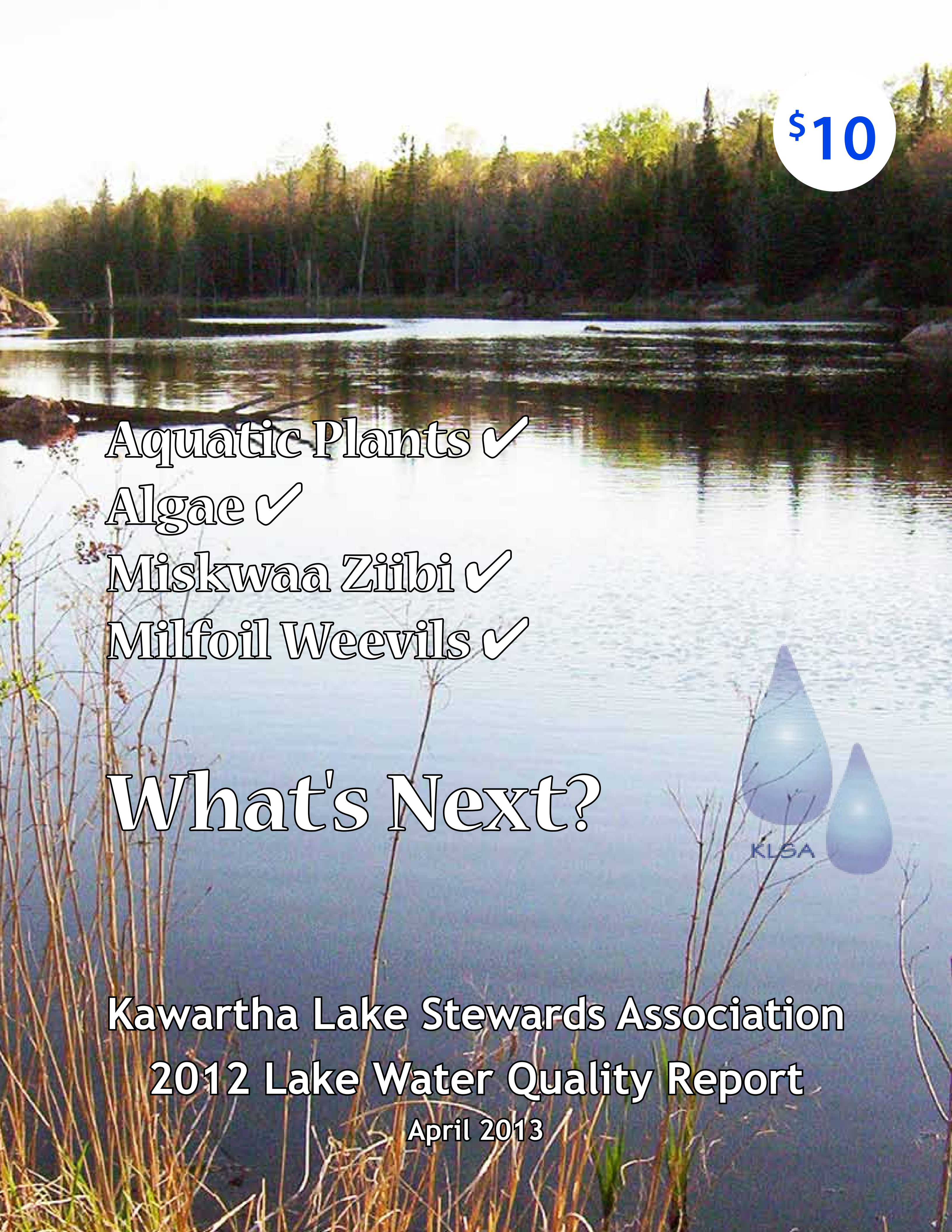

$10

Aquatic Plants ✓
Algae ✓
Miskwaa Ziibi ✓
Milfoil Weevils ✓

What's Next?

KLSA

Kawartha Lake Stewards Association
2012 Lake Water Quality Report

April 2013

KLSA

Kawartha Lake Stewards Association

Lake Water Quality Report - 2012

This report was prepared exclusively for the information of and for use by the members of the KLSA, its funders, interested academics and researchers, and other non-profit associations and individuals engaged in similar water quality testing in Ontario. The accuracy of the information and the conclusions in this report are subject to risks and uncertainties including but not limited to errors in sampling methodology, testing, reporting and statistics. KLSA does not guarantee the reliability or completeness of the data published in this report. Nothing in this report should be taken as an assurance that any part of any particular body of water has any particular water quality characteristics, or is (or is not) safe for swimming or drinking. There can be no assurance that conditions that prevailed at the time and place that any given testing result was obtained will continue into the future, or that trends suggested in this report will continue. The use of this report for commercial, promotional or transactional purposes of any kind whatsoever, including but not limited to the valuation, leasing or sale of real estate, is inappropriate and is expressly prohibited. This report may be reproduced in whole or in part by members of KLSA or KLSA's funders or research partners, for their own internal purposes. Others require the prior permission of KLSA.

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

klsa.wordpress.com

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Cover page
Over the past few years KLSA has sponsored important research into aquatic plants, algae, the effects of shoreline development on water quality, milfoil weevils and more. Among the ideas being considered for future action is the restoration of the Mississagua River to its original channel (see Vice-Chair Kevin Walters' article on page 36), restoring the flow of the Mississagua River to one of its original paths supplying lakes from Big Bald Lake to Buckhorn Lake with high-flow, low-nutrient water.

Photo by Kevin Walters

THE ONTARIO TRILLIUM FOUNDATION

LA FONDATION TRILLIUM DE L'ONTARIO

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Kawartha Lake Stewards Association Board and its scientific advisors: left to right, back row: Colleen Middleton and Dr. Paul Frost (both Scientific Advisors), Kevin Walters, Chris Appleton, Ann Ambler, Mike Dolbey, Jeff Chalmers, Doug Erlandson and Tom Cathcart. Front Row: Janet Duval, Mike Stedman and Sheila Gordon-Dillane. Absent: Kathleen Mackenzie.

Chair's Message

Mike Stedman, Chair, Kawartha Lake Stewards Association (KLSA)

Do you realize KLSA was started in 2000? You have to agree, "this organization has legs." Congratulations to the members and supporters who make this happen.

This KLSA 2012 Annual Water Quality Report stands on many shoulders, especially our volunteer stewards/testers, the contributing authors and our KLSA editorial committee. We hope you find it informative. One of our objectives with this publication is to give you speaking points for your local lake association meetings. It is through informed community opinion based on science that we can work to ensure the sustainability of our watershed. So don't just read it, use it as a platform at your next meeting.

A new opportunity?

Today's bad news is the negative environmental impact resulting from government austerity measures. But we can see this through a positive lens, as an opportunity for volunteers to promote the use of best management practices. Regulation and enforcement involve bureaucracy and money. Best management practices adopted by an informed community often offer a lower cost alternative - just right for the times.

How are we doing?

I offer the following quotes to help give you a picture of KLSA, both its successes and its challenges.

Referencing KLSA's water testing program

"We have been participating in the KLSA water testing program for the last few years. Thanks to the KLSA for organizing this initiative. It has been very well received and appreciated by our members."
Phil Taylor, President, Shadow Lake Association

*Referencing KLSA's **The Algae of the Kawartha Lakes** publication*

"The feedback has been all positive. People have found it to be a valuable resource tool. From our (KRCA) perspective the booklet puts another layer of educational knowledge in the hands of private landowners to actively participate in water quality protection and complements our Blue Canoe tool kit nicely."
Shalin Abbott, Stewardship Coordinator, Kawartha Region Conservation Authority

Referencing growing concern about the health of the Kawartha Lakes

"… A major reason for growing concerns is that today's expectations are greater. We are now less tolerant of what we see as environmental degradation; not that we see the lakes getting worse: the evidence suggests that they're the best they've been in decades. However, 'just OK' is not good enough anymore and we must not allow any slippage."
Kevin Walters, Vice-Chair, KLSA

Referencing a biological control method for invasive milfoil

"We are very appreciative of the KLSA involvement in studying invasive species, particularly the milfoil problem and all your other efforts in maintaining the environmental integrity of our region."
John Graham, Vice-Chair, Big Cedar Lake Stewardship Association

Referencing the importance of collective involvement

"No single entity, whether a municipal, provincial or federal government or a non-governmental organization, can accomplish what needs to be done on its own."
William Barlow, Chair, Lake Winnipeg Stewardship Board

Referencing cyanobacteria (blue-green algae)

"... Under some weather conditions, blue-green algae blooms can be triggered by phosphorus concentrations that are much lower than the Provincial Water Quality Objective for lakes (20 micrograms/L)."

2012 Monitoring Report, Kawartha Conservation

Plans for 2013

We will continue with **two public meetings per year,** a spring meeting in Bobcaygeon on Saturday, May 4th, and our fall annual general meeting in Lakehurst on Saturday, October 5th. Our objective is to facilitate and convene a community conversation concerning the health of our Kawartha Lakes.

This summer will see the **distribution of more than 4,000 copies of our booklet** *The Algae of the Kawartha Lakes* describing the place of algae in the ecosystem, when they become a hazard, and what controls their growth. Bulk copies can be obtained by contacting any board member or through our KLSA website. This publication is a companion piece to our 2009 *Aquatic Plants Guide,* both made possible by Ontario Trillium Foundation grants.

KLSA continues to support the Kawartha Conservation Authority's multi-year process of **lake management planning**. Our role includes water quality testing as well as participation in community and scientific advisory committees. A few years ago the emphasis was on starting the lake management program. Today, the emphasis is on finalizing the plan. The public has high expectations and deserves specific action plans and goals directed at improved water quality. This will call for constructive collaboration between the professionals authoring the plan and township authorities responsible for the resources required for implementation.

We congratulate the Townships of Selwyn and Trent Lakes on their name change and remind them that we see the need for more involvement with our lakes. With reduced federal statute protection, as evidenced by the recent Omnibus Bill redefining the Navigable Water Protection and Fisheries Acts, townships need to realize **a responsibility to protect the waters** surrounding our towns and hamlets. The opportunity remains to convince Selwyn and Trent Lakes Townships to see the value in lake management planning. A first step is to bring the Otonabee Conservation Authority into the conversation.

The KLSA summer **water quality research** initiative for 2012 saw the completion of field work by our Trent University team. We look forward to deliverables including a nutrient budget assessment of the **Miskwaa Ziibi**. This project was designed to help determine the extent that human shoreline development increases nutrient output into the river. Complementary studies included an evaluation of the use of stable nitrogen isotopes as an indicator of human nutrient inputs. All this leads to a better understanding of the sources and fate of human-derived nutrients in the Kawartha Lakes. The conversations this will affect include septic inspection and lake buffer strip legislation, both subjects of serious debate in our townships.

Our County and Township **Official Plans (OP)** include environmental policy direction that is reflected in local bylaws. Triggered by the province's five year updating cycle, we expect our Official Plan drafts to be circulated for discussion and input this coming summer. KLSA intends to use this opportunity to ensure that reasonable best management practices are promoted for inclusion. We expect Selwyn and other townships to be open to encouraging lake management planning much as is currently in place in the City of Kawartha Lakes. It was through this process over ten years ago that our planners recognized land use planning based on watershed boundaries, as opposed to our historical geographic property and township boundaries. More recently the 20 metre shoreline setback for maintenance of a vegetative buffer was prompted by OP policy. We as a group need to make our views available to this OP amendment process. KLSA will work in collaboration with the Stony Lake Environmental Council and the Peterborough County Planning Department.

Having completed our *Algae of the Kawartha Lakes* study, KLSA is busy defining a next project. To twig your imagination, think of Charlton Heston parting the waters of the Red Sea. KLSA has traditionally focussed on minimizing nutrient inputs from the land to the lakes. How about a plan to restore a formerly existing source of local, pristine waters to enhance the flushing rate of our central Kawartha Lakes? Look for KLSA Vice-Chair Kevin Walters' article *Restoring the Mississagua River's Domain* to learn how **restoring the flow of the Mississagua River** to one of its original paths would supply lakes from Big Bald Lake to Buckhorn Lake with high-flow, low-nutrient water. This Kawartha Lake enhancement could be done for the relatively low cost of some dam refurbishment, an under-highway culvert and land clearing. Approvals from governing bodies should be forthcoming given the benefit of improved water quality.

Less exciting but still important are the following ongoing KLSA activities:

- Water sampling on 16 lakes
- Monitoring of *E.coli,* phosphorus and water clarity
- Reporting on the performance of our local sewage treatment plants
- Community education through publications, public meetings, a KLSA website and Facebook
- Collaboration with the Trent-Severn Waterway, Ministry of the Environment's Lake Partner Program, Federation of Ontario Cottagers' Associations, Stony Lake Heritage Foundation, Lakeland Alliance, Kawarthas Naturally Connected (KNC) and the Environmental Council for Clear, Stony and White Lakes
- Annual publication of our nationally recognized KLSA Water Quality Report

A special thanks

On behalf of the KLSA Board and volunteers, I want to extend sincere thanks to our donors and supporters, workshop speakers, SGS Lakefield Research staff, the staff at MOE's Lake Partner Program, Trent University's Biology Department, the Centre for Alternative Wastewater Treatment, our scientific advisors and above all the fifty or more volunteer stewards commonly referred to as our testers. I especially want to acknowledge the following for generously offering their time, support and advice:

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

The Algae Project Team under Dr. Frost including Dr. Emily Porter-Goff, Andrew Scott and Colleen Middleton

Simon Conolly, the Lakefield Herald

George Gillespie, McColl Turner LLP

Rob Messervey, Chief Administrative Officer, Kawartha Conservation

Dr. Eric Sager, Coordinator, Ecological Restoration, Fleming College

Paul Reeds, Agriculture Development Advisory Board, City of Kawartha Lakes

John Graham and Brian Stock, Big Cedar Lake Milfoil Project

Our thanks for significant financial support goes to:

Ontario Trillium Foundation (algae project)

Stony Lake Heritage Foundation

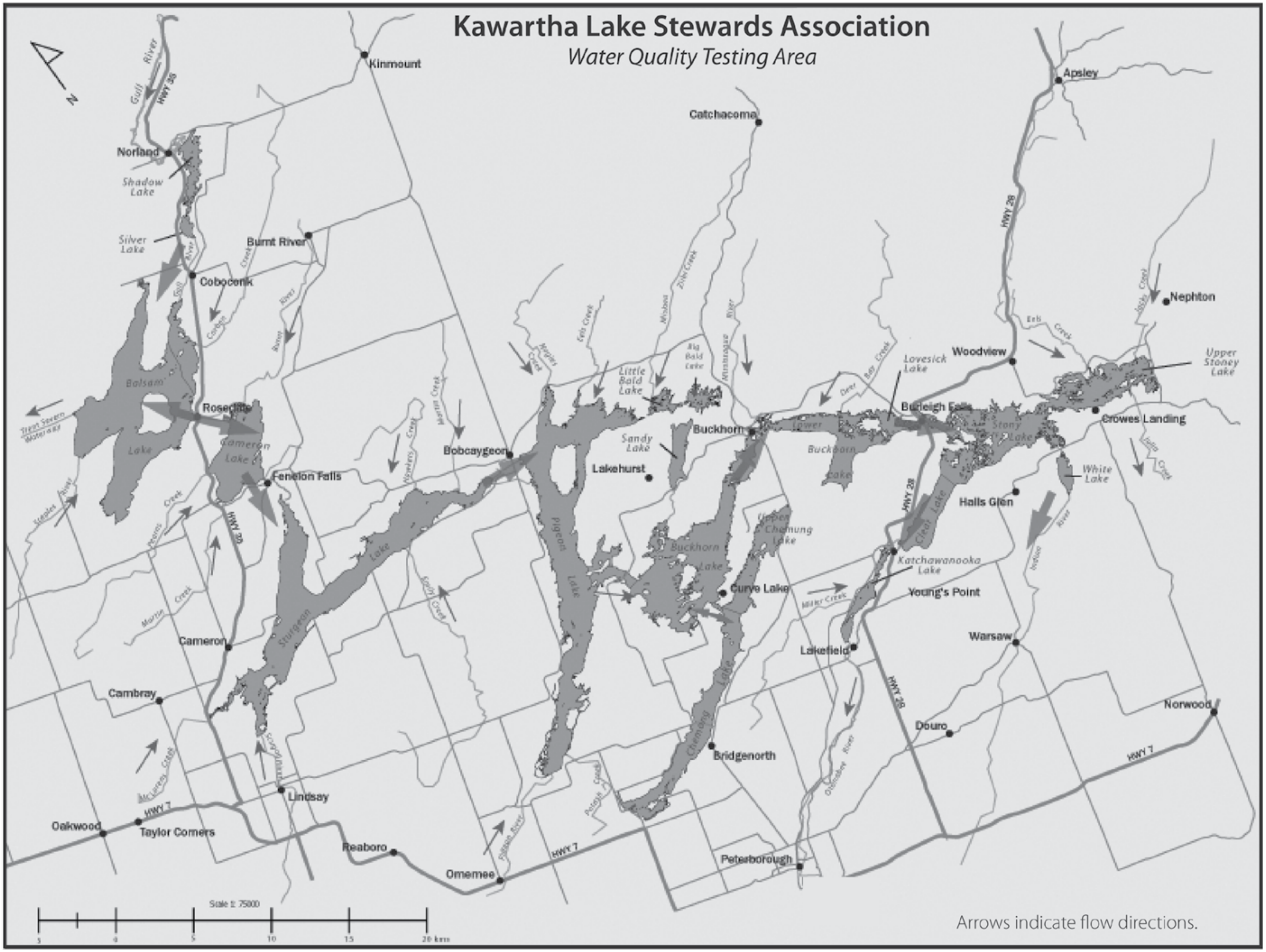
Mr. Ralph Ingleton, Lakefield

Trent-Severn Waterway (Parks Canada)

City of Kawartha Lakes and the Townships of Douro-Dummer, Trent Lakes and Selwyn

Our many supporting lake associations

KLSA is successful to the extent that we have your support


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

Executive Summary - 2012 Report

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. Established to provide a coordinated approach to lake water monitoring, the Association tests lake water for phosphorus, water clarity and *E.coli* bacteria during the spring, summer and early fall. In recent years, KLSA has expanded its activities significantly, primarily into the areas of research and public education. Over the past decade, KLSA has forged valuable partnerships with Trent University, Fleming College and Kawartha Conservation resulting in research studies of aquatic plants and algae, the impact of nutrients on water quality and bacteria in stormwater runoff into the lakes.

With the support of the Ontario Trillium Foundation, KLSA has published two booklets: *Aquatic Plants Guide* (2009) and *The Algae of the Kawartha Lakes* (2012) to inform the public about causes of aquatic plant and algae growth and environmentally responsible management practices. This year's report highlights further research on algae growth and the effect of shoreline development on nutrient levels in the Kawartha Lakes. KLSA also continues to support lake management planning processes. A summary of the articles contained in the 2012 KLSA Annual Water Quality Report follows.

The Toronto Lakes
Kevin Walters, KLSA Vice-Chair, provides historical evidence that prior to 1800, the Kawartha Lakes were known as the Toronto Lakes. The name "Toronto", an Iroquois name meaning "where trees stand in the water" described fish fences or weirs located between the lakes and applied to the entire chain of lakes from Georgian Bay, including what is now Lake Simcoe, to the Bay of Quinte on Lake Ontario.

Understanding Algae Growth – A Scientific Perspective
Master of Science candidate Colleen Middleton describes experiments conducted both in the laboratory and the field to determine whether the factors that resulted in blue-green algae blooms in 2011 could be causing an increase in other types of algae as well. Colleen's study focused on the effect of water chemistry on the growth of three forms of filamentous green algae: *Mougeotia, Spirogyra* and *Zygnema*. These algae are typically found as large free-floating blooms or attached clumps in shallow water bodies. Colleen tested the relative effect of various amounts of nitrogen and phosphorus on *Mougeotia* (also known as 'elephant snot'). In the laboratory, she found that rapid growth occurred when both phosphorus and nitrogen levels were high and the algae grew faster particularly when nitrogen levels were five times higher than the level of phosphorus. A further field study was conducted on algae and water samples from seven Kawartha Lakes. Colleen found that filamentous green algae were present in all seven lakes from early spring to late fall. Because these algae grow faster when nitrogen and phosphorus levels are high, actions that reduce the amounts of nitrogen and phosphorus in the lakes will be beneficial.

Shoreline Nutrient Contributions to the Kawartha Lakes
Dr. Paul Frost, David Schindler Professor of Aquatic Science at Trent University in Peterborough and Scientific Advisor to KLSA, studied nutrient contributions of shoreline residences to receiving waters. One part of the study was conducted on a river, Miskwaa Ziibi, that flows into the Bald Lakes. He compared the export of P from its undeveloped upstream to that from downstream of a developed area, where there are cottages on both sides of the river. Preliminary results indicated phosphorus was retained in the developed section of the river over the course of the summer. A second study examined nutrients in shoreline areas between residences and the open water of the lakes to determine whether the nutrients were derived from shoreline sources. The analysis of samples collected in this part of the study is still continuing.

How Much Natural Cover is Enough Around Our Lakes?
Dave Pridham and Brett Tregunno of Kawartha Conservation examine the premise that maintaining natural cover (wetlands, forests, thickets and meadows) is crucial to maintaining healthy natural systems. They state that research has shown that streams tend to be healthy when 75% of their length is naturally vegetated and that 30 metre-wide vegetated areas on both sides maintain ecological benefits. Their preliminary study on Sturgeon Lake using aerial photography to classify the shoreline as developed, natural or agricultural showed that the shoreline does not meet the recommended guidelines. A further "rapid shoreline classification

project" study was conducted by University of Toronto students examining the Sturgeon Lake shoreline by boat during the summer of 2012. Results will be provided in the spring of 2013. These studies will help to determine how to best manage lake shorelines.

Harvesting Lake Nutrients: Musings of a Lakeside Gardener

For many years, KLSA Board member Mike Dolbey has gathered the aquatic weeds that drifted to his cottage shoreline and mixed them with dry leaves to create fertilizer for his garden. In 2012, he decided to measure the amount of phosphorus he was removing from the lake. Aquatic plants were prolific last year and Mike collected about 225 cubic feet of weeds from the lake, about three times more than usual. In addition to phosphorus, the weeds are high in nitrogen and when they are layered with carbon-rich dry leaves, produce excellent and free garden fertilizer.

***E.coli* Bacteria Testing**

In 2012, KLSA volunteers tested 102 sites in 16 lakes for *E.coli* bacteria. Samples were analyzed by SGS Lakefield Research and 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, consistent with other years. Of the 90 sites tested either five or six times, 68 were "very clean" (no readings above 20 *E.coli* per 100mL), 21 were "clean" (one or two readings above 20), and only one was "somewhat elevated" (three readings over 20). High results are generally located in areas of low water circulation, near wetlands or are due to pollution from waterfowl. Generally, counts were lower than usual, probably because it was such a dry year. Detailed lake and site results can be found in Appendix E. Thank you to all our volunteer water samplers for their efforts to collect the samples and deliver them to the laboratories.

Phosphorus Testing

In 2012, as part of the Ministry of the Environment's Lake Partner Program, volunteers collected water samples four to six times (monthly from May to October) at 37 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 2012, average phosphorus levels were similar to those of previous years, although they were lower than usual at the end of August. The usual patterns of rising and falling phosphorus levels occurred from month to month in the higher phosphorus lakes (south and east end of Sturgeon, Pigeon, Chemong, Buckhorn, Lower Buckhorn, Lovesick, Stony, White, Clear and Katchewanooka). Levels tend to be low in May, rise from June to August and decline in September. Detailed results of the 2012 Lake Partner Program are provided in Appendix F. The KLSA is grateful to the many volunteers who participate in this program.

2011 Kawartha Lakes Sewage Treatment Plants Report

Each year, KLSA Vice-Chair Kevin Walters monitors and reports on output from local sewage treatment plants. Phosphorus output is a key indicator, and a primary cause of increased plant and algae growth in our lakes. In 2011, the two sewage treatment plants (STPs) at Bobcaygeon improved their performance significantly over previous years with a phosphorus removal rate of 97.6%. The plants at Fenelon Falls and Coboconk had good performance with phosphorus removal of 98.8% and 98.5% respectively. However there were odour problems at Coboconk. The performance of the Lindsay STP was good with an average removal rate of 97.2%. However, two spills or bypasses occurred resulting in raw or partially treated sewage being discharged. The plants at Kings Bay and Omemee operated well. The Kings Bay plant discharges effluent into the ground and the Omemee system sprays the effluent onto nearby fields. Therefore the effect on the waterways is minimal. The total amount of phosphorus discharged to the lakes in 2011 was 392 kg, down 6% from the 416 kg in 2010. Almost 75% was from Lindsay. Continued monitoring of all STPs is vital.

Showcasing Water Innovation – Floating Wetlands to Improve Stormwater and Sewage Treatment Effluent

Rob Gamache, Supervisor, Regulatory Compliance, City of Kawartha Lakes, describes a project funded by the Ministry of the Environment and conducted in partnership with Fleming College's Centre for Alternative Wastewater Treatment, C&M Aquatics and Queen's University, to use floating wetlands to improve water quality where stormwater and sewage treatment effluent enter surface watercourses. The floating wetlands (a system called PhytoLinks) collect nutrients and pollutants in the plant biomass through contact with the plants' roots. Systems have been installed in Lindsay, Coboconk and Omemee. A public education program to demonstrate the technology has been developed and the project will be expanded to other locations in 2013. The results of the study will be compiled in a report to be shared with governments, stakeholders and conservation authorities.

Lake Demise – Sedimentation and Erosion Processes
KLSA Vice-Chair Kevin Walters discusses the process of sedimentation and its causes – including eutrophication and outlet erosion filling in or draining the lakes over a long period of time. There are a number of sources of sediment including organic material from wetlands or aquatic plants, inorganic materials washed off the land or re-precipitating calcium carbonate (marl). Some lakes have disappeared as a result of sedimentation. The process can be slowed down somewhat through reduction of nutrients and good stewardship practices.

Big Cedar Lake Stewardship Association Milfoil Project
In last year's report, we described experiments being conducted for biological control of Eurasian watermilfoil (EWM) using milfoil weevils to bore into the stalks, damaging them and reducing their growth. John Graham, Vice President of the Big Cedar Lake Stewardship Association, reports on his Association's experience with stocking the lake with milfoil weevils in an effort to counteract a serious problem with EWM that was affecting residents' enjoyment of the lake. Stocking took place in August of 2011 and July of 2012. Results have been encouraging, particularly in 2012 – there was significant damage to the milfoil not only in the sites stocked but throughout the lake. Grant applications to assist with the significant cost of the weevils were unsuccessful so the cost was borne by the cottagers. The project will be continued in 2013. Further details can be found at www.bclsa.ca.

Restoring the Mississagua River's Domain: Water Quality Benefits Worth Investigating
Kevin Walters, KLSA Vice-Chair, has studied the history of the Mississagua River and previously wrote about the existence of a west channel of the river that formerly fed into Big Bald Lake via the long narrow channel at the northeast end, where Catalina Bay Resort is located. This branch is blocked off by an earthwork dam, constructed by 19th century lumbermen. Kevin proposes the re-opening of the western branch of the river to increase the flushing rate through the Bald Lakes, Pigeon and Buckhorn Lakes in order to dilute the nutrient levels, resulting in improved water quality. KLSA will be investigating potential sources of funding for a feasibility study to determine the costs and impact of this project.

Upcoming Meetings
KLSA holds two general meetings per year in the spring and fall. The fall meeting includes the Association's Annual General Meeting. In 2013, the spring meeting will be held at the Bobcaygeon Community Centre on Saturday, May 4 at 10 a.m. This meeting will include presentations expanding on the articles in this report. The fall meeting will be on Saturday, October 5 at 10 a.m. at Lakehurst Community Hall.

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, cottage associations, ratepayer associations, municipalities and businesses that provide financial support. We are also very grateful to the Trent-Severn Waterway for its annual grant and to the Ontario Trillium Foundation for funding our aquatic plants and algae projects. Thank you also to Dr. Paul Frost, Dr. Eric Sager, Dr. Emily Porter-Goff, Andrew Scott and Colleen Middleton 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 for assisting with the testing program. Thank you also to George Gillespie of McColl Turner LLP for reviewing our financial records. We are also very grateful to Simon Conolly, publisher of the Lakefield Herald, for his assistance with the publication of this report.

Please consider making a donation to support the work of the Kawartha Lake Stewards Association.
For further details, visit our website: http://klsa.wordpress.com.

KLSA Editorial Committee

Sheila Gordon-Dillane (Chair)

Tom Cathcart

Janet Duval

Ruth Kuchinad

Anita Locke

Kathleen Mackenzie

Kevin Walters

Frog in the weeds

The Toronto Lakes

Kevin Walters, KLSA Vice-Chair

We all know of the name 'Toronto' applying to that metropolis to the southwest, but few are aware of the original employment of that name, how it originated, or what it really means.

For a long period in the past, the rather fanciful and likely wishful-thinking 'meeting place' was assumed to be the meaning.

Linguists generally agree that it is an Iroquois word, and means, essentially, *'where trees stand in the water'.* Did this apply to the area where the City of Toronto is located? This would seem unlikely, since 'where trees stand in the water' might apply to any area of silver maple or black ash swamp, or anywhere one found beavers. Toronto was not a particularly swampy locale owing to the fairly steep gradient of its terrain, and was unlikely to have had more beavers than other areas. As well, unlike villages or other populated areas, regions of empty forest like the Toronto region at the time simply did not acquire any names.

In fact, we see on very early French maps, that 'Toronto' or rather 'Taronto' was applied to what we know as Lake Simcoe, not the area where Toronto sits. So why was this lake referred to as 'where trees stand in the water'? A major clue is found in its alternate name that subsequently came into use, Lac La Clie, or Lac Aux Clies. The meaning of these French names, being 'wattle lake' in English (wattle being interlaced sticks used for fencing or even building construction as in 'wattle-and-daub'), is understood to have referred to the fish fences or weirs that spanned the narrows between Simcoe and Couchiching. These were essentially rows of stakes made of cut saplings, interlaced with other smaller saplings to offer support to the structure. When one places fresh-cut saplings in water, they sprout branches and leaves, which persist for some time until they finally die off. Hence the water-borne traveller would have passed through an area where 'trees' stood in the water.

The City of Toronto acquired its name by virtue of the portage, or 'The Toronto Passage', between Lakes Ontario and Huron, that utilized Lake Toronto for the central portion of the route. Accordingly, the French fort that was constructed at the Lake Ontario foot of this portage was called 'Fort Toronto', and eventually, a harbour, a town, and then a city grew up in this locale and became 'Toronto'. It seems that 'Hogtown' then 'hogged' the name Toronto all to itself.

Most interesting to us, is that we have recently heard that the remains of similar fish fences or weirs have been found in the beds of the rapids submerged by the dam of Lovesick Lake. This suggests that such fish fences may have been commonly employed in many or all of the shallow narrows or rapids found along the Kawartha Lake chain, and perhaps elsewhere, quite likely along the Severn, Otonabee and Trent rivers.

'Toronto' then, might have applied equally well to Lovesick Lake, and even all of the Kawarthas and the connecting rivers.

In fact, it did. The 1799 *Gazetteer of the Province of Upper Canada* lists many place names. (1799 happens to be the year in which Governor Simcoe renamed Lake Toronto or Lac Aux Clies as ' Lake Simcoe', which stands today as the only large lake in the Great Lakes basin not bearing its aboriginal/French derived name.)

In the *Gazetteer*, we see that the name Toronto applied to the bay upon which York (now Toronto) was founded, as well as being the former name of Lac La Clie (which soon after became 'Lake Simcoe'), the Humber River, and "... the Chain of Lakes from the vicinity of Matchedash Bay [on Georgian Bay] towards the head of the Bay of Quinte...". It also applied concurrently to the Severn River flowing from Lake Couchiching to Georgian Bay near Matchedash Bay.

So, indeed, we see that the Kawartha Lakes were once known as the Toronto Lakes, no doubt in no small measure due to a series of fish fences located between the lakes.

Understanding Algae Growth – A Scientific Perspective

Colleen Middleton, Master of Science candidate, Trent University

I have been enjoying the scenic views and welcoming waters of the Kawartha Lakes from my family cottage on Pigeon Lake for 26 years. Over this time, I have become aware of several changes in these lakes: the invasion of zebra mussels, an increase in the amount of aquatic plants, and declines in the number and size of fish catches. There has been a lot of "back in my day" talk, but I wasn't sure how much of it was subject to bias, exaggeration or misinterpretation. I wanted to know the facts. Thus, I started a Masters project in aquatic ecology with Dr. Paul Frost at Trent University.

Central to gaining a better understanding of the changes I have observed in the Kawartha Lakes is the scientific method. The scientific method is a process that allows us to improve our understanding of some of nature's most puzzling ecological phenomena, and is based on empirical and measurable evidence that is subject to specific principles of reasoning. By applying this process to my research, I am able to organize my thoughts, execute studies to test hypotheses and begin communicating my findings. What follows is a description of my laboratory study on the factors affecting algae growth, using the scientific method as the backbone of my story.

Mike Dolbey

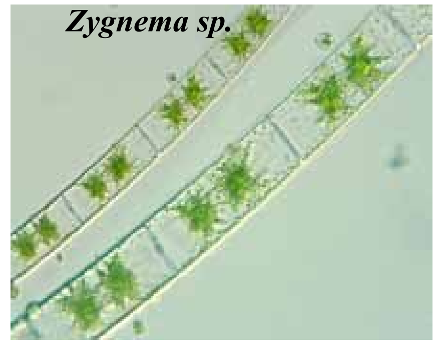
A blanket of filamentous green algae under the water's surface

It all starts with an observation

Algae are a natural part of aquatic ecosystems. They can be very diverse in form, function, distribution and abundance. (For more information about general algae ecology, see KLSA's *The Algae of the Kawartha Lakes* 2012.) Since reports of blue-green algae blooms are increasing in some areas (Winter et al., 2011), I wondered if the same factors that are affecting the blue-green algae could be causing an increase in the other types of algae as well. It was brought to my attention by the KLSA that I wasn't the only one concerned about increases in algae abundance in recent years. In particular, people were concerned about the apparent abundance of a type of algae, often referred to as 'elephant snot', that looks like green cotton candy.

Elephant snot, usually called filamentous green algae by science types, is comprised of three main algal genera: *Mougeotia, Spirogyra*, and *Zygnema*. To the naked eye, they all look the same – like stringy filaments of green, slimy 'goo'. It is only under a microscope that the differences become clear: *Mougeotia* has flat chloroplasts, *Spirogyra* has spiraling chloroplasts and *Zygnema* has two chloroplasts per cell. (The chloroplast is the part of an algal or green plant cell that contains the green pigment chlorophyll.)

Microscopic differences



Filamentous green algae are typically found as large blooms of free-floating or attached clumps in shallow water bodies. They are commonly viewed as a nuisance because they detract from the aesthetic and recreational values of a lake. In high abundance, algae can out-compete plants for light, decrease habitat diversity for fish and other animals and alter nutrient cycling. Despite their importance, we know little about their ecology and what makes algae grow in the way that they do in lakes.

This leads to many questions

Among the most interesting to me are:

- How are the amounts and distributions of filamentous green algae changing over time?
- Which lakes are more susceptible to filamentous green algae growth and why?
- What are the ecological consequences of large blooms of filamentous green algae?
- What factors drive these population dynamics?
- If we have an algae problem, what can we do about it?

For my Master's thesis, I chose to focus on this question: "How does water chemistry affect the growth of filamentous green algae?"

Make a hypothesis

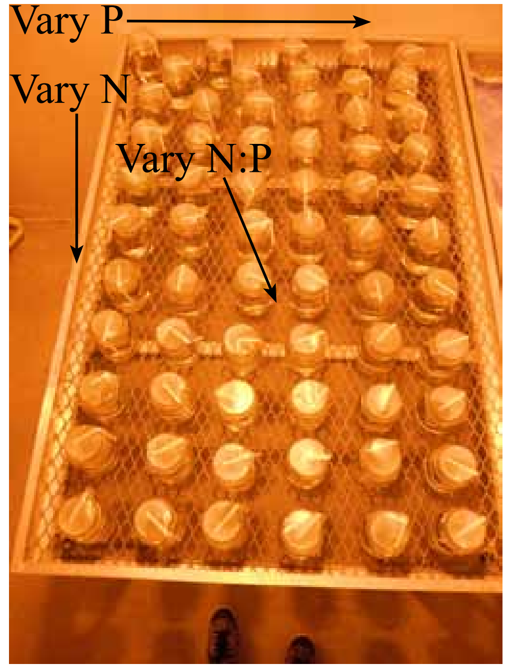
A hypothesis, by definition, is a tentative explanation to a well thought-out question. Algae, like plants, require sunlight, nutrients and moisture to survive -- and the Kawartha Lakes have abundant sunlight and moisture. It is therefore commonly accepted that the addition of nutrients (specifically the essential nutrients nitrogen (N) and phosphorus (P)) will cause more algae to grow. But this only applies to a certain extent because, much like in baking bread, if you do not have the correct proportions of ingredients, you can only make as much bread as the ingredient you have in least supply allows. In other words, the effects of adding one nutrient may depend on the relative availability of other nutrients. As this ingredient in least supply is known as the limiting factor, its identification is a first step in controlling nuisance algal growth in lakes.

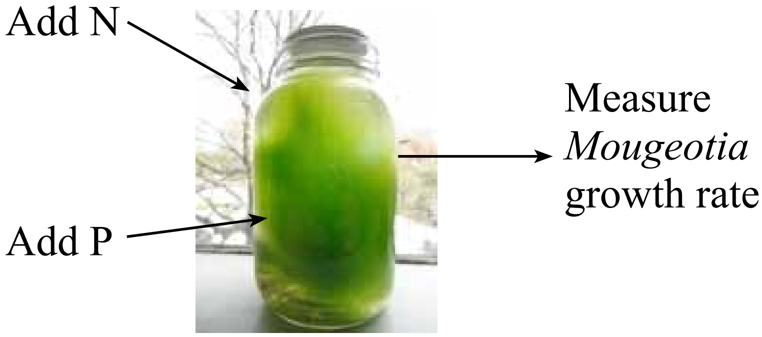
I hypothesized that both the total amount and relative proportions of N and P in the surrounding media (water or sediment) have an effect on filamentous green algae growth. I also hoped to determine whether relative supply of N and P result alters the biological properties of filamentous green algae.

Test your hypothesis

A good experimental design requires a few key elements: namely a large number of samples and a range of levels of the variable you are manipulating. At the same time, you must keep the other variables constant and use enough precision and consistency in what you measure so that another person could follow your methods and obtain the same results.

Because it is a common genus making up the filamentous green algae in the Kawartha Lakes, I decided to focus my study on *Mougeotia*.





I collected *Mougeotia* from the Kawartha Lakes and was able to produce a pure, repopulating colony for the experiment. I began by adding equal amounts of *Mougeotia* to mason jars with 400mL of water and the basic nutrients they need to survive, excluding N and P. I then added varying amounts of N and P (which resulted in different ratios of N and P), for a total of 20 different treatments, with three replications of each. I kept other variables - light and temperature - constant by keeping my samples in an environmental chamber. I grew *Mougeotia* this way for 17 days. At the end of 17 days I analyzed the samples for total P, N, chlorophyll *a*, and biomass.

And finally… we have results!

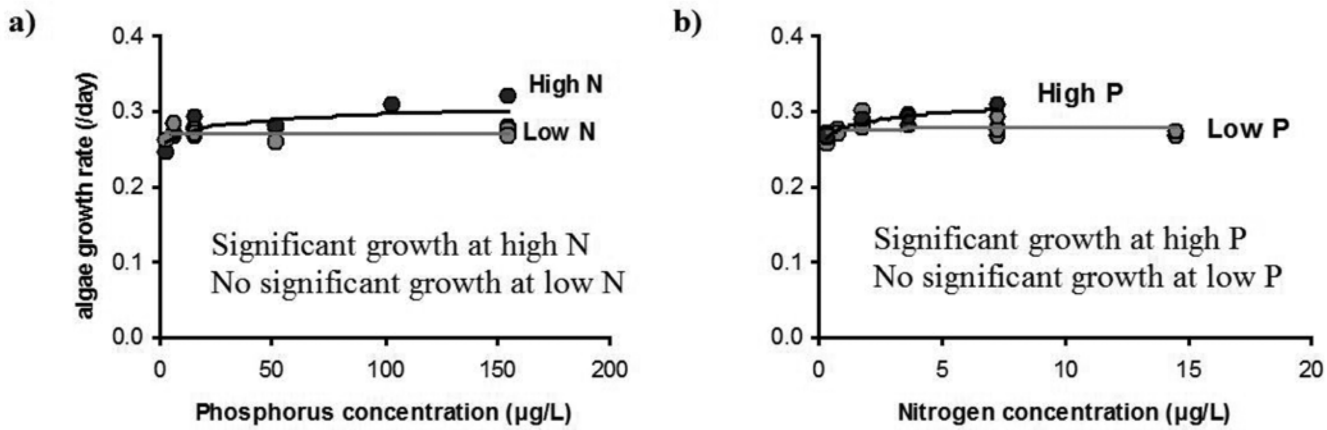


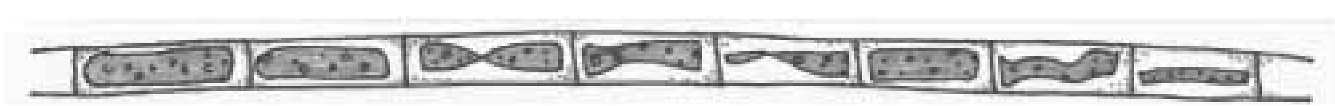
Figure 1. The mass specific growth rate of *Mougeotia* at varying amounts of N and P in the water.

In Figure 1a we see that, when there was lots of N (upper line), adding P resulted in more algae growth. However, when there was not much N (lower line), it did not matter how much P was added – there was still no increase in algal growth. So, in the lower line, N was the limiting nutrient.

The reverse held true (Figure 1b). When there was plenty of P (upper line), adding N increased growth. However, when P was low (lower line), adding N did not increase the growth rate. In this lower line, P was the limiting nutrient.

While there were limited differences in growth of *Mougeotia*, I was able to determine the ratio at which *Mougeotia* grew the fastest. This "recipe" or "stoichiometric ratio" turned out to be five N atoms for every P atom. That means *Mougeotia* needs five times more N than it does P to grow quickly. I also found (data not shown) evidence that higher or lower N: P ratios created physiological stress in the *Mougeotia* and that it was altering its own nutrient content in response to changes in the media nutrient content. This leads to further questions, like: "What is the actual ratio of N to P in the waters of the Kawartha Lakes?", and "Is *Mougeotia* growth limited by the amount of N or P in the Kawartha Lakes?"

It is important to note that there are limitations to this finding based on the experimental design. As with any lab study, results are only applicable in the environment in which the experiment was conducted, as the actual variability of nutrients and interaction of factors in the natural environment cannot all be accounted for. This result of an "optimal" N to P ratio in laboratory conditions is a good starting point. To further understand the dynamics of *Mougeotia* growth I took my study to the field.



Field research

In the summer of 2012, I collected data on water chemistry and filamentous green algae on seven Kawartha Lakes: Chemong, Lower Buckhorn, Bald, Pigeon, Sturgeon, Balsam and Stony. I measured various water parameters including pH, temperature and dissolved oxygen. I also looked at the amount of plants and other types of algae. Most importantly, I collected water, sediment and algae for which I determined the amounts of N and P. I could now analyze the effect of N and P supply in water and sediment on *Mougeotia* N and P composition. Combining these data with results from the laboratory experiment, I should be able to determine if *Mougeotia* growth is N or P limited in the Kawartha Lakes, and get an idea of when and where water nutrients might result in excessive *Mougeotia* growth.

Results for the field experiment are preliminary, but I can say that *Mougeotia* was found in all seven lakes that I surveyed and its presence was more site-specific than lake-specific. I found it in the Kawartha Lakes from early spring to late fall suggesting that its presence isn't a summer-only seasonal occurrence.

This ends the official "scientific method", but our work here isn't done yet!

Apply your findings

Findings from my lab study help explain a piece of the puzzle about excessive algae growth. The results show that *Mougeotia* (and likely the other genera of filamentous green algae) is able to continue to grow at a wide range of nutrient supplies. This likely explains why it can be so prevalent in the Kawartha Lakes, even though these lakes are not excessively nutrient rich. At the same time, my research shows that *Mougeotia* is most happy at elevated nutrient levels. Therefore, in order to manage for excessive growth of this "elephant snot", we should limit the amount of both phosphorus and nitrogen flowing in to our lakes. You can help fight nutrient pollution by continuing to seek knowledge and being active in stewardship groups like KLSA. Ask questions, get answers, and try your best!

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Shoreline Nutrient Contributions to the Kawartha Lakes

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

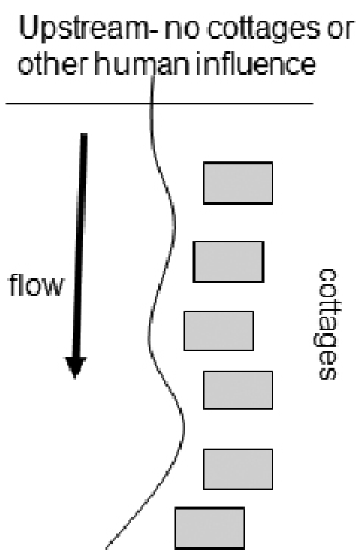
The Kawartha Lakes face growing pressures from a range of activities and uses. While this intensive use of the Kawartha Lakes reflects positively on their importance to our region, it will likely be accompanied with greater stress to these ecosystems. One obvious use that continues to grow is that of shoreline residences both in terms of the number of developed lots and the days used per year. With this overt human presence on the shoreline, there is a need to understand contributions and fates of nutrients from shoreline sources in Kawartha Lakes. Given their proximity to lakeshores and their potential to contribute nutrients from septic tanks and fertilizers, shoreline residences could contribute nutrients that increase the growth of plants and algae in nearshore areas of the Kawartha Lakes. On the other hand, properly-maintained septic systems and careful management of other sources (fertilizers) may minimize these inputs and make them relatively insignificant in terms of the overall lake nutrient budget. Research by my laboratory at Trent University in the summer of 2012 assessed this question of shoreline contributions of nutrients into nearshore ecosystems. This work was split into two main components, each of which informs us whether and how nutrients from shorelines are released into proximate water bodies.

Miskwaa Ziibi nutrient budget study

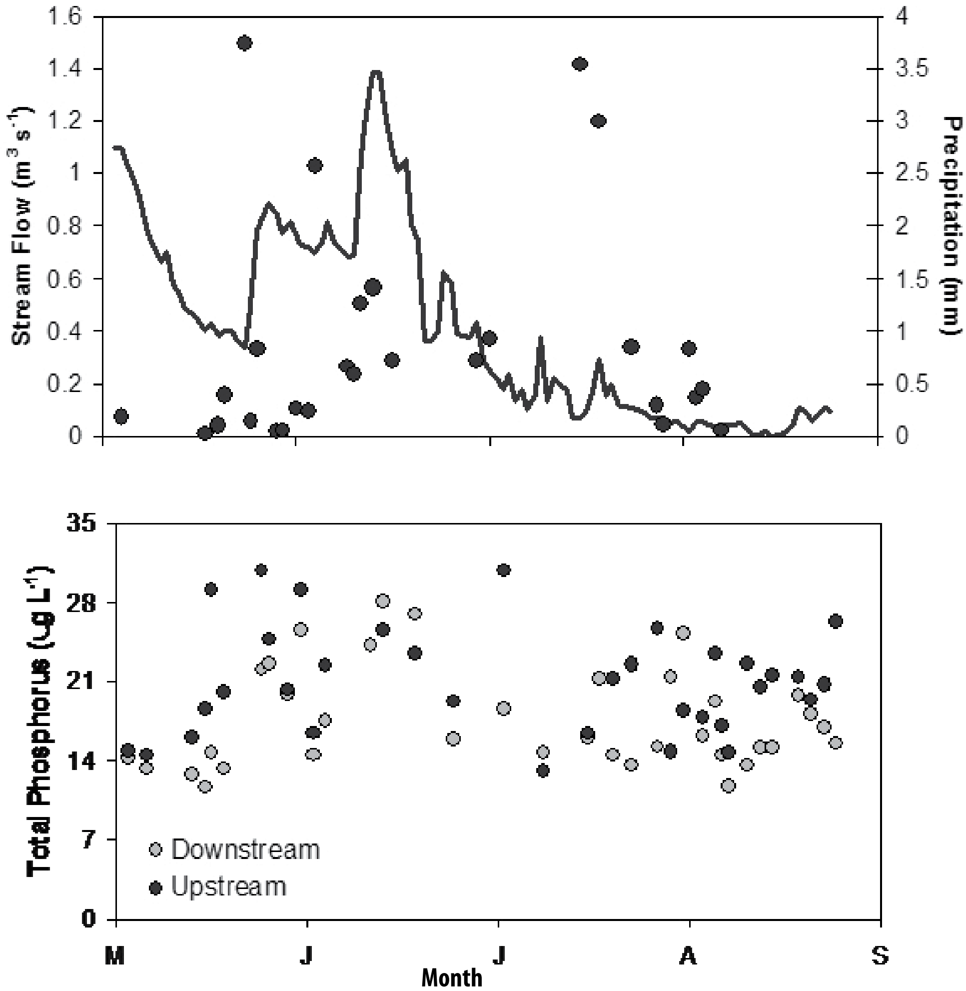
The river, Miskwaa Ziibi, presents a unique opportunity to directly determine the nutrient contributions of shoreline residences to receiving waters. The upstream watershed is largely undeveloped and has few known human nutrient inputs into the river. The final reach into Little Bald Lake has shoreline residences on both sides of the river. Consequently, by sampling water flowing in and out of the bottom section of the Miskwaa Ziibi, we directly determined the nutrient contributions originating from shoreline human activities.

We did this by frequently sampling water for total and dissolved nutrients upstream and downstream of this river reach. As nutrient export could vary with stormflow and other high water events, we also included more extensive sampling before, during, and after mid-summer storms. This nutrient sampling was coupled to continuous river flow measurements by an automatic water level logger placed at the weir at the river's outlet. By coupling the total water flow and our frequent water chemistry sampling, we calculated the total nutrient export out of the portion of the stream potentially affected by shoreline residences.

We also sampled the river from upstream to downstream once during the summer. We measured water nutrient chemistry, benthic communities, and used unique chemical indicators of human-derived nutrients. This sampling provides further evidence of human-related nutrient loading in the developed reach.

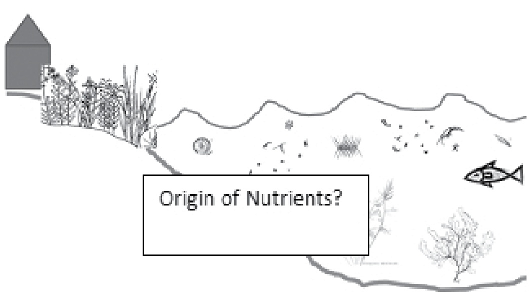


Stream flow through the Miskwaa Ziibi was generally high in spring and early summer and gradually declined as summer progressed. August in particular was quite dry and the stream flow was reduced to very low levels. Total phosphorus (P) concentrations, both upstream and downstream, showed no obvious relationship with stream flow and were about 20 µg/L throughout the summer. However, we consistently found higher concentrations at the upstream site, especially during the higher flow period in May and early June. Consequently, the total P export across the sampling period was lower at the downstream (78.3 kg) compared to the upstream (91.8 kg) sampling location. This equates to a net summer retention of 13.5 kg of P in the developed section of the Miskwaa Ziibi river. This is opposite of our expectation of more P leaving the downstream versus the upstream sections. Future work is needed to determine the fate of the retained P and whether this net retention occurs throughout the year or is a summer-related phenomenon.



Benthic nutrient study of the nearshore littoral zone

Littoral zones spatially sit between shoreline residences and the open water of lakes. This intermediate position means that shoreline-derived nutrients would likely have the most effect on these shallow areas of the lake. Consequently, understanding the source of nutrients driving plant and algal growth in these areas is of critical importance.



We also studied nutrients in the littoral zones to address whether they originated from shoreline sources or the open lake water. To do so, we sampled open lake water, benthic filamentous algae, aquatic plants, and submerged shoreline sediments. To derive the origin of these nutrients, chemical markers (stable isotopes of nitrogen) are being analyzed in subsamples of collected material. Our basic sampling scheme focused on shorelines with and without extensive residential development. Greater shoreline nutrient inputs should produce an isotopic composition different from that observed in open water areas. Such differences should be minimal in naturalized shorelines provided that background nutrient sources feeding these ecosystems do not mimic human-derived nutrients in more developed areas.

Preliminary results from our sampling indicate minimal differences in water chemistry among shorelines within the same lake. This is expected given the relatively fast horizontal mixing expected in lakes. Isotope chemistry is still being completed on plants, algae and sediments and no data is currently available.

How Much Natural Cover Is Enough Around Our Lakes?

Dave Pridham and Brett Tregunno
Kawartha Conservation

Settlement activities over the last two centuries in the Kawartha Lakes basin have significantly altered or degraded much of its original fish and wildlife habitat. Considerable research within the Great Lakes basin over the last few decades supports the premise that **maintaining natural cover (e.g., wetlands, forests, thickets, meadows) in the landscape is crucial to maintaining healthy natural systems.**

Large tracts of high quality natural cover maintain groundwater recharge, surface water quality and quantity, flood reduction capacity, and the connectivity of various habitats (mammals, fish, amphibians, birds, pollinators), while maintaining capacity for genetic diversity - especially with those species that are less mobile, e.g., salamanders, tree frogs or turtles.

The role of wetlands is well understood, however woodlands and other natural cover are also very important for maintaining high quality water in your lake. This natural function is what we can call 'ecological goods and services', i.e., nature's purification of water. Walk into any woodland and, in most forest soils, you can probably scuff out a 5-10 cm deep depression quite easily with the toe of your boot. This type of loose, organic soil soaks up heavy rains or spring melt runoff, filtering the sediments from the water, with roots of natural vegetation utilizing nutrients before they reach the lake, and gradually releases water to the lake over time. From a landscape perspective, research[1] has shown that a **minimum of 30-50% forest cover within the drainage basin(s) of our lakes is necessary to maintain these types of ecological benefits.** However, as we get closer to the land/water interface (i.e., along streams, lakeshores, etc.), it is likely that even more natural vegetative cover is required to protect our lakes.

Consider developed shorelines. Watch how quickly heavy rainfall and rapid snowmelt runs off hardened surfaces - roofs, patios, walkways, down driveways, across the compacted soil of extensive lawns - or be directed by cottage road ditches, directly into your lake. Over the first 75-100 year period of lake development, certain property management practices evolved. In fact, with nearshore development, a basic objective was to move water as quickly as possible – with sediments, nutrients, and other contaminants – directly off the near shore into the lake.

It is difficult to identify the development "threshold" along our shorelines. What is the point at which nearshore development causes serious impacts to our lakes? How much of our shoreline can we harden without having a significant impact? No such targets exist for shorelines along Kawartha Lakes; however, the guidelines that have been proposed for streams may serve as a good starting point.

Research[1] has shown that **streams tend to be healthy when 75% of their length is naturally vegetated**, and that the appropriate **buffer width of vegetation varies depending on local conditions but in general, 30-metre wide naturally vegetated areas on both sides maintain ecological benefits.** Using this knowledge, we may be able to obtain a rough expectation of how healthy our lake shorelines are.

Let's use the Sturgeon Lake shoreline as an example. Using aerial photography, we classified land cover along the shoreline at various distances from the lake using Ecological Land Classification - a provincial-standard approach. We've grouped our results into three primary land use types: developed, natural, and agricultural (Figure 1).

1 Please see 'More Information' for examples.

Figure 1: Dominant land use, using 2008 aerial imagery, along varying distances from the Sturgeon Lake shoreline. Numbers expressed as percentages.

Land Use	15 metres	**30 metres**	100 metres	500 metres	1 kilometre
Developed	48	**53**	49	21	15
Natural	52	**48**	49	57	50
Agriculture	<1	**<1**	2	22	35

As you can see from the above table, the majority of the development along the lake is within 30 metres of shore – a result that is not unique to this lake. When comparing the amount of existing natural lands within this zone against science-based research, it is clear that there is significant room for improvement. **Natural land use along the Sturgeon Lake shoreline fails to meet the minimum recommended guidelines used for streams, and as such we can infer that the "ecological goods and services" that the shoreline provides are not meeting their potential.**

Now consider this – these results are based on a "birds-eye-view" of land use. Tree canopies and imagery-resolution issues obscure our ability to truly characterize land use. For example, how much of the lands underneath large tree canopies are actually developed? Our experience suggests that we are underestimating the amount of developed lands through this approach. We expect actual values to be much higher, even further below the guidelines. To test this notion, we have partnered with the University of Toronto in conducting a "rapid shoreline classification project", by boat along Sturgeon Lake, to gain a better understanding of land use along the immediate land-water interface. Sampling was completed in summer of 2012, and results are expected to be provided by the university students in Spring, 2013.

Now look around your lake – take a slow boat cruise and examine your lake's shoreline. How much would you estimate to be natural cover? Will it meet your expectations for long term sustainability?

Next look around your property or community. How much of it is hardened surfaces? How much of the shoreline frontage is vegetated? Do you feel that your property contributes to protecting lake water quality and habitat values in the long term? Should you and your lake community be targeting a greater percentage of natural cover?

It is time to change how we manage our shorelines and near lake zones – our lakes need innovators and leadership at many levels – shoreline owners, municipalities, development industry, resource users and resource managers.

More Information
[reports available online via Google search]

Environment Canada. 2004. How much habitat is enough? A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern (Second Edition).

Environmental Law Institute. 2003. Conservation thresholds for land use planners.

Latornell Symposium. 2011. How much habitat is enough? The philosophy of thresholds and targets. (Presentation: revisiting 2004 Environment Canada guidelines).

Photos of Sturgeon Lake shoreline showing examples of win-win situations: maintaining the majority of the shoreline in a natural state while still providing access opportunities.

Shoreline property for sale on Sturgeon Lake. How much of this shoreline would you modify if you were the successful buyer? What it would it take to convince you to maintain 75% of this mature vegetation?

Harvesting Lake Nutrients: Musings of a Lakeside Gardener

Mike Dolbey, KLSA Director

Mike Dolbey

Most shoreline property owners are quite familiar with aquatic macrophytes or plants that may grow near their shoreline. When they are blown in from afar they are viewed as lake weeds. Our property is on the east side of Lake Katchewanooka and the prevailing westerly wind blows weeds cut by boat traffic on the Trent-Severn Waterway (TSW) channel onto our shore and into a nearby sheltered bay. For years I have gathered the weeds and mixed them with last year's dried leaves to make compost which is used on our gardens instead of commercial fertilizer. We are told that phosphorus is generally the limiting nutrient that controls the amount of aquatic plants and algae that grow in our lakes. As I hauled a wheelbarrow of lake weeds to the pile, I wondered how much phosphorus I was removing from the lake and I decided to find out.

In the 1980s, McGill scientists Carignan and Kalff studied aquatic macrophytes in Lake Memphremagog, Quebec. They determined the amount of phosphorus (P) contained in nine common types of aquatic macrophyte, expressed as micrograms phosphorus per gram (µg/g) dry weight of plants. The aquatic macrophytes they studied are all common in the Kawartha Lakes, including *Myriophyllum spicatum* (milfoil) and *Vallisneria Americana* (tape grass). The values of total phosphorus in various plant samples varied between 2,210 and 5,020 µg/g with an average of 3,073 µg/g.[1]

By repeatedly weighing a known volume of lake weeds I determined that, on average, one litre of fresh weeds weighed only 18 grams after being dried. Because fresh weeds have a similar density to water, I was surprised at first to find that a litre of packed fresh weeds, spun in a lettuce spinner to get rid of external water, weighed only about 200 grams. However, measuring the amount of water required to fill the container of weeds proved that 80 per cent of the volume of the container was filled with air among the weeds. The weight of dry weeds was about 10 per cent of the weight of spun fresh weeds.

I calculated that one cubic foot (28.32 litres) of fresh weeds contains approximately 1.57 grams of phosphorus per cubic foot (ft^3) of weeds ($28.32\ L \times 18\ g/L \times 3.073 \times 10^{-3}\ gP/g = 1.57\ g/\ ft^3$). My small wheelbarrow holds three cubic feet, so each load I haul away removes about 4.7 grams of phosphorus from the lake. Is this a lot or a little?

The Ontario Government's *Lakeshore Capacity Assessment Handbook (2010)* [2] estimates that an average person contributes 660 grams of phosphorus to their septic system each year. How much of this phosphorus goes from the septic system into the lake now or in the future is an important question. If all of it were to reach the lake it would be equivalent to 420 cubic feet or 140 wheelbarrow loads of weeds per year for each of us!

Chemical commercial fertilizer has three numbers on a package, known as the N-P-K ratio. It gives the per cent weight of nitrogen (N), phosphate (P_2O_5) of which 43.6 per cent is elemental phosphorus (P), and potassium oxide (K_2O) of which 80 per cent is elemental potassium (K). Nitrogen promotes the growth of green leaves and vegetation (it is an essential building block of chlorophyll); phosphorus promotes the growth of healthy roots and shoots; potassium promotes flowering, fruiting and general hardiness.

We do not use chemical commercial fertilizer on our gardens but if we did, for example, use a 3.6 kg container of all-purpose fertilizer with an N-P-K ratio of 10-10-10 it would contain 157 grams of phosphorus, equivalent to 100 cubic feet or 33 wheelbarrow loads of weeds (3,600 gram container x 0.10 (10% P_2O_5) x 0.436 (43.6% P in P_2O_5) = 157g)). A nine kg bag of 20-27-5 Lawn Starter fertilizer contains 1,060 grams of phosphorus equivalent to 675 cubic feet or 225 wheelbarrow loads of weeds.

Clearly a little phosphorus can potentially lead to a very large quantity of aquatic plant growth. But is phosphorus all we should be worrying about?

Mike Dolbey

Nuisance weeds or free fertilizer?

A number of U.S. states have banned the use of phosphorus in lawn fertilizer because of concern that its runoff will damage lake ecology. Hence, most lawn fertilizer now being sold is phosphorus-free (the middle number is 0). It has been found that once a lawn's roots are established, there is sufficient phosphorus in the soil to maintain the lawn. When grass goes dormant during winter, it stores some of its nitrogen in its roots but much is lost. Applying nitrogen-rich fertilizer in the spring stimulates rapid growth of bright green grass. Similarly the foliage of most lake plants dies back in winter and some of the nitrogen stored in their green foliage is stored in their roots but much is lost. In the spring, is it possible that runoff of nitrogen rich, no-phosphorus lawn fertilizer might stimulate rapid green growth of the lake's plants? I wonder if using phosphorus-free fertilizer is as bad for a lake as it is good for a lawn.

The fact that fresh green lake weeds contain a lot of nitrogen is what makes them so valuable for mixing in a compost pile. Dry leaves and garden waste are broken down by microorganisms (bacteria, fungi, etc.) to produce carbon dioxide, water, heat and humus, the stable organic end product much prized by gardeners. To do their work efficiently, microorganisms require carbon, nitrogen, water and air. Brown dry leaves and dry garden waste contain lots of carbon but very little nitrogen, water or air. Fresh green lake weeds contain lots of nitrogen and water, and the process of building a compost pile by alternately layering dry leaves and wet lake weeds introduces lots of air into the pile. Within a few weeks of building such a pile, the temperature in the middle of the pile rises to as much as 55°C (130°F) and it shrinks to half its size. By the following spring such a pile is ready to use in the garden whereas a pile of dry leaves may take many years to break down.

In 2012 aquatic plants were much more prolific than usual, perhaps because the mild dry winter and spring provided very little flushing of nutrients from the lake, and the early spring and warm dry summer promoted rapid plant growth. I collected about 225 cubic feet of weeds from the lake in 2012; approximately three times as much as in an average year.

Does collecting and mixing lake weeds sound like unpleasant work? I see it as an enjoyable 45 minute aerobic workout every few days that converts a nuisance waste product (weeds on my shore) into a free valuable resource (good quality compost for my garden) while removing nutrients from the lake ecosystem. To me, it is better than golf!

How large a pile of aquatic plants would be produced by the phosphorus that is released each year by sewage treatment plants that discharge into the Kawartha lakes?

The amount of phosphorus released by sewage treatment plants on the lakes is approximately 400 kg/year. This is equivalent to about 255,000 cubic feet of aquatic plants, which would make a pile larger than Lakefield's Memorial Hall, including its library wing. That is a lot of weeds.

Mike Dolbey

Lakefield Memorial Hall

Janet Duval

Floating Weed Rake

Here's one way to harvest floating weeds. This cedar rake was custom-made for a resident of Lower Buckhorn Lake. It can be thrown out into the lake some distance from shore, then hauled in by the rope. Because it floats, it easily captures large rafts of drifting weeds. The tines were cut and formed from rigid fencing plastic available at farm supply stores.

References

1 R. Carignan and J. Kalff. 1982. Limnology and Oceanography 27(3): 419-427

2 Ministry of the Environment, Ministry of Natural Resources, Ministry of Municipal Affairs and Housing. Lakeshore Capacity Assessment Handbook: Protecting Water Quality in Inland Lakes on Ontario's Precambrian Shield. 2010. Available at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079878.pdf

E.coli Bacteria Testing

Kathleen Mackenzie, KLSA Vice-Chair

Thank you to our fleet of volunteers, who collected water samples and transported them to the laboratory. You were, as always, generous with your time and your gas tanks. This is actually a fun activity, and an excellent excuse to get out onto the water. Please contact KLSA if you are interested in becoming a water tester!

We were especially pleased to see tests being done on Cameron Lake for the first year; this meant that KLSA tested on every lake from Shadow Lake downstream to Katchewanooka Lake.

In 2012, KLSA volunteers tested 102 sites on 16 lakes for *E.coli*. Each site was tested up to six times through the summer. Samples from 74 sites were analyzed by SGS Environmental Services in Lakefield, and samples from 28 sites in the more western lakes were analyzed by the Centre for Alternative Wastewater Treatment at Fleming College in Lindsay.

To see complete results, please refer to Appendix E.

A very dry year

As in previous years, the huge majority of counts are very low, indicating generally very good water quality. Of the 90 sites that were tested five or six times, results can be summarized as follows:

Site Rating	Number of Sites	Comments
'Very clean': all readings less than 20 *E.coli*/100 mL	68	These low counts indicate excellent recreational quality, and reflect good management practices by various lake users.
'Clean': one or two readings over 20 *E.coli*/100 mL	21	
'Somewhat elevated': three readings over 20 *E.coli*/100 mL	1	This location may be affected by wildlife, including waterfowl, or possibly by nearby agriculture.

It is difficult to compare results year to year because the sites change somewhat. Generally, though, in 2012 *E.coli* counts seemed somewhat lower than usual. This was probably because it was such a dry year. As seen in Appendix H, the rainfall for July was less than two-thirds the long term average, and rainfall for August was just over one-half the long term average. On all the main testing dates (July 2, 23, 30, August 7, 18, September 4/5), there had been no rain in the 48 hours preceding the testing, so there was very little recent runoff to raise bacteria counts.

Phosphorus Testing

Kathleen Mackenzie, KLSA Vice-Chair

In 2012, phosphorus levels were measured monthly on 37 sites on 15 Kawartha lakes, four to six times over the summer. Analysis is provided free by the Ministry of the Environment's Lake Partner Program. Many thanks to our KLSA volunteers for sampling so faithfully; we have an excellent database, now 11 years old.

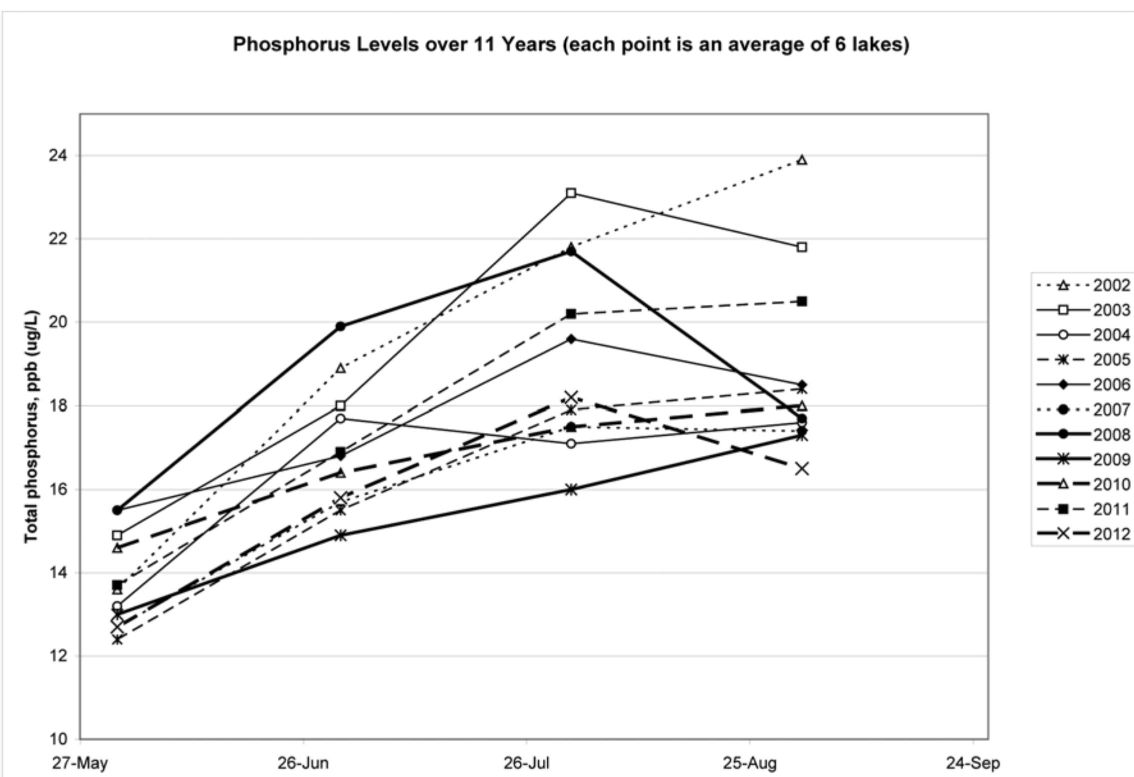
To see complete data, please refer to Appendix F.

A very dry year, but business as usual

The summer of 2012 was unusually hot and very dry, SO…

- With less runoff, would our water have less phosphorus?
- With less local precipitation, would there be more low-phosphorus water brought down from the northern feeder lakes, thus reducing phosphorus levels?
- Would the warmer water cause more growth of aquatic plants and animals, which might absorb more phosphorus, again reducing phosphorus levels?

These were some of our guesses. However, if we look at the system as a whole (see graph below), phosphorus levels in June and July were similar to previous years, though they were lower than usual at the end of August.



Phosphorus patterns as in previous years

The Kawartha Lakes make for a very interesting phosphorus study because phosphorus levels vary so much from lake to lake. As in previous years, the lakes could be classified as:

Classification	Phosphorus levels	Names of lakes	Comments
Low phosphorus lakes	Approximately 10 ppb on June 1, rising to less than 15 ppb during July and August	Big Bald, Upper Stoney, Balsam, Cameron, north end of Sturgeon, Sandy	These lakes are 'off-line' from the nutrient inputs of Fenelon Falls, Lindsay and Bobcaygeon.
Higher phosphorus lakes	Approximately 10 ppb on June 1, rising to 20 or 25 ppb during July and August	Sturgeon (south and east end), Pigeon, Chemong, Buckhorn, Lower Buckhorn, Lovesick, Stony, White, Clear, Katchewanooka	These lakes have water draining into them from more local and southern sources. Over the years, their sediments have become enriched, and these sediments may be leaching phosphorus.

In 2012, as in previous years, two patterns emerge in the higher phosphorus lakes:

1. Phosphorus is lowest in the spring (probably due to a flushing out of the system by water from the north, mainly via Gull River and Burnt River). Phosphorus then rises until about mid-August as river inflows decrease and, we believe, sediment releases predominate. Phosphorus levels then dip slightly in late August.
2. There is a jump in July/August phosphorus levels from the top of Sturgeon (S. Fenelon R. site) to mid-Sturgeon. Levels remain at this higher level in Pigeon, Chemong, Buckhorn, Lower Buckhorn and Lovesick Lakes. They decrease somewhat in Stony Lake due to the inflow of water from low-phosphorus Upper Stoney Lake. They then rise again in Clear Lake and Katchewanooka Lake.

2011 Kawartha Lakes Sewage Treatment Plants Report

Kevin Walters, KLSA Vice-Chair

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 prior to going to press. We would like to thank Cathy Curlew at the Ministry of the Environment (MOE) in Peterborough and Julie Preston and Julie Mulligan at the Ontario Clean Water Agency for providing us with the annual reports and/or answering our questions regarding plant operations.

Bobcaygeon:
This has frequently been a problematic plant, with operational problems and high phosphorus (P) discharges. For this past year, the two-plant system has been functioning well, with discharges to Pigeon Lake being far below the generous amount allowed by the Certificate of Approval (C of A). Maximum monthly P discharges are allowed to be 1.3 kg per day, which is an intolerably high amount (nearly a half tonne per year) by current standards. However, the annual average output has been 0.181 kg/day, or only 66 kg per year, a large improvement over last year. The average annual discharge concentration was 0.090mg/L out of an allowable limit close to 1.0. The removal rate was, annually, 97.6%, which is not far from our desired target of 99%. We hope this greatly improved discharge can be maintained, if not improved even more.

E.coli discharges were also very low, at only 2.27 colony-forming units (cfu) per 100 ml on an annual basis.

While no by-passes, overflows or spillage to the lakes were reported, sewer cross-connections may be an issue, given a complaint of street catchbasin cleaning causing water to spray out of bathroom fixtures. This is of some concern, and should be investigated by the City.

Odour from the plant is a problem from time to time, and the MOE has requested implementation of odour control.

Coboconk:
This lagoon system has been functioning well, with discharges to the Gull River occurring in May and December only. Phosphorus discharges have been averaging 0.068 mg/L. The removal rate has been 98.52%, close to our target of 99%. The total annual discharge of phosphorus was 5.8 kg, less than one-tenth that of Bobcaygeon, and a big improvement over last year.

E.coli discharges have been under 2 cfu per 100 ml.

No spills, bypasses or overflows were reported, and flow rates were actually down from last year, likely due to the removal of sewer infiltration sources.

Odour complaints were, however, received on a number of occasions, and this issue continues to be a problem for lagoon area residents.

Fenelon Falls:
This plant continues to perform well, and the mystery remains as to why phosphorus levels in Sturgeon Lake rise so much below the town.

The phosphorus removal rate was 98.8%, more or less meeting our target of 99%, with discharge rates being between 0.03 and 0.15 mg/L every month (average 0.08 mg/L). The C of A allows 0.5 mg/L. This removal rate occurs in spite of ongoing problems with tertiary filter operation.

Cross-connections may also be a problem here, as, on a number of occasions, partially treated sewage bypasses have occurred during high rainfall/snowmelt events. It is hoped that this ongoing issue will be explored and resolved.

Total phosphorus discharge for the year was 32.1 kg, about half of Bobcaygeon's P discharge. So if Fenelon Falls can do it, so should Bobcaygeon.

E.coli levels in the effluent were around 2 cfu per 100 ml.

Lindsay:
This plant, the largest on the lakes, continues to work well, although not quite as well as in the past. Phosphorus discharges averaged 0.05 mg/L, whereas the C of A allows 0.2 mg/L. The removal rate averaged 97.2%, the lowest of the three Sturgeon Lake area plants. Total annual phosphorus discharge amounted to 288 kg, or 4.4 times that of Bobcaygeon, which is commensurate with the population difference. This is slightly up from the 255 kg of 2010, but is comparable to the increase in flows seen at the plant over last year. This underscores our concern with increasing the population of Lindsay; as population increases, so does the amount of sewage effluent – and phosphorus – that is discharged to our lakes.

Two spills/bypasses were recorded:

In April, a power unit at the plant failed for 40 minutes and 500m^3 of partially treated sewage was discharged to the Scugog River at Sturgeon Lake.

In July, a pumping station was overwhelmed by heavy rains, at a time when two of three pumps were shut down for maintenance, and 60m^3 of raw sewage entered the Scugog River over a period of about 1 hour and 40 minutes. There was supposed to be a contingency plan implemented for such situations, but this did not occur.

Average *E.coli* in the discharges were 4.73 cfu per 100 ml, the highest of all the Sturgeon Lake area plants.

Many serious deficiencies have been identified with the plant by the MOE, affecting, or potentially affecting operations of the plant or its integrity. One of these concerns pertained to leakages from the old lagoons used for storing high sewage flows for later treatment. Work has been commenced on many of the outstanding improvements required, and the threat of a lagoon failure has been averted.

Kings Bay:
This plant has been functioning much better, and the effluent targets are now routinely being met.

Phosphorus discharge to the underground disposal bed averaged 0.52 mg/L out of an allowable 1.0 mg/L. The allowable discharge volume is 0.17 kg/day; however the actual was 0.04 kg/day.

Actual loading to the lake is likely nil, since the discharge is to the ground, as with a septic tile bed. Monitoring wells 15m down gradient from the bed had P levels averaging 0.037 mg/L, a fourteen-fold decrease. This amounts to an overall 99.4% P removal rate at that point, and that meets our target. Last year was equally good at 99.3%.

Since the trenches average 150m from the lake or river, this suggests that at least for the time being, we have effectively 100% removal.

One 'bypass' from the plant of 40m^3 occurred, with the bypassed flow discharged to a wetland area. This would have absorbed at least some of the nutrients and other contaminants.

Omemee:
This lagoon facility did not require any emergency discharges to the Pigeon River this year, and all effluent was spray-irrigated onto nearby fields. Phosphorus was reduced to 0.79 mg/L of an allowable 1.0 mg/L, reflecting a 98.1% removal rate to the point of spray irrigation, and virtually 100% removal with respect to our lakes.

E.coli levels averaged a relatively high 84 cfu per 100 ml, however, again, this was to land, not our waterways.

Summary:
The total volume of phosphorus discharged to the lakes from the four aquatic discharge plants in 2011 was 392 kg, down 6% from the 416 kg of the previous year. We note, however, that nearly three-quarters of that total is from Lindsay.

Showcasing Water Innovation – Floating Wetlands to Improve Stormwater and Sewage Treatment Effluent

Rob Gamache, Supervisor, Regulatory Compliance, City of Kawartha Lakes

The City of Kawartha Lakes is committed to improving surface water quality within its lakes and rivers used for recreational purposes and drinking water supply for generations to come. That's why the City, in partnership with Fleming College's Centre for Alternative Wastewater Treatment, C&M Aquatics and Queen's University, have been awarded funding from the Ministry of the Environment (MOE) to introduce floating wetlands to improve stormwater and sewage treatment effluent.

The project objectives are to demonstrate and assess floating wetland technology in a number of locations throughout the City of Kawartha Lakes. These demonstration locations include the Old Mill Site in Lindsay, the Omemee Sewage Lagoons, the Coboconk Sewage Lagoons and the Coboconk recreational pond opposite the Coboconk Service Centre. The scientific results, including the learning outcomes, from the project will be communicated to stakeholders such as municipalities, governments, conservation authorities, water managers and others so they may benefit from this information and form a better understanding of the applicability of floating wetlands in Ontario.

The goals of the project are to:

1. Improve water quality where stormwater and sewage treatment effluent enters surface water courses
2. Recognize cost-effective sustainable technology using natural-based systems
3. Improve raw water supply from drinking water intakes
4. Reduce risk associated with stormwater effluent health hazards
5. Suggest a broad-based application to other municipalities and commercial/Industrial applications
6. Indicate a more reasonable cost effective alternative to the current best available technologies
7. Educate the public through environmental education, interpretive signage and other communication activities
8. Increase stewardship activities and awareness.

The project is using PhytoLinks which is an engineered modular floating treatment wetland system developed by C&M Aquatics based on their extensive experience with floating island technology. The PhytoLink system was designed specifically with larger scale applications such as stormwater ponds in mind. Easily scalable and flexible enough to allow for any desired layout, PhytoLinks is a very cost effective solution for management of water quality in a variety of different applications. The intent is for the Floating Treatment Wetlands to collect various nutrients and pollutants in the plant biomass – through contact with the floating plants' roots. The project has already installed 1288 square feet of floating treatment wetlands (PhytoLinks) in the Omemee and Coboconk Sewage Lagoons. A total of 60 PhytoLinks were successfully installed at the Omemee location and a total of 100 PhytoLinks were installed at the Coboconk location. Further work will be undertaken in the spring to reseed the PhytoLinks and reposition them from their temporary winter position until more favourable conditions arrive in the spring. These chosen locations will offer an opportunity for more comprehensive scientific research into the technology as well as to assess the viability and applicability of floating wetlands in cold and variable climates.

To date the project research has been successful in that we have learned about growth mats and plant species and which species grow and survive best in extreme weather conditions. We will be introducing a new growth mat this spring and introducing other plant species to ensure the seedlings become established, forming a strong root mass throughout the hot but short growing season.

The project holds weekly progress meetings between Queen's University, Fleming College – Centre for Alternative Wastewater Treatment, and C&M Aquatics to ensure deliverables are met. In addition, the Kawartha Lakes Water Table Group meets the second Thursday of every month with the Mayor, Council, Management, Fleming College and Kawartha Conservation to provide updates and the opportunity for discussions.

Omemee Floating Wetlands

The project has supported local companies through the procurement of the PhytoLinks where due to manufacturing and development of the PhytoLinks product, C&M Aquatics has hired and trained new employees on various manufacturing and seeding techniques.

The Kawartha Conservation Educational Outreach Program has included Showcasing Water Innovation brochures in its Kawartha Conservation packages. These are being distributed to residents' homes throughout the Kawartha Lakes. In addition, the Kawartha Lake Stewards Association wrote a letter of support as part of the funding application. The City appreciates this support from Kawartha Lake Stewards Association in helping to establish this groundbreaking project.

As part of the outreach program, the City water and wastewater staff attended the Coboconk Fresh Water Summit which was a great opportunity to introduce the Floating Wetlands Project to the local community. It also helped educate the community on innovative and cost-effective solutions to improve water quality in the City of Kawartha Lakes. The feedback from the local community was very positive and led to engaging conversations about the project and the technology being used.

The project managers also attended the Haliburton-Muskoka-Kawartha Children's Water Festival. This was an excellent event to teach children from grade 3 to 6 the importance of wetlands in the natural environment and to demonstrate how wetlands work to improve water quality in water bodies. The children enjoyed the interactive presentation and the promotional giveaways such as the frisbees that each child received. The presentation was positively received by the festival presenter (Friends of Ecological Environmental Learning) and we were asked to present at next year's festival.

Coboconk Lagoon - Floating Wetlands

The results of 2012's research have been invaluable in terms of further understanding Floating Treatment Wetland technology and the challenges of establishing viable, bio-diverse and robust vegetation growth in wastewater. The project will be installing an additional 180 PhytoLinks (approx. 1440 sq. ft. of islands) in stormwater ponds and in the Trent-Severn Waterway in the spring of 2013. Samples of the plant biomass taken from the islands will be harvested later in the project. The samples will then be studied and the amount of specific nutrients being taken up by the plants will be quantified. These results will be compiled into a report and shared with stakeholders, governments and conservation authorities.

Lake Demise – Sedimentation and Erosion Processes

Kevin Walters, KLSA Vice-Chair

Some people have expressed a concern about lake sedimentation, what it means for their lake and what can be done to stop it. As a generality, lakes accumulate sediments as a natural process. Ultimately they fill in completely, barring other contrary processes occurring. This is one reason why lakes are uncommon outside of glaciated areas; they are a product of glaciation and were relatively recently created, or recreated, by glacial scouring, as opposed to non-glaciated areas where they are relatively rare.

In years past, much was made of the effects of the process of **eutrophication** (over-enrichment by nutrients such as nitrogen and phosphorus: see Glossary) and how enriching lakes ultimately led to the complete filling in of those lakes with organic material. However, this is only one source of sedimentation, and it is questionable if any lakes have met their demise by this process alone.

Another lake-killing process is **outlet erosion** causing the lake to drain away, where the outflow of water is able to cut down through the material forming its outlet. This can be a fairly rapid process. Our local lakes still exist because the material forming the outlets is sufficiently hard, resisting erosion and this down-cutting process. Other lakes in our region have not lasted so long. Basins that formerly were occupied by lakes can be discerned from topographic maps. One large lake that has almost disappeared is located just west of Lake Simcoe (formerly Lake Toronto, see separate story *The Toronto Lakes* in this publication). Lake Minesing was a sister lake to Lake Simcoe for a time following the retreat of glacial Lake Algonquin. While the outlet from Lake Simcoe - Couchiching was the hard rock of the Canadian Shield at Washago, the outlet of Lake Minesing was unconsolidated glacial deposits. As a result, Lake Simcoe's sister gradually cut an ever deepening gorge at her outlet and the lake has mostly drained away. Not entirely, however, as it remains a vast uninhabited swamp and marshland called the Minesing Swamp. Every spring, this vast area fills with water from the spring melt and the lake is temporarily restored, until all that ponded water can funnel through its outlet located just north of Highway 26 at Edenvale.

Our local lakes, which were also created during the last glacial period, are more like Lake Simcoe in that hard metamorphic Shield rock or sedimentary limestone and dolomite control the outlets (now reinforced by concrete dams). Accordingly, outlet erosion is minimal, but the sedimentation process continues. Our lakes then will meet their eventual demise by filling in. Already, we have areas of deep sediment in quieter areas where currents concentrate the sediment, and other areas of hard unchanging bottom where currents sweep them clean.

What forms sediment in our lakes?
The sources of this sediment are typically fivefold:

- Organics from surrounding wetlands and forests that blow or wash into the lakes and accumulate in quiet bays as thick black peat (i.e. windfall)
- Inorganic material that washes off the land or is scoured by rivers and streams, and is aggravated by storms, floods and forest fires (i.e. erosion)
- Inorganic material that accumulates as a very soft mud, being the re-precipitation of calcium carbonate from dissolved limestone in the watersheds of hard or semi-hard water lakes, which occurs as lake water warms in summer (i.e. marl)
- Organic muck that results from the fallout of dead algae or aquatic plants formerly suspended in the water column (i.e. aquatic fallout). (This is the infilling material of the eutrophication theory.)
- Finally, a mixture of organic and inorganic atmospheric fallout that falls on the lake and incoming river surfaces, then sinks to the bottom (i.e. atmospheric fallout).

These processes are often accelerated by human activities, save for the peat and marl accumulations, which are largely unaffected. In our area, this can be the fastest process. Lake Scugog, a hard-water lake, is reportedly filling in at the average rate of one millimetre per year, primarily from marl production.

Many of our local lakes have disappeared as a result of sedimentation, particularly due to marl production and accumulation. Just to the west of Balsam and Shadow Lakes is a limestone plain area of marl lakes, many of which have largely filled in or are nearing the end of their existence. Here, and elsewhere in the Kawartha Lakes area, these lakes can be seen in satellite images as vast shallow areas filled with light coloured marl, often ringed with encroaching wetlands.

Google

Raven Lake near Kirkfield is reaching the end of its life. The area used for marl extraction is seen as the deep area in the SE part of the lake. The lake is shallow, boggy near shore, and mostly unnavigable.

Some of these lakes were used for marl extraction a century ago for the production of cement, notably Buckley Lake near Lakefield, and Raven Lake north of Kirkfield and west of Balsam Lake. There are, as well, a number of swamps or bogs in the region that likely started out as lakes, and have since filled in and converted to bogs, many of which now support treed areas or even forests.

Sandy, Big Bald, Chemong and Julian lakes are the other lakes in our area most vulnerable to the marl sedimentation process, as most of their watersheds are composed of marble (metamorphosed limestone), sedimentary limestone, or such derived material. Big Bald Lake is a recent addition to this list. Once it had the soft-water Mississagua River flowing through it, preventing marl precipitation (see separate story *Restoring the Mississagua River's Domain*). It will likely be thousands of years however before any of these lakes will be completely filled in by marl.

Other lakes have been the victim of significant **river-borne sedimentation**, notably Little Bald Lake and former small lakes connected to Lower Buckhorn and Big Bald Lake. This has been partly natural, and partly due to human activity. The watersheds of the Miskwaa Ziibi and Mississagua rivers include areas of thin rocky soils vulnerable to forest fires and the erosion that often follows. Accordingly, large amounts of soil have washed off the rocky landscape and down these rivers from time to time, depositing tonnes of silt in the receiving lakes. This was greatly aggravated by the logging of the 19th century, when workers clear cut huge areas, removed the logs, and left everything else to dry in the sun. The resulting forest fires burned off most of the soil humus and left the remaining mineral soil exposed to the elements. This soil soon washed off into these streams. As a result, large portions of Little Bald Lake are now marshland, particularly along the Squaw River channel. The Mississagua River, which at that time still retained its two outlets, discharged its sediment load into small basins located at the end of each channel.

The west channel's basin, located between Big Bald Lake and County Road 36 just north of Buckhorn, exists today as a large marshland with scattered scrub trees. This basin accepted most of the sediment before it reached Big Bald Lake. The east channel discharged into a basin located just north of County Road 36 east of Buckhorn. It appears to have retained most of the sediment prior to proceeding into Lower Buckhorn (a.k.a. Upper Lovesick) Lake. However, we can't know how much may have escaped into Lower Buckhorn because the main Trent River flow would have swept away any sediment that approached the main channel. Today, the Mississagua's east channel flows through a huge wetland before it passes under C.R. 36 and on into Lower Buckhorn.

Google

Little Bald Lake, left, and Big Bald on the right. At upper left, note the marshy shallows at the mouth of the Miskwaa Ziibi, with the 'Squaw River' flowing through it. The marsh to the east of Big Bald Lake is at the mouth of the west channel of the Mississagua River, of which the east channel is just visible at the extreme right. As well, we see a small marl lake surrounded by encroaching marsh just southeast of Big Bald Lake. In the 19th century, clear cutting, forest fires, and resulting soil erosion contributed to the development of these marshy areas.

In terms of contrary processes, there are two, both of which occur in our area lakes. One is **isostatic rebound**, discussed in earlier KLSA articles. This is the return of the land to elevations that existed prior to the weight of the glaciers depressing it down. In our area, the land to the northeast rises faster than that to the southwest, given that the glaciers retreated to the Laurentian area of Quebec. This means that the landscape is slowly tilting back, and lakes with their outlets to the northeast are being inexorably dammed up by a rising outlet, whereas those with their outlets to the southwest are being slowly drained out. Accordingly, this can either compensate for the sedimentation process, or aggravate it.

The water level in our largest basin is rising (Lake Kawartha or Great Buckhorn, also known as the tri-lakes as described in previous KLSA reports.[1]). Since this is our shallowest system, this is a good thing. On the other hand, Stony and Clear Lakes are slowly being emptied out. Fortunately, they are in one of our deepest basins with a slow sedimentation process, so they are likely to remain in existence for a considerable time.

The other mitigating process is **human activity**. Centuries of sedimentation or isostatic draining can be counteracted instantaneously by the construction of a dam on a lake's outlet. All of our local lakes, save for White, Four Mile, Julian and Big Cedar, have been raised by damming. The Shadow Lakes are also controlled, albeit not raised particularly, by the dam at Coboconk. Dredging is also a counteracting measure, but this is usually only applied in specific areas, for example in navigation channels as opposed to a lake-wide measure.

KLSA is concerned about those activities speeding up the demise of our lakes, particularly the nutrient-fueled process of eutrophication. To a large degree, the agricultural land erosion problem that has added large amounts of both organic and inorganic material to our lakes in the past has been tackled, or is being tackled, so we have focused our efforts on reducing nutrient enrichment. This effort also improves the aesthetic aquatic environment, and presumably enhances the natural environment too, if only because we are helping the lakes to be more 'natural'. There is little that we can do about all other sediment processes. Presumably they do not adversely affect the flora and fauna of our lakes unduly, because they could be expected to be adapted to this natural process.

We cannot eradicate lake sedimentation. However, if we can slow down the accumulation, and give the algae/weed sourced sediment more time to decay and re-dissolve in the water column, we may be able to slow or even reverse one aspect of the infilling process. Then we only need to ensure that the dissolved material is flushed out of the system.

1 KLSA. *The Root of the Matter: Lake Water Quality Report 2008* and KLSA. *A Decade of Stewardship: Lake Water Quality Report 2009.*

Big Cedar Lake Stewardship Association Milfoil Project

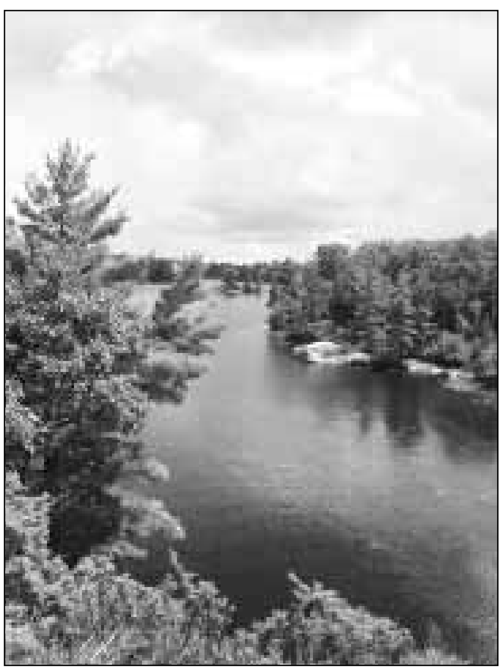
John Graham, Vice President, Big Cedar Lake Stewardship Association

Big Cedar Lake has 130 homes and cottages and is situated in the municipality of North Kawartha. To the north is the Kawartha Highlands Provincial Park, to the west Coon Lake and to the southeast Julian Lake. Big Cedar Lake drains into Eels Creek.

Big Cedar Lake by Google Earth

Big Cedar Lake has until recently been one of the most pristine lakes in the Kawarthas. In many respects it still is – low in Phosphorus (P) and *E.coli*, and with excellent clarity. However it became invaded first with zebra mussels and now Eurasian watermilfoil (EWM).

EWM became a serious problem in the last several years. Residents speculate that the first stands started at the west end of the lake and rapidly expanded along the south shore, filling in bays and behind islands. It has now reached the eastern end and is gradually inundating the northern shore. These dense EWM beds inhibit swimming, boating and fishing which could have an impact on property values.



Milfoil bed in the most western bay of Big Cedar Lake

David Clutton Jr.

Lake residents had tried various methods of control: mats, mechanical harvesting, hand raking and cutting. Some methods provided opportunities for the spread of EWM and none were effective for long-term control.

In the summer of 2010, a committee was formed to look into a long-term solution to reduce and control the EWM. Information gathered illustrated the potential for a biological solution using weevils (*Euhrychiopsis lecontei*) that preferred EWM as their host. The weevil was a very appealing option, since it is a native insect, has no negative impact, its use is significantly less expensive than hand harvesting, and it has the potential for a long-term solution.

There were several reported successful Ontario projects using weevils as control: Lake Scugog (Port Perry), Puslinch Lake (Cambridge) and Clear Lake (Espanola). There were also several lakes in New York State that reported success. Other information influenced the committee's direction: Kawartha Lake Stewards Association interest in the EWM problem and the decision of the City of Sudbury to invest in a multi-year project, stocking several area lakes. On the basis of the data gathered, the Committee invited EnviroScience to visit the lake and present a proposal.

- The EnviroScience proposal is to establish a self-sustaining weevil population that keeps the milfoil below nuisance levels.
- Once a self-sustaining population is achieved, management costs drop significantly and only occasional monitoring of the weevil and milfoil levels should be necessary.
- Long-term monitoring is an important component for the milfoil management program.
- The length of time needed for the weevils to achieve lake-wide control is proportional to the number that are stocked and the size of the milfoil infestation.

Noticeable weevil activity during the first stocking season may be limited and will usually be restricted to the immediate stocking areas. Over the course of the next two to three years, the weevils will move from the stocking areas and spread out around the lake, ultimately reaching the density required to control the milfoil within 2 to 5 years.

A five year initial plan was adopted:

2011 – 30,000 5 sites	2012 – 30,000 5 sites	2013 – 20,000 undetermined	2014 – 15,000 undetermined	2015 - survey

With the EnviroScience proposal in hand, no mechanism to contract the work existed and there was limited time to raise funds for the project, knowing that most if not all the funding must come from the lake residents and cottagers.

The Big Cedar Lake Stewardship Association was formed in 2011. Its objectives were:

- The preservation and improvement (or regeneration) of the environmental health of Big Cedar Lake in the Province of Ontario and its surroundings
- Serving as a focal point for Big Cedar Lake stewardship and improvement projects
- Providing information concerning matters related to the Big Cedar Lake community
- Providing a forum for Big Cedar Lake users to meet and get to know each other.

Using tax roll numbers, the Association contacted the residents and cottagers of the lake, presented the problem and its proposed solution and solicited support. There was a 65% favourable response, enough it was reasoned, to go forward.

In 2011 the Association raised $39,000 from 80 contributors, an average of $487 per contributor. In 2012 there were 81 contributors; the contribution requested was reduced to $350, raising approximately $29,000. Due to an early ability to pay for the stocking in 2012, the Association received a discount. For both years, individual contributors could purchase additional weevils to stock around their shoreline at a cost of $1500 for 2000 weevils.

The Association applied for grants from various non-governmental and government ministries:

- 2011 September - Cottage Life, Cottage Life Environment Grant - application for $2,000 was unsuccessful.
- 2011 November - Environment Canada (EC), Invasive Alien Species Partnership Program (IASPP) - program was cancelled following our application for $33,282 over three years.
- 2012 February - Ministry of Natural Resources (MNR), Community Fish and Wildlife Involvement Program (CFWIP) - application for $4,000 was unsuccessful.
- 2012 September - Cottage Life, Cottage Life Environment Grant - application for $2,000 was unsuccessful.
- 2012 October - Ministry of the Environment (MOE), Great Lakes Guardian Community Fund (GLGCF) - application for $8,984.52 was unsuccessful.

Milfoil Progress Report for 2011

In 2011 stocking began on August 9th, 11th and 15th. The weevils were raised on milfoil from lakes in the Sudbury area. There was concern that the lateness of the stocking would lower the success of the first year project, even though it had been initially anticipated that the results in year one would be minimal.

The final survey was conducted mid-September with some encouraging results.

- Based on results from the 2011 initial and follow-up surveys, it appears that Big Cedar Lake contains the conditions necessary to support an augmented weevil population.
- Weevil population density has increased at six of seven sites from the initial (pre-weevil stocking) survey to the follow-up survey. This statistic is highly encouraging as it is often typical to find very few weevils on 30 randomly-collected stems within a large site. However milfoil densities also increased indicating the weevil population is yet unable to keep up with the increase in milfoil density. This was expected - over time as the weevil population grows, milfoil density is expected to decrease.
- Milfoil samples from all sites exhibited indicators unique to a weevil population such as holes in the stems and extensively damaged areas where larvae have burrowed through the stems.

Milfoil Progress Report for 2012

Partly based on the recommendations in the 2011 milfoil report, 35,000 weevils were stocked at six sites on July 1st and 17th, 2012. The summer of 2012 had ideal conditions for milfoil growth across Ontario. Thus Big Cedar Lake, like many other lakes, saw an increase in milfoil density.

The results were more encouraging from this year's stocking. There was significant damage to the milfoil not only in the sites stocked but throughout the lake. A large percentage of plants were discoloured, brittle and bent over. With lower water levels this year, the plants did not reach the surface and there were open areas within the sites.

Clearly this is a catch-up game. Milfoil is still growing but it is hoped that with the continuation of the milfoil project the milfoil can be reduced to a manageable level.

Plans and challenges

- Continue the stocking program in 2013 at the earliest possible date.
- Enlist stronger support from the residents and cottagers of Big Cedar Lake to reduce the cost per participant, emphasizing that suppressing this invasive species will be gradual and will require continued support.
- Encourage property owners to establish natural shoreline habitat to provide optimum overwintering conditions for weevils. Successful overwintering will maintain a healthier population.
- Educate residents on how the spread of EWM can be minimized.
- If and when there is a substantial reduction of EWM, establish a monitoring program and keep owners aware that EWM could reappear if not kept in check.
- Keep residents engaged in the Association and encourage active participation.

The full 2012 Milfoil Report can be found on the Big Cedar Lake Stewardship Association's web site: http://www.bclsa.ca/weevil

Where Does The Milfoil Weevil Spend The Winter?

Janet Duval, KLSA Director

In lakes where the milfoil weevil is found, populations of this native insect seem to decline over the years, despite the ready source of their favourite and only food source. Does something happen to weevils during the winter? Trent University student Colin Cassin tried to find out during the winter of 2011 – 2012.[1]

Previous research in other areas had shown that weevils migrate to shore each fall when water temperatures range from 10 to 15°C, nestling into leaf litter and other debris up to six metres from the water's edge. Choosing his sites carefully, Colin took multiple soil samples at various depths and in differing ecozones near the water's edge on Lower Buckhorn and Pigeon Lakes.

Surprisingly, no weevils were found in any of the test samples. Why not? He noted that the coldest mean temperatures were at the leaf litter sites, at depths of both 2 cm and 15 cm. According to other studies, it's leaf litter that weevils prefer, supposedly because of its insulating value. "Leaf litter did not provide the insulation against the cold as expected," he wrote. "This study raises doubt about how weevils actually overwinter in the Kawartha Lakes, as methods that work in more southern regions seem to be ineffective here."

The study was done during one of the mildest winters on record, with little snow cover to provide extra insulation. Could this be why no weevils were found? Some weevils survived into summer 2012, but where did they do it? Is it possible that some are able to overwinter on the milfoil plant itself?

"It's a bit like searching for a needle in a haystack," says Colin's supervisor, Professor Eric Sager. "Just because we didn't find them doesn't mean that they aren't there! Given the healthy populations densities that we find in the lakes, I expect this suggests that, in addition to overwintering onshore, some must be overwintering in some form within the lake as well."

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1 Cassin, Colin. April 2012. *The overwintering ecology of the milfoil weevil (Eurichiopsis lecontei) in the Kawartha Lakes area*. Senior Undergraduate Thesis Course, Environmental Resource Science Department – Trent University, Peterborough

Restoring the Mississagua River's Domain: Water Quality Benefits Worth Investigating

Kevin Walters, KLSA Vice-Chair


Kevin Walters

Mississagua River – Scotts Mills Dam

In our 2008 Report, we wrote about the Mississagua River and how physical evidence revealed the existence of a west channel of the River that formerly fed into Big Bald Lake via the long narrow (and former river) channel at the northeast end, where Catalina Bay Resort is located. Where the main river had formerly split, this branch is blocked off by an earth and stone dam, likely constructed by the lumbermen of Scotts Mills, which was located just downstream along the east branch. The lumbermen would, no doubt, have wanted all the river water to operate their mills. As a result, water that formerly flowed through the Bald Lakes, Pigeon Lake and Buckhorn Lake now bypasses those lakes to flow exclusively into Lower Buckhorn Lake (or Upper Lovesick Lake, but that is another story). Scotts Mills was undoubtedly located on the eastern branch owing to the greater drop, given that this reach includes the drop of the Trent-Severn Waterway (TSW) dam at Buckhorn, whereas the west branch did not.

It is unfortunate that this was the better branch for the mills, given that we are experiencing nutrient water quality issues on many lakes creating weed and algae problems.

The Mississagua River is a very low nutrient stream, flowing out of the cluster of lakes just to the north, being Mississagua, Catchacoma, Gold, Cold, Beaver and others. The nutrient level in the water is no doubt further reduced as it flows along the length of the river downstream of the Mississagua dam. It has a significant flow rate, averaging around 100 cubic feet per second (35 m^3/s), which is relatively constant year-round owing to the large reservoir of impounded lakes and the operation of the dam by the TSW. The resulting flow into Lower Buckhorn Lake dilutes the relatively high nutrient level of the main water coming into it via Buckhorn Lake, and produces a better lake water quality.

Along the chain of lakes now deprived of its share of the flow of the Mississagua, we first have Big Bald Lake, with an average water quality, but a high vulnerability to inputs from increasing development within its small watershed, and correspondingly very low flushing rate. Weeds, as in most of the Kawartha Lakes, are plentiful.

Next we have Little Bald Lake, a lake with extensive shallows filled with rice beds and other aquatic plants. Most if its water currently comes from the Miskwaa Ziibi, a large creek that drains a mostly undeveloped

Kevin Walters

Earth and stone barrier dam

watershed with extensive areas of rock barrens, swamps and other wetlands. This produces very dark brown water stained with tannins, and with moderate nutrient levels, all leached from the wetlands. As a result, Little Bald Lake is a 'distrophic' lake, tea-coloured and fairly weedy.

Next on the flow path is Pigeon Lake. Like Sturgeon above it, this lake has been the recipient of substantial inputs of nutrients like phosphorus from both agriculture in the region and stormwater runoff from the three towns at Sturgeon's extremities and sewage from those same towns. Initially, it was raw sewage, later, treated sewage, but without removal of phosphorus. Only in recent decades has this very influential nutrient been limited, both by regulations limiting its use in products ending up in the sewage stream, and by specific-process removal at the treatment plants. What once had been over ten tonnes of phosphorus dumped into our waterways annually has been reduced to a few hundred kilograms.

But a sizeable portion of that added phosphorus is still in our lakes, having settled to the bottom as a rich mud, a superb bed for prolific weeds. These weeds now enjoy renewed sunlight reaching to the depths, from water clearer than it has been for a century.

Pigeon, and therefore Buckhorn, and to a lesser extent Chemong, have acquired this nutrient-rich bottom that supplies the weeds which later die off and re-release the nutrient to the lake along with phosphorus that re-dissolves directly into the water from the sediments on its own. This latter process occurs primarily during late summer and very early fall, as the waters warm, and oxygen levels in the lake water fall nearer to the lake bottom. This creates what is known as an anoxic condition, and phosphorus is released from the sediments. During this period, we see phosphorus levels rise very perceptibly in these lakes, whereas it is more common in other less nutrified lakes to see these levels fall or remain stable in the same time period. Unfortunately, the period of this rise in phosphorus corresponds to the period in which the flow rate through the TSW is usually at its minimum, meaning that just at the time when we have all this dissolved phosphorus in the water, we have the least flow with which to flush it out.

Re-releasing phosphorus from the sediments might be nature's way of re-establishing an equilibrium between nutrient-rich sediment and relatively low nutrient water above. If the process of producing the rich mud took decades, it may well be decades before the sediments are able to release the excess back to the water. It would seem then, that critical to hastening that process is having nutrient levels as low as possible in our incoming water, and maximum flow-through rate to flush out the nutrients that dissolve into the water, particularly during the periods of sediment release and aquatic plant die-off and decay.

Accordingly, while the Kawartha Lake Stewards Association (KLSA) remains vigilant towards minimizing nutrient inputs from the land to the lakes, it now looks to what could be done to enhance that flushing rate. Restoring the high-flow, low-nutrient Mississagua River to its western channel to Big Bald Lake is likely the only practical way we can do this, since we can't influence the amount of rain that falls from the sky.

The main advantages of having the Mississagua River available to us as a flushing agent are that this is a particularly low nutrient stream with a substantial and well-regulated volume. Its flow amounts to about one-sixth of the flow through the Lovesick Lakes during dry summer weather. Routing the flow upstream along our lakes starting at the Bald Lakes would benefit that vast central body, which I have labeled as 'Lake Kawartha' or 'Great Buckhorn', which happens to be our shallowest and most weed-plagued lake basin. In fact, we can ascribe a certain portion of our nutrient and weed problem in this basin to the fact that the Mississagua River was diverted away from it.

The TSW reservoirs could be a part of the answer as well, since they influence the timing of the water flowing through the system, although not the total amount. This would require releasing a larger flow during our anoxic late-summer period, which would necessitate lowering water levels on the reservoir lakes during this period. We expect that this would be unpopular on those lakes, so perhaps the best we can ask for is to at least maintain the status quo.

Kevin Walters

Old river channel downstream of barrier dam (now a beaver pond)

Utilizing the Mississagua River as a flushing enhancement appears to have no negative impacts elsewhere.

The division of flow between the east and west branches could be strictly regulated by the Scotts Mills dam, still in serviceable shape, and in the TSW's possession. This dam sits on the east channel just northeast of the big bend on C.R. 36 just north of Buckhorn. While the Bald Lakes in particular would enjoy crystal clear water with diminished weed growth, and greatly reduced vulnerability and Pigeon and Buckhorn would see noticeable water quality improvement with a faster nutrient depletion rate, no one suffers a corresponding disadvantage. Lower Buckhorn, and the lakes downstream, would still receive the same flow rate, with similar water quality, albeit marginally more enriched while Pigeon and Buckhorn Lakes are flushed of their excess nutrients at a faster rate. It is unlikely that the difference here would be detectable by the casual observer. As well, even if most of the Mississagua River was directed down the west channel, the east channel would continue to convey the flow from its major tributary, Buckhorn Creek, which joins with the east channel about halfway along its route leading to Lower Buckhorn Lake.

Meanwhile, Big Bald Lake would likely end up being the lake with what we would consider the 'highest' water quality in the central Kawarthas, matching or exceeding that of the Mississagua-Catchacoma chain to the north, followed by Little Bald Lake.

The old river channel leading into Big Bald Lake where Catalina Bay resort is located would experience a constant flushing with the clear Mississagua flow, and would have some of the lowest nutrient levels found on the TSW system.

Even without any such benefits, restoring this river channel would seem to be the right thing to do: restoring a long lost waterway, for its own aesthetic and environmental benefits. Additional fish habitat and riparian areas are restored, and the rapids that could be expected in the vicinity of the crossing of C.R. 36 would add additional scenery to the area. New canoe route opportunities would be created, both a circle route around


Kevin Walters
Old river channel upstream of barrier dam

'Lake Kawartha' via the Mississagua River channels, and a route to or from Kawartha Highlands Park from the Bald Lakes.

The expense and impacts are likely quite low, as the entire stretch of land affected is undeveloped, and we are talking about restoring a river to its former channel, still in existence, as opposed to creating a new one.

The Scotts Mills dam would require refurbishment (like so many TSW dams), (see photos), and a new bridge or culvert would be needed under C.R. 36 where the river crosses, and where a mere 4-foot +/-steel culvert exists to handle the small remnant creek. Of course, the old channel is now filled with trees and/or marshland, and this would need clearing out to minimize the wash of organic debris that would otherwise be flushed into Big Bald Lake with the river's return. Finally, the earth and stone dam (see photos) would need either breaching or complete removal, along with the return of stop logs into the Scotts Mills dam, to raise the water level and send flows back down the west channel. Over time, it is likely that this water level could be lowered again somewhat, as the river re-scours the west branch to former elevations. However, the dam would remain useful to regulate the amount of flow utilizing either branch.

The earth and stone barrier sits in Kawartha Highlands Provincial Park, while Scotts Mills dam sits on land owned by the TSW. C.R. 36 is owned by the County, so all key sites are under the control of government. Before anything happens to the earthen dam, we would like to see an archeological investigation undertaken to answer the questions as to how, when, and why this barrier was constructed, and by whom.

Any private property owner who would find their property re-coursed by the restored river would also benefit. We would ideally want the bed of the river surveyed and placed in the public domain, and the land owners would then find their lands severed into two parts –two building lots instead of one; both of which would now be waterfront.

As this seems to be a project that would have major benefits for the central Kawartha Lakes area, this is one that KLSA will be investigating further. First we will need to find funding for the studies needed to determine the cost and impacts of the work, and then funding to implement it, should it prove as feasible and beneficial as it appears to us.

Appendix A

KLSA Mission Statement, Board of Directors & Volunteer Testers

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.

2012-2013 Board of Directors

Mike Stedman, Chair
Lakefield

Kathleen Mackenzie, Vice-Chair
Stony Lake

Kevin Walters, Vice-Chair
Shadow, Lovesick and Sandy Lakes

Chris Appleton, Treasurer
Sturgeon Lake

Ann Ambler, Secretary
Lovesick Lake

Sheila Gordon-Dillane, Recording Secretary
Pigeon Lake

Tom Cathcart, Director
Peterborough

Jeffrey Chalmers, Director
Clear Lake

Mike Dolbey, Director
Katchewanooka Lake

Janet Duval, Director
Lower Buckhorn Lake

Doug Erlandson, Director
Balsam Lake

Mike Frings, Director*
Pigeon Lake

*until October 1, 2012

Scientific Advisors

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

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

Volunteers Testers, 2012

Balsam Lake – funding provided by *Balsam Lake Association, North Bay Association, Driftwood Village, Killarney Bay Association*.

Volunteers: Ross Bird, Catherine Couchman, Douglas and Peggy Erlandson, Leslie Joynt, Barbara Peel, Diane Smith, Jeff Taylor, Bob Tuckett, Maryanne Watson, Steve and Laura Watt

Big Bald Lake - *Big Bald Lake Association*: Heathyr Francis, Colin Hoag

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

Buckhorn Lake – *Buckhorn Sands Property Owners*: Jackie Shaver

Cameron Lake - Ruth Pillsorth

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, Ann Ambler

Lower Buckhorn Lake – *Lower Buckhorn Lake Owners' Association*: Jeff Lang, Peter Miller, Mike Piekny, Mark and Diane Potter, Harry Shulman, Dave Thompson

Pigeon Lake – *Concession 17 Pigeon Lake Cottagers Association*: Jim Dillane, Sheila Gordon-Dillane
Pigeon Lake – *North Pigeon Lake Ratepayers' Association*: Tom McCarron, Francis Kerr
Pigeon Lake – *Victoria Place*: Ralph and Nona Erskine

Sandy Lake – *Sandy Lake Cottagers Association*: Mike and Diane Boysen
Sandy Lake and Little Bald Lake – *Harvey Lakeland Commonlands Association (Harvey Lakeland Estates)*: Brian and Marg Norman

Shadow Lake and Silver Lake - Phil Taylor, Dave Parsons, Eveline Eilert

Stony Lake – *Association of Stony Lake Cottagers*: 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 Stoney Lake - *Upper Stoney Lake Association*: Karl, Kathy, Ken and Kori Macarthur, and their Golden Retriever Kooper

White Lake – *White Lake Association*: Wayne Horner

Appendix B: Financial Partners

Thank You to Our 2012 Supporters

Federal Government Contributions
Trent-Severn Waterway (Parks Canada)

Provincial Government Contributions
Ontario Trillium Foundation

Municipal Government Contributions
City of Kawartha Lakes
Township of Douro-Dummer
Township of Galway-Cavendish & Harvey (Trent Lakes)
Township of Smith-Ennismore-Lakefield (Selwyn)

Community Association Donations
Balsam Lake Association
Big Cedar Lake Road Committee
Big Cedar Lake Stewardship Association
Birchcliff Property Owners Association
Buckhorn Lake Estates Rate Payers Association
Buckhorn Sands Property Owners Association
Deer Bay Reach Property Owners Association
East Beehive Community Association
Harvey Lakeland Cottage Owners Association
Jack Lake Association
Killarney Bay ~ Cedar Point Cottage Association
Lovesick Lake Association
North Pigeon Lake Ratepayers' Association
Shadow Lakes Association
Stinson's Bay Property Owners Association
Stony Lake Heritage Foundation

Private Business Donations
Buckeye Marine
Camp Kawartha
Clearview Cottage Resort
Egan Houseboat Rentals
Pinewood Cottages and Trailer Park Ltd.
Reach Harbour Marina
Rosedale Marina
Scotsman Point Resort

Individual Donations
Mary Auld
David Bain
Monica Berdin
Robin Blake
Eleonore and Thomas Boljkovac
Robert Brown
Mike Dolbey
Janet Duval
Rocky and Debbie Gaetan
Gabrielle Garcia
Patricia and Robert Green
David Heaman
Allan J. Heritage
Edward (Ted) and Mary Hill
Barry and Carol Hooper
Anne Hurd
Ralph Ingleton
Barbara Karthein
Jim Keyser
Ken King
Robert and Penny Little
Carol McCanse
Peter Miller
Lou and Judy Probst
Claudio Rosada
Kay (Kathleen)Ross
Linda Trott
Jelle and Karen Visser
Jim Watt
John Williamson
Maria and Alan Williamson
Two anonymous donors

Many thanks to all of our generous donors

Appendix C: Treasurer's Report

March 8, 2013

Chris Appleton, Treasurer; Mike Stedman, Chair

Attached are financial statements showing Revenue, Expenditures and Net Assets for the Kawartha Lake Stewards Association for the years 2012 and 2011. The financial statements have been reviewed by McColl Turner LLP Chartered Accountants in Peterborough, Ontario. A copy of their Review Engagement Report is included. Our thanks to George Gillespie for his continuing support of KLSA.

The Statements show that KLSA had a loss of $11,770 in 2012. The 2012 budget had forecasted a loss of about $22,000, due primarily to two major expenditures: 1) completion of the Algae Project (funded by advances from the Ontario Trillium Foundation in 2011 - see below), and 2) $10,000 towards the Miskwaa Ziibi River Study conducted by Paul Frost of Trent University (funded from 2011 surplus). Fortunately, the 2012 loss was less than forecast due to lower than expected expenses and higher than expected revenue. In summary, 2012 results were better than expected by about $10,000.

The Statements show that KLSA had Net Assets of $17,696 at year-end 2012. The Board considers that $10,000 is available for project funding. New projects are being considered, but no commitments have been made at this date.

The Algae Project was completed in 2012 in collaboration with Trent University. It was funded by an Ontario Trillium Foundation grant. OTF monitored progress through regular reports. OTF has confirmed that the project has been completed in accordance with the terms of the grant.

KLSA thanks the Stony Lake Heritage Foundation for its continuing support in accepting donations on behalf of KLSA and providing charitable receipts.

Janet Duvall

Cottage life

Financial Statements of

KAWARTHA LAKES STEWARDS ASSOCIATION

December 31, 2012

Note To The Financial Statements
December 31, 2012

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.

In 2010, the Association collaborated with Trent University on an Algae Project with funding from the Ontario Trillium Foundation. The project is a 27 month study and has concluded in 2012 with no further funding from Ontario Trillium Foundation while expenditures to conclude the project totalled $7,835 in the current fiscal year (2011 – $20,000).

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
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www.mccollturner.com

REVIEW ENGAGEMENT REPORT

To Mr. Chris Appleton, Treasurer
KAWARTHA LAKES STEWARDS ASSOCIATION

We have reviewed the statement of financial position of Kawartha Lakes Stewards Association as at December 31, 2012, December 31, 2011 and January 1, 2011 and the statement of operations for the years ended December 31, 2012 and 2011. Our reviews were made in accordance with generally accepted standards for review engagements and accordingly consisted primarily of inquiry, 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 upon our reviews, 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.

We draw attention to the fact that Kawartha Lakes Stewards Association adopted Canadian accounting standards for not-for-profit organizations on January 1, 2012 with a transition date of January 1, 2011. These standards were applied retrospectively by management to the comparative information in these financial statements, including the statement of financial position as at December 31, 2011 and the statement of operations for the year then ended. We further report that the adoption of Canadian accounting standards for not-for-profit organization did not result in any adjustments to the previously reported assets, net assets and results of operations of the Association.

McColl Turner LLP
Licensed Public Accountants

Peterborough, Ontario
February 27, 2013

KAWARTHA LAKES STEWARDS ASSOCIATION

Statement of Financial Position - December 31, 2012

	(Unaudited) 2012	2011
ASSETS		
Current Assets		
Cash	$ 12,696	24,466
Guaranteed Investment Certificate	5,000	5,000
	17,696	29,466
NET ASSETS	17,696	29,466
	$ 17,696	$ 29,466

Statement of Operations
Year ended December 31, 2012

	(Unaudited) 2012	2011
REVENUE		
Parks Canada, Trent-Severn Waterway	$ 3,000	$ 3,000
Ontario Trillium Foundation Grant	-	36,000
Municipal grants	5,876	5,755
Associations	1,910	2,110
Private contributions	3,165	2,300
Water testing fees	5,795	4,145
Interest		40
	19,746	53,350
EXPENDITURES		
Water testing fees	5,817	5,546
Algae project / Aquatic plant project	7,835	20,000
Miskwaa Zibii River Study	10,000	-
Annual report costs	4,770	6,275
Insurance	1,637	1,599
Telephone, copies and other administrative costs	1,257	2,692
Bank charges	200	66
	31,516	36,178
EXCESS OF REVENUE OVER EXPENDITURES (EXPENDITURES OVER REVENUE) FOR THE YEAR	(11,770)	17,172

Appendix D: Privacy Policy

Jeffrey Chalmers, KLSA Privacy Officer

As a result of recent 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
RR #3 Lakefield, ON K0L 2H0

Appendix E: Rationale for *E.coli* Testing and 2012 Lake-by-Lake Results

Kathleen Mackenzie, KLSA Vice-Chair

Choosing sites

The goals of this testing were 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 .

Why did we test for *E.coli*?

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, such as in the Walkerton tragedy, or occasionally in 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.

Note: <3 means less than 3.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Balsam Lake							
2012 *E.coli* Lake Water Testing *E.coli*/100 mL							
Site	**3-Jul-12**	**23-Jul-12**	**27-Jul-12**	**30-Jul-12**	**7-Aug-12**	**13-Aug-12**	**5-Sep-12**
00	<3	13	--	3	3	3	16
01	3	<3	--	<3	3	3	<3
02	5	--	<3	3	<3	--	3
03	<3	5	--	<3	<3	3	<3
04	3	5	--	3	<3	<3	--
05	8	13	--	<3	11	3	3
06	<3	<3	--	8	<3	3	<3
07	<3	5	--	16	<3	<3	<3
08	<3	--	--	3	28	16	5
12A	8	5	--	8	<3	<3	11
12B	8	<3	--	3	<3	11	<3
12C	<3	16	--	<3	<3	3	<3

As in previous years, counts were low on Balsam Lake.

Big Bald Lake						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-12**	**23-Jul-12**	**30-Jul-12**	**7-Aug-12**	**14-Aug-12**	**4-Sep-12**
1	6	2	6	1, 0	1	121
2	18	4	14	0	1	26
3	0	5	2	1	0	14
8	0	0	0	0	0	1
9	0	2	4	1	2	21
10	0	0	0	0	0	4

Similar to previous years, counts were consistently low on Big Bald Lake. A large group of geese arrived at the end of August, which may have been responsible for the slightly elevated September results. Curiously, the geese were not particularly populous at Site 1, which had the highest reading.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Big Cedar Lake						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-12**	**23Jul-12**	**30-Jul-12**	**7-Aug-12**	**13-Aug-12**	**4-Sep-12**
640	0	3	4	2	2	2

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

Buckhorn Lake: Buckhorn Sands						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-12**	**23-Jul-12**	**30-Jul-12**	**7-Aug-12**	**12-Aug-12**	**3-Sep-12**
A	0	0	0	1	3	0
B	4	4	6	2	25	0
C	0	0	0	0	8	1
D	2	0	2	1	5	3

As in previous years, counts were uniformly low at all four locations tested in the Buckhorn Sands area.

Cameron Lake				
2012 *E.coli* Lake Water Testing *E.coli*/100 mL				
Site	**3-Jul-12**	**23Jul-12**	**30-Jul-12**	**7-Aug-12**
1	3	<3	<3	<3

This is the first year KLSA has received results from Cameron Lake. We hope to see more tests (and just as low!) in future years.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Clear Lake: Birchcliff Property Owners						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-12**	**25-Jul-12**	**2-Aug-12**	**7-Aug-12**	**20-Aug-12**	**5-Sep-12**
BB	18	1	0	0	0	1
1	0	3	4	0	0	0
2	0	1	0	1	1	0
3	2	0	12	36	4	40
4	0	1	0	6	1	4
5	2	0	2	3	0	0
6	0	1	4	6	0	5
7	2	0	2	0	0	2
8	2	2	132	60	6	1

Site 8 is near a shoal where birds tend to roost, and this would likely be the source of the elevated counts here on August 2 and 7. Otherwise, counts were low, as in previous years.

Clear Lake: Kawartha Park						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-12**	**23-Jul-12**	**30-Jul-12**	**7-Aug-12**	**13-Aug-12**	**5-Sep-12**
A	0	0	0	0	0	1
B	1	0	0	1	6	1
C	1	0	2	1	0	0
D	0	1	0	6	1	0
P	0	1	2	2	1	1
W	0	1	0	1	1	7

As in previous years, the Kawartha Park area exhibited very low counts.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Katchewanooka Lake							
2012 *E.coli* Lake Water Testing *E.coli*/100 mL							
Site	**2-Jul-12**	**3-Jul-12**	**23-Jul-12**	**30-Jul-12**	**7-Aug-12**	**13-Aug-12**	**4-Sep-12**
2	--	8	0	2	4	7	--
5	--	8	5	12	0	1	--
6	--	12	2	4	1	8	--
7	2	--	15	6	1	1	1

Counts were uniformly low on all sites on Katchewanooka Lake. In previous years, Site 2 and Site 5 have had occasional elevated counts, but there was no indication of this in 2012.

Lovesick Lake						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**2-Jul-12**	**22-Jul-12**	**30-Jul-12**	**7-Aug-12**	**13-Aug-12**	**4-Sep-12**
16	0	9	4	2	1	0
18	0	5	0	0	0	0
19	2	0	0	1	0	7

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

Lower Buckhorn Lake					
2012 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**3-Jul-12**	**23-Jul-12**	**7-Aug-12**	**13-Aug-12**	**5-Sep-12**
1	0	1	5	1	0
2	3	0	2	1	4
5	3	1	2	110	0
8	3	1	0	0	1
9	0	0	0	3	0
11	1	0	5	2	16
13B	--	--	--	0	--

There was no obvious reason for the high count at Site 5/Aug 13. All other readings were very low.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Pigeon Lake: Concession 17 Pigeon Lake Cottagers Assoc.						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-12**	**23-Jul-12**	**29-Jul-12**	**7-Aug-12**	**12-Aug-12**	**3-Sep-12**
A	0	1	18	1	18	0
B	0	0	44	1	3	3
3	0	2	18	4	24	1

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

Pigeon Lake: North Pigeon Lake Ratepayers' Assoc.				
2012 *E.coli* Lake Water Testing *E.coli*/100 mL				
Site	**5-Jul-12**	**24-Jul-12**	**10-Aug-12**	**4-Sep-12**
1A	19	11	48	12
5	6	20	26	0
6	4	35	16	3
8	1	15	0	0
13	1	4	18	8

In the past, Sites 5 and 6 have had occasional counts between 50 and 100, but counts have been consistently below 50 over the past three years.

Pigeon Lake: Victoria Place						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-12**	**23-Jul-12**	**30-Jul-12**	**7-Aug-12**	**13-Aug-12**	**5-Sep-12**
1	<3	<3	<3	<3	<3	3
2	3	3	<3	3	<3	13
3	3	<3	<3	<3	<3	8
4	5	<3	<3	3	8	11
5	<3	5	3	<3	3	25

All counts were low this year in Victoria Place.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Sandy Lake: Fire Route 48					
2012 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**2-Jul-12**	**22-Jul-12**	**6-Aug-12**	**23-Aug-12**	**9-Sep-12**
MD1	0	0	1	0	4
MD2	0	0	1	0	4

As in the three previous years, counts were uniformly very low on these Sandy Lake sites.

Sandy Lake & Little Bald Lake: Harvey Lakeland Estates							
2012 *E.coli* Lake Water Testing *E.coli*/100 mL							
Site	**12-Jul-12**	**23-Jul-12**	**30-Jul-12**	**2-Aug-12**	**7-Aug-12**	**13-Aug-12**	**4-Sep-12**
38	5, 7, 8	39	22	10	8, 13, 7	2, 7, 5	8
1258	2, 3, 2	4	0	6	0, 0, 1	2, 2, 2	0
1501	1, 3, 8	4	4	14	6, 10, 17	3, 5, 7	26

Counts were very low on these Harvey Lakeland sites.

Shadow Lake						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-12**	**23-Jul-12**	**30-Jul-12**	**7-Aug-12**	**13-Aug-12**	**5-Sep-12**
SH01	3	8	<3	16	<3	3
SH02	8	5	<3	--	<3	5

As in 2011, readings were very low on this Shadow Lake site.

Silver Lake					
2012 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**3-Jul-12**	**23-Jul-12**	**30-Jul-12**	**13-Aug-12**	**5-Sep-12**
SI01	<3	3	<3	<3	8

As in 2011, readings were very low on this Silver Lake site.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Stony Lake: Association of Stony Lake Cottagers									
2012 *E.coli* Lake Water Testing *E.coli*/100 mL									
Site	**3-Jul-12**	**4-Jul-12**	**23-Jul-12**	**30-Jul-12**	**31-Jul-12**	**7-Aug-12**	**13-Aug-12**	**14-Aug-12**	**4-Sep-12**
E	17	--	1	2	--	3	--	0	0
F	0	--	0	0	--	0	--	2	2
I	1	--	52	2	--	9	--	14	3
J	--	10	4	--	14	11	5	--	5
K	--	0	1	--	8	0	0	--	1
L	0	--	14	20	--	0	--	2	1
P	0	--	1	0	--	4	--	1	0
26	4	--	6	6	--	4	--	--	10
27	3	--	13	18	--	8	--	--	53
28	0	--	8	8	--	7	--	--	1

Counts were generally low on Stony Lake. There was no obvious explanation for the somewhat elevated counts at Site I/Jul 23 and Site 27/Sep 4.

Sturgeon Lake: North Shore Combined Group								
2012 *E.coli* Lake Water Testing *E.coli*/100 mL								
Site	**3-Jul-12**	**4-Jul-12**	**23-Jul-12**	**30-Jul-12**	**7-Aug-12**	**13-Aug-12**	**14-Aug-12**	**5-Sep-12**
NS2A	87	--	3	3	194	5	--	13
NS3	110	--	28	11	16	62	--	62
NS4	<3	--	5	<3	5	<3	--	<3
SB1	<3	--	<3	3	<3	3	--	13
WS1	19	--	5	<3	<3	19	--	33
SH	161	--	16	8	59	--	--	<3
S1	--	<3	--	<3	3	--	<3	--
S2	--	<3	--	36	5	--	5	--
S3	--	<3	--	3	3	--	3	--

The results for Sturgeon were typical of previous years; that is, mostly low but with several readings over 50 and a few over 100. These high counts are unusual for a Kawartha Lake. Further work is needed before the source of the elevated *E.coli* counts at these three Sturgeon Lake sites can be firmly identified. Are they coming from the sediments? From incoming streams (which may imply agriculture or wetland wildlife)? From swimmers or boats? The mystery remains, and the suspects are many.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Upper Stoney Lake: Upper Stoney Lake Assoc.						
2012 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-12**	**22-Jul-12**	**30-Jul-12**	**7-Aug-12**	**13-Aug-12**	**5-Sep-12**
6	2	9	10	9	11	109
20	6	9	10	7	1	30
21	0	1	2	4	0	14
52	8	11	6	15	22	24
65	2	3	0	2	1	8
70	0	0	2	2	2	1
78A	4	6	6	0	0	5

Readings were generally low on Upper Stoney Lake. The reading of 109 at Site 6/Sep 5 was most unusual for this site.

Janet Duvall

On the dock at sunset

Appendix F: 2012 Phosphorus and Secchi Data

Kathleen Mackenzie, KLSA Vice-Chair

Why test for phosphorus? Arguably, phosphorus is the chemical that does the most aesthetic damage to inland lakes. Phosphorus encourages algal growth, resulting in a turbid lake and eventually thicker, enriched sediments that are more likely to grow aquatic plants. The Ontario Ministry of the Environment's Interim Provincial Water Quality Objective for Total Phosphorus is as follows:

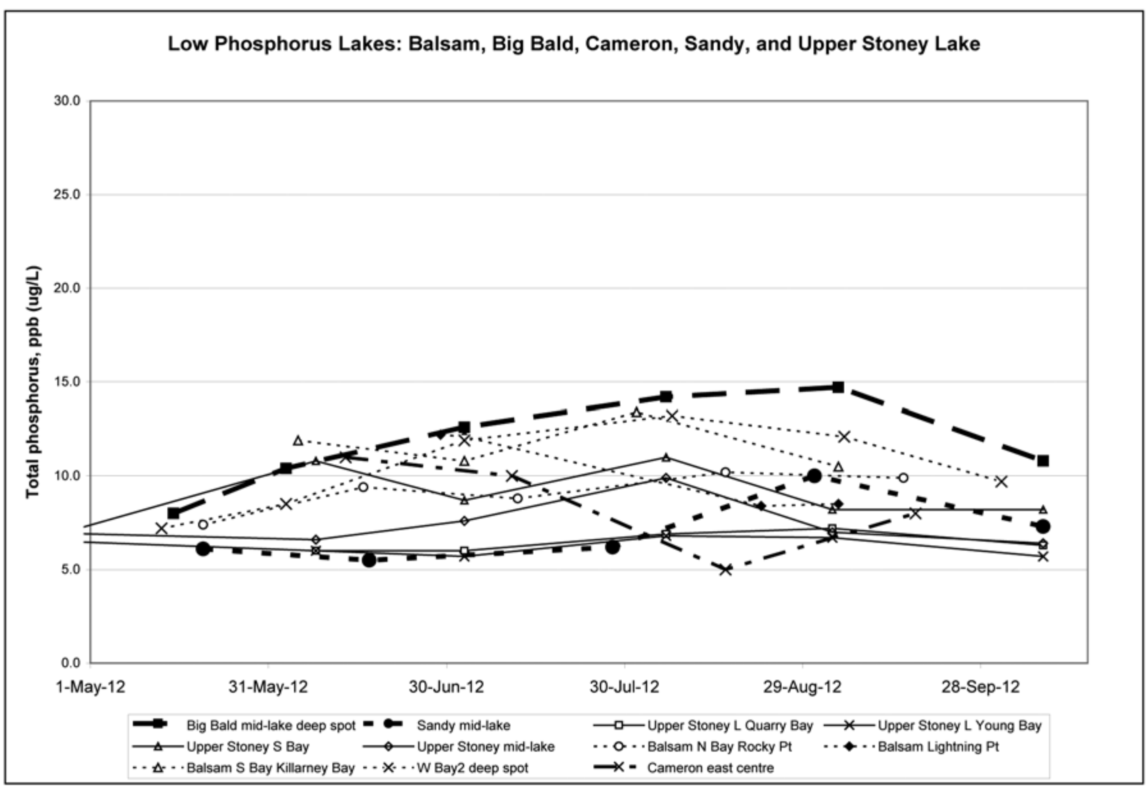
Current scientific evidence is insufficient to develop a firm Objective at this time. Accordingly, the following phosphorus concentrations should be considered as general guidelines which should be supplemented by site-specific studies:

- *To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20µg/L;*
- *A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10µg/L or less. This should apply to all lakes naturally below this value;*

Natural sources of lake phosphorus include rock, soil and decaying vegetation. Human sources include sewage treatment plants, septic systems, fertilizers, and urban and agricultural runoff.

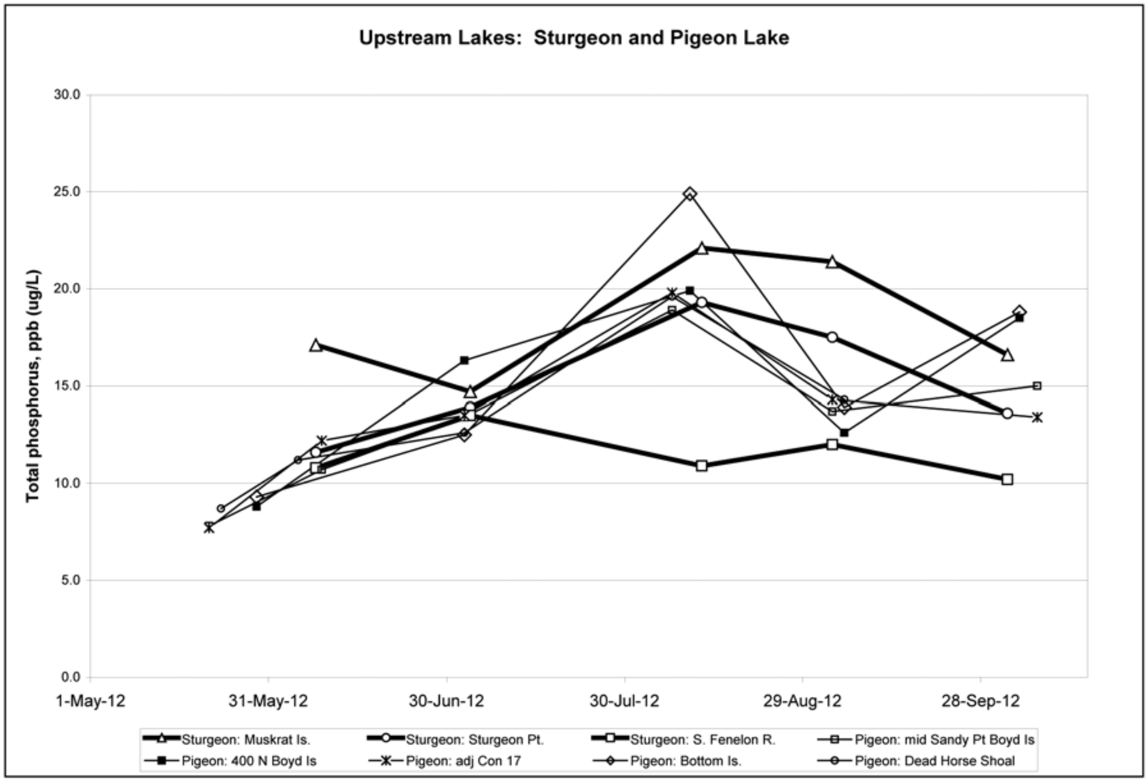
Phosphorus levels are constantly changing in the Kawartha Lakes. They change in each lake from month to month, and on any one date, phosphorus levels differ from lake to lake. And they are somewhat different from year to year! Tracking these fluctuating phosphorus levels helps us to understand the chemistry of our lakes.

Low Phosphorus Lakes: Away from urban and agricultural influences



These lakes reside in the northern part of the Kawartha Lakes region, where there are fewer people and less agriculture, and more forest and nutrient-poor granite. Their phosphorus curve is 'flat'; that is, levels stay below 15 ppb for the entire summer.

Upstream Lakes: A change in phosphorus character



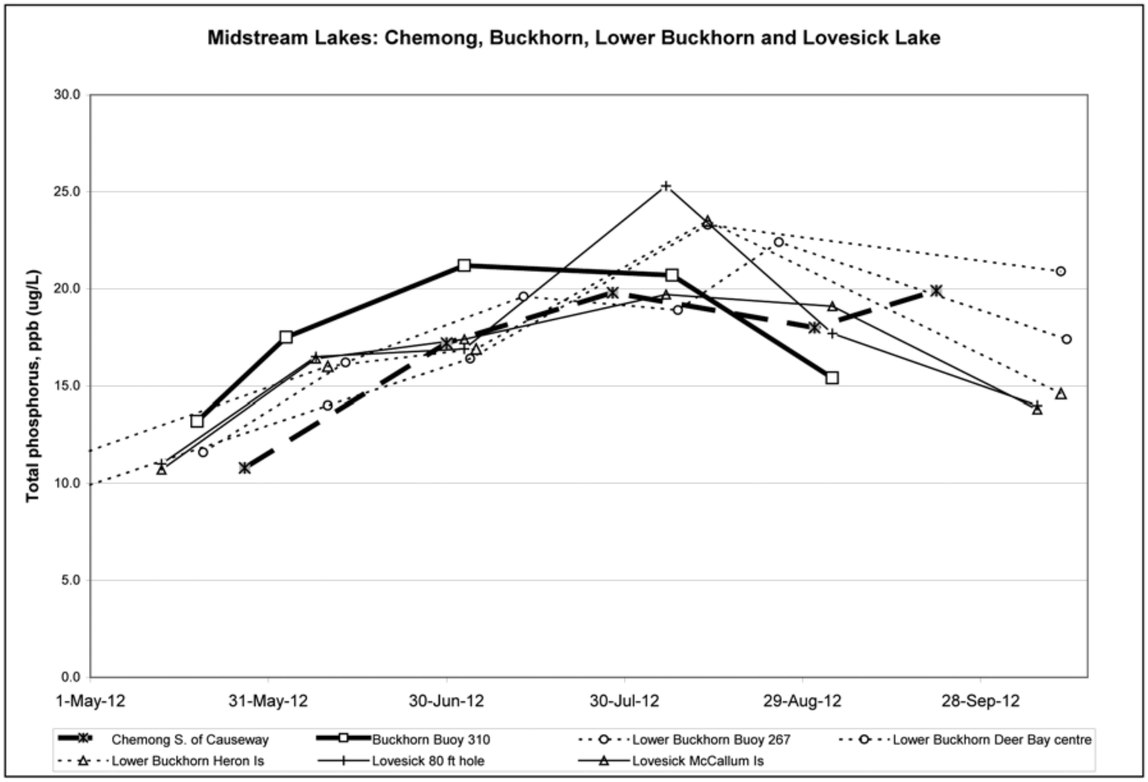
Phosphorus levels increase quite suddenly in Sturgeon Lake. We have come to understand that the sediments in north Sturgeon Lake have been enriched over the years, and that they are now releasing this 'archived' phosphorus. As well, nutrients continue to enter the lakes from agriculture, storm runoff, and sewage treatment plants.

Sturgeon Lake is the place where the Kawartha Lakes transform from low-nutrient lakes to the more typical higher-nutrient lakes.

Janet Duvall

Water lily

Midstream Lakes: Typical Kawartha Lakes



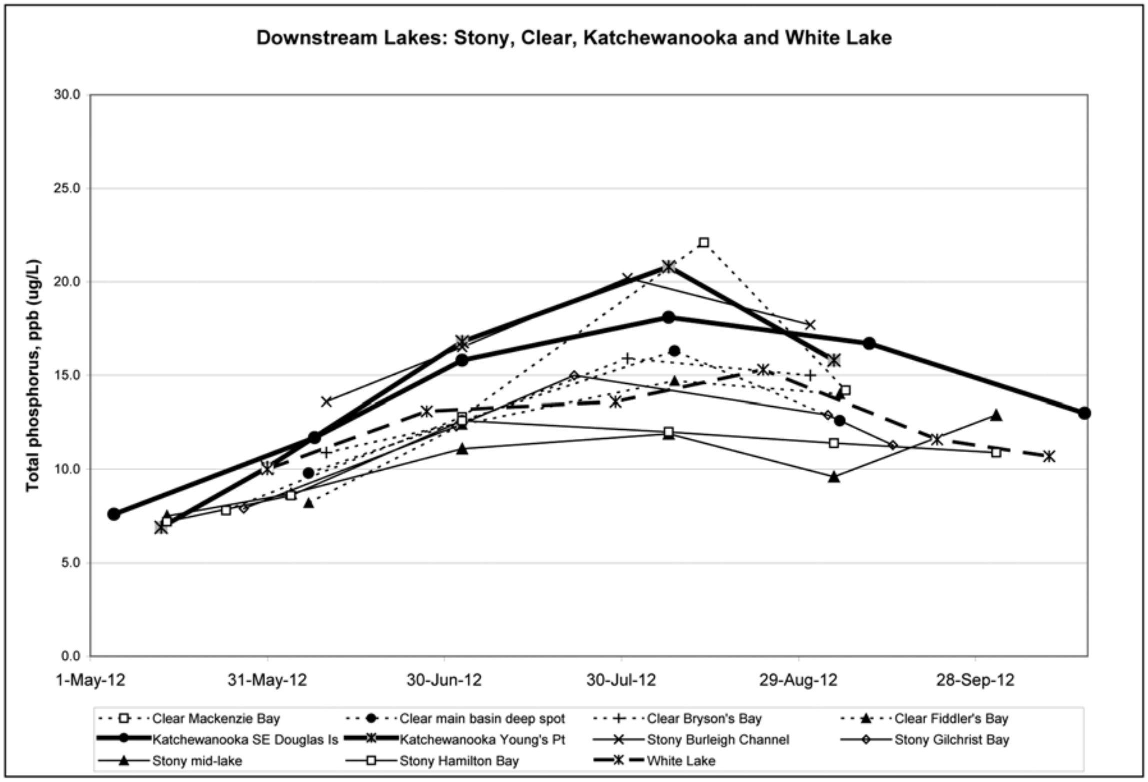
Phosphorus levels in these mid-Kawartha Lakes were similar to those in downstream Sturgeon Lake and in Pigeon Lake.

Phosphorus levels in Buckhorn Lake for some reason were relatively high in June and early July.

Lower Buckhorn Lake phosphorus levels were relatively high in late August and September.

Chemong Lake is long and thin with a local watershed that includes towns and agriculture. Therefore, one would expect it to have higher phosphorus levels than Buckhorn Lake. However, as in previous years, phosphorus levels were a bit lower than in Buckhorn. This is probably because Chemong does not receive much water from the main nutrient-rich stream from Sturgeon Lake. Also, it is a marl lake.

Downstream Lakes: Typical Kawartha Lakes; Some Dilution from Upper Stoney Lake



The Stony Burleigh Channel site is directly downstream from Lovesick Lake, and had a similar phosphorus curve. The other Stony Lake sites, though, showed lower phosphorus levels, due to water inflow from low-phosphorus Upper Stoney Lake.

Phosphorus levels then rose somewhat in Clear Lake and again in Katchewanooka Lake.

As would be expected, White Lake had very similar phosphorus levels to Gilchrist Bay, its main source of water.

Conclusion

2012 was an average year for phosphorus levels in the Kawartha Lakes. The usual patterns emerged:

I. Phosphorus levels tend to increase in the Kawartha Lakes
- as water flows downstream
- as the summer goes on. Levels rise from June 1 to August 1, then decline somewhat by September 1.

II. The exceptions to this are the low phosphorus lakes, whose phosphorus levels remain low throughout the summer.

2012 Total Phosphorus Measurements
Data in **bold** were considered mistakes, and were not used to calculate the average TP.

LAKE NAME	Site Description	Date	TP(ug/L)	TP(ug/L)	AveTP(ug/L)
BALSAM LAKE	E of Grand Is	17-Jun-12	8.6	9.4	9.0
BALSAM LAKE	E of Grand Is	9-Jul-12	9.6	9.0	9.3
BALSAM LAKE	E of Grand Is	13-Aug-12	8.8	8.8	8.8
BALSAM LAKE	N Bay Rocky Pt.	20-May-12	7.6	7.2	7.4
BALSAM LAKE	N Bay Rocky Pt.	16-Jun-12	9.2	9.6	9.4
BALSAM LAKE	N Bay Rocky Pt.	12-Jul-12	8.8	8.8	8.8
BALSAM LAKE	N Bay Rocky Pt.	16-Aug-12	10.2	10.2	10.2
BALSAM LAKE	N Bay Rocky Pt.	15-Sep-12	10.2	9.6	9.9
BALSAM LAKE	NE end-Lightning Pt	29-Jun-12	12.8	11.6	12.2
BALSAM LAKE	NE end-Lightning Pt	3-Jul-12	13.8	10.4	12.1
BALSAM LAKE	NE end-Lightning Pt	22-Aug-12	8.4	8.4	8.4
BALSAM LAKE	NE end-Lightning Pt	4-Sep-12	8.2	8.8	8.5
BALSAM LAKE	South B-Killarney B	5-Jun-12	10.4	13.4	11.9
BALSAM LAKE	South B-Killarney B	3-Jul-12	11.4	10.2	10.8
BALSAM LAKE	South B-Killarney B	1-Aug-12	13.0	13.8	13.4
BALSAM LAKE	South B-Killarney B	4-Sep-12	10.4	10.6	10.5
BALSAM LAKE	W Bay2, deep spot	13-May-12	7.2	7.2	7.2
BALSAM LAKE	W Bay2, deep spot	3-Jun-12	8.8	8.2	8.5
BALSAM LAKE	W Bay2, deep spot	3-Jul-12	12.8	11.0	11.9
BALSAM LAKE	W Bay2, deep spot	7-Aug-12	14.6	11.8	13.2
BALSAM LAKE	W Bay2, deep spot	5-Sep-12	10.2	14.0	12.1
BALSAM LAKE	W Bay2, deep spot	1-Oct-12	9.4	10.0	9.7
BIG BALD LAKE	Mid Lake, deep spot	15-May-12	7.6	8.4	8.0
BIG BALD LAKE	Mid Lake, deep spot	3-Jun-12	9.6	11.2	10.4
BIG BALD LAKE	Mid Lake, deep spot	3-Jul-12	12.8	12.4	12.6
BIG BALD LAKE	Mid Lake, deep spot	6-Aug-12	14.4	14.0	14.2
BIG BALD LAKE	Mid Lake, deep spot	4-Sep-12	17.0	12.4	14.7
BIG BALD LAKE	Mid Lake, deep spot	8-Oct-12	10.6	11.0	10.8
BIG CEDAR LAKE	Mid Lake, deep spot	20-May-12	5.0	5.0	5.0
BUCKHORN LAKE (U)	Narrows-redbuoy C310	19-May-12	12.4	14.0	13.2
BUCKHORN LAKE (U)	Narrows-redbuoy C310	3-Jun-12	17.0	18.0	17.5
BUCKHORN LAKE (U)	Narrows-redbuoy C310	3-Jul-12	19.4	23.0	21.2
BUCKHORN LAKE (U)	Narrows-redbuoy C310	7-Aug-12	20.8	20.6	20.7
BUCKHORN LAKE (U)	Narrows-redbuoy C310	3-Sep-12	16.0	14.8	15.4
CAMERON LAKE	East centre	13-Jun-12	11.0	--	11.0
CAMERON LAKE	East centre	11-Jul-12	10.0	--	10.0
CAMERON LAKE	East centre	16-Aug-12	5.0	--	5.0

CAMERON LAKE	East centre	17-Sep-12	8.0	--	8.0
CHEMONG LAKE	S. of Causeway	27-May-12	10.6	11.0	10.8
CHEMONG LAKE	S. of Causeway	30-Jun-12	17.6	16.8	17.2
CHEMONG LAKE	S. of Causeway	28-Jul-12	19.8	19.8	19.8
CHEMONG LAKE	S. of Causeway	31-Aug-12	18.4	17.6	18.0
CHEMONG LAKE	S. of Causeway	20-Sep-12	22.6	17.2	19.9
CLEAR LAKE	Brysons Bay	10-Jun-12	11.4	10.4	10.9
CLEAR LAKE	Brysons Bay	3-Jul-12	12.2	12.8	12.5
CLEAR LAKE	Brysons Bay	31-Jul-12	15.6	16.2	15.9
CLEAR LAKE	Brysons Bay	31-Aug-12	24.6	15.0	19.8
CLEAR LAKE	Fiddlers Bay	7-Jun-12	8.6	7.8	8.2
CLEAR LAKE	Fiddlers Bay	3-Jul-12	12.4	12.4	12.4
CLEAR LAKE	Fiddlers Bay	8-Aug-12	14.6	14.8	14.7
CLEAR LAKE	Fiddlers Bay	5-Sep-12	14.2	13.8	14.0
CLEAR LAKE	MacKenzie Bay	24-May-12	8.0	7.6	7.8
CLEAR LAKE	MacKenzie Bay	3-Jul-12	13.0	12.6	12.8
CLEAR LAKE	MacKenzie Bay	13-Aug-12	22.4	21.8	22.1
CLEAR LAKE	MacKenzie Bay	6-Sep-12	14.8	13.6	14.2
CLEAR LAKE	Main Basin-deep spot	7-Jun-12	9.4	10.2	9.8
CLEAR LAKE	Main Basin-deep spot	3-Jul-12	13.6	11.6	12.6
CLEAR LAKE	Main Basin-deep spot	8-Aug-12	15.6	17.0	16.3
CLEAR LAKE	Main Basin-deep spot	5-Sep-12	12.2	13.0	12.6
KATCHEWANOOKA LAKE	S/E Douglas Island	5-May-12	7.6	7.6	7.6
KATCHEWANOOKA LAKE	S/E Douglas Island	8-Jun-12	10.2	13.2	11.7
KATCHEWANOOKA LAKE	S/E Douglas Island	3-Jul-12	16.0	15.6	15.8
KATCHEWANOOKA LAKE	S/E Douglas Island	7-Aug-12	18.8	17.4	18.1
KATCHEWANOOKA LAKE	S/E Douglas Island	10-Sep-12	16.8	16.6	16.7
KATCHEWANOOKA LAKE	S/E Douglas Island	16-Oct-12	12.8	13.2	13.0
KATCHEWANOOKA LAKE	Young Pt near locks	13-May-12	7.4	6.4	6.9
KATCHEWANOOKA LAKE	Young Pt near locks	31-May-12	10.2	10.0	10.1
KATCHEWANOOKA LAKE	Young Pt near locks	3-Jul-12	14.8	18.8	16.8
KATCHEWANOOKA LAKE	Young Pt near locks	7-Aug-12	19.0	22.6	20.8
KATCHEWANOOKA LAKE	Young Pt near locks	4-Sep-12	15.6	16.0	15.8
LOVESICK LAKE	80' hole at N. end	13-May-12	11.2	10.8	11.0
LOVESICK LAKE	80' hole at N. end	8-Jun-12	17.2	15.8	16.5
LOVESICK LAKE	80' hole at N. end	3-Jul-12	17.0	16.8	16.9
LOVESICK LAKE	80' hole at N. end	6-Jul-12	24.6	26.0	25.3
LOVESICK LAKE	80' hole at N. end	3-Sep-12	18.0	17.4	17.7
LOVESICK LAKE	80' hole at N. end	7-Oct-12	13.0	15.0	14.0
LOVESICK LAKE	McCallum Island	13-May-12	10.2	11.2	10.7
LOVESICK LAKE	McCallum Island	8-Jun-12	15.8	17.0	16.4

LOVESICK LAKE	McCallum Island	3-Jul-12	17.6	17.2	17.4
LOVESICK LAKE	McCallum Island	6-Jul-12	19.4	20.0	19.7
LOVESICK LAKE	McCallum Island	3-Sep-12	18.4	19.8	19.1
LOVESICK LAKE	McCallum Island	7-Oct-12	14.2	13.4	13.8
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	20-May-12	12.6	10.6	11.6
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	13-Jun-12	16.4	16.0	16.2
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	13-Jul-12	18.8	20.4	19.6
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	8-Aug-12	19.0	18.8	18.9
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	25-Aug-12	21.2	23.6	22.4
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	12-Oct-12	16.8	18.0	17.4
LOWER BUCKHORN LAKE	Deer Bay-centre	20-Apr-12	8.8	8.8	8.8
LOWER BUCKHORN LAKE	Deer Bay-centre	10-Jun-12	14.0	14.0	14.0
LOWER BUCKHORN LAKE	Deer Bay-centre	4-Jul-12	30.8	16.4	23.6
LOWER BUCKHORN LAKE	Deer Bay-centre	13-Aug-12	22.8	23.8	23.3
LOWER BUCKHORN LAKE	Deer Bay-centre	11-Oct-12	20.8	21.0	20.9
LOWER BUCKHORN LAKE	Heron Island	20-Apr-12	10.2	10.8	10.5
LOWER BUCKHORN LAKE	Heron Island	10-Jun-12	16.2	15.8	16.0
LOWER BUCKHORN LAKE	Heron Island	5-Jul-12	18.2	15.6	16.9
LOWER BUCKHORN LAKE	Heron Island	13-Aug-12	23.2	23.8	23.5
LOWER BUCKHORN LAKE	Heron Island	11-Oct-12	14.4	14.8	14.6
PIGEON LAKE	C340-DeadHorseShoal	23-May-12	8.6	8.8	8.7
PIGEON LAKE	C340-DeadHorseShoal	5-Jun-12	11.2	11.2	11.2
PIGEON LAKE	C340-DeadHorseShoal	3-Jul-12	12.6	12.6	12.6
PIGEON LAKE	C340-DeadHorseShoal	7-Aug-12	20.0	19.2	19.6
PIGEON LAKE	C340-DeadHorseShoal	5-Sep-12	13.4	15.2	14.3
PIGEON LAKE	Middle-SandyPtBoyd I	21-May-12	8.4	7.2	7.8
PIGEON LAKE	Middle-SandyPtBoyd I	9-Jun-12	10.8	10.6	10.7
PIGEON LAKE	Middle-SandyPtBoyd I	3-Jul-12	13.2	13.6	13.4
PIGEON LAKE	Middle-SandyPtBoyd I	7-Aug-12	19.2	18.6	18.9
PIGEON LAKE	Middle-SandyPtBoyd I	3-Sep-12	13.0	14.4	13.7
PIGEON LAKE	Middle-SandyPtBoyd I	7-Oct-12	14.8	15.2	15.0
PIGEON LAKE	N end-Adjacent Con17	21-May-12	6.6	8.8	7.7
PIGEON LAKE	N end-Adjacent Con17	9-Jun-12	12.0	12.4	12.2
PIGEON LAKE	N end-Adjacent Con17	3-Jul-12	13.0	14.0	13.5
PIGEON LAKE	N end-Adjacent Con17	7-Aug-12	19.8	19.8	19.8
PIGEON LAKE	N end-Adjacent Con17	3-Sep-12	13.8	14.8	14.3
PIGEON LAKE	N end-Adjacent Con17	7-Oct-12	13.2	13.6	13.4
PIGEON LAKE	N300yds off Bottom I	29-May-12	9.0	9.6	9.3
PIGEON LAKE	N300yds off Bottom I	3-Jul-12	12.2	12.8	12.5
PIGEON LAKE	N300yds off Bottom I	10-Aug-12	20.2	29.6	24.9
PIGEON LAKE	N300yds off Bottom I	5-Sep-12	13.8	14.0	13.9

PIGEON LAKE	N300yds off Bottom I	4-Oct-12	18.6	19.0	18.8
PIGEON LAKE	N-400m N of Boyd Is.	29-May-12	8.2	9.4	8.8
PIGEON LAKE	N-400m N of Boyd Is.	3-Jul-12	16.0	16.6	16.3
PIGEON LAKE	N-400m N of Boyd Is.	10-Aug-12	19.8	20.0	19.9
PIGEON LAKE	N-400m N of Boyd Is.	5-Sep-12	12.8	12.4	12.6
PIGEON LAKE	N-400m N of Boyd Is.	4-Oct-12	17.8	19.2	18.5
SANDY LAKE	Mid Lake, deep spot	20-May-12	5.4	6.8	6.1
SANDY LAKE	Mid Lake, deep spot	17-Jun-12	4.6	6.4	5.5
SANDY LAKE	Mid Lake, deep spot	28-Jul-12	6.8	5.6	6.2
SANDY LAKE	Mid Lake, deep spot	31-Aug-12	10.8	9.2	10.0
SANDY LAKE	Mid Lake, deep spot	8-Oct-12	6.4	8.2	7.3
STONY LAKE	Burleigh locks chan.	10-Jun-12	14.6	12.6	13.6
STONY LAKE	Burleigh locks chan.	3-Jul-12	17.0	16.0	16.5
STONY LAKE	Burleigh locks chan.	31-Jul-12	20.8	19.6	20.2
STONY LAKE	Burleigh locks chan.	31-Aug-12	17.4	18.0	17.7
STONY LAKE	Gilchrist Bay	27-May-12	8.0	7.8	7.9
STONY LAKE	Gilchrist Bay	2-Jul-12	12.6	12.0	12.3
STONY LAKE	Gilchrist Bay	22-Jul-12	15.8	14.2	15.0
STONY LAKE	Gilchrist Bay	3-Sep-12	13.6	12.2	12.9
STONY LAKE	Gilchrist Bay	14-Sep-12	11.6	11.0	11.3
STONY LAKE	Hamilton Bay	14-May-12	7.4	7.0	7.2
STONY LAKE	Hamilton Bay	4-Jun-12	8.6	8.6	8.6
STONY LAKE	Hamilton Bay	3-Jul-12	12.6	12.6	12.6
STONY LAKE	Hamilton Bay	7-Aug-12	12.6	11.4	12.0
STONY LAKE	Hamilton Bay	4-Sep-12	11.4	11.4	11.4
STONY LAKE	Hamilton Bay	1-Oct-12	11.2	10.6	10.9
STONY LAKE	Mouse Is.	14-May-12	7.4	7.6	7.5
STONY LAKE	Mouse Is.	4-Jun-12	8.2	9.2	8.7
STONY LAKE	Mouse Is.	3-Jul-12	11.2	11.0	11.1
STONY LAKE	Mouse Is.	7-Aug-12	12.0	11.8	11.9
STONY LAKE	Mouse Is.	4-Sep-12	9.6	9.6	9.6
STONY LAKE	Mouse Is.	1-Oct-12	12.4	13.4	12.9
STURGEON LAKE	Muskrat I-Buoy C388	8-Jun-12	17.6	16.6	17.1
STURGEON LAKE	Muskrat I-Buoy C388	4-Jul-12	14.4	15.0	14.7
STURGEON LAKE	Muskrat I-Buoy C388	12-Aug-12	22.0	22.2	22.1
STURGEON LAKE	Muskrat I-Buoy C388	3-Sep-12	21.4	21.4	21.4
STURGEON LAKE	Muskrat I-Buoy C388	2-Oct-12	16.8	16.4	16.6
STURGEON LAKE	S Fenelon R-Buoy N5	8-Jun-12	10.6	11.0	10.8
STURGEON LAKE	S Fenelon R-Buoy N5	4-Jul-12	13.6	13.4	13.5
STURGEON LAKE	S Fenelon R-Buoy N5	12-Aug-12	11.2	10.6	10.9
STURGEON LAKE	S Fenelon R-Buoy N5	3-Sep-12	11.4	12.6	12.0
STURGEON LAKE	S Fenelon R-Buoy N5	2-Oct-12	9.6	10.8	10.2

STURGEON LAKE	Sturgeon Point Buoy	8-Jun-12	11.4	11.8	11.6
STURGEON LAKE	Sturgeon Point Buoy	4-Jul-12	14.2	13.6	13.9
STURGEON LAKE	Sturgeon Point Buoy	12-Aug-12	19.2	19.4	19.3
STURGEON LAKE	Sturgeon Point Buoy	3-Sep-12	17.8	17.2	17.5
STURGEON LAKE	Sturgeon Point Buoy	2-Oct-12	13.6		13.6
UPPER STONEY LAKE	Crowes Landing	19-Apr-12	6.2	6.4	6.3
UPPER STONEY LAKE	Crowes Landing	8-Jun-12	6.2	6.6	6.4
UPPER STONEY LAKE	Crowes Landing	3-Jul-12	7.2	7.6	7.4
UPPER STONEY LAKE	Crowes Landing	6-Aug-12	**56.8**	9.8	33.3
UPPER STONEY LAKE	Crowes Landing	3-Sep-12	7.2	7.4	7.3
UPPER STONEY LAKE	Crowes Landing	8-Oct-12	8.0	6.0	7.0
UPPER STONEY LAKE	Mid Lake, deep spot	19-Apr-12	6.6	7.4	7.0
UPPER STONEY LAKE	Mid Lake, deep spot	8-Jun-12	7.0	6.2	6.6
UPPER STONEY LAKE	Mid Lake, deep spot	3-Jul-12	6.2	9.0	7.6
UPPER STONEY LAKE	Mid Lake, deep spot	6-Aug-12	13.0	6.8	9.9
UPPER STONEY LAKE	Mid Lake, deep spot	3-Sep-12	7.4	6.6	7.0
UPPER STONEY LAKE	Mid Lake, deep spot	8-Oct-12	7.2	5.6	6.4
UPPER STONEY LAKE	Quarry Bay	19-Apr-12	7.0	6.2	6.6
UPPER STONEY LAKE	Quarry Bay	8-Jun-12	6.2	5.8	6.0
UPPER STONEY LAKE	Quarry Bay	3-Jul-12	6.0	6.0	6.0
UPPER STONEY LAKE	Quarry Bay	6-Aug-12	7.0	6.8	6.9
UPPER STONEY LAKE	Quarry Bay	3-Sep-12	7.2	7.2	7.2
UPPER STONEY LAKE	Quarry Bay	8-Oct-12	5.8	6.8	6.3
UPPER STONEY LAKE	S Bay, deep spot	19-Apr-12	6.6	6.0	6.3
UPPER STONEY LAKE	S Bay, deep spot	8-Jun-12	10.6	11.0	10.8
UPPER STONEY LAKE	S Bay, deep spot	3-Jul-12	9.0	8.4	8.7
UPPER STONEY LAKE	S Bay, deep spot	6-Aug-12	**47.0**	11.0	29.0
UPPER STONEY LAKE	S Bay, deep spot	3-Sep-12	8.4	8.0	8.2
UPPER STONEY LAKE	S Bay, deep spot	8-Oct-12	8.2	8.2	8.2
UPPER STONEY LAKE	Young Bay	19-Apr-12	6.4	6.8	6.6
UPPER STONEY LAKE	Young Bay	8-Jun-12	5.8	6.2	6.0
UPPER STONEY LAKE	Young Bay	3-Jul-12	5.6	5.8	5.7
UPPER STONEY LAKE	Young Bay	6-Aug-12	7.0	6.6	6.8
UPPER STONEY LAKE	Young Bay	3-Sep-12	7.4	6.0	6.7
UPPER STONEY LAKE	Young Bay	8-Oct-12	5.6	5.8	5.7
WHITE LAKE (DUMMER)	S end, deep spot	31-May-12	9.6	10.4	10.0
WHITE LAKE (DUMMER)	S end, deep spot	27-Jun-12	14.0	12.2	13.1
WHITE LAKE (DUMMER)	S end, deep spot	29-Jul-12	14.4	12.8	13.6
WHITE LAKE (DUMMER)	S end, deep spot	23-Aug-12	15.6	15.0	15.3
WHITE LAKE (DUMMER)	S end, deep spot	21-Sep-12	11.4	11.8	11.6
WHITE LAKE (DUMMER)	S end, deep spot	10-Oct-12	10.6	10.8	10.7

2012 Secchi Depth Measurements

KLSA volunteers measure water clarity using the Secchi disk method. In the past, Secchi measurements in the Kawarthas increased (indicating clearer water) after sewage treatment plants were upgraded in the 1970s. The Kawarthas also experienced increased water clarity when zebra mussels invaded in the 1990s. It's interesting to track these changes. A drop in Secchi depth (indicating murkier water) would be cause for concern.

LAKE_NAME	Site Description	Date	Secchi (m)
BALSAM LAKE	N Bay Rocky Pt.	20-May-12	5.8
BALSAM LAKE	N Bay Rocky Pt.	16-Jun-12	5.3
BALSAM LAKE	N Bay Rocky Pt.	29-Jun-12	5.5
BALSAM LAKE	N Bay Rocky Pt.	12-Jul-12	6.3
BALSAM LAKE	N Bay Rocky Pt.	6-Aug-12	5.0
BALSAM LAKE	N Bay Rocky Pt.	16-Aug-12	4.5
BALSAM LAKE	N Bay Rocky Pt.	29-Aug-12	6.3
BALSAM LAKE	N Bay Rocky Pt.	15-Sep-12	5.8
BALSAM LAKE	NE end-Lightning Pt	29-Jun-12	4.0
BALSAM LAKE	NE end-Lightning Pt	3-Jul-12	3.4
BALSAM LAKE	South B-Killarney B	5-Jun-12	3.1
BALSAM LAKE	South B-Killarney B	3-Jul-12	3.4
BALSAM LAKE	South B-Killarney B	1-Aug-12	3.3
BALSAM LAKE	South B-Killarney B	4-Sep-12	3.8
BALSAM LAKE	South B-Killarney B	2-Oct-12	4.9
BALSAM LAKE	W Bay2, deep spot	13-May-12	4.1
BALSAM LAKE	W Bay2, deep spot	3-Jun-12	4.2
BALSAM LAKE	W Bay2, deep spot	3-Jul-12	4.9
BALSAM LAKE	W Bay2, deep spot	23-Jul-12	4.3
BALSAM LAKE	W Bay2, deep spot	30-Jul-12	4.4
BALSAM LAKE	W Bay2, deep spot	7-Aug-12	4.8
BALSAM LAKE	W Bay2, deep spot	5-Sep-12	4.2
BALSAM LAKE	W Bay2, deep spot	1-Oct-12	4.4
BALSAM LAKE	E of Grand Is	17-Jun-12	3.8
BALSAM LAKE	E of Grand Is	9-Jul-12	4.0
BALSAM LAKE	E of Grand Is	13-Aug-12	3.8
BIG BALD LAKE	Mid Lake, deep spot	15-May-12	6.2
BIG BALD LAKE	Mid Lake, deep spot	3-Jun-12	5.4
BIG BALD LAKE	Mid Lake, deep spot	3-Jul-12	4.9
BIG BALD LAKE	Mid Lake, deep spot	7-Aug-12	3.8
BIG BALD LAKE	Mid Lake, deep spot	4-Sep-12	4.4
BIG BALD LAKE	Mid Lake, deep spot	8-Oct-12	5.3
BIG CEDAR LAKE	Mid Lake, deep spot	20-May-12	7.5
BIG CEDAR LAKE	Mid Lake, deep spot	9-Jun-12	6.5
BIG CEDAR LAKE	Mid Lake, deep spot	23-Jun-12	6.5

BIG CEDAR LAKE	Mid Lake, deep spot	14-Jul-12	6.5
BIG CEDAR LAKE	Mid Lake, deep spot	29-Jul-12	5.5
BIG CEDAR LAKE	Mid Lake, deep spot	13-Aug-12	5.0
BIG CEDAR LAKE	Mid Lake, deep spot	24-Aug-12	5.8
BIG CEDAR LAKE	Mid Lake, deep spot	5-Sep-12	6.0
BIG CEDAR LAKE	Mid Lake, deep spot	12-Sep-12	5.0
BIG CEDAR LAKE	Mid Lake, deep spot	28-Sep-12	7.2
BUCKHORN LAKE (U)	Narrows-redbuoy C310	19-May-12	3.4
BUCKHORN LAKE (U)	Narrows-redbuoy C310	3-Jun-12	2.3
BUCKHORN LAKE (U)	Narrows-redbuoy C310	17-Jun-12	2.5
BUCKHORN LAKE (U)	Narrows-redbuoy C310	3-Jul-12	2.7
BUCKHORN LAKE (U)	Narrows-redbuoy C310	15-Jul-12	2.7
BUCKHORN LAKE (U)	Narrows-redbuoy C310	30-Jul-12	2.2
BUCKHORN LAKE (U)	Narrows-redbuoy C310	7-Aug-12	2.0
BUCKHORN LAKE (U)	Narrows-redbuoy C310	21-Aug-12	2.0
BUCKHORN LAKE (U)	Narrows-redbuoy C310	3-Sep-12	2.1
BUCKHORN LAKE (U)	Narrows-redbuoy C310	16-Sep-12	2.5
BUCKHORN LAKE (U)	Narrows-redbuoy C310	30-Sep-12	2.7
CHEMONG LAKE	S. of Causeway	24-May-12	4.0
CHEMONG LAKE	S. of Causeway	30-Jun-12	3.2
CHEMONG LAKE	S. of Causeway	28-Jul-12	2.0
CHEMONG LAKE	S. of Causeway	31-Aug-12	3.0
CHEMONG LAKE	S. of Causeway	20-Sep-12	3.0
CLEAR LAKE	Main Basin-deep spot	7-Jun-12	4.7
CLEAR LAKE	Main Basin-deep spot	3-Jul-12	4.3
CLEAR LAKE	Main Basin-deep spot	8-Aug-12	2.5
CLEAR LAKE	Main Basin-deep spot	5-Sep-12	3.6
CLEAR LAKE	Fiddlers Bay	7-Jun-12	2.9
CLEAR LAKE	Fiddlers Bay	3-Jul-12	2.8
CLEAR LAKE	Fiddlers Bay	8-Aug-12	3.0
CLEAR LAKE	Fiddlers Bay	5-Sep-12	3.3
KATCHEWANOOKA LAKE	S/E Douglas Island	4-May-12	5.3
KATCHEWANOOKA LAKE	S/E Douglas Island	8-Jun-12	6.5
KATCHEWANOOKA LAKE	S/E Douglas Island	3-Jul-12	4.8
KATCHEWANOOKA LAKE	S/E Douglas Island	17-Jul-12	4.1
KATCHEWANOOKA LAKE	S/E Douglas Island	7-Aug-12	3.5
KATCHEWANOOKA LAKE	S/E Douglas Island	10-Sep-12	5.5
KATCHEWANOOKA LAKE	S/E Douglas Island	16-Oct-12	5.6
KATCHEWANOOKA LAKE	Young Pt near locks	13-May-12	5.7
KATCHEWANOOKA LAKE	Young Pt near locks	31-May-12	5.0
KATCHEWANOOKA LAKE	Young Pt near locks	15-Jun-12	5.0

KATCHEWANOOKA LAKE	Young Pt near locks	3-Jul-12	4.4
KATCHEWANOOKA LAKE	Young Pt near locks	20-Jul-12	4.5
KATCHEWANOOKA LAKE	Young Pt near locks	7-Aug-12	3.5
KATCHEWANOOKA LAKE	Young Pt near locks	21-Aug-12	5.1
KATCHEWANOOKA LAKE	Young Pt near locks	4-Sep-12	4.8
KATCHEWANOOKA LAKE	Young Pt near locks	21-Sep-12	4.1
KATCHEWANOOKA LAKE	Young Pt near locks	1-Oct-12	6.1
KATCHEWANOOKA LAKE	Young Pt near locks	16-Oct-12	5.2
KATCHEWANOOKA LAKE	Young Pt near locks	1-Nov-12	4.6
LOWER BUCKHORN LAKE	Heron Island	20-Apr-12	4.3
LOWER BUCKHORN LAKE	Heron Island	5-Jun-12	4.8
LOWER BUCKHORN LAKE	Heron Island	4-Jul-12	4.1
LOWER BUCKHORN LAKE	Heron Island	5-Jul-12	4.1
LOWER BUCKHORN LAKE	Heron Island	13-Aug-12	1.8
LOWER BUCKHORN LAKE	Heron Island	11-Oct-12	4.1
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	19-May-12	3.7
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	31-May-12	3.9
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	13-Jun-12	4.3
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	23-Jun-12	5.4
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	2-Jul-12	4.0
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	12-Jul-12	3.7
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	22-Jul-12	3.6
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	8-Aug-12	3.1
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	25-Aug-12	3.2
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	12-Oct-12	4.8
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	18-Oct-12	5.0
LOWER BUCKHORN LAKE	Deer Bay-centre	20-Apr-12	3.9
LOWER BUCKHORN LAKE	Deer Bay-centre	5-Jun-12	4.2
LOWER BUCKHORN LAKE	Deer Bay-centre	4-Jul-12	4.0
LOWER BUCKHORN LAKE	Deer Bay-centre	13-Aug-12	1.9
LOWER BUCKHORN LAKE	Deer Bay-centre	11-Oct-12	4.1
PIGEON LAKE	Middle-SandyPtBoyd I	21-May-12	3.5
PIGEON LAKE	Middle-SandyPtBoyd I	9-Jun-12	3.1
PIGEON LAKE	Middle-SandyPtBoyd I	3-Jul-12	2.8
PIGEON LAKE	Middle-SandyPtBoyd I	7-Aug-12	2.2
PIGEON LAKE	Middle-SandyPtBoyd I	3-Sep-12	3.1
PIGEON LAKE	Middle-SandyPtBoyd I	7-Oct-12	3.7
PIGEON LAKE	N-400m N of Boyd Is.	3-Jul-12	3.0
PIGEON LAKE	N end-Adjacent Con17	21-May-12	4.0
PIGEON LAKE	N end-Adjacent Con17	9-Jun-12	3.0
PIGEON LAKE	N end-Adjacent Con17	3-Jul-12	3.2
PIGEON LAKE	N end-Adjacent Con17	7-Aug-12	2.3

PIGEON LAKE	N end-Adjacent Con17	3-Sep-12	3.0
PIGEON LAKE	N end-Adjacent Con17	7-Oct-12	3.8
PIGEON LAKE	C340-DeadHorseShoal	23-May-12	4.2
PIGEON LAKE	C340-DeadHorseShoal	5-Jun-12	3.9
PIGEON LAKE	C340-DeadHorseShoal	3-Jul-12	3.0
PIGEON LAKE	C340-DeadHorseShoal	7-Aug-12	3.1
PIGEON LAKE	C340-DeadHorseShoal	5-Sep-12	3.5
PIGEON LAKE	N300yds off Bottom I	3-Jul-12	3.5
SANDY LAKE	Mid Lake, deep spot	20-May-12	5.0
SANDY LAKE	Mid Lake, deep spot	17-Jun-12	5.2
SANDY LAKE	Mid Lake, deep spot	28-Jul-12	4.9
SANDY LAKE	Mid Lake, deep spot	29-Aug-12	4.6
SANDY LAKE	Mid Lake, deep spot	8-Oct-12	4.8
STONY LAKE	Gilchrist Bay	27-May-12	4.5
STONY LAKE	Gilchrist Bay	2-Jul-12	3.8
STONY LAKE	Gilchrist Bay	22-Jul-12	3.8
STONY LAKE	Gilchrist Bay	3-Sep-12	3.8
STONY LAKE	Gilchrist Bay	14-Sep-12	3.0
STONY LAKE	Mouse Is.	14-May-12	6.1
STONY LAKE	Mouse Is.	4-Jun-12	4.4
STONY LAKE	Mouse Is.	3-Jul-12	5.2
STONY LAKE	Mouse Is.	7-Aug-12	4.0
STONY LAKE	Mouse Is.	3-Sep-12	5.1
STONY LAKE	Mouse Is.	1-Oct-12	4.1
STONY LAKE	Hamilton Bay	14-May-12	4.1
STONY LAKE	Hamilton Bay	4-Jun-12	4.1
STONY LAKE	Hamilton Bay	3-Jul-12	4.1
STONY LAKE	Hamilton Bay	7-Aug-12	4.0
STONY LAKE	Hamilton Bay	3-Sep-12	4.1
STONY LAKE	Hamilton Bay	1-Oct-12	4.1
STURGEON LAKE	Muskrat I-Buoy C388	4-Jul-12	6.1
STURGEON LAKE	Muskrat I-Buoy C388	13-Aug-12	6.1
STURGEON LAKE	Muskrat I-Buoy C388	5-Sep-12	3.2
STURGEON LAKE	Muskrat I-Buoy C388	2-Oct-12	2.9
STURGEON LAKE	Sturgeon Point Buoy	4-Jul-12	1.7
STURGEON LAKE	Sturgeon Point Buoy	4-Jul-12	3.1
STURGEON LAKE	Sturgeon Point Buoy	13-Aug-12	1.9
STURGEON LAKE	Snug Harb Pr-Buoy CP6	4-Jul-12	1.7
STURGEON LAKE	Snug Harb Pr-Buoy CP6	13-Aug-12	3.5
STURGEON LAKE	Snug Harb Pr-Buoy CP6	13-Aug-12	3.5
STURGEON LAKE	Snug Harb Pr-Buoy CP6	5-Sep-12	3.1
STURGEON LAKE	Snug Harb Pr-Buoy CP6	5-Sep-12	2.8

STURGEON LAKE	Snug Harb Pr-Buoy CP6	2-Oct-12	3.1
STURGEON LAKE	Snug Harb Pr-Buoy CP6	2-Oct-12	3.1
UPPER STONEY LAKE	Quarry Bay	19-Apr-12	6.1
UPPER STONEY LAKE	Quarry Bay	11-Jun-12	7.6
UPPER STONEY LAKE	Quarry Bay	6-Jul-12	7.5
UPPER STONEY LAKE	Quarry Bay	7-Aug-12	6.5
UPPER STONEY LAKE	Quarry Bay	5-Sep-12	6.9
UPPER STONEY LAKE	Quarry Bay	7-Oct-12	6.9
UPPER STONEY LAKE	Young Bay	19-Apr-12	6.5
UPPER STONEY LAKE	Young Bay	11-Jun-12	7.1
UPPER STONEY LAKE	Young Bay	6-Jul-12	7.7
UPPER STONEY LAKE	Young Bay	7-Aug-12	6.1
UPPER STONEY LAKE	Young Bay	5-Sep-12	7.4
UPPER STONEY LAKE	Young Bay	7-Oct-12	7.8
UPPER STONEY LAKE	Crowes Landing	19-Apr-12	5.8
UPPER STONEY LAKE	Crowes Landing	11-Jun-12	6.5
UPPER STONEY LAKE	Crowes Landing	6-Jul-12	7.1
UPPER STONEY LAKE	Crowes Landing	7-Aug-12	5.5
UPPER STONEY LAKE	Crowes Landing	5-Sep-12	7.1
UPPER STONEY LAKE	Crowes Landing	7-Oct-12	7.0
UPPER STONEY LAKE	Mid Lake, deep spot	19-Apr-12	6.2
UPPER STONEY LAKE	Mid Lake, deep spot	11-Jun-12	7.0
UPPER STONEY LAKE	Mid Lake, deep spot	6-Jul-12	7.1
UPPER STONEY LAKE	Mid Lake, deep spot	7-Aug-12	6.0
UPPER STONEY LAKE	Mid Lake, deep spot	5-Sep-12	7.2
UPPER STONEY LAKE	Mid Lake, deep spot	7-Oct-12	6.9
WHITE LAKE (DUMMER)	S end, deep spot	31-May-12	3.8
WHITE LAKE (DUMMER)	S end, deep spot	28-Jun-12	3.5
WHITE LAKE (DUMMER)	S end, deep spot	29-Jul-12	3.4
WHITE LAKE (DUMMER)	S end, deep spot	23-Aug-12	3.3
WHITE LAKE (DUMMER)	S end, deep spot	21-Sep-12	3.4
WHITE LAKE (DUMMER)	S end, deep spot	10-Oct-12	3.5

Appendix G: Glossary

Algae – Simple one-celled or colonial plant-like organisms that grow in water, contain chlorophyll and do not differentiate into specialized cells and tissues like roots and leaves. Alga is the singular noun, algae is the plural, algal is an adjective.

Atmospheric fallout – the settling to the ground of dust or fine particles ejected into the atmosphere by events such as explosions or forest fires.

Benthic – Dwelling on the bottom of a water body, such as a lake or stream.

Chloroplast – The part of an algal or green plant cell containing chlorophyll.

***E.coli* bacteria (*Escherichia coli*)** – Bacteria living in the intestines of warm-blooded animals such as birds, beavers and humans. While most are harmless, a few strains of *E.coli* can cause severe gastrointestinal illness. Drinking water and recreational water are tested for the presence of these bacteria, which may indicate contamination by fecal matter.

Ecozone – An area with unified terrain, vegetation and animal life.

Environmental Assessment (EA) – A critical appraisal of the likely effects of a proposed project on the environment, including natural, social and economic aspects.

Eutrophication -- The aging of a body of water as nutrients like phosphorus and nitrogen increase, and oxygen decreases. Excessive growth of algae and other plants may result, and the extinction of some organisms.

Flux – The rate of flow of fluid, particles, or energy.

Isotope – An atom with the same number of protons, but differing numbers of neutrons. There are 275 isotopes of the 81 stable elements, in addition to over 800 radioactive isotopes, and every element has known isotopic forms. Different isotopes of the same element may come from different sources, helping scientists to figure out how they entered the water or air, for example.

Limiting nutrient – An often scarce but necessary nutrient within a specific environment that is, as a result, most influential in controlling the growth of a particular organism. Phosphorus, for example, appears to be the limiting nutrient for algae.

Littoral zone – The part of a sea, lake or river that is close to the shore. In lake environments, the littoral zone extends from the high water mark to the deepest area where rooted aquatic plants grow.

Macrophyte – A plant, generally aquatic, that is visible to the eye, not microscopic.

Marl – Calcium carbonate particulate that forms when carbon dioxide is forced out of solution in lakes that contain dissolved limestone. This comes about through plant photosynthesis, or simply due to the warming of the lake water in summer. Limestone is dissolved by acidic rainfall as it percolates through rocks and soil. The marl collects on the lake bottom as a soft mud, eventually filling the water body over time.

Milfoil – Common aquatic plant in the Kawarthas. There are several varieties, including the native northern milfoil, the invasive Eurasian milfoil and a hybrid between the two. Eurasian milfoil and the hybrid can grow rapidly in certain areas, pushing out native plants.

Nitrogen (N) – A chemical element essential to life, comprising four-fifths of the atmosphere. Nitrogen can be available to living organisms through the air, the decay of organic material and animal waste, and as a soluble compound in water.

Parts per billion (ppb) – A measure of concentration, used for extremely small quantities of one substance within another substance. One part per billion of phosphorus means one unit of phosphorus within a billion units of water, which corresponds to one drop of water in an Olympic swimming pool. For our purposes, micrograms per litre and parts per billion are equal.

Peat – Soil formed of dead but not fully decayed plants found in bog areas, where flooding obstructs flows of oxygen from the atmosphere, reducing rates of decomposition.

Phosphorus (P) – A chemical element that stimulates the growth of terrestrial and aquatic plants and algae. In the Kawarthas, phosphorus comes from the atmosphere, from decaying vegetation, and from within the bedrock, especially limestone, which is soluble. Human sources include agriculture, sewage treatment plants and urban stormwater runoff.

Sediment – Matter such as silt, sand, chemical precipitates and decayed plants that settle to the bottom of a lake.

Shield rock – One of the oldest geological formations in the world, the Canadian Shield is composed of a mixture of rocks that melted millions of years ago, then hardened into a bedrock that is mainly non-soluble, covering much of central and northeastern Canada and the U.S. Often covered with forest, it contributes very little phosphorus to the Kawartha Lakes after rainfall or snow melts.

Weevil – A small beetle. The milfoil weevil is one of 60,000 species of weevils, some of which are destructive to crops or stored grain.

Janet Duvall

Stumps at sunset

Appendix H: Rainfall in the Kawarthas Summer 2012

This chart shows rainfall at five sites in the Kawarthas during the summer of 2012. Rainfall over 10 mm is in **bold**. Gauge locations are southwest Balsam Lake (SWB), southwest Sturgeon Lake (SWS), northeast Sturgeon Lake (NES), southeast Pigeon Lake (SEP) and Stony Lake (SL). **Long-term averages are from Trent University.

	Rainfall, mm						Rainfall, mm				
Date/12	SWB	SWS	NES	SEP	SL	Date/12	SWB	SWS	NES	SEP	SL
Jun25	**28.1**	8.5	**21.6**	**23.8**	--	Aug1	**19.3**	0	7.7	8	0
Jun26	0	0	0	0	--	Aug2	0	0	0	0	0
Jun27	0	0	0	0	--	Aug3	0	0	0	0	0
Jun28	0	0	0	0	--	Aug4	0	0	0	0	0
Jun29	0	0	0	0	--	Aug5	0	0	0	0	1.5
Jun30	0	0	0	0	--	Aug6	0	0	0	0	0
June Total	90.5	112.9	112.3	123.5	--	Aug7	**18.6**	1.7	6.6	0	0
June Ave.**	78.9					Aug8	0	0	0	4.4	0
Jul1	0	0	0	0	0	Aug9	0	0	0	0	**12.3**
Jul2	0	0	0	0	0	Aug10	0	0	0	0	6.3
Jul3	0	0	0	0	1.8	Aug11	0	0	0	0	2.9
Jul4	0	2.6	0	0	0	Aug12	0	0	0	0	0.3
Jul5	0	0	0	0	0	Aug13	0	0	0	0	0
Jul6	0	0	0	0	0	Aug14	0	0	0	0	0
Jul7	0	0	0	0	1.5	Aug15	**51.6**	**33.5**	**28.4**	**44.6**	0
Jul8	0	0	0	0	0	Aug16	0	0	0	0	0
Jul9	6.6	8.5	2.6	0	0	Aug17	0	0	0	0	0
Jul10	0	8	0	9.4	0	Aug18	0	0	0	0	0
Jul11	0	0	0	0	0	Aug19	0	0	0	0	2.9
Jul12	0	0	0.4	0	0	Aug20	4.4	0.2	0.3	0	0
Jul13	0	0	0	0	0	Aug21	0	0	0	1.6	0
Jul14	0	0	0	0	0	Aug22	0	0	0	0	0
Jul15	0	0	0	0	3.2	Aug23	0	0	0	0	0
Jul16	2.0	0	0	0	0	Aug24	0	0	0	0	0
Jul17	0	0	0	0	0	Aug25	0	0	0	0	0
Jul18	0	0	0	0	0	Aug26	0	0	0	0	0
Jul19	0	0	0	0	0	Aug27	1.8	0	1.9	1.7	2.9
Jul20	0	0	0	0	0	Aug28	0	**12.8**	2.3	0	0
Jul21	0	0	0	0	0	Aug29	0	0	0	0	0
Jul22	0	0	0	0	0	Aug30	0	0	0	3.5	0
Jul23	0	0	0	0	**14.1**	Aug31	0	0	0	0	0
Jul24	0	0	0	**10.7**	0	**Aug Total**	57.8	48.2	47.2	63.8	27.6
Jul25	0.7	2.4	5.5	0	0	**Aug Ave.****	91.6				
Jul26	0	6.6	0	0	**15.0**	Sep1	0	0	0	0	0
Jul27	**18.3**	**19.5**	0	0	0	Sep2	0	0	0	0	0
Jul28	0	0	0	0	0	Sep3	0	0	0	0	0
Jul29	0	0	0	0	0	Sep4	0	0	0	0	**28.5**
Jul30	0	0	**19.7**	**28.6**	0	Sep5	**24.4**	**16.4**	**21.2**	0	0
Jul31	0	**10.8**	0	0	3.2	Sep6	0	0	0	44	0
July Total	27.6	58.4	28.2	48.7	38.8	Sep7	0	0	0	0	0
July Ave.**	68.4					Sep8	0	0	0	0	**32.2**
						Sep9	0	0	0	0	

Kawartha Lake Stewards Association

Spring and Fall Meetings Coming Up!

KLSA's Spring General Meeting will be held on:

Saturday, May 4, 2013, 10 a.m.
Bobcaygeon Community Centre

The spring meeting agenda will include presentations expanding on the content of our 2012 annual Water Quality Report. It is designed to give attendees background material for discussion at their cottage association meetings during the summer.

KLSA's Fall Annual General Meeting will be held on:

Saturday, October 5, 2013, 10 a.m.
Lakehurst Community Hall

The Annual General Meeting will include the election of the Board of Directors.

For further information, visit klsa.wordpress.com

We hope to see you at these meetings!
Bring your questions and comments! Bring your neighbours!

Find us on Facebook. What's new on your lake?
Share your findings and find out what others are doing.

Free To You And Me ~ Sort Of

KLSA distributes all its publications, including this one, at no charge. But they aren't really free! It costs us $8 to $10 per copy to print and send these annual reports to cottage associations, libraries, government agencies, academics, and people like you. That's a huge chunk of our annual budget.

If you benefited from this report, and if you want to keep our future work in the public eye, please consider a donation. Completely run by volunteers, KLSA provides excellent value for every dollar it receives, and gratefully acknowledges every donor.

Please clip and mail to KLSA

- ☐ Here's a donation of $________
- ☐ This gift is from my business, or from my cottage or road association. (Cheque to Kawartha Lake Stewards Association)

Personal donations of $40 or more qualify for a charitable tax receipt, issued by our friends at The Stony Lake Heritage Foundation. Individual donors please tick one box below:

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