not only nutrients, but significant suspended solids using oil and grit separators and a four acre engineered wetland. The lake edge of this wetland will be a berm topped with an attractive pedestrian walkway, and fishing areas and habitat. Material dredged from the lake bottom will be used for the 17 acre filtering wetland which will then be planted with native plants and shrubs. Final permits from Fisheries and Oceans Canada and other agencies are well on the way for this project which has been in planning for more than three years. It is thought that it will cost in the range of $2.5 million and although it is listed as a Township of Scugog Project, Kawartha Conservation and the Scugog Lake Stewards are also partners. There are so many environmental, economic, and recreational benefits to this project, and it will be amazing to see this type of restoration take place. You can stay up to date on this project at www.lakescugogenhancement.ca and support it with your donations.

You can follow the Scugog Lake Stewards on Facebook, YouTube, and on their website at www.scugoglakestewards.com.

Dr. Thienpont and volunteer Guy Latreille measuring water chemistry through the ice on Lake Scugog.

2016 Kawartha Lakes Sewage Treatment Plants Report

Mike Dolbey Ph.D., P.Eng., KLSA Director

Each year, KLSA monitors the performance of Sewage Treatment Plants (STPs) that discharge effluent either directly to the Kawartha Lakes or their watershed, or to waterbodies that flow into the Kawartha Lakes. The purpose of STPs is to protect public health by minimizing the discharge of pathogens and to protect the environment by minimizing the discharge of phosphorus (P) to our lakes. Of primary interest to KLSA is the quantity of phosphorus that is discharged by these plants to our lakes because phosphorus is known to be the limiting nutrient that controls the growth of aquatic plants and algae.

Lake management studies have shown that the amount of phosphorus now discharged from STPs is only a small percentage of the phosphorus entering our lakes from all sources. This was not always the case. Prior to the 1970s, STPs discharged between 50 and 100 times more phosphorus than modern STPs. Unlike most other phosphorus sources that are widely distributed, STPs are localized sources that can be controlled and municipalities spend considerable taxpayers' dollars to build and operate these plants to protect our health and the environment.

KLSA monitors the performance of STPs to determine if they are being operated to their fullest potential. Ideally KLSA would like all STPs that discharge directly to our lakes to achieve a 99% phosphorus removal rate. This means that only one part in 100 of the phosphorus entering the plant leaves in the effluent. A drop of removal efficiency to 95% means five parts in 100 leave the plant, a 500% increase in phosphorus release compared to 99% removal efficiency. What might seem like small changes in removal efficiency can have very large consequences!

As we have indicated in past years, our STP data is always one year behind, because the reports for the previous year are not available to us before going to press. In past years most of these reports were available online on the websites of their respective municipalities. Due to changes in the City of Kawartha Lakes website, the reports for their plants were not available online but were provided upon request.

Again this year we have included three STPs, Minden, Port Perry and King's Bay, which do not discharge directly into the Kawartha Lakes. These plants are upstream of our Kawartha Lakes and have at least one body of water in between to attenuate the effects of their effluent discharge.

Minden

Minden's STP discharges to the Gull River just above Gull Lake, which is two lakes away from our most upstream Kawartha lake, Shadow Lake. In 2016 this plant incorrectly reported an overall removal efficiency of 98.2%. This was the best removal efficiency achieved in the month of December. The average annual removal efficiency was only 94.8% without accounting for bypasses. During the year Minden's STP was overwhelmed by rain causing bypassing of its tertiary filters on five occasions. Twice, the Orde Street pumping station bypassed raw sewage to the Gull River. An estimated 96840 m^3 of raw or partially treated sewage entered the river. Total Phosphorus (TP) content of samples taken during these events varied considerably but it is estimated that the P load to the river from these events was 22.9 kg, slightly higher than the 22.0 kg output of the plant for the whole year. This total annual P load of 44.9 kg reduced the Minden STP's effective removal efficiency to 89.7%. A break in a sewer main close to the plant caused a spill of approximately 75 m^3 of raw sewage to a field. This was cleaned up without any escaping to the river.

Average *E. coli* discharges were generally low during the year but on several occasions readings as high as 81 colony forming units per 100 mL (cfu/100mL) were recorded. During the bypass events in March the geometric mean of 3 readings was a high 1688 cfu/100mL well above the plant's Certificate of Approval level of 200 cfu/100mL.

Coboconk

This lagoon system continued to function well in 2016, with planned discharges to the Gull River just above town occurring in April, May and December. The average phosphorus content of effluent discharges was 0.05 mg/L in the spring and 0.08 mg/L in the fall. With lagoon systems such as Coboconk's, the volume of effluent released from the lagoons each year may be considerably more or less than the volume of raw input to the plant during the year. This may be due to operational considerations and variable amounts of precipitation and evaporation. Hence, determining the phosphorus removal rate is problematic. Considering all inputs and outputs over the past six years, the overall phosphorus removal rate was greater than 97.6% during that period and the 2016 total annual discharge of phosphorus was estimated to be 4.16 kg.

Average *E. coli* in the discharges in spring and fall were a low 3.4 and 1.4 cfu/100mL respectively. No spills, bypasses or overflows were reported. Six odour complaints that were attributed to the hot dry summer and lower than normal inflows to the lagoons were received between May 31 and July 29.

Fenelon Falls

In 2016 the Fenelon Falls Waste Water Treatment Plant (WWTP) performed adequately with no spills or overflows at the plant. The annual average removal rate was 96.0%, down slightly from last year's 96.3% and well below our target of 99%. This resulted in a P discharge from the WWTP to Sturgeon Lake of 28.4 kg for the year. However, heavy rains at the end of March overwhelmed the Colbourne pumping station resulting in the discharge of 9000 m^3 of raw influent (sewage and stormwater) to the Fenelon River over five days. It is estimated that this could have resulted in as much as 10.4 kg of phosphorus entering Sturgeon Lake. (No sampling of the bypassed material was reported so the estimate is made based on the average monthly TP concentration of raw influent for March). Consequently, the Fenelon Falls system as a whole discharged a total of up to 38.8 kg of phosphorus to Sturgeon Lake and had an effective P removal rate of 94.6%.

Bypasses at the Colbourne pumping station have occurred many times over the past six years. Work began on a holding tank at the Ellice Street pumping station to solve the problem in April 2016. It was completed in April 2017.

Again this year *E. coli* levels in the effluent from the Fenelon Falls WWTP were generally low with an annual average of 3.2 cfu/100mL. There were several odour complaints from a resident on Ellice Street near the WWTP. No details of time of year or cause were given.

Lindsay

The Lindsay WWTP is the largest on the lakes.The City of Kawartha Lakes (CKL) operated the Lindsay WWTP until July 31, 2015, after which its operation was contracted to the Ontario Clean Water Agency (OCWA) which operates all the other sewage treatment plants owned by CKL. In 2016 the Lindsay WWTP operated very well with no reported spills, bypasses or abnormal discharges. It is estimated that the 2016 annual average phosphorus removal rate was greater than 98.7%. This would result in a P discharge to Sturgeon Lake of less than 176.7 kg, down from 239.4 kg last year. (The minimum resolution for TP concentration measurements of effluent is 0.03 mg/L. When one or more samples during a month are reported as <0.03 mg/L, the average of all samples is reported as <average mg/L. Our calculations use the average monthly concentrations resulting in the 'less than' and 'greater than' terms above).

The annual average *E. coli* in the discharge was 3.5 cfu/100 mL. One complaint about odour near the Jennings Street Pumping Station was reported in 2016. Remedial actions were taken.

Bobcaygeon

This town has two side-by-side sewage treatment plants constructed at different times that share a combined outfall into Pigeon Lake. In the past, one of the plants was problematic, with operational problems and high phosphorus discharges as documented in the separate reports for each plant. In 2010, the Ministry of the Environment and Climate Change (MOECC) recommended a single "combined" effluent sampling program with only one performance report being produced for the combined output of the two plants (or process streams as they are now referred to). In 2016 the average removal rate was calculated to be 95.8%, down considerably from last year's 98.0% and well below our desired target of 99%. The reported annual phosphorus load was 125.6 kg, more than double last year's 51.8 kg and by far the highest since we began reviewing these plants in 2012.

There were no operational problems reported that explain the apparent poor performance. Inflow of raw influent was about 20% higher in 2016 than 2015 but monthly effluent TP concentrations in 2016 were virtually double the corresponding values the year before. Because one report summarizes the performance of the two STPs, it is not possible to tell if one STP is operating well and the other poorly or if both STPs are operating in a similar way. The Ontario Clean Water Agency (OCWA), who operate the plants, suggested that high flows through the plant in the spring of 2016 resulted in the poor performance but a comparison with previous years does not appear to support this explanation. The higher than normal effluent phosphorus concentrations began in December 2015 when flows were low and continued throughout most of 2016 after high spring flows had subsided. They dropped to normal level by December 2016. It will be interesting to see if the improvement continues in 2017.

E. coli discharges were relatively high at 31 cfu/100 mL on an annual basis. One spill of only one litre was reported and no bypasses or abnormal discharges occurred during the year. One odour complaint was received in July. Various odour abatement technologies have been studied and rejected. Meanwhile, operational strategies are being employed to minimize the impact of odour on local residents.

Omemee

This facility consists of two large settling lagoons. Until 2014 all of the effluent was spray-irrigated onto nearby fields during the summer months. A subsurface effluent disposal system began commissioning trials at the site in March, 2014 and operated simultaneously with the spray-irrigation system for parts of that year. Both the spray irrigation and subsurface disposal systems were used in 2015 and 2016. Earlier problems with water breaking through the mantel (surface) of the subsurface disposal system did not occur in 2016 but there were other issues with the system including pump failures, valve issues and broken pipes which were either replaced or repaired. Despite the problems, approximately 25% of the year's effluent was disposed of by this system during the cold winter months. The remainder was applied to fields by a spray irrigation system between April and October.

We are pleased to see that more detailed information about the quantity and quality of raw influent and treated effluent continued to be provided for this facility in 2016. The average effluent phosphorus concentration in 2016 was 0.39 mg/L, well below last year's 1.6 mg/L and the allowable 1.0 mg/L. Lagoon systems can have considerable volume buffering capacity with the volume of raw influent and treated effluent varying considerably from year to year. In 2016 the effluent discharged was about 80% of the influent volume. Based on the numbers provided, phosphorus removal was estimated to be ~85% with ~67.3 kg being distributed to the irrigation fields and subsurface system. However, because the effluent is applied to land far from Pigeon Lake, removal is probably almost 100% with respect to our lakes.

The annual average *E. coli* level in the effluent was a high 496 cfu/100 mL this year. This lagoon facility did not require any emergency discharges to the Pigeon River in 2016 and there were no spills or bypasses reported and no complaints were received.

King's Bay

The King's Bay STP serves a golf course community situated on a peninsula between Lake Scugog and the Nonquon River. Houses down the centre of the peninsula are surrounded by the golf course. Treated effluent from the STP at the apex of the peninsula is discharged into two large disposal beds under the golf course on each side of the peninsula. One up-gradient and three down-gradient wells are located around each disposal bed to monitor groundwater for phosphorus migration.

This plant functioned well in 2016 until a major breakdown of one of the two Rotating Biological Contactor units (RBC#2) in November. Until repairs are completed sometime in 2017 all treatment is dependent on RBC#1. Effluent TP concentration of discharge to the underground disposal beds averaged 0.27 mg/L, down from 0.29 mg/L in 2015, out of an allowable 1.0 mg/L. The annual daily loading for 2015 was 0.012 kg per day, less than 10% of the allowable discharge of 0.17 kg per day. Phosphorus annual average removal efficiency within the plant was an excellent 99.4% this year. No bypasses, spills or abnormal discharges occurred in 2016 and there were no complaints about the plant.

Monitoring wells located both up and down gradient from the disposal sites have had sporadic high TP readings in past years. In 2016 the TP measurement procedure was changed to collecting a field filtered grab sample from each well twice a year. TP levels in all wells were very low this year. The purpose of the monitoring wells is to detect phosphorus migration towards the lake or the Nonquon River. Since these wells average 100 m from the lake or the Nonquon River, it is probable that, at least for the time being, we still have effectively 100% removal.

Port Perry

This plant consists of lagoons that discharge seasonally into the Nonquon River northwest of Port Perry, which, in turn, empties into Lake Scugog at Seagrave, where the King's Bay facility is located. In 2016, phosphorus was reduced to a monthly average of 0.09 mg/L for a total loading of 75.7 kg, up slightly from last years 69.7 kg but significantly less than in earlier years. This reflects a good removal rate of 97.7%. No information was provided about *E. coli* levels this year. There were no reported bypasses or spills and no odour complaints during 2015.

The Port Perry lagoons are being replaced by a new tertiary treatment plant to allow for the expansion of Port Perry. Construction began in May 2015. Commissioning of the new plant is scheduled for the winter of 2017. This new plant will have a much larger capacity than the old lagoon system and should result in reduced phosphorus discharge amounts and, we hope, a 99+% removal rate that we would like to see attained by all STPs in our area.

Summary

The total weight of phosphorus discharged to the mainstream Kawartha Lakes from the Lindsay, Fenelon Falls and Bobcaygeon WWTPs in 2016 was 341 kg, slightly more than last year's 318 kg. If we include all the plants that we now monitor, we had total phosphorus loading to the lakes of 465 kg in 2016 compared to 407 kg in 2015. If all plants were to achieve the 99% removal rate that we would like, the total phosphorus discharge for the year would have been about 211 kg or about 45% of the 2016 total.

2016 Kawartha Lakes Sewage Treatment Report

KLSA Annual Review of Area Sewage Treatment Plant Performance

Plant Location - Discharges to & Type	Year	Phosphorus Removal Rate % (1)	Total Annual TP Load Out kg (2)	Annual TP Load if 99% kg (3)	E. coli (cfu/100 ml)	Bypasses, Spills, Comments
Minden - Gull river	2012	98.0%	12.8	6.4	2.7	None reported
Extended aeration activated sludge	2013	90.1%	53.9	5.4	7.2	Bypass resulted in ~40 kg extra P load
process with tertiary treatment	2014	96.7%	19.4	5.8	9.0	None reported
	2015	96.4%	17.9	4.9	68.0	None reported
	2016	89.7%	44.9	4.4	81.0	Bypass resulted in ~22 kg extra P load
Coboconk - Gull River Mill Pond	2012	99.4%	1.2	1.2	5.5	None reported
Dual lagoons	2013	97.4%	3.2	1.0	12.4	None reported
semi annual discharge to river	2014	>97.8%	< 3.1	1.7	3.7	None reported
	2015	>98.0%	< 2.2	1.1	2.5	None reported
	2016	>97.6%	4.2	1.2	3.4	None reported
Fenelon Falls - Sturgeon Lake	2012	97.3%	27.5	8.7	2.0	Bypass resulted in ~ 8.1 kg extra P load.
Extended aeration activated sludge	2013	95.2%	45.6	9.1	2.0	Bypass resulted in ~ 19.1 kg extra P load.
process with tertiary treatment	2014	94.5%	51.8	9.1	2.0	Bypass resulted in ~ 21 kg extra P load.
	2015	96.3%	26.3	7.2	2.0	None reported
	2016	94.6%	38.8	7.2	3.3	Bypass resulted in ~ 10.4 kg extra P load.
Lindsay - Sturgeon Lake	2012	98.1%	193	101.6	2.4	None reported
Flow equalization lagoons;	2013	98.0%	220	112.2	4.0	None reported
extended aeration activated sludge	2014	96.0%	622	149.7	2.6	Bypass resulted in ~ 402 kg extra P load.
process with Actiflo tertiary treatment	2015	>98.2%	<239.4	131.7	2.5	None reported
	2016	>98.6%	<176.8	134.3	3.5	None reported
Bobcaygeon - Pigeon Lake	2012	97.8%	43.2	19.6	2.5	None reported
Extended aeration activated sludge	2013	96.9%	85.4	27.5	3.4	None reported
process with tertiary treatment	2014	97.9%	61.7	29.4	7.4	None reported
	2015	98.0%	51.8	26.9	21.0	None reported
	2016	95.8%	125.6	30.0	31.0	Spill of 1 Litre reported
Omemee - Fields/Underground	2012	100.0%	0	0.0	309.0	None reported
Dual lagoons with spray irrigation;	2013	100.0%	0	0.0	-	None reported
pumped into underground disposal	2014	100.0%	0	0.0	-	None reported
beds beginning 2015	2015	100.0%	0	0.0	143.0	None reported
	2016	100.0%	0	0.0	496.0	None reported
King's Bay - Underground	2012	100.0%	0	0.0	-	None reported
Pumped into underground disposal	2013	100.0%	0	0.0	-	None reported
beds.	2014	100.0%	0	0.0	-	None reported
	2015	100.0%	0	1.1	-	Spill resulted in ~1.14 kg release to lake
	2016	100.0%	0	0.0	-	None reported
Port Perry - Lake Scugog	2012	96.7%	148.9	45.1	-	None reported
6 lagoons, 2 extended aeration cells	2013	97.0%	121.3	40.4	-	None reported
effluent discharge to Nonquon River.	2014	96.6%	144.2	42.4	-	None reported
	2015	98.2%	69.7	37.8	-	None reported
	2016	97.8%	75.3	33.6		None reported

(1) 'Phosphorus Removal Rate %' is the percentage of the phosphorus in the plant influent that is removed before effluent is discharged.
(2) 'Total Annual TP Load Out kg' is the total weight of phosphorus, in kilograms, that is discharged from the plant during the year.
(3) 'Annual TP Load if 99% kg' is the total weight of phosphorus, in kilograms, that would be discharged from the plant during the year if the plant achieved a 99 % Phosphorus Removal Rate.

Osprey in Flight

Photo by Robin Blake

E. coli Bacteria Testing 2017

Kathleen Mackenzie
KLSA Vice-Chair

During one of the coolest and wettest summers in years, KLSA's volunteer testers stalwartly gathered their water samples for bacteria testing. Dodging the rainstorms, they were able to test 64 sites on 11 Kawartha Lakes, most of them six times over the summer. Thanks to all of our dippers and deliverers.

Despite the high rainfall and resulting high runoff throughout the summer, *Escherichia coli* counts were, overall, similar to other years (see chart below). The vast majority of readings were under 20 *E. coli* colony forming units (cfu)/100 mL, with a small number between 21 and 100, and a very few over 100. Since 100 *E. coli* cfu/100 mL is the level at which beaches are closed, almost all of these elevated sites were retested within a few days, and counts returned to normal.

See Appendix E for complete results.

For an overview of 17 years of *E. coli* testing by KLSA volunteers, please refer to Mike Dolbey's article in this issue.

KLSA would like to have bacteria testing on the more western Kawartha Lakes. All we need is a few volunteers, plus a coordinator to work with the laboratory at Fleming College. Please let us know if you are on Balsam, Sturgeon, Cameron or west Pigeon and are interested in participating in this important program. (kawarthalakestewards@yahoo.ca).

If you would like to test a location of your choice on your lake, please let KLSA know. There is an excellent instructional video about bacteria testing on our website in the 'Published Material' section if you would like to see what is involved.
https://www.youtube.com/watch?v=rBQX44RYw3E&feature=youtu.be

Number of Readings				
Year	0 – 20 *E. coli* cfu/100 mL	21 – 50 *E. coli* cfu/100 mL	50 – 100 *E. coli* cfu/100 mL	Over 100 *E. coli* cfu/100 mL
2017	324	16	6	6
2016	351	12	6	3
2015	296	17	16	5
2014	333	23	13	1
2013	335	14	7	3

Wood ducks on Lower Buckhorn Lake

Photo by Robin Blake

Phosphorus Testing 2017

Kathleen Mackenzie KLSA Vice-Chair
Mike Dolbey PhD, P.Eng, KLSA Director

Taking water samples in the summer of 2017 was not the usual joyride! Thank you to all our volunteers who managed to get out in the late, wet spring, despite waterlogged docks, and who then persevered throughout a cool, rainy summer. Total phosphorus (TP) was tested at 44 sites on 14 lakes, 5 or 6 times over the summer. Samples were analyzed by the Ministry of the Environment and Climate Change's Lake Partner Program. We now have up to 16 years of measurements on these lakes - an unusually complete database!

The multi-lake database is especially important for two reasons. First, our lakes are closely linked so that a change in water quality in one lake will affect the lakes downstream. Second, the Kawartha lakes show quite a variation in phosphorus levels between lakes, and it's interesting to 'tease out' the reasons for these differences.

To current volunteers: If you are unable to continue testing, please let any KLSA Director know, so we can help find a replacement for you. To new volunteers: The program is free, and kits are mailed to you along with instructions. We have fairly complete coverage of the Kawartha Lakes, but are looking for testers on Cameron Lake, south Pigeon Lake, and Chemong north of the causeway. Please let us know if you are interested.

What follows is a summary of the 2017 results. The complete chart of TP measurements and Secchi average measurements is found in Appendix F.

Why measure phosphorus levels in lake water?
Phosphorus is generally the chemical that is most responsible for increased algal growth in freshwater lakes, causing murky water. Sources of phosphorus include shoreline erosion, fertilizers, wildlife, septic systems, sewage treatment plants and pet waste. Limited fertilizer use and a well-vegetated shoreline are good ways to limit your phosphorus input.

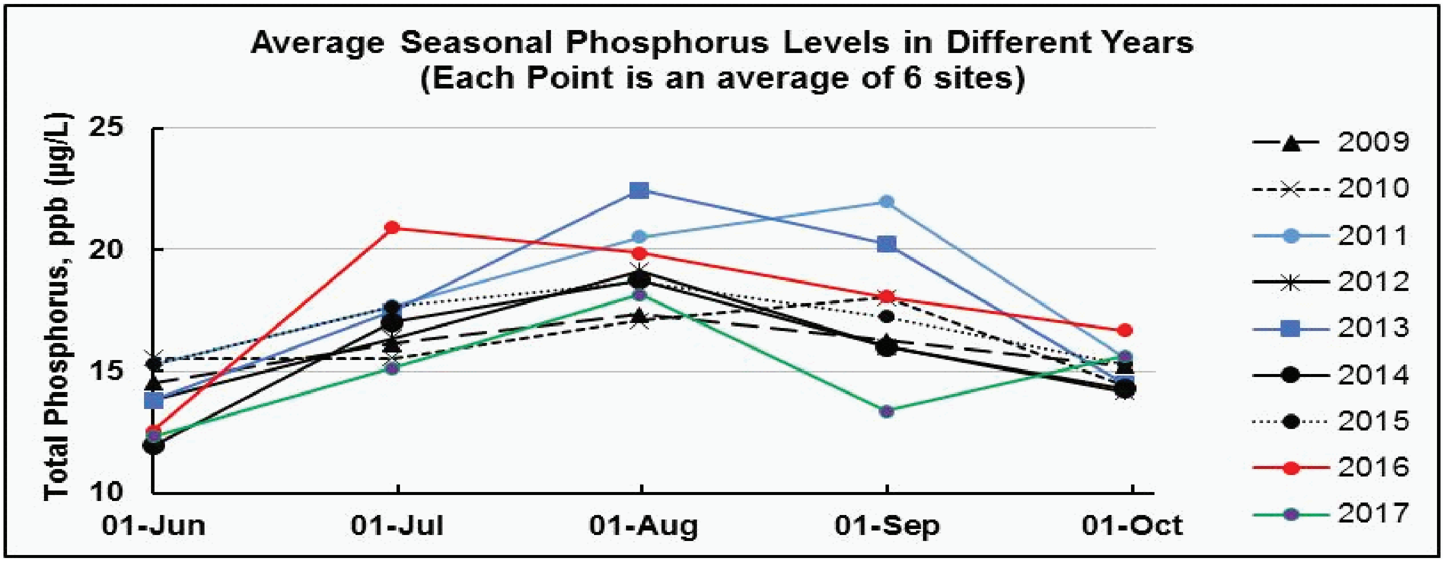
The Ontario Ministry of the Environment and Climate Change has issued the following guidelines for total phosphorus in our lakes:

- To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L
- A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 µg/L or less.
- (Note: 1 µg/L is the same as 1 ppb, a unit referred to later in the article)

2017: A Low Phosphorus Year
2017 was a low phosphorus year, (see graph below, "Average Seasonal Phosphorus"). The low spring phosphorus levels were probably the result of an extremely wet May (see table below, "Rainfall 2017 Compared to 30-year Average"). Spring rains 'flush' the Kawartha Lakes with low phosphorus water from the north. The low phosphorus levels in August and September may have been due to less rainfall and resulting lower runoff. However, there are other factors which might have affected phosphorus levels. For instance, the author remembers the lakes were unusually cool, and this would have affected the biological cycles in the lakes (e.g., less growth, less die off). It is very difficult to identify factors affecting phosphorus levels in our complex lake ecosystems.

Rainfall 2017 Compared to 30-year Average (Peterborough Trent U station)

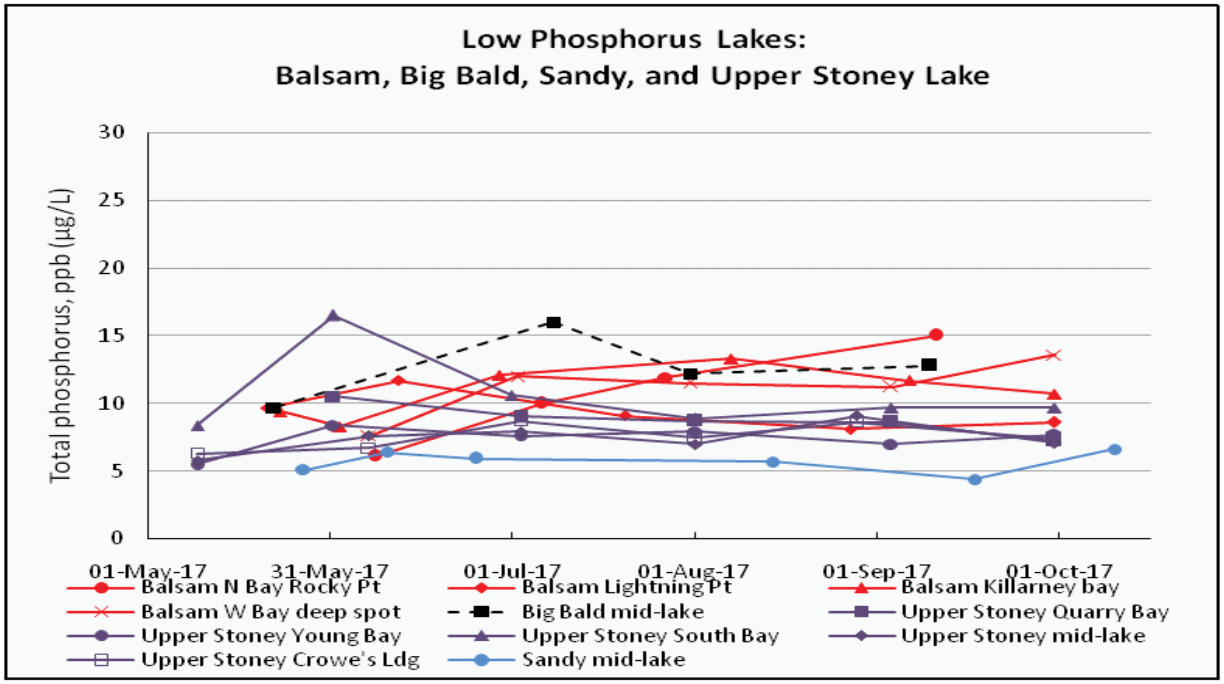
Rainfall mm	May	June	July	August	September
30-year average	90	84	76	88	93
2017	170	87	87	67	45



It seems that a soggy May and a cool summer may keep phosphorus levels down. Perhaps this was the silver lining to our less-than-ideal summer of 2017!

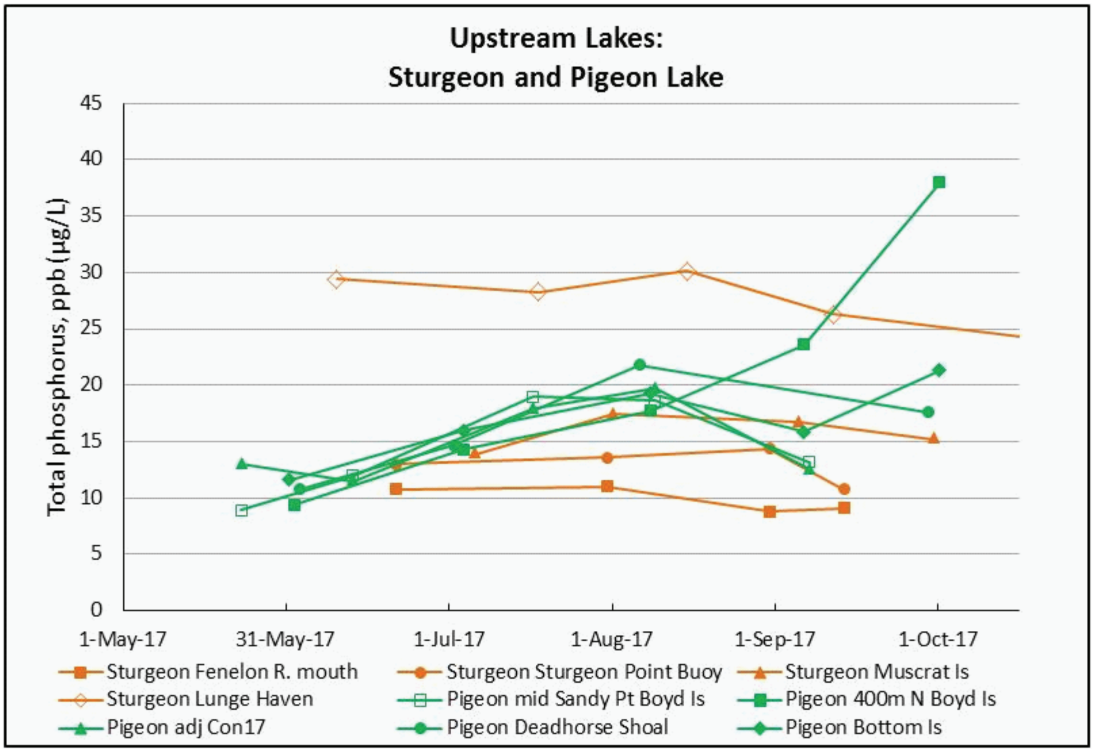
Lake-to-Lake Phosphorus Results

Although phosphorus levels were unusually low in 2017, the patterns remained the same throughout the Kawarthas. For comparison purposes, KLSA has classified the lakes as low phosphorus lakes, upstream lakes, midstream lakes, and downstream lakes.



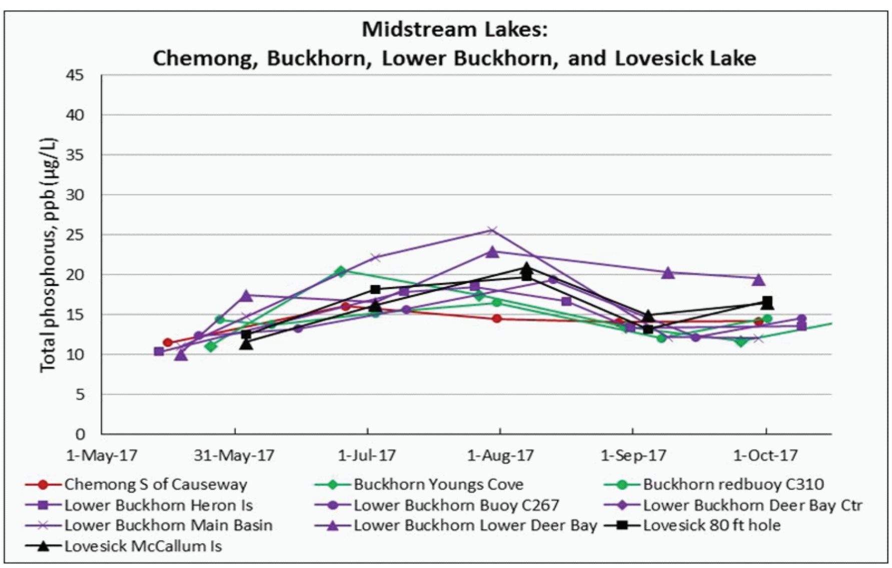
Low Phosphorus Lakes

The phosphorus levels in these lakes remained under 15 ppb all summer. Upper Stoney and Balsam Lake are fed with low phosphorus water from the north all summer. Sandy Lake is chemically unique among the Kawarthas, as much of its phosphorus is precipitated down into the sediments to form marl.



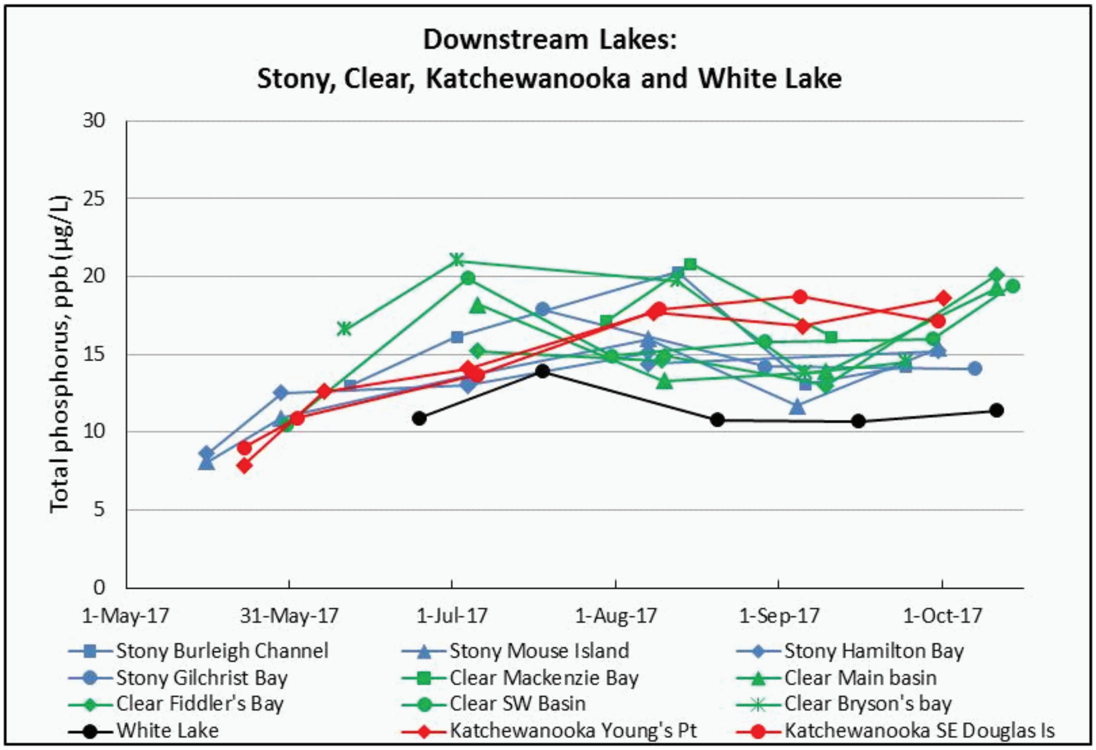
Upstream Lakes

As water flows down the Trent-Severn Waterway (TSW), the phosphorus levels rise somewhat. The Lunge Haven site is an exception; it is at the south end of Sturgeon Lake where it receives inflows from Lindsay via the Scugog River. It is the mixing of this high phosphorus water with the water from the Fenelon Falls site that results in higher phosphorus level at Sturgeon Point. The high reading in October at Pigeon Bottom Is. is puzzling; there was a rise similar to this in 2016.



Midstream Lakes

These lakes have similar phosphorus levels to the upstream lakes. As in previous years, there are somewhat higher levels in the Lower Deer Bay and Lower Buckhorn Main Basin sites.



Downstream Lakes
As seen in previous years, Stony Lake's phosphorus levels at the Burleigh Channel are similar to Lovesick Lake, which is directly upstream. However, the other two Stony Lake sites, which are mixed with water from low phosphorus Upper Stoney Lake, are somewhat lower in phosphorus. Levels increase slightly in Clear Lake and are similar in Katchewanooka. As usual, White Lake, which flows directly out of Gilchrist Bay on Stony Lake, has relatively low phosphorus levels. Our guess is that there are low phosphorus springs that feed this small, relatively shallow lake.

In conclusion, 2017 showed phosphorus differences among the lakes that were very similar to those in other years. These differences were less obvious because, overall, phosphorus levels were lower than in any other year since we started measuring in 2002.

Paleolimnology Study: Status and Update

Kawartha Lakes Paleolimnology Study: Status and Update

W. A. Napier, Chair, Kawartha Lake Stewards Association
Dr. Brian Cumming, Professor and Head, Department of Biology, Queen's University
Dr. Kathleen Laird, Paleoecological Environmental Assessment and Research Laboratory, Queen's University

Introduction

The Kawartha Lake Stewards Association (KLSA) along with its partners have undertaken a sediment core study at the bottom of three lakes (Cameron, Pigeon and Stony) to identify whether or not these lakes were subject to human-induced eutrophication (also called cultural eutrophication). Eutrophic status refers to the productivity of a lake, with oligotrophic being low nutrients, low productivity, eutrophic being high nutrients, high productivity, and mesotrophic being somewhere in the middle. Figure 1, "The process of lake eutrophication" (reference: Quebec Volunteer Lake Monitoring Program:, Ministère du Développement durable,de l'Environnement et de la Lutte-contre les changementsclimatiques. http://www.mddefp.gouv.qc.ca/eau/rsvl/methodes-en.htm), below, shows the various lake stages related to natural, long-term eutrophication over thousands of years under stable climatic conditions, and cultural eutrophication, a process that occurs over decades. Cultural eutrophication results in increased algal biomass (i.e., more primary production caused by nutrient loading). For more information on the origins of this study and the applications of paleolimnology techniques, please see the KLSA 2016 Annual Lake Water Quality Report (Napier and Cumming,Paleolimnology: what is it and why is it useful?; and Cumming and Napier, Kawartha Lakes Paleolimnology Study: Collection, Analysis and Age-dating of Sediment Cores).
Sediment cores were collected by Queen's University in three lakes: Cameron Lake, Pigeon Lake and Stony Lake (Cumming and Napier: 2016 KLSA Annual Report).

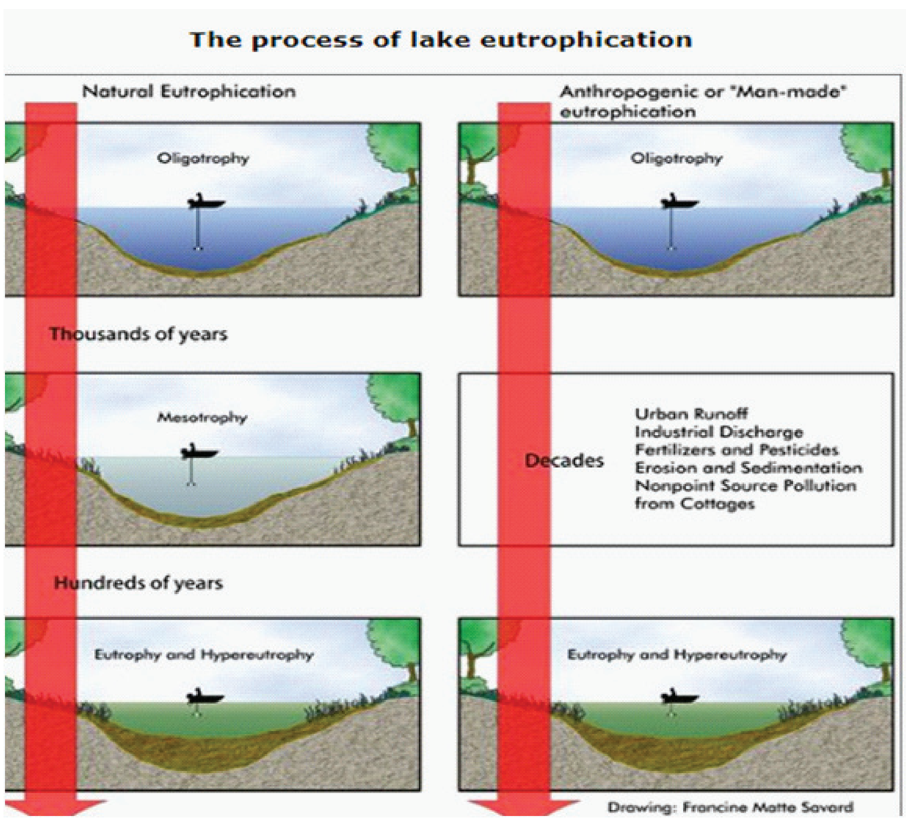


Table 1. A summary of the array and status of the analyses and techniques used to assess the sediment cores

Parameter	Description	Status
Sample collection and analysis	Sample collected at locations selected by Queen's University following sub-bottom profiling of the location	Complete
Age-dating	The core is split into 0.5 cm intervals and age dated by measuring the activities of radioisotopes of 210Pb and 137Cs.	Age-dating analysis complete, but pollen analysis will be added to identify the arrival of European settlers in the 1800s.
Identifying diatom communities	Diatoms are algae that are well preserved in lakes sediments. The assemblages of diatoms can be used to estimate the historical Total Phosphorus (TP) concentrations. Changes in the diatom assemblages determine if the lake has changed in trophic status (i.e., from oligotrophic to mesotrophic to eutrophic or hypertrophic), as well as provide an estimate of nutrient levels and natural variation prior to large-scale activities in the catchment of a lake (see Figure 1).	Complete
Fossil pigments	Provides an indication of the major communities of algal assemblage composition and how the algae community has changed over time. For example, the change in the presence of blue-green algae can be detected.	Complete
Spectrally-inferred Chl *a* estimates of total algal production	Provides a proxy of overall lake production from algae, and can be used in conjunction with estimate from algal pigments to determine changes overall lake production.	Complete
Elemental analysis	The elemental analysis measures the concentrations of metals in lake sediment.	Complete
Organic matter	Measures the difference between the deposition of organic matter (carbon based material left by living organisms – plants and animals) and inorganic matter (void of organic carbon such as sands and minerals).	Complete
Pollen analysis	The male reproductive grains of seed plants that can be used to identify changes to the terrestrial vegetation. In this case, pollen analysis will be used to identify the time horizon with European settlement (i.e., forest clearance, and the resultant increase in key species including ragweed).	Added to project to determine the European settlement horizon in the cores, due to relatively low 210Pb activity.

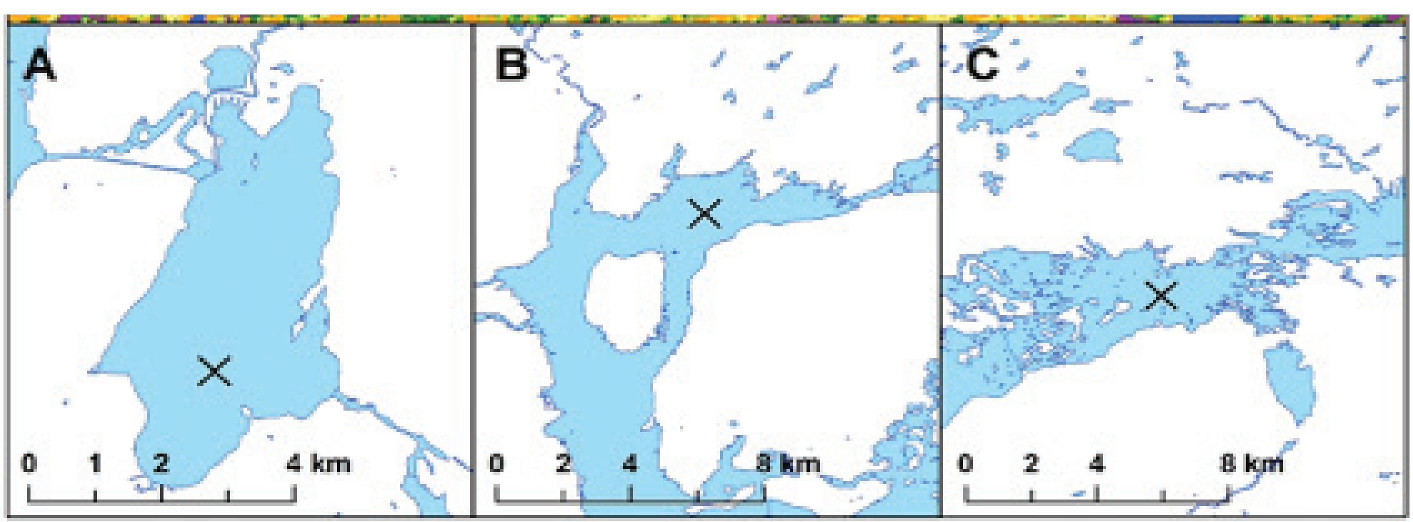
As noted in Table 1, the interpretation of the age of each core segment is being refined, by identifying the settlement horizon in this region. The deeper and older the core the greater the uncertainty in the date assigned to the core segment. It is expected this analysis and interpretation will be completed this year, which will be used to help refine the settlement horizon in the cores. Additional analyses on changes in subfossil cladocerans in the core from Pigeon Lake by M. Stein, an undergraduate student at Queen's University is currently underway.

A. Preliminary Results

Cluster analysis, a multivariate statistical technique, was used to identify major zones in the sediment cores defined by the diatom assemblages, thereby allowing a framework to discuss the changes over the period of time covered by the sediment cores. A summary of the preliminary results of sediment core analysis is provided in Table 2.

Table 2: Preliminary Interpretation of the Sediment Core Samples

Lake	Preliminary Results
Cameron Lake	Diatom-inferred Total Phosphorus (TP) concentrations increased in the 1800s and 1900s but since the early to mid-1900s have been trending towards TP concentrations similar to pre-colonization times. However, pigment proxies suggest a post-1950 shift toan algal assemblage consisting of cryptophytes and slight increases in green algae and cyanobacteria.
Pigeon Lake	Changes in diatom assemblages and increases in biogenic silica assemblages suggest a continuous shift towards more eutrophic conditions since the early-to-mid-1800s. These changes are supported by increases in concentrations of algal pigment. Post-1990s increases in scaled chrysophytes and increases in cyanobacteria also occur in the core from Pigeon Lake. Reductions of oligotrophic algae and the emergence of hypereutrophic diatoms and cyanobacteria are noted.
Stony Lake	Changes in production in Stony Lake are complex, but diatom-inferred TP conditions have generally increased over time. Sediment core suggests there was an event that caused a significant increase in TP some centuries ago. During the last 100 years TP concentrations are constant but a noticeable shift to eutrophic algae.Cyanobacteria have increased post-1990.



Map showing the location of the cores in the three Kawartha study lakes used in this study: (A: Cameron, B: Pigeon, C: Stony)

Table 3 provides the metal results found in the top 3.5 cm of the sediment core.
The metal concentrations are compared to the Ontario Sediment Guidelines.

Table 3: Preliminary Review of Metal in the Sediment Core

	Provincial Guidelines			Lakes		
Metal	**BL**	**LEL**	**SEL**	**Cameron**	**Pigeon**	**Stony**
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Arsenic	4	6	33	6.1-11	6.4 - 7.3	6.4 - 7.1
Cadmium	1	0.6	10	0.55 - 1.0	1.7 - 1.8	2.2- 2.3
Chromium	31	26	110	26-31	33-35	27 – 29
Copper	25	16	110	23-29	53 – 57	48 – 50
Iron	30,000	20,000	40,000	61,000-77,000	40,000 - 42,000	33,000 - 36,000
Lead	23	31	250	24-51	79 – 82	170-180
Manganese	400	460	1100	910-3800	1500 - 4100	960 - 2200
Nickel	31	16	75	11 to 14	21-26	19
Zinc	65	120	820	130 -180	220 - 240	250- 260

Notes:

(i) BL: Background level for pre-colonial Great Lakes Sediment.

(ii) LEL: Lowest Effect Level indicates a level of contamination that can be tolerated by the majority of sediment-dwelling organisms. Sediments meeting the LEL are considered clean to marginally polluted.

(iii) SEL: Severe Effect Level indicates a level of contamination that is expected to be detrimental to the majority of sediment-dwelling organisms. Sediments exceeding the SEL are considered heavily contaminated.

(iv) The background levels, guidelines and definitions for LEL and SEL can be found in *"Guidelines for Identifying, Assessing and Managing Contaminated Sediments in Ontario":* https://www.ontario.ca/document/guidelines-identifying-assessing-and-managing-contaminated-sediments-ontario)

B. Preliminary Conclusions

General comments

All lakes have shown the effects of cultural (human-accelerated) eutrophication to varying degrees. Shifts in the aquatic ecosystem of each lake can be attributed to landscape changes causing increased runoff, the addition of phosphates (fertilization) and the introduction of invasive species. Recent changes are likely the result of complex interactions involving zebra mussels and a changing climate that influences lake seasonality and growing season. The introduction of zebra mussels has reduced the amount of algae in the lakes, which resulted in a clearer water column. This has allowed for the proliferation of aquatic plants (the clearer water allows deeper light penetration coupled with the zebra mussels increasing the amount of available phosphate). For more information on zebra mussels in the Kawartha Lakes see page 53 of the KLSA 2005 Annual Report: What about Zebra Mussels?

Metal concentrations

Manganese (Mn) exceeded the sediment SEL in all the lakes and iron exceeded the SEL in Cameron and Pigeon Lakes. Over the past centuries, manganese concentrations have increased 6-fold in some of the core samples. The increase in Mn concentrations has been observed in a core from Lake Wabagashik, a circumneutral lake near Sudbury (Cumming, personal communications). The Ontario sediment guidelines referenced above contains a Figure entitled: *Decision-Making Framework for Contaminated Sediments* which provides the process to undertake a screening exercise to determine the risk to the aquatic ecosystem if results exceed the provincial sediment quality concentrations. Water quality manganese concentrations taken at Rosedale, Bobcaygeon and Burleigh Falls in 2000, 2001, 2002, 2015 and 2016 ranged from 3.5 ug/L to 29 ug/L. Manganese is one of the least toxic elements to animals. The federal "aesthetic" guideline for Mn in drinking water is 50 ug/L. This is because Mn can cause discolouration of clothes and plumbing and can cause an undesirable taste.

Cameron Lake
Balsam Lake and Cameron Lake are characterized as being on the threshold between oligotrophic (low productivity) and mesotrophic (moderately productive) water bodies. The reduction of historical TP is a positive outcome but the continuing presence of eutrophic algal species needs to be assessed. This matter is addressed in the Kawartha Conservation Balsam/Cameron Lake Watershed Management Plan. The Plan has developed a number of objectives and actions to maintain water quality and prevent accelerated eutrophication of the Lake. This Plan should be continued to be implemented.

The monitoring of Total Phosphorus in Cameron Lake is sporadic because of the lack of volunteers to undertake water sampling. While the Ontario provincial government will cover the cost of TP sampling, volunteers must collect the water samples. For the past three years, there have been limited samples collected in Cameron Lake. Without monitoring and the collection of long-term data, changes in the lake's water quality will go undetected.

Pigeon Lake
The recent TP concentrations indicate stable TP concentrations since the early 2000s. However, the sediment core data suggest that cyanobacteria may be increasing in the proportion of littoral cladocera species over time parallel the changes in the diatom assemblages (M. Stein, unpublished data). The shift suggests that littoral communities have increased in this lake over time.The reduction of oligotrophic algae and emergence of eutrophic and hypereutrophic algae and other proxies indicate Pigeon Lake has become increasingly eutrophic over the last several hundred years and has accelerated in the past few decades. The results of the paleolimnology study reinforces the need for immediate management action to prevent the continued deterioration of the lake's current aquatic ecosystem.

Stony Lake
It is unclear what caused the historical increase and then decrease in TP concentrations in Stony Lake. A major forest fire or other changes in the regional landscape could have caused a temporary influx of phosphate loadings. The TP concentrations are currently stable and organic productivity is not excessive. However, if there is an increase in TP a shift to a more eutrophic state is likely. The Clear, Ston(e)y and White Lake Plan identified this issue and made two recommendations (specifically #3 and #7) that need to be implemented by an accountable government agency. These recommendations are: *"3. Encourage our four townships to recognize the Lake Plan watershed philosophy in promoting lakeshore-specific legislation (policies and by-laws); and 7. The Lake Plan will develop stewardship incentives for community success in achieving lake-water improvement against specific goals and measures."*

C. Next steps
Once the analysis and interpretation of the data is completed the Report will be released. The Report should be finalized by June 2018. After the Report is released, KLSA will present the findings to the Lake Associations, key government agencies and interested members of the public.

D. Acknowledgements
KLSA would like to thank Dr. B. Cumming and Dr. K. Laird, PEARL, Queen's University for their work on the Report. The technical staff at Kawartha Conservation, Mr. B. Tregunno and Ms. D. Balika, provided valuable comments and Trent University's Dr. P. Frost assisted with the study design. KLSA is appreciative of the Project funders, the Stony Lake Heritage Foundation, the City of Kawartha Lakes, Kawartha Conservation and private donors.

Appendix A

Appendix A: KLSA Mission Statement, Board of Directors, Scientific Advisors and Volunteer Testers

KLSA Mission Statement

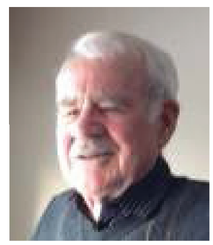
The Kawartha Lake Stewards Association (KLSA) was founded to carry out a coordinated, consistent water quality testing program (including bacteria and phosphorus) in lake water in the Kawartha Lakes. KLSA ensures that water quality test results, prepared according to professionally validated protocols with summary analysis, are made available to interested parties. The Kawartha Lake Stewards Association has expanded into research activities that help to better understand lake water quality and may expand its program into other related issues in the future.

2017 – 2018 Board of Directors

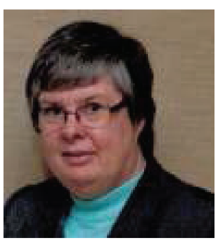
William A. Napier
Chair
Lovesick Lake

Kathleen Mackenzie
Vice-Chair
Stony Lake

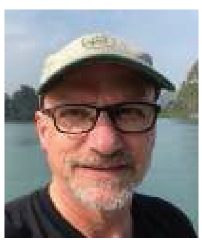
Lynn Woodcroft
Secretary
Buckhorn



Mike Stedman
Treasurer
Lakefield



Sheila Gordon-Dillane
Recording Secretary
Pigeon Lake

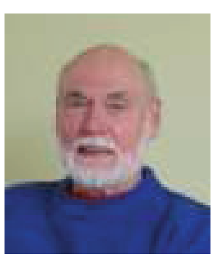


Jeffrey Chalmers
Director
Clear Lake

Doug Colmer
Director
Big Cedar Lake

Colleen Dempster
Director
Pigeon Lake

Tracy Logan
Director
Big Bald Lake



Mike Dolbey
Director
Katchewanooka Lake

Tom McAllister
Director
Lower Buckhorn Lake

Shari Paykarimah
Director
Peterborough

Appendix A

Scientific Advisors

Dr. Brian Cumming, Professor and Head, Department of Biology; Director, School of Environmental Studies; Co-Director, Paleoecological Environmental Assessment and Research Laboratory (PEARL), Queen's University, Kingston

Dr. Paul Frost, David Schindler Professor of Aquatic Science, Trent University, Peterborough

Sara Kelly, Faculty, Ecosystem Management Program and Sustainable Agriculture Co-op Coordinator, Fleming College, Lindsay

Dr. Eric Sager, Ecological Restoration Program, Fleming College and Trent University, Peterborough

KLSA Volunteer Testers, 2017

Balsam Lake - Douglas and Peggy Erlandson, Jim and Kathy Armstrong, Jeff Taylor, Richard Braniff, Ross Bird, Leslie Joynt

Big Bald Lake - Big Bald Lake Cottagers' Association: Rich Corbin, Norm Maia, John Boyce
Big Bald Lake - Big Bald Lake Road Association: Gord Rance

Big Cedar Lake - Big Cedar Lake Stewardship Association: Rudi Harner, Ralph and Diane Trauzzi

Cameron Lake – Lisa Martin, Stu Kinsinger

Chemong Lake – Brian and Linda Neck

Clear Lake – Birchcliff Property Owners Association: Jeff Chalmers
Clear Lake - Kawartha Park Cottagers Association: Judy Finch

Katchewanooka Lake - Peter Fischer, Mike Dolbey

Lovesick Lake – Lovesick Lake Association: Ron Brown, John Ambler, Matthew Brown

Lower Buckhorn Lake – Lower Buckhorn Lake Owners Association: Jeff Lang, Mark and Diane Potter, Dave Thompson, Janet and Paul Duval

Pigeon Lake – Concession 17 Pigeon Lake Cottagers Association: Donald Morrison
Pigeon Lake – North Pigeon Lake Association: Line Pinard, George Brown, Kent Crawford.
Pigeon Lake – Victoria Place: Brenda Oundjian, Bob Johnson

Sandy Lake – Sandy Lake Cottagers Association: The Boysen family, the Streeter family, the Lundie family

Stony Lake – Association of Stony Lake Cottagers: Bev and Don Foster, Rob Little, Ralph and Barb Reed, Kathleen Mackenzie, Bob Woosnam, Gail Szego

Sturgeon Lake – Bruce Hadfield, Sherry and Dave Young, Rod Martin, Kelly Tatchell

Upper Buckhorn Lake- Buckhorn Sands Property Owners Association: Craig, Anastasia, Henry and Lawrence Charlton.
Upper Buckhorn Lake - Darrell Darling

Upper Stoney Lake - Upper Stoney Lake Association: Karl Macarthur

White Lake – White Lake Association: Wayne Horner

Appendix B: Financial Partners

Thank You to our 2017 Supporters

Foundations and Municipalities

Gold ($5,000+)
Stony Lake Heritage Foundation

Silver ($1,000 – $4,999)
Township of Douro-Dummer
Kawartha Conservation
Municipality of Trent Lakes

Bronze (less than $1,000)
Township of Selwyn

Associations/Businesses/Individuals

Gold ($200+)
Agnico Eagle Mines Limited
Susan and Mike Dolbey
Mary and Jim Keyser
Kathleen and Blair Mackenzie
Patti and Tom McAllister
Lois and Bill Napier
Pinewood Cottages and Trailer Park
Lou Probst
Rosedale Marina
Donelda and Mike Stedman

Silver ($100-$199)
Anonymous
Kathy and James Armstrong
Big Bald Lake Cottagers' Association
Birchcliff Park Property Owners Association
Camp Kawartha
Clearview Cottage Resort
Curve Lake First Nation
Janet Duval
Egan Marine
Fire Route 44 Cottagers Association
Gillian Fisher
Forest Hill Lodge
Sheila Gordon-Dillane
Killarney Bay Cedar Point Cottage Association
Lakefield Foodland
Patricia and John Moffat
Sandy Lake Cottagers Association
Janet Haslett & Larry Theall
White Lake Association
Jean and Joseph Wood

Bronze (less than $100)
Mary Auld
Buckhorn Sands Association
Jeffrey Chalmers
Peter Chapell
East Beehive Community Association
Ted Hill
Les Hulett
Anne Hurd
Carol and Ralph Ingleton
Lakeside Cottages
Penny and Rob Little
Tom McCarron
Daniel McMurdy
Claudio Rosada
Jacqueline and Murray Shaver
Linda Trott
Norma and Alan Walker
Cathy and Jeff Webb

Appendix C: KLSA Treasurer's Report

Mike Stedman, KLSA Treasurer

This Treasurer's Report refers to the 2017calendar year and the McColl Turner LLP Chartered Accountants Statement of Financial Position summarizing revenue, expenditure and assets for 2016 and 2017. Our thanks to Mr. John West who provided this community service.

2017 revenue of $12,107 is less than recent years due to a reduction in municipal grants. This change was partially offset by a 36% increase in business and individual donations supporting our paleolimnology study.

Our continuing sources of income were:

• Water testing fees	$2,705
• Municipal grants	$4,450
• Private business/individual donations	$3,856
• Association donations	$1,070

Previous special project fund raising held in a $5,185 GIC was used as part of KLSA's Paleo Project obligation.

2017 total expenses of $21,548 included a $12,500 payment to Queen's University Paleoecological Environmental Assessment and Research Laboratory (PEARL) for the collection, analysis and age-dating of sediment cores.

Re-occurring operating expenses included:

• E. coli test costs	$2,640
• KLSA insurance	$1,724
• KLSA Annual Report	$4,313

In terms of total assets, we closed 2017 with a cash balance of $12,907, enough to cover a final $7,500 payment for the Queen's participation in our Paleo Project and working capital requirements for early 2017 annual report and insurance expenditures.

In February 2018 the final payment for the Paleo Project Queen's involvement of $40,000 was paid. Some donor contributions are not seen in our KLSA accounts because their bylaws require direct payment to Queen's. This project was made possible by significant "project-related" financial support in 2017 from the Stony Lake Heritage Foundation and Kawartha Conservation.

McCOLL TURNER LLP
CHARTERED PROFESSIONAL ACCOUNTANTS

362 Queen Street
Peterborough, ON
K9H 3J6

P: 705.743.5020
F: 705.743.5081
E: info@mccollturner.com
www.mccollturner.com

NOTICE TO READER

On the basis of information provided by management, we have compiled the statement of financial position of Kawartha Lake Stewards Association as at December 31, 2017 and the statement of operations and changes in net assets for the year then ended.

We have not performed an audit or review engagement in respect of these financial statements and, accordingly, we express no assurance thereon.

Readers are cautioned that these statements may not be appropriate for their purposes.

McColl Turner LLP
Licensed Public Accountants

Peterborough, Ontario
February 16, 2018

Financial Statements of

KAWARTHA LAKE STEWARDS ASSOCIATION

December 31, 2017

Note To The Financial Statements
December 31, 2017

BASIS OF PRESENTATION

The accompanying financial statements relate to the incorporated association registered by Letters Patent as Kawartha Lake Stewards Association. The Association conducts co-ordinated, consistent water quality testing programs (including bacteria and phosphorus) of lake water on lakes within the Trent Canal System watershed. The Association derives its revenue from those groups and individuals who are concerned about maintaining the quality of water within the watershed.

Kawartha Lake Stewards Association qualifies as a non-profit organization under section 149(1)(l) of the Income Tax Act, and, as such, is not responsible to pay income tax. The distribution of any of its assets or profits to, or for the personal benefit, of its members, directors or affiliates is prohibited.

McCOLL TURNER LLP
CHARTERED PROFESSIONAL ACCOUNTANTS

KAWARTHA LAKE STEWARDS ASSOCIATION

Statement of Financial Position (Unaudited - see Notice to Reader)
December 31, 2017

	2017 $	2016 $
ASSETS		
Current Assets		
Cash	12,907	17,163
Guaranteed Investment Certificate	-	5,185
	12,907	22,348
NET ASSETS	12,907	22,348
	12,907	22,348

Statement of Operations and Changes in Net Assets
(Unaudited - See Notice to Reader)
Year ended December 31, 2017

	2017 $	2016 $
REVENUE		
Municipal grants	4,450	6,200
Associations	1,070	1,240
Private contributions and donations	3,856	2,816
Water testing fees	2,705	3,060
Membership fees	-	79
Interest	26	26
	12,107	13,421
EXPENDITURES		
Water testing fees	2,640	3,259
Special projects	12,670	151
Annual report costs	4,313	4,969
Insurance	1,724	1,704
Telephone, copies and other administrative costs	154	634
Bank charges	47	42
	21,548	10,759
EXCESS OF REVENUE OVER EXPENDITURES (EXPENDITURES OVER REVENUE) FOR THE YEAR	(9,441)	2,662
NET ASSETS - beginning of year	22,348	19,686
NET ASSETS - end of year	12,907	22,348

McCOLL TURNER LLP
CHARTERED PROFESSIONAL ACCOUNTANTS

Appendix D: KLSA Privacy Policy

Lynn Woodcroft, KLSA Privacy Officer

As a result of Federal Privacy Legislation changes, all businesses and associations that collect personal information from their customers and members must develop and post a Privacy Policy. The following is the policy that your Board has developed to protect you and your personal information held by the Kawartha Lake Stewards Association (KLSA).

To our Membership: Your privacy is important to us. This policy tells you what information we gather about you, how we would use it, to whom we may disclose it, how you can opt out of the collection, use or disclosure of your personal information, and how to get access to the information we may have about you.

Collecting Information: We collect information about our members and volunteers such as name, address, relevant telephone numbers, email address and preferred method of communication. We obtain this information through the attendance form at our workshops and AGM, and by information provided by the many volunteers assisting in our lake water quality testing programs. We may keep the information in written form and/or electronically. Keeping your email address information at our email site allows us to send you information in an efficient and low cost manner. By providing this information to us, you enable us to serve you better.

Using Information: We use the information collected to provide you with information about the association activities and related lake water issues of interest to residents of the Kawartha Lakes. We will retain your personal information only for as long as required by law or as necessary for the purposes for which it is collected. Your personal information will not be used for other purposes without your consent.

Disclosing Information: We will not disclose any personal information collected about you to anybody else, unless required to do so by law. We will comply with all laws, which require us to supply the information to government agencies and others. We will not otherwise sell, transfer or trade any mailing list, which includes your information.

Keeping Information Secure: We will keep written information in a secure place.

Access to Information: If you wish to review the personal information we keep about you please contact the association c/o “Privacy Officer” at the address set out below. At your request, subject to applicable law, we will delete your personal information from our records. The Privacy Officer is not intended to be an elected position. It is an appointment to one of the elected directors of the Board providing they are in good standing and have the support of the Chair and other directors.

Obtaining Your Consent: By providing personal information to us, you are consenting to us using it for the purposes set out above and disclosing it to the parties described above. If you do not want us to use any personal information about you, or wish to limit the use or disclosure of such personal information by us, please contact the Privacy Officer at the address set out below by mail.

Contacting us: We may be contacted by email at kawarthalakestewards@yahoo.ca or by regular mail to:

KLSA
24 Charles Court
Lakefield, ON K0L 2H0

Appendix E: Rationale for *E. coli* Testing and 2017 Lake-by-Lake Results

Kathleen Mackenzie, KLSA Vice-Chair
Tom McAllister, KLSA Director

Providing context for these results

• In Ontario, a public beach is "posted" when the level of *E. coli* in the water exceeds 100 Escherichia coli cfu/100mL (colony-forming units/100mL) of water. This means that the water is unsafe for recreational use, including human bathing (swimming).
• KLSA considers counts over 50 cfu/100mL as somewhat high for the Kawartha Lakes, and re-testing is performed where possible.
• Counts of 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Choosing sites for the KLSA *E. coli* testing program

The goals of this testing are threefold:
• To see how safe the water was for swimming at these sites
• To provide baseline data for ongoing monitoring in future years
• To discover sources of elevated bacterial counts

Almost all sites were chosen because it was thought that they would have the highest *E. coli* counts in the lake; that is, we were "looking for trouble". Therefore, please realize that the readings shown here do not represent the average bacterial levels on our lakes; rather, they would represent some of the highest bacterial levels on our lakes. Test sites included:
• Areas of high use (resorts, live-aboard docking areas, etc.)
• Areas of low circulation (quiet, protected bays)
• Areas near inflows (from culverts, streams, wetlands)
• Areas of concentrated populations of wildlife (near wetlands, areas popular with waterfowl)

Please note:
• KLSA does not test drinking water. Only surface waters are tested. All untreated surface waters are considered unsafe for drinking.
• KLSA results are valid only for the times and locations tested, and are no guarantee that a lake will be safe to swim in at all times and in all locations.
• Only sites consistent with provincial sampling protocol have been reported.

How and why did we test for *E. coli*?

The protocol for *E. coli* testing is found in the Ontario Ministry of Health's "Beach Management Guidance Document, 2014", in the section "Water Sample Collection". This document can be found at http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/guidance/guide_beach.pdf
E. coli was the bacteria of choice because:
• The presence of *E. coli* usually indicates fecal contamination from warm-blooded animals such as birds or mammals, including humans. The presence of *E. coli* indicates the possible presence of other disease-causing organisms found in fecal material, such as those causing gastrointestinal and outer ear infections.

• *E. coli* is present in fecal material in very high numbers. Healthy humans excrete about 100 million *E. coli* per ¼ teaspoon of fecal matter! Therefore, it is easier to 'find' than most other less plentiful bacteria.

• *E. coli* itself can be dangerous. Although most strains of *E. coli* are harmless, some strains cause serious disease or illness, as occurs in occasional ground beef 'scares' which can lead to food poisoning. The basic analysis done by the laboratories cannot distinguish the difference between the harmless and the deadly, so we always treat *E. coli* as if we were dealing with a harmful strain.

Results are expressed as *E. coli* cfu/100mL. When sample water is plated on growth medium in the laboratory, each live bacterium will grow to form a visible colony. 'Cfu' signifies 'colony forming units'. 'Cfu' generally represents numbers of live bacteria as opposed to a microscopic count, which would count both live and dead bacteria.

What do this year's results tell us?

All lakes and sites were, for the most part, safe to swim in (i.e., with readings less than 100). Any readings over 100 tended to be isolated and generally returned to low or more moderate readings shortly thereafter.

Big Bald Lake – Big Bald Lake Cottagers Association
2017 E. coli Lake Water Testing – *E. coli* cfu/100mL

Site	July4	July24	July 31	August 8	August 14	Sept 5	Sept 11
1	14	12	4	1	2	4	--
2	<2	12	2	1	2	8	--
3	<2	8	2	4	4	18	--
9	10	8	2	1	2	2	--
10	<2	<2	2	6	4	**126**	3, 10, 4, 2, 6

Counts were generally low on Big Bald Lake. The high reading at Site 10/Sep 5 may have been due to heavy rains and excessive runoff. Following the high September 5 count at site 10, testers were asked to perform multiple tests at this site, as per protocol.

Big Cedar Lake - Big Cedar Lake Road Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 17	July 31	August 8	September 5
640	<2	<2	4	0	6

Counts were consistently low at this location on Big Cedar Lake.

Buckhorn Lake - Buckhorn Sands Property Owners Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 24	August 1	August 8	August 15	September 1
7	4	31	3	0	2	8
8	2	4	2	1	<2	10
9	<2	<2	2	3	<2	4
10	4	<2	2	3	5	44

Counts were low at the four locations tested by Buckhorn Sands.

Clear Lake – Birchcliff Property Owners Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 6	July 24	July 31	August 10	August 17	Sept 10
2	<2	4	0	<2	<2	<2
3	10	<2	0	2	<2	<2
4	<2	4	2	<2	<2	<2
5	2	30	0	<2	<2	<2
6	0	2	10	2	<2	2
7	4	<2	0	2	<2	1,080
8	<2	10	30	560	2, <2, <2, <2, <2	<2
B-B	<2	<2	2	1	<2	2

There were two unusually high counts. The Site 8/Aug 10 reading was at a shoal that birds & turtles congregate on. Depending on the wind, wave action and sequence of birds, the count in the past has shown similar temporary spikes.The Site 7/Sep 10 reading was taken near some natural shorelines. Two deer families had been using this area during the summer; this may have caused the high count.

Clear Lake – Kawartha Park Cottagers Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	Aug 15	Sep 12	
A	0	<2	
B	0	<2	
C	0	2	
D	0	<2	
P	0	<2	
W	0	<2	

E. coli counts were consistently low at all six Kawartha Park sites.

Katchewanooka Lake – Site 2
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 24	August 1	August 9	August 14	September 5
2	4	2	32	24	18	4

Counts were consistently low at Site 2 on Katchewanooka Lake.

Katchewanooka Lake – Site 7
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 24	July 31	Aug 8	August 21	September 5
7	2	2	1	1	<2	6

All counts were very low at Site 7.

Lovesick Lake – Lovesick Lake Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 3	July 24	July 31	August 7	August 17	September 4
16	2	2	0	1	2	4
18	2	8	2	3	<2	<2
19	4	<2	4	1	<2	<2

Counts were very low at these three locations on Lovesick Lake.

Lower Buckhorn Lake - Lower Buckhorn Lake Owners Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 10	July 26	August 1	August 16	September 5	September 6
2	4	<2	4	<2	<2	--
5	2	4	26	22	<2	--
11	<2	<2	<2	2	<2	--
20	<2	<2	2	<2	<2	--
13A	--	--	--	--	--	<2
13B	--	--	--	--	--	<2
13C	--	--	--	--	--	<2
13D	--	--	--	--	--	<2

Counts were consistently low on the Lower Buckhorn Lake sites.

Appendix E

Pigeon Lake – Concession 17 Pigeon Lake Cottagers Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 17	August 9	September 7
3	<2	6	<2	<2
A	<2	1	<2	16
B	<2	<2	2	<2

Counts were consistently low at all three sites in the Pigeon Lake Concession 17 area.

Pigeon Lake – North Pigeon Lake Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 25	July 31	August 8	August 14	September 6
1A	<2	<2	0	0	<2	<2
5A	30	**68**	**66**	49, 53, 39	24	<2
6	14	112	72	37, **60**, 34	28	14
8	14	2	38	2	2	<2
13	<2	1	6	4	12	8

Site 5A and 6 have over the years shown more elevated counts than the average Kawartha Lake site (see KLSA's *E. coli* Testing Program: Analysis of results 2001-2017). The high counts appear to be due to large numbers of geese that congregate on the shorelines in these areas. The sustained rainfall over the past summer and resulting runoff were probably the cause of the elevated counts from July 25 to August 8.

Pigeon Lake – Victoria Place
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 10	July 17	July 24	August 14	September 5
1	10	<2	2	<2	<2	<2
2	<2	<2	<2	<2	<2	<2
3	108	<2	2	<2	<2	<2
4	6	<2	<2	<2	<2	2
5	6	<2	<2	<2	0	<2

Counts were generally very low. The count of 108 at Site 3/July 4 may have been caused by high human activity combined with high rainfall.

Sandy Lake – Sandy Lake Cottagers Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 25	August 1	August 8	August 15	September 5
1	<2	4	<2	<2	<2	1
2	<2	<2	<2	<2	<2	<2
3	<2	4	<2	0	<2	4

Counts were extremely low at all three Sandy Lake sites.

Stony Lake –Association of Stony Lake Cottagers
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 24	July 31	August 8	August 14	September 5
E	4	16	0	3	<2	<2
F	<2	2	2	0	<2	<2
I	<2	**152**	24	44	8	10
L	4	<2	0	0	<2	<2
P	<2	<2	0	0	<2	<2
PRV28	**60**	4	4	8	14	14
Ia	--	**380**	6	--	--	--

Generally, counts were low on Stony Lake.The count of 60 at PRV28 on July 4 may have been due to high rainfall and runoff. This is a narrow bay with fairly heavy human use on the shoreline.
Site Ia was near Site I. The volunteer tested here because there were lots of geese, and lots of algae indicating still water. This area may have been the source of the high counts at nearby Site I.

Stony Lake –Association of Stony Lake Cottagers – Site J, K
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 6	July 25	August 8	August 14	August 24	September 5
J	<2	16	6	2	--	2
K	<2	2	1	**60**	<2	2

The KLSA volunteer tester could see no obvious cause for the elevated count of 60 at Site K on August 14. All other tests had low results.

Upper Stoney Lake–Upper Stoney Lake Association
2017 *E. coli* Lake Water Testing – *E. coli* cfu/100mL

Site	July 4	July 25	August 1	August 14	September 5
6	4	6	5	4	20
20	10	10	12	22	18
21	4	<2	<2	2	<2
52	**50**	10	22	**100**	12
65	16	2	2	2	2
70	2	2	<2	<2	<2
78A	0	<2	<2	<2	2

Upper Stoney Lake counts were standard for a Kawartha lake – most below 20, several between 20 and 50. The two counts of 50 and 100 at Site 52 were a bit unusual, but this site is affected by an inflowing stream, and the high rainfall resulted in more runoff and more stirring up of sediments.

Appendix F

Appendix F: 2017 Phosphorus and Secchi Data

Total Phosphorus (TP) Measurements

In 2017 volunteers tested 44 sites on 14 Kawartha lakes. Results are listed below. Three TP measurements are in bold type. These were considered outliers, and were not used to calculate the TP average.

STN	ID	Lake Name	Site Descriptiom	Date	TP 1 µg/L	TP 20 µg/L	Avg µg/L
6902	2	BALSAM LAKE	N Bay Rocky Pt.	8-Jun-17	6.2	6.0	6.1
6902	2	BALSAM LAKE	N Bay Rocky Pt.	6-Jul-17	9.6	10.4	10.0
6902	2	BALSAM LAKE	N Bay Rocky Pt.	27-Jul-17	12.2	11.6	11.9
6902	2	BALSAM LAKE	N Bay Rocky Pt.	11-Sep-17	12.8	17.2	15.0
6902	5	BALSAM LAKE	NE end-Lightning Pt	21-May-17	10.4	9.0	9.7
6902	5	BALSAM LAKE	NE end-Lightning Pt	12-Jun-17	13.0	10.4	11.7
6902	5	BALSAM LAKE	NE end-Lightning Pt	20-Jul-17	8.6	9.6	9.1
6902	5	BALSAM LAKE	NE end-Lightning Pt	27-Aug-17	9.0	7.2	8.1
6902	5	BALSAM LAKE	NE end-Lightning Pt	1-Oct-17	9.6	7.6	8.6
6902	7	BALSAM LAKE	South B-Killarney B	23-May-17	7.2	11.6	9.4
6902	7	BALSAM LAKE	South B-Killarney B	2-Jun-17	9.6	7.0	8.3
6902	7	BALSAM LAKE	South B-Killarney B	29-Jun-17	13.4	10.8	12.1
6902	7	BALSAM LAKE	South B-Killarney B	7-Aug-17	15.0	11.6	13.3
6902	7	BALSAM LAKE	South B-Killarney B	6-Sep-17	11.0	12.4	11.7
6902	7	BALSAM LAKE	South B-Killarney B	1-Oct-17	10.0	11.4	10.7
6902	8	BALSAM LAKE	W Bay2, deep spot	7-Jun-17	7.6	7.6	7.6
6902	8	BALSAM LAKE	W Bay2, deep spot	2-Jul-17	12.0		12.0
6902	8	BALSAM LAKE	W Bay2, deep spot	31-Jul-17	11.2	11.8	11.5
6902	8	BALSAM LAKE	W Bay2, deep spot	3-Sep-17	11.6	10.8	11.2
6902	8	BALSAM LAKE	W Bay2, deep spot	1-Oct-17	12.4	14.8	13.6
6941	1	BIG BALD LAKE	Mid Lake, deep spot	22-May-17	10.2	9.2	9.7
6941	1	BIG BALD LAKE	Mid Lake, deep spot	8-Jul-17	14.8	17.2	16.0
6941	1	BIG BALD LAKE	Mid Lake, deep spot	31-Jul-17	11.6	12.8	12.2
6941	1	BIG BALD LAKE	Mid Lake, deep spot	10-Sep-17	**18.6**	12.8	12.8
363	1	BIG CEDAR LAKE	Mid Lake, deep spot	20-May-17	4.8	6.0	5.4
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	28-May-17	13.6	15.0	14.3
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	9-Jun-17	13.8	13.6	13.7
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	3-Jul-17	15.4	14.8	15.1
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	31-Jul-17	16.4	16.4	16.4
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	7-Sep-17	11.8	12.2	12.0
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	2-Oct-17	14.6	14.4	14.5
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	26-May-17	11.0	11.2	11.1
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	25-Jun-17	19.2	21.8	20.5

STN	ID	Lake Name	Site Description	Date	TP 1 µg/L	TP 2 µg/L	Ave µg/L
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	27-Jul-17	17.6	17.2	17.4
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	30-Aug-17	12.4	14.4	13.4
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	26-Sep-17	12.4	11.0	11.7
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	21-Oct-17	13.2	15.4	14.3
6951	9	CHEMONG LAKE	S. of Causeway	16-May-17	11.8	11.0	11.4
6951	9	CHEMONG LAKE	S. of Causeway	26-Jun-17	15.8	16.2	16.0
6951	9	CHEMONG LAKE	S. of Causeway	31-Jul-17	13.4	15.4	14.4
6951	9	CHEMONG LAKE	S. of Causeway	28-Aug-17	14.0	14.0	14.0
6951	9	CHEMONG LAKE	S. of Causeway	30-Sep-17	14.4	13.8	14.1
6951	10	CHEMONG LAKE	Deep Spot, N. of Bridge North	16-May-17	12.4	10.8	11.6
6955	1	CLEAR LAKE	MacKenzie Bay	30-Jul-17	17.0	17.2	17.1
6955	1	CLEAR LAKE	MacKenzie Bay	15-Aug-17	20.8	**28.4**	20.8
6955	1	CLEAR LAKE	MacKenzie Bay	11-Sep-17	15.0	17.2	16.1
6955	2	CLEAR LAKE	Main Basin-deep spot	6-Jul-17	17.8	18.6	18.2
6955	2	CLEAR LAKE	Main Basin-deep spot	10-Aug-17	13.2	13.4	13.3
6955	2	CLEAR LAKE	Main Basin-deep spot	10-Sep-17	13.8	14.0	13.9
6955	2	CLEAR LAKE	Main Basin-deep spot	12-Oct-17	19.6	19.0	19.3
6955	3	CLEAR LAKE	Fiddlers Bay	6-Jul-17	15.0	15.4	15.2
6955	3	CLEAR LAKE	Fiddlers Bay	10-Aug-17	14.6		14.6
6955	3	CLEAR LAKE	Fiddlers Bay	10-Aug-17	14.6	15.2	14.9
6955	3	CLEAR LAKE	Fiddlers Bay	10-Sep-17	12.8	13.2	13.0
6955	3	CLEAR LAKE	Fiddlers Bay	12-Oct-17	19.6	20.6	20.1
6955	4	CLEAR LAKE	Brysons Bay	11-Jun-17	18.0	15.2	16.6
6955	4	CLEAR LAKE	Brysons Bay	2-Jul-17	21.4	20.6	21.0
6955	4	CLEAR LAKE	Brysons Bay	13-Aug-17	23.6	15.8	19.7
6955	4	CLEAR LAKE	Brysons Bay	6-Sep-17	14.4	13.2	13.8
6955	4	CLEAR LAKE	Brysons Bay	25-Sep-17	14.6	14.4	14.5
6955	5	CLEAR LAKE	Southwest Basin, Deep Spot	31-May-17	10.4	10.6	10.5
6955	5	CLEAR LAKE	Southwest Basin, Deep Spot	4-Jul-17	19.6	20.2	19.9
6955	5	CLEAR LAKE	Southwest Basin, Deep Spot	31-Jul-17	15.2	14.6	14.9
6955	5	CLEAR LAKE	Southwest Basin, Deep Spot	29-Aug-17	15.8	15.8	15.8
6955	5	CLEAR LAKE	Southwest Basin, Deep Spot	30-Sep-17	15.8	16.2	16.0
6955	5	CLEAR LAKE	Southwest Basin, Deep Spot	15-Oct-17	19.0	19.8	19.4
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	23-May-17	8.6	9.4	9.0
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	2-Jun-17	10.6	11.2	10.9
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	6-Jul-17	13.8	13.6	13.7
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	9-Aug-17	18.6	17.2	17.9
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	5-Sep-17	19.2	18.2	18.7

Appendix F

STN	ID	Lake Name	Site Description	Date	TP 1 µg/L	TP 2 µg/L	Avg µg/L
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	1-Oct-17	16.6	17.6	17.1
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	23-May-17	8.0	7.8	7.9
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	7-Jun-17	12.8	12.4	12.6
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	4-Jul-17	14.0	14.2	14.1
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	8-Aug-17	17.4	18.0	17.7
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	5-Sep-17	16.6	17.0	16.8
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	2-Oct-17	18.6	18.6	18.6
7087	1	LOVESICK LAKE	80' hole at N. end	3-Jun-17	12.4	12.4	12.4
7087	1	LOVESICK LAKE	80' hole at N. end	3-Jul-17	16.6	19.6	18.1
7087	1	LOVESICK LAKE	80' hole at N. end	7-Aug-17	19.4	20.0	19.7
7087	1	LOVESICK LAKE	80' hole at N. end	4-Sep-17	13.2	13.0	13.1
7087	1	LOVESICK LAKE	80' hole at N. end	2-Oct-17	17.0	16.4	16.7
7087	3	LOVESICK LAKE	McCallum Island	3-Jun-17	11.0	12.0	11.5
7087	3	LOVESICK LAKE	McCallum Island	3-Jul-17	15.4	17.0	16.2
7087	3	LOVESICK LAKE	McCallum Island	7-Aug-17	21.2	20.6	20.9
7087	3	LOVESICK LAKE	McCallum Island	4-Sep-17	14.2	15.6	14.9
7087	3	LOVESICK LAKE	McCallum Island	2-Oct-17	16.2	16.6	16.4
6990	1	LOWER BUCKHORN LAKE	Heron Island	14-May-17	11.8	8.8	10.3
6990	1	LOWER BUCKHORN LAKE	Heron Island	10-Jul-17	17.8		17.8
6990	1	LOWER BUCKHORN LAKE	Heron Island	26-Jul-17	18.4	18.4	18.4
6990	1	LOWER BUCKHORN LAKE	Heron Island	16-Aug-17	16.6	16.6	16.6
6990	1	LOWER BUCKHORN LAKE	Heron Island	31-Aug-17	12.6	14.0	13.3
6990	1	LOWER BUCKHORN LAKE	Heron Island	10-Oct-17	13.6	13.4	13.5
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	23-May-17	11.6	13.0	12.3
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	15-Jun-17	13.0	13.4	13.2
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	10-Jul-17	15.8	15.4	15.6
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	13-Aug-17	20.0	18.6	19.3
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	15-Sep-17	12.6	11.6	12.1
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	10-Oct-17	14.8	14.2	14.5
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	10-Jul-17	14.2	16.4	15.3
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	10-Jul-17	13.6		13.6
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	26-Jul-17	15.0	13.6	14.3
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	16-Aug-17	15.4	15.8	15.6
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	31-Aug-17	16.4	16.4	16.4
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	10-Oct-17	18.2	17.2	17.7
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	19-May-17	10.0	10.2	10.1
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	3-Jun-17	13.6	21.2	17.4
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	3-Jul-17	16.8	16.2	16.5
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	30-Jul-17	20.6	25.2	22.9

STN	ID	Lake Name	Site Description	Date	TP 1 µg/L	TP 2 µg/L	Avg µg/L
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	9-Sep-17	21.8	18.8	20.3
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	30-Sep-17	19.2	19.8	19.5
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	19-May-17	11.4	10.4	10.9
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	3-Jun-17	15.6	13.8	14.7
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	3-Jul-17	23.2	21.0	22.1
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	30-Jul-17	36.0	15.0	25.5
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	9-Sep-17	12.2	12.0	12.1
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	30-Sep-17	11.4	12.6	12.0
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	23-May-17	9.0	8.8	8.9
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	13-Jun-17	11.6	12.4	12.0
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	17-Jul-17	19.0	19.0	19.0
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	9-Aug-17	19.2	18.0	18.6
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	7-Sep-17	13.6	12.8	13.2
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	2-Jun-17	9.4		9.4
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	4-Jul-17	14.4	14.2	14.3
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	8-Aug-17	17.4	18.0	17.7
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	6-Sep-17	23.2	24.0	23.6
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	2-Oct-17	37.6	38.4	38.0
6919	13	PIGEON LAKE	N end-Adjacent Con17	23-May-17	8.8	17.2	13.0
6919	13	PIGEON LAKE	N end-Adjacent Con17	13-Jun-17	11.8	11.2	11.5
6919	13	PIGEON LAKE	N end-Adjacent Con17	17-Jul-17	17.8	18.0	17.9
6919	13	PIGEON LAKE	N end-Adjacent Con17	9-Aug-17	19.8	19.6	19.7
6919	13	PIGEON LAKE	N end-Adjacent Con17	7-Sep-17	12.8	12.2	12.5
6919	15	PIGEON LAKE	C340-DeadHorseSho	3-Jun-17	10.0	11.6	10.8
6919	15	PIGEON LAKE	C340-DeadHorseSho	2-Jul-17	14.4	15.0	14.7
6919	15	PIGEON LAKE	C340-DeadHorseSho	6-Aug-17	21.8	21.8	21.8
6919	15	PIGEON LAKE	C340-DeadHorseSho	30-Sep-17	17.8	17.4	17.6
6919	16	PIGEON LAKE	N300yds off Bottom I	1-Jun-17	11.6		11.6
6919	16	PIGEON LAKE	N300yds off Bottom I	4-Jul-17	16.2	15.8	16.0
6919	16	PIGEON LAKE	N300yds off Bottom I	8-Aug-17	19.6	19.0	19.3
6919	16	PIGEON LAKE	N300yds off Bottom I	6-Sep-17	15.8	16.0	15.9
6919	16	PIGEON LAKE	N300yds off Bottom I	2-Oct-17	21.6	21.0	21.3
7241	2	SANDY LAKE	Mid Lake, deep spot	27-May-17	5.0	5.2	5.1
7241	2	SANDY LAKE	Mid Lake, deep spot	10-Jun-17	6.0	6.8	6.4
7241	2	SANDY LAKE	Mid Lake, deep spot	25-Jun-17	5.8	6.0	5.9
7241	2	SANDY LAKE	Mid Lake, deep spot	14-Aug-17	5.8	5.6	5.7
7241	2	SANDY LAKE	Mid Lake, deep spot	17-Sep-17	4.4	4.4	4.4
7241	2	SANDY LAKE	Mid Lake, deep spot	11-Oct-17	6.8	6.4	6.6
7133	4	STONY LAKE	Burleigh locks chan.	12-Jun-17	12.6	13.4	13.0

STN	ID	Lake Name	Description	Date	TP 1 µg/L	TP 2 µg/L	Avg µg/L
7133	4	STONY LAKE	Burleigh locks chan.	2-Jul-17	16.0	16.2	16.1
7133	4	STONY LAKE	Burleigh locks chan.	13-Aug-17	20.6	20.0	20.3
7133	4	STONY LAKE	Burleigh locks chan.	6-Sep-17	13.4	12.8	13.1
7133	4	STONY LAKE	Burleigh locks chan.	25-Sep-17	14.2	14.2	14.2
7133	6	STONY LAKE	Gilchrist Bay	18-Jul-17	18.6	17.2	17.9
7133	6	STONY LAKE	Gilchrist Bay	29-Aug-17	14.4	14.0	14.2
7133	6	STONY LAKE	Gilchrist Bay	8-Oct-17	15.8	12.4	14.1
7133	7	STONY LAKE	Mouse Is.	16-May-17	7.6	8.6	8.1
7133	7	STONY LAKE	Mouse Is.	30-May-17	11.0	10.8	10.9
7133	7	STONY LAKE	Mouse Is.	4-Jul-17	13.6	13.6	13.6
7133	7	STONY LAKE	Mouse Is.	7-Aug-17	16.0		16.0
7133	7	STONY LAKE	Mouse Is.	4-Sep-17	11.6	11.8	11.7
7133	7	STONY LAKE	Mouse Is.	1-Oct-17	15.6	15.2	15.4
7133	8	STONY LAKE	Hamilton Bay	16-May-17	7.8	9.4	8.6
7133	8	STONY LAKE	Hamilton Bay	30-May-17	11.4	13.6	12.5
7133	8	STONY LAKE	Hamilton Bay	4-Jul-17	13.0	13.0	13.0
7133	8	STONY LAKE	Hamilton Bay	7-Aug-17	15.6	14.6	15.1
7133	8	STONY LAKE	Hamilton Bay	7-Aug-17	14.4		14.4
7133	8	STONY LAKE	Hamilton Bay	1-Oct-17	15.2	15.2	15.2
6924	4	STURGEON LAKE	Muskrat I-Buoy C388	6-Jul-17	13.8	14.0	13.9
6924	4	STURGEON LAKE	Muskrat I-Buoy C388	1-Aug-17	17.6	17.2	17.4
6924	4	STURGEON LAKE	Muskrat I-Buoy C388	5-Sep-17	17.0	16.4	16.7
6924	4	STURGEON LAKE	Muskrat I-Buoy C388	1-Oct-17	15.0	15.4	15.2
6924	5	STURGEON LAKE	Sturgeon Point Buoy	21-Jun-17	13.6	12.4	13.0
6924	5	STURGEON LAKE	Sturgeon Point Buoy	31-Jul-17	13.4	13.8	13.6
6924	5	STURGEON LAKE	Sturgeon Point Buoy	31-Aug-17	14.4	14.4	14.4
6924	5	STURGEON LAKE	Sturgeon Point Buoy	14-Sep-17	10.2	11.4	10.8
6924	9	STURGEON LAKE	Fenelon R. mouth	21-Jun-17	11.2	10.4	10.8
6924	9	STURGEON LAKE	Fenelon R. mouth	31-Jul-17	9.6	12.4	11.0
6924	9	STURGEON LAKE	Fenelon R. mouth	31-Aug-17	9.2	8.4	8.8
6924	9	STURGEON LAKE	Fenelon R. mouth	14-Sep-17	8.8	9.4	9.1
6924	10	STURGEON LAKE	Lunge Haven	10-Jun-17	29.6	29.2	29.4
6924	10	STURGEON LAKE	Lunge Haven	18-Jul-17	28.4	28.2	28.3
6924	10	STURGEON LAKE	Lunge Haven	15-Aug-17	31.2	29.0	30.1
6924	10	STURGEON LAKE	Lunge Haven	12-Sep-17	25.8	26.8	26.3
6924	10	STURGEON LAKE	Lunge Haven	22-Oct-17	23.6	24.6	24.1
5178	1	UPPER STONEY LAKE	Quarry Bay	1-Jun-17	11.6	9.4	10.5
5178	1	UPPER STONEY LAKE	Quarry Bay	3-Jul-17	7.6	10.6	9.1
5178	1	UPPER STONEY LAKE	Quarry Bay	1-Aug-17	8.6	8.8	8.7

STN	ID	Lake Name	Description	Date	TP 1 µg/L	TP 2 µg/L	Avg µg/L
5178	1	UPPER STONEY LAKE	Quarry Bay	3-Sep-17	8.4	8.8	8.6
5178	1	UPPER STONEY LAKE	Quarry Bay	1-Oct-17	7.2	7.2	7.2
5178	3	UPPER STONEY LAKE	Young Bay	9-May-17	5.6	5.4	5.5
5178	3	UPPER STONEY LAKE	Young Bay	1-Jun-17	**30.8**	8.4	8.4
5178	3	UPPER STONEY LAKE	Young Bay	3-Jul-17	7.2	8.0	7.6
5178	3	UPPER STONEY LAKE	Young Bay	1-Aug-17	7.8	8.0	7.9
5178	3	UPPER STONEY LAKE	Young Bay	3-Sep-17	6.8	7.2	7.0
5178	3	UPPER STONEY LAKE	Young Bay	1-Oct-17	7.8	7.6	7.7
5178	4	UPPER STONEY LAKE	S Bay, deep spot	9-May-17	8.4	8.4	8.4
5178	4	UPPER STONEY LAKE	S Bay, deep spot	1-Jun-17	15.8	17.2	16.5
5178	4	UPPER STONEY LAKE	S Bay, deep spot	1-Jul-17	10.2	11.0	10.6
5178	4	UPPER STONEY LAKE	S Bay, deep spot	1-Aug-17	8.4	9.4	8.9
5178	4	UPPER STONEY LAKE	S Bay, deep spot	3-Sep-17	10.0	9.4	9.7
5178	4	UPPER STONEY LAKE	S Bay, deep spot	1-Oct-17	10.4	9.0	9.7
5178	5	UPPER STONEY LAKE	Crowes Landing	9-May-17	6.6	6.0	6.3
5178	5	UPPER STONEY LAKE	Crowes Landing	7-Jun-17	6.6	6.8	6.7
5178	5	UPPER STONEY LAKE	Crowes Landing	3-Jul-17	9.2	8.2	8.7
5178	5	UPPER STONEY LAKE	Crowes Landing	1-Aug-17	6.8	8.2	7.5
5178	5	UPPER STONEY LAKE	Crowes Landing	28-Aug-17	7.6	9.6	8.6
5178	5	UPPER STONEY LAKE	Crowes Landing	1-Oct-17	7.0	7.8	7.4
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	9-May-17	5.8	5.8	5.8
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	7-Jun-17	7.2	8.0	7.6
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	3-Jul-17	8.2	7.6	7.9
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	1-Aug-17	6.6	7.4	7.0
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	28-Aug-17	6.8	11.4	9.1
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	1-Oct-17	7.2	7.0	7.1
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	25-Jun-17	10.2	11.6	10.9
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	18-Jul-17	11.8	16.0	13.9
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	20-Aug-17	10.6	11.0	10.8
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	16-Sep-17	10.0	11.4	10.7
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	12-Oct-17	10.0	12.8	11.4

Shoreline naturalization

Photo by Colleen Dempster

Appendix F: 2017 Phosphorus and Secchi Data

2017 Secchi Depth Measurements

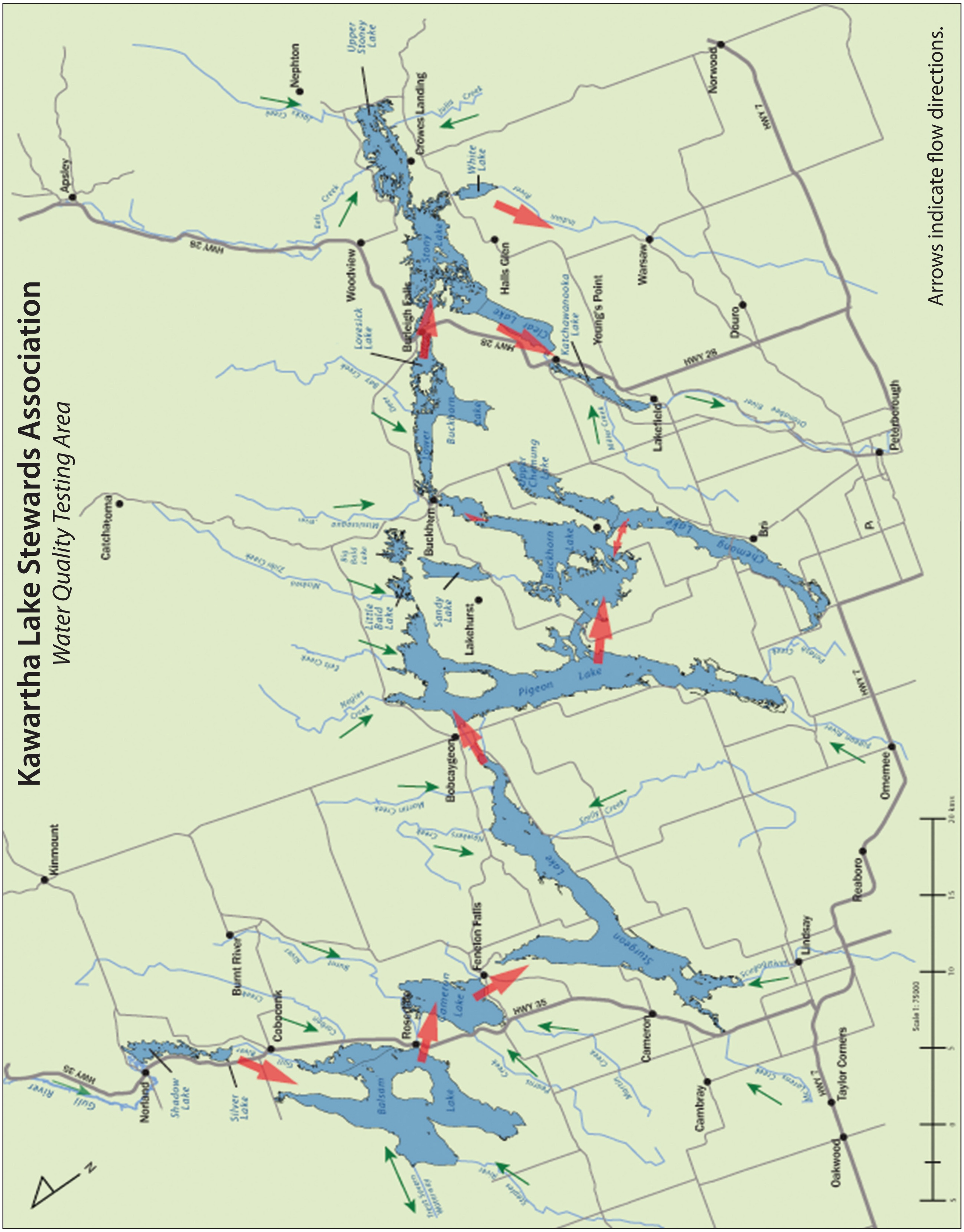
Named after its inventor, Angelo Secchi, a Secchi disk is a device for measuring water clarity. It is a weighted disc 20cm in diameter with alternate black and white quadrants. When lowered into a lake, the depth at which the disc can no longer be seen (the black and white quadrants cannot be distinguished) is called the Secchi depth. The deeper the Secchi depth, the clearer the water. Basic water clarity can be affected by the amount of sediments or Dissolved Organic Matter (DOM) that the water contains. Seasonal variation of water clarity is usually related to the amount of algae it contains resulting in spring and fall Secchi depths being greater than mid-summer values.

The Lake Partner Program (LPP) asks volunteers to measure the Secchi depth every two weeks between early May to early October but for practical reasons many sites can only be measured in conjunction with phosphorus sample collection, about six times a year. Until 2015, LPP published all the Secchi readings for each site but in 2016 and 2017 they have published only the annual average Secchi depth and the number of measurements averaged.

STN	Site ID	Lake	Site Description	SecchiAvg (m)	# of Secchi mmts
6902	2	BALSAM LAKE	N Bay Rocky Pt.	No Data	No Data
6902	5	BALSAM LAKE	NE end-Lightning Pt	3.7	8
6902	7	BALSAM LAKE	South B-Killarney B	3.3	6
6902	8	BALSAM LAKE	W Bay2, deep spot	3.8	11
6902	9	BALSAM LAKE	E of Grand Is	No Data	No Data
6941	1	BIG BALD LAKE	Mid Lake, deep spot	No Data	No Data
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	3.4	6
6951	10	CHEMONG LAKE	Deep Spot, N. of Bridge North	3.3	12
6955	1	CLEAR LAKE	Mackenzie Bay	3.5	4
6955	2	CLEAR LAKE	Main Basin-deep spot	3.7	8
6955	3	CLEAR LAKE	Fiddlers Bay	4.1	8
6955	4	CLEAR LAKE	Brysons Bay	3.2	5
6955	5	CLEAR LAKE	Southwest Basin, Deep Spot	3.4	6
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	No Data	No Data
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	6.0	11
7087	1	LOVESICK LAKE	80' hole at N. end	4.7	5
7087	3	LOVESICK LAKE	McCallum Island	4.6	5
6990	1	LOWER BUCKHORN LAKE	Heron Island	4.3	3

6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	5.5	10
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	3.8	2
STN	**ID**	**Lake Name**	**Site Description**	**Secchi Avg (m)**	**# of Secchi mmts**
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	2.0	10
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	2.6	10
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	3.0	5
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	3.3	8
6919	13	PIGEON LAKE	N end-Adjacent Con17	3.0	5
6919	15	PIGEON LAKE	C340-DeadHorseSho	3.0	5
6919	16	PIGEON LAKE	N300yds off Bottom I	3.3	8
7133	4	STONY LAKE	Burleigh locks chan.	4.1	5
7133	6	STONY LAKE	Gilchrist Bay	3.8	3
7133	7	STONY LAKE	Mouse Is.	4.7	6
7133	8	STONY LAKE	Hamilton Bay	4.0	6
6924	4	STURGEON LAKE	Muskrat I-Buoy C388	3.7	4
6924	5	STURGEON LAKE	Sturgeon Point Buoy	3.3	3
6924	9	STURGEON LAKE	Fenelon R. mouth	3.5	3
5178	1	UPPER STONEY LAKE	Quarry Bay	No Data	No Data
5178	3	UPPER STONEY LAKE	Young Bay	No Data	No Data
5178	5	UPPER STONEY LAKE	Crowes Landing	No Data	No Data
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	No Data	No Data
6963	1	WHITE LAKE	S end, deep spot	4.4	5

A kingbird snags a dragonfly. *Photo by Robin Blake*


Kawartha Lake Stewards Association
Water Quality Testing Area
Arrows indicate flow directions.
Apsley
Nephton
Upper Stoney Lake
Burleigh Falls
Woodview
Stony Lake
Halls Glen
Warsaw
Norwood
White Lake
Clear Lake
Katchewanooka Lake
Young's Point
Dummer
Douro
Lakefield
Peterborough
Lovesick Lake
Lower Buckhorn Lake
Upper Chemung Lake
Chemung Lake
Bridgenorth
Buckhorn
Buckhorn Lake
Catchacoma
Big Bald Lake
Little Bald Lake
Sandy Lake
Lakehurst
Pigeon Lake
Bobcaygeon
Omemee
Kinmount
Sturgeon Lake
Fenelon Falls
Lindsay
Reaboro
Burnt River
Coboconk
Rosedale
Cameron Lake
Cameron
Cambray
Taylor Corners
Oakwood
Norland
Shadow Lake
Silver Lake
Balsam Lake
Gull River
HWY 35
HWY 28
HWY 7
N

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