The Nature of Our Lakes

Kawartha Lake Stewards Association

2014 Lake Water Quality Report

May 2015

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

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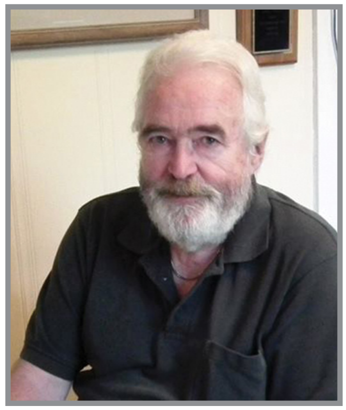
You can view Adobe pdf versions of KLSA reports on the KLSA website:

klsa.wordpress.com

Cover photo courtesy of Lakefield Herald

This report is dedicated
to the memory of
SIMON CONOLLY
with fondness and gratitude.



Beginning in 2007, Simon handled the layout and production of the KLSA annual report and other publications as a volunteer like the rest of us, along with his responsibilities as co-owner and publisher of the Lakefield Herald.
Simon was a humble and gentle man,
super-humanly patient during the editing and production process with its myriad details of punctuation, illustrations, additions and deletions.
Almost invariably, he found the perfect cover photo and title for our reports.
Simon was a true and kind friend, generous with his time and talents and genuinely interested in each of us and in the work we were doing.
We miss him greatly.

The KLSA Editorial Committee

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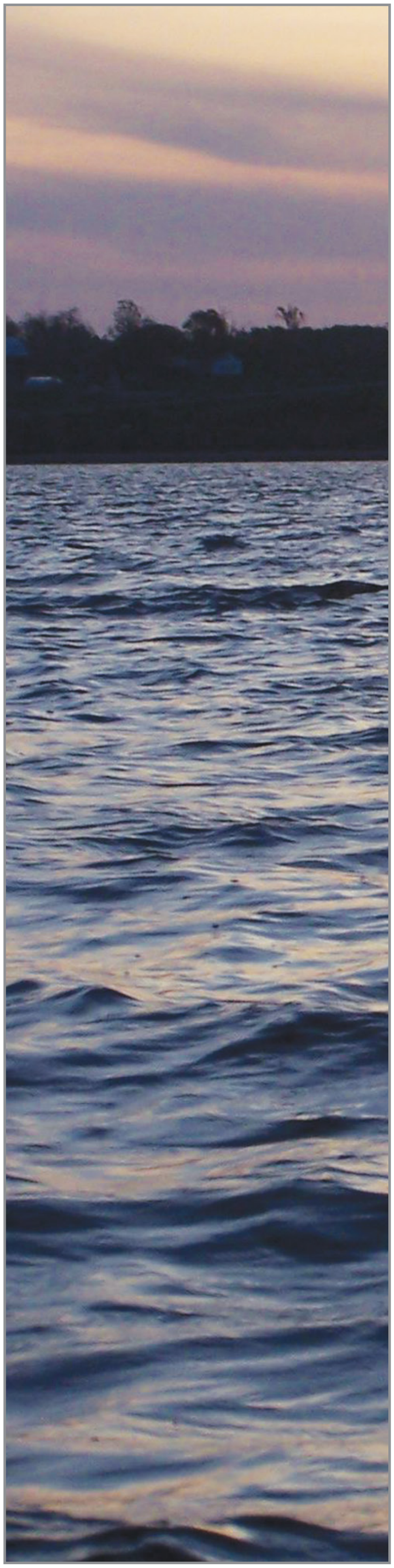

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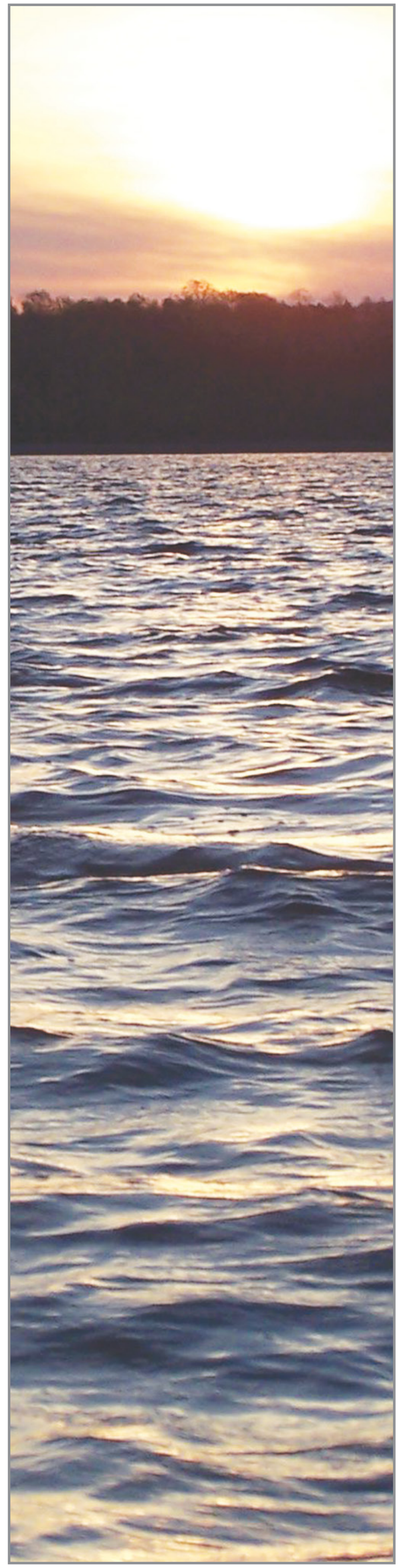


Executive Summary

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 during the spring, summer and early fall and research and public education about water quality issues. KLSA has formed valuable partnerships with Trent University, Fleming College and Kawartha Conservation resulting in research studies of aquatic plants and algae and the impact of nutrients on water quality. KLSA has published booklets such as the Aquatic Plants Guide (2009) and The Algae of the Kawartha Lakes (2012), which inform the public about causes of aquatic plant and algae growth and environmentally responsible management practices. This year's report addresses issues of climate change and invasive species and their impact on the Kawartha Lakes.

KLSA is led by a 12-member Board of Directors. A list of the members of the Board is provided in Appendix A. A summary of articles contained in the 2014 KLSA Annual Water Quality Report follows.

Climate Change in the Kawarthas

Drew Monkman, a naturalist and nature writer, discusses the effects of climate change on wildlife and plants in the Kawarthas. Noting that 14 of the warmest 15 years on record have occurred since the year 2000, he describes changes that have taken place such as trees blooming earlier resulting in increased pollen counts, birds returning from migration and breeding earlier in the spring and the ice on the lakes freezing later and going out earlier than in previous years. There has also been an increase in non-native invasive species of plants that thrive in an environment of higher CO_2 levels, affecting other plants and wildlife habitat. Extreme weather events have also become more frequent and have detrimental effects on plants, animals and human health. Mr. Monkman concludes that it is not too late to reduce the impacts of climate change if we drastically reduce greenhouse gases. He recommends a revenue-neutral carbon tax and lifestyle changes to protect future generations.

Invasive Species in the Kawarthas

Invasive species are a significant threat to biodiversity and the world's environment. Using three examples – buckthorn, garlic mustard and the emerald ash borer – Dave Pridham, Manager, Technical and Stewardship Services at Kawartha Conservation, provides an introduction to the threat posed by invasive species. In part because there are few natural controls, invasive species can overwhelm native species by displacing them or destroying their habitat. The article discusses prevention and control measures and concludes with a list of resources for further information.

Look for the Blue Canoe

Holly Shipclark, a Stewardship Technician at Kawartha Conservation, describes the Blue Canoe Program, a public education program aiming to raise awareness of environmental concerns and provide information about best practices for shoreline conservation. Trained summer staff visit cottagers at their docks to distribute resources on topics such as septic system maintenance, invasive species and shoreline protection. They also conduct Dock Talks (group presentations) and participate in community events. Funded in 2012 – 2014 by a three-year grant from the RBC Blue Water fund, the program was offered in parts of Sturgeon, Cameron, Balsam and Pigeon Lakes. Blue Canoe is seeking new funding opportunities and partners to continue its work and expand the Program.

Goose Habitat Modification at the Public Beach in Norwood, Ontario

Erin McGauley, Watershed Biologist at the Otonabee Region Conservation Authority describes a naturalization project initiated in 2009 to discourage Canada Geese from polluting the public beach and the pond at Norwood, Ontario. Because geese prefer areas with clear sight lines between grass and the water, beaches are attractive locations for flocks to gather. By planting 'islands' of vegetation in various locations on the beach, Otonabee Conservation and partners were able to provide some protection for the Norwood Pond beach, discouraging geese from landing there.

2013 Kawartha Lakes Sewage Treatment Plants Report

Each year, KLSA Directors monitor and report on output from local sewage treatment plants. Data is only available for 2013. Phosphorus output is a key indicator, and a primary cause of increased plant and algae growth in our lakes. The report includes results for Minden, Bobcaygeon, Coboconk, Fenelon Falls, Lindsay, Kings Bay, Omemee and Port Perry. The total amount of phosphorus discharged from all these plants in 2013 was 477 kg, up from 427 kg, in 2012. There is still significant room for improvement to meet the goal of 99% phosphorus removal. Continued monitoring of all STPs is vital.

E.coli Bacteria Testing

In 2014, KLSA volunteers tested 91 sites in 16 lakes for *E.coli* bacteria. Samples were analyzed by SGS Lakefield Research or the Centre for Alternative Wastewater Treatment (CAWT) laboratory at Fleming College in Lindsay. Public beaches are posted as unsafe for swimming when levels reach 100 *E.coli*/100 mL of water. The KLSA believes that counts in the Kawartha Lakes should not exceed 50 *E.coli/*100 mL, given their high recreational use. In general, *E.coli* levels were low throughout the summer of 2014, consistent with other years. Of the 91 sites tested, 58 were "very clean" (no readings above 20 *E.coli* per 100mL), 27 were "clean" (one or two readings above 20), and 6 were "somewhat elevated" (three readings over 20), mostly attributable to waterfowl. Detailed results can be found in Appendix E.

Phosphorus Testing

In 2014, as part of the Ministry of the Environment and Climate Change's Lake Partner Program (LPP), volunteers collected water samples four to six times (monthly from May to October) at 41 sites on 15 lakes for phosphorus testing. Samples were analyzed by the Ministry laboratory. Volunteers also measured water clarity, using a Secchi disk. The Ministry's Provincial Water Quality Objectives consider average phosphorus levels exceeding 20 parts per billion (ppb) to be of concern since at that point algae growth accelerates, adversely affecting enjoyment of the lakes. Overall in the summer of 2014, average phosphorus levels were similar to those of previous years. Further investigation is needed to explain a mid-summer rise in phosphorus levels in Sturgeon Lake. Detailed results of the 2014 Lake Partner Program are provided in Appendix F.

Analysis of Ontario Lake Partner Program – Total Phosphorus Data for the Kawartha Lakes

KLSA Board member Mike Dolbey has conducted a detailed analysis of the data collected during the past 13 years of the LPP. His study concludes that total phosphorus (TP) levels have been generally stable but there have been increases in parts of Sturgeon and Pigeon Lakes that require further investigation. The study suggests that the lakes are in a state of delicate balance since increases in TP are difficult and costly to reverse. It is important to continue to monitor the testing sites to build a valuable database for continued analysis. Detailed data is provided for each site included in the LPP.

Model Development of Seasonal Phosphorus Variation in Sturgeon Lake

KLSA Directors Mike Dolbey and Mike Stedman worked with Professor Sara Kelly from Fleming College on a Credit for Product project measuring the seasonal variation in TP levels in Sturgeon Lake, using a four basin model that looked at TP levels and inputs to four LPP test sites. The course is designed to teach students all aspects of planning, researching, carrying out and reporting on a project. The three students on the research team were also each required to conduct a literature review on one component of the study, in this case, internal loading, climate and agricultural practice. The report that resulted from the students' analysis is available on the KLSA website.

KLSA Membership and Spring Public Meeting

In 2014, KLSA introduced a new system of paid membership. The membership fee is $20 per year ($10 for full-time students). This entitles members to vote at the AGM and to have a copy of the annual report mailed to them. KLSA holds two general meetings per year in the spring and fall. The fall meeting includes the Association's Annual General Meeting. In 2015, the spring meeting will be held at the Bobcaygeon Community Centre on Saturday, May 9 at 10 a.m.

Thank you

The Kawartha Lake Stewards Association could not achieve its goals without the extraordinary support of the many volunteers who participate in our monitoring programs and the individuals and organizations that provide financial support. Thank you also to Dr. Paul Frost, Dr. Eric Sager, Sara Kelly and their colleagues at Trent University and Fleming College for their scientific advice and ongoing support of our work, staff at the Ministry of the Environment Lake Partner Program and staff at SGS Lakefield Research and the Centre for Alternative Wastewater Treatment at Fleming College who assist with the water testing program. Thank you also to George Gillespie of McColl Turner LLP for reviewing our financial records. We are also very grateful to Joyce Volpe of the Lakefield Herald for her assistance with the publication of this report. Please join the KLSA and also consider making a donation to support our work. For further details, visit our website: http://klsa.wordpress.com.

KLSA Editorial Committee: Sheila Gordon-Dillane (Chair), Tom Cathcart, Janet Duval, Ruth Kuchinad, Kathleen Mackenzie and Pat Moffat

Chair's Message

Kathleen Mackenzie, KLSA Co-Chair

The summer of 2014 was described by some as a 'sorta summer'. After a record-breaking long, cold winter, and then a late, cold and very wet spring, the summer of 2014 may have been the coldest and buggiest summer most of us remember! Temperatures were below average by 1.4°C in May, 0.6°C in June, 2.4°C in July, and 1.5°C in August. Perhaps the most obvious effect of all this cold was that aquatic plant growth was much less than it had been for decades – everyone noticed it. Surprisingly, though, bacterial counts and phosphorus were not greatly changed. Our lakes seem to be remarkably stable, which we hope is a sign of a diverse ecosystem.

Thank You

So many people have worked over the past year to keep KLSA thriving! Many thanks to:

- Our fleet of capable, conscientious volunteer monitors whose fourteen years of carefully gathered data are now allowing us to do longer term analyses
- SGS Lakefield, the Centre for Alternative Wastewater Management at Fleming College, and MOE's Lake Partner Program for their analysis of water samples, all at bargain rates
- Our many generous financial partners (see full list in Appendix B). These funds allow us to publish our report, hold meetings, and carry out research projects.
- George Gillespie of McColl Turner Chartered Accountants in Peterborough, for reviewing our financial records
- Director Mike Dolbey, who tackled fourteen years of phosphorus data to write his article about long-term trends on the Kawartha Lakes
- Director Doug Erlandson, who developed our new paid membership system and restructured our database of members and meeting attendees
- Director Jeff Chalmers, who has greatly improved our website with the help of Gooderham Productions of Peterborough, and who looks after our Facebook page
- Director Sheila Gordon-Dillane, who heads up the editorial board for this report and the members of the board. We were greatly saddened last spring by the death of Simon Conolly, who contributed countless volunteer hours to produce our reports in recent years. We are very grateful to Simon's colleagues at the *Lakefield Herald*, Joyce Volpe and Terry McQuitty, who continue to contribute their publishing skills to create our annual report. It's a huge job and we are extremely grateful!
- Our guest speakers, who have informed and intrigued us
- Our entire Board of Directors, who organize our various activities, including research, publicity, and education
- Ann Ambler, Chris Appleton, Tom Cathcart and Heathyr Francis, who stepped down from the Board of Directors during the past year, for their contributions to our work. Ann deserves special appreciation – she was a Director for ten years and Secretary for many of those years and took the lead with arrangements for our public meetings. We are grateful to Director Lynn Woodcroft, who has taken over some of these functions.

Plans for 2015

As in the past 14 years, KLSA will continue to test for phosphorus and *E.coli* in the Kawartha Lakes. Many *E.coli* sites have been tested for ten years or more and results are usually consistently low. As a result, some groups may decide to stop testing in the near future. Therefore, *E.coli* testing may be winding down over the next few years, so if you want to test, 2015 would be a good time.

We continue to be puzzled by the rise in phosphorus in Sturgeon Lake, which 'sets the tone' for all other downstream lakes. We think that some well-timed and well-placed phosphorus tests will help us feel more confident about why Sturgeon Lake demonstrates a 'phosphorus jump' compared to lakes directly upstream. This cannot be done through the Lake Partner Program, so we will be carrying out these tests independently this summer.

Membership

KLSA now has memberships available for $20 per person, $10 for students. Members can vote at the public meetings and will receive a copy of the annual report. Please consider joining at a meeting, or on-line through our website, and help support KLSA.

Testers needed

There are six sites we would like to test for phosphorus: south Sturgeon (one site); south Pigeon Lake (two sites), south and mid-Buckhorn Lake (two sites), Balsam Lake east of Grand Island, and north Chemong (one site). Please let us know if you would like to test in any of these areas, or contact the Lake Partner Program directly.

Spring meeting

We hope to see you at our spring meeting, Saturday, May 9 at the Bobcaygeon Arena. We will be reviewing this year's monitoring results and discussing the upcoming summer's activities. Director Mike Dolbey will be showing us what 14 consecutive years of KLSA data can tell us about phosphorus trends. We will also be featuring a guest speaker. Please bring your questions and concerns.

Thanks for your interest and involvement!

KLSA Board of Directors

l-r: Jeff Chalmers, Kathleen Mackenzie, Doug Erlandson, Lynn Woodcroft, Sheila Gordon-Dillane, Mike Dolbey, Shari Paykarimah, Mike Stedman. *Absent:* Tracy Logan, Erin McGauley, Bill Napier, Kevin Walters.

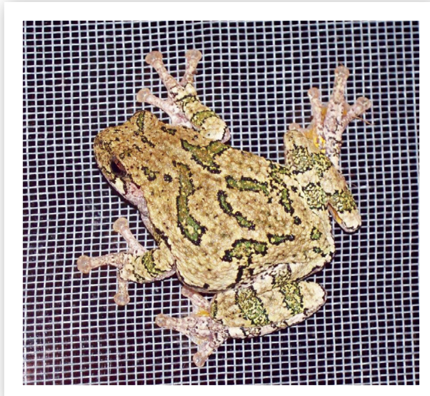
KLSA Editorial Committee

l-r: Pat Moffat, Tom Cathcart, Kathleen Mackenzie, Sheila Gordon-Dillane (Chair), Joyce Volpe. Absent: Janet Duval and Ruth Kuchinad

Climate Change in the Kawarthas

Drew Monkman
Naturalist and Nature Writer

Slowly but steadily, nature in the Kawarthas is changing. New species are arriving, the dates of key biological events are shifting and extreme events are becoming more common. In this article, I would like to share a number of the changes that local birders, naturalists, biologists and researchers have been noticing and documenting in recent years. Although some of the observations are anecdotal, others are supported by studies by the Ministry of Natural Resources (MNR), Trent University and researchers in other parts of the continent. What all of these changes have in common is a probable link to a warming climate. Although many of the events and trends may not seem so bad in themselves, they do represent the canary in the coal mine and point towards what the future is likely to bring.



Martin Parker
Gray Tree Frog on screen at cottage

Warming temperatures

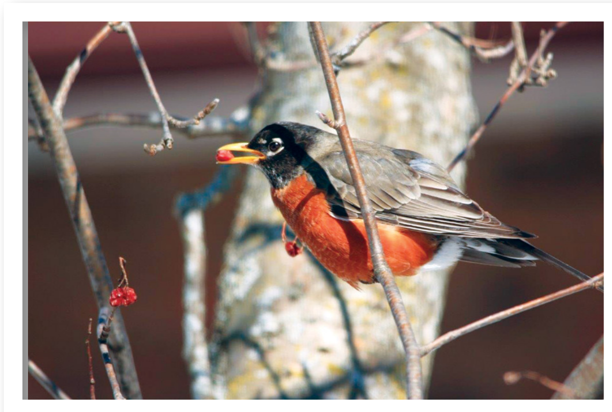
Over the past five years, about three-quarters of the months in the Kawarthas have been warmer than the 1971 – 2000 average (data for Peterborough). Despite a cooler than average 2014 locally, this past year was the warmest year on record for the planet as a whole. In fact, 14 of the warmest 15 years on record have occurred since the year 2000. According to Climate Change Research Report CCRR-16, prepared by MNR in 2010, our 6E ecoregion is projected to warm from an annual mean temperature of about 6.4°C (1971-2000) to approximately 7.7°C (2011-2040), 9.2° C (2041-2070), and 11.4°C (2071-2100). (Ecoregions are defined by a characteristic range and pattern in climate variables; 6E is where most of the Kawarthas is located.) Although annual precipitation is not likely to change significantly, extreme precipitation events will be more common. These projections are based on an 'A2' greenhouse gas emis-

Drew Monkman
Hepatica

sions scenario, which means a future world of higher human population, delayed development of renewable energy and higher CO_2 emissions – in other words, a future of 'business as usual.' To put this into context, in just 25 years the Kawarthas could very well have a climate similar to what Windsor, Ontario has today. By the 2080s, the climate might resemble that of present-day southern Pennsylvania.

A new timetable

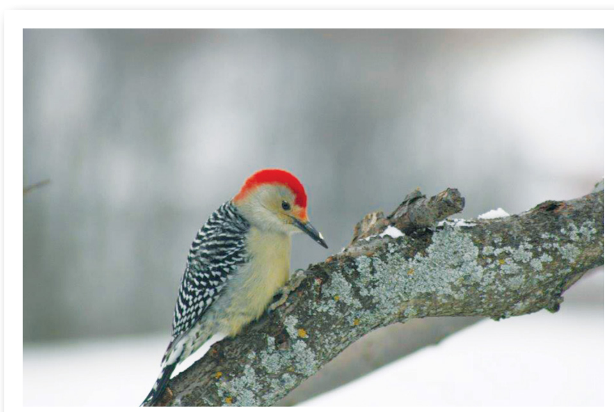
A whole series of nature events in the Kawarthas is now happening, on average, earlier in the spring than ever before. Other phenomena are occurring later in the fall.



Jeff Keller

American robin in mountain ash

- According to a report published in *Herpetological Conservation and Biology* in 2012, the peak calling period in the Lake Simcoe watershed for early breeding frogs such as spring peepers, wood frogs, chorus frogs and northern leopard frogs is now 10-20 days earlier than in 1995.
- Another study has shown that bullfrogs and gray treefrogs are also calling earlier.
- Trees are coming into flower earlier. A study done in Alberta and published in *BioScience* in 2011 showed that over the period from 1936 to 2006, the bloom dates for early-blooming trees such as trembling aspen have advanced by two weeks.



Robert Latham

Red-bellied woodpecker

- Earlier blooming means that pollen is being released into the air earlier. In fact, pollen counts are expected to double by 2040. According to a study published in *PLOS ONE* in November 2014, we can expect as much as a 200 percent increase in pollen production by grasses such as Timothy (*Phleum pratense*), since many grasses are expected to grow faster and larger due to the increased amount of atmospheric CO_2.
- Over the past two decades, local wildflowers such as trilliums and hepatica have been reaching peak bloom in late April or early May, instead of the long-term average date of mid-May.
- Although there is no data specific to the Kawarthas, many bird species are arriving back on breeding grounds earlier in the spring in many parts of their range. These include Canada geese, common loons, great blue herons, turkey vultures, ospreys, common grackles, tree swallows and red-winged blackbirds. The average egg-laying date for tree swallows is up to nine days earlier across North America. Red-wings are laying their eggs about a week earlier in many areas.
- On average, black fly populations are at their highest in early May. In the 1960s, peak numbers didn't occur until the May 24th Weekend.
- According to my own research, the long-term average
- According to my own research, the long-term average date for freeze-up of the Kawartha Lakes is mid-December, while the ice is usually out by about April 20. Recently, however, the lakes have been ice-free by early April, while freeze-up hasn't happened until late December or early January.

Changes in the numbers and kinds of plants and animals

- In recent decades, 'southern' birds have expanded their breeding range northwards into central Ontario and, in some cases, the Kawarthas. These include hooded warblers, blue-gray gnatcatchers and red-bellied woodpeckers.
- A study published in 2014 in Global Change Biology and based on 22 years of data from Project FeederWatch has shown that as minimum winter temperatures have increased, migratory birds that used to spend the winter solely in the south are now wintering farther north. These include Carolina wrens, eastern bluebirds and red-bellied woodpeckers. This is not just a result of people feeding birds, since the number of feeders in eastern North America has remained much the same since 1991.
- Similarly, researchers looking at decades of Christmas Bird Count data collected across eastern North America have seen a 200-mile shift northward of the region where American robins are spending the winter. They believe that this is likely an indication that our winters have gotten milder. The number of robins recorded on Peterborough Christmas Bird

Bird Counts is, on average, much higher now than in past decades.

• The Virginia opossum, a southern species of mammal, has now extended its range into the Kawarthas and is frequently seen year round.

• During a series of warm winters between 1995 and 2003, the southern flying squirrel rapidly expanded its northern range limit by approximately 200 km. Now, a study done by Trent University and MNR has shown that these southern squirrels are mating with their northern counterpart, the northern flying squirrel. This has resulted in a zone of hybrid squirrels right here in the Kawarthas. The authors of the study, Jeff Bowman and Colin Garroway, believe that the range expansion and interbreeding is a possible effect of climate change.

Drew Monkman

Red admirals on maple sap April 2012

• A number of southern butterfly species (Carolinian Zone) have expanded their range north into central Ontario. The most noticeable is the giant swallowtail, Canada's largest butterfly. Until recently, its Canadian range was restricted to southwestern Ontario. Giant swallowtails are now quite common in the Kawarthas.

• We are seeing a marked increase in the abundance of non-native invasive species in the Kawarthas. These include common reed (Phragmites), dog-strangling vine, garlic mustard and purple loosestrife. Non-native invasives are more adaptable to a warming world than most native plants. They also thrive in higher atmospheric CO_2 levels.

Jeff Keller

Snowy owl

• Two native plants, ragweed and poison ivy, appear to be increasing both in abundance and in size in many parts of the Kawarthas. Like the invasive species mentioned above, both of these plants have been shown to flourish in higher CO_2 levels.

• Monarch butterfly numbers in the Kawarthas have dropped precipitously in the last few years. Although the elimination of milkweed in the American mid-west may be the main cause, climate change-related droughts and abnormal weather patterns along the Ontario-to-Mexico migration route have also had an impact.

Extreme events

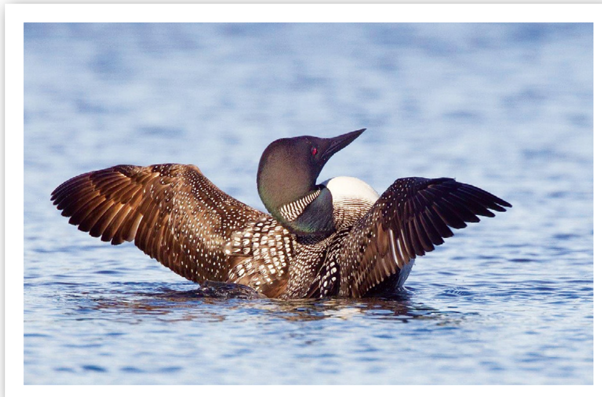
• Extreme weather events such as wind- and rainstorms seem to be occurring more often. These include the Peterborough Flood of 2004, when 174 mm of rain fell overnight, causing extensive damage. In August 2006, the Township of Galway-Cavendish and Harvey in northern Peterborough County was hit by a severe windstorm and an F0 tornado. (Tornados are rated on the Fujita intensity scale from 0 to 5.) Storms like these do great damage to forests and city trees. Peterborough has lost numerous mature trees in recent years as a result of windstorms.

• In March 2012, the Kawarthas experienced eight days of temperatures above 20°C, which was unprecedented. Frogs were calling three weeks earlier than usual, mourning doves were nesting, trees came into flower and the Kawartha Lakes were ice-free by March 20 -- a full month earlier than usual.

• In April 2012, over 300 million red admiral butterflies poured into eastern Canada from the southern U.S. Hundreds were seen even along George Street in downtown Peterborough. The invasion was linked to an historic drought in Texas (possibly an effect of climate change?) that had killed nearly all of the predatory insects. When rain finally came and wildflowers flourished, red admiral reproductive success went through the roof, since predators were mostly absent. Strong southerly winds carried wave after wave of red admirals north out of Texas and into eastern Canada from April through early May. However, the butterflies arrived here too early to lay eggs, because their host plant, the stinging nettle, had not yet emerged from the ground. They were therefore unable to reproduce. A species arriving too early or too late to take advantage of the resources it needs for reproduction (e.g., sufficient food to feed the young) is a common climate change scenario and one that is already being seen in some migratory bird populations.

- The winter of 2014 saw the largest incursion of snowy owls into southern Canada and the Kawarthas on record. Owl numbers had exploded because of an abundance of lemmings in the Arctic. Some scientists see a possible link between a warming Arctic and higher than usual lemming populations.

- The frigid winter weather of 2014 and 2015 may itself have been related to the warming of the Arctic. The strength of the high-altitude winds known as the jet stream is directly proportional to the difference in temperature between the poles and the tropics. A warming Arctic means that this difference is getting smaller. Some scientists believe this is causing the jet stream to weaken and take on a wavy shape that stays in place for long periods of time. This is allowing frigid Arctic air to flow southward in parts of the Northern Hemisphere, while in other areas, southern air is moving much farther north than usual.



Karl Egressy

Common loon

- With the Great Lakes frozen over at more than 90 percent in 2014 and more than 80 percent by late February 2015, ducks and grebes that normally overwinter on these lakes were frozen out and had to look for other areas to find food and open water. Many turned up on the Otonabee River here in the Kawarthas. Species that we almost never see in winter locally (e.g., long-tailed duck, red-breasted merganser, red-necked grebe) arrived and stayed for weeks and even months.

Terry Carpenter

Sugar maples

Concern for the future

- According to Audubon's Birds and Climate Change Report published in September 2014, no fewer than 314 of the 588 North American bird species studied will lose more than 50 percent of their current climatic range by 2080. As for the Kawarthas, a number of iconic birds may no longer be able to breed here, their ecoregion (i.e., habitat requirements) having moved farther north as a result of warming. Some of these birds include the ovenbird, veery and common loon.

- Insects should thrive in a warming climate and have more life cycles per year. New species are certain to expand their range north into the Kawarthas. These include the black-legged tick, which carries Lyme disease. Invasive and non-native species such as the gypsy moth, which were once restricted by colder winter temperatures, are expected to continue to spread at an increased rate.

- A major decline in forest health will almost certainly occur as a result of higher temperatures, drought, invasive plants, insect pests and fungal infections. By mid-century, we may no longer have the temperature and precipitation regime for the kind of forest and vegetation we have now, since 'our climate' may have moved as far north as Sudbury. Species such as white pine, sugar maple and white spruce will find survival in the Kawarthas increasingly difficult, if not impossible.

- The health of our lakes and rivers is likely to suffer. Warmer temperatures and increased evaporation may lead to lower water levels, altered stream flow patterns and decreased water quality. Although warm-water fish like large-mouthed bass should be able to cope, cool-water fish like walleye will struggle to survive here. The conditions may allow non-native fish (e.g., round goby) to thrive and out-compete native species for food. There will likely be an increase in the types and abundance of other invasive species such as zebra mussel, Eurasian water-milfoil, frog-bit and fanwort.

Unfortunately, climate change may also bring emotional distress. For older people at least, we can expect a change in how it 'feels' to live in the Kawarthas. Seasonal rituals like a backyard skating rink are almost certain to disappear. There may also be a marked decline in the quality of our experience of the natural world. With less of a sense of what species and natural events to anticipate -- and what is 'normal' -- we will have to learn to expect the unexpected.

Unless thousands of scientists have it all wrong, climate change is probably the greatest known risk humanity faces. President Obama, in his State of the Union address in January 2015, said, "No challenge...no challenge...poses a greater threat to future generations than climate change." But, here's the good news: The International Panel on Climate Change, a scientific body affiliated with the United Nations that assesses the most recent scientific, technical and socioeconomic information relevant to climate change, says that there is still time to substantially reduce the impacts of climate change—and the costs of adapting to it— if we drastically cut greenhouse gas emissions.

I encourage people to make climate change a regular topic of conversation with friends and relatives and to respectfully challenge deniers or those who don't consider it a serious threat. The most important thing we can do right now is lobby aggressively for a price on carbon emissions, preferably in the form of a revenue-neutral carbon tax like that of British Columbia. This is also known as a carbon fee and dividend.

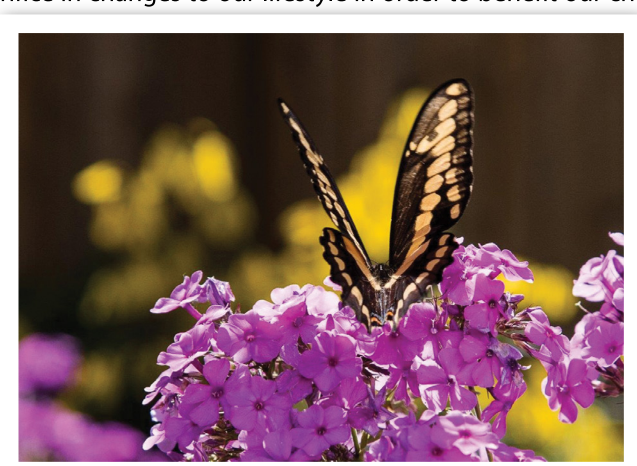
Many people will argue that human beings are too myopic and our political system too partisan for even revenue-neutral taxation to be accepted on a wide scale. This argument is hard to dismiss out of hand. However, because a carbon tax represents a market solution, it should be able to garner support beyond traditional environmentalists. Proponents of a revenue-neutral carbon tax need to emphasize that it is not a tax hike. All of the money collected is returned to taxpayers, either through a monthly cheque or by reducing other taxes such as income tax. Human beings are capable of making tremendous sacrifices for their children and grandchildren's well-being. Just think of how we work so hard to pay for higher education savings plans that won't provide measurable benefits for years to come. This is how we should look at a carbon tax: a little bit of short-term sacrifice in changes to our lifestyle in order to benefit our children and grandchildren.

By finally addressing the problem of climate change in a serious manner, another benefit would immediately accrue to all of us: a greater sense of optimism about the future.

Note:
The Ministry of Natural Resources has published two excellent resources on climate change in Ontario. They are: Climate Change Research Report CCRR-16, which is entitled "Current and Projected Future Climatic Conditions for Ecoregions and Selected Natural Heritage Areas in Ontario" and Climate Change Research Report CCRR-36, entitled "Community-Level Effects of Climate Change on Ontario's Terrestrial Biodiversity."

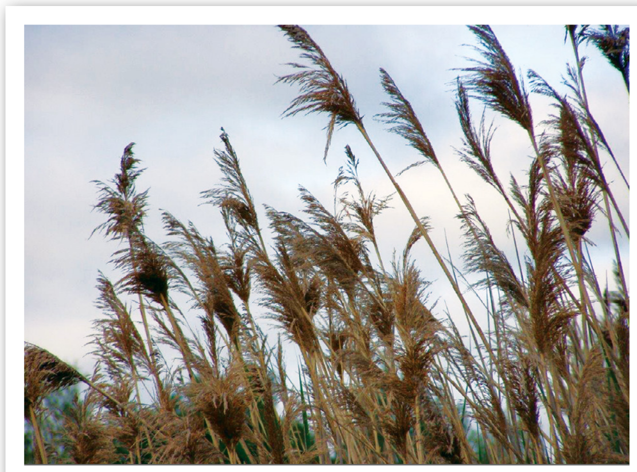
As this report goes to press, the Ontario government has announced that it is adopting a cap and trade system of carbon emission controls.

Drew Monkman is the author of Nature's Year: Changing Seasons in Central and Eastern Ontario.



Drew Monkman

Giant swallowtail on phlox



Drew Monkman

Phragmites - common reed

John Urquhart; Ontario Nature

Spring peeper

Invasive Species in the Kawarthas

Dave Pridham
Manager, Technical and Stewardship Services,
Kawartha Conservation

Over the last several decades invasive species have become arguably one of the most significant threats to biodiversity and the world's environment. In North America, invasive species include terrestrial and aquatic plants and shrubs (buckthorn, Tartarian honeysuckle, barberry, dog strangling vine, Eurasian milfoil, fragmites, Japanese knotweed, periwinkle), insects (gypsy moth, emerald ash borer), amphibians and reptiles (python in the everglades), fish (round goby, Asian carp, sea lamprey), tree diseases (Dutch elm disease, beech bark disease, butternut canker), and birds (starlings, feral domestic pigeon).

The intent of this article is to provide an introduction to this significant environmental concern. As examples, I will briefly discuss one invasive plant, one invasive shrub, and one invasive insect – each being a woodland threat and coming to your cottage road.

The largest factor contributing to the spread of any invasive species is the fact that few natural controls exist here for that species. In their native habitat, natural controls such as climate, animals, insects, fungi, and other plants restrict them to a certain habitat niche. When introduced to new habitats (perhaps your garden) without their natural controls, some have the potential to overwhelm certain habitats, displace native vegetation such as trilliums and ferns, or interfere with the natural regeneration of forest tree species. Certain rare flora and fauna may become locally endangered.

All gardeners should strive to use native plants, and be aware of plants from other origins that are suited to our climate zone and will grow on a wide variety of sites, as this is an indication of a potential invader.

The economic impact of invasive species is immense. The cost of the damage caused by invasive species affecting forestry and agriculture in Canada in the early 2000s was estimated to be $7.5 billion annually[1]. Their impact on native ecosystems and species is often severe and seemingly irreversible. It has been estimated that approximately 24% of the species at risk in Canada may be threatened with extinction by invasive species[2].

Buckthorn – description, life history, ecological impact and control

Buckthorns are native to Europe, likely introduced into North America in the late 1700s and widespread here by the early 1900s. They have naturalized from Nova Scotia to Saskatchewan and well across the United States. Although they generally grow as large shrubs, they can become small trees reaching six to seven metres (20 to 25 feet) in height and 25 cm (10 inches) in diameter. The shrubs have low, wide-spreading, and loosely branched crowns with upwards of 15 stems. The thorns themselves are very small and not to be confused with our native hawthorns.

Buckthorn is noted for prolific reproduction by seed. Under full sun conditions, it can produce seed a few years after establishment. Seedlings establish best in high light conditions, but also germinate and grow in the shade. The seedlings have very rapid growth rates and shrubs resprout vigorously after cutting. To effectively control regrowth, the application of herbicide is generally required either to the cut surface or to the suckers that sprout from the root.

Dave Pridham

Buckthorn foliage

Dave Pridham

Buckthorn thorns are short

[1] Dawson, Marcel. 2002. Plant Quarantine: Preventing the introduction and spread of alien species harmful to Plants. Alien Invaders in Canada's Waters, Wetlands, and Forests pp. 243-252. Canadian Forest Service, Natural Resources Canada.

[2] Stronen, Astrid Vik. 2002. Impacts on Canadian Species at Risk from Invasive Alien Species. Canadian Wildlife Service, Environment Canada.

Its suitability as a hedgerow shrub resulted in widespread planting across the country, with subsequent invasion in a variety of natural areas from old fields to wetland edges and woodland understoreys. Once established it spreads very quickly, creating a thick cover that will shade out native shrubs and plants and prevent natural regeneration of native trees and shrubs. Buckthorn may also be allelopathic (its root-exuded chemicals can harm other species and prevent them from growing nearby), which means that once established, natural areas can contain almost exclusively buckthorn.

Buckthorn is most easily controlled when present in small numbers and removed as soon as noted. When present in larger numbers over a large area, you should develop a priority based strategy. For example:
1. Identify and remove the most prolific seed producers early – generally those specimens growing in the open, with the largest crowns.
2. Consider your favourite areas and prioritize where you want to clear out buckthorn – e.g., wildflower patches, the understorey of a mature hardwood stand, a favourite natural area, or trail sides.

Basic steps for removing buckthorn

1. Focus on buckthorn trees greater than 8 cm (3 inches) in diameter. Buckthorns of this size produce berries. It is necessary to treat freshly cut stumps with a herbicide. If stumps are not treated or removed, they will resprout vigorously.

2. Control of buckthorns with systemic herbicides has been successful in many situations. Application of Roundup®, Accord®, Glypro® or Garlon 4® to cut stumps during the growing season and in warm days of winter has proven to be effective. Other application methods may include basal bark and foliar application. A foliar application of Garlon 3A® in dense thickets may be very effective in the spring and fall. Without treatment, stems will resprout vigorously after cutting due to the extensive root system.

Dave Pridham

Native hawthorn is not invasive. It has longer thorns than buckthorn.

Garlic mustard – description, life history, ecological impacts and control

Garlic mustard is native to Europe and was introduced to North America in the late 1800s. It was historically eaten as a potherb green, considered useful for medicinal purposes such as treating gangrene and ulcers, and utilized for its high Vitamin A and C content. It is a cool season biennial herb, germinating in the late summer and overwintering as a rosette. Plants surviving the winter will mature, produce flowers and seeds in the late spring of the second year. The new leaves emit the distinctive odour of garlic when crushed; however, this scent fades as the plant matures.

This invasive plant is now established throughout the Kawartha landscape. It is generally introduced by hitchhiking in with mud stuck in the tread of a hiking boot or vehicle, or perhaps within commercially composted garden soil. It is often first noted on the edges of a residence, or perhaps along a roadway or walking trail, and then spreads into a woodland. Guests should clean the mud from the soles of their boots before they arrive.

Established clumps produce more than 60,000 seeds per square metre; single plants can self-pollinate and propagate a large population in a few years. It begins growing early in the spring while native plants are still dormant. Established garlic mustard populations double in size every four years, and displace native woodland wildflowers such as trilliums and trout lilies. Garlic mustard roots produce several phytotoxic chemicals including sinigrin that may interfere with the function of the mycorrhizae (beneficial root fungi) necessary for the long-term health and survival of other plants.

Two basic control measures are effective for garlic mustard. The first is to identify and eradicate new or satellite infestations before a seed bank is established. Monitoring should be focused on the edges of your driveway or backyard, and along trails, roadways and field edges particularly in public and recreational areas. The second measure is the more difficult task of eradicating well established invasion fronts. Once initiated, the follow-up strategy over the next few years is to identify and control remnant plants until the seed bank is depleted. Seeds can remain viable for five years.

Pulling individual plants is a preferred option and will produce good results, especially in sandy soils, if plants are removed before they set seed. They generally pull easily, but pulling from heavier soils such as clay and clay loams may cause the plant to snap off at or below the root crown allowing it to send up new flower stalks. Cut or pulled flower stems can still form viable seeds if left lying on the ground -- they must be removed from the site and properly disposed of.

Chemical control using Glyphosate is effective when applied at 1 to 3% concentrations in the fall or early spring to the dormant garlic mustard rosettes (first year plants). As the active ingredient breaks down quickly, garlic mustard seedlings that appear after a Glyphosate application will not be affected by this herbicide. Care must be taken with spring applications especially -- Glyphosate is non-selective and nearby native vegetation can be damaged or killed. The fall can therefore be a preferred season for herbicide control of the newly germinated rosettes – most native plants are dormant and applications of Glyphosate may be effective until late fall.

Cautions re herbicide use

1. Special licences are required for the purchase and use of most herbicides.
2. The herbicides referred to are non-selective and will kill or damage adjacent vegetation.
3. Read the label and store safely.

When landowners learn to identify invasive plants and become familiar with control options, and work together on their own properties or cottage road, success is possible if hotspots are identified early.

The search for biological controls is ongoing, with insects that feed on these plants in their natural range being studied. It must be determined that any potential insect introduced to North America will feed only on that plant.

Collaborative efforts to prevent additional introductions and manage invasive plants are being organized by the Canadian Food Inspection Agency, Ontario Ministry of Natural Resources and Forestry, conservation authorities, stewardship councils, and organizations such as the Ontario Federation of Anglers and Hunters, and the Ontario Invasive Plant Council.

Emerald ash borer

The emerald ash borer was accidentally brought to America in the ash wood used in shipping materials, and first discovered in America in June 2002 in Michigan. Since that time, it has spread across much of the central United States and is present in hotspots across Ontario and most recently in Quebec.

This insect is an extremely serious pest. Ash are common across our landscape, with white ash being one of the two or three most significant species in our upland hardwood forests. In addition, ash was commonly planted in urban areas after elm were decimated by Dutch elm disease 50 years ago.

Dave Pridham

Garlic mustard, well established in an upland hardwood understorey, with mayapple behind

Damage and subsequent mortality is due to larval feeding, with serpentine feeding galleries of the larvae under the bark disrupting flow of nutrients and water. The result is that trees are girdled. Infestations initiate in the higher branches and work their way down in subsequent years as the crown dies.

Within a few years of the insect establishing itself, few if any living ash will remain. In many areas, remaining ash are seedlings and small saplings.

The control of this insect across the landscape is not possible; however there is an option for highly prized individual trees, if initiated in time. TreeAzin® Systemic Insecticide is an injectable systemic insecticide formulated with an extract of neem tree seeds.

Online resources

Ontario's Invading Species Awareness Program:
www.invadingspecies.com
See the resources section

Invasive Species Best Management Practices Webinars: Ongoing free live webinars about invasive species. Past webinars are available to watch. Click the Information and Resources menu at:
www.ontarioinvasiveplants.ca

New Best Management Practices Guides:
Look in the Resources section at :
www.invadingspecies.com

Invasive Plants Website Information
The Ontario Invasive Plants Council is taking the lead for developing programs to address invasive plants in Ontario. For more information, please visit their website:
www.ontarioinvasiveplants.ca

Simply typing the common names of these plants into your search engine will result in a wealth of information on various plants, including:

- Buckthorn species
- Garlic mustard
- Dog strangling vine
- Exotic honeysuckles
- Japanese knotweed
- Norway maple and its various cultivars
- Barberry species
- Giant hogweed
- Wild parsnip
- Spotted knapweed
- Multiflora rose

Dave Pridham

Dog strangling vine in a red pine plantation in the Orono area

Exit holes in ash tree

Emerald ash borer

Emerald ash borer online

- www.toronto.ca/trees/eab.htm
- www.bioforest.ca/index.cfm?fuseaction=content&menuid=12&pageid=1012
- www.inspection.gc.ca/english/plaveg/pestrava/agrpla/ agrplae.shtml

Look for the Blue Canoe

Holly Shipclark
Stewardship Technician, Kawartha Conservation

The Blue Canoe program is an outreach initiative first launched on Lake Scugog from 2006 to 2010 and again during the summers of 2012 to 2014 – primarily on Sturgeon, Pigeon, Balsam and Cameron Lakes within the City of Kawartha Lakes. This program takes a unique hands-on approach to landowner engagement by connecting with landowners on their stretch of shoreline. Program objectives are achieved by trained summer staff who travel dock to dock by canoe or, when weather is questionable, door to door by cottage road.

Blue Canoe staff have three tasks to achieve with each resident they engage, as follows:

1. To provide the resident with a package containing information about lake management planning, invasive species, shoreline protection and septic maintenance. It includes Kawartha Conservation's Landowner's Guide to Protecting Water Quality in the Kawarthas;
2. To initiate constructive discussion, answer questions and address concerns about issues associated with shoreline living and lake health;
3. To conduct the Blue Canoe survey, or direct the resident to the survey online. Incentive to complete the survey is provided by the chance to win a free rain barrel.

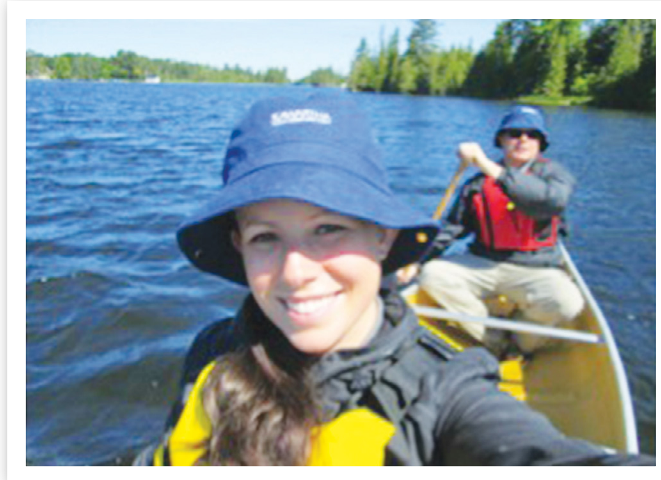
Should shoreline residents not be home, the weather-resistant information package is left, along with a calling card. Residents who have missed a Blue Canoe visit are encouraged to call and schedule a site visit with Kawartha Conservation staff.

Also included in the program is the delivery of Dock Talks. These are organized in partnership with lakeside community members who help promote the event and encourage participation from their neighbours. A Dock Talk includes presentations and discussions tailored to address issues and concerns faced by the participating neighbourhood.

The Blue Canoe staff also attend community events, such as lake association Annual General Meetings and farmers' markets. These events provide opportunities to engage with large numbers of people.

Blue Canoe staff with City of Kawartha Lakes Councillor Pat Warren and community member John Bush at a Dock Talk in Bobcaygeon, June 2014

Kawartha Conservation



Blue Canoe staff paddling on Mitchell Lake, July 2014

During the first three years in the Kawartha Lakes, the Blue Canoe program engaged directly with 3,376 shoreline residents. Efforts were focused on lakes for which Lake Management Planning had been completed or was in its final stages. Due to increasing demand in 2013 and 2014, the program was delivered to a lesser degree on lakes in the early stages of Lake Management Planning.

As 2014 marked the final year of the three-year program being funded in part by RBC Blue Water, it was a good time to evaluate the entire history of the Blue Canoe program, back to its origin on Lake Scugog. Overall, the program has seen good success and continues to educate lakeshore residents. The program provides the necessary awareness, knowledge and incentive for lakeshore residents to practice best management on their properties. For more information about the program, please visit www.kawarthaconservation.com/bluecanoe.

Moving forward

Kawartha Conservation has been actively seeking new funding sources to support the ongoing delivery of the Blue Canoe program, and is optimistic this program can be continued in 2015 and beyond. It is hoped that the program will be expanded to have a greater presence on all the lakes for which lake management planning has been initiated, including:

- Sturgeon Lake
- Canal Lake
- Mitchell Lake
- Four Mile Lake
- Balsam Lake
- Cameron Lake
- Head Lake
- Pigeon Lake

BLUE CANOE PROGRAM

For more information about the Blue Canoe Program, Lake Management Planning and other programs and services provided by Kawartha Conservation, visit their website: www.KawarthaConservation.com

Goose Habitat Modification at the Public Beach in Norwood, Ontario

Erin McGauley, Watershed Biologist
Otonabee Region Conservation Authority
KLSA Director

Waterfowl feces are never a welcome sight along a shoreline. In large amounts, waterfowl feces can cause bacterial contamination, making the water unsafe for human recreation. Home and cottage owners can naturalize their shorelines by planting native shrubs and trees to discourage geese, but what about a beach?

It is particularly difficult to discourage waterfowl, particularly Canada Geese, from congregating at beaches. Large populations of Canada Geese are becoming a concern at beaches and recreational areas across the Province. By definition, a public beach is an open sandy area at the shoreline, which is often paired with grassy expanses for sunbathing and field sports. Canada Geese prefer areas with clear sight lines between their feeding areas which are often expanses of lush grass, and the water, where they can easily escape predators by paddling away, making beaches the perfect habitat.

In the Village of Norwood, Ontario, a beach naturalization project was initiated in 2009 to discourage geese from using the local Norwood Beach. The water quality of the Norwood Pond resulted in several beach closures annually, and the beach and picnic areas were frequently rendered unusable due to the presence of large numbers of Canada Geese. In order to restore the appeal of this popular beach and picnic area, a habitat modification plan was developed by Otonabee Conservation in conjunction with a number of partners including local schools, the Municipality of Asphodel-Norwood, the Norwood and District Lions and Lioness Clubs, Norwood and District Horticultural Society, Norwood Mill Pond Revitalization Committee, Ontario Drinking Water Stewardship Program and Otonabee Conservation Foundation.

Within the beach area itself, seven shallow pits approximately five feet in diameter were excavated, filled with topsoil and compost and planted with over 250 native shrubs and flowering perennials. These 'islands' of vegetation were ringed by round river stone and spaced so that the public could still gain access to the water. The spacing was staggered to impede the clear sight lines that the geese depended on between grassed picnic areas and the water of the Norwood Pond. Native plant species used for this project include: red osier dogwood, speckled alder, pasture rose, chokecherry, potentilla, fragrant sumac, sandbar willow, nannyberry, swamp milkweed, Joe Pye weed, flat-topped aster, New England aster, switchgrass, Canada wild rye, helenium and purple coneflower.

Habitat modification at the Norwood Beach has been complemented by additional efforts to discourage the geese from using the pond and surrounding land, including shoreline plantings, a falconry program and public education.

ORCA file photo

Islands of vegetation were planted within the beach area, which when established, will obstruct goose sight lines from the water.

MFS

Waterfowl feces can cause bacterial contamination, making the water unsafe for human recreation.

2013 Kawartha Lakes Sewage Treatment Plants Report

Kevin Walters B.A.Sc., P.Eng.
Co-Chair, KLSA

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

As we have indicated before, our plant data is always behind one year, as the reports for the previous year are not available to us before going to press. Most of these reports are now online on the City of Kawartha Lakes (CKL) website: http://www.city.kawarthalakes.on.ca/residents/water-and-wastewater/reports/annual-wastewater-reports

Again this year we have included two 'indirect' sewage treatment plants (STPs), Minden and Port Perry, which are outside of the City of Kawartha Lakes. By indirect, we mean those plants that are not discharging directly to our Kawartha Lakes, and have at least one body of water in between to attenuate the effects of the effluent discharge.

Minden

Minden's plant discharges to the Gull River just above Gull Lake, which is two lakes away from our most upstream Kawartha lake, Shadow Lake. In 2013 this plant performed quite well with a phosphorus (P) removal rate of 97.2%, down slightly from 2012's 98.0%, and resulting in a loading of 13.9 kg P for the year. However, the unusually high and long 2013 spring flood in Minden resulted in sewage bypasses at a pumping station (10 days), the STP (11 days) and a tertiary filter (14 days). The total discharge of phosphorus due to these events was estimated to be about 40 kg bringing the total phosphorus discharge for the year to 53.9 kg. This effectively reduced the treatment rate of Minden's wastewater to 90.1%.

Average *E.coli* discharges were up from the previous year at 7.20 colony forming units per 100 ml (cfu/100ml). Except for the flood events discussed above, no other problems were reported with this plant.

Bobcaygeon

This town has two side-by-side sewage treatment plants. 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. Since 2011, only one performance report giving results for the combined output of the two plants has been produced. In 2012, excellent performance suggested that both plants were operating well. However, in 2013 the reported annual phosphorus load was 85.4 kg, almost double the 2012 load of 43.2 kg, but still substantially below the 1.3 kg per day that the plant is permitted to discharge. The average removal rate for the year was 96.9%, down from 97.9% in 2012 and well below our desired target of 99%. Both monthly loading rates and % removal rates were fairly consistent and no problems were reported that would indicate a reason for the large increase in phosphorus load.

E.coli discharges were quite low, at only 3.41 cfu/100 ml on an annual basis. No bypasses, overflows or spillage to the lakes were reported. Odour from the plant continues to be reported from time to time. A pilot study using photoionization was implemented at the Bobcaygeon plant in 2013 and the results indicated that this method was not able to sufficiently achieve the desired results. Further studies are planned with alternative technologies.

Coboconk

This lagoon system continues to function well, with discharges to the Gull River just above town occurring in May and November/December only. Average phosphorus discharges were 0.05 mg/L. The removal rate was 97.42%,down from 2012's excellent 99.43%, and below our target of 99%. The total annual discharge of phosphorus was approximately 3.2 kg.

Average *E.coli* discharges in May were a fairly high 12.4 cfu/100 ml but in November were a more normal 2.3 cfu/100 ml. Given the time of year for the discharges, this is not particularly a concern. No spills, bypasses or overflows were reported. Only one odour complaint was received in September and it was attributed to unusual weather conditions.

Fenelon Falls

Again this year we caught a recurring error in the Fenelon Falls plant report. What they have been stating in their reports as their annual average phosphorus removal rate, has, in fact, been their highest monthly removal rate. We had thought that these 99%+ rates were surprisingly high. Accordingly, for 2013, the stated 98.1% removal rate was in fact only 97.1%, down from 97.8% in 2012 and below our target of 99%. We expect that all future reports will avoid this error.

Discharge rates were between 0.05 and 0.11 mg/L every month (average 0.06 mg/L). The Certificate of Approval (C of A) allows 10 times that at 0.5 mg/L. Still, total phosphorus discharge for the year from this plant was 26.4 kg, less than half of Bobcaygeon's.

Cross-connections (storm sewer connections into sanitary sewer systems and vice versa) still appear to be a serious problem here. During three high rainfall and/or snowmelt events in January, March and April of 2013, the Ellice Street pumping station was overwhelmed and raw sewage was discharged straight into the lake from the Colbourne Street pumping station. Each bypass lasted about three days resulting in estimated discharges of 4214, 970 and 3130 m^3 of untreated sewage directly to Sturgeon Lake. These discharges amount to over 2% of the total amount of sewage processed by the plant during the year and resulted in an estimated 19.1 kg of additional phosphorus entering the lake. This brings the total discharges from Fenelon Falls to 45.6 kg, diminishing the effective treatment of Fenelon's sewage to 94.9%. It is clear that this ongoing inflow issue must be explored and resolved by the City. In 2015, CKL Council is considering a proposal to install a holding tank at the Ellice Street pumping station to alleviate this problem.

Again this year *E.coli* levels in the effluent were around 2 cfu/100ml.

2013 Kawartha Lakes Sewage Treatment Plants Report

Lindsay

This plant, the largest on the lakes, continues to work well. Phosphorus discharges averaged 0.041 mg/L, whereas the C of A allows five times this at 0.2 mg/L. The removal rate averaged 98.04%, down slightly from 98.23% in 2012. Total annual phosphorus discharge amounted to 220 kg, up a little from the previous year but still substantially lower than the 288 kg it discharged in 2011. Even more good news is that there were no spills or bypasses in 2013, and no complaints were received.

Average *E.coli* in the discharge was 4.0 cfu/100 ml, compared to 2.4 cfu/100 ml in 2012.

Kings Bay

This plant is functioning better than in 2012, and the effluent targets continue to be met. Phosphorus discharge to the underground disposal bed averaged 0.21 mg/L in 2013, down significantly from the previous year, out of an allowable 1.0 mg/L. The annual daily loading for 2013, was 0.009 kg per day, only 5% of the allowable discharge volume of 0.17 kg per day.

Actual loading to Lake Scugog likely remains nil since the discharge is to the ground, as with a septic tile bed. Monitoring wells located 15 m down gradient from the bed had high P levels in the early half of the year continuing the trend from 2012 believed to have been caused by sediments getting into the wells. In September 2013 the well casings were repaired with "screenings and holeplug" and the surface was graded around the wells to prevent infiltration of surface water. The subsequent P level was very low. The late season results amount to an overall 99.5% P removal rate at the test well, which more than meets our target. It will be interesting to see if the latest test well maintenance will result in more consistent readings in future years.

Since these wells average 150 m from the lake or the Nonquon River, this suggests that, at least for the time being, we still have effectively 100% removal. No bypasses were reported in 2013.

Omemee

This lagoon facility did not require any emergency discharges to the Pigeon River and in 2013 all effluent was spray-irrigated onto nearby fields. However, the report does not explicitly state this fact and says that "there are no effluent reporting criteria requirements for this facility". The average daily flow into the facility for 2013 was 115% of its design flow. In total, there were 156 days in 2013 when the raw sewage flow exceeded the rated design capacity of the lagoons, in some cases by 600%. An Environmental Assessment was done to determine the preferred option for upgrading the facility.

Phosphorus was reduced to 1.34 mg/L, higher than the allowable 1.0 mg/L, reflecting an 80.5% removal rate to the point of spray irrigation. This is about 8% lower than the previous year. However, because the effluent is applied to land, removal is probably almost 100% with respect to our lakes.

E.coli levels averaged a more moderate 50.8 cfu/100ml in 2013 down from 2012's rather high 309 cfu/100ml. Though high in comparison to the output of other plants, this was applied to land, not to our waterways.

Port Perry

This plant consists of lagoons that discharge seasonally to the Nonquon River northwest of Port Perry, which in turn empties into Lake Scugog at Seagrave, where the Kings Bay facility is located. In 2013, phosphorus was reduced to a monthly average of 0.11 mg/L for a total loading of 121.3 kg, which is its lowest in 5 years. However, this reflects a removal rate of only 97.0%, a poor performance compared to most other area sewage plants. There were no reported bypasses this year and only one minor spill of treated wastewater to ground in the vicinity that was contained within 24 hours. No complaints were received from the public during the reporting period.

The Port Perry lagoons are to be replaced by a new mechanical sewage treatment plant to allow for the expansion of Port Perry. Construction is scheduled to begin in early 2015 with completion in mid-2016. This new plant 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 amount of phosphorus discharged to the mainstream Kawartha Lakes from the four aquatic discharge plants in 2013 was 332 kg, up 25% from 265 kg in 2012 but better than the 392 kg in 2011 and 416 kg in 2010.

If we include all the plants that we now monitor, we have total phosphorus loading rates to the lakes of 471 kg in 2013, compared to 427 kg in 2012, an increase of about 10%. 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 197 kg or about 40% of the 2013 total.

Omemee floating wetlands

E.coli Bacteria Testing

Kathleen Mackenzie, KLSA Co-Chair

Thank you to our volunteer testers for collecting information that we all appreciate. The combination of all the results over 14 years gives us a good indication that our Kawartha Lakes have very few bacterial problems. There have been a few sites that have had recurring high readings, usually in areas where there are large populations of waterfowl. However, a huge majority of the sites have consistently had readings between 0 and 20 *E.coli*/100 mL, with an occasional reading between 20 and 100. This is normal for a lake with thriving wildlife.

To see complete results, please refer to Appendix E.

In 2014, KLSA volunteers tested 91 sites on 16 lakes for *E.coli*, 6 times over the summer. As in the past 13 summers, counts were generally low, and there were no locations that had consistently high counts (see chart below).

One might have expected bacteria levels to be lower in 2014 due to the cold weather, the cold water, and the resulting lower level of human activity on the water. However, counts were similar to other years.

If you would be interested in testing a location on your lake, please let us know. Because KLSA minimizes administration at our two testing labs, testing with KLSA costs far less than if you take samples in yourself. Our cost is $60 per site, and that is for 6 tests over the summer. KLSA will pay for up to three sites for an association, or one site for individuals, for the first year of testing.

As many groups have been testing for 10 years or more, and are now confident that their sites are problem-free, they may not be testing for much longer. That would spell the end of the program, because it only works on a bulk basis. So, if you think you might like to test for *E.coli*, this may be a good year to sign up!

Site Rating	**Number of Sites**	**Comments**
'Very Clean': all readings less than 20 *E.coli*/100 mL	58	These sites exhibit excellent recreational water quality, and good management practices by lake users.
'Clean': one or two readings over 20 *E.coli*/100 mL	27	
'Somewhat elevated': three readings over 20 *E.coli*/100 mL	6	Most of these sites have had the occasional elevated count before, often thought to be caused by resident waterfowl.

MSF

Phosphorus Testing

Kathleen Mackenzie, KLSA Co-Chair

In 2014, KLSA volunteers tested for total phosphorus at 41 sites on 15 Kawartha Lakes up to six times during the ice-out season. Sites with at least three consecutive readings (e.g., June-July-August) were graphed. Locations of the sites can be seen on the map on page 28, and also at www.ontario.ca/environment-and-energy/map-lake-partner

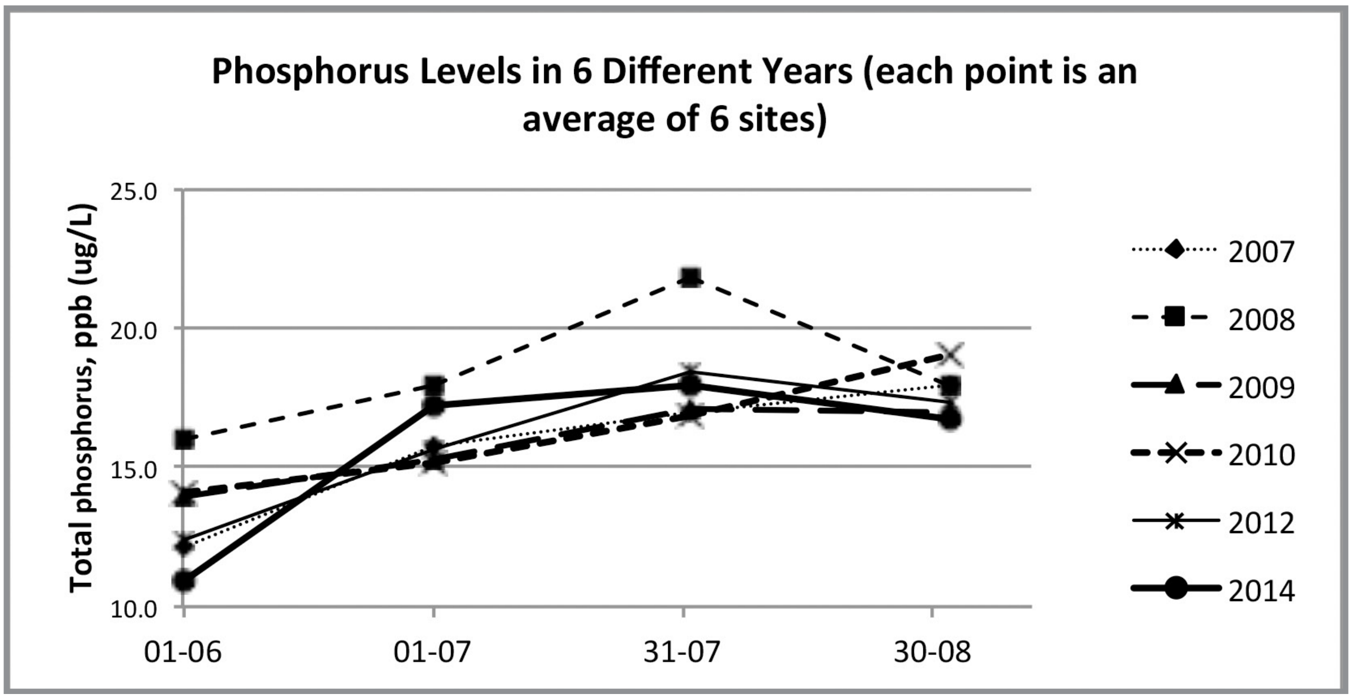
Testing is done through the Lake Partner Program of Ontario's Ministry of the Environment and Climate Change. Kits are mailed in the spring. All you need to do is go out for four to six rides in your boat and fill up a bottle with lake water. Kits, postage and analysis are free. Results for hundreds of Ontario lakes are found on the Lake Partner Program website. To see all data for KLSA tested lakes, please refer to Appendix F.

KLSA has just a few areas that still need to be tested: south Sturgeon (1 site); south Pigeon Lake (2 sites), Buckhorn Lake (2 sites), and north Chemong (1 site). If you are interested in testing, please let KLSA know, or contact the Lake Partner Program directly.

A cool summer after a cold winter and spring

The spring of 2014 was very late, cold and wet after a record-breaking long, cold winter. The summer followed suit, being cool and wet. Everyone noticed that there was less aquatic plant growth near them, probably due to the long period of thick ice and snow coverage.

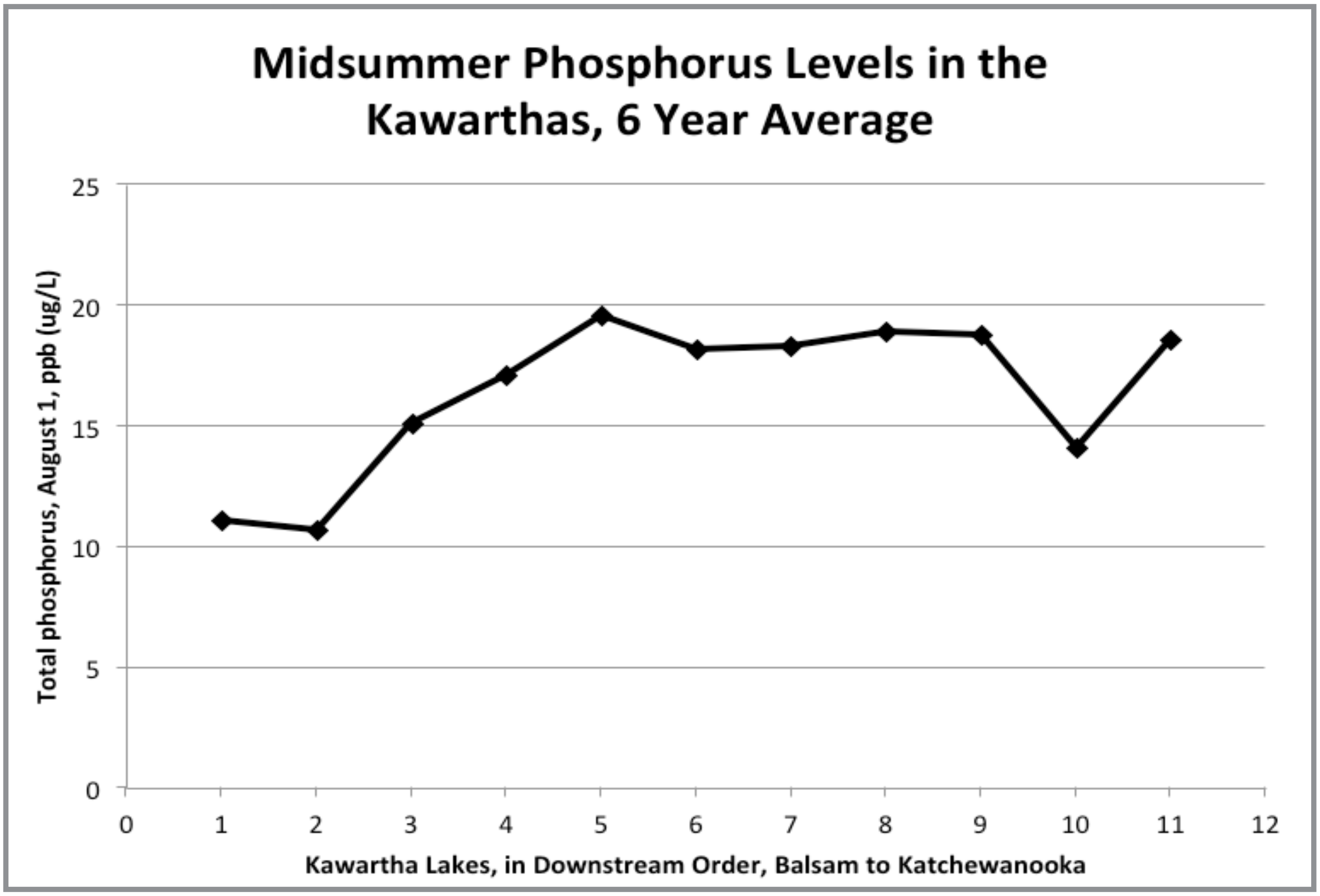
How did the cold winter, spring and summer affect phosphorus levels?



As seen in the graph above, 2014 started out in early June with unusually low phosphorus levels. This would make sense, as there had just been a huge and late spring flush, sending enormous amounts of low-phosphorus water down from the north. However, by late June, phosphorus levels were similar to other years. It seems that phosphorus levels on the Kawarthas are quite consistent from year to year, despite changes in weather.

Sturgeon Lake: Where phosphorus levels jump – but why?

We at KLSA continue to be intrigued by the phosphorus 'jump' that occurs in Sturgeon Lake.



The points in the graph above are 6-year average phosphorus levels at 11 sites. Values are for August 1, when phosphorus is at its peak. Sites are all along the main flow of the Trent-Severn Waterway, namely:
#1. Balsam, E. Grand Is.: #2 Cameron Lake, average of several sites: #3. Sturgeon, Fenelon R. #4. Sturgeon, Sturgeon Pt. #5. Sturgeon, Muskrat Is. #6. Pigeon, mid Sandy Pt. Boyd Is. #7. Buckhorn, Buoy 310 #8. Lower Buckhorn, Buoy 267. #9. Lovesick, McCallum Is. #10. Stony, Mouse Is. #11. Katchewanooka, Douglas Is.

This graph demonstrates that:

- Balsam Lake and Cameron Lake phosphorus levels are very low. This is similar to most of the lakes to the north. Both Balsam and Cameron Lake receive huge inflows of low-phosphorus water directly from the north, via Gull River and Burnt River.
- There is a large (4.5 ppb) increase in midsummer phosphorus levels between Cameron Lake and the top of Sturgeon Lake – a very short distance! (see map with next article, p. 28)
- There is a large (4 ppb) increase in midsummer phosphorus levels within Sturgeon Lake, from the upstream end (Fenelon River) to the downstream end (Muskrat Island).
- Phosphorus levels then remain at this higher level in the rest of the lakes; Sturgeon Lake seems to 'set the tone' for all the lakes downstream.
- There is a drop in phosphorus levels in Stony Lake, due to dilution from Upper Stoney Lake, but then phosphorus levels bounce back in Katchewanooka Lake.

Why is there such a big jump in phosphorus levels in Sturgeon Lake? Is this something we could control or change? If so, could we reduce phosphorus levels on many lakes downstream of Sturgeon Lake?

These are questions that KLSA intends to look into further. If we take more phosphorus measurements on Cameron and Sturgeon Lake and their inflows, we might have a better idea of where the phosphorus is coming from.

Please note: *A graph such as the one above can only be created if there are readings going back many years, on many sites, with no missing data. KLSA is able to create such graphs only because we have a fleet of persistent, conscientious volunteer testers. Thanks to all of you!*

Analysis of Ontario Lake Partner Program Total Phosphorus Data for the Kawartha Lakes

Mike Dolbey, PhD, P.Eng, KLSA Director

Summary & conclusions

This paper presents an analysis of Lake Partner Program (LPP) total phosphorus (TP) measurements made primarily by KLSA volunteers between 2002 and 2013 at 43 test sites throughout the Kawartha Lakes.

Results of this analysis show that over the past 12 years total phosphorus concentrations in the Kawartha Lakes appear to have remained quite stable. In a 2006 study for KLSA, *Phosphorus and the Kawartha Lakes*, Michael White (White, 2006) showed that TP concentrations in the Kawartha Lakes dropped significantly between 1972 and 1988, attributed to the construction of the Lindsay wastewater treatment plant in the mid-1960s, and then remained relatively constant between 1988 and 2005. The present analysis shows a continuation of that trend in most lakes. However, Kawartha Conservation's Sturgeon Lake Watershed Characterization Report (KRCA, 2014) indicates that TP concentrations in McLaren's Creek and the Scugog River downstream of Lindsay, both of which flow into Sturgeon Lake, have been increasing in recent years. Most of the LPP test sites showing increasing TP concentrations are in Sturgeon Lake and Pigeon Lake into which it flows. This suggests that the Kawartha Lakes are in a state of delicate balance. Increases in TP concentration in our lakes could be difficult and costly to reverse. Continued monitoring is important to assess whether we are offsetting the effects of increased development with 'Best Management Practices' for controlling phosphorus.

The present analysis highlights the need for additional research to understand a number of observations such as the following: a) the cause of the significant increase in TP concentration, referred to as the 'phosphorus jump', that occurs between the outlet of Cameron Lake and the Fenelon arm of Sturgeon Lake, b) the cause of continued late season rise in TP in north Pigeon Lake and the east side of Clear Lake and c) the cause of the approxiamately 40 day delay relative to upstream lakes in the TP seasonal peak in Lake Katchewanooka.

Examination of long term TP trends and profiles in the Kawartha Lakes has provided valuable insights as well as interesting questions about factors affecting the water quality of our lakes. The importance of continuing to monitor these sites cannot be overstressed. KLSA expresses our gratitude to all LPP testers and urges them to continue or, if necessary, to find a replacement tester for their site so continuity of this valuable data set will be preserved.

Introduction

The Ontario Lake Partner Program (LPP) is a volunteer-based lake water quality monitoring program that has been coordinated by the Ontario Ministry of the Environment's Dorset Environmental Science Centre (DESC) since 2002. Each year more than 600 volunteers on more than 550 lakes throughout Ontario monitor total phosphorus (TP) and water clarity (Secchi disc measurement). In southern lakes with considerable seasonal phosphorus variation, testers collect water samples six times each year between May and October that are sent to DESC for total phosphorus analysis. Results for all years of testing are provided in spreadsheet form annually on the LPP website, **http://desc.ca/programs/lpp.**

The Kawartha Lake Stewards Association (KLSA) was formed in 2001 to monitor water quality in our lakes by recruiting and coordinating volunteers to perform LPP testing as well as collecting water samples for E.coli assessment. Each year since its inception KLSA has published its Annual Water Quality Report in which it presents results and analysis of the previous year's testing. All are available on our website, **http://klsa.wordpress.com/published-material/**. With 12 years of LPP data now available for most of our lakes, it was thought that a more thorough analysis of the TP data needed to be performed.

Method

This article presents the TP data for each test site graphically in two ways. First, all years of data for a given site are plotted against collection date as illustrated in Figure 1. The periodic rise and fall due to seasonal variation is observed as peaks and troughs. A linear best-fit trend-line is displayed through the data. The slope of this trend-line indicates whether TP is increasing or decreasing over time at this site. The second graph of the data for each sampling site superimposes each year's data on top of each other with the date of each measurement plotted as the number of days after April 1st, as shown in Figure 2. A best fit second order polynomial trend-line is calculated to show the average seasonal variation of TP. The peak of this curve is the best estimate of the nominal maximum TP concentration for the site during the years of testing.

Analysis of Ontario Lake Partner Program Total Phosphorus Data for the Kawartha Lakes

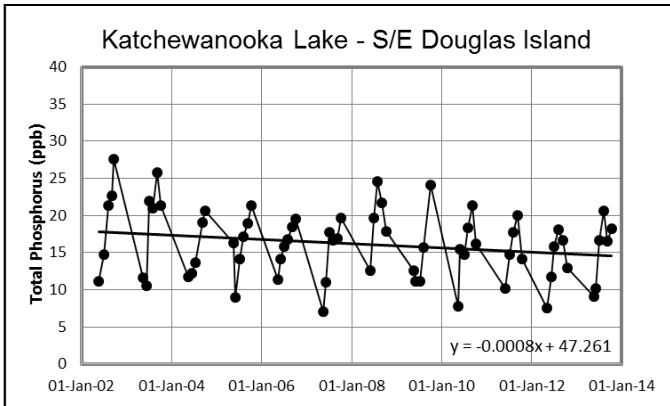


Figure 1. Long-term TP concentration

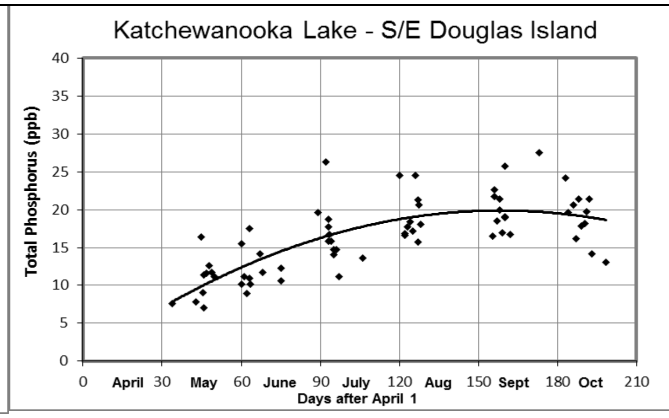


Figure 2. Average Seasonal TP

These two graphs with a brief analysis of results are presented beginning on Page 31 for all test sites in the Kawartha Lakes. The lakes are presented starting with Balsam Lake and working downstream. The lakes evaluated are Balsam, Cameron, Sturgeon, Big Bald, Pigeon, Sandy, Chemong, Buckhorn, Lower Buckhorn, Lovesick, Upper Stoney, Stony, White, Clear and Katchewanooka. The results of this study are summarized below. Figure 3 shows a map of site locations and peak average seasonal TP.

Summary of results

The key characteristics of the TP curves for each LPP test site in the Kawartha Lakes are summarized in Table 1 and compared graphically in Figure 4. These characteristics are as follows:

Total Phosphorus Rate of Change (Column 1 in Table 1 & Figure 4)

Of the 43 sites examined in this study, 23 showed decreasing and 20 showed increasing TP over time. Increases and decreases appear to be generally balanced suggesting no significant overall change in total phosphorus concentrations in the system of lakes over the period from 2002 to 2013. However, the charted values show that most of the increases are clustered in the area of Sturgeon and Pigeon Lakes. TP rate of change is the average rate of change in TP measured over the full period of testing at a site as determined by the slope of the linear trend-line in the left-hand plot. The slope, in parts-per-billion/day (ppb/day), is the first number in the trend-line equation shown in the graph. A negative slope indicates decreasing TP over the measurement period while a positive slope indicates increasing TP over the measurement period. The TP rate of change is converted to ppb/year by multiplying by 365.25 days/year and increases and decreases are shown in separate columns in Table 1 for statistical purposes.

2013 Average TP Level (Column 2 in Table 1 & Figure 4)

This is the TP value at the right-hand end of the linear trend-line in the left-hand plot and represents the average TP level for 2013 (or the last year of measurement) at a test site. Average levels vary from a low of 7 ppb in Upper Stoney Lake to a high of 20 ppb in the Burleigh Locks channel of Stony Lake. The table and graphs confirm the trends previously reported that generally high TP water, developed in Sturgeon Lake due to inputs from Lindsay and the Scugog River, flow down through the system to Stony Lake with relatively small increase in TP. Relatively little dilution by low phosphorus water from the Bald Lakes, Nogies Creek, Sandy Lake and Chemong Lake occurs because of their low flow throughout the summer. Mixing in Stony Lake with very low TP water from Upper Stoney Lake, which is fed primarily by Jack's Creek and Eels Creek, dilutes the TSW flow from the upper lakes in spring and early summer. This results in an average reduction of ~1.5 ppb in the lowest Lake, Katchewanooka.

Average Seasonal Peak TP Concentration (Column 3 in Table 1 & Figure 4)

Most Kawartha Lakes with low TP water, (Cameron, Big Bald, Sandy and Upper Stoney), as well as Chemong do not exhibit a seasonal TP peak. All of these except Cameron are not on the main TSW system. Various reasons have been suggested for the seasonal variation of the TP curves in the other lakes. One view is that it is due to internal loading (release of phosphorus from lake sediments during the summer); another is that the seasonal flow of the TSW modulates the dilution of the high phosphorus water in Sturgeon Lake and there may be other factors. Probably some combination of these factors is occurring. The difference in TP profiles of the test sites in Pigeon Lake north and south of Bobcaygeon, where TSW flow enters, is revealing. In north Pigeon, TP continues to rise throughout the summer and fall whereas in south Pigeon the TP peaks in mid-July and then declines. This is possibly due to increased flow of TSW water as the feeder lakes are drawn down diluting the water flowing through south Pigeon but not north Pigeon. Where the additional late season phosphorus in north Pigeon is coming from is a question that needs to be addressed. A similar continually rising TP profile is seen on the east side of Clear Lake. It is hypothesized that the low phosphorus water from Upper Stoney flows primarily down the east side of Clear Lake. This flow is greatest in the spring and dwindles to a minimum in the late summer and fall allowing the TP on the east side of Clear Lake to rise. The TSW flow is assumed to be primarily down the west side of the lake. After mixing occurs in the short river between Clear and Katchewanooka Lakes, the peaked TP profile re-emerges but with the peak occurring about 40 days later than the TSW inflow to Stony Lake. Again, the question of where the late season phosphorus in Clear Lake is coming from needs to be addressed.

Timing of the Annual TP Peak (Column 4 in Table 1 & Figure 4)

For sites on most lakes through which the TSW flows, the seasonal TP peak occurs quite consistently between the end of July and mid-August (120 to 140 days after April 1st). Most exceptions have been discussed above. The other is the Mouse Island site in central Stony Lake. This location, south of Mount Julian, appears to get a mixture of TSW flow and Upper Stoney Lake water resulting in an intermediate peak TP level that occurs about 30 days later than full flow TSW lakes. In this respect this site reflects a transition between full flow TSW lake profiles and those on the east side of Clear Lake.

References

KRCA, 2014, Sturgeon Lake Watershed Characterization Report February 2014 – Final Draft, Kawartha Region Conservation Authority, pages 79 & 85. http://www.kawarthaconservation.com/sturgeonlake/SturgeonLake_WRC_April2014_Draft.pdf

White, Michael, 2006, Phosphorus and the Kawartha Lakes, Kawartha Lake Stewards Association. http://www.lakefieldherald.com/KLSA/MikeWhitereport.pdf

LEGEND							
		11	Big Bald Lake - Bay nr Golf course	22	Lower Buckhorn - Deer Bay W-Buoy C267	33	Upper Stoney Lake - South Bay deep spot
1	Balsam Lake - N Bay Rocky Pt.	12	Pigeon Lake N300yds off Bottom I	23	Lower Buckhorn - Heron Island	34	Upper Stoney Lake - Quarry Bay
2	Balsam Lake - NE End - Lightning Pt.	13	Pigeon Lake N-400m N of Boyd Island	24	Lower Buckhorn - Deer Bay Centre	35	Upper Stoney Lake - Mid-Lake deep spot
3	Balsam Lake - South Bay-Killarney Bay	14	Pigeon Lake N end-Adjacent Con 17	25	Lovesick Lake - 80' hole N end	36	Upper Stoney Lake - Crowes Landing
4	Balsam Lake - West Bay2, Deep Spot	15	Pigeon Lake C340-Deadhorse Shoal	26	Lovesick Lake - McCallum Island	37	Upper Stoney Lake - Young Bay
5	Balsam Lake - East of Grand Island	16	Pigeon Lake Middle-Sandy Pt. Boyd Island	27	Lovesick Lake - Spenceley's Bay	38	Clear Lake - MacKenzie Bay
6	Cameron Lake - All Sites	17	Sandy Lake - Mid lake deep spot	28	Stony Lake - Burleigh Locks Channel	39	Clear Lake - Bryson's Bay
7	Sturgeon Lake - S. Fenlon River N5/Mouth	18	Chemong Lake - Lancaster Bay	29	Stony Lake - Mouse Island	40	Clear Lake - Main Basin deep spot
8	Sturgeon Lake - Sturgeon Point Buoy	19	Chemong Lake - Poplar Point	30	Stony Lake - Hamilton Bay	41	Clear Lake - Fiddler's Bay
9	Sturgeon Lake - Muskrat I-Buoy C388	20	Chemong Lake - S. of Causeway	31	Stony Lake - Gilchrist Bay	42	Katchewanooka Lake - Young's Pt. Nr Lks
10	Big Bald Lake - Mid Lake Deep Spot	21	Buckhorn Lake -Narrows Redbuoy C310	32	White Lake - S end deep spot	43	Katchewanooka Lake - S/E Douglas Island

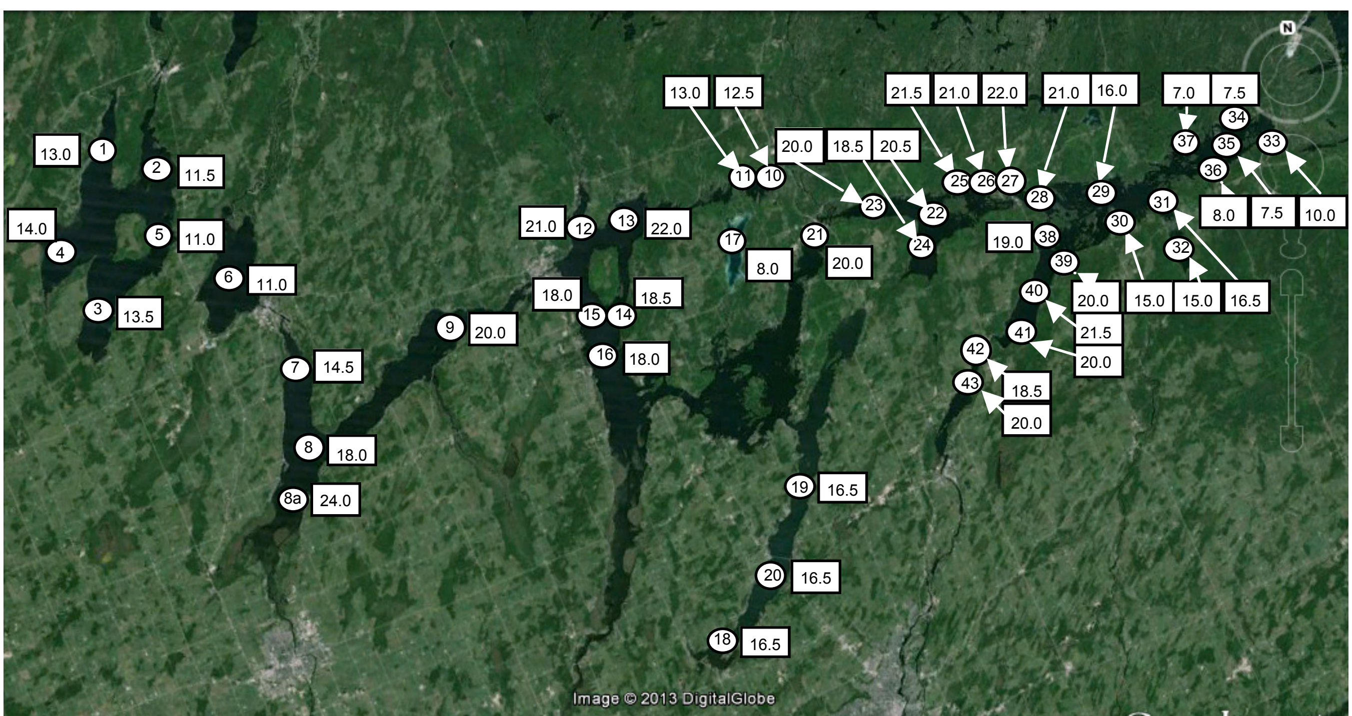
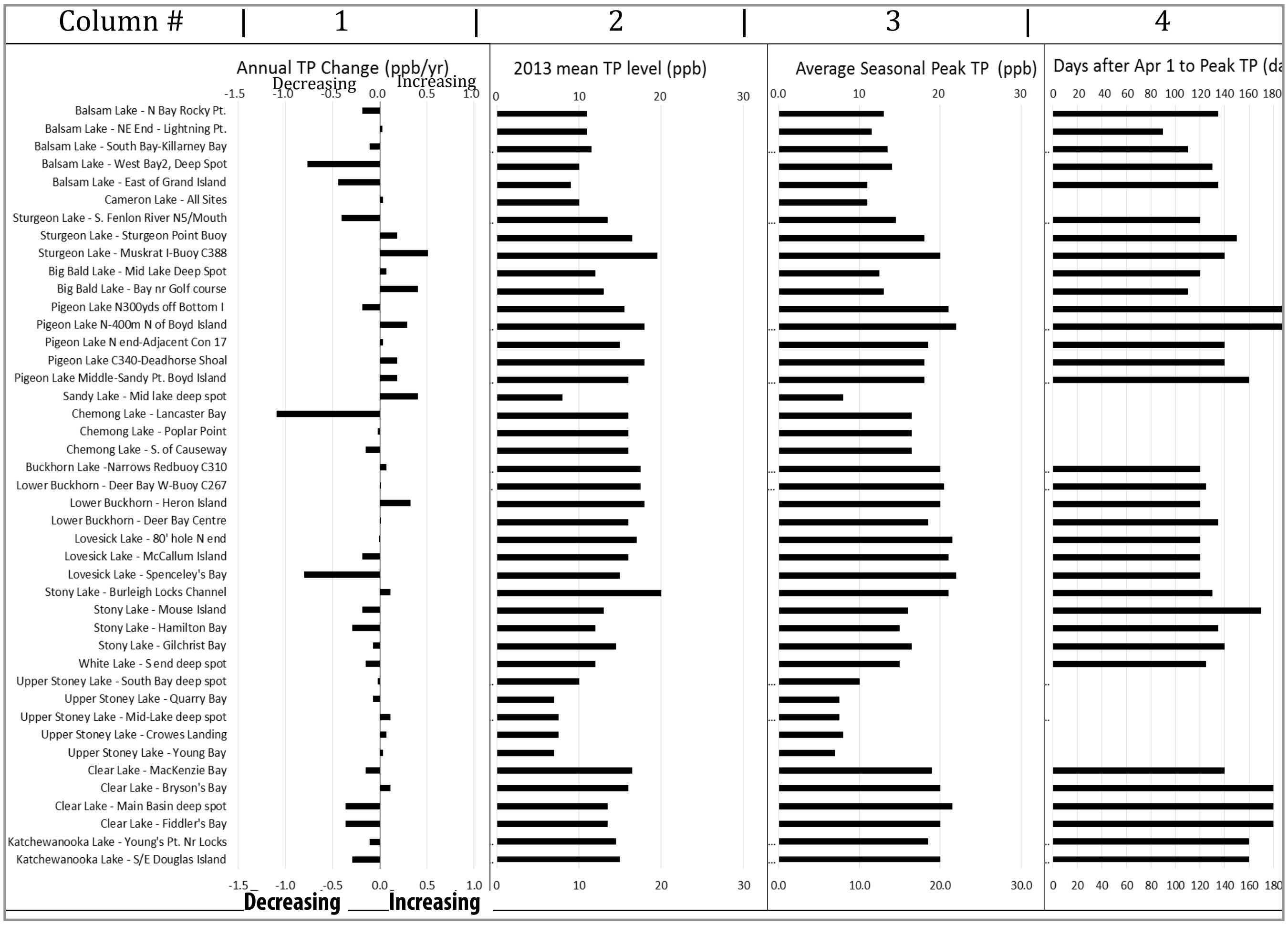


Figure 3. 2003-2013 Average Peak TP at LPP sites in the Kawartha Lakes

Table 1. Summary of TP curve characteristics for all LPP sites in the Kawartha Lakes

Column #			1		2	3	4
Lake	TP rate of Change/day (ppb/day)	TP rate of Change/yr (ppb/yr)	TP Decreases (ppb/yr)	TP Increases (ppb/yr)	2013 avg TP level (ppb)	Avg Ann TP peak (ppb)	Days after Apr 1st to peak (days)
Balsam Lake - N Bay Rocky Pt.	-0.00050	-0.18	-0.18		11.0	13.0	135
Balsam Lake - NE End - Lightning Pt.	0.00008	0.03		0.03	11.0	11.5	90
Balsam Lake - South Bay-Killarney Bay	-0.00030	-0.11	-0.11		11.5	13.5	110
Balsam Lake - West Bay2, Deep Spot	-0.00210	-0.77	-0.77		10.0	14.0	130
Balsam Lake - East of Grand Island	-0.00120	-0.44	-0.44		9.0	11.0	135
Cameron Lake - All Sites	0.00009	0.03		0.03	10.0	11.0	
Sturgeon Lake - S. Fenlon River N5/Mouth	-0.00110	-0.40	-0.40		13.5	14.5	120
Sturgeon Lake - Sturgeon Point Buoy	0.00050	0.18		0.18	16.5	18.0	150
Sturgeon Lake - Muskrat I-Buoy C388	0.00140	0.51		0.51	19.5	20.0	140
Big Bald Lake - Mid Lake Deep Spot	0.00020	0.07		0.07	12.0	12.5	120
Big Bald Lake - Bay nr Golf course	0.00110	0.40		0.40	13.0	13.0	110
Pigeon Lake N300yds off Bottom I	-0.00050	-0.18	-0.18		15.5	21.0	200
Pigeon Lake N-400m N of Boyd Island	0.00080	0.29		0.29	18.0	22.0	200
Pigeon Lake N end-Adjacent Con 17	0.00010	0.04		0.04	15.0	18.5	140
Pigeon Lake C340-Deadhorse Shoal	0.00050	0.18		0.18	18.0	18.0	140
Pigeon Lake Middle-Sandy Pt. Boyd Island	0.00050	0.18		0.18	16.0	18.0	160
Sandy Lake - Mid lake deep spot	0.00110	0.40		0.40	8.0	8.0	
Chemong Lake - Lancaster Bay	-0.00300	-1.10	-1.10		16.0	16.5	
Chemong Lake - Poplar Point	-0.00006	-0.02	-0.02		16.0	16.5	
Chemong Lake - S. of Causeway	-0.00040	-0.15	-0.15		16.0	16.5	
Buckhorn Lake -Narrows Redbuoy C310	0.00020	0.07		0.07	17.5	20.0	120
Lower Buckhorn - Deer Bay W-Buoy C267	0.00004	0.01		0.01	17.5	20.5	125
Lower Buckhorn - Heron Island	0.00090	0.33		0.33	18.0	20.0	120
Lower Buckhorn - Deer Bay Centre	0.00003	0.01		0.01	16.0	18.5	135
Lovesick Lake - 80' hole N end	-0.00003	-0.01	-0.01		17.0	21.5	120
Lovesick Lake - McCallum Island	-0.00050	-0.18	-0.18		16.0	21.0	120
Lovesick Lake - Spenceley's Bay	-0.00220	-0.80	-0.80		15.0	22.0	120
Stony Lake - Burleigh Locks Channel	0.00030	0.11		0.11	20.0	21.0	130
Stony Lake - Mouse Island	-0.00050	-0.18	-0.18		13.0	16.0	170
Stony Lake - Hamilton Bay	-0.00080	-0.29	-0.29		12.0	15.0	135
Stony Lake - Gilchrist Bay	-0.00020	-0.07	-0.07		14.5	16.5	140
White Lake - S end deep spot	-0.00040	-0.15	-0.15		12.0	15.0	125
Upper Stoney Lake - South Bay deep spot	-0.00006	-0.02	-0.02		10.0	10.0	
Upper Stoney Lake - Quarry Bay	-0.00020	-0.07	-0.07		7.0	7.5	
Upper Stoney Lake - Mid-Lake deep spot	0.00030	0.11		0.11	7.5	7.5	
Upper Stoney Lake - Crowes Landing	0.00020	0.07		0.07	7.5	8.0	
Upper Stoney Lake - Young Bay	0.00010	0.04		0.04	7.0	7.0	
Clear Lake - MacKenzie Bay	-0.00040	-0.15	-0.15		16.5	19.0	140
Clear Lake - Bryson's Bay	0.00030	0.11		0.11	16.0	20.0	180
Clear Lake - Main Basin deep spot	-0.00100	-0.37	-0.37		13.5	21.5	180
Clear Lake - Fiddler's Bay	-0.00100	-0.37	-0.37		13.5	20.0	180
Katchewanooka Lake - Young's Pt. Nr Lock	-0.00030	-0.11	-0.11		14.5	18.5	160
Katchewanooka Lake - S/E Douglas Island	-0.00080	-0.29	-0.29		15.0	20.0	160
	Count	43.00	23.00	20.00	43.00	43.00	33.00
	Avg	-0.07	-0.28	0.16	13.77	16.12	140.61
	max	0.51	-0.01	0.51	20.00	22.00	200.00
	min	-1.10	-1.10	0.01	7.00	7.00	90.00
	Median	-0.02	-0.18	0.11	14.50	16.50	135.00

Analysis of Ontario Lake Partner Program Total Phosphorus Data for the Kawartha Lakes



Appendix

Analysis of LPP Total Phosphorus Data for Test Sites in the Kawartha Lakes 2002 to 2013

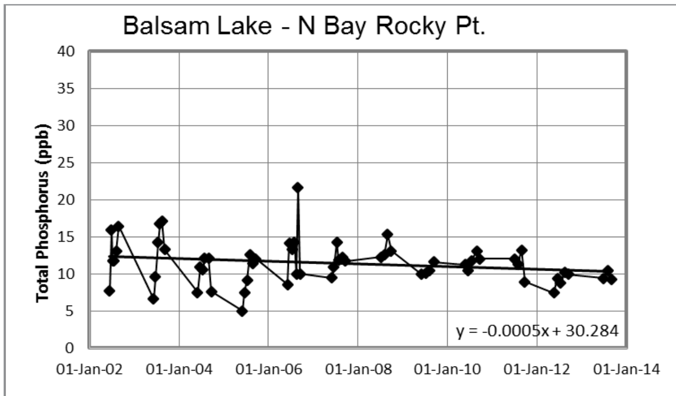
The Ontario Lake Partner Program (LPP) total phosphorus (TP) results for all years of testing are provided in spreadsheet form annually on the LPP website, **http://desc.ca/programs/lpp.**

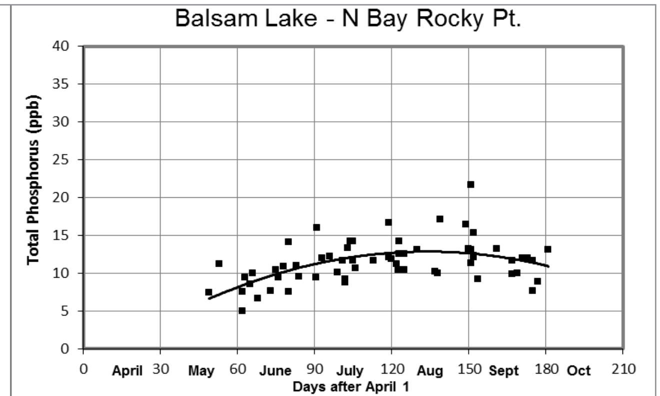
A small portion of the LPP TP data file is shown in Figure A1. At each sampling, three vials of water are submitted to DESC and two determinations of TP are made as given in columns I and J in the spreadsheet. If these two values differ significantly (>30% from the lowest value and a difference of >5ppb), they are shaded to indicate that the higher value may be the result of a contaminated sample. In this article, the average of the two values is used as the best estimate of TP unless they are shaded in which case the lower of the two values is used as recommended by DESC. (Guide to interpreting Total Phosphorus and Secchi Depth data from the Lake Partner Program, DESC publication, December 2013).

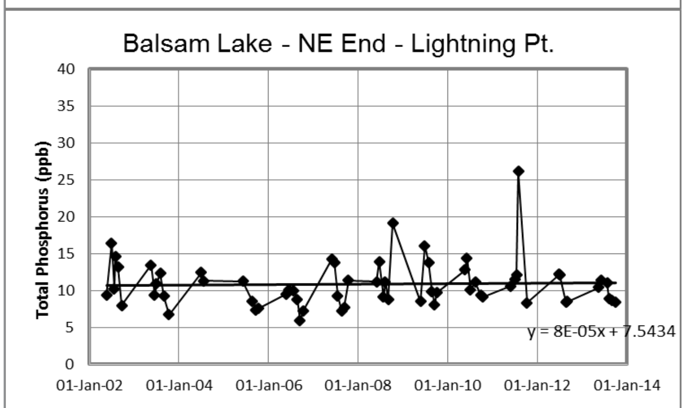
	A	B	C	D	E	F	G	H	I	J	K
8	Lake Name	Township	STN	Site ID	Site Description	Latitude	Longitude	Date	(µg/L)	(µg/L)	Data Collector
726	KATCHEWANOOKA LAKE	DOURO-DUMMER	7076	1	S/E Douglas Island	442800	781456	03-Jun-07	10.4	11.5	LPP Volunteer
727	KATCHEWANOOKA LAKE	DOURO-DUMMER	7076	1	S/E Douglas Island	442800	781456	03-Jul-07	17.3	18.2	LPP Volunteer
728	KATCHEWANOOKA LAKE	DOURO-DUMMER	7076	1	S/E Douglas Island	442800	781456	01-Aug-07	17.0	16.2	LPP Volunteer
729	KATCHEWANOOKA LAKE	DOURO-DUMMER	7076	1	S/E Douglas Island	442800	781456	07-Sep-07	16.8	17.1	LPP Volunteer
730	KATCHEWANOOKA LAKE	DOURO-DUMMER	7076	1	S/E Douglas Island	442800	781456	09-Oct-07	20.2	19.2	LPP Volunteer
731	KATCHEWANOOKA LAKE	DOURO-DUMMER	7076	1	S/E Douglas Island	442800	781456	03-Jun-08	12.6	22.3	LPP Volunteer
732	KATCHEWANOOKA LAKE	DOURO-DUMMER	7076	1	S/E Douglas Island	442800	781456	29-Jun-08	20.8	18.5	LPP Volunteer

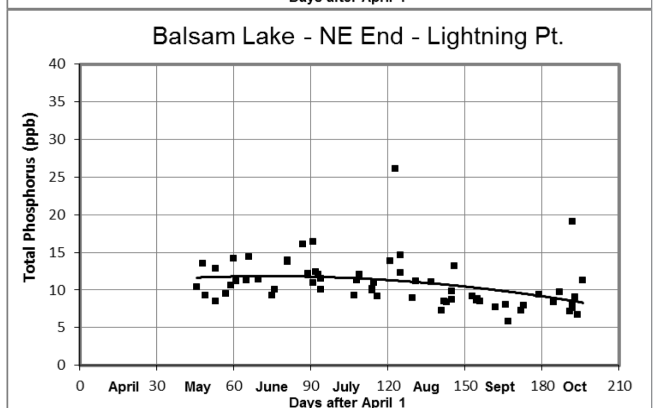
Figure A1. Small section of LPP TP data showing unreliable data point shaded.

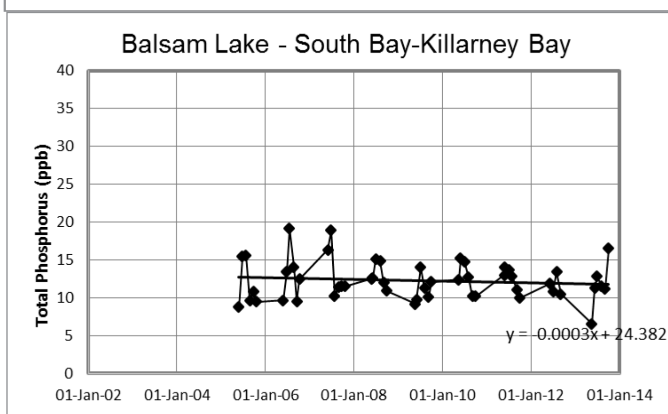
Balsam Lake: 5 sites. All show level or declining TP concentrations over time and nominal maximum seasonal TP between 11 and 14 ppb.

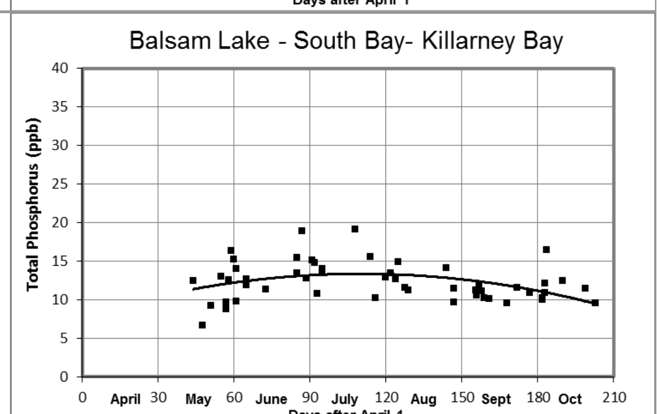


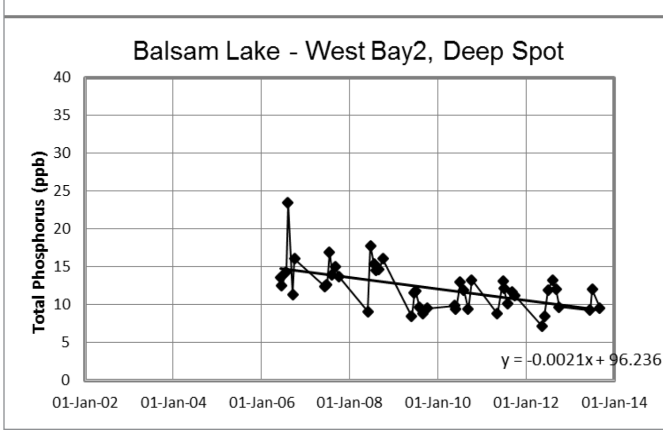


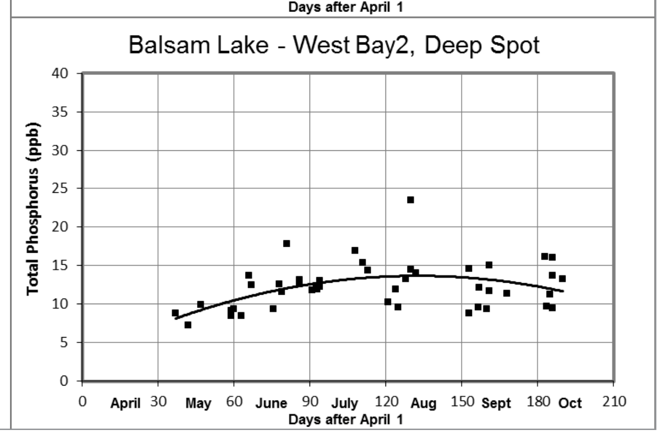


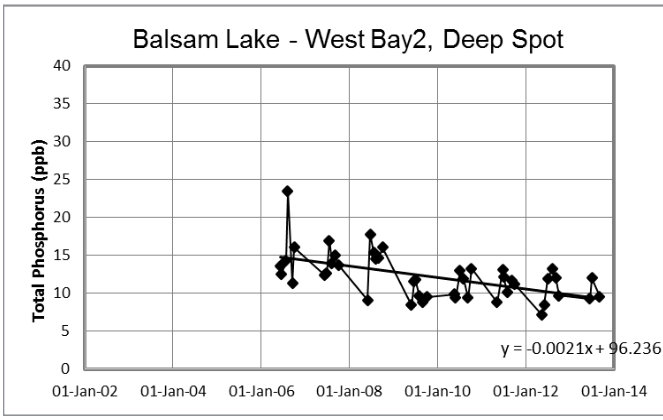


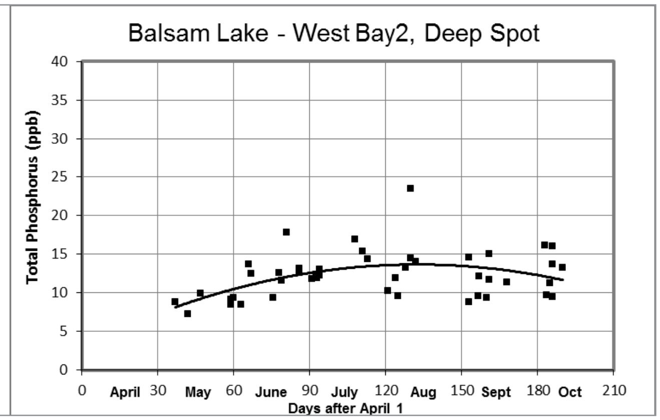




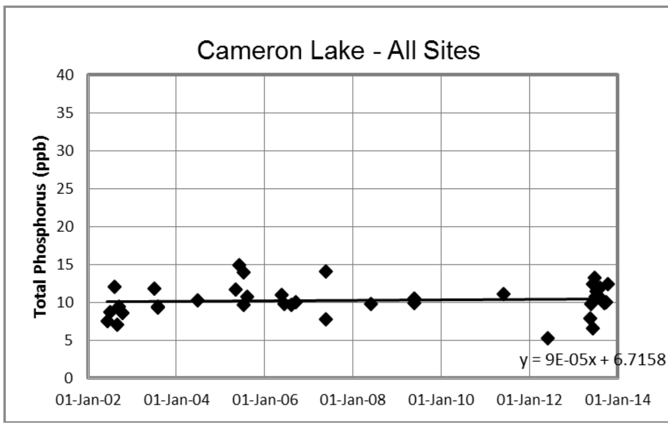


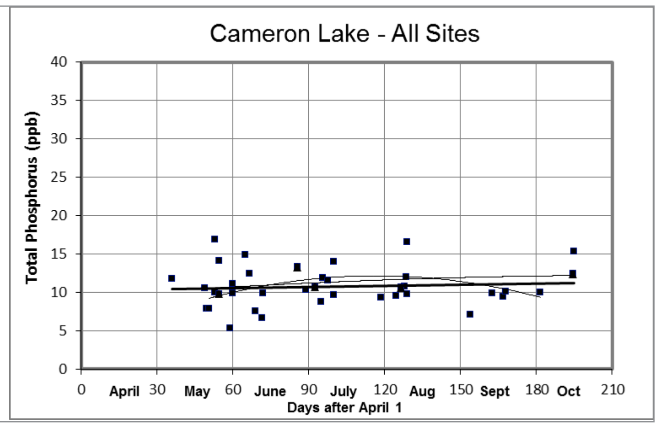




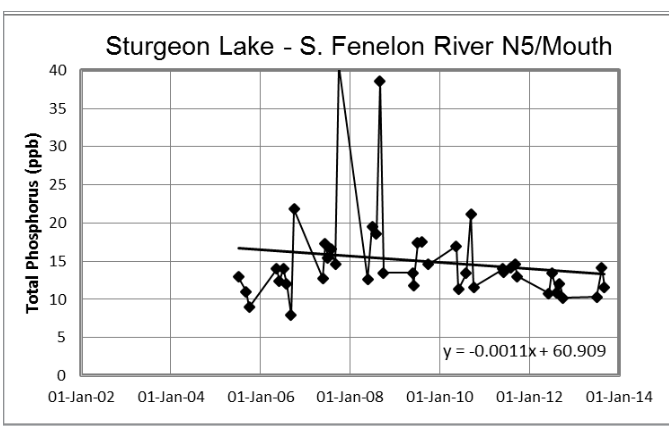


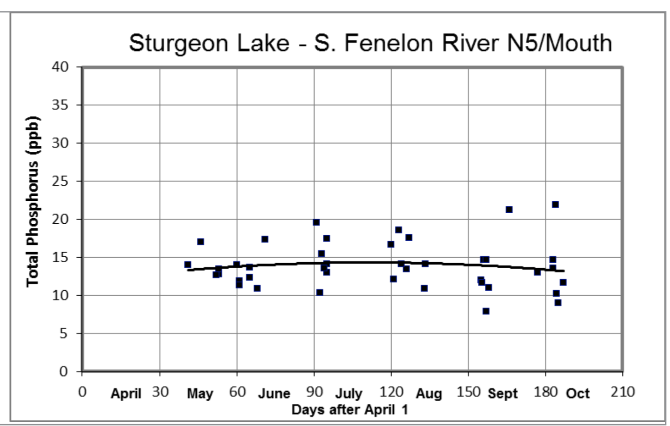
Cameron Lake: 5 sites. TP sampling has been sporadic on Cameron Lake so the data from all sites have been combined on one graph pair. In 2013, full data sets of six readings were made at two sites, N end deep spot and S end deep spot. The thin trend-lines on the annual plot show that these two sets are consistent with the long term trend-line. Stable TP levels of about 10 ppb are observed both seasonally and over the long term. Continued monitoring at these two sites would be desirable.

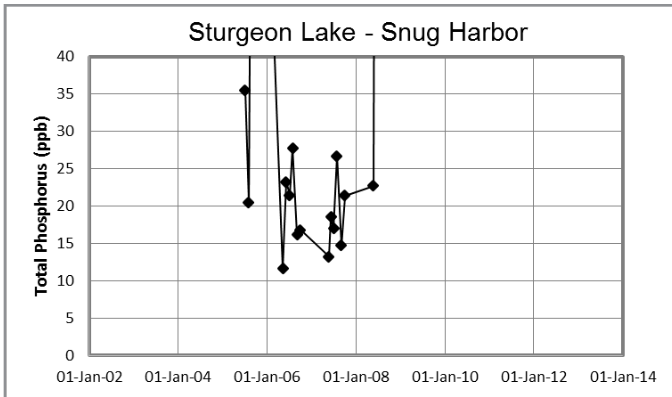


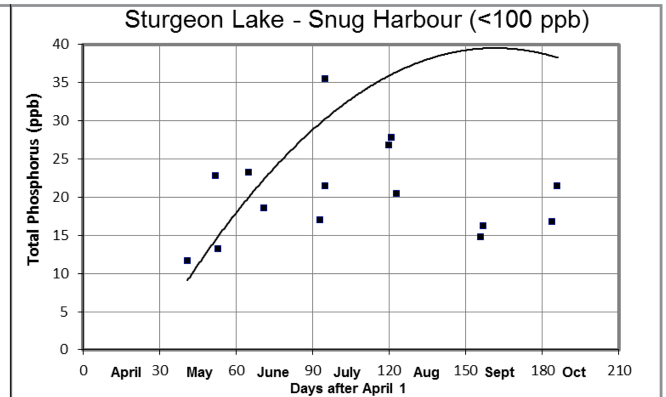


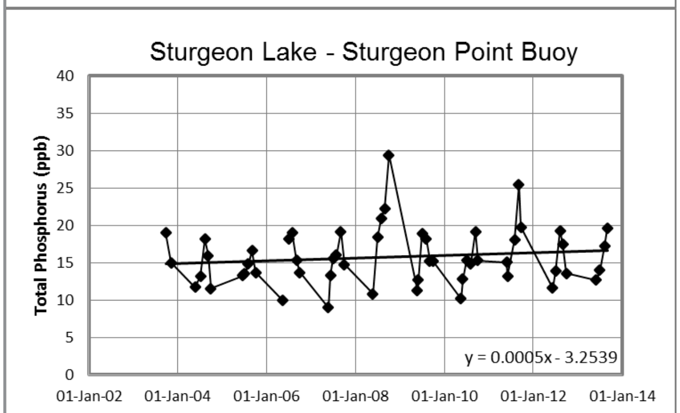
Sturgeon Lake: 4 sites. The Fenelon River data was collected at the N5 buoy mid-way between Fenelon Falls and Sturgeon Point until 2013 when the site was moved north closer to the entrance to the Fenelon River. The 2013 data appears to be consistent with the previous measurements. The seasonal TP level is about 14 ppb or about 4 ppb higher than that in Cameron Lake. The reason for the 'phosphorus jump' between the lakes is as yet unknown. The Snug Harbour data is for only a few years and contains many abnormally high readings. Shallow depth and silt stirred up by boat traffic at this site made continued sampling unproductive. Only points <40 ppb were plotted and no trend-line was fitted to the long term graph. Both Sturgeon Point and Muskrat Island sites show increasing TP levels over the years and nominal maximum seasonal levels of about 18 and 20 ppb respectively.

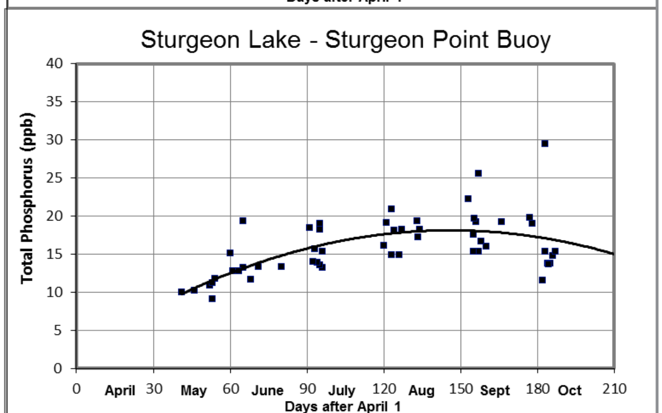


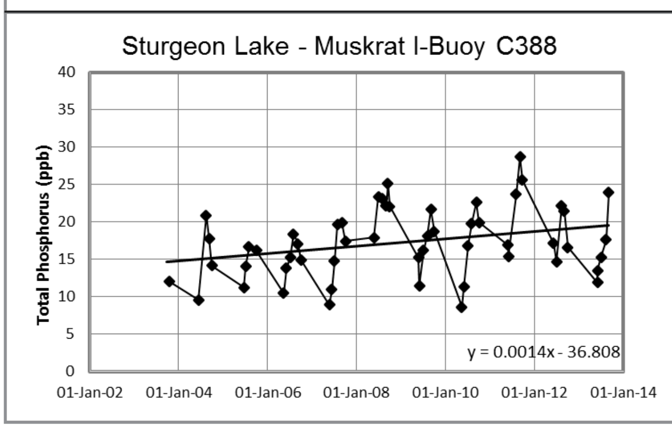


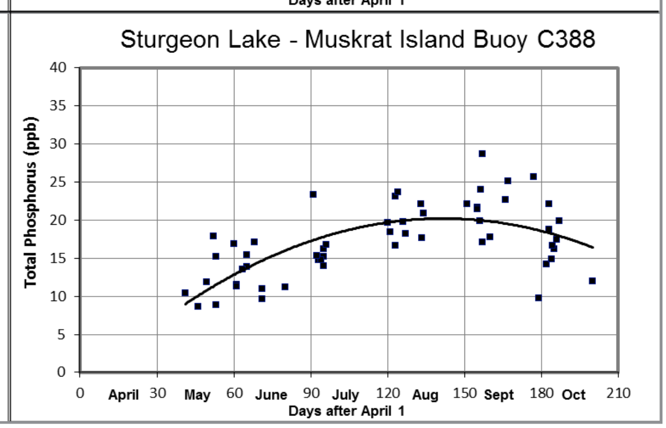




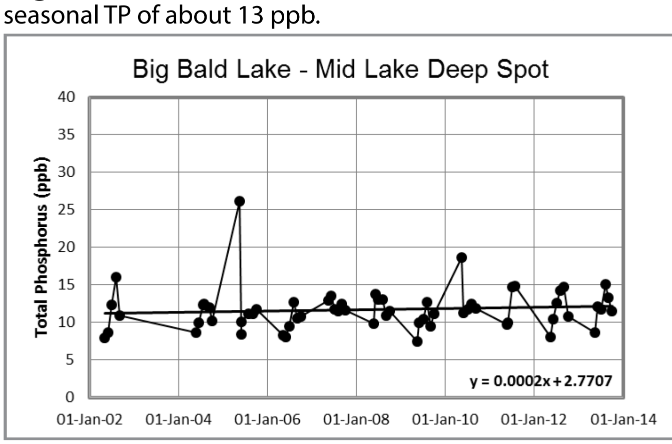


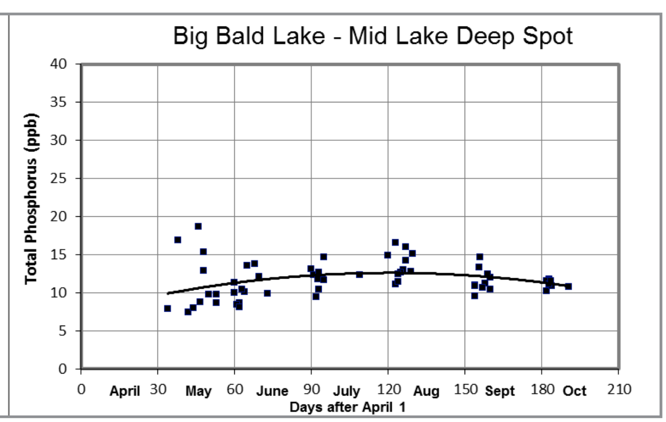




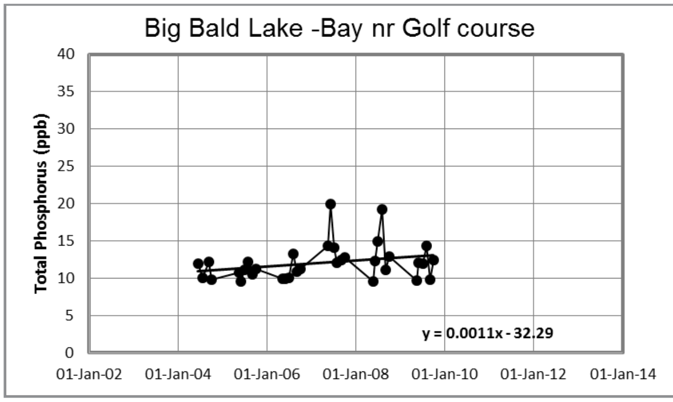


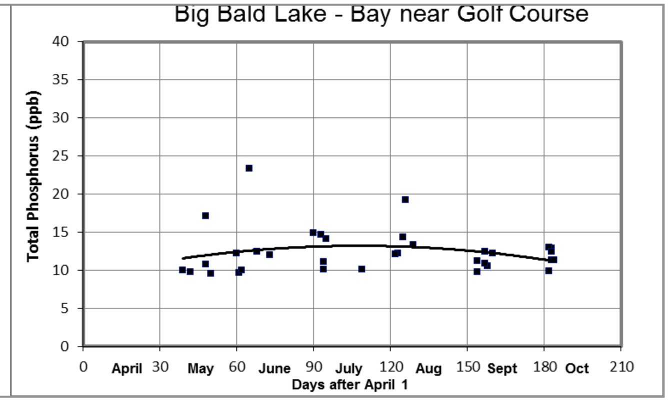
Big Bald Lake: 2 Sites. Both sites show slightly increasing TP concentrations over time and nominal maximum seasonal TP of about 13 ppb.



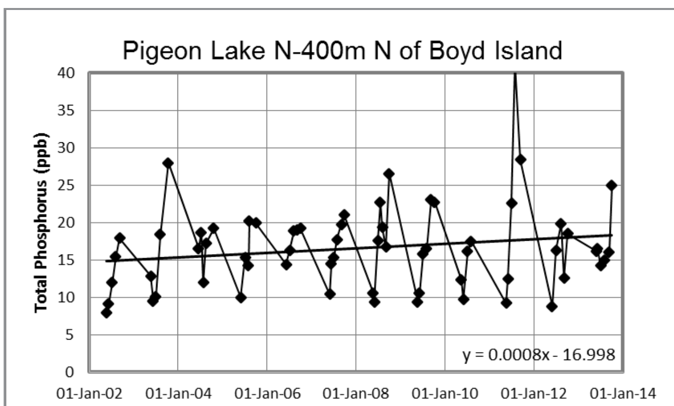


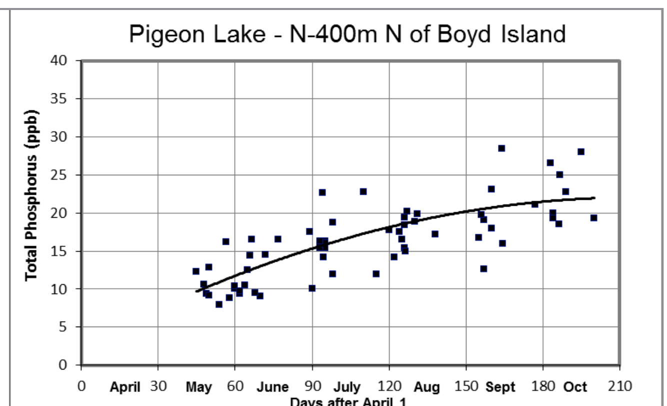
Analysis of Ontario Lake Partner Program Total Phosphorus Data for the Kawartha Lakes

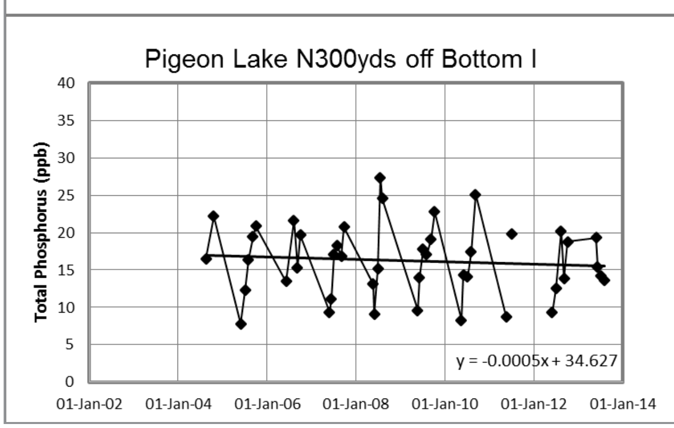


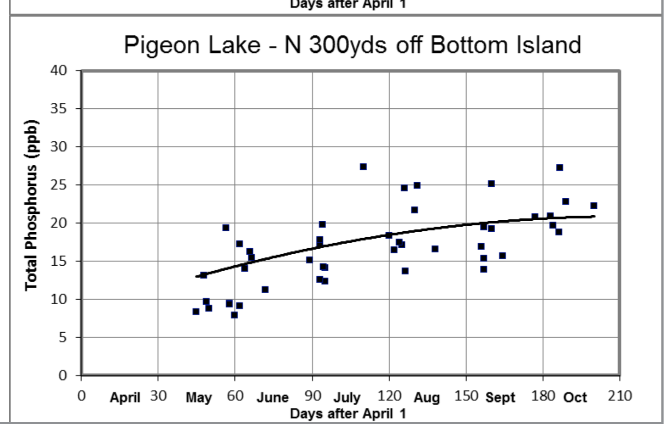


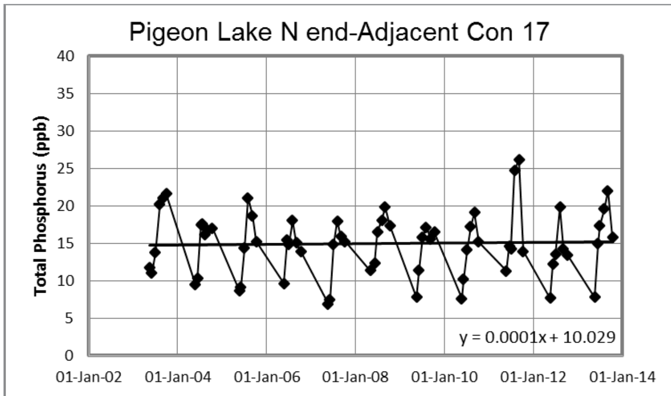
Pigeon Lake: 5 sites. The first two sites (N of Boyd & Bottom Island) are at the north end of Pigeon Lake which receives water from the Bald Lakes and Nogies Creek. The last three (Con. 17, Deadhorse Shoal & Sandy Pt.) are south of the TSW inflow at Bobcaygeon. All sites show a level to slightly increasing TP concentration over time and nominal maximum seasonal TP between 18 and 22 ppb. The northern sites appear to retain higher TP levels late in the season, perhaps because they do not receive the increased late summer/fall flow of the TSW as feeder lakes are drawn down.

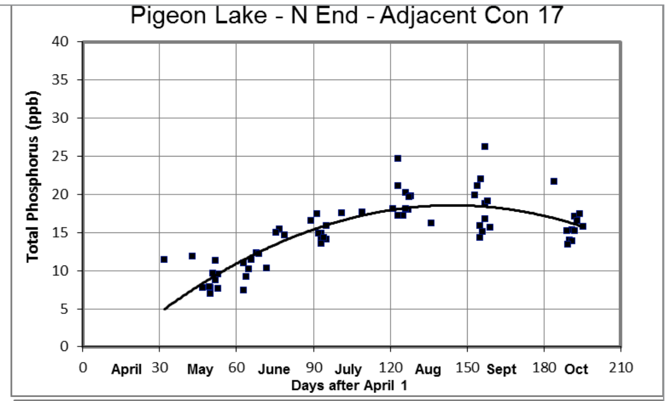


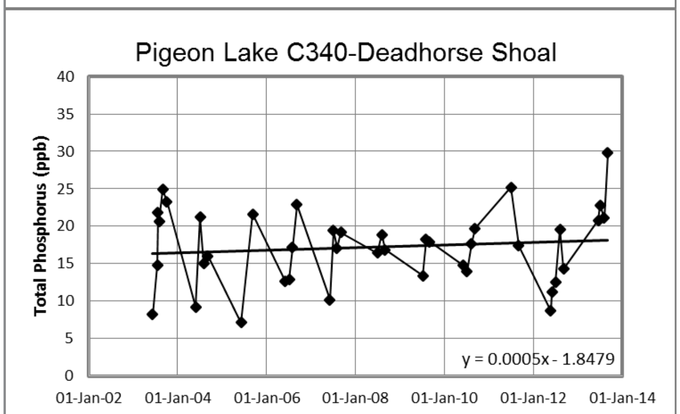


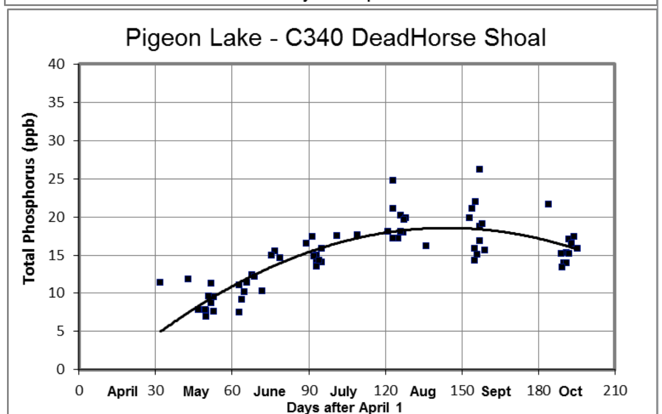


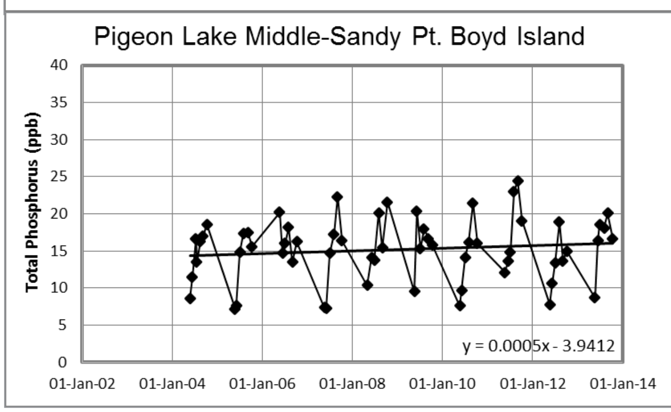


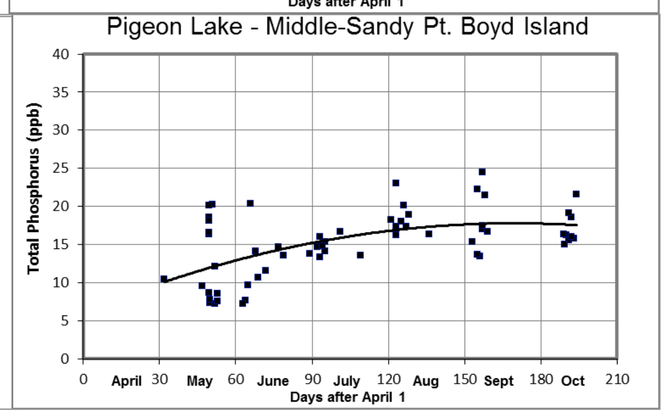




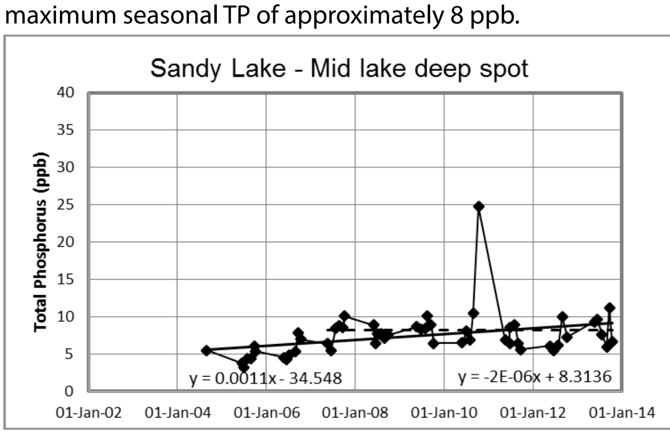


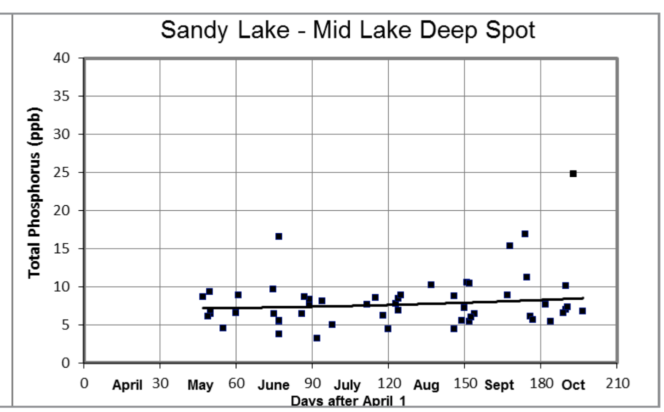






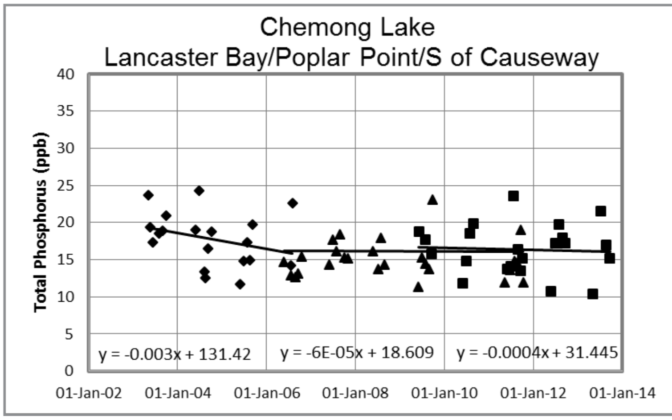
Sandy Lake: 1 site. This marl lake has very low TP readings between 5 and 10 ppb. The long-term trend-line suggests an increasing level. However, after very low readings in 2005 and 2006, TP levels appear to have stabilized --with nominal maximum seasonal TP of approximately 8 ppb.

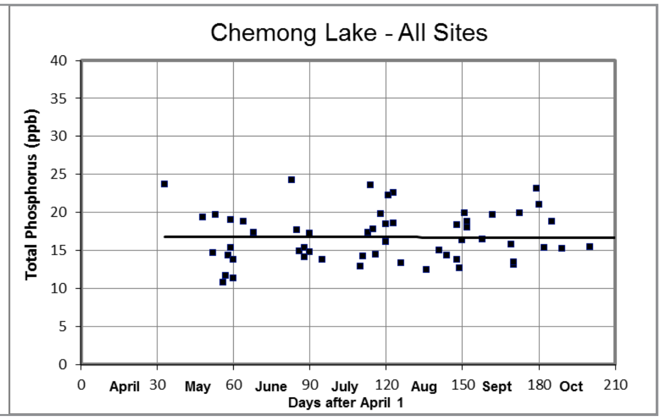




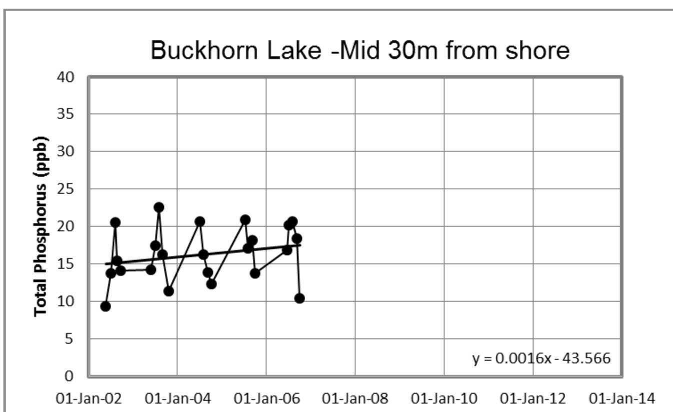
Analysis of Ontario Lake Partner Program Total Phosphorus Data for the Kawartha Lakes

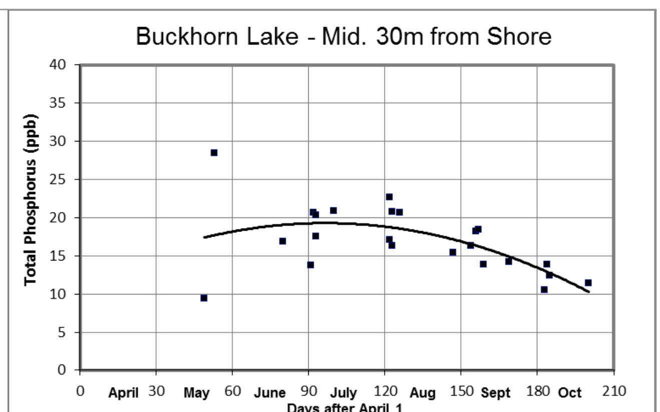
Chemong Lake: 3 sites sampled over different time periods and combined on one chart. Despite the wide separation of these three sites (Lancaster Bay is at the south end, S of Causeway near the middle and Poplar Point about halfway between the Causeway and Curve Lake narrows) all have similar TP profiles. Both long term and nominal seasonal TP levels are steady at about 16 ppb. Chemong is a marl lake which explains its relatively uniform TP curve.

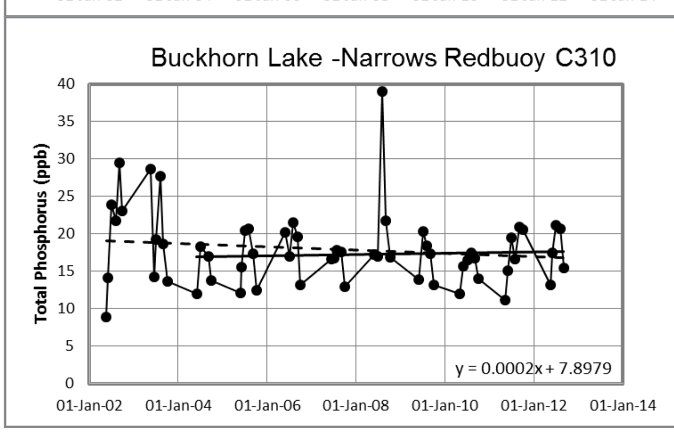


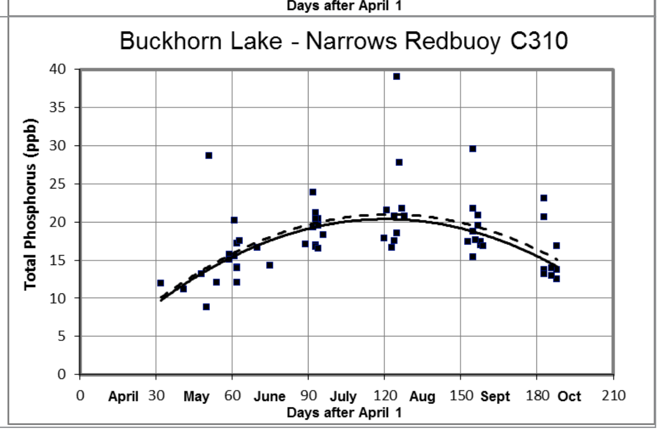


Buckhorn Lake: Unfortunately no sites were tested on this large lake in 2013 and there is only one site where there has been long term testing prior to 2012. Coordinates for the 'Mid. 30m from shore' site suggest that it is in the south-western part of the lake. A lack of early season data results in poor definition of the seasonal variation curve for this site. The 'Narrows Redbuoy C310' site is near the lake outlet close to Buckhorn. The long term trend-line for all data (dashed) suggests a slight decrease in TP over time but this may be due to high readings during the first two years of testing. Since 2004 TP concentration over time appears to be steady at around 17 ppb (solid line) and nominal maximum seasonal TP is about 20 ppb.



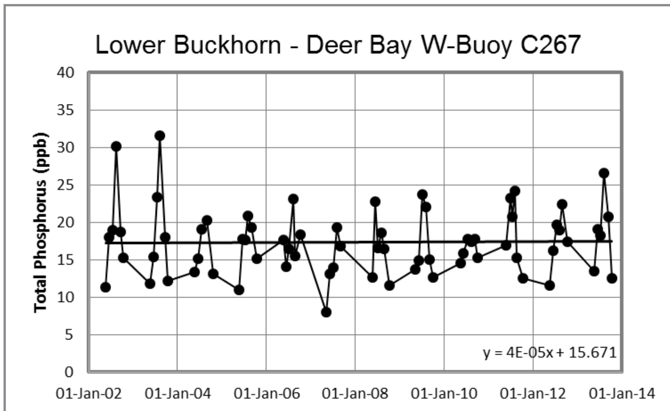


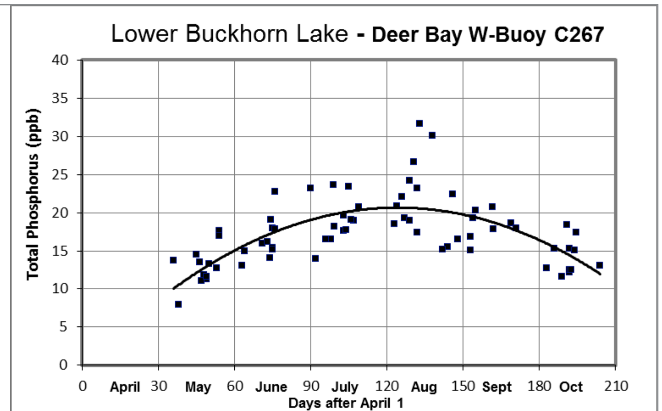


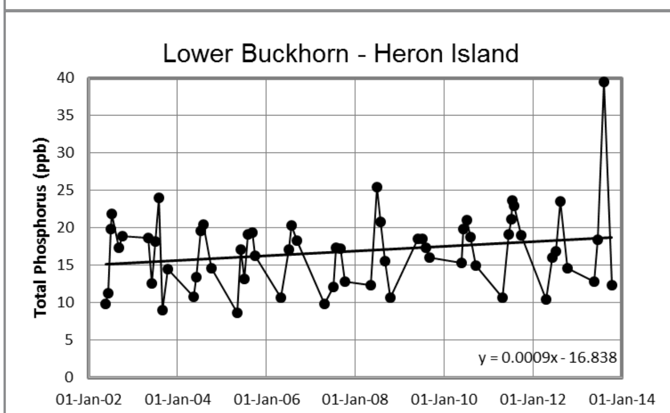


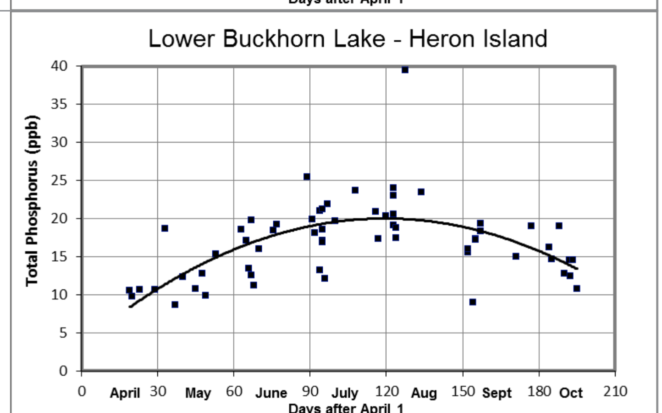
Lower Buckhorn: 3 sites. The first two, Deer Bay west buoy C267 and Heron Island are close together on the main channel and both sites show a level to slightly increasing average TP concentration of about17 ppb over time and nominal maximum seasonal TP of about 20 ppb.

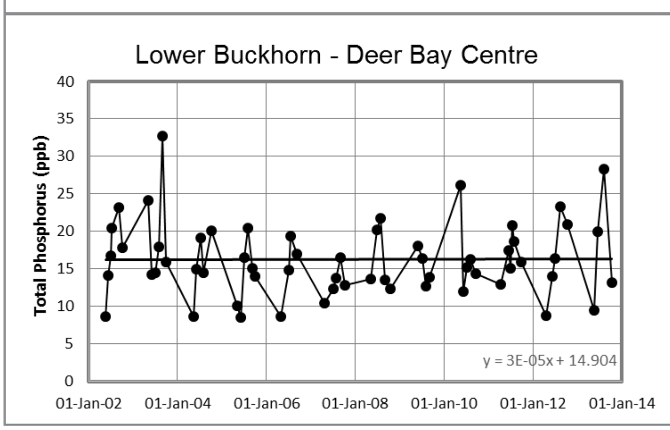
The third site in the centre of Deer Bay is off the main TSW channel. It shows a level average TP concentration of about16 ppb over time and nominal maximum seasonal TP of about18 ppb. TP does not drop as quickly in the fall as at the first two sites perhaps because it does not receive the increased flow of the TSW main channel as feeder lakes are drawn down in the fall.

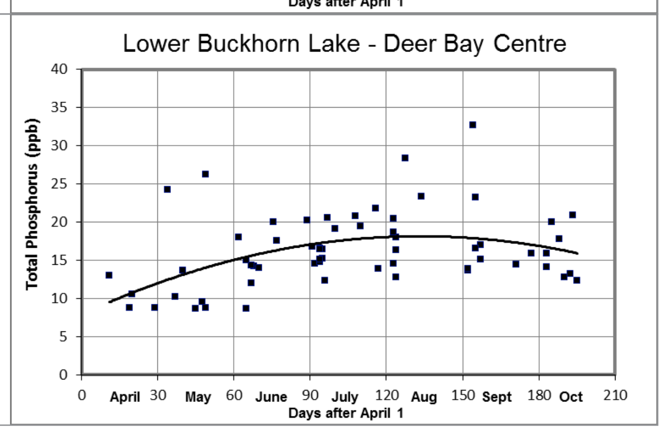




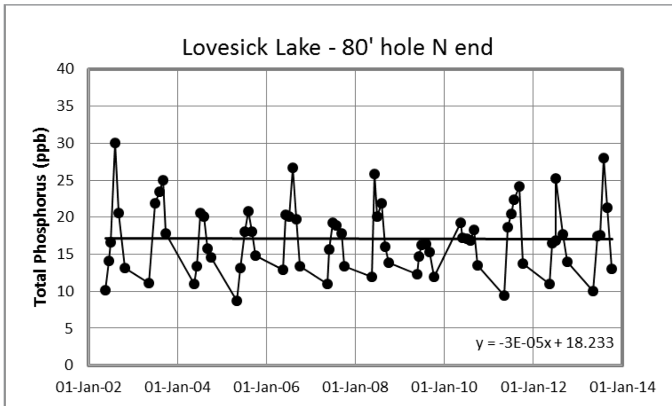


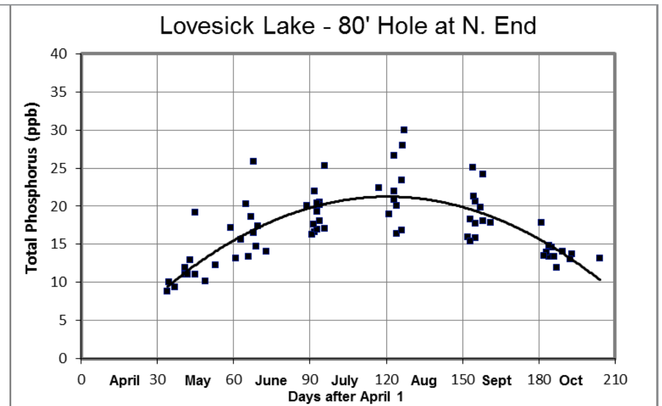


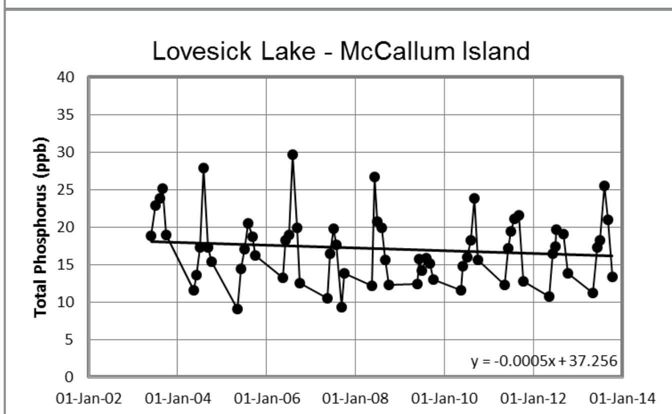


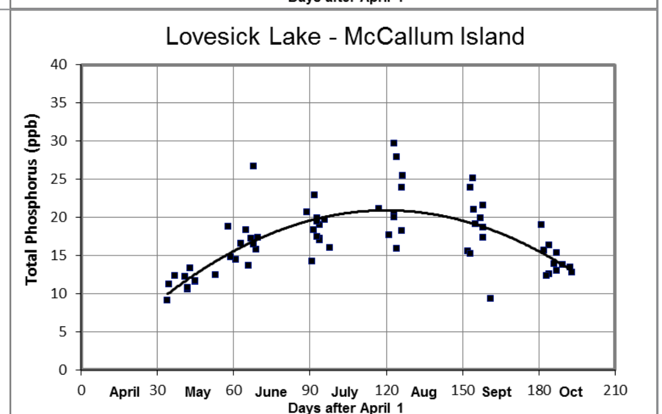


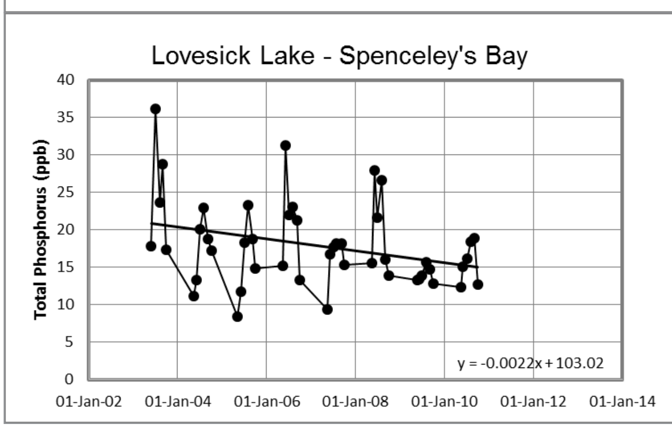
Lovesick Lake: 3 sites. All sites show level to slightly declining average TP levels of about 17 ppb over time and nominal maximum seasonal TP between 21 and 22 ppb.

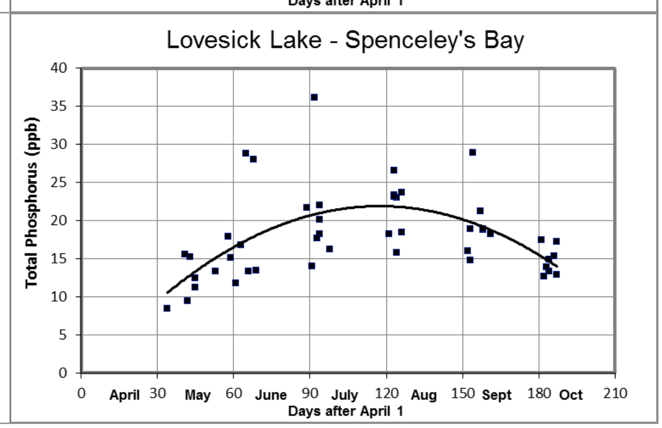




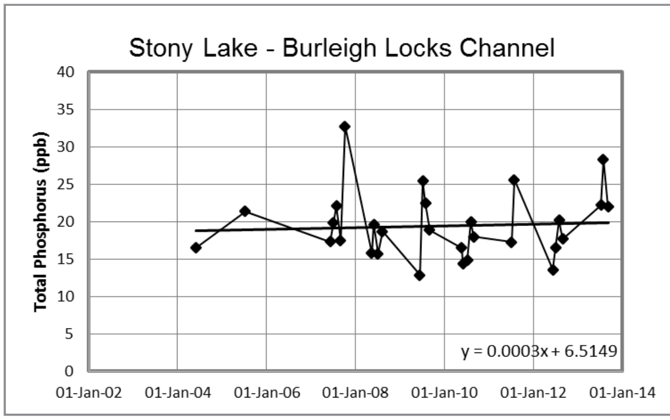


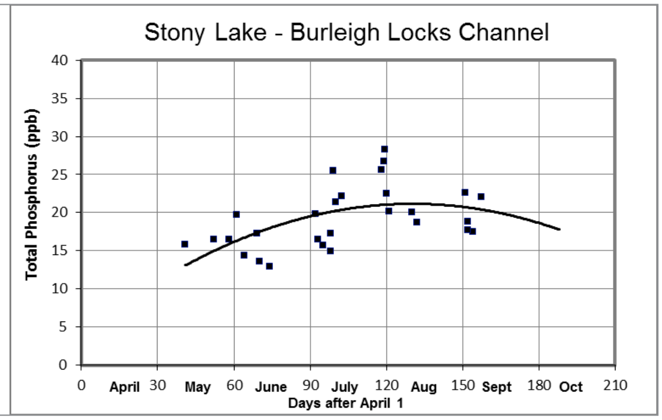






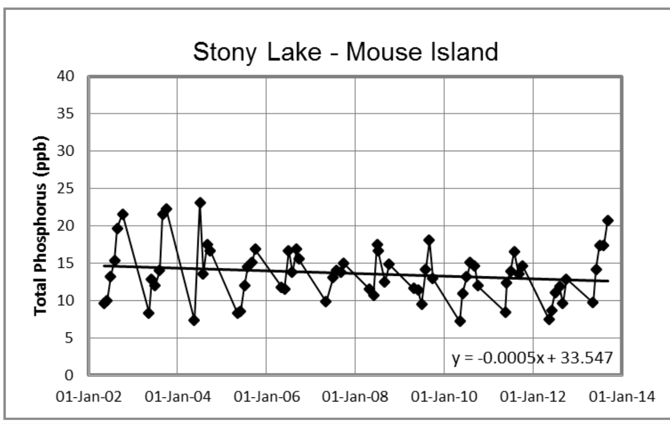
Stony Lake: TP levels at the 'Burleigh locks channel' site where the inflow from the upper lakes enters Stony Lake are similar to those in Lovesick Lake. They show a level to slightly increasing average TP level of 19 to 20 ppb over time and nominal maximum seasonal TP of about21 ppb.

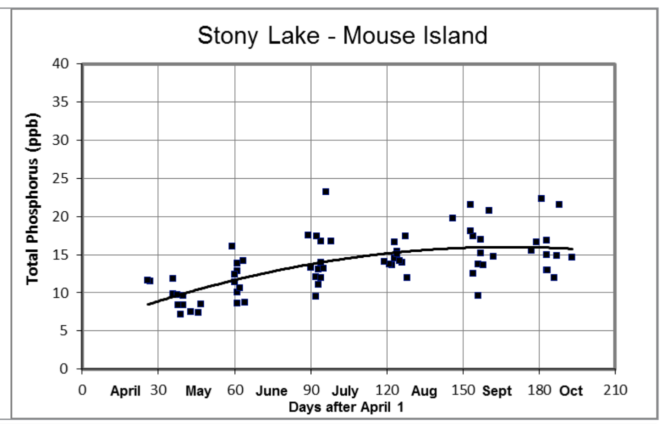


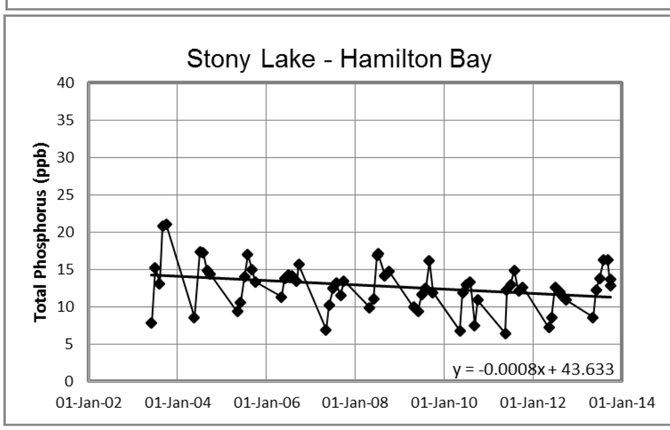


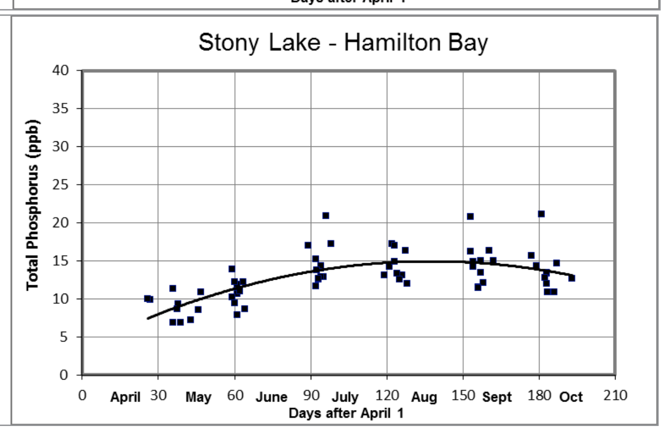
Stony Lake: 4 sites with differing TP profiles depending on their location.

The 'Mouse Island' site is in central Stony Lake south of Mount Julian. It shows a declining average TP level of 15 to 13 ppb over time and nominal maximum seasonal TP of about16 ppb. The seasonal peak occurs later and declines less in the fall. The lower TP levels of this and the 'Hamilton Bay' and 'Gilchrist Bay' sites reflect the mixing of high phosphorus water from the upper lakes with low phosphorus water from Upper Stoney Lake. 'Hamilton Bay' is on the south shore of Stony Lake south of Mouse Island and has a similar TP profile. 'Gilchrist Bay', further east on the south shore of Stony Lake, is long and narrow. The upper Indian River flows out of the south end of Gilchrist Bay feeding White Lake. 'Gilchrist Bay' site shows a level average TP level of 15 ppb over time and nominal maximum seasonal TP of about16 to 17 ppb.



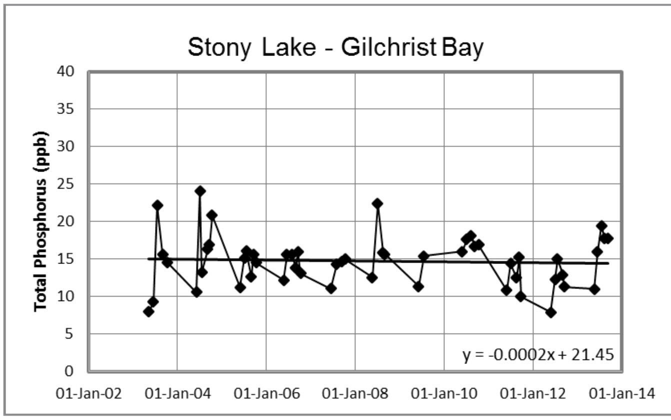


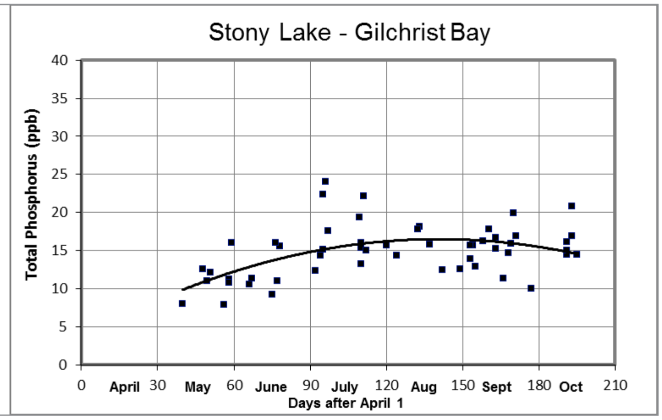




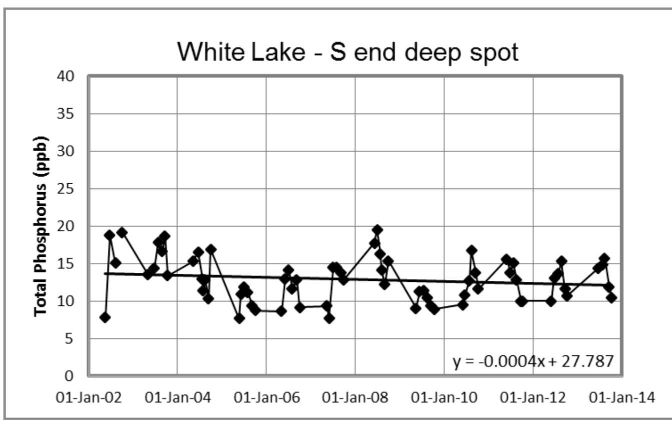
cont. Pg. 40

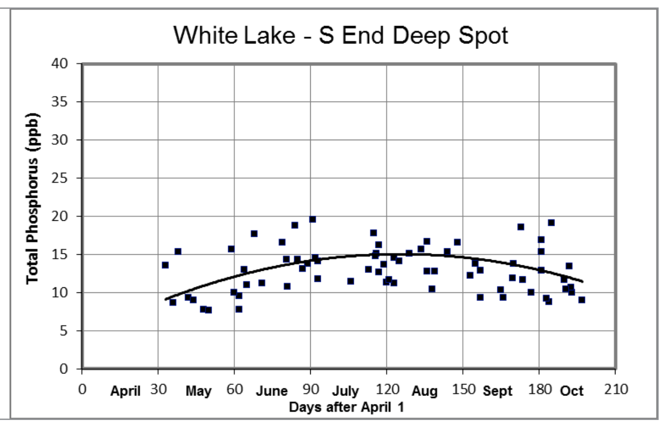
cont. from Pg. 39



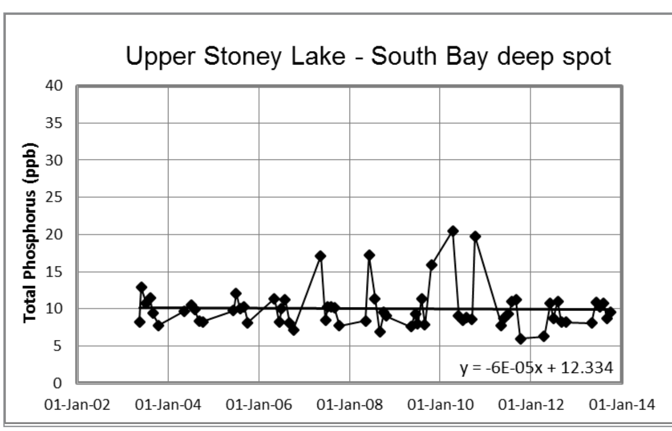


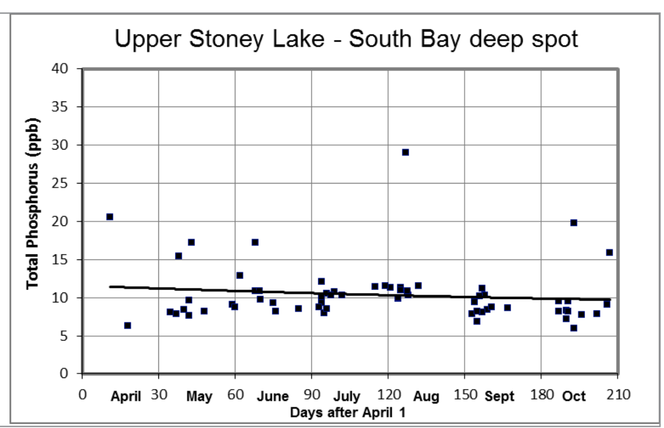
White Lake: 1 site with a TP profile that is very similar to those from the east end of Stony Lake and lower than Gilchrist Bay, perhaps because of the significant input from springs. It shows a slightly declining average TP level of 14-12 ppb over time and nominal maximum seasonal TP of about15 ppb.



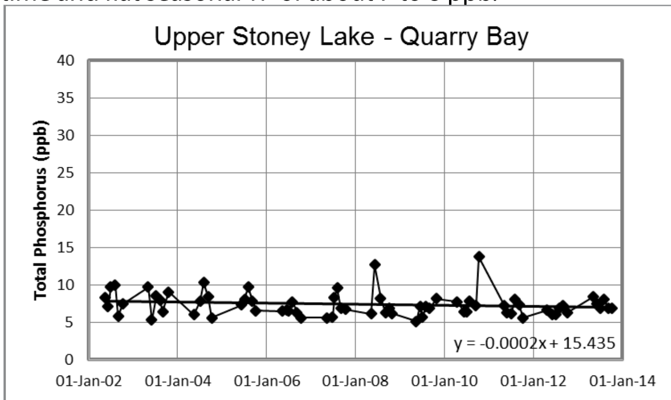


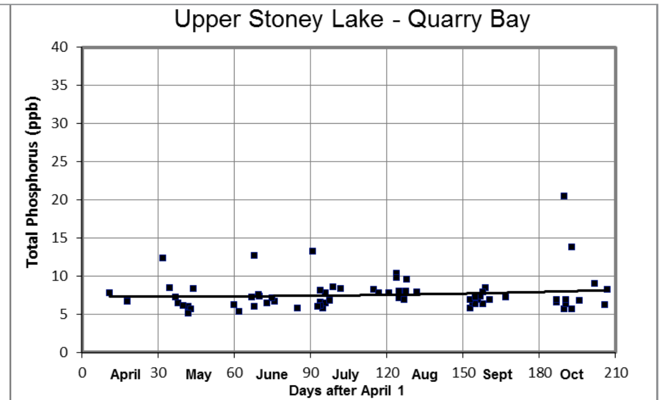
Upper Stoney Lake: 5 sites which are presented here from east to west, the direction of flow. South Bay is on the extreme south-east end of Upper Stoney Lake. It has small inflows from wetlands to the south and east which have some adjacent agricultural land. However, the 'South Bay' site has a similar TP profile to the other Upper Stoney Lake sites with an average TP level of 10 ppb over time and fairly flat seasonal TP of about10 ppb.

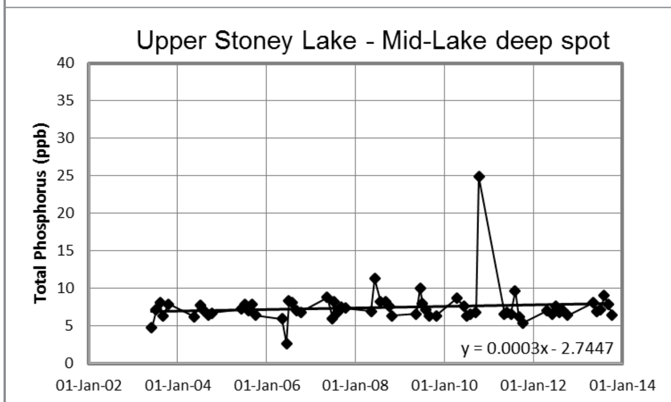


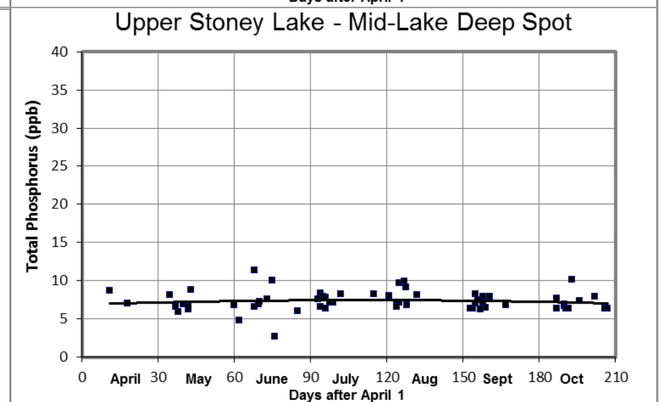


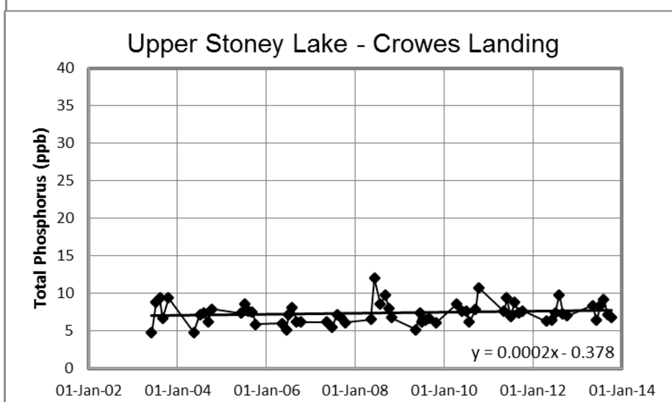
Stoney Lake: The other four sites, 'Quarry Bay' and 'Young Bay' near the north shore, 'Mid lake deep spot' in the middle and 'Crowe's Landing' near the south shore, all show very similar TP profiles. All have an average TP level of 7 to 8 ppb over time and flat seasonal TP of about 7 to 8 ppb.

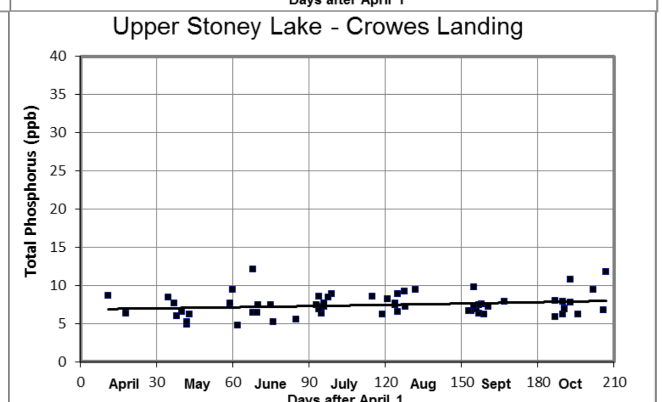


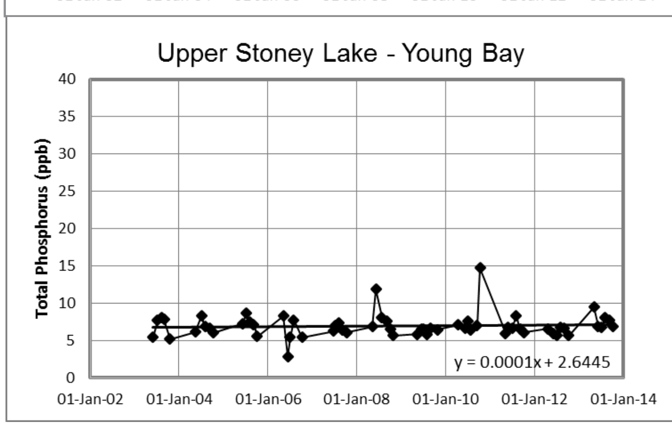


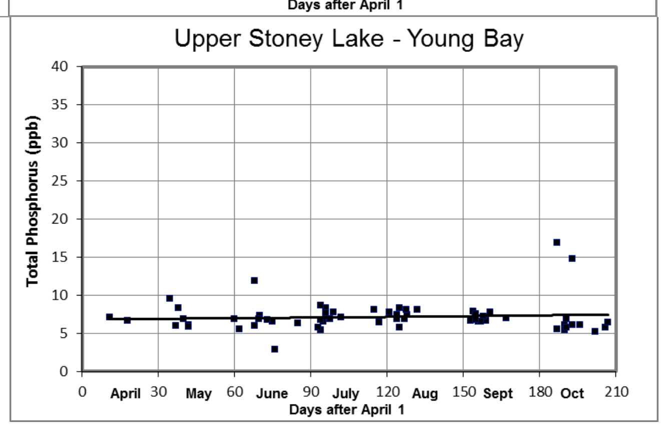






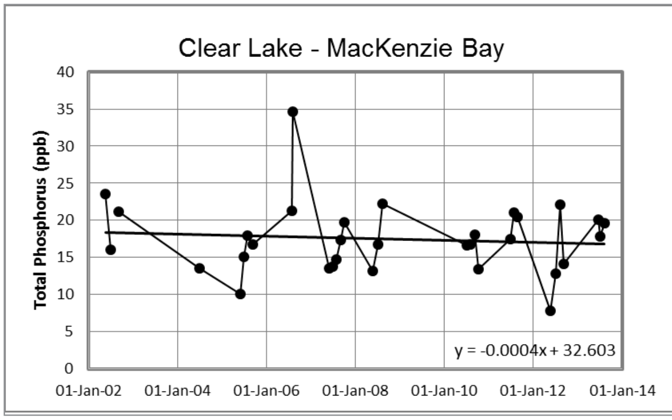


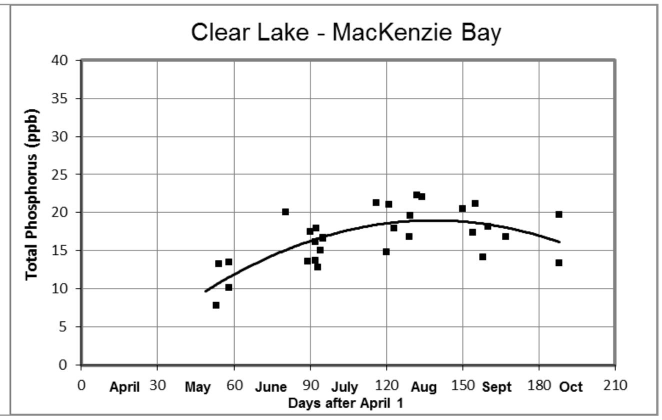




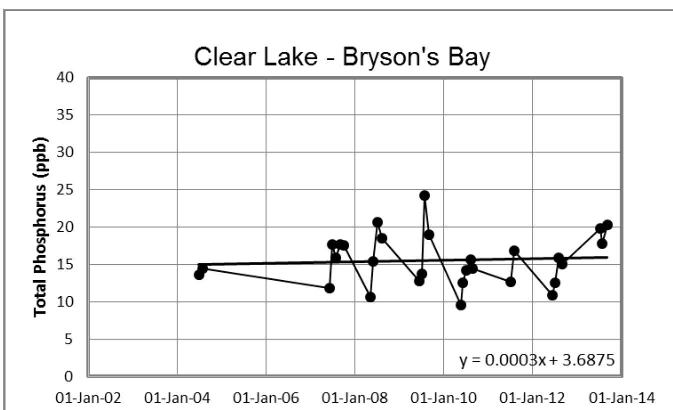
Analysis of Ontario Lake Partner Program Total Phosphorus Data for the Kawartha Lakes

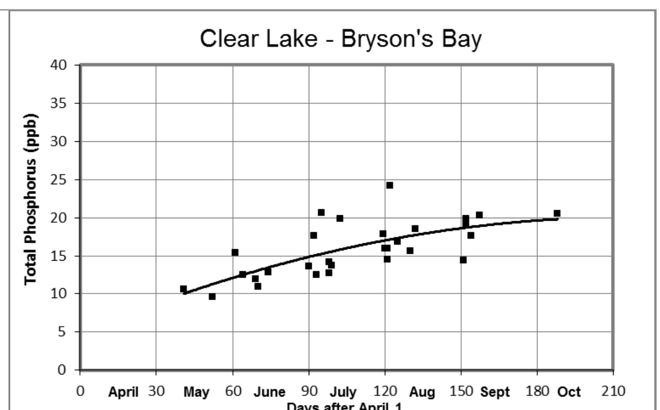
Clear Lake: 4 sites. The 'Mackenzie Bay' site is in the north-west corner of Clear Lake with water supplied primarily from the upper lakes via the Burleigh Channel. TP levels are slightly lower than in the Burleigh Channel but the peaked seasonal profile is similar. This site has a slightly declining average TP level of 18 to 16 ppb over time and a maximum seasonal TP of about 19 ppb.

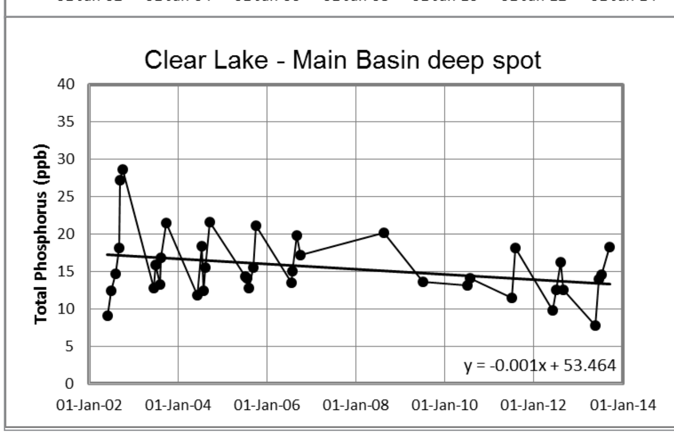


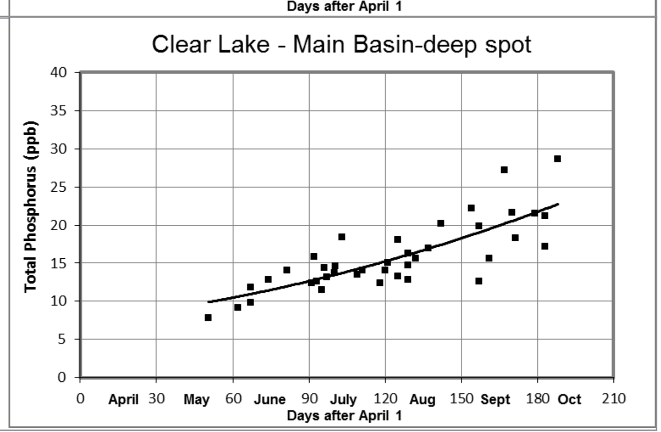


The three other Clear Lake sites, 'Bryson's Bay', 'Main Basin Deep Spot' and 'Fiddler's Bay', are all on the east side of Clear Lake and exhibit a TP profile that is different than that seen in both upstream and downstream lakes. At all three sites, the average TP level is about15 ppb over time and the seasonal TP gradually rises to a maximum of about 20 ppb in the fall. It is probable that the low phosphorus water from Upper Stoney Lake flows predominantly down the east side of the lake mixing gradually with the higher phosphorus water from the upper lakes resulting in lower average TP water. In the fall, the flow of low phosphorus water from Upper Stoney Lake is probably less and the increased TSW flow of lower phosphorus water down the west side of the lake may not dilute water on the east side resulting in TP levels continuing to rise. However, the cause of this unusual behaviour is not well understood.

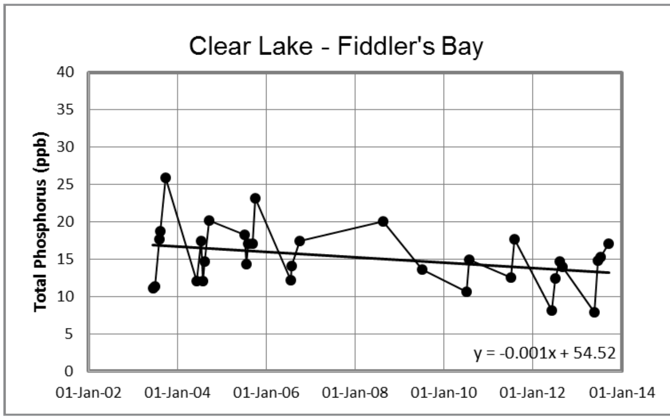


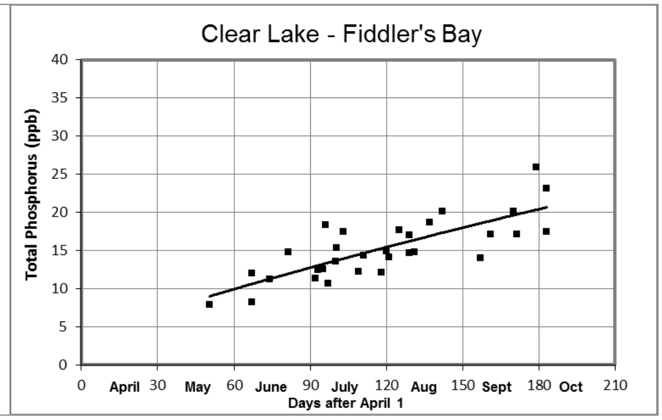




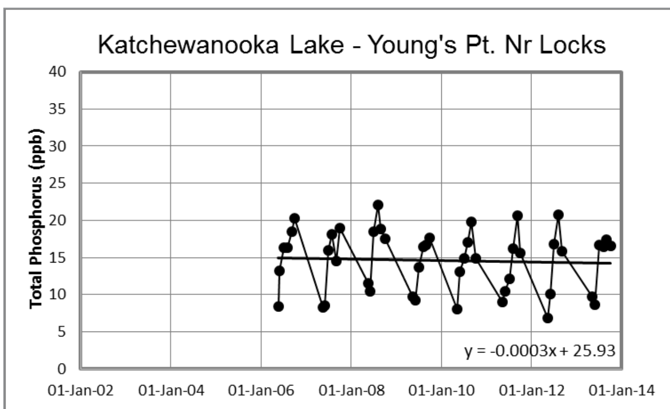


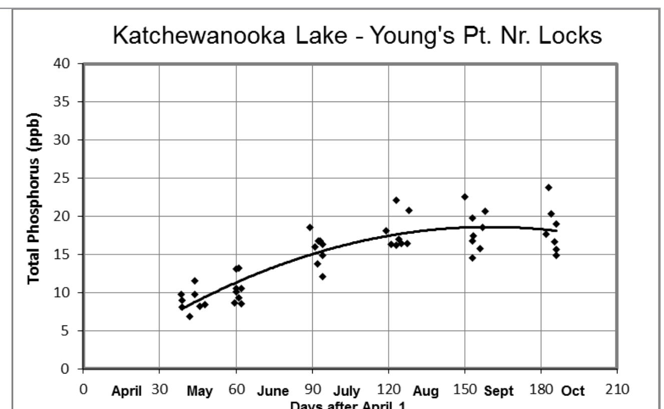
Clear Lake *cont'd*

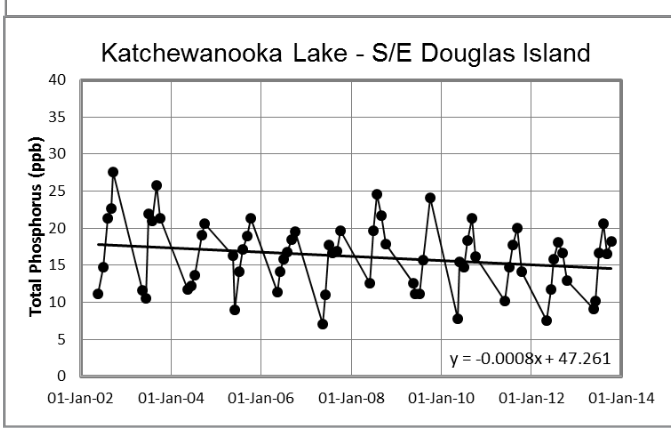


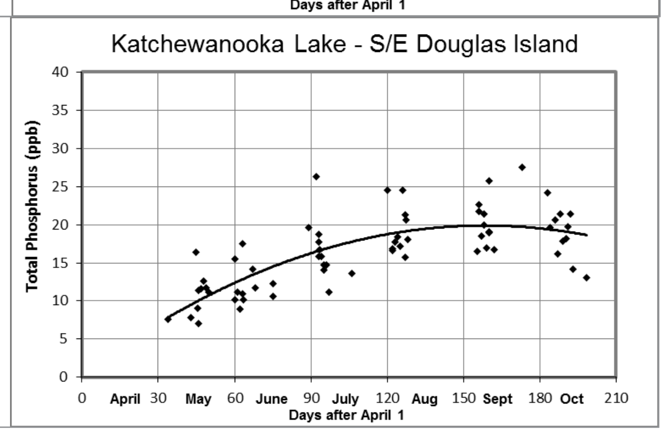


Katchewanooka Lake: 2 sites both of which are in the north half of the lake. The TP profiles of both sites are very similar with level to slightly declining average TP of 18 to 15 ppb over time and a maximum seasonal TP of 19 to 20 ppb. However, the peak of the seasonal curve is shifted ~40 days later in the fall than that seen in upstream lakes such as Lovesick, Lower Buckhorn and Buckhorn Lakes. The apparently somewhat segregated flows through Clear Lake from the upper lakes to the west and Upper Stoney Lake to the east appear to be thoroughly mixed after flowing through the short narrow river between Clear and Katchewanooka Lakes. The later peak and slower decline of TP in the fall in Katchewanooka reflects the combination of these two flows.









Model Development of Seasonal Phosphorus Variation in Sturgeon Lake

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

In 2014, KLSA sponsored a student Credit for Product project in Fleming College's Ecosystem Management Program entitled Model Development of Seasonal Phosphorus Variation in Sturgeon Lake. Mike Dolbey wrote the project proposal and he and Mike Stedman jointly mentored the students.

The idea for the project originated with discussion among KLSA Directors about the possible reasons for the seasonal variation in Total Phosphorus (TP) concentrations that are measured in many of our lakes by KLSA/ Lake Partner Program (LPP) volunteers. One opinion is that the variation is caused by 'internal loading', that is, the release of phosphorus from lake sediments that occurs when the water near the sediment is depleted of oxygen (anoxia). It is generally believed that anoxia occurs when decaying matter absorbs the dissolved oxygen in the water at the bottom of deep lakes where mixing with oxygen surface water is inhibited by thermoclines in the lake. It has been argued by others that most of the Kawartha Lakes are too shallow to allow the development of thermoclines and relatively little internal loading should occur. An alternative explanation for the seasonal variation is that it is caused by the seasonal inputs of phosphorus from all sources including considerable modulation by the variable flow of the Trent-Severn Waterway (TSW) through the lakes.

Early in 2014, Kawartha Conservation (KC) completed the Sturgeon Lake Management Plan (SLMP) and released a companion report, the Sturgeon Lake Watershed Characterization Report (SLWCR), both of which contained a wealth of data about the sources of phosphorus entering Sturgeon Lake. In addition to giving annual total amounts for each source of phosphorus, the reports included limited information about its distribution throughout the year. Both reports are available on the KC website:
http://www.kawarthaconservation.com/sturgeon-lake/index.html

Using this information, Dolbey developed an Excel spreadsheet model of the seasonal variation in TP concentration in Sturgeon Lake. Initially, Sturgeon Lake was represented as a single basin into and out of which water from different sources and with different TP concentrations flowed. The year was divided into 52 weekly intervals and the flows and TP concentrations and loads were distributed throughout the year using information provided in the Sturgeon Lake reports, or assumptions when information was lacking. The model was based on the application of conservation principles such as the conservation of volume of the basin and the conservation of TP load in lake water in the basin over the course of the year. This means that over the course of one year, water input to the basin from all sources equals water output from all sources and that P inputs to the basin from all sources must equal P outputs from all sources. These conservation principles were applied to calculate the TP concentration in the basin at the end of each week throughout the year.

The early single basin model showed promise predicting a seasonal TP curve of similar shape to the LPP measurements. However, there are four locations at which LPP TP measurements are made and they differ considerably because of the geometry of the lake and the location of the main phosphorus sources. After discussing the results of the single basin model with others, the idea of a Fleming College Student project was suggested to develop an improved four basin model of Sturgeon Lake using better data that might be obtained from sources such as TSW and Kawartha Conservation.

Student field trip on Sturgeon Lake

In August, 2014, Mike Dolbey and Mike Stedman submitted the project proposal to Fleming College. It was accepted with the understanding that Dolbey might have to assist with some of the spreadsheet program development. On September 8th the project was assigned to our student team, Allan Fretz, Katrine Hunter and Anne-Lise Watson, all in their graduation year.

The Credit for Product course is structured to teach students all aspects of planning, researching, carrying out and reporting a project. The students have one full day per week for twelve weeks to accomplish their goal. Part of their time is spent in class work. They are also each required to write a literature review on some aspect of the project. The three students reviewed the effects on seasonal variation of TP in lakes due to three factors: Internal Loading (Watson), Climate (Hunter) and Agricultural Practices (Fretz). Their reviews are appended to their final project report. KLSA was also required to provide the students with an outside activity related to the project. KLSA/LPP volunteer testers Rod Martin and Dave Young took the students, along with Dolbey and Stedman out in their boats to collect the October TP samples at two sites on Sturgeon Lake. The weather was warm and sunny and the trip was pleasant and informative. After the sampling trip we all visited Fleming College's Centre for Alternative Wastewater Treatment (CAWT) to see a typical water sample testing laboratory. The remainder of the students' course time was spent on the primary project objectives and writing their final report.

Acquiring real seasonal flow and TP data from TSW and KC was an important objective for the students. Dave Ness of TSW was helpful but could only supply gate settings for the various dams at the inlets and outlets of Sturgeon Lake. TSW does not calculate flow through the system but operates only to control water levels. While formulas are available to calculate flow from gate settings in the system, they are complex and do not take all factors into account. Fortunately, Kawartha Conservation had processed the TSW data for a number of years as part of the SLMP study. Alex Shulyarenco of Kawartha Conservation provided our students with this information and also provided a large amount of measured flow and TP data for streams flowing into Sturgeon Lake.

The second objective for the students was to improve the Microsoft Excel® spreadsheet model by changing it to incorporate four basins instead of one and use the real flow and TP data that had been acquired to replace assumed flow and TP distributions. Having been forewarned that the time and skill required to change the model would be a challenge for the students, Dolbey developed the four basin model and provided it to the students. He also assisted with analysis and input of the KC data into the four basin model and comparison of the results with TP measurements made by KLSA/LPP volunteers and Kawartha Conservation.

The four basin model of seasonal variation of phosphorus in Sturgeon Lake divides the lake into four separate basins: the Fenelon Basin is the area between the Fenelon River inlet and Sturgeon Point; the Lindsay Basin is the area between the Scugog River inlet and Sturgeon Point; the Mid Basin is the area between Sturgeon Point and Emily Creek; the Lower Basin is the area between Emily Creek and Sturgeon Lake's outlet at Bobcaygeon. The total volume, area and shoreline length of Sturgeon Lake were apportioned to the four basins based on maps and data from the SLMP. Inputs to the model are the flow and TP concentrations of the rivers, creeks, sewage treatment plants (STP) and shoreline (runoff and septic system) contributions (referred to as Sturgeon Lake Tributaries) flowing into Sturgeon Lake over 52 weekly periods. The Sturgeon Lake Tributaries (SLT) inputs for each basin are apportioned according to the basin's estimated percentage of total lake shoreline length. Input sources for the Fenelon Basin are the Fenelon River, the Fenelon Falls STP and SLT; input sources for the Lindsay Basin are the Scugog River, McLaren's Creek, Jennings Creek, the Lindsay STP and SLT; input sources for the Mid Basin are the outputs of the Fenelon and Lindsay basins and SLT; input sources for the Lower Basin are the output of the Mid basin, Emily Creek, Martin Creek, Hawkers Creek and SLT. Simplifying assumptions are that the water level of the lake remains constant throughout the year and that there is perfect mixing within each basin on a weekly basis. The same conservation principles used for the single basin model were applied to each of the four basins. The model output for each basin, the resulting graph of weekly TP values vs. time, is the profile of seasonal TP variation for that basin.

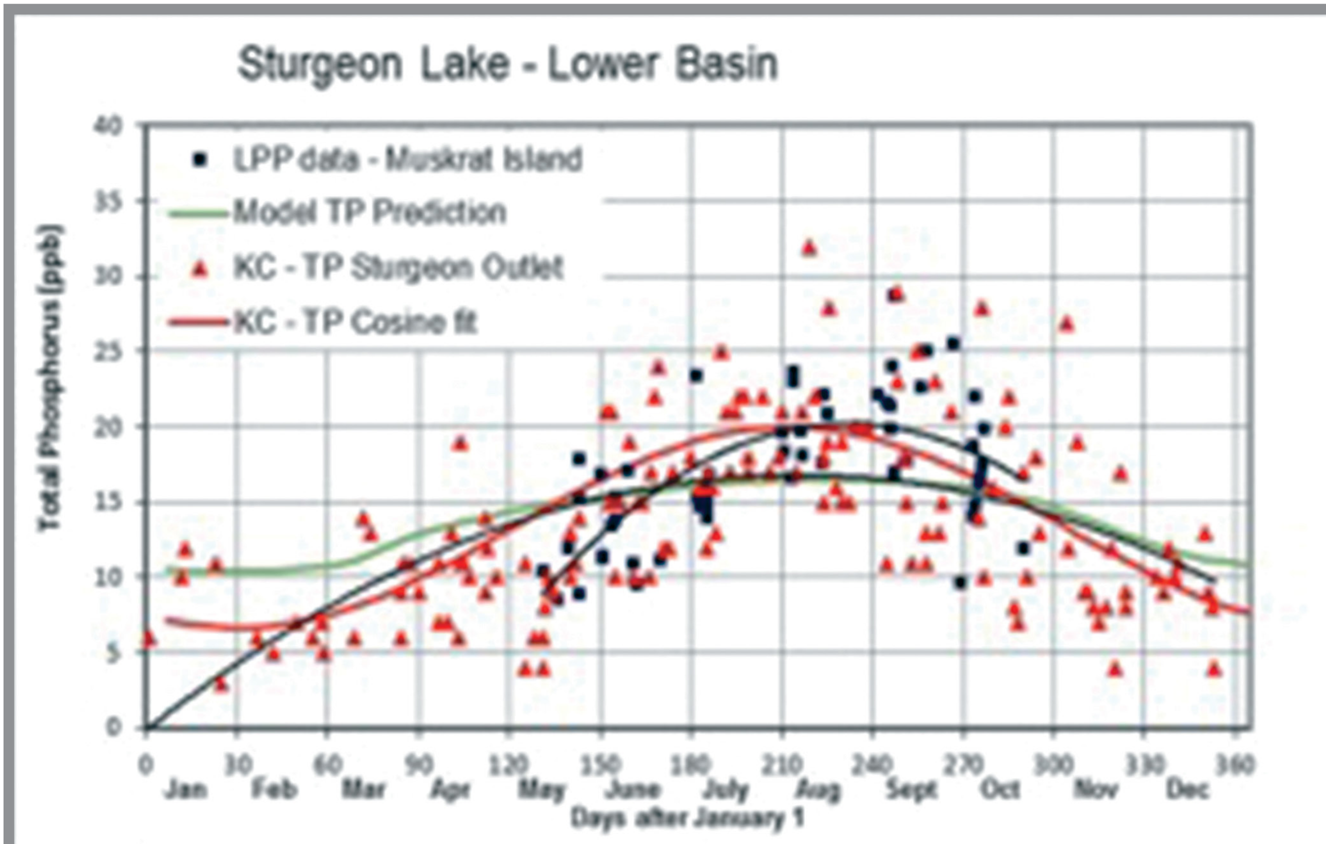
Comparison of the model results for each basin with measured values of TP by KLSA/LPP volunteers and KC showed generally good qualitative agreement. The seasonal variation observed in measurements was predicted by the model but it rose earlier in the spring, possibly due to the unrealistic simplifying assumption in the model that phosphorus entering the long, shallow Lindsay basin is uniformly distributed through the basin on a weekly basis. This spreading of the phosphorus over time also resulted in lower predicted peak mid-summer TP levels than measured. No attempt was made to include internal loading into the model because there was insufficient knowledge about the mechanism of internal loading to allow it to be modelled. While some contribution from internal loading cannot be ruled out, the model results indicate that the seasonal variation of TP concentration that we observe in our lakes can be explained in large measure by the seasonal variation of flow and phosphorus inputs.

The students' complete report of this project is posted on the KLSA website, **http://klsa.wordpress.com/** under the heading 'Projects'. It contains a full description of the project with many graphs and it contains the literature reviews referred to earlier.

KLSA thanks Fleming College and specifically Professor Sara Kelly, Program Coordinator for the Ecosystem

Model Development of Seasonal Phosphorus Variation in Sturgeon Lake

Management Technology Program, for the opportunity to participate in their Credit for Product program. We hope that it was as much of a learning experience for the student team as it was for us.



Model output for Sturgeon Lake Lower Basin compared to measurement data

Mission Statement:

The Kawartha Lake Stewards Association was founded to carry out a coordinated, consistent, water quality testing program (including bacteria and phosphorus) in lake water in the Kawartha Lakes. The Kawartha Lake Stewards Association ensures that water quality test results, prepared according to professionally validated protocols with summary analysis, are made available to all 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.

2014-2015 Board of Directors

Chris Appleton, Chair*
Sturgeon Lake

Kathleen Mackenzie, Vice-Chair/Co-Chair**
Stony Lake

Kevin Walters, Vice-Chair/Co-Chair**
Shadow, Lovesick and Sandy Lakes

Mike Stedman, Treasurer
Lakefield

Ann Ambler, Secretary***
Lovesick Lake

Lynn Woodcroft, Secretary**
Buckhorn

Sheila Gordon-Dillane, Recording Secretary
Pigeon Lake

Tom Cathcart, Director***
Lower Buckhorn Lake

Jeffrey Chalmers, Director
Clear Lake

Mike Dolbey, Director
Katchewanooka Lake

Doug Erlandson, Director
Balsam Lake

Heathyr Francis, Director***
Big Bald Lake

Tracy Logan, Director**
Lakefield

Erin McGauley, Director**
Peterborough

William Napier, Director**
Buckhorn

Shari Paykariman, Director**
Peterborough

*until July 5, 2014
**effective September 27, 2014
***until September 27, 2014

Scientific Advisors

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

Dr. Eric Sager
Coordinator of the Ecological Restoration Program at Fleming College and Adjunct Professor at Trent University, Peterborough

Volunteer Testers, 2014

Balsam Lake – funding provided by Balsam Lake Association, North Bay Association, Driftwood Village, Killarney Bay Association
Volunteers: Ross Bird, Douglas and Peggy Erlandson, Leslie Joynt, Barbara Peel, Diane Smith, Jeff Taylor, Bob Tuckett, Gary and Maryanne Watson, Steve and Laura Watt

Big Bald Lake - Big Bald Lake Association: Bruce Barnes, Heathyr Francis, Colin Hoag

Big Cedar Lake - Big Cedar Lake Stewardship Association: Rudi Harner

Cameron Lake - Ruth Pillsworth

Clear Lake – Birchcliff Property Owners Association: Jeff Chalmers
Clear Lake - Kawartha Park Cottagers' Association: Vivian Walsworth

Katchewanooka Lake – Lake Edge Cottages: Peter Fischer, Mike Dolbey

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

Lower Buckhorn Lake – Lower Buckhorn Lake Owners' Association: Brian Brady, Jeff Lang, Mark and Diane Potter, Dave Thompson

Pigeon Lake – Concession 17 Pigeon Lake Cottagers Associaton: Jim Dillane, Sheila Gordon-Dillane
Pigeon Lake – North Pigeon Lake Ratepayers' Association: Tom McCarron, Francis Currer
Pigeon Lake – Victoria Place: Ralph Erskine
Pigeon Lake – Tates Bay: Ted and Pat Oakes

Sandy Lake – Sandy Lake Cottagers Association: Mike and Diane Boysen, Stephen Streeter

Shadow Lake and Silver Lake - Phil Taylor, Eveline Eilert

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

Sturgeon Lake – funding provided by Bayview Estates Association, Blythe Shores, East Beehive Association, Hawkers Creek, Kawartha Protect Our Shores, Kenhill Beach, Snug Harbour, Stinson's Bay Road Association
Volunteers: Chris Appleton, Bruce Hadfield, Rod Martin, Paul Reeds, Dave Young

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

Upper Stoney Lake - Upper Stoney Lake Association: Karl and Kathy Macarthur, and their Golden Retriever Kooper

White Lake – White Lake Association: Wayne Horner

Appendix B
Financial Partners

Thank You to Our 2014 Supporters

Municipal Government Contributions

City of Kawartha Lakes
Township of Douro-Dummer
Municipality of Trent Lakes
Township of Selwyn

Community Association Donations

- Balsam Lake Association
- Big Cedar Lake Road Committee
- Big Cedar Lake Stewardship Association
- Birchcliff Property Owners Association
- Buckhorn Lake Estates Ratepayers Association
- Buckhorn Sands Property Owners Association
- Curve Lake First Nations Cultural Centre
- Deer Bay Reach Property Owners Association
- East Beehive Community Association
- Harvey Lakeland Commonland Owners' Association
- Jack Lake Association
- Killarney Bay - Cedar Point Cottage Association
- North Pigeon Lake Ratepayers' Association
- Sandy Lake Cottagers Association
- Stony Lake Heritage Foundation
- Sturgeon Point Association
- White Lake Association

Private Business Donations

Birch Point Marina
Buckeye Marine
Clearview Cottage Resort
Egan Houseboat Rentals
Lakefield Foodland
Pine Vista Resort
Rosedale Marina

Private Donations

- Kathy Armstrong
- Mike Dolbey
- Janet Duval
- Rocky & Debbie Gaetan
- Sheila Gordon-Dillane
- Robert Hogg
- Barry and Carol Hooper
- Jim Keyser
- Carol McCanse
- Colleen Middleton
- Ted Oakes
- Jacqueline Shaver
- Mike Stedman

Appendix C:
Treasurer's Report

Mike Stedman, KLSA Treasurer

As in previous years, our financial statements have been approved by McColl Turner LLP Chartered Accountants -Peterborough, Ontario. Their Review Engagement Report summarizes revenue, expenditure and assets for 2013 and 2014. Our thanks to Mr. George Gillespie for his continued support providing this community service.

2014 Revenue of $14,896 is considerably less than previous years. Parks Canada, Trent-Severn Waterway under severe budget cuts, had to withdraw KLSA financial support that had been at the $3,000 level for several years.

Our continuing sources of income were:

- Municipal Township grants $5,750
- Water testing fees $4,453
- Community Association donations $1,305
- Private business/individual donations $2,114
- Membership fees $1,234

KLSA introduced a membership fee model at our spring 2014 general meeting. Membership fees of $1,234, representing 63 members, exceeded our budget expectations, suggesting that we will get support at the $20 fee level. Associations, business and individual donations will continue to be an important funding source for KLSA.

2014 Total Expenses of $14,146 remained consistent with past years excluding major project activities like our Aquatic Plants Guide, the Milfoil Weevil Guide and the Algae of the Kawartha Lakes study.

The major operating expense accounts included:

- E.coli water test fees $5,130
- KLSA insurance $1,675
- Printing KLSA Annual Report $3,677
- Ongoing projects $3,016

This year saw the introduction of a new annual report publishing process employing newspaper industry techniques. For significantly less than the previous year's total cost for 300 copies, we are now able to print 2,000 copies at a cost of less than $2.00 each. Postage at over $3.00 a copy forces us to minimize distribution by mail. The Ongoing Projects account includes costs for general meetings, a Fleming College Credit-for-Product project, website design, and publication reprints.

The excess of revenue over expenditures for 2014 was $750, down from last year by the $3,000 no longer awarded by Parks Canada-TSW.

In terms of total assets, we closed 2014 with a cash balance of $16,899 and an RBC GIC of $5,118 for total assets of $22,017. The Board considers we need approximately $8,000 for working capital leaving the remainder for project activity employing our strategy to leverage KLSA monies with funds available from granting authorities such as the Ontario Trillium Foundation and the RBC Blue Water Project. To this end, work is underway to define a project addressing KLSA's goals of partnership alliances, public awareness, lake water quality monitoring and related scientific research.

KLSA could not effectively meet these goals without your support, both financial and in-kind.

Financial Statements of

KAWARTHA LAKES STEWARDS ASSOCIATION

December 31, 2014

Note To The Financial Statements
December 31, 2014

BASIS OF PRESENTATION

The accompanying financial statements relate to the incorporated association registered by Letters Patent as Kawartha Lakes 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 Lakes 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 any 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 ACCOUNTANTS

McCOLL TURNER LLP
CHARTERED ACCOUNTANTS

362 Queen Street
Peterborough, ON
K9H 3J6

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

REVIEW ENGAGEMENT REPORT

To Mr. Mike Stedman, Treasurer

KAWARTHA LAKES STEWARDS ASSOCIATION

We have reviewed the statement of financial position of Kawartha Lakes Stewards Association as at December 31, 2014 and the statement of operations for the year then ended. Our review was made in accordance with generally accepted standards for review engagements and accordingly consisted primarily of enquiry, analytical procedures and discussion related to information supplied to us by the organization.

A review does not constitute an audit and consequently we do not express an audit opinion on these financial statements.

Based on our review, nothing has come to our attention that causes us to believe that these financial statements are not, in all material respects, in accordance with Canadian accounting standards for not-for-profit organizations.

McColl Turner LLP

Licensed Public Accountants

Peterborough, Ontario
February 18, 2015

KAWARTHA LAKES STEWARDS ASSOCIATION

Statement of Financial Position - December 31, 2014

	(Unaudited) 2014	2013
ASSETS		
Current Assets		
Cash	$ 16,899	16,189
Guaranteed Investment Certificate	5,118	5,078
	22,017	21,267
NET ASSETS	22,017	21,267
	$ 22,017	$ 21,267

Statement of Operations
Year ended December 31, 2014

	(Unaudited) 2014	2013
REVENUE		
Parks Canada, Trent-Severn Waterway	$ -	$ 3,000
Municipal grants	5,750	5,765
Associations	1,305	1,445
Private contributions	2,114	2,323
Water testing fees	4,453	5,075
Membership fees	1,234	-
Interest	40	78
	14,896	17,686
EXPENDITURES		
Water testing fees	5,130	5,344
Special projects	3,016	-
Annual report costs	3,677	6,148
Insurance	1,675	1,656
Telephone, copies and other administrative costs	604	922
Bank charges	44	45
	14,146	14,115
EXCESS OF REVENUE OVER EXPENDITURES FOR THE YEAR	750	3,571
NET ASSETS - beginning of year	21,267	17,696
NET ASSETS - end of year	$ 22,017	$ 21,267

McCOLL TURNER LLP
CHARTERED ACCOUNTANTS

Appendix D:
Privacy Statement

Jeffrey Chalmers, 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 2014 Lake-by-Lake Results

Kathleen Mackenzie, KLSA Co-Chair

Choosing sites

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, as occurs in occasional ground beef 'scares'. 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.

Appendix E:
Rationale for E.coli Testing and 2014 Lake-by-Lake Results

Balsam Lake

2014 E.coli Lake Water Testing - E.coli/100 mL

Site	2-Jul-14	21-Jul-14	28-Jul-14	5-Aug-14	11-Aug-14	2-Sep-14
00	5	8	13	28	22	<3
01	<3	<3	3	19	3	16
02	5	5	11	<3	8	3
03	<3	<3	5	<3	<3	<3
04	25	3	3	<3	3	<3
05	8	<3	3	5	<3	5
06	3	<3	3	<3	3	<3
07	5	5	3	30	3	13
08	11	<3	5	19	5	3
12A	5	3	<3	3	<3	87
12B	3	3	11	3	<3	5
12C	3	<3	28	<3	3	5

As in previous years, counts were low on Balsam Lake. The high count of 87 at Site 12A/ Sep 2 had no obvious cause.

Big Bald Lake

2014 E.coli Lake Water Testing - E.coli/100 mL

Site	2-Jul-14	24-Jul-14	31-Jul-14	12-Aug-14	25-Aug-14
1	21	3	2	34	5
2	7	1	31	18	1
3	3	2	3	0	1
9	4	2	4	2	2
10	77	1	0	25	0
11	8	0	1	6	1

Similar to previous years, counts were consistently low on Big Bald Lake. The high reading of 77 at Site 10/Jul 9 had no obvious cause, other than generally heavy use of the lake during the previous week.

Big Cedar Lake

2014 E.coli Lake Water Testing - E.coli/100 mL

Site	2-Jul-14	21-Jul-14	28-Jul-14	5-Aug-14	11-Aug-14	2-Sep-14
640	1	0	2	1	0	0

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

Buckhorn Lake: Buckhorn Sands Property Owners Association

2014 E.coli Lake Water Testing - E.coli/100 mL

Site	3-Jul-14	21-Jul-14	28-Jul-14	5-Aug-14	11-Aug-14	2-Sep-14
A	2	0	12	0	0	1
B	19	6	9	13	1	14
C	3	16	3	4	13	32
D	7	2	2	9	3	4

Counts on all four sites on Buckhorn Lake were uniformly low.

Cameron Lake

2014 E.coli Lake Water Testing - E.coli/100 mL				
Site	2-Jul-14	5-Aug-14	11-Aug-14	2-Sep-14
CL-01	8	5	<3	<3

Counts were low in this third year of testing on Cameron Lake.

Clear Lake: Birchcliff Property Owners Association

2014 E.coli Lake Water Testing - E.coli/100 mL						
Site	10-Jul-14	25-Jul-14	30-Jul-14	20-Aug-14	5-Sep-14	16-Sep-14
BB	0	0	2	0	0	3
1	0	1	0	1	0	0
2	0	0	0	0	0	1
3	0	2	21	0	6	0
4	1	2	1	0	0	0
5	0	1	0	2	0	1
6	0	17	12	3	3	2
7	0	0	0	10	0	2
8	0	3	0	0	10	1

Counts were uniformly low on all test sites.

Clear Lake: Kawartha Park

2014 E.coli Lake Water Testing - E.coli/100 mL						
Site	2-Jul-14	22-Jul-14	30-Jul-14	5-Aug-14	11-Aug-14	3-Sep-14
A	0	0	0	0	0	1
B	0	23	0	0	0	0
C	0	0	0	0	0	3
D	0	1	0	0	0	0
P	1	18	0	1	1	1
W	1	3	4	0	1	1

This year, all E.coli counts were low on all 6 sites tested by Kawartha Park.

Katchewanooka Lake: Sites 2, 6, 7

2014 E.coli Lake Water Testing - E.coli/100 mL								
Site	2-Jul-14	21-Jul-14	28-Jul-14	29-Jul-14	5-Aug-14	11-Aug-14	2-Sep-14	3-Sep-14
2	20	2	--	10	22	17	--	5
6	2	76	--	1	3	6	--	0
7	3	3	8	--	1	1	5	--

Counts were generally low. There was no obvious reason for the count of 76 on Site 6/Jul21.

Appendix E:
2014 Lake-by-Lake Results

Lovesick Lake						
2014 E.coli Lake Water Testing - E.coli/100 mL						
Site	**3-Jul-14**	**21-Jul-14**	**28-Jul-14**	**5-Aug-14**	**11-Aug-14**	**2-Sep-14**
16	4	5	2	4	3	0
18	1	0	0	2	1	0
19	2	2	0	0	0	1

All counts were very low at these 3 locations on Lovesick Lake.

Lower Buckhorn Lake						
2014 E.coli Lake Water Testing - E.coli/100 mL						
Site	**3-Jul-14**	**22-Jul-14**	**30-Jul-14**	**10-Aug-14**	**18-Aug-14**	**2-Sep-14**
1	19	17	7	5	51	4
2	8	3	2	4	2	3
5	4	4	7	33	2	3
8	13	1	5	0	1	3
9	3	0	2	2	5	0
11	7	8	0	4	3	3
15	2	1	2	3	0	1

The only elevated reading was Site 1/Aug18. This may have been as a result of some heavy rains just previous to this test date, causing increased runoff.

Pigeon Lake: Concession 17 Pigeon Lake Cottagers Assoc.						
2014 E.coli Lake Water Testing E.coli/100 mL						
Site	**6-Jul-14**	**27-Jul-14**	**4-Aug-14**	**10-Aug-14**	**12-Aug-14**	**3-Sep-14**
A	12	9	15	45	4	7,6,6
B	3	14	0	19	25	2,1,0
3	2	1	4	8	62	4.3.2.2.1

Counts were normal for these 3 sites. There was no obvious reason for the elevated count of 62 at Site 3/Aug12.

Pigeon Lake: North Pigeon Lake Ratepayers' Assoc.						
2014 E.coli Lake Water Testing - E.coli/100 mL						
Site	**7-Jul-14**	**15-Jul-14**	**23-Jul-14**	**5-Aug-14**	**11-Aug-14**	**4-Sep-14**
1A	69	49,24,20,16,6	24,7,14,7,17	8	28	55
5	242	2,6,3,2,4	25,49,30,20,56	91	31,26,36,26,141	--
6	73	32,90,41,33,176	36	--	--	5,10,5,6,8
8	0	--	10	4	0	--
13	0	--	2	9	18	9

Over 14 years of testing, Sites 1A, 5 and 6 have fairly frequently had counts between 50 and 100. One might have expected somewhat lower counts in 2015 due to cooler water after an extended winter, but this doesn't seem to have been the case.

Pigeon Lake: Victoria Place

2014 E.coli Lake Water Testing - E.coli/100 mL							
Site	2-Jul-14	21-Jul-14	28-Jul-14	31-Jul-14	5-Aug-14	18-Aug-14	2-Sep-14
1	16	3	2,424	<3,<3,8	8	13	25
2	<3	8	94	3,3,5	8	52	72
3	<3	3	28	--	<3	5	59
4	3	5	33	--	43	33	43
5	8	<3	36	--	16	23	30

On July 28, the high counts might have been due to the heavy rains for the two days previous to testing, and also wave action on the testing day. There were also 25 – 30 geese in the area.

Pigeon Lake: Tait Bay

2014 E.coli Lake Water Testing - E.coli/100 mL					
Site	2-Jul-14	21-Jul-14	28-Jul-14	5-Aug-14	11-Aug-14
TB	25	11	59	49	<3

This is the first year of testing at Tait Bay.

Sandy Lake

2014 E.coli Lake Water Testing - E.coli/100 mL					
Site	2-Jul-14	21-Jul-14	28-Jul-14	15-Aug-14	2-Sep-14
M&D1	2	0	0	--	3
M&D2	2	3	0	--	0
M&D4	9	0	7	--	4
SL-1	--	--	--	12	--
SL-2	--	--	--	1	--
SL-3	--	--	--	21	--
SL-4	--	--	--	1	--
SL-5	--	--	--	0	--

Counts were uniformly very low on these Sandy Lake sites.

Shadow Lake

2014 E.coli Lake Water Testing - E.coli/100 mL						
Site	2-Jul-14	21-Jul-14	28-Jul-14	5-Aug-14	11-Aug-14	2-Sep-14
SH01	3	<3	16	3	--	3
SH02	11	<3	3	11	<3	8

As in the past 3 years, readings were very low on these Shadow Lake sites.

Silver Lake

2014 E.coli Lake Water Testing - E.coli/100 mL					
Site	2-Jul-14	21-Jul-14	28-Jul-14	5-Aug-14	2Sep-14
SL01	3	<3	5	<3	<3

As in the past 3 years, readings were very low on this Silver Lake site.

Stony Lake: Association of Stony Lake Cottagers								
2014 E.coli Lake Water Testing - E.coli/100 mL								
Site	**2-Jul-14**	**21-Jul-14**	**22-Jul-14**	**28-Jul-14**	**5-Aug-14**	**11-Aug-14**	**2-Sep--14**	**4-Sep-14**
E	10	8	--	3	1	1	1	--
F	0	2	--	0	1	0	5	--
I	8	4	--	14	6	3	2	--
J	3	--	5	4	--	--	--	0
K	2	--	1	4	--	--	--	0
L	1	0	--	1	15	7	1	--
P	1	0	--	1	1	1	0	--
28	4	30	--	8	11	12	8	--

Counts were uniformly low on these eight Stony Lake sites.

Sturgeon Lake: North Shore Combined Group						
2014 E.coli Lake Water Testing - E.coli/100 mL						
Site	**2-Jul-14**	**21-Jul-14**	**28-Jul-14**	**5-Aug-14**	**11-Aug-14**	**2-Sep-14**
NS2A	127	<3	119	3	16	30
NS4	<3	<3	3	<3	858	19
WS1	28	<3	16	3	36	16

Counts were generally low on Sturgeon Lake. NS2 has had occasional elevated readings in past years. NS2 will be moved as it is somewhat shallow for testing. On July 2, it was windy, and some sediments may have been stirred up.
The count of 858 at NS4/Aug 11 was likely caused by droppings from local waterfowl.

Upper Stoney Lake: Upper Stoney Lake Association						
2014 E.coli Lake Water Testing - E.coli/100 mL						
Site	**2-Jul-14**	**21-Jul-14**	**28-Jul-14**	**5-Aug-14**	**11-Aug-14**	**2-Sep-14**
6	12	13	59	6	6	5
20	2	24	3	5	12	23
21	0	0	1	0	6	2
52	13	2	4	9	11	24
65	1	0	1	3	2	8
70	4	0	2	3	0	7
78A	2	2	3	2	4	3

Counts were generally low on the seven sites on Upper Stoney Lake. There was no obvious cause of the elevated reading of 59 on Site 6/Jul28.

Appendix F:
2014 Phosphorus and Secchi Data

By Kathleen Mackenzie, KLSA Co-Chair

KLSA volunteers have been testing the Kawartha Lakes for total phosphorus for fourteen consecutive summers. Historical results from these and hundreds of other Ontario lakes can be seen at the Lake Partner Program website or at the website of the Federation of Ontario Cottagers' Associations (FOCA).

Why do so many people in the province continue to test their lakes for phosphorus? Phosphorus is only one of many factors that determine water quality, but it is an important one because it is the most likely chemical to increase algal growth, thus resulting in murky, unattractive water. Controlling phosphorus means controlling inputs from sources such as agriculture, sewage treatment plants, urban runoff, domestic fertilizers, precipitation, septic systems, and erosion. If phosphorus levels in a lake gradually rise over the years, it is probably a sign of careless human shoreline activity.

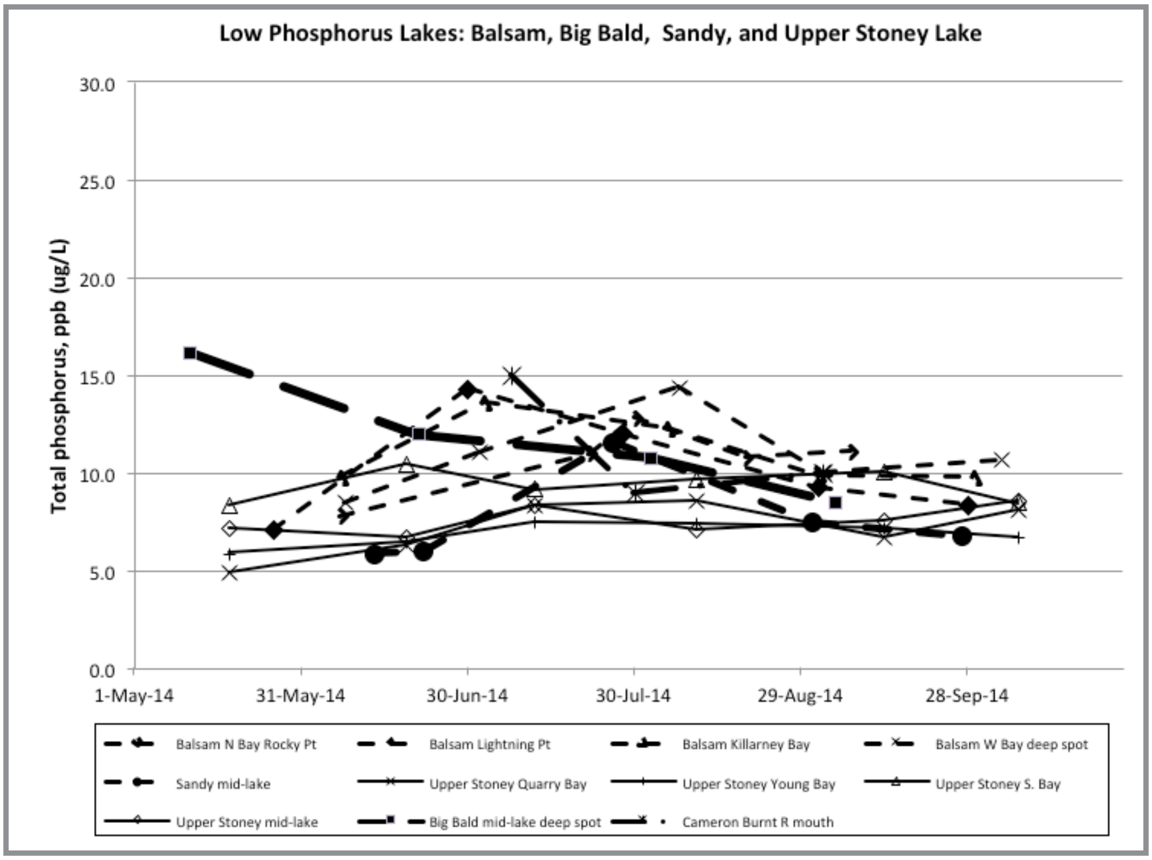
The Ontario Ministry of the Environment's (MOE) Interim Provincial Water Quality Objective for Total Phosphorus is as follows:

Current scientific evidence is insufficient to develop a firm objective at this time. Accordingly, the following phosphorus concentrations should be considered as general guidelines which should be supplemented by site-specific studies:

- *To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 ug/L.*
- *A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice- free period of 10 ug/L or less.*

Following are graphs illustrating phosphorus levels in the Kawartha Lakes, along with a discussion of why they vary so much from lake to lake and from month to month.

Low Phosphorus Lakes: Maximum phosphorus level 12 – 15 ppb

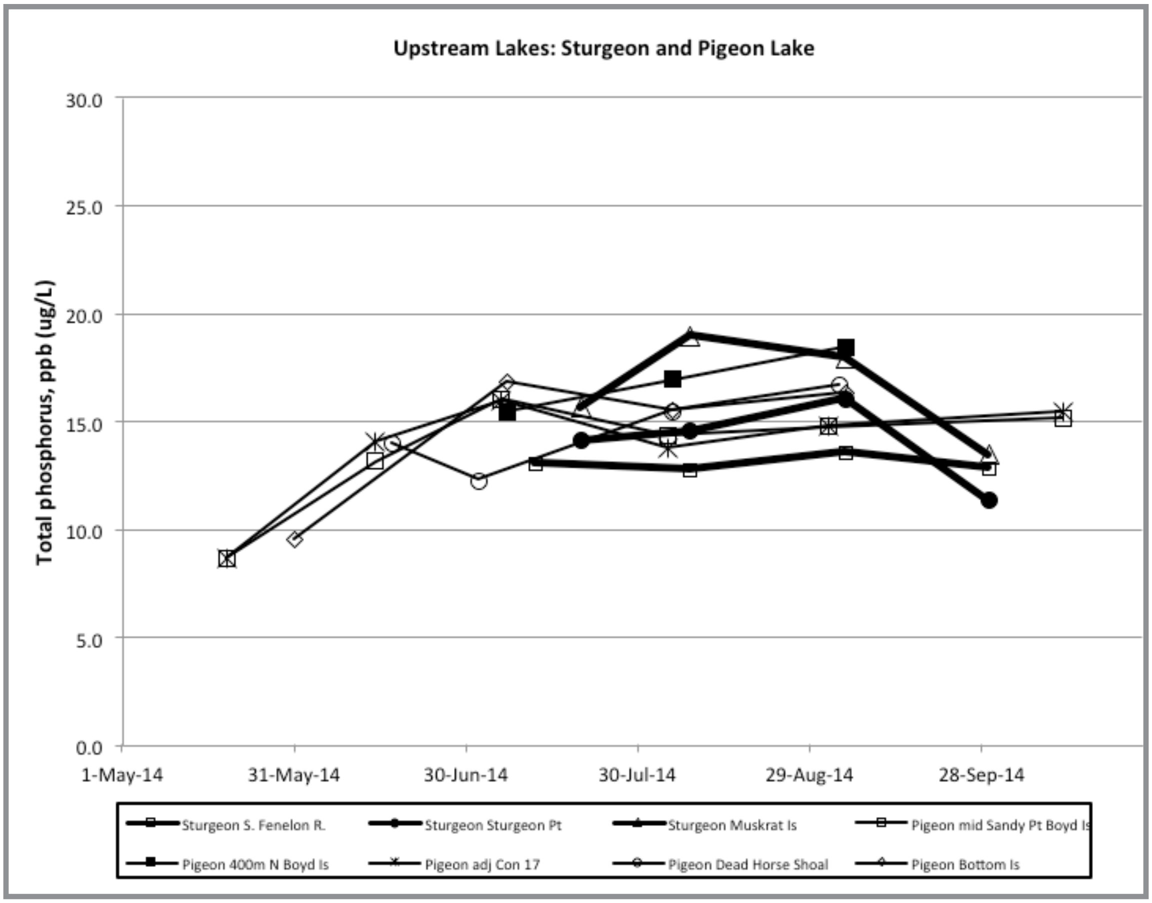


There are two main reasons why phosphorus is so low in these lakes.

1. In Upper Stoney Lake and Balsam Lake, there is a direct inflow from northern streams and rivers. This northern water is low in phosphorus because of the granitic geology and sparse human population north of the Kawarthas.
2. In Big Bald Lake and Sandy Lake, phosphorus is precipitated out of the lake during warm weather by the action of algae. This precipitate, called marl, forms soft, powdery sediments.

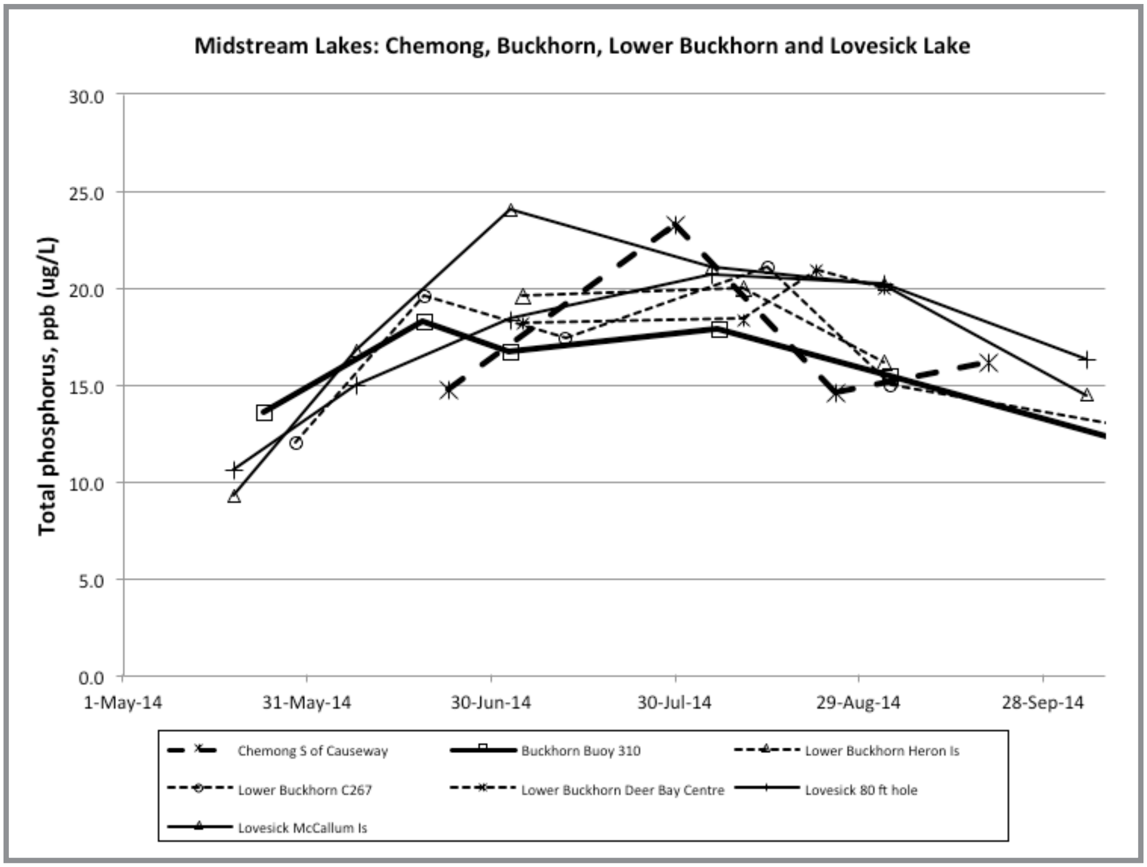
Appendix F:
2014 Phosphorus and Secchi Data

Upstream Lakes: Maximum phosphorus level 13 – 18 ppb



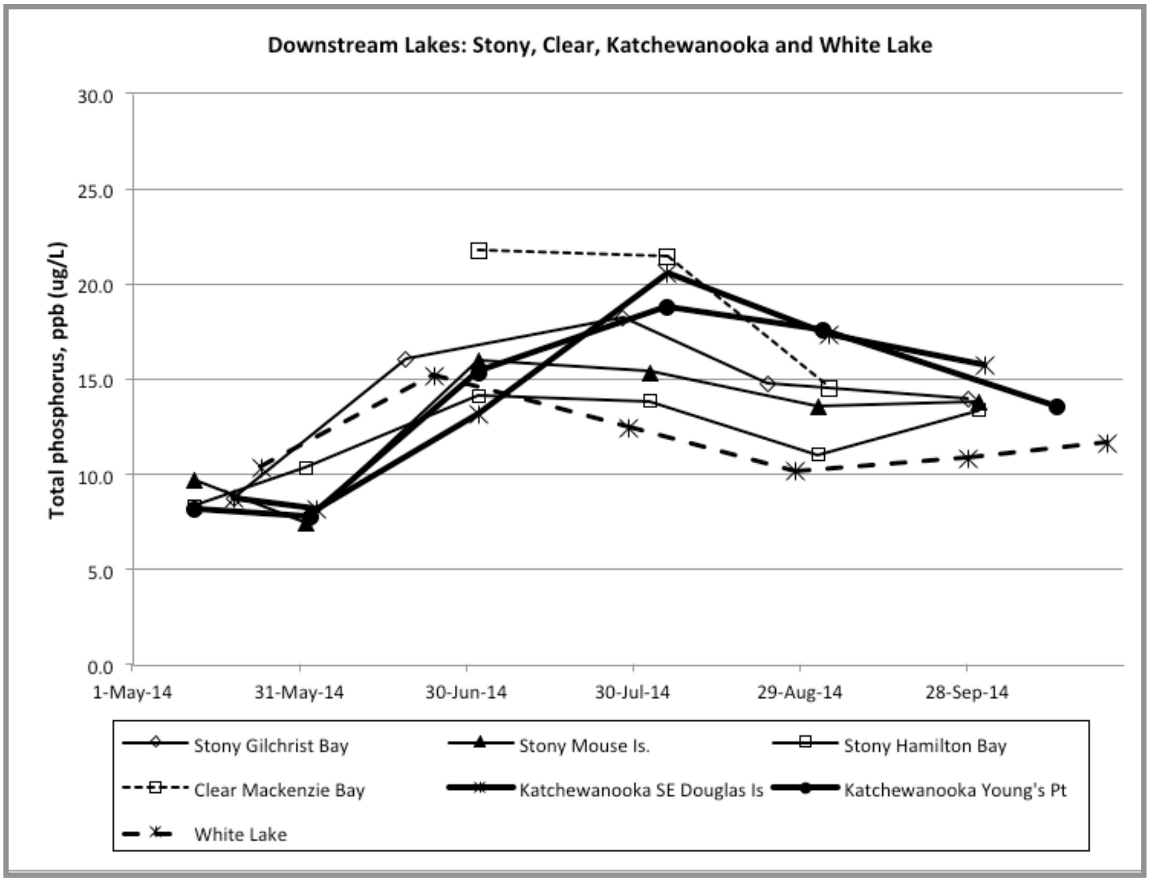
These lakes start the summer with low phosphorus levels similar to the low phosphorus lakes, but levels climb to 13 – 18 ppb in August. As in other years, the site at the 'top' of Sturgeon, Fenelon River, is lower than the two more downstream sites. This site receives low phosphorus water directly from Cameron Lake. As the water flows through Sturgeon Lake, phosphorus levels rise. This may be because there is phosphorus coming into the Trent-Severn Waterway from Lindsay. Or perhaps the character of the lake changes because it is now flowing through a more southern (more populated, more agricultural) watershed. Or perhaps the phosphorus levels are controlled by biological processes in the lakes.

Midstream Lakes: Maximum phosphorus level 17 – 22 ppb



As in many other years, these lakes are about 3 ppb higher in phosphorus than the upstream lakes. It seems that, as the water flows down the system, it gains phosphorus somehow.

Downstream Lakes: Maximum phosphorus level 13 – 18 ppb



As in other years, Stony Lake is lower in phosphorus due to dilution by an inflow from low-phosphorus Upper Stoney Lake. Then phosphorus levels rise again in Katchewanooka Lake.

White Lake is fed directly from Gilchrist Bay. White Lake has historically been slightly lower in phosphorus than Gilchrist Bay, possibly because of low-phosphorus springs.

Conclusion

Phosphorus levels in 2014 showed similar patterns to other years:

- Phosphorus levels in May are low in all the Kawartha Lakes, about 10 ppb, probably due to a flushing of the Trent-Severn Waterway by low-phosphorus water from the north.
- Some lakes stay low in phosphorus all summer, either because they are fed directly from the north, or because phosphorus is removed as marl precipitate.
- In most Kawartha Lakes, phosphorus rises throughout June and July, then decreases somewhat through August.
- Phosphorus levels in midsummer rise as water flows downstream. The only exception is that Stony Lake shows a dip in phosphorus due to dilution from Upper Stoney Lake.
- Several of the Kawartha Lakes are near or over 20 ppb in late July and early August. We are at the border of having phosphorus levels that could cause nuisance algal 'blooms' in midsummer. It is important to monitor and control phosphorus inputs into our lakes.

Lake Name	Site Description	Date	TP1	TP2	Average TP
BALSAM LAKE	N Bay Rocky Pt.	07-Jun-14	7.80	7.80	7.8
BALSAM LAKE	N Bay Rocky Pt.	22-Jul-14	10.40	11.60	11
BALSAM LAKE	N Bay Rocky Pt.	30-Jul-14	13.00	12.60	12.8
BALSAM LAKE	N Bay Rocky Pt.	19-Aug-14	11.00	10.60	10.8
BALSAM LAKE	N Bay Rocky Pt.	07-Sep-14	11.00	11.20	11.1
BALSAM LAKE	NE end-Lightning Pt	26-May-14	7.40	6.80	7.1
BALSAM LAKE	NE end-Lightning Pt	30-Jun-14	14.60	14.00	14.3
BALSAM LAKE	NE end-Lightning Pt	28-Jul-14	13.60	10.40	12
BALSAM LAKE	NE end-Lightning Pt	01-Sep-14	9.60	9.00	9.3
BALSAM LAKE	NE end-Lightning Pt	28-Sep-14	8.00	8.80	8.4
BALSAM LAKE	South B-Killarney B	07-Jun-14	9.80	9.80	9.8
BALSAM LAKE	South B-Killarney B	03-Jul-14	12.60	14.60	13.6
BALSAM LAKE	South B-Killarney B	05-Aug-14	12.00	12.60	12.3
BALSAM LAKE	South B-Killarney B	01-Sep-14	10.20	9.60	9.9
BALSAM LAKE	South B-Killarney B	29-Sep-14	8.80	10.80	9.8
BALSAM LAKE	W Bay2, deep spot	08-Jun-14	8.40	8.60	8.5
BALSAM LAKE	W Bay2, deep spot	02-Jul-14	11.20	11.00	11.1
BALSAM LAKE	W Bay2, deep spot	07-Aug-14	16.40	12.40	14.4
BALSAM LAKE	W Bay2, deep spot	02-Sep-14	10.00	10.20	10.1
BALSAM LAKE	W Bay2, deep spot	04-Oct-14	11.00	10.40	10.7
BALSAM LAKE	E of Grand Is	11-Aug-14	11.20	11.80	11.5
BALSAM LAKE	E of Grand Is	29-Sep-14	9.60	9.60	9.6
BIG BALD LAKE	Mid Lake, deep spot	11-May-14	16.40	16.00	16.2
BIG BALD LAKE	Mid Lake, deep spot	21-Jun-14	12.00	12.00	12
BIG BALD LAKE	Mid Lake, deep spot	02-Aug-14	10.80	10.80	10.8
BIG BALD LAKE	Mid Lake, deep spot	04-Sep-14	8.40	8.60	8.5
BIG CEDAR LAKE	Mid Lake, deep spot	24-May-14	10.00	6.60	8.3
BUCKHORN LAKE (U)	Narrows-redbuoy C310	24-May-14	13.60	13.60	13.6
BUCKHORN LAKE (U)	Narrows-redbuoy C310	19-Jun-14	17.40	19.20	18.3
BUCKHORN LAKE (U)	Narrows-redbuoy C310	03-Jul-14	17.00	16.40	16.7
BUCKHORN LAKE (U)	Narrows-redbuoy C310	06-Aug-14	18.40	17.40	17.9
BUCKHORN LAKE (U)	Narrows-redbuoy C310	03-Sep-14	15.20	15.80	15.5
BUCKHORN LAKE (U)	Narrows-redbuoy C310	11-Oct-14	11.20	13.00	12.1

Appendix F:
2014 Phosphorus and Secchi Data

Lake Name	Site Description	Date	TP1	TP2	Average TP
CAMERON LAKE	S end, deep spot	08-Jun-14	12.80	13.00	12.9
CHEMONG LAKE	S. of Causeway	23-Jun-14	14.80	14.80	14.8
CHEMONG LAKE	S. of Causeway	30-Jul-14	22.80	23.80	23.3
CHEMONG LAKE	S. of Causeway	25-Aug-14	15.20	14.00	14.6
CHEMONG LAKE	S. of Causeway	19-Sep-14	16.00	16.40	16.2
CLEAR LAKE	MacKenzie Bay	02-Jul-14	23.00	20.60	21.8
CLEAR LAKE	MacKenzie Bay	05-Aug-14	21.80	21.20	21.5
CLEAR LAKE	MacKenzie Bay	03-Sep-14	14.40	14.80	14.6
CLEAR LAKE	Main Basin-deep spot	10-Jul-14	16.00	17.00	16.5
CLEAR LAKE	Main Basin-deep spot	20-Aug-14	16.00	16.40	16.2
CLEAR LAKE	Main Basin-deep spot	16-Oct-14	12.00	13.20	12.6
CLEAR LAKE	Fiddlers Bay	10-Jul-14	14.20	13.60	13.9
CLEAR LAKE	Fiddlers Bay	20-Aug-14	17.20	16.80	17
CLEAR LAKE	Fiddlers Bay	16-Oct-14	14.80	14.80	14.8
CLEAR LAKE	Brysons Bay	06-Jun-14	12.80	12.40	12.6
CLEAR LAKE	Brysons Bay	16-Jul-14	16.80	16.80	16.8
CLEAR LAKE	Brysons Bay	06-Sep-14	16.40	16.00	16.2
KATCHEWANOOKA LAKE	S/E Douglas Island	19-May-14	11.20	8.80	10
KATCHEWANOOKA LAKE	S/E Douglas Island	03-Jun-14	8.40	8.20	8.3
KATCHEWANOOKA LAKE	S/E Douglas Island	02-Jul-14	13.20	13.20	13.2
KATCHEWANOOKA LAKE	S/E Douglas Island	05-Aug-14	21.00	20.60	20.8
KATCHEWANOOKA LAKE	S/E Douglas Island	03-Sep-14	16.60	17.40	17
KATCHEWANOOKA LAKE	S/E Douglas Island	01-Oct-14	15.40	15.80	15.6
KATCHEWANOOKA LAKE	Young Pt near locks	12-May-14	8.40	8.20	8.3
KATCHEWANOOKA LAKE	Young Pt near locks	02-Jun-14	7.20	7.80	7.5
KATCHEWANOOKA LAKE	Young Pt near locks	02-Jul-14	15.00	15.40	15.2
KATCHEWANOOKA LAKE	Young Pt near locks	05-Aug-14	18.60	18.80	18.7
KATCHEWANOOKA LAKE	Young Pt near locks	02-Sep-14	18.40	17.60	18
KATCHEWANOOKA LAKE	Young Pt near locks	14-Oct-14	14.00	13.60	13.8
LOVESICK LAKE	80' hole at N. end	19-May-14	10.40	10.80	10.6
LOVESICK LAKE	80' hole at N. end	08-Jun-14	14.00	16.00	15
LOVESICK LAKE	80' hole at N. end	03-Jul-14	19.20	17.60	18.4
LOVESICK LAKE	80' hole at N. end	05-Aug-14	20.20	21.20	20.7
LOVESICK LAKE	80' hole at N. end	02-Sep-14	19.60	20.80	20.2

Lake Name	Site Description	Date	TP1	TP2	Average TP
LOVESICK LAKE	80' hole at N. end	05-Oct-14	16.00	16.60	16.3
LOVESICK LAKE	McCallum Island	19-May-14	8.80	9.80	9.3
LOVESICK LAKE	McCallum Island	08-Jun-14	16.60	17.00	16.8
LOVESICK LAKE	McCallum Island	03-Jul-14	24.80	23.40	24.1
LOVESICK LAKE	McCallum Island	05-Aug-14	21.60	20.60	21.1
LOVESICK LAKE	McCallum Island	02-Sep-14	20.60	19.80	20.2
LOVESICK LAKE	McCallum Island	05-Oct-14	14.80	14.20	14.5
LOWER BUCKHORN LAKE	Heron Island	01-May-14	11.00	11.00	11
LOWER BUCKHORN LAKE	Heron Island	05-Jul-14	19.80	19.40	19.6
LOWER BUCKHORN LAKE	Heron Island	10-Aug-14	20.20	19.80	20
LOWER BUCKHORN LAKE	Heron Island	02-Sep-14	15.80	16.60	16.2
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	29-May-14	12.20	11.80	12
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	19-Jun-14	19.00	20.20	19.6
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	12-Jul-14	17.40	17.40	17.4
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	14-Aug-14	21.00	21.20	21.1
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	03-Sep-14	14.80	15.20	15
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	22-Oct-14	12.60	12.00	12.3
LOWER BUCKHORN LAKE	Deer Bay-centre	07-May-14	11.20	11.20	11.2
LOWER BUCKHORN LAKE	Deer Bay-centre	05-Jul-14	19.60	16.80	18.2
LOWER BUCKHORN LAKE	Deer Bay-centre	10-Aug-14	18.60	18.20	18.4
LOWER BUCKHORN LAKE	Deer Bay-centre	22-Aug-14	20.80	21.00	20.9
LOWER BUCKHORN LAKE	Deer Bay-centre	02-Sep-14	19.00	21.00	20
LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	02-Jul-14	24.20	28.80	26.5
LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	01-Aug-14	18.80	22.60	20.7
LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	26-Aug-14	17.60	17.60	17.6
LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	22-Sep-14	13.60	15.20	14.4
LOWER BUCKHORN LAKE	Main basin, deep- spot	02-Jul-14	25.60	24.40	25
LOWER BUCKHORN LAKE	Main basin, deep- spot	01-Aug-14	38.60	77.60	58.1
LOWER BUCKHORN LAKE	Main basin, deep- spot	26-Aug-14	21.60	18.40	20
LOWER BUCKHORN LAKE	Main basin, deep- spot	22-Sep-14	14.40	15.20	14.8
PIGEON LAKE	Middle-SandyPtBoyd I	19-May-14	9.00	8.40	8.7
PIGEON LAKE	Middle-SandyPtBoyd I	14-Jun-14	13.20	13.20	13.2
PIGEON LAKE	Middle-SandyPtBoyd I	06-Jul-14	16.60	15.60	16.1
PIGEON LAKE	Middle-SandyPtBoyd I	04-Aug-14	14.40	14.40	14.4

Lake Name	Site Description	Date	TP1	TP2	Average TP
PIGEON LAKE	Middle-SandyPtBoyd I	01-Sep-14	14.60	15.00	14.8
PIGEON LAKE	Middle-SandyPtBoyd I	12-Oct-14	15.00	15.40	15.2
PIGEON LAKE	N-400m N of Boyd Is.	07-Jul-14	15.00	16.00	15.5
PIGEON LAKE	N-400m N of Boyd Is.	05-Aug-14	16.40	17.60	17
PIGEON LAKE	N-400m N of Boyd Is.	04-Sep-14	18.80	18.20	18.5
PIGEON LAKE	N end-Adjacent Con17	19-May-14	8.80	8.60	8.7
PIGEON LAKE	N end-Adjacent Con17	14-Jun-14	14.20	14.00	14.1
PIGEON LAKE	N end-Adjacent Con17	06-Jul-14	15.80	16.20	16
PIGEON LAKE	N end-Adjacent Con17	04-Aug-14	13.80	13.80	13.8
PIGEON LAKE	N end-Adjacent Con17	01-Sep-14	15.00	14.60	14.8
PIGEON LAKE	N end-Adjacent Con17	12-Oct-14	16.00	15.00	15.5
PIGEON LAKE	C340-DeadHorseShoal	17-Jun-14	14.80	13.20	14
PIGEON LAKE	C340-DeadHorseShoal	02-Jul-14	12.20	12.40	12.3
PIGEON LAKE	C340-DeadHorseShoal	05-Aug-14	15.80	15.20	15.5
PIGEON LAKE	C340-DeadHorseShoal	03-Sep-14	17.40	16.00	16.7
PIGEON LAKE	N300yds off Bottom I	31-May-14	9.80	9.40	9.6
PIGEON LAKE	N300yds off Bottom I	07-Jul-14	16.40	17.40	16.9
PIGEON LAKE	N300yds off Bottom I	05-Aug-14	16.00	15.20	15.6
PIGEON LAKE	N300yds off Bottom I	04-Sep-14	16.60	16.20	16.4
SANDY LAKE	Mid Lake, deep spot	13-Jun-14	6.00	5.80	5.9
SANDY LAKE	Mid Lake, deep spot	22-Jun-14	6.00	6.00	6
SANDY LAKE	Mid Lake, deep spot	26-Jul-14	11.40	11.80	11.6
SANDY LAKE	Mid Lake, deep spot	31-Aug-14	8.20	6.80	7.5
SANDY LAKE	Mid Lake, deep spot	27-Sep-14	5.80	7.80	6.8
STONY LAKE	Burleigh locks chan.	06-Jun-14	13.00	14.00	13.5
STONY LAKE	Burleigh locks chan.	16-Jul-14	18.20	18.60	18.4
STONY LAKE	Burleigh locks chan.	10-Sep-14	30.20	20.20	25.2
STONY LAKE	Gilchrist Bay	19-May-14	8.80	8.80	8.8
STONY LAKE	Gilchrist Bay	19-Jun-14	15.20	17.00	16.1
STONY LAKE	Gilchrist Bay	28-Jul-14	17.20	19.40	18.3
STONY LAKE	Gilchrist Bay	23-Aug-14	14.60	15.00	14.8
STONY LAKE	Gilchrist Bay	28-Sep-14	16.40	11.60	14
STONY LAKE	Mouse Is.	12-May-14	9.20	10.20	9.7
STONY LAKE	Mouse Is.	01-Jun-14	7.40	7.60	7.5

Lake Name	Site Description	Date	TP1	TP2	Average TP
STONY LAKE	Mouse Is.	02-Jul-14	16.00	16.00	16
STONY LAKE	Mouse Is.	02-Aug-14	15.80	15.00	15.4
STONY LAKE	Mouse Is.	01-Sep-14	13.80	13.40	13.6
STONY LAKE	Mouse Is.	30-Sep-14	14.80	12.80	13.8
STONY LAKE	Hamilton Bay	12-May-14	8.20	8.60	8.4
STONY LAKE	Hamilton Bay	01-Jun-14	9.60	11.20	10.4
STONY LAKE	Hamilton Bay	02-Jul-14	14.00	14.40	14.2
STONY LAKE	Hamilton Bay	02-Aug-14	14.00	13.80	13.9
STONY LAKE	Hamilton Bay	01-Sep-14	11.00	11.20	11.1
STONY LAKE	Hamilton Bay	30-Sep-14	12.20	14.60	13.4
STURGEON LAKE	Muskrat I-Buoy C388	20-Jul-14	16.20	15.20	15.7
STURGEON LAKE	Muskrat I-Buoy C388	08-Aug-14	18.20	19.80	19
STURGEON LAKE	Muskrat I-Buoy C388	04-Sep-14	18.00	18.00	18
STURGEON LAKE	Muskrat I-Buoy C388	29-Sep-14	12.80	14.20	13.5
STURGEON LAKE	Sturgeon Point Buoy	20-Jul-14	14.40	14.00	14.2
STURGEON LAKE	Sturgeon Point Buoy	08-Aug-14	14.00	15.20	14.6
STURGEON LAKE	Sturgeon Point Buoy	04-Sep-14	16.20	16.00	16.1
STURGEON LAKE	Sturgeon Point Buoy	29-Sep-14	11.20	11.60	11.4
STURGEON LAKE	Fenelon R. mouth	12-Jul-14	13.20	13.00	13.1
STURGEON LAKE	Fenelon R. mouth	08-Aug-14	13.00	12.60	12.8
STURGEON LAKE	Fenelon R. mouth	04-Sep-14	12.80	14.40	13.6
STURGEON LAKE	Fenelon R. mouth	29-Sep-14	13.60	12.20	12.9
UPPER STONEY LAKE	Quarry Bay	18-May-14	5.00	4.80	4.9
UPPER STONEY LAKE	Quarry Bay	19-Jun-14	6.20	6.40	6.3
UPPER STONEY LAKE	Quarry Bay	12-Jul-14	8.20	8.60	8.4
UPPER STONEY LAKE	Quarry Bay	10-Aug-14	9.00	8.20	8.6
UPPER STONEY LAKE	Quarry Bay	13-Sep-14	6.60	6.80	6.7
UPPER STONEY LAKE	Quarry Bay	07-Oct-14	8.00	8.20	8.1
UPPER STONEY LAKE	Young Bay	18-May-14	6.00	5.80	5.9
UPPER STONEY LAKE	Young Bay	19-Jun-14	6.60	6.40	6.5
UPPER STONEY LAKE	Young Bay	12-Jul-14	7.80	7.20	7.5
UPPER STONEY LAKE	Young Bay	10-Aug-14	7.20	7.60	7.4
UPPER STONEY LAKE	Young Bay	13-Sep-14	7.20	7.20	7.2

Appendix F:
2014 Phosphorus and Secchi Data

Lake Name	Site Description	Date	TP1	TP2	Average TP
UPPER STONEY LAKE	Young Bay	07-Oct-14	6.80	6.60	6.7
UPPER STONEY LAKE	S Bay, deep spot	18-May-14	8.40	8.40	8.4
UPPER STONEY LAKE	S Bay, deep spot	19-Jun-14	11.20	9.80	10.5
UPPER STONEY LAKE	S Bay, deep spot	12-Jul-14	9.40	9.00	9.2
UPPER STONEY LAKE	S Bay, deep spot	10-Aug-14	10.40	9.00	9.7
UPPER STONEY LAKE	S Bay, deep spot	13-Sep-14	8.40	11.80	10.1
UPPER STONEY LAKE	S Bay, deep spot	07-Oct-14	8.20	8.80	8.5
UPPER STONEY LAKE	Crowes Landing	18-May-14	5.80	5.80	5.8
UPPER STONEY LAKE	Crowes Landing	19-Jun-14	7.00	8.40	7.7
UPPER STONEY LAKE	Crowes Landing	12-Jul-14	8.40	8.40	8.4
UPPER STONEY LAKE	Crowes Landing	10-Aug-14	7.20	7.00	7.1
UPPER STONEY LAKE	Crowes Landing	13-Sep-14	7.60	7.40	7.5
UPPER STONEY LAKE	Crowes Landing	07-Oct-14	11.00	13.60	12.3
UPPER STONEY LAKE	Mid Lake, deep spot	18-May-14	6.60	7.80	7.2
UPPER STONEY LAKE	Mid Lake, deep spot	19-Jun-14	6.60	6.80	6.7
UPPER STONEY LAKE	Mid Lake, deep spot	12-Jul-14	8.20	8.60	8.4
UPPER STONEY LAKE	Mid Lake, deep spot	10-Aug-14	7.00	7.20	7.1
UPPER STONEY LAKE	Mid Lake, deep spot	13-Sep-14	7.80	7.40	7.6
UPPER STONEY LAKE	Mid Lake, deep spot	07-Oct-14	8.60	8.60	8.6
WHITE LAKE (DUMMER)	S end, deep spot	24-May-14	10.60	10.20	10.4
WHITE LAKE (DUMMER)	S end, deep spot	24-Jun-14	15.80	14.60	15.2
WHITE LAKE (DUMMER)	S end, deep spot	29-Jul-14	12.60	12.40	12.5
WHITE LAKE (DUMMER)	S end, deep spot	28-Aug-14	10.00	10.40	10.2
WHITE LAKE (DUMMER)	S end, deep spot	28-Sep-14	12.00	9.80	10.9
WHITE LAKE (DUMMER)	S end, deep spot	23-Oct-14	12.40	11.00	11.7

2014 Secchi Depth Measurements

Secchi depth indicates the clarity of a lake: the greater the Secchi depth, the clearer the lake. Factors affecting clarity include:

- Phosphorus levels: Usually lakes with higher phosphorus have more algal growth, making them less clear. For example, the average Secchi reading in early August of three sites on low-phosphorus Upper Stoney Lake was 6.2 while the average August reading for three sites on higher-phosphorus Pigeon Lake was 2.7.
- Tea-coloured runoff from wetlands: This is most noticeable in the spring, but this colour can be seen in Cameron and Little Bald Lakes year-round due to many wetlands in their watersheds.
- Marl precipitation: In hard-water lakes such as Chemong, Sandy, and Big Bald, a milky-looking precipitate forms in the water column in warm weather. In cooler weather, this sinks to the bottom as powdery marl.
- Zebra mussels: These filter out large quantities of algae, clearing the water.

Lake Name	Site Description	Date	Secchi
BALSAM LAKE	N Bay Rocky Pt.	07-Jun-14	4.00
BALSAM LAKE	N Bay Rocky Pt.	22-Jun-14	4.00
BALSAM LAKE	N Bay Rocky Pt.	22-Jul-14	5.50
BALSAM LAKE	N Bay Rocky Pt.	31-Jul-14	4.50
BALSAM LAKE	N Bay Rocky Pt.	19-Aug-14	4.75
BALSAM LAKE	N Bay Rocky Pt.	07-Sep-14	5.25
BALSAM LAKE	N Bay Rocky Pt.	28-Sep-14	5.50
BALSAM LAKE	NE end-Lightning Pt	26-May-14	3.60
BALSAM LAKE	NE end-Lightning Pt	26-May-14	3.60
BALSAM LAKE	NE end-Lightning Pt	30-Jun-14	3.20
BALSAM LAKE	NE end-Lightning Pt	30-Jun-14	3.20
BALSAM LAKE	NE end-Lightning Pt	28-Jul-14	3.60
BALSAM LAKE	NE end-Lightning Pt	28-Jul-14	3.60
BALSAM LAKE	NE end-Lightning Pt	01-Sep-14	3.20
BALSAM LAKE	NE end-Lightning Pt	28-Sep-14	5.80
BALSAM LAKE	South B-Killarney B	07-Jun-14	3.86
BALSAM LAKE	South B-Killarney B	03-Jul-14	3.79
BALSAM LAKE	South B-Killarney B	05-Aug-14	3.74
BALSAM LAKE	South B-Killarney B	01-Sep-14	3.78
BALSAM LAKE	South B-Killarney B	29-Sep-14	3.81
BALSAM LAKE	W Bay2, deep spot	09-Jun-14	3.30
BALSAM LAKE	W Bay2, deep spot	02-Jul-14	3.50
BALSAM LAKE	W Bay2, deep spot	07-Aug-14	3.50
BALSAM LAKE	W Bay2, deep spot	02-Sep-14	3.90
BALSAM LAKE	W Bay2, deep spot	04-Oct-14	4.00
BALSAM LAKE	E of Grand Is	11-Aug-14	3.75
BALSAM LAKE	E of Grand Is	12-Aug-14	4.50
BALSAM LAKE	E of Grand Is	29-Sep-14	4.50

Appendix F:
2014 Phosphorus and Secchi Data

Lake Name	Site Description	Date	Secchi
BUCKHORN LAKE (U)	Narrows-redbuoy C310	17-May-14	3.10
BUCKHORN LAKE (U)	Narrows-redbuoy C310	19-Jun-14	3.30
BUCKHORN LAKE (U)	Narrows-redbuoy C310	03-Jul-14	2.90
BUCKHORN LAKE (U)	Narrows-redbuoy C310	06-Aug-14	3.20
BUCKHORN LAKE (U)	Narrows-redbuoy C310	03-Sep-14	3.40
BUCKHORN LAKE (U)	Narrows-redbuoy C310	11-Oct-14	5.70
CHEMONG LAKE	S. of Causeway	23-Jun-14	3.00
CHEMONG LAKE	S. of Causeway	30-Jul-14	2.00
CHEMONG LAKE	S. of Causeway	25-Aug-14	2.30
CHEMONG LAKE	S. of Causeway	19-Sep-14	2.00
CLEAR LAKE	MacKenzie Bay	02-Jul-14	3.36
CLEAR LAKE	MacKenzie Bay	14-Jul-14	3.54
CLEAR LAKE	MacKenzie Bay	05-Aug-14	3.22
CLEAR LAKE	MacKenzie Bay	03-Sep-14	5.20
CLEAR LAKE	Main Basin-deep spot	10-Jul-14	3.60
CLEAR LAKE	Main Basin-deep spot	20-Aug-14	3.60
CLEAR LAKE	Main Basin-deep spot	16-Oct-14	4.50
CLEAR LAKE	Fiddlers Bay	10-Jul-14	3.60
CLEAR LAKE	Fiddlers Bay	20-Aug-14	3.30
CLEAR LAKE	Brysons Bay	06-Jun-14	3.50
CLEAR LAKE	Brysons Bay	16-Jul-14	2.10
CLEAR LAKE	Brysons Bay	06-Sep-14	3.60
KATCHEWANOOKA LAKE	S/E Douglas Island	19-May-14	5.05
KATCHEWANOOKA LAKE	S/E Douglas Island	03-Jun-14	4.70
KATCHEWANOOKA LAKE	S/E Douglas Island	19-Jun-14	5.90
KATCHEWANOOKA LAKE	S/E Douglas Island	02-Jul-14	4.75
KATCHEWANOOKA LAKE	S/E Douglas Island	16-Jul-14	3.40
KATCHEWANOOKA LAKE	S/E Douglas Island	05-Aug-14	3.20
KATCHEWANOOKA LAKE	S/E Douglas Island	03-Sep-14	4.50
KATCHEWANOOKA LAKE	S/E Douglas Island	15-Sep-14	3.35
KATCHEWANOOKA LAKE	S/E Douglas Island	01-Oct-14	6.00
KATCHEWANOOKA LAKE	S/E Douglas Island	16-Oct-14	4.45
KATCHEWANOOKA LAKE	Young Pt near locks	21-May-14	5.10
KATCHEWANOOKA LAKE	Young Pt near locks	02-Jun-14	4.60
KATCHEWANOOKA LAKE	Young Pt near locks	19-Jun-14	6.80
KATCHEWANOOKA LAKE	Young Pt near locks	02-Jul-14	4.50
KATCHEWANOOKA LAKE	Young Pt near locks	14-Jul-14	3.90

Lake Name	Site Description	Date	Secchi
KATCHEWANOOKA LAKE	Young Pt near locks	05-Aug-14	4.30
KATCHEWANOOKA LAKE	Young Pt near locks	18-Aug-14	5.20
KATCHEWANOOKA LAKE	Young Pt near locks	02-Sep-14	4.70
KATCHEWANOOKA LAKE	Young Pt near locks	16-Sep-14	5.20
KATCHEWANOOKA LAKE	Young Pt near locks	14-Oct-14	5.00
KATCHEWANOOKA LAKE	Young Pt near locks	30-Oct-14	6.20
LOVESICK LAKE	80' hole at N. end	19-May-14	5.25
LOVESICK LAKE	80' hole at N. end	08-Jun-14	5.00
LOVESICK LAKE	80' hole at N. end	03-Jul-14	4.00
LOVESICK LAKE	80' hole at N. end	05-Aug-14	4.00
LOVESICK LAKE	80' hole at N. end	02-Sep-14	4.00
LOVESICK LAKE	80' hole at N. end	05-Oct-14	5.00
LOVESICK LAKE	McCallum Island	19-May-14	5.00
LOVESICK LAKE	McCallum Island	08-Jun-14	5.00
LOVESICK LAKE	McCallum Island	03-Jul-14	5.00
LOVESICK LAKE	McCallum Island	05-Aug-14	3.00
LOVESICK LAKE	McCallum Island	02-Sep-14	5.00
LOVESICK LAKE	McCallum Island	05-Oct-14	5.00
LOWER BUCKHORN LAKE	Heron Island	01-May-14	3.70
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	29-May-14	5.63
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	09-Jun-14	4.51
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	19-Jun-14	5.50
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	08-Jul-14	6.02
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	12-Jul-14	5.24
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	30-Jul-14	3.52
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	14-Aug-14	3.17
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	03-Sep-14	4.02
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	22-Oct-14	6.08
LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	02-Jul-14	1.90
LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	01-Aug-14	2.50
LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	26-Aug-14	1.50
LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	22-Sep-14	2.70
LOWER BUCKHORN LAKE	Main basin, deep- spot	02-Jul-14	2.40
LOWER BUCKHORN LAKE	Main basin, deep- spot	01-Aug-14	2.50
LOWER BUCKHORN LAKE	Main basin, deep- spot	26-Aug-14	3.10
LOWER BUCKHORN LAKE	Main basin, deep- spot	22-Sep-14	2.50
PIGEON LAKE	Middle-SandyPtBoyd I	19-May-14	3.60

Lake Name	Site Description	Date	Secchi
PIGEON LAKE	Middle-SandyPtBoyd I	14-Jun-14	2.90
PIGEON LAKE	Middle-SandyPtBoyd I	06-Jul-14	2.80
PIGEON LAKE	Middle-SandyPtBoyd I	04-Aug-14	2.60
PIGEON LAKE	Middle-SandyPtBoyd I	01-Sep-14	2.70
PIGEON LAKE	Middle-SandyPtBoyd I	12-Oct-14	2.80
PIGEON LAKE	N-400m N of Boyd Is.	07-Jul-14	2.80
PIGEON LAKE	N-400m N of Boyd Is.	04-Sep-14	3.20
PIGEON LAKE	N end-Adjacent Con17	19-May-14	3.20
PIGEON LAKE	N end-Adjacent Con17	14-Jun-14	2.80
PIGEON LAKE	N end-Adjacent Con17	06-Jul-14	2.70
PIGEON LAKE	N end-Adjacent Con17	04-Aug-14	2.70
PIGEON LAKE	N end-Adjacent Con17	01-Sep-14	2.70
PIGEON LAKE	N end-Adjacent Con17	12-Oct-14	3.40
PIGEON LAKE	C340-DeadHorseShoal	17-Jun-14	3.00
PIGEON LAKE	C340-DeadHorseShoal	02-Jul-14	3.20
PIGEON LAKE	C340-DeadHorseShoal	05-Aug-14	2.70
PIGEON LAKE	C340-DeadHorseShoal	03-Sep-14	3.00
PIGEON LAKE	N300yds off Bottom I	07-Jul-14	2.90
PIGEON LAKE	N300yds off Bottom I	04-Sep-14	3.20
STONY LAKE	Burleigh locks chan.	06-Jun-14	2.60
STONY LAKE	Burleigh locks chan.	16-Jul-14	1.60
STONY LAKE	Burleigh locks chan.	06-Sep-14	3.10
STONY LAKE	Gilchrist Bay	19-May-14	3.00
STONY LAKE	Gilchrist Bay	28-Jul-14	2.50
STONY LAKE	Gilchrist Bay	28-Aug-14	3.25
STONY LAKE	Gilchrist Bay	28-Sep-14	3.75
STONY LAKE	Mouse Is.	12-May-14	4.90
STONY LAKE	Mouse Is.	01-Jun-14	4.70
STONY LAKE	Mouse Is.	02-Jul-14	4.50
STONY LAKE	Mouse Is.	02-Aug-14	3.20
STONY LAKE	Mouse Is.	01-Sep-14	4.80
STONY LAKE	Mouse Is.	30-Sep-14	5.40
STONY LAKE	Hamilton Bay	02-Jul-14	3.90
STONY LAKE	Hamilton Bay	02-Aug-14	3.20
STURGEON LAKE	Muskrat I-Buoy C388	10-Jul-14	2.60
STURGEON LAKE	Muskrat I-Buoy C388	06-Aug-14	2.90
STURGEON LAKE	Muskrat I-Buoy C388	04-Sep-14	2.80
STURGEON LAKE	Muskrat I-Buoy C388	29-Sep-14	3.80

Lake Name	Site Description	Date	Secchi
STURGEON LAKE	Sturgeon Point Buoy	10-Jul-14	2.60
STURGEON LAKE	Sturgeon Point Buoy	06-Aug-14	3.00
STURGEON LAKE	Sturgeon Point Buoy	04-Sep-14	2.70
STURGEON LAKE	Sturgeon Point Buoy	29-Sep-14	3.60
STURGEON LAKE	Fenelon R. mouth	10-Jul-14	2.10
STURGEON LAKE	Fenelon R. mouth	06-Aug-14	2.80
STURGEON LAKE	Fenelon R. mouth	04-Sep-14	2.70
UPPER STONEY LAKE	Quarry Bay	20-May-14	4.10
UPPER STONEY LAKE	Quarry Bay	18-Jun-14	5.20
UPPER STONEY LAKE	Quarry Bay	21-Jul-14	6.00
UPPER STONEY LAKE	Quarry Bay	11-Aug-14	6.10
UPPER STONEY LAKE	Quarry Bay	14-Sep-14	7.20
UPPER STONEY LAKE	Quarry Bay	07-Oct-14	7.10
UPPER STONEY LAKE	Young Bay	20-May-14	4.50
UPPER STONEY LAKE	Young Bay	18-Jun-14	5.10
UPPER STONEY LAKE	Young Bay	21-Jul-14	5.30
UPPER STONEY LAKE	Young Bay	11-Aug-14	6.30
UPPER STONEY LAKE	Young Bay	14-Sep-14	6.90
UPPER STONEY LAKE	Young Bay	07-Oct-14	7.10
UPPER STONEY LAKE	Crowes Landing	20-May-14	4.10
UPPER STONEY LAKE	Crowes Landing	18-Jun-14	6.10
UPPER STONEY LAKE	Crowes Landing	21-Jul-14	5.20
UPPER STONEY LAKE	Crowes Landing	11-Aug-14	6.30
UPPER STONEY LAKE	Crowes Landing	14-Sep-14	6.70
UPPER STONEY LAKE	Crowes Landing	07-Oct-14	6.20
UPPER STONEY LAKE	Mid Lake, deep spot	20-May-14	4.50
UPPER STONEY LAKE	Mid Lake, deep spot	18-Jun-14	6.10
UPPER STONEY LAKE	Mid Lake, deep spot	21-Jul-14	5.10
UPPER STONEY LAKE	Mid Lake, deep spot	11-Aug-14	6.40
UPPER STONEY LAKE	Mid Lake, deep spot	14-Sep-14	6.70
UPPER STONEY LAKE	Mid Lake, deep spot	07-Oct-14	6.20
WHITE LAKE (DUMMER)	S end, deep spot	24-May-14	3.80
WHITE LAKE (DUMMER)	S end, deep spot	24-Jun-14	3.80
WHITE LAKE (DUMMER)	S end, deep spot	29-Jul-14	4.00
WHITE LAKE (DUMMER)	S end, deep spot	28-Aug-14	4.50
WHITE LAKE (DUMMER)	S end, deep spot	28-Sep-14	4.50
WHITE LAKE (DUMMER)	S end, deep spot	27-Oct-14	5.00

Join the Kawartha Lake Stewards Association

The KLSA is a non-profit, completely volunteer organization of cottagers and year-round residents formed to monitor the water quality of the Kawartha Lakes. The organization was formed in 2001 and over the years has conducted water testing and sponsored a number of scientific studies focused on improving and sustaining the health of the Kawartha Lakes. We work co-operatively with the Trent-Severn Waterway, area municipalities, Conservation Authorities, Trent University, Fleming College and other partners.

The work of the KLSA is documented in a series of Annual Lake Water Quality Reports as well as the 2009 Aquatic Plants Guide, the 2011 Guide to the Watermilfoil Weevil, and the 2012 The Algae of the Kawartha Lakes, all of which are specific to the Kawartha Lakes. The organization is well-recognized and was the winner of the Kawartha Conservation 2012 Community Conservationist Award, the Cottage Life 2008 Green Cottager Award and the Federation of Ontario Cottagers' Associations' 2002 Jerry Strickland Award.

Historically, KLSA has funded its work with donations from individuals, businesses and local groups, and with grants from local governments and organizations such as the Trent-Severn Waterway and The Ontario Trillium Foundation. In the current fiscal climate, there is a concern that some of these grants will be more difficult to secure.
In addition to funding concerns, forthcoming legislation regarding not-for-profit organizations requires that the KLSA develop a more structured membership policy. As a result, the KLSA Board of Directors decided in 2014 to transition to a paid membership. More than sixty individuals joined the KLSA in 2014 and we are looking forward to increasing our membership in 2015.

KLSA has two categories of membership – Individual and Student. The cost is $20 per year for the Individual category and $10 per year for full-time students. Members are entitled to vote at the KLSA Annual General Meeting and are eligible to have a printed copy of the Annual Lake Water Quality Report mailed to their home in the spring of the following year. For example, if you join the KLSA in 2015 and indicate that you would like a printed copy of the report, you will receive the Annual Report via mail when it is published in April 2016.

If you have benefited from the KLSA Annual Report and public education programs, and if you want to keep our future work in the public eye, please join the KLSA and consider making an additional donation. Run by volunteers, KLSA provides excellent value for every dollar it receives, and gratefully acknowledges every donor.

You can join the KLSA by visiting our website at : http://klsa.wordpress.com/ and completing the membership form. Payment can be made via PayPal or major credit card.

OR

You can complete the form on the next page and mail it with a cheque to:

Kawartha Lake Stewards Association
– Membership
c/o 142 West Bay Boulevard
Kirkfield, Ontario, K0M 2B0

KLSA

KLSA Membership

Individual Membership - $20. Student Membership - $10.
Complete one form below for each membership.
Please direct questions regarding KLSA Membership to joinklsa@gmail.com.

Name: ______________________________

Address: ______________________________

City: ______________________________

Postal Code: ______________________________

Email: ______________________________

My Lake: ______________________________

My Association: ______________________________

____

Individual $20 ________________

Student $10 ________________

Additional donation to support the work of KLSA: $____________

Total Enclosed $

I wish to receive the next KLSA Annual Water Quality Report mailed to the above address.

O Yes O No

Note: KLSA is not able to issue charitable tax receipts for personal donations.

Name: ______________________________

Address: ______________________________

City: ______________________________

Postal Code: ______________________________

Email: ______________________________

My Lake: ______________________________

My Association: ______________________________

____

Individual $20 ________________

Student $10 ________________

Additional donation to support the work of KLSA: $____________

Total Enclosed $

I wish to receive the next KLSA Annual Water Quality Report mailed to the above address.

O Yes O No

Note: KLSA is not able to issue charitable tax receipts for personal donations.

Donation from an Association or Business

Organization Name: ______________________________

____

Donation Amount: $

Contact Name and Address: ______________________________

____

____

Business receipt required? O Yes O No

Donation from an Association or Business

Organization Name: ______________________________

____

Donation Amount: $

Contact Name and Address: ______________________________

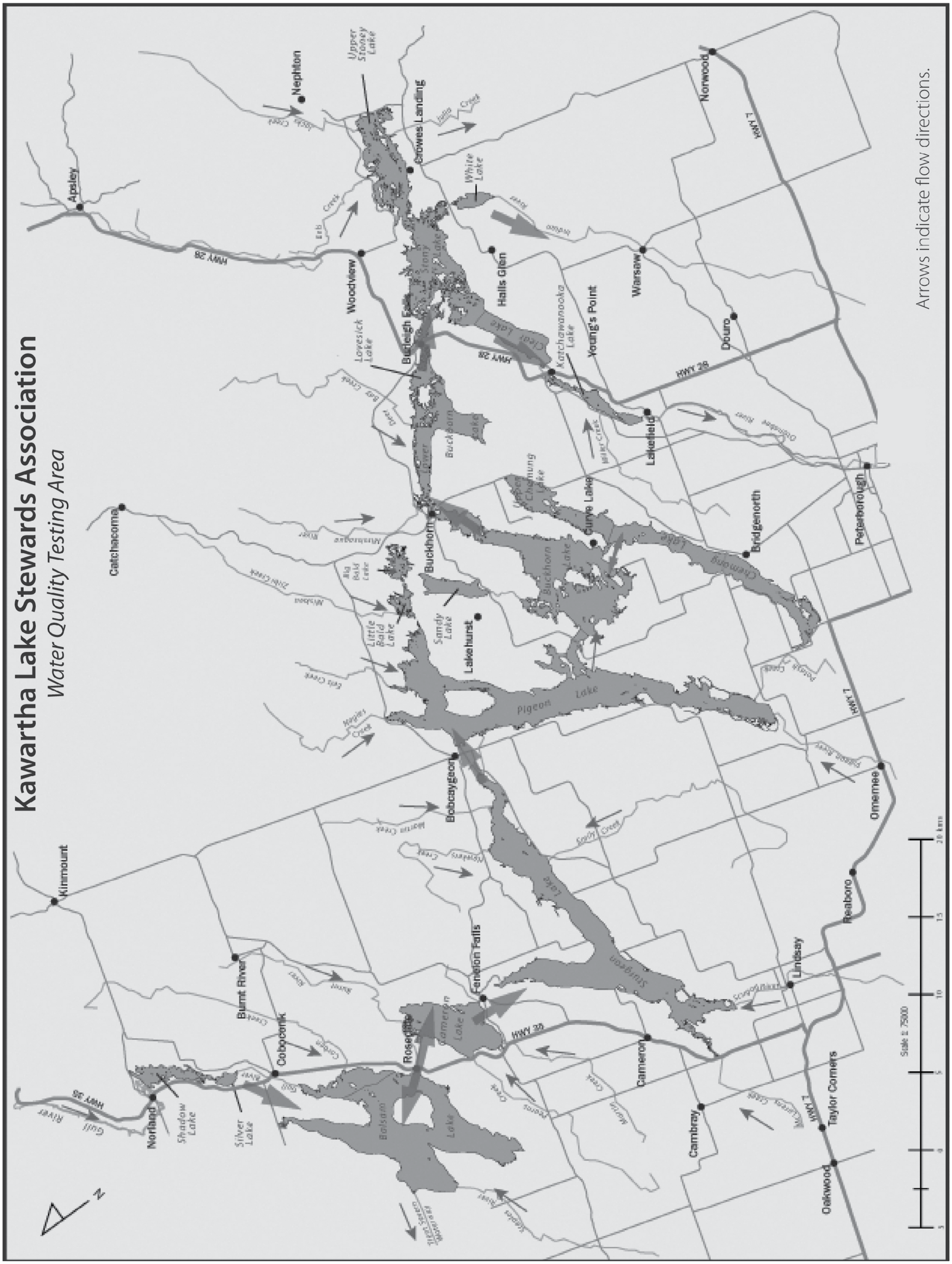
____

____

Business receipt required? O Yes O No

Please make your cheque payable to Kawartha Lake Stewards Association and mail it with the above form to:

Kawartha Lake Stewards Association – Membership
c/o 142 West Bay Boulevard
Kirkfield, Ontario, K0M 2B0


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