Pigeon Lake Management Plan

2019

KAWARTHA CONSERVATION

Discover · Protect · Restore

About Kawartha Conservation

A plentiful supply of clean water is a key component of our natural infrastructure. Our surface and groundwater resources supply our drinking water, maintain property values, sustain an agricultural industry, and support tourism.

Kawartha Conservation is the local environmental agency that helps protect our water and other natural resources. Our mandate is to ensure the conservation, restoration, and responsible management of water, land, and natural habitats through programs and services that balance human, environmental, and economic needs.

We are a non-profit environmental organization, established in 1979 under the Ontario *Conservation Authorities Act* (1946). We are governed by the six municipalities that overlap the natural boundaries of our watershed and who voted to form the Kawartha Region Conservation Authority. These municipalities include the City of Kawartha Lakes, Township of Scugog (Region of Durham), Township of Brock (Region of Durham), Municipality of Clarington (Region of Durham), Township of Cavan Monaghan, and Municipality of Trent Lakes.

Cover photo: Shores of Big (Boyd) Island.

Acknowledgements

This plan was written by Kawartha Conservation and developed with significant input from local communities, stakeholders, and agencies, including:

Balsam Lake Association (including Indian Point and Killarney Bay Cedar Point Associations)
Cameron Lake Moorings Association
City of Kawartha Lakes, Agricultural Development Advisory Board
City of Kawartha Lakes, Environmental Advisory Committee
City of Kawartha Lakes, Councillors and staff
Curve Lake First Nation
Federation of Ontario Cottagers' Associations
Fleming College
Gamiing Nature Centre
Haliburton, Kawartha, Pine Ridge District Health Unit
Kawartha Conservation
Kawartha Lake Stewards Association
Kawartha Land Trust
Mississaugas of Scugog Island First Nation
Municipality of Trent Lakes
North Pigeon Lake Ratepayers Association
Ontario Federation of Anglers and Hunters
Ontario Ministry of Agriculture, Food and Rural Affairs
Ontario Ministry of Natural Resources and Forestry
Ontario Ministry of the Environment and Climate Change
Otonabee Conservation
Parks Canada, Ontario Waterways
Save Pigeon Lake
Selwyn Township
Sturgeon Point Association
Trent University

Funding for this project was provided by the municipality of the City of Kawartha Lakes, and supported by the Municipality of Trent Lakes.

Pigeon Lake Management Plan

Executive Summary

Pigeon Lake is a central, connecting lake of the Trent-Severn Waterway and is highly valued for providing significant economic, social, and ecological benefits to those who live, work, and play in the Kawartha Lakes region. Pigeon Lake exists within the Trent-Severn Waterway National Historic Site and within traditional lands of Williams Treaties First Nation, as such Parks Canada consults with local First Nations communities on matters regarding water resources in the lake including the management of wild rice.

The *Pigeon Lake Management Plan* is a community-driven endeavour, stemming from a common resolve to maintain a healthy lake environment in light of pressures that threaten its long-term sustainability.

What constitutes a healthy lake? How do we know we are sustaining lake resources? To help steer us, a vision statement has been developed as the guiding principle for the plan:

"Ensure the long-term sustainability of a Pigeon Lake ecosystem that provides a high-quality destination for living and working, boating, swimming, fishing, tourism, and access to water for household uses."

The lake ecosystem is complex, with many interrelated components. The lake ecosystem changes through time, mirroring changes in land use practices and naturally occurring processes in its drainage basin and in the Kawartha Lakes system as a whole. The lakes continue to experience the cumulative effects of pressures such as shoreline and urban development, agriculture, climate change, invasive species, and other impacts.

The intent of the *Pigeon Lake Management Plan* is to document the ecological state of the lake, list several lake health objectives and issues of common interest, and to provide several practical management recommendations that can be undertaken by the various parties that are active on the lake. It is the culmination of a four-year planning project, supported by the City of Kawartha Lakes, and Municipality of Trent Lakes developed with significant input from local stakeholders, agencies, and organizations. Recently we have also been supported by Otonabee Conservation. The first three years of the project were dedicated to science-based assessments of the current state of the lake and its watershed, as well as capturing the key values and concerns of community stakeholders. Year four has focused on crafting the management plan. Members of the Community Advisory Panel, the Science and Technical Committee, and local stakeholders, agencies, and organizations have been instrumental in providing guidance and review of the *Pigeon Lake Management Plan* and associated materials.

Goals:

To ensure the *Pigeon Lake Management Plan* addresses land use pressures and other community-based concerns, the following strategic goals were developed at the project onset:

- **Maintain excellent water quality in the lakes and their tributaries for human use and ecological needs.**
- **Promote sustainable human and natural resources management activities that protect and enhance overall watershed and lake health.**

- **Use science-based findings to guide *Official Plan* policies, by-laws, and other strategic planning documents to ensure a supportive planning policy framework with a primary goal of protecting the lake and its watershed.**

Objectives:

The project management team further defined our management approach through seven objectives. These were formed by considering all of the science-based and agency, community, and lake stakeholder-based issues facing the lakes and reorganizing them in a positive form to assist with framing management actions.

Objectives	Issues Addressed
1. Maintain excellent water quality conditions	• Pollutants in surface water runoff from urban areas • Potential eutrophication of the lake through excessive nutrient and sediment inputs • Potential contamination from other sources
2. Consult on concerns with regard to wild rice	• There are varying perspectives on wild rice in Southern Pigeon Lake.
3. Enhance swimming opportunities at public beaches	• High *E. coli* at certain beaches, leading to beach postings
4. Maintain the biodiversity of the lake ecosystem	• Protect and maintain important aquatic vegetation communities • Proliferation of non-native invasive species • Loss and fragmentation of natural habitats • Wildlife species at risk
5. Enhance and maintain the natural integrity of the shoreline	• Dense urban development along the lake shoreline • Loss of shoreline property from erosion
6. Maintain healthy and productive sport fish populations	• Potential future decline in muskellunge due to northern pike range expansion • Loss and fragmentation of aquatic habitat along the shoreline and in small- to medium-sized tributaries
7. Ensure permit application process for development projects is transparent and efficient	• Confusion and/or frustration from shoreline owners and contractors
8. Improve our understanding of how the lakes will respond to emerging pressures	• Lack of coordination of research and monitoring initiatives, and information management

Targets:

All Areas

- Within a five-year period, achieve a target of increasing forest cover in the core Pigeon Lake planning area by 1% (33 acres) of the current deficit, per year, by planting (50%) and natural regeneration (50%). This equates

to planting approximately 10,000 to 15,000 trees and shrubs annually in targeted locations, with an emphasis on priority stream corridors.

- Maintain the existing streamside vegetative cover at 83% in the core Pigeon Lake planning area.

- Maintain the existing wetland cover at 15% in the core Pigeon Lake planning area.

- Over the long term, achieve a 15% reduction in existing phosphorus loadings from all manageable sources (i.e., urban areas, agricultural areas, and shoreline septic systems) from local subwatershed inputs into Pigeon Lake, to achieve a loading target of approximately 4,976 kilograms (kg) per year.

Agricultural Areas

- Every year, conduct three to five agricultural improvement projects in priority subwatersheds, such as creating streamside vegetated buffers and improving manure storage and fertilizer application.

- Over the long term, achieve a 25% reduction in existing phosphorus loading from local agricultural sources to achieve a loading target of approximately 787 kg per year into Pigeon Lake.

- Over the long term, achieve an average phosphorus concentration of 30 ug/L or less at the outlet of Reforestation Creek by implementing better nutrient and sediment control measures on farms within its subwatershed.

Urban Areas

- Within a five-year period, achieve a target of 50% of urban residential and commercial properties implementing lot-level measures such as capturing stormwater runoff, using low or no phosphorus fertilizer, and utilizing 'low impact development' measures to increase infiltration.

- Over the long term, achieve a 15% reduction in existing phosphorus loading from local urban sources to achieve a loading target of approximately 856 kg per year into Pigeon Lake.

Shoreline Areas

- Every year, decommission vertical retaining walls or repair severely ice-damaged shorelines on three to five properties.

- Within a five-year period, achieve a target of 50% of shoreline properties practising lot-level measures, such as limiting artificial structures (excluding erosion protection) to 25% along shorelines, reducing fertilizer use, and retaining fallen trees in the nearshore area.

- Within a five-year period, achieve a target of 50% of residences having greater than 25% of their shoreline naturalized to a minimum of three metres (10 feet) from the water's edge.

- Within a five-year period, achieve a target of 80% (40 postings) reduction in the amount of time that public beaches are posted as "unsafe for swimming."

- Over the long term, achieve a 5% reduction in existing phosphorus loading from shoreline septic systems to achieve a loading target of approximately 979 kg per year into Pigeon Lake.

- Over the long term, rehabilitate 75 or more septic systems along the lake shoreline, given that currently 5% of septic systems are estimated failing and there are an estimated 1560 shoreline properties.

Management Actions:

Upon synthesizing and analysing all available science-based information, as well as through extensive stakeholder consultations, 34 "best bet" management actions were identified and grouped under five strategic themes:

- Stewardship,
- Strategic Planning,
- Urban and Rural Infrastructure,
- Research and Monitoring, and
- Communications and Outreach.

We have tried to develop actions as specific to Pigeon Lake as possible by identifying priority areas for our management actions. Given the similar management pressures on lakes in the Kawarthas, most of these management actions are transferable to other lakes and will form the framework for all future lake management plans.

For each recommended action, these details are provided: level of urgency, rationale, priority areas, agent responsible for implementation, and deliverables. The following provides a summary of key actions contained in the plan.

Stewardship Strategy:
Actions tailored to rural, urban, and shoreline landowners, public land managers, and lake users for implementing best management practices on their properties for the benefit of all and the future health of the lakes

Actions	Urgency
A1: Undertake lot-level measures such as reducing fertilizer use, increasing infiltration, capturing stormwater runoff, and other practices that conserve water and reduce pollution in targeted urban areas and waterfront communities.	High
A2: Implement a natural landscaping approach along shoreline properties, with particular focus on decommissioning hardened shorelines and addressing severely eroded/ice-damaged sections.	High
A3: Implement measures such as boat and equipment sanitization to reduce the risk of transfer of invasive species between water bodies.	High
A4: Develop a reforestation program to re-establish and manage natural cover on marginal rural lands, particularly in subwatersheds that do not meet forest cover benchmarks.	Medium
A5: Reduce potential pollution from septic systems into the lakes by undertaking responsible management and maintenance.	Medium
A6: Implement measures such as vegetated buffer strips along streams, conservation tillage, and other practices that reduce nutrient and soil loss from farms with assistance from cost–share programs.	Medium
A7: Implement programs to educate lake users about proper boat maintenance, grey water disposal, and the locations of sensitive habitats to reduce the risk of pollution and lake ecosystem disturbance.	Medium

Strategic Planning Strategy:
Actions that focus on strengthening the land use planning and policy framework, with an emphasis on updating the municipal Official Plan

Actions	Urgency
B1: Amend and strengthen municipal Official Plans and Secondary Plans policy to require protection of the natural environment through specific measures such as development setbacks adjacent to shorelines or streams.	High
B2: Undertake responsible development planning along the shoreline.	High
B3: Complete consultations with stakeholders and continue to work with First Nations toward the development of wild rice management principles to address all user interests to the extent possible while recognizing First Nations rights.	High
B4: Implement the following plans: *Fisheries Management Plan for Fisheries Management Zone 17*; Kawarthas, Naturally Connected Natural Heritage Systems Strategy; and Integrated Community Sustainability Plans.	Medium
B5: Undertake an enhanced level of coordination in the review of shoreline development projects between approval authorities.	Medium
B6: Implement a strategic land acquisition program to identify and protect lands that are ecologically and/or culturally significant.	Medium

Urban and Rural Infrastructure Strategy:
Actions that focus on maintaining sustainable operations for government infrastructure projects and other construction works including stormwater and wastewater network as well as shoreline public-access areas, other roads, agricultural drains, and all construction sites

Actions	Urgency
C1: Through stormwater management planning, improve the quality and control of stormwater in urban settlement areas of Bobcaygeon and Omemee.	High
C2: Implement effective sediment and erosion control measures and other practices to prevent contaminants from reaching local watercourses during road work, agricultural drainage, and other construction projects.	High
C3: Increase community enjoyment of public beaches and parks by deterring geese and conducting regular maintenance, and increase public access to shorelines.	Medium
C4: Operate Bobcaygeon sewage treatment facility at maximum efficiency for pollutant removal and capacity.	Medium

Research and Monitoring Strategy:
Actions focused on addressing science-based information gaps to better understand the response of the lakes to emerging pressures, as well as tracking environmental health and plan effectiveness through time

Actions	Urgency
D1: Undertake pilot projects to test the effectiveness of innovative management approaches to overly abundant aquatic plants and poor water quality in priority areas.	High
D2: Conduct research on aquatic plant distribution, composition, and their ecological and cultural	High

significance to better inform aquatic plant management approaches.	
D3: Implement a coordinated lake monitoring program that regularly tracks key indicators of lake watershed health including nutrients, aquatic plants, forest cover, fish communities, and oxygen levels.	Medium
D4: Conduct research to more accurately identify shoreline sources of nutrients, such as septic systems, and potential impacts to nearshore areas of the lakes.	Medium
D5: Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species.	Low
D6: Work towards quantifying and monitoring the economic values of Pigeon Lake.	Low

Communications and Outreach Strategy:
Actions that stimulate dialogue and information sharing among all communities, agencies, and stakeholders and promote sustainable practices to maintain a healthy lake environment

Actions	Urgency
E1: Make available to shoreline residents information that clarifies options for aquatic plant control.	High
E2: Communicate the science, solutions, and outcomes of plan implementation.	High
E3: Maintain the Community Advisory Panel to ensure effective communication, agency support, and collaboration among lake stakeholders during plan implementation.	High
E4: Maintain the Science and Technical Committee to ensure effective communication, support, and collaboration among monitoring and research-based organizations.	High
E5: Create opportunities for stakeholder input through plan implementation, and regularly assess stakeholder needs, concerns, barriers, and knowledge gaps regularly.	High
E6: Profile the natural heritage features, social values, and economic values of Pigeon Lake, including a long-term vision for the lake and a shared sense of responsibility to protect it.	High
E7: Work collaboratively with people who and projects that contribute to the objectives of the lake plan.	High
E8: Undertake Community Outreach to motivate shoreline residents and businesses to implement lake and watershed friendly lifestyles, and to make connections in the community.	Medium
E9: Engage school youth in environmental programming and volunteer opportunities.	Medium

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Acronyms and Unit Conversions

ug/L: Micrograms per litre

m: Metres (1 m = approx. 3.3 feet)

km: Kilometres (1 km = approx. 0.6 miles)

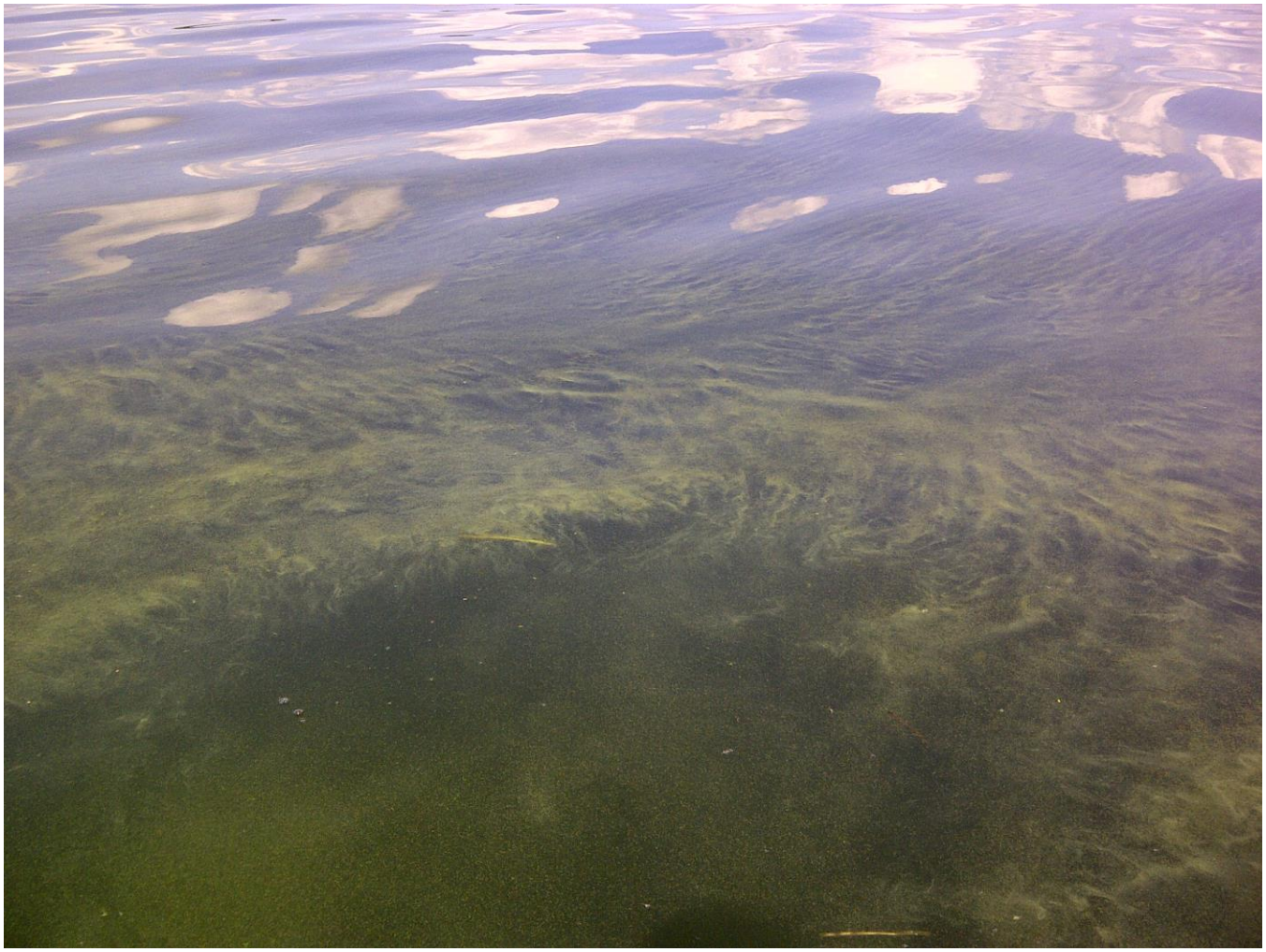
km^2: Square kilometres (1 km^2 = approx. 0.386 $miles^2$ = 100 hectares = approx. 250 acres)

ha: Hectares (1 ha = 0.01 km^2 = approx. 2.47 acres)

kg: Kilograms (1 kg = approx. 2.2 pounds)

m^3: Cubic metres (1 m^3 = approx. 35 cubic feet)

1.0 Setting the Context



Algae Bloom, North Pigeon Lake
(July 2012)

1.1 Introduction

The *Pigeon Lake Management Plan* is the culmination of a four-year study coordinated by Kawartha Conservation and funded by the municipality of the City of Kawartha Lakes, with support from the Municipality of Trent Lakes, and Otonabee Conservation. The Plan is a community-driven endeavour, providing a framework for the implementation of collaborative strategies for maintaining the health of Pigeon Lake and its watershed for all uses.

Pigeon Lake is located in the centre of a chain of lakes known as the Kawartha Lakes, which collectively form the central navigable route of the Trent-Severn Waterway system. The lake is situated within the municipality of the City of Kawartha Lakes, and County of Peterborough (Selwyn Township, and Municipality of Trent Lakes). Waters from Pigeon Lake flow east into Buckhorn Lake, and eventually flow through the Kawartha Lakes and the Trent River into the Bay of Quinte and out to Lake Ontario.

The overall drainage area into Pigeon Lake is approximately 5,287 square kilometres (km^2) and encompasses almost one half of the entire Trent River basin (Figure 1.1). Most of this drainage area comes from Sturgeon Lake watershed from the north-west. The remaining lands drain directly into the lake through Little Bald Lake, as well through several small streams and rivers. Pigeon Lake's surface area, at approximately 57 km^2, is the third largest lake of the 13 named largest Kawartha Lakes along the Trent-Severn Waterway route.

The core management planning area of the *Pigeon Lake Management Plan*, including the lakes, is 711 km^2 (Figure 1.2). Therefore, management actions in this plan are focused on lands and waters that drain directly into Pigeon Lake (including the lake itself), excluding the watersheds of Sturgeon Lake, Big Bald Lake, and Little Bald Lake. The planning area encompasses five municipalities (City of Kawartha Lakes, Peterborough County, Municipality of Trent Lakes, Selwyn Township, and Cavan-Monaghan Township).

Document Layout

Chapter 1 provides the foundation upon which the *Pigeon Lake Management Plan* is developed and includes a summary of lake management drivers, stakeholder values and concerns, management vision and goals, and background characterization.

Chapter 2 provides a summary of management objectives. These include the aspirations of lake-based stakeholders, agencies, and organizations and ultimately provide the foundation for the Implementation Plan. Within each objective, a number of issues hindering their achievement have been presented.

Chapter 3 presents the preferred lake management actions that address the key points and issues identified in Chapter 2. These actions are categorized into five strategies focused on sector-based action items. The strategies include Stewardship, Strategic Planning, Urban and Rural Infrastructure, Research and Monitoring, and Communications and Outreach.

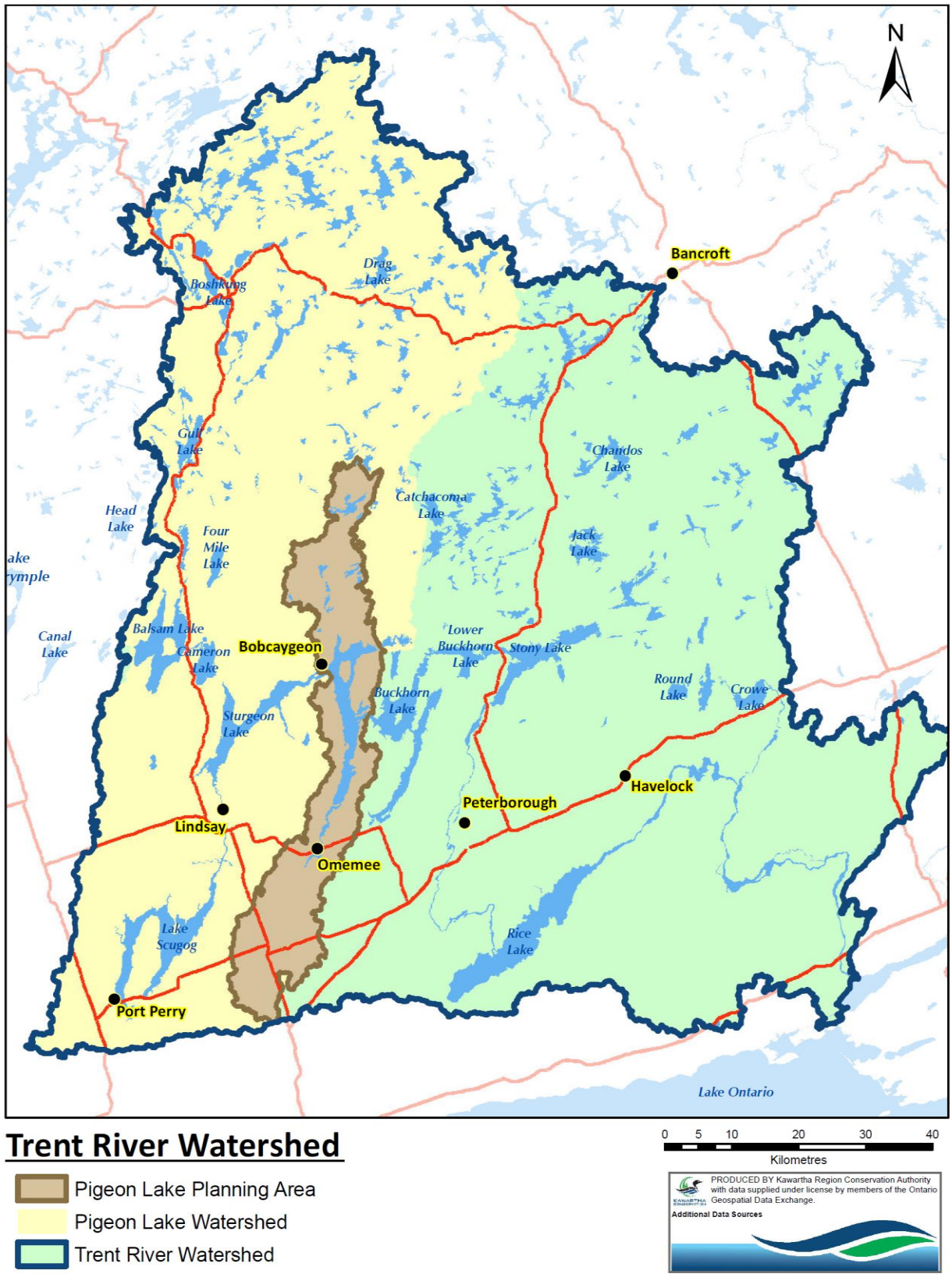


Figure 1.1: Map showing the core Pigeon Lake Management Planning area, in relation to its upstream catchments and the entire Trent River drainage basin

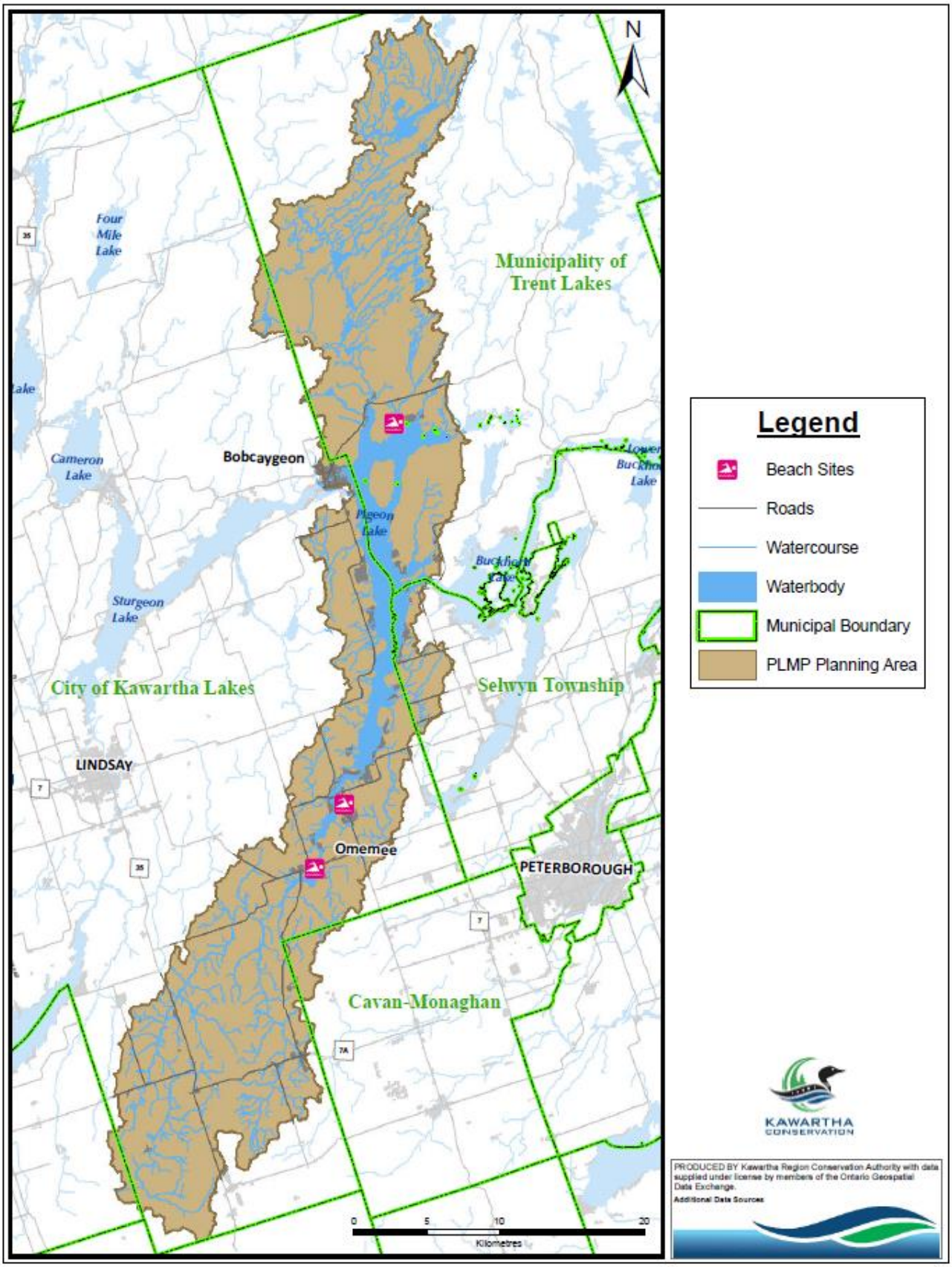


Figure 1.2: Map showing the core Pigeon Lake Management Planning area

1.2 Lake Management Drivers, Values, and Concerns

Pigeon Lake is a water resource of the utmost value to local municipalities, First Nations, shoreline residents, seasonal visitors, and local businesses. Surrounding communities benefit from their economic, environmental, and recreational enjoyment opportunities. For many people, these lakes are an integral part of their identity and livelihood.

The following reports, studies, and recent developments demonstrate the imperative for lake management plans for the Kawartha Lakes:

- In 2002, a report commissioned by the City of Kawartha Lakes, titled *Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes* (Gartner Lee and French Planning Services, 2002), recommended that the municipality encourage the development of individual lake management plans as a cooperative process among lake residents, the municipality, businesses, and provincial and federal agencies.

- In 2007, the *Discussion Paper #1: Natural Environment* tabled for the Panel on the Future of the Trent-Severn Waterway identified ongoing issues that threaten the sustainability of all the Trent-Severn Waterway lakes, including cumulative and ongoing waterfront development and shoreline hardening, wetland loss, upland habitat loss and fragmentation, eutrophication (nutrient enrichment of the lake), and invasive species.

- In 2008, a report by the Panel on the Future of the Trent-Severn Waterway, entitled *It's All About The Water: Report of the Panel on the Future of the Trent-Severn Waterway*, presented 26 recommendations to address issues and opportunities in sustaining the system. Of particular note are the findings from the Executive Summary: "...we have found that the economies of communities and the lives and lifestyles of millions of Canadians depend on effective management of that water."

- In 2008 and 2009, the City of Kawartha Lakes Environmental Advisory Committee hosted a series of Environmental Roundtables, inviting various community representatives to put forward initiatives to help realize their goals of protecting the environment. Twenty-two local associations and organizations with an interest or role in water quality participated. By a wide margin, lake management planning was selected as the number one priority.

- In 2009, a municipal staff report was presented to council, outlining support for lake management plans that aim to sustain healthy lakes. Council supported recommendations that lake management planning actions be coordinated by the local conservation authority. Following the commencement of the Sturgeon Lake Management Planning project, Kawartha Conservation entered into a four-year partnership with the City of Kawartha Lakes to lead the development of the *Pigeon Lake Management Plan*. Plans for additional lakes were also considered at that time.

- In the summer of 2011, lake-water use restriction advisories were issued after widespread and potentially harmful blue-green algae outbreaks were confirmed in sections of nearby Sturgeon Lake and Pigeon Lake.

- In 2012, the City of Kawartha Lakes adopted a new Official Plan; the primary goal is to enhance and protect the quality of the natural environment within the municipality, with a particular emphasis on maintaining healthy water resources.

- In 2013, the Our Kawartha Lakes Integrated Community Sustainability Plan (City of Kawartha Lakes. Draft, 2013) identified numerous water sustainability goals, and the municipality now seeks to achieve many of these through a lake management planning process.

- In 2014, the *Sturgeon Lake Management Plan* (Kawartha Conservation, 2014) was published. This plan was well received by lake stakeholders and recognized as a professional template on which further lake

management plans can be built. Sturgeon Lake drains directly into Pigeon Lake thus implementation of the actions contained within this plan would ultimately have an influence on Pigeon Lake.

- In 2015, the *Balsam Lake and Cameron Lake Management Plan* (Kawartha Conservation, 2015) was published. Balsam Lake and Cameron Lake are located upstream of Pigeon Lake, thus implementation of the actions contained within this plan would ultimately have an influence on Pigeon Lake.

- In 2018 Parks Canada will be undertaking an initiative to update its management plan for the Trent-Severn Waterway. The recommendations outlined within the *Pigeon Lake Management Plan* will provide background information to inform the process.

Community-Based Values and Concerns

Throughout the development of the *Pigeon Lake Management Plan*, significant effort was placed on gathering input from local stakeholders, agencies, and organizations. Particularly, guidance was received from the Community Advisory Panel, a group of committed individuals that met on a routine basis and provided invaluable project support and insight into "what the community wants for their lake."

The following provides a list of key values (Table 1.1) and concerns (Table 1.2) identified by the lake community. These were obtained from consultations with public and lake-specific stakeholders, agencies, and organizations primarily through the Kawartha Conservation Blue Canoe shoreline communication program (summers of 2012 to 2015), a series of public open houses (fall of 2011 and summers of 2013, 2014, and 2015), and several Community Advisory Panel meetings and Science and Technical Committee meetings.

To ensure the lake-based values remain, and lake-based concerns are addressed, a coordinated management approach by all local stakeholders, agencies, organizations (see Appendix A) is required. Open house events provided a clear indication that the lake community is well aware of the issues and will work together with partners who provide effective leadership and a sound action plan.

Table 1.1: Lake values identified by community stakeholders

Lake Values Identified By Watershed Community	Details
Clean Water	Lake stakeholders desire clean water. There are numerous private water intakes along the shoreline that provide water for domestic purposes.
Abundant Wildlife	Healthy fish and wildlife populations provide ample viewing, hunting, and fishing opportunities. The north end of the lake is located in an ecologically significant area known as “The Land Between," which supports high biodiversity.
Aesthetics and Scenery	Many individuals value the lakes as a place of clean water, relaxation, and beautiful scenery. The Kawartha Lakes is a unique place, offering a natural setting within close proximity to urban and agricultural areas.
Wild Rice (Manomin)	First Nations have been active in the Kawartha Lakes area for a significant period of time and have a deep connection to the region. Wild rice is an aquatic plant that is of particular importance to First Nations communities, who rely on its environmental, ceremonial, and dietary benefits to sustain their traditional cultural heritage.
Recreational Opportunities	The lake is known for excellent boating, fishing, and swimming potential. The lake is one of the Tri-Lakes, which allow continuous lock-free boating between Pigeon Lake, Buckhorn Lake, and Chemong Lake (known as the Tri-Lakes), and Big Bald Lake and Little Bald Lake. Further, Emily Provincial Park is accessible, and there are 2 popular sand bars, and several trailer parks and resorts.
Vacation/Cottage/Retreat	The Kawartha Lakes, including Pigeon Lake, have been an attractive tourism attraction for over 70 years. The lakes present a unique opportunity, providing an

	affordable and accessible vacation and retirement destination from urban areas within the Greater Toronto Area and beyond.
Economic Driver	The lake – and the Trent-Severn Waterway as a whole – is a significant tourist attraction that helps sustain local businesses, economies, and property values that rely on or are closely linked to healthy water conditions. The City of Kawartha Lakes, Peterborough County, Selwyn Township, and Municipality of Trent Lakes reap these benefits and, in particular, so do Bobcaygeon and Omemee.

Table 1.2: Lake concerns identified by community stakeholders

Lake Concerns Identified By Watershed Community	Details
Algae Blooms	Residents have reported several incidences of algae blooms in the north end of Pigeon Lake within the last few years. Blue-green algae blooms, in particular, are potentially toxic leading to restrictions on potable water use, as well as being a skin irritant for swimmers.
Condition of Public Beaches	During summer periods, some public beaches are occasionally unfit for swimming as a result of contamination from *Escherichia coli (E. coli)* bacteria. Peace Park Beach in Omemee is of particular concern due to frequent contamination.
Proliferation of Aquatic Plants	Within Pigeon Lake, aquatic vegetation is prolific in localized shallow, protected bays and shoreline areas. The southern half of Pigeon Lake is of particular concern due to its shallow depths and productive sediments, and the recent (within the last decade) proliferation of aquatic plants including wild rice. Shoreline residents feel that a reduction in aesthetics, boating access, and property values has occurred as a result. There are concerns that active planting of new rice beds is a major contributor to its proliferation occurring in southern Pigeon Lake, and that the decaying plant matter accelerates the rates of sedimentation on the lake bottom.
Excessive Nutrient Inputs	There are concerns that excessive nutrients (e.g., nitrogen and phosphorus from lawn and crop fertilizers, animal wastes, and soil sediments) from runoff and human sources are causing contamination of the lakes. There are some concerns related to the efficacy of the Bobcaygeon Water Pollution Control Plant in terms of pollutant removal and spills of untreated wastewater into north Pigeon Lake.
Sedimentation	There are concerns that excessive sedimentation (e.g., soil carried to the lake in water) from runoff is contributing to decreasing water depth, smothering of fish habitat, and increasing productivity of aquatic vegetation.
Poorly Functioning Septic Systems	Concerns have been expressed regarding the potential for faulty or inadequate septic systems/tanks from aging shoreline dwellings, resulting in high nutrient inputs and/or contamination, especially in the nearshore zone.
Invasive Species	Non-native species (plants, fishes, and invertebrates) may be outcompeting or displacing native species, resulting in unbalanced ecosystems.
Water Level Management	High water levels can lead to (minor) flooding of properties and increased erosion. Historical high flows occurred in spring of 2013 and spring of 2014. Conversely, low water levels (winter 2014/spring 2015) can cause perceptive concern. Manipulation of water levels and flows through dams are potentially impacting fish populations and the lake ecosystem.
Geese Management	Many shorelines are frequented by Canada geese; geese droppings and grazing affect shorelines and public beach areas.
Youth Engagement	Some stakeholders have expressed concerns that the younger generation may not be as engaged and active in water quality and natural environment protection.

1.3 Management Vision and Goals

The *Pigeon Lake Management Plan* seeks to solidify a common respect for the lake, maintain a healthy resource for our current generation, and sustain healthy conditions for future generations. The issues facing the lakes will not be addressed overnight. As such, the plan should be considered a long-term endeavour, one that will be achieved only through ongoing collaboration.

Pigeon Lake exists within the Trent-Severn Waterway National Historic Site and within traditional lands of Williams Treaties First Nation, as such Parks Canada consults with local First Nations communities on matters regarding water resources in the lake including the management of wild rice.

The Vision of Pigeon Lake is to

"Ensure the long-term sustainability of a Pigeon Lake ecosystem that provides a high-quality destination for living and working, boating, swimming, fishing, tourism, and access to water for household uses."

The Goals of the *Pigeon Lake Management Plan* are as follows:

- Maintain excellent water quality in Pigeon Lake and its tributaries for human use and ecological needs.
- Promote sustainable human and natural resources management activities that protect and enhance overall watershed and lake health.
- Use science-based findings to guide *City of Kawartha Lakes Official Plan* (and those of other local municipalities) policies, by-laws, and other strategic planning documents to ensure a supportive planning policy framework with a primary goal of protecting the lakes and their watersheds.

Management actions are guided by the following principles:

- Promote an ecological approach to the use of land and water as a fundamental perspective to healthy lakes and as the foundation for effective land use planning within the lakes' watersheds.
- Recognize the links between human health and environmental health, while supporting a healthy economy.
- Maintain a watershed-scale perspective and consider the implications of cumulative actions on the lake basins as a whole.
- Recognize that management is a shared responsibility and requires a shared approach to coordination and implementation of actions.
- Use the management actions in the *Sturgeon Lake Management Plan and Balsam Lake and Cameron Lake Management Plan* to guide the development of the *Pigeon Lake Management Plan*.

1.4 Roles and Responsibilities

The Plan was authored by Kawartha Conservation and submitted to City of Kawartha Lakes as fulfillment of a key funding deliverable: to develop individual Lake Management Plans for all major lakes within the City of Kawartha Lakes, which includes Pigeon Lake. Ownership of the Plan therefore lies with the City of Kawartha Lakes, however, responsibility for undertaking the various management recommendations is presented in the Plan as shared amongst all major parties active in and around Pigeon Lake (Table 1.3). These parties (including local residents, Kawartha Conservation, City of Kawartha Lakes, Ontario Ministry of Natural Resources and Forestry, among others), are listed for each recommendation in Chapter 3 of this Plan as being the most appropriate entity that should be responsible to lead, co-lead, or partner on implementation activities. The plan is not legally binding, therefore implementation is expected to occur on a voluntary basis as willingness, opportunity, and resources become available to the various parties.

Table 1.3: Definition of the roles of various key players in the management of Pigeon Lake.

Partner	Typical Role	Role in Plan Development	Notes
Kawartha Conservation	• Administer Ontario Regulation **182/06** of the *Conservation Authorities Act*, which regulates development in the following areas: shorelines, wetlands, watercourses, watercourse valleys, hazardous lands such as steep slopes, and flood plains. • Review Planning Act proposals (e.g., minor variances, severances, Plans of Subdivision, etc.) as per Service Agreement with City of Kawartha Lakes, and provide recommendations to ensure conformity with Provincial Policy Statement for Natural Hazards, Natural Heritage Features, and Water Resources.	• Hired by City of Kawartha Lakes to study the lake, meet with local stakeholders, and produce a Plan that provides several recommendations towards maintaining a healthy lake. • Undertake a multi-year science-based study of water resources in lake and its watershed. • Organize and facilitate public consultation and communication (e.g., local open houses, stakeholder meetings, media releases, etc.). • Lead writer of Management Plan and Characterization Report.	• There exists another conservation authority (Otonabee Conservation) that administers the *Conservation Authorities Act* in lands along the central-east side of the lake.
City of Kawartha Lakes	• Administer land use policies and bylaws as per Official Plan. • Undertake public infrastructure works (e.g., maintenance on local and county roads and ditches, etc.). • Approve septic system works as per Ontario Building Code.	• Hired Kawartha Conservation on a 4-year project basis to study the lake, meet with local stakeholders, and produce a Plan that provides several recommendations towards maintaining a healthy lake. • Provide input into the process and review key documents.	• There exists numerous municipal jurisdictions within the Planning Area in addition to City of Kawartha Lakes (please refer to Figure 1.2), including Peterborough County, Township of Trent Lakes, Township of Selwyn, and Township of Cavan-Monaghan.

Parks Canada (Ontario Waterways, Trent-Severn Division)	• Various water management goals, as summarized by AECOM (2011):
	  • Reducing threats to public safety and negative impacts to public and private infrastructure from over-bank flooding, ice damage, extreme water level fluctuations, and high volume flows.
	  • Contributing to the health of Canadians through the availability of drinking water for residents, cities and towns throughout the watershed
	  • Providing safe boating and navigation along the marked navigation channels
	  • Protecting significant aquatic habitats and species
	  • Optimizing the enjoyment of the water throughout the watershed
		• Provide input into the process and review key documents.
		• Active participant on the Community Advisory Panel during lake studies and plan preparation.
			• The bed of Pigeon Lake is under the administration and jurisdiction of Parks Canada.

Partner	Typical Role	Role in Plan Development	Notes
	by shoreline, residents and visitors, of the Trent Severn Waterway • Allowing hydroelectric generation plants to operate at plant capacity and meet demand for renewable energy insofar as possible		
Williams Treaties First Nation	• Protection, conservation and sustainable collaborative management are a priority for the Williams Treaties First Nation.	• Provide input into the process and review key documents. • Active participant on the Community Advisory Panel during lake studies and plan preparation.	• The Williams Treaties First Nation are comprised of the Mississaugas of Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, Scugog Island First Nation and the Chippewas of Beausoleil First Nation, Georgina Island First Nation and the Rama First Nation. • Pigeon Lake exists in the Treaty 20 area.
Residents and community members residing along shoreline and in watershed.	• Routine sampling of lake water quality as per volunteer-based Lake Partner Program. • Live, work, socialize, and recreate.	• Provide input into the process and review key documents. • Some residents participated on the Community Advisory Panel, while others provided one on one input upon request following the 2016 Open Houses	•
Ontario Ministry of Natural Resources and Forestry	• Administer policies as per Endangered Species Act (e.g., ensuring species and habitats of Endangered or Threatened species are protected), and Fish and Wildlife Conservation Act (e.g., fishing and hunting regulations). • Support invasive species management, including Invading Species Awareness Program. • Monitor recreational fishery as per Broad Scale Monitoring program.	• Provide input into the process and review key documents. • Active participant on the Community Advisory Panel during lake studies and plan preparation.	•
Fisheries and Oceans Canada	• Administering policies as per the Fisheries Act, including reviewing and approving proposals that have potential to cause serious harm to fish habitat that supports the local fishery.	• Minimal, provide input into the process and review key documents.	•
Various other non-governmental organizations	• Various roles, including: land stewardship and community-based projects.	• Provide input into the process and review key documents. • Active participant on the Community Advisory Panel during lake studies and plan preparation.	• Please refer to Appendix A: Key Communities and Stakeholders for a comprehensive list.

1.5 Lake Background Characterization

To provide background information on the current environmental state of Pigeon Lake and its subwatersheds, a companion report was developed alongside the *Pigeon Lake Management Plan* that characterizes current lake conditions. This report, the *Pigeon Lake Watershed Characterization Report* (Kawartha Conservation, 2015), presents current information on lake resources (such as land use trends, water quality trends, etc.) as well as their functions, linkages, key issues, and information gaps.

In characterizing Pigeon Lake, the project team has drawn upon all available data, studies, and sampling results and combined this information into a report for review and update as required. This background information, compiled primarily by specialist staff of Kawartha Conservation and vetted through science-minded peers, and other community groups helped to inform management decisions and actions developed through the planning process.

The following is a summary of the report findings, presented in five key themes: Land and Lake Use, Water Levels and Flows, Water Quality, Aquatic Ecosystems, and Terrestrial Natural Heritage.

1.5.1 Land and Lake Use

Historical Context

The region around Pigeon Lake was historically occupied by First Nations peoples, who likely had little or short-term environmental impact. A recent archaeological site discovered in Jacob Island, with artifacts and remains dating back to 4700 BC, is considered to be the earliest known collective burials in south-central Ontario (Conolly et al. 2014). It is likely that more of these historical sites will emerge in the coming years during archaeological investigations associated with shoreline development planning.

As European settlement expanded into the area, there was a gradual but steady shift from exploiting the lakes' resources for commercial purposes (particularly through the extensive logging of forests and transporting large quantities of cut timber to mills, along with other products, on the Kawartha Lakes system) to enjoying the lakes for recreational purposes in the post-war era (such as providing a seasonal vacation retreat). In recent years, it has supported a more permanent population through conversions of seasonal to year-round residences, and it has steadily become more attractive as a retirement destination.

The surface area of Pigeon Lake was expanded in the early 1830's through the construction of a dam by a local settler in what is now known as the town of Buckhorn, consequently causing the water level of Pigeon Lake to rise and enlarging some portion of the southern end of the lake. In the mid 1880's the dam was further improved, potentially further enlarging the surface area of southern Pigeon Lake to current levels as part of the construction of the Trent-Severn Waterway.

During settlement in the 19th century, steam boats and log runs were common sights on the Kawartha Lakes, due to the construction of the dam and locks systems at Bobcaygeon and Buckhorn. Further inland, expansive forests were cleared to fuel the timber industry (and later to allow for farming), and wetlands were drained to create fertile crop lands.

By the mid-20th century, land use in the upland and southern parts of the basins formed a distinctly rural landscape interspersed with remnant tracts of natural lands that have historically been too wet or too rocky to farm productively. The shoreline became heavily settled with residential cottages and dwellings during and after this time period, particularly in the urban centre of Bobcaygeon, but also in several smaller lakeside communities such as Windward Sands, Lakeview Estates, the Glen, and Victoria Place, among others.

Current Land Use

The major land use types in the core planning area are natural areas (56%), agriculture (27%), open water (10%), and development (7%) (Figure 1.3). The northern part of the basin is mostly natural cover, owing in large part to large expanses of forest and wetland within Nogies Creek and Eels Creek subwatershed.

The landscape around the western, eastern, and southern parts of the lake's basin is distinctly agriculture-based. Farming is a main source of economic activity in this region. Grain and hay crops dominate farm enterprises, and beef cattle production is second. Due to market forces, there is an apparent trend to more land conversion from pasture lands to crop fields resulting in land clearing and drainage improvements, typically tile draining. Also, there seems to be a trend toward fewer farms, managing larger areas of land.

The natural areas on the landscape consist mainly of large forest and wetland tracts in the northern section, and forested areas in the southern section associated within the Oak Ridges Moraine. As well, there are several isolated forest and wetland areas; the majority of which still exist today within a rural setting because they have always been too difficult to farm effectively, as they are typically wet, low-lying areas.

Most of the developed areas in the planning area are located in Bobcaygeon, Omemee, and scattered along shoreline areas. There is a significant summer influx of seasonal residents in these areas due to cottage, tourism, and recreational opportunities. Reliable tourism and manufacturing industries, as well as transportation corridors to and from the Greater Toronto Area, are key to sustaining the prosperity of these communities. Numerous lake-related businesses and organizations cater to tourism and seasonal residents, for example, lodges, golf courses, bed and breakfasts, entertainment, landscaping, and property management.

A specific population count for the Pigeon Lake watershed is unknown, however, the current population (as of 2011) of the City of Kawartha Lakes is 73,215. By 2031, the forecast for the municipality is a permanent population totaling approximately 100,000. The majority of this increase will occur in urban areas around lakes.

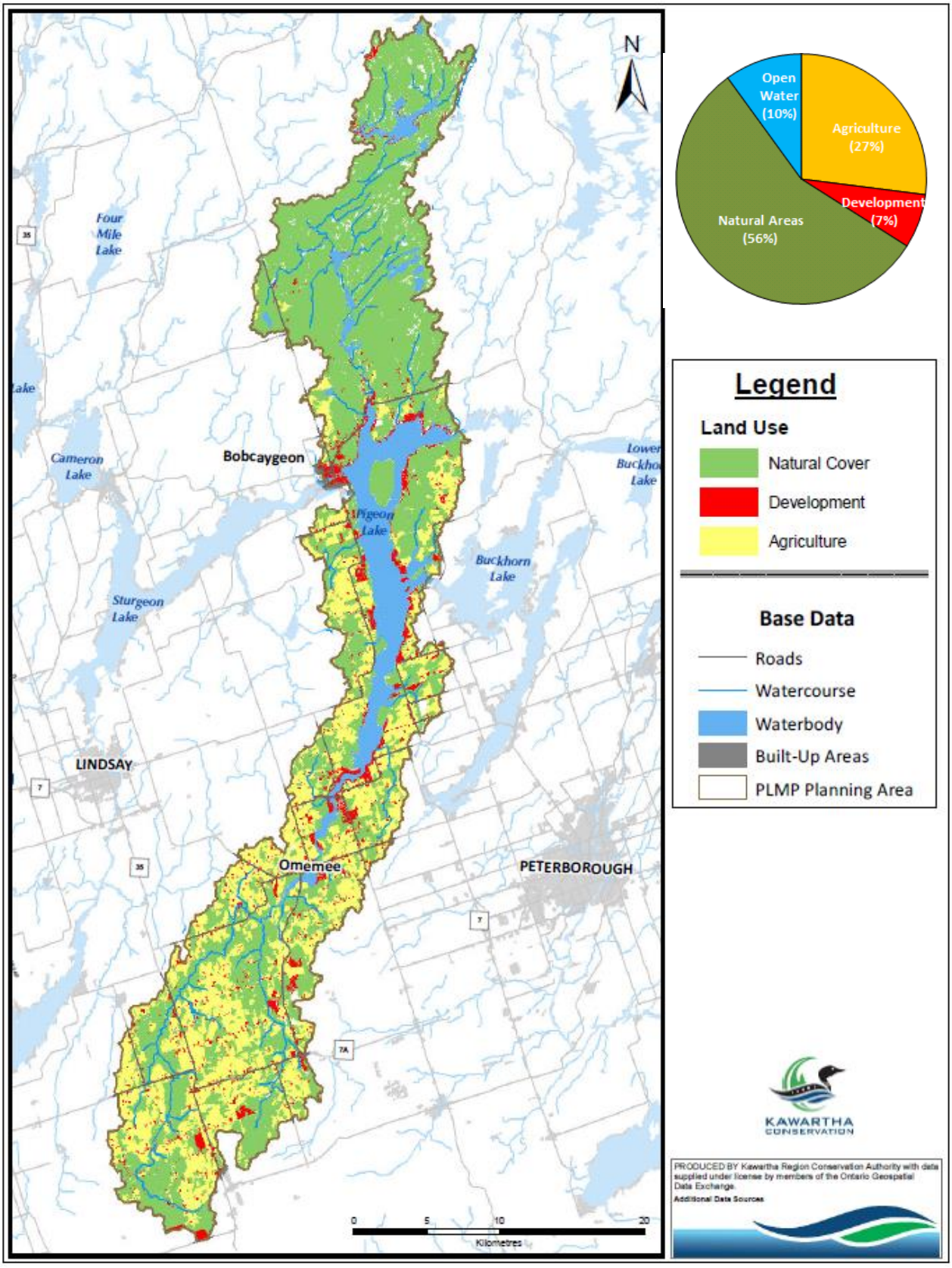


Figure 1.3: Map showing major land use types within the core Pigeon Lake Management Planning boundary

Shoreline

The shoreline of Pigeon Lake is approximately 100 kilometres (km) in length. As shown in Figure 1.3, and Table 1.4, urban development in Pigeon Lake planning area is concentrated within Bobcaygeon, Omemee, and along shoreline areas. As of 2013, approximately 29% of the shoreline on Pigeon Lake has been developed within a 30-metre distance from shore. Most of this area has been cleared of natural vegetation to accommodate cottage or residential property development. Historically, shoreline development was dominated by three-season cottage dwellings. More recently, there has been a shift to more permanent home dwellings as seasonal dwellings are being upgraded to four-season residences.

The rate of development has been more rapid along the shoreline of Pigeon Lake than in many other Kawartha Lakes. Mystic Consulting Services and Ecoplans Limited (2005) report that building densities along the shorelines of all the Kawartha Lakes have dramatically increased since the 1950s. Pigeon Lake experienced a 66% increase between 1952 and 1968 and a Kawartha Lakes high of 232% increase between 1968 and 1994 (Figure 1.4). At present, there are approximately 1560 residences located along the shoreline of Pigeon Lake. It is estimated that 55% of these are permanent dwellings, and 45% are in seasonal use.

As a consequence of increased development intensity, the shoreline has also been significantly altered at the water's edge (that is, the shore/water interface). In Pigeon Lake, it is estimated that 17%, or 24 km in length of the water's edge consists of artificial land use including concrete, wood, manicured lawn, armour stone, and other materials (Figure 1.5).

Table 1.4: Table showing major land use types along the Pigeon Lake shoreline, within varying distances from shore

Distance from Shore:		15m	**30m**	100m	500m	1km
Pigeon Lake	Developed (%)	29%	**29%**	28%	17%	13%
	Natural (%)	70%	**69%**	68%	63%	62%
	Agricultural (%)	1%	**1%**	4%	20%	26%

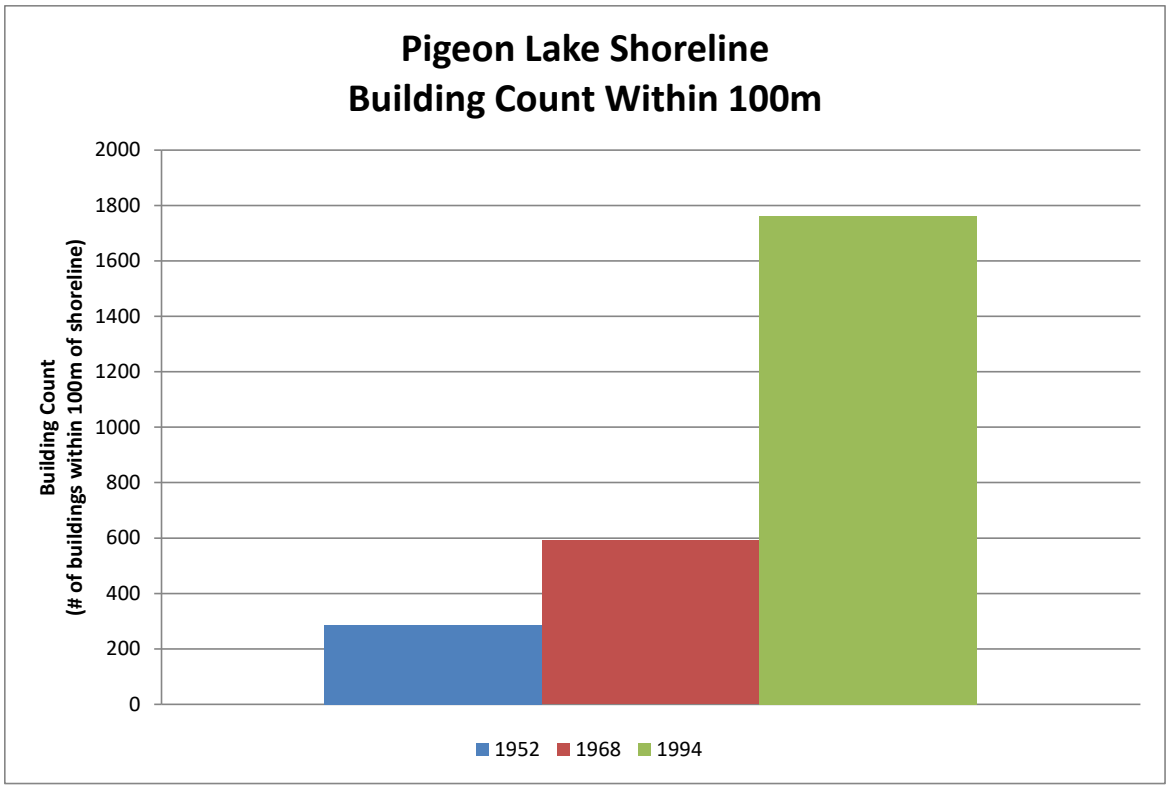


Figure 1.4: Pigeon Lake shoreline building density in 1952, 1968, and 1994

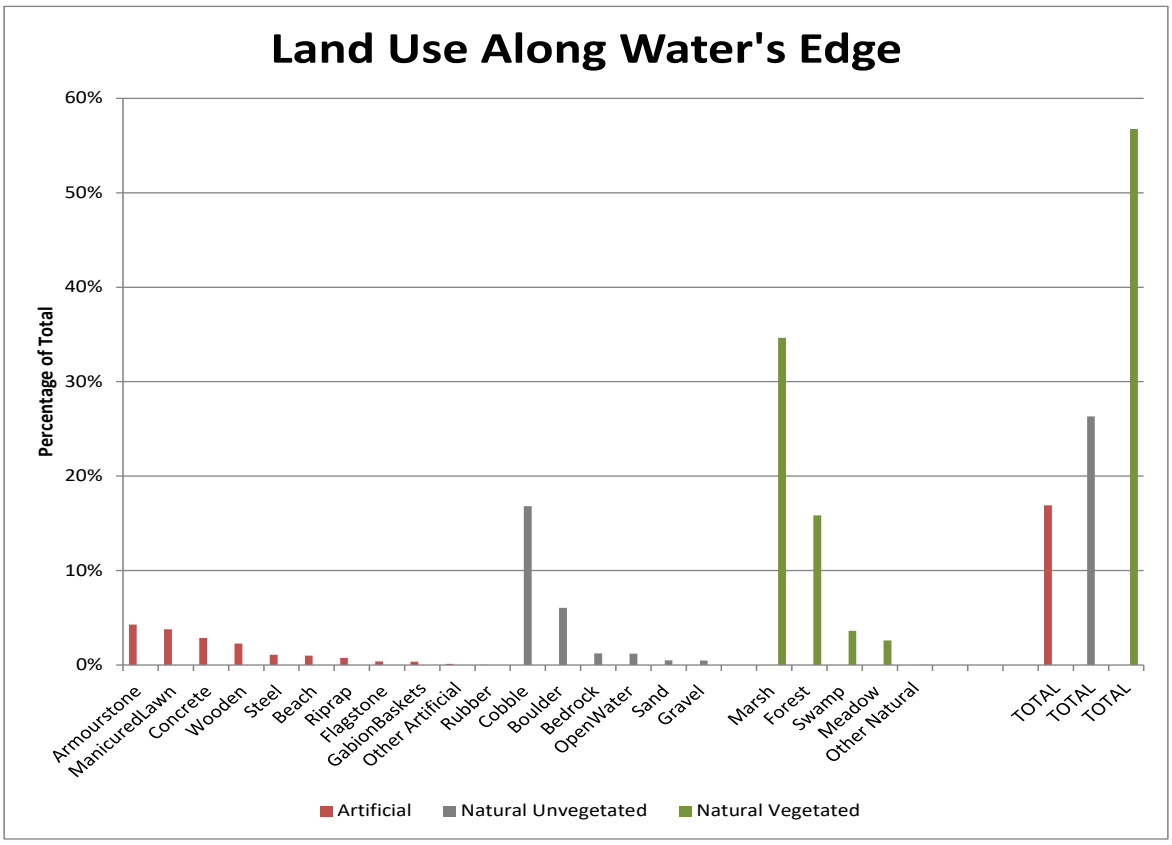


Figure 1.5: Major land use characteristics at the water's edge of the Pigeon Lake shoreline

Tourism and Recreation

Pigeon Lake is a central lake of the Trent-Severn Waterway system. The lake is directly connected to Buckhorn Lake, Chemong Lake, Little Bald Lake, and Big Bald Lake, and via locks to Sturgeon Lake (Bobcaygeon Lock #32). The locks at Bobcaygeon are the busiest along the entire navigable system. In 2011 alone, approximately 7,400 vessels travelled through Bobcaygeon.

The lakes provide ample opportunities for swimming, boating (power, canoe, and sailboat), fishing, and hunting, all of which are key recreational activities on the lake. Fishing is particularly significant. A 2005 survey of recreational fishing in Ontario (Ministry of Natural Resources, 2009) indicates that the Kawartha Lakes provide one of the largest recreational fisheries in Ontario in terms of number of days fished. Pigeon Lake was ranked as the 14th most-fished lake in Ontario in terms of number of days fished, and it hosts numerous competitive fishing tournaments every year. Historically, the Kawartha Lakes have attracted significant numbers of anglers because of highly desired fish stocks (especially walleye) and high natural productivity of the lakes. Within Fisheries Management Zone 17 (i.e., the Kawartha Lakes region and coldwater streams along Lake Ontario), it is estimated that investment expenditures related directly or indirectly to fishing totaled approximately $114 million in 2005 alone (Ontario Ministry of Natural Resources, 2010).

There are two sandbars on the west-side of Pigeon Lake, near Long Point Bay and just north of Grenadier Island. These are shallow sandy areas out into the lake that are popular mooring and swimming locations.

There are three active public beaches within the planning area: Crowe's Line Beach, Omemee Peace Park Beach, and Emily Provincial Park Beach. All beaches have been posted as "unsafe for swimming" at least once during the last five years, due to high levels of bacteria in the water (Figure 1.2 and Figure 1.6). Peace Park Omemee Beach has most often been posted.

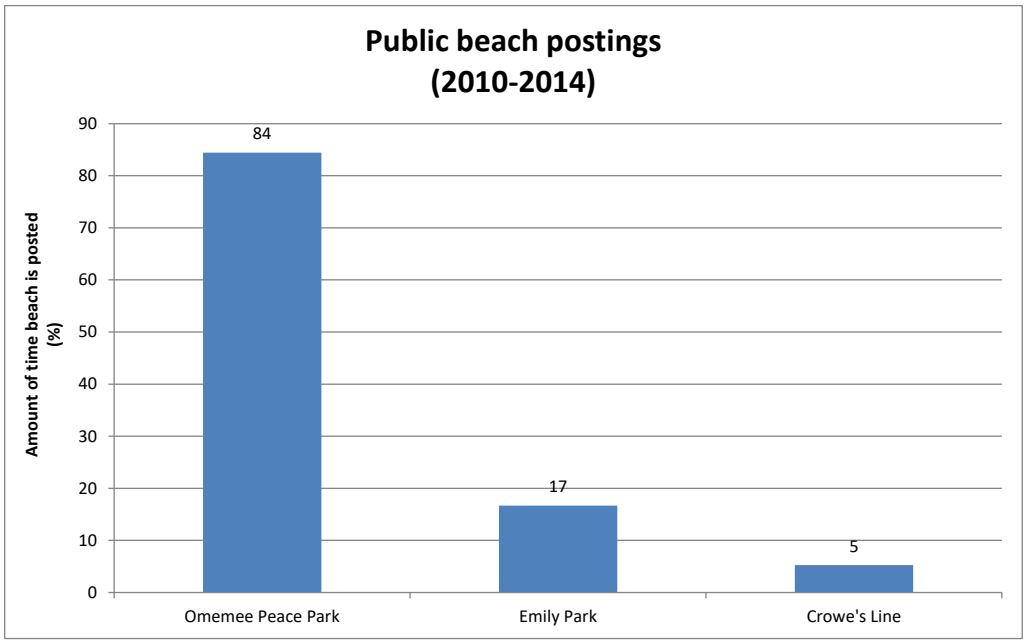


Figure 1.6: The amount of time (in percent) that each public beach has been posted during the swimming season (June, July, and August), between 2010 and 2014. Note Crowe's Line and Emily Park have only been sampled since 2013.

The seasonal influx of vacationers in the municipality in the summer months is upwards of 17,500 (which equals an increase of 25% of the population), who mostly visit cottages and lakeside communities. The total seasonal population is forecast to grow from 31,000 (as of 2006) to approximately 37,500 by 2031. In 2008, an estimated total of 1,263,000 personal visits were made to the City of Kawartha Lakes, 56% of which were made for pleasure, making it the seventh most visited destination in Ontario. Total visitor spending that year was approximately $111 million, and visitors were mostly Ontario residents. Pigeon Lake, due to the ability to travel into various lakes without locking, is particularly attractive for waterfront living and water-based recreational activities.

Emily Provincial Park is a popular tourism destination in the summer, offering approximately 300 camping sites. In an average year, the park attracts thousands of visitors.

Drinking Water and Wastewater

There are no municipal intake systems that draw water from Pigeon Lake. Many private shoreline residences have individual or communal pump intakes on lake shorelines; however, most private residences along the lake draw groundwater from wells. In terms of wastewater, the majority of residents along Pigeon Lake are on private septic systems. Within Bobcaygeon, a water pollution control plant treats wastewater and discharges into the north-west shore of Pigeon Lake near the outlet of Big Bob Channel. Within Omemee, a water pollution control plant (lagoons) treats wastewater and discharges on-site. This facility is located approximately 1 km away (west) from Pigeon River and thus effluent likely has no impact on Pigeon Lake.

1.5.2 Water Levels and Flows

The surface area of Pigeon Lake is approximately 57 km^2, making it the 3rd largest lake of the 13 large named Kawartha Lakes (lakes include Pigeon, Balsam, Cameron, Sturgeon, Little Bald, Big Bald, Buckhorn, Lower Buckhorn, Lovesick, Clear, Katchewanooka, Rice, and Scugog). In water volume, Pigeon Lake is also the 3rd largest lake, at approximately 189 million cubic metres (m^3). Pigeon Lake has an average depth of 3.3 metres, and a maximum depth of 13.5 m. The water levels of the lake are regulated by a Trent-Severn Waterway dam in the village of Buckhorn. As such, Pigeon Lake water levels are the same as neighbouring connected Buckhorn Lake and Chemong Lake (collectively known as the Tri-Lakes), Little Bald Lake, and Big Bald Lake.

Pigeon Lake, on average, receives 2.25 billion m^3 of water flow every year. Most of this water (89%) comes from Sturgeon Lake, which outlets at Bobcaygeon through the Big Bob and Little Bob Channels in the north-west end of the lake (Figure 1.7). The remaining water inputs include Pigeon River Subwatershed (4%, which includes Fleetwood Creek Subwatershed), Nogies Creek Subwatershed (3%), local surface inflow (2%, which includes Pigeon Lake Subwatershed, Eels Creek, and Reforestation Creek), direct precipitation (2%), Potash Creek (<1%), and septic systems around the lake (<0.1%). Water exits Pigeon Lake through Gannon's Narrows into Buckhorn Lake and eventually continues in a general southeast direction through the Kawartha Lakes, eventually draining into Lake Ontario through the Trent River and the Bay of Quinte.

Water levels in the lake are regulated by Parks Canada, Trent-Severn Waterway, with the primary mandate to maintain enough water in the system during the months of late spring, summer, and early fall to accommodate vessel navigation through the waterway. The full navigation water level, as monitored in Buckhorn, is approximately 246 metres above sea level. The lake levels are reduced in the winter months in preparation for spring runoff, largely from the northern reservoir lakes and their watersheds extending into Algonquin Park. These fluctuations are similar to those expected on natural lakes, except that on natural lakes the frequency and amplitude of water level fluctuations (that is, extreme highs and lows) are typically greater. The average annual water level regime is shown in Figure 1.8.

The tributaries entering Pigeon Lake, however, tend to exhibit well-defined seasonal flow patterns, more typical of a natural flow regime. High flows typically occur during early spring, associated with snowmelt, and throughout the year following high precipitation events. Low flows are usually observed in the summer and winter months. Groundwater discharge areas are limited in the planning area, therefore many sections on the smaller tributaries often run dry during summer months or have limited sustained flow.

The locations of all water inputs including local subwatershed drainage areas are shown in Figure 1.9. During certain times of the year, some of the tributaries at their downstream sections (e.g., Pigeon River, Nogies Creek, Eels Creek, etc.) may actually flow upstream or backwards, as significant inputs into the lake from Sturgeon Lake raise the lakes water levels higher than the outlets of these systems.

Abundant wetlands and forested areas in the northern portion of the Pigeon Lake watershed provide significant benefits for surface water by moderating stream flow, providing high and low flow mitigation, and assisting in groundwater recharge.

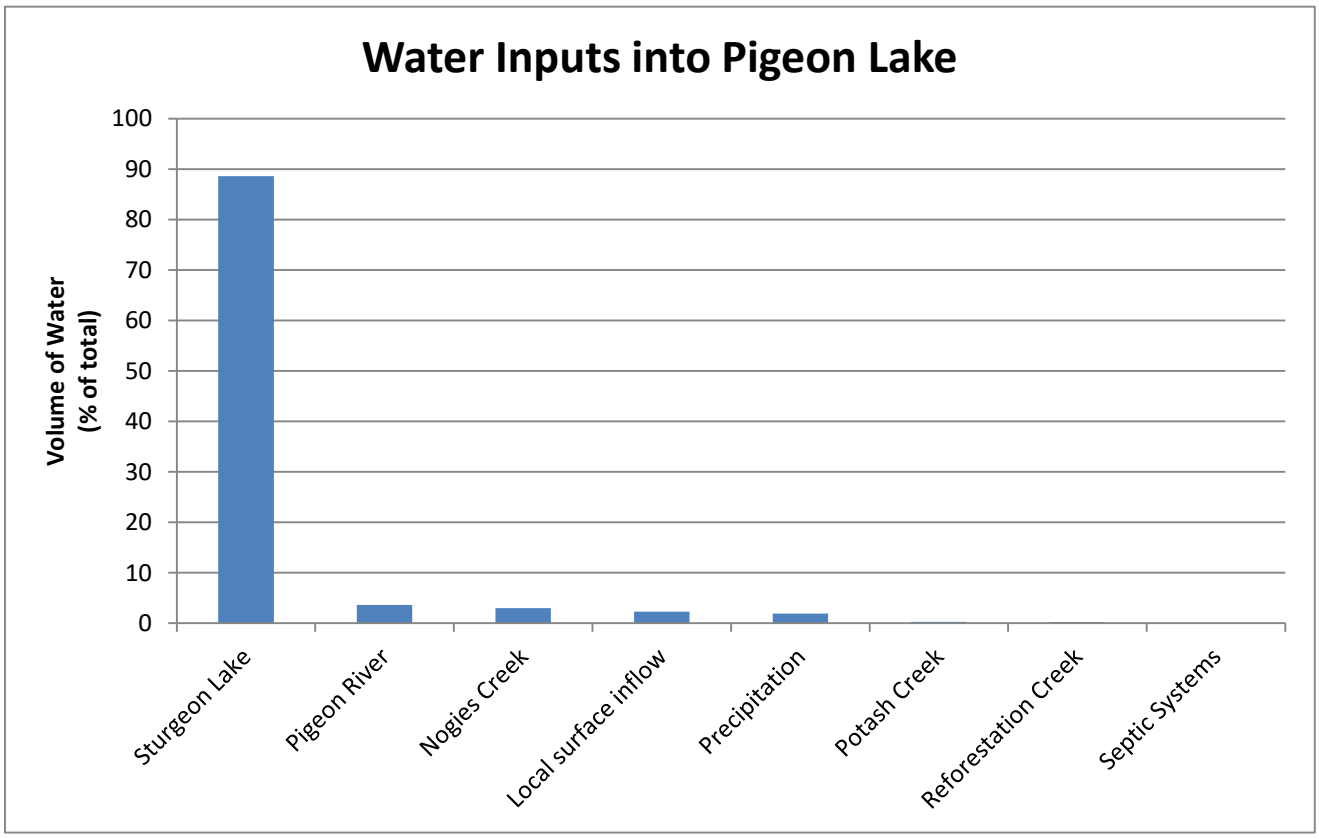


Figure 1.7: The major sources of water, by volume, entering Pigeon Lake on an average yearly basis (2012-2015)

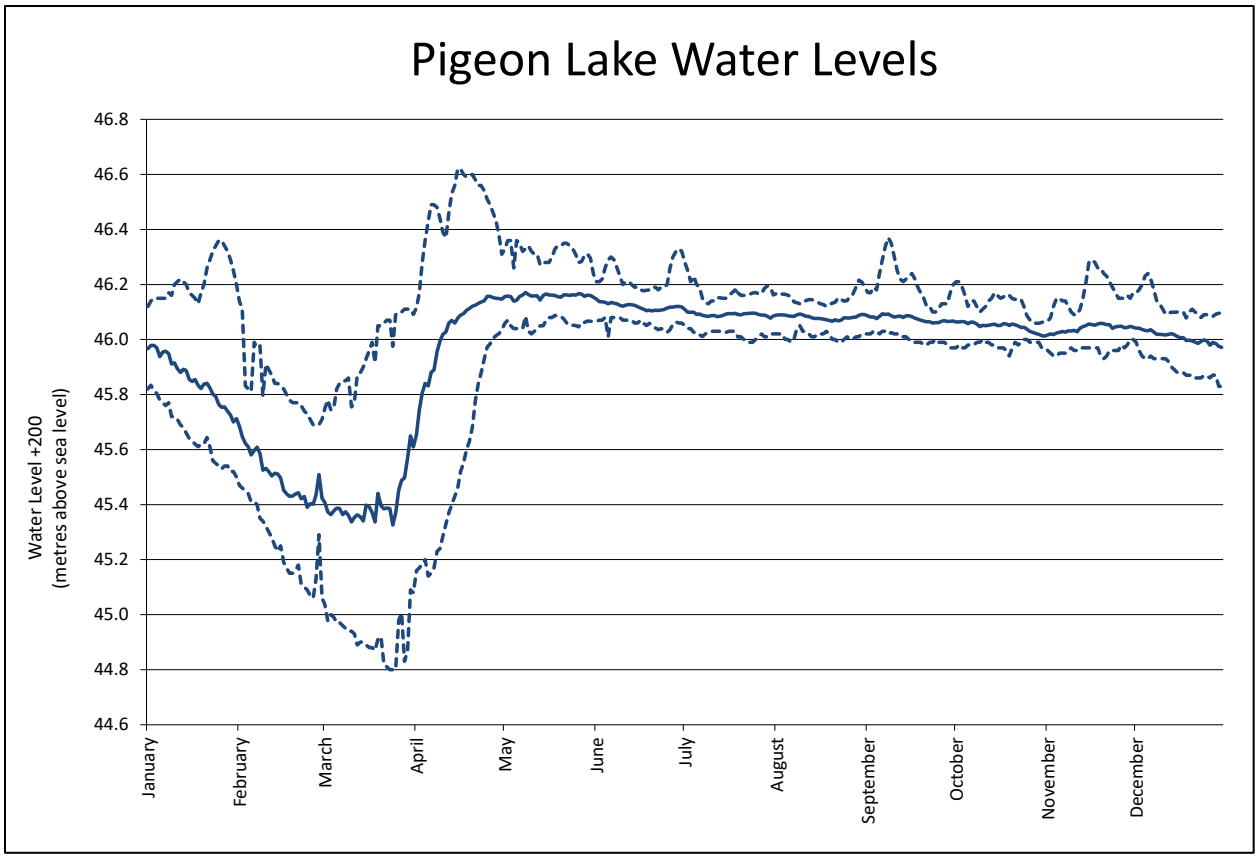


Figure 1.8: Daily average (solid line), maximum and minimum (dashed lines) water levels of Pigeon Lake (1973-2011)

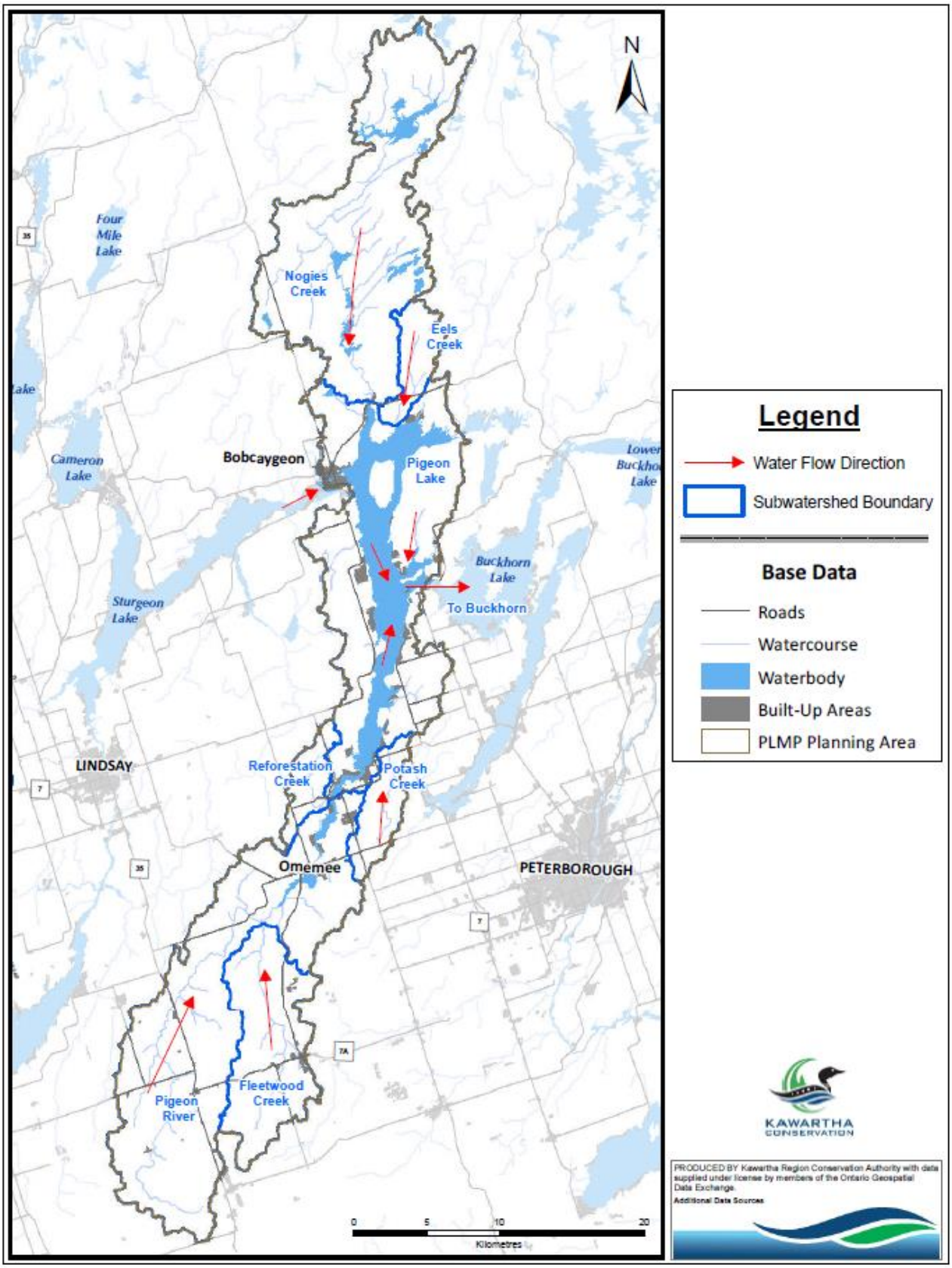


Figure 1.9: Major subwatersheds and their flow direction within the Pigeon Lake Management Planning area

1.5.3 Water Quality

The need to maintain good water quality conditions in Pigeon Lake is a major trigger for development of the *Pigeon Lake Management Plan*. Good water quality is important to maintaining the environmental, economic, and socio-cultural benefits provided by the lakes.

Pigeon Lake receives most of its water from Sturgeon Lake, which is historically recognized as one of the lakes with its water quality most compromised in all the Kawartha Lakes system (along with Rice Lake and Lake Scugog). As such, there have been elevated concentrations of pollutants (e.g., phosphorus, etc.) in the north end of Pigeon Lake which led to frequent reports of algae bloom outbreaks. At present, Pigeon Lake is characterized as being a meso-trophic (moderately productive) water body with relatively good water quality. According to the *Provincial Water Quality Objectives* (Ontario Ministry of Environment and Energy, 1994), to avoid nuisance concentrations of algae in lakes, the average total phosphorus concentrations for the ice-free period should not exceed 20 micrograms per litre (ug/L). As shown in Figure 1.10, according to recent water chemistry sampling, all sections of Pigeon Lake meet this criterion (lake-wide average of 16.4 ug/L).

Some lakes in the Kawartha Lakes system (e.g., Sturgeon Lake and Rice Lake) have shifted in the last 40 years from murky open-water dominated lakes with frequent algae blooms to clearer lakes with more abundant aquatic plants. This coincided with substantial decreases in nutrient concentrations, due in large part to phosphate reduction regulations and wastewater treatment improvements. Other processes have likely contributed to this apparent shift such as internal nutrient cycling, invasive species, and water temperature changes among others. During this time period, average total phosphorus concentrations in Pigeon Lake decreased by approximately 35%. According to volunteer-data from the Kawartha Lake Stewards Association collected between 2003 and 2014, sample sites within the lake show stable (or slightly increasing) phosphorus concentrations over this time (KLSA, 2015). The northern sites appear to retain higher phosphorus levels late in the season, perhaps because they do not receive the increased late summer/fall flow through the Trent-Severn Waterway as feeder lakes are drawn down. The northern, deeper section of the lake is also prone to episodic cyanobacteria (blue-green algae) blooms.

As stated in the *Provincial Water Quality Objectives* (Ontario Ministry of Environment and Energy, 1994), excessive plant growth in rivers and streams should not be evident at a total phosphorus concentration below 30 ug/L. As shown in Figure 1.11, according to recent water chemistry sampling, all Local Subwatersheds have phosphorus concentrations that meet this objective except for Reforestation Creek. This subwatershed has extremely high average concentrations, over three times the Provincial Water Quality Objective.

Phosphorus Loading by Water Source

Another way of summarizing phosphorus information is to convert concentrations to loading amounts. Loading is the amount of phosphorus, by weight, that enters the lake on a yearly basis.

For Pigeon Lake, the phosphorus loading data from 2012 to 2015 indicate that approximately 29,161 kg of phosphorus enter the lake every year. The majority of phosphorus enters the lake during the spring, when elevated runoff caused by snowmelt and precipitation carries large quantities of nutrients into the lake. Figure 1.12 provides a breakdown of current phosphorus inputs into the lake by water input source. The categories represent inputs from the catchment areas identified in Figure 1.9. The following provides a summary of current phosphorus loadings into Pigeon Lake each year by water source.

- Sturgeon Lake accounts for 80% (23,201 kg) of the total. Flow from Sturgeon Lake has some of the lowest average phosphorus concentrations (13.4 ug/L) of any inflow. However, since the volume of flow entering Pigeon Lake from the river is extremely high (89% of the total annual inflow), it accounts for the majority portion of nutrient loadings into the lake.

- Local Subwatersheds account for 19% (5,437 kg) of the total. This includes all phosphorus entering Pigeon Lake from subwatersheds within the core planning area. The Pigeon Lake Tribs. Subwatershed accounts for the majority of phosphorus in this category (9% or 2,609 kg), which includes several unnamed tributaries as well as all of the shoreline septic systems around the lake and the loadings from the Bobcaygeon Water Pollution Control Plant. Pigeon River accounts for 5% (1,350 kg), Nogies Creek for 2% (701 kg), Reforestation Creek for 2% (581 kg), Potash Creek for <1% (123 kg), and Eels Creek for <1% (73 kg).

- Atmospheric deposition accounts for 2% (523 kg) of the total. This category was measured from rain and snow sampling and includes inputs from wet deposition such as rain, snow, and dew, as well as from dry deposition from dust. Due to the large watershed area of Pigeon Lake compared with its total lake area, the contribution from atmospheric deposition is relatively low compared to other large lakes in southern Ontario. For example, this category accounts for approximately 27% of all phosphorus entering Lake Simcoe and 20% for Lake Scugog. These two lakes differ from Pigeon Lake in that they have relatively small upstream catchment areas in relation to their large lake surface areas.

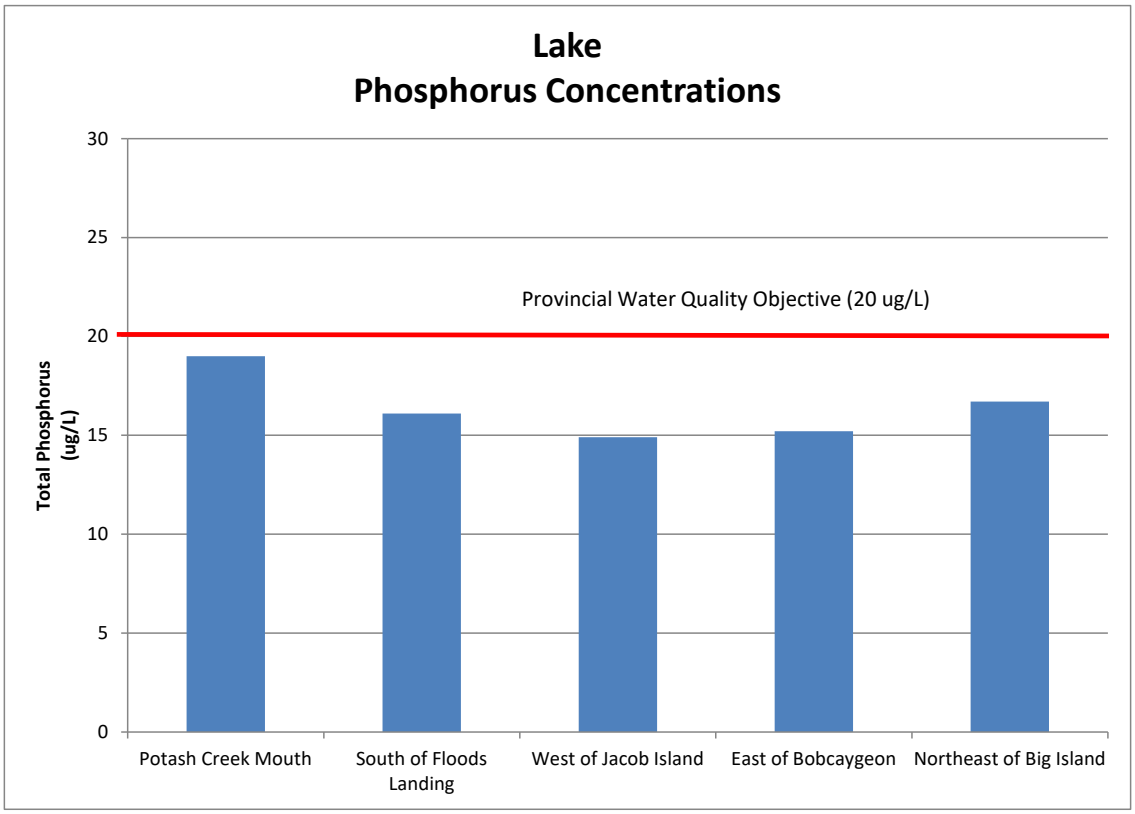


Figure 1.10: Average phosphorus concentrations (2012-2015) in Pigeon Lake during the ice-free period, in relation to provincial water quality objectives

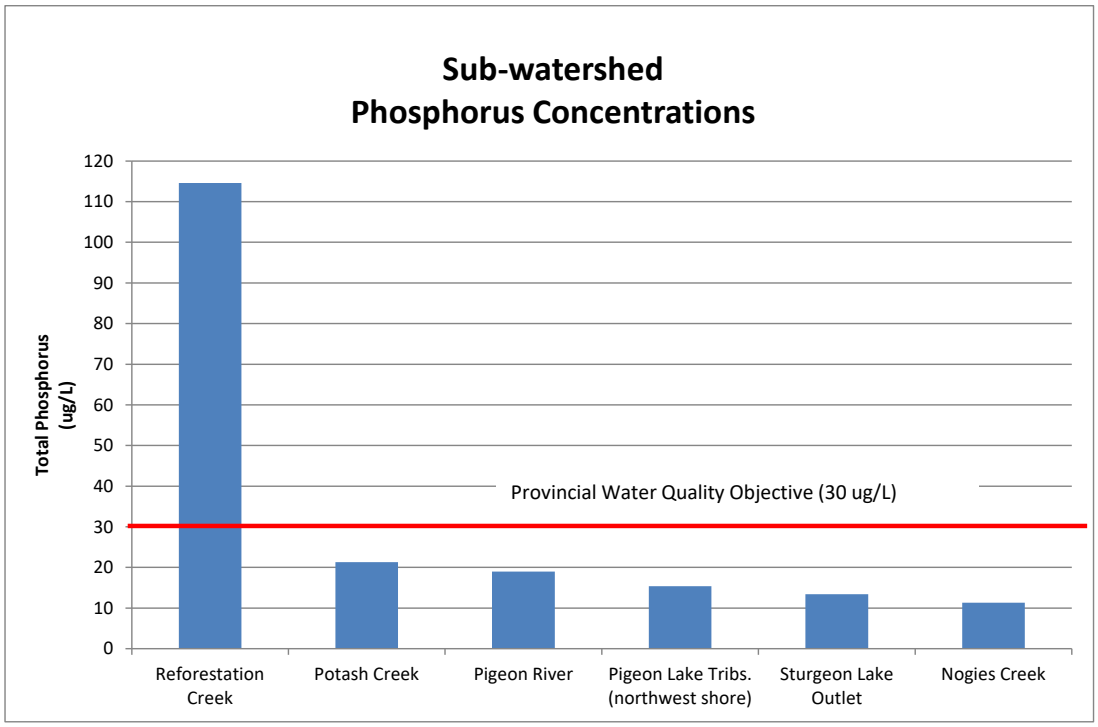


Figure 1.11: Average phosphorus concentrations (2012-2015) in lake subwatersheds and large tributaries, in relation to provincial water quality objectives

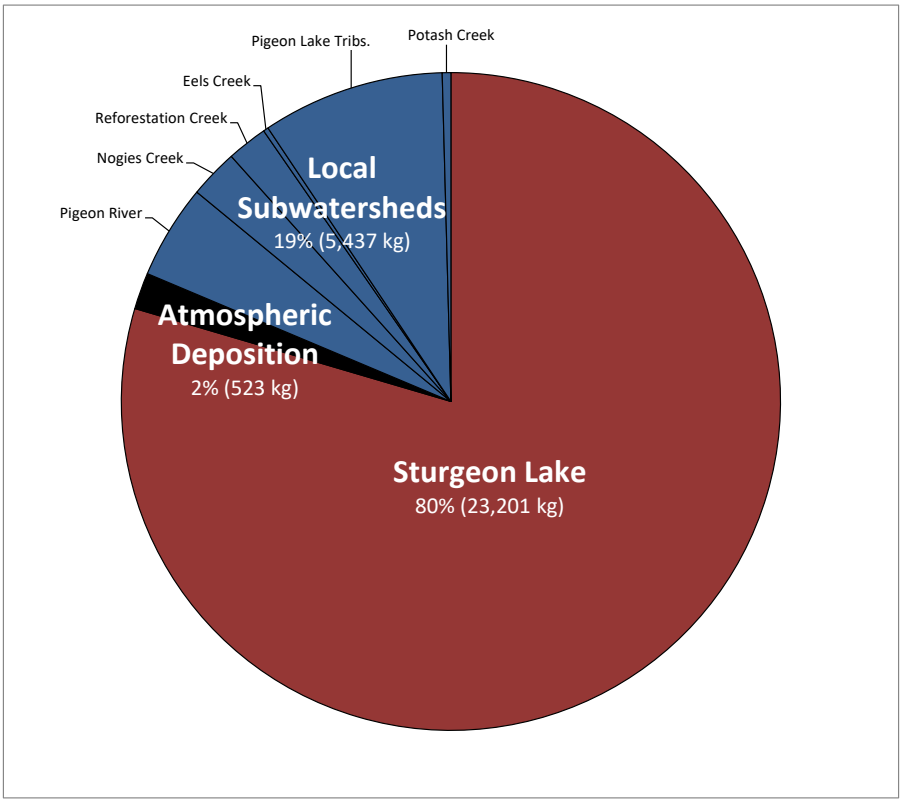


Figure 1.12: Average annual phosphorus loadings into Pigeon Lake, by major water source (2012-2015)

Phosphorus Loading by Sector

To determine the amount of phosphorus loadings into the lake by sector, inputs from the Local Subwatersheds category (i.e., the blue pie slices of Figures 1.12) have been broken out into the estimated inputs generated from Natural Sources, Agricultural Runoff, Urban Runoff, and Shoreline Septic Systems. This approach assists in developing water quality benchmarks for the Local Subwatersheds in the core Pigeon Lake Management Planning area.

The following provides a summary of current phosphorus loadings into Pigeon Lake, by sector, in the Local Subwatersheds category (Figure 1.13). These account for 19% (5,437 kg) of the total inputs into the lake from the subwatersheds of Pigeon Lake Tribs., Pigeon River, Nogies Creek, Reforestation Creek, Potash Creek, and Eels Creek water sources.

- Natural Sources account for an estimated 42% (2,287 kg) of the Local Subwatersheds category or 7.8% of the total entering Pigeon Lake. This source represents phosphorus that is deemed to enter the lake naturally (that is, without human origin) through stream and river flow within the core planning area. Examples of these inputs include wetlands and forests.

- Agricultural Runoff accounts for an estimated 19% (1,049 kg) of the Local Subwatersheds category or 3.6% of the total entering Pigeon Lake. This represents the farm-generated phosphorus estimated to come from crop lands and pasture fields that enters the lake through stream and river flow within the core planning area. Examples of these inputs include fertilizer applications, field erosion, and livestock manure.

- Shoreline Septic Systems account for an estimated 19% (1,027 kg) of the Local Subwatersheds category or 3.5% of the total entering Pigeon Lake. This value includes estimated inputs from systems in close proximity to the Pigeon Lake shoreline. There are approximately 1,560 residences with private septic systems within 75 m of the lake. To calculate phosphorus loading from septics, it was estimated that 50% of the phosphorus leaving each septic tank eventually reaches the lake. The phosphorus entering the lake from septic systems is of particular concern because it is orthophosphate, a form of phosphorus that is readily available for instantaneous algae growth.

- Urban Runoff accounts for an estimated 19% (1,007 kg) of the Local Subwatersheds category or 3.5% of the total entering Pigeon Lake. This represents the phosphorus generated from towns and other developed areas around the lake that enters the lake through stream overland flow within the core planning area. Examples of phosphorus inputs from urban areas include lawn fertilizers and pet wastes.

- Wastewater Treatment Plant accounts for 1% (67 kg) of the subtotal or <1% of the total. This includes loadings from Bobcaygeon Water Pollution Control Plant, which services approximately 2,500 people.

Phosphorus Benchmarks

All subwatersheds, except for Reforestation Creek, have phosphorus concentrations that meet the *Provincial Water Quality Objectives* (Ontario Ministry of Environment and Energy, 1994). In striving to improve and maintain the existing healthy water quality conditions, there is a need to reduce contamination to buffer impacts from future cumulative pressures. Thus, management benchmarks have been developed for phosphorus loading amounts based on their estimated contributions by sector.

As illustrated, there are 8 major water sources that load phosphorus into Pigeon Lake: Sturgeon Lake, Pigeon Lake Tribs. Pigeon River, Nogies Creek, Reforestation Creek, Potash Creek, Eels Creek, and Atmospheric Deposition (Figure 1.12). Sector-specific benchmarks have been developed for the sources of phosphorus considered manageable and within the scope of the core Pigeon Lake planning area. This only includes the Local Subwatersheds category.

Specific benchmarks have been recently developed for Sturgeon Lake through the *Sturgeon Lake Management Plan* (Kawartha Conservation, 2014); therefore it will be important to work with 'upstream' partners to ensure responsible water quality management for the major inflow into Pigeon Lake. No benchmarks have been developed for Atmospheric Deposition because it is considered an unmanageable source.

As shown in Figure 1.13, the Local Subwatershed category has been further broken down into four sector-specific phosphorus contributions: Natural Sources, Agricultural Runoff, Urban Runoff, and Shoreline Septic Systems. The sector-based benchmarks only apply to Agricultural Runoff, Urban Runoff, and Shoreline Septic Systems categories. These three sources are considered manageable, whereas Natural Sources are not.

Benchmarks for urban runoff were developed by estimating that the existing loading from developed areas could be reduced by approximately 15% with the uptake of lot-level water quality improvement practices. Estimates are based on current research (e.g., Steinman et al., 2015) that suggests that implementation of various best management practices such as infiltration swales, permeable pavement, and rain gardens can reduce phosphorus loading by approximately 15%. Benchmarks for shoreline septic systems were developed by estimating that approximately 5% of existing systems are "failing" (i.e., not functioning properly, which in the worst case equates to direct pollution into the lake). Estimates are based on recent findings (e.g., BM Ross and Associates Ltd., 2014) that suggest that approximately 5% of inspected septic systems were deemed to be either an environmental hazard or structurally unsafe. Therefore, the benchmark expresses how much reduction is needed to offset the "failing" loadings. Benchmarks for agricultural runoff were developed by estimating that the existing loading from farmlands could be reduced by approximately 25% with the uptake of water quality improvement practices. Estimates are based on current research (e.g., Makarewicz et al., 2015) that suggest that implementation of various best management practices such as grassed waterways, cover crops, and streambank stabilization can reduce phosphorus loading by approximately 25%.

- The overall phosphorus benchmark for Pigeon Lake is a maximum loading rate of approximately 4,976 kg per year from the core planning area. This equals a reduction of existing average annual phosphorous loadings by 461 kg (minus 15% of current loading from manageable sources) from the core planning area that drains into Pigeon Lake (Table 1.5). Sector-specific phosphorus benchmarks are
    - 856 kg/year (minus 15% of current loading) or less, from Urban Runoff;
    - 787 kg/year (minus 25% of current loading) or less, from Agricultural Runoff; and
    - 979 kg/year (minus 5% of current loading) or less, from Shoreline Septic Systems.

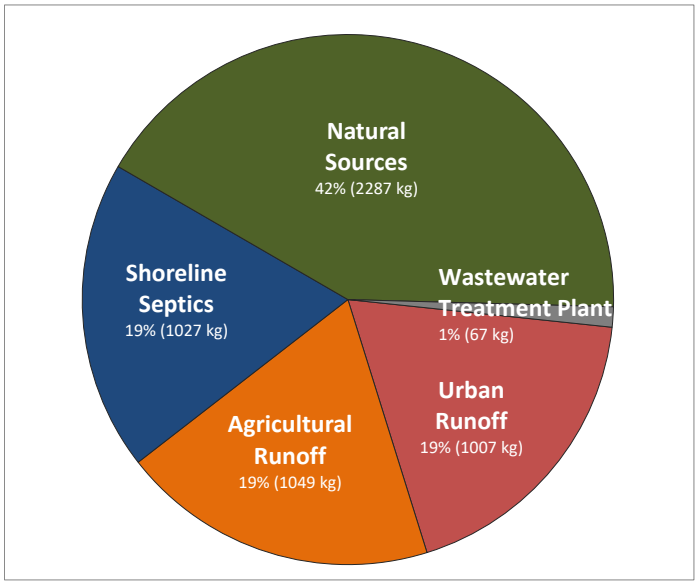


Figure 1.13: Average annual phosphorus loading into Pigeon Lake from Local Subwatersheds only, by sector (2012-2015).

Table 1.5: Phosphorus benchmarks on a sector basis

	Major Input Source	Existing Phosphorus Inputs (kg/year)	Benchmark Water Quality Objectives (kg/year)	Overall Reduction Needed (kg/year)
Pigeon Lake	Urban Runoff	1,007	856	151 (15%)*
	Agricultural Runoff	1,049	787	262 (25%)**
	Shoreline Septic Systems	1,027	979	48 (5%)***
	Subtotal: Manageable Sectors	3,083	2,622	461 (15%)
	Wastewater Treatment Plant	67	67	0 (0%)****
	Natural Sources	2,287	2,287	0 (0%)*****
	Total: All Sectors in Local Subwatersheds	**5,437**	**4,976**	**461**

**Benchmarks for urban runoff are based on recent research from other areas (e.g., Steinman et al., 2015) that suggests by implementing various best-management practices, it is reasonable to expect a 15% decrease in phosphorous inputs from urban areas.*

***Benchmarks for agricultural runoff are based on recent research from other areas (e.g., Makarewicz et al., 2015) that suggests by implementing various best-management practices, it is reasonable to expect a 25% decrease in phosphorus inputs from agricultural areas.*

**** Benchmarks for shoreline septic systems are based on recent research from other areas (e.g., BM Ross and Associates Ltd., 2014) that suggests that approximately 5% of existing shoreline septic systems are considered high risk of failing (i.e., an environmental hazard or structurally unsafe), which equals approximately 48 kg per year of phosphorus going into Pigeon Lake. Therefore, a 5% reduction from existing loading values is needed to make up this difference.*

***** Benchmarks for the Bobcaygeon Wastewater Treatment Plant are mandated through a Certificate of Approval (CofA) from the Ontario Ministry of the Environment. Presently, effluent quality is considerably better than the limits and objects set by the Certificate of Approval. As such, existing phosphorus inputs from this source are expected to increase as a result of development growth expected in Bobcaygeon, but will continue to meet CofA objectives.*

****** Benchmarks for natural sources are not applicable, and thus are not included in the overall reduction needed values.*

1.5.4 Aquatic Ecosystems

Aquatic ecosystems refer to the water-related components that support life in and around Pigeon Lake. Healthy aquatic life provides significant benefits such as economic revenue (e.g., a high quality fishery that attracts anglers to the area), social significance (e.g., a picturesque cottage-country setting with abundant wildlife), and ecological integrity (e.g., a self-perpetuating food web). As our lake-based communities continue to grow, so does the pressures placed on its ecosystem. The cumulative effects of pressures such as incremental habitat loss, pollution, and introductions of non-native species can cause dramatic shifts in the lake food web. Responsible management is needed not just at a property level, but also in recognizing that life in these lakes is dependent upon multiple components connected at a broader ecosystem level.

Due to the interconnectedness of the Kawartha Lakes, most aquatic life found in Pigeon Lake and their tributaries is found in the other Kawartha Lakes as well. However, there are many unique characteristics worth noting, particularly in fish communities and aquatic habitat conditions.

Aquatic habitat conditions and the fish community structure in the Kawartha Lakes have changed with time. In general, since the mid-1970s, their aquatic ecosystems have shifted from a relatively murky, nutrient-enriched environment to more clear-water, aquatic plant-dominated systems. This is a result of reductions in nutrient loadings, the invasion of zebra mussels, and increasing water temperature, along with other factors. Consequently, the fish community structure in the lake has also changed, not only from the Kawartha Lakes-wide ecosystem shift but from other factors such as invasive species proliferation.

Pigeon Lake and its tributaries support diverse coldwater, coolwater and warmwater fish communities. Approximately 38 fish species have been documented in the core Pigeon Lake Management Planning area (Table 1.6). The fish community structure in both lakes has changed over time through intentional stocking, range extensions, unintentional introductions, and non-native species invasions. According to recent netting programs (2013), the most large-bodied fish species found in Pigeon Lake, in terms of relative biomass, are bluegill, black crappie, walleye, common carp, largemouth bass, smallmouth bass, pumpkinseed, muskellunge, yellow perch, brown bullhead, and rockbass. Lake herring, a coldwater fish species, has been documented in the deeper northern basin of the lake; however, the amount of coldwater habitat to support this species is limited to small volumes. Further, the headwaters of several subwatersheds (Pigeon River, Fleetwood Creek, Potash Creek, Reforestation Creek, and Nogies Creek) contain Brook Trout, a sensitive stream fish. No known fish species listed as Special Concern, Threatened, or Endangered have been documented.

The Kawartha Lakes are heavily fished, and support one of the largest inland lake recreational fisheries in Ontario. According to most recent data (2005), Pigeon Lake is among the top fifteen lakes in Ontario in terms of angler activity, has been relatively consistently fished over the last decade at 115,000 angling hours per year. The most sought-after species for anglers has shifted within the past 30 years, from predominately walleye to bass and walleye. Also during this time, fish harvested by anglers has shifted from walleye to bass and panfish (bluegill and black crappie). Muskellunge are sought after fish as well.

The north end of Pigeon Lake (north of Gannons Narrows) can be characterized as relatively deep (>3 metres) open water conditions, consisting of steep and narrow nearshore areas with coarse substrates. These areas are preferable habitats for fish species such as smallmouth bass, rock bass, and walleye. This area of the lake contains the deepest basin within the lake (approximately 18m depth) that thermally stratifies in the summer months, providing cold water habitat in relatively small water volumes. The south end of the lake is relatively shallow (<3 metres), broad nearshore areas that are dominated by large tracts of marsh wetlands and extension colonization of submerged aquatic plants. These areas are particularly important areas of biological productivity, and are preferable habitats for fish species such as largemouth bass, yellow perch, and various other fishes found in the lake.

Lake tributaries provide important ecological pathways to and from the lakes. There are approximately 35 tributaries that drain directly into Pigeon Lake. Many of these, including Bobcaygeon River, Nogies Creek, Pigeon River, and Eels Creek have been documented as providing spawning habitat for important migratory lake-dwelling fish species such as walleye, muskellunge, and/or white sucker. For the most part, there is unimpeded access along most lake-tributary pathways. Notable exceptions are the dams located at Bobcaygeon and Omemee which impede access to aquatic habitat within Sturgeon Lake and Pigeon River, respectively. Most tributaries have extensive wetland areas along the outlets, whereas their upper headwaters (except the northern tributaries) typically flow through, and drain, active agricultural lands.

Table 1.6: Fish species present or recorded historically in Pigeon Lake and in tributaries within the core planning area

Fish by Common Names		
Black Crappie[1]	Creek Chub	Pearl Dace
Blacknose Dace	Emerald Shiner	Redhorse
Blacknose Shiner	Fathead Minnow	Pumpkinseed
Bluegill[1]	Finescale Dace	Rock Bass
Bluntnose Minnow	Golden Shiner	**Smallmouth Bass**
Brassy Minnow	Iowa Darter	Spottail Shiner
Brook Stickleback	**Largemouth Bass**[1]	Trout-perch
Brown Bullhead	Least Darter	**Walleye**[1]
Burbot	Logperch	White Sucker
Central Mudminnow	Mottled Sculpin	Yellow Perch
Cisco (Lake Herring)	**Muskellunge**	
Common Carp[1]	Northern Pike[1]	
Common Shiner	Northern Redbelly Dace	

[1] denotes species that are non-native to the Kawartha Lakes region
Bold indicates important species to the recreational fishery

1.5.5 Terrestrial Natural Heritage

The northern portion of Pigeon Lake is located in an area known as “The Land Between," a transitional zone between two distinct ecological units: the Canadian Shield and the St. Lawrence Lowlands. This overlap in area is significant on a provincial scale as it provides a unique concentration and diversity of natural heritage features that occur within both of these distinct land-form types.

Natural cover on the landscape (that is, forests, wetlands, meadows, and vegetative corridors along water courses and shorelines) is essential to maintaining healthy lakes and their watersheds. The services provided by these natural features include the following:

- Filter and utilize nutrients, absorbing sediments and other pollutants from surface water runoff.
- Improve air quality through filtration and oxygen release.
- Provide natural aesthetic vistas.
- Provide wildlife habitat, including habitat for species we are just starting to understand (e.g., a wide range of pollinators).
- Provide the first line of defense in flood attenuation by absorbing high water levels.
- Provide recreational opportunities such as hunting, hiking, and wildlife watching.
- Reduce shoreline erosion.
- Sequester carbon to reduce atmospheric carbon dioxide levels, thus contributing to the mitigation of the effects of climate change.
- Moderate summer temperature extremes through shade and transpiration.

Agricultural and urban development typically results in the loss and fragmentation of natural cover. At present, the core Pigeon Lake planning area contains approximately 396 km^2 of natural cover, representing 60% of the total *terrestrial* land cover (i.e., Pigeon Lake surface area excluded) (Figure 1.13). Areas of natural cover are more extensive in the northern part of the planning area than in the south. In the north, there are extensive tracts of natural cover corresponding with few areas of urban development and agriculture. Forest cover that includes treed wetlands (i.e., swamps) accounts for 48%. Wetlands that also include treed wetlands account for 15%. Meadows and grasslands account for 5%. The largest natural community types are coniferous forests (14%), deciduous forests (11%), and mixed forests (11%).

Approximately 69% of the shoreline area around Pigeon Lake is considered as natural cover, with shallow marshes as the dominant type. There are 12 provincially significant wetlands along the shoreline. Several of which occur in the southern end of the lake including: Cowan’s Bay at the outlet of Reforestation Creek, Pigeon Lake No.14 along the west shore next to Tracy’s Hill Rd., Ennismore No.10 along the east shore next to Cedarview Dr., Ennismore No.9 along the east shore next to Birch Point Dr., Ennismore No.8 along the east shore next to Edenderry Ln., Pigeon Lake No.15 on the west shore south of Perdue Rd., and Victoria Park Marsh along the west shore next to Pigeon Lake Rd. In the middle section of the lake exists: Killaby’s Point along the west shore next to Victoria Place, Fulton’s Bay – Oak Orchard north of Gannon’s Narrows, and Bear Creek south of Elim Lodge Rd. In the north end exists: Bear Creek next to Crowe’s Line Rd., and Nogies Creek Mouth at the outlet of Nogies Creek.

The extensive wetland areas within the southern portion of the lake are a result, in large part, to the flooding of lands created through damming and the construction of the Trent-Severn Waterway in the 19th century. The shallow and productive nature of this “flooded” section of the lake makes it particularly prone to the establishment of aquatic plants.

Within the core Pigeon Lake planning area, natural cover provides habitat for locally or provincially rare wildlife species including:

- eight bird species: barn swallow, black tern, bobolink, eastern meadowlark, Henslow’s sparrow, least bittern, redheaded woodpecker, and whip-poor-will;

- six turtle species: Blanding's turtle, eastern musk turtle, northern map turtle, spotted turtle, wood turtle, and snapping turtle;
- two snake species: eastern hog-nosed snake, and milksnake; and,
- one lizard species: five-lined skink.

Many of these species at risk will benefit from maintaining and/or enhancing healthy ecosystems within the core Pigeon Lake planning area.

According to a research document titled *How Much Habitat is Enough?* (Environment Canada, 2013), a certain minimum amount of natural cover types are needed on the landscape to maintain healthy ecosystems. These benchmarks exist for forest, wetland, and streamside vegetation amounts. We can compare existing natural cover values in the core planning area against these benchmarks to provide insight into the condition of our terrestrial natural heritage. Table 1.8 provides a summary of management benchmarks calculated for each subwatershed and the core planning area. Where the existing natural cover level is below the benchmark, the additional cover required to meet the benchmark has been presented.

The forest cover benchmark is 50%. These benchmarks can vary depending on the level of risk. The minimum forest cover benchmark is 30 to 39% forest cover. This is a high-risk approach that may only support marginally healthy aquatic systems. Forest cover of 40 to 49% is a medium-risk approach likely to support moderately healthy aquatic systems. Forest cover of 50% or more is a low-risk approach likely to support most of the potential species and healthy aquatic systems. The existing forest cover in the core planning area is 48%, so it falls into the medium-risk category, and it does not meet the low-risk benchmark. An increase in 1,320 hectares (ha) of forest cover is needed to meet the low-risk benchmark. Nogies Creek and Eels's Creek are the only sub-watersheds to meet the low-risk benchmark.

The wetland cover benchmark is 10%. At least 10% of any subwatershed or planning area should be in a wetland state to maintain ecological benefits. Existing wetland cover in the core Pigeon Lake planning area is 15%, which meets this benchmark. The Eels's Creek subwatershed has particularly extensive wetland areas.

The streamside vegetation benchmark is 75%. At least 75% of the total stream and/or river length in any subwatershed or planning area should have natural vegetation along both banks. Existing streamside cover in the core Pigeon Lake planning area is 83%, which meets this benchmark. Streamside vegetation is lacking however in three of the subwatersheds, including Pigeon Lake Subwatershed, Pigeon River, and Reforestation Creek.

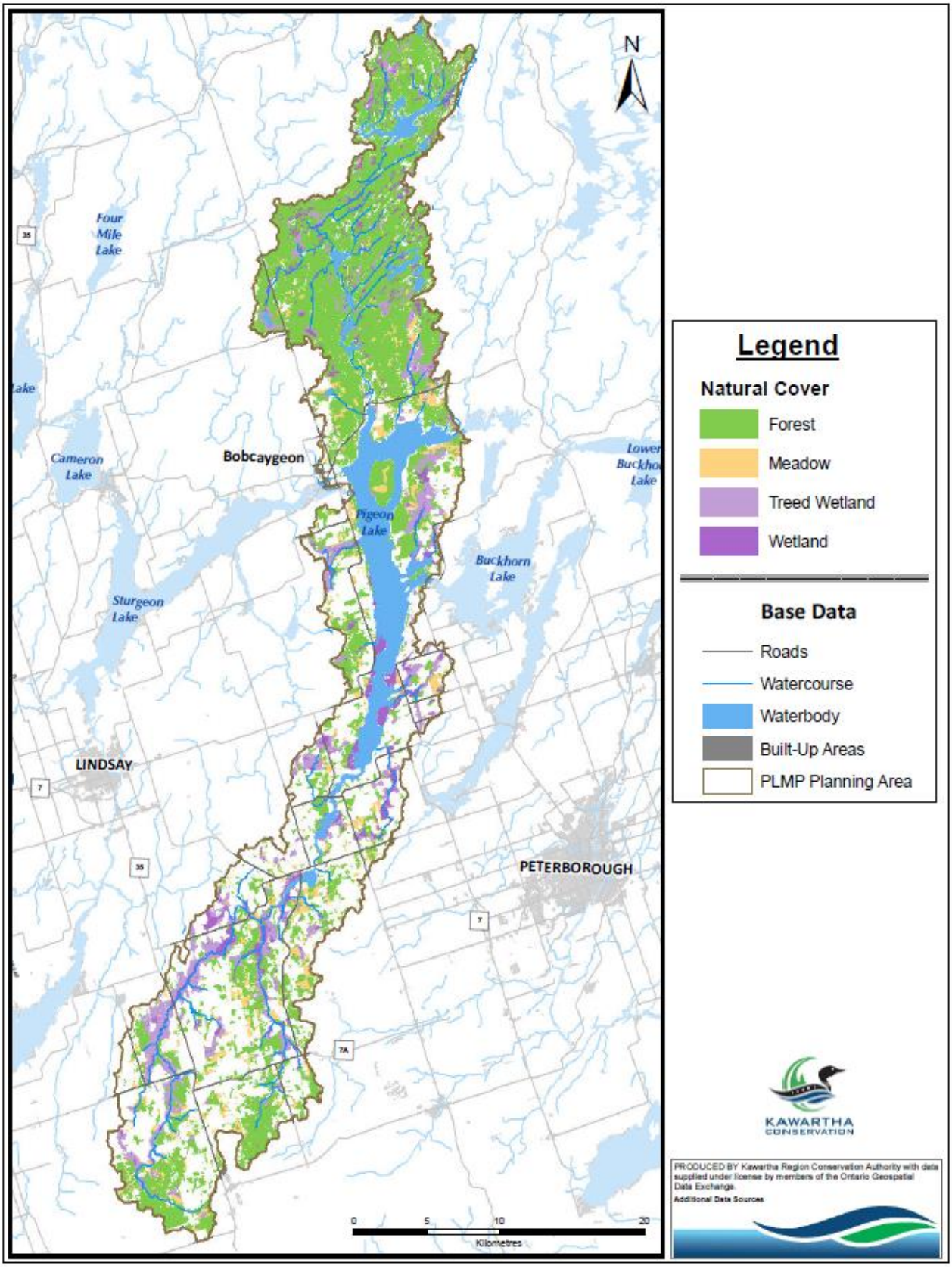


Figure 1.13: Map showing natural cover types within the Pigeon Lake Management Planning area

Table 1.8: Table summarizing existing forest, wetland, and streamside vegetation cover within the core Pigeon Lake Management Planning area, in relation to ecosystem health benchmarks

	Forests Benchmark = >50%		Wetlands Benchmark = >10%		Streamside Vegetation Benchmark = >75%	
Subwatershed	**Existing %**	**Needed % (ha)**	**Existing %**	**Needed % (ha)**	**Existing %**	**Needed % (ha)**
Nogies Creek	79	-	12	-	98%	-
Pigeon River	32	18% (3619ha)	16	-	74%	1% (17 ha)
Pigeon Lake Tribs.	35	15% (2159ha)	18	-	69%	6% (77 ha)
Fleetwood Creek	45	5% (365ha)	11	-	85%	-
Eels Creek	77	-	24	-	96%	-
Potash Creek	26	24% (524ha)	19	-	83%	-
Reforestation Creek	33	17% (261ha)	18	-	74%	1% (1 ha)
Total Pigeon Lake Sub-watersheds (i.e., core management plan area)	**48**	**2% (1320ha)**	**15**	**-**	**83**	**-**

Red highlight: existing amount does not meet benchmark
Green highlight: existing amount meets benchmark

2.0 Management Objectives

Public Open House
(Omemee, July 2013)

2.1 Introduction

This chapter provides a summary of the management objectives of the Pigeon Lake Management Plan. Objectives are "*what we want to achieve*" through a coordinated approach to managing the lakes. The objectives form the basis of the Implementation Strategies and were developed through community consultation. Each management objective is organized into the following: Background, Issues, and Implementation Approach. There are seven objectives in total.

Background provides a summary of the objective, including its origin and why it's important. Key points are highlighted, such as valued components, current state, and apparent trends that are relevant in implementing the *Pigeon Lake Management Plan*. Wherever possible, pictures help illustrate key points.

Issues are barriers that prevent us from realizing the objective. Issues have been identified by two means: (1) technical studies, science-based research, and anticipated relevance and (2) concerns expressed through the lake-stakeholder consultation process.

Implementation Approach is a summary of how we intend to address issues and fully realize our objectives. Actions are presented under each strategy in Chapter 3: Implementation Strategies. For specific details related to each action, please refer to Implementation Strategies.

Strategies

- **Stewardship:** Actions that are tailored to rural, urban, and shoreline landowners, including public property managers and lake users to deliver best management practices on their properties for the benefit of all and the future health of the lakes

- **Strategic Planning:** Actions that focus on strengthening the land use planning and policy framework, with an emphasis on updating the municipal Official Plan

- **Urban and Rural Infrastructure:** Actions that focus on maintaining sustainable operations in government infrastructure and construction works, including the stormwater and wastewater network, shoreline public-access areas, roads, municipal drains, and construction sites

- **Research and Monitoring:** Actions that are focused on research to better understand the lakes' responses to emerging pressures, as well as tracking environmental health and plan effectiveness through time

- **Communications and Outreach:** Actions that encourage dialogue and information-sharing among all stakeholders and promote sustainable practices to maintain healthy lake environments. In this chapter, there are no specific Communications and Outreach actions identified under each Management Objective because effective communication is crucial to implementing all aspects of the management plan. Please refer to the Communications and Outreach Strategy in Chapter 3 for all communication and outreach actions.

2.2 Management Objective #1:

Maintain good water quality conditions

BACKGROUND:

- Pigeon Lake has good water quality. There is overwhelming community support for maintaining good water quality conditions. Aside from occasional algae blooms in the north end of the lake, Pigeon Lake in general has relatively good water quality. Since the early 1970's, the quality of water in Pigeon Lake has improved, owed in large part to the increased effectiveness of treating wastewater in the Town of Lindsay. This has led to improvements in water quality in Sturgeon Lake, which flows directly into Pigeon Lake. Current phosphorus data suggests that this lake is in a state of moderate productivity (meso-trophic), and has remained relatively stable over the last decade.

- Life in and around the lake needs clean water. Several lakeside residents draw water along shorelines for personal use, and thus need access to clean water. Aquatic ecosystems also need clean water to thrive. Excessive inputs of raw sewage, nutrients, sediments, toxic chemicals, and other elements can negatively impact the quality of the lake water for human use and ecosystem needs.

ISSUES:

- Pollutants in surface water runoff from urban areas. Although urban areas are limited around these lakes to Bobcaygeon, Omemee, and shoreline properties, they tend to contain significant amounts of hardened surfaces where pollutants (such as pet feces, oil, fertilizers, salt, etc.) accumulate. After a rain, these harmful substances are washed into the lake instead of being purified by gradually filtering through vegetation into the ground.

- Potential eutrophication of the lake through excessive nutrient and sediment inputs. Eutrophication is the term used to describe the accelerated aging process of lakes from consistently high nutrient inputs, in particular, phosphorus and nitrogen. Symptoms of eutrophication include frequent blue-green algae blooms, high algae growth, and oxygen depletion in lake water. Significant inputs of nutrients enter the lake from surface water runoff, but also from other sources such as septic systems and precipitation. In recent years (e.g., June 2011), algae blooms in the north end of the lake have been reported by local residents. These blooms happened in spite of the fact that current water quality data show that nutrient concentrations meet provincial water quality objectives. Further, the bottom waters of the deeper northern-basin experience localized oxygen depletion in late summer months. In terms of subwatershed inputs to the lake, Reforestation Creek has extremely high phosphorus levels, being more than three times the provincial water quality objectives.

- Potential contamination from other sources. Contaminant spills from power boats, grey water discharge from houseboats, oil spills from shoreline properties, raw wastes from partial bypasses at Bobcaygeon Sewage Treatment Facility, and other disturbances are all potential areas of concern when trying to maintain good water quality conditions.

IMPLEMENTATION ACTIONS:

Stewardship

- Implement lot-level measures such as reducing fertilizer use, increasing infiltration, capturing stormwater runoff, and other practices that conserve water and reduce pollution in targeted urban areas and waterfront communities *[Action A1 - page 53]*.

- Implement a natural landscaping approach along shoreline properties, with particular focus on decommissioning hardened shorelines and addressing severely eroded /ice-damaged sections *[Action A2 - page 54]*.

- Reduce potential pollution from septic systems into the lakes by undertaking responsible management and maintenance *[Action A5 - page 57]*.

- Implement measures such as vegetated buffer strips along streams, conservation tillage, and other practices that reduce nutrient and soil loss from farms, with assistance from local cost–share programs *[Action A6 - page 58]*.

- Implement programs to educate lake users about proper boat maintenance, grey water disposal, and the locations of sensitive habitats to reduce the risk of pollution and lake ecosystem disturbance *[Action A7 – page 59].*

Strategic Planning

- Amend and strengthen municipal Official Plans and Secondary Plans policy to require protection of the natural environment through specific measures, such as development setbacks adjacent to shorelines or streams *[Action B1 - page 60]*.

- Undertake responsible development planning along the shoreline *[Action B2 – page 61].*

Urban and Rural Infrastructure

- Through stormwater management planning, improve the quality and control of stormwater in the urban settlement areas of Bobcaygeon and Omemee *[Action C1 – page 67]*.

- Implement effective sediment and erosion control measures and other practices to prevent contaminants from reaching local watercourses during road work, agricultural drainage, and other construction projects *[Action C2 – page 68]*.

- Operate Bobcaygeon sewage treatment facility at maximum efficiency in terms of pollutant removal and capacity *[Action C4 – page 70]*.

Research and Monitoring

- Undertake pilot projects to test the effectiveness of innovative approaches in identified priority areas that have abundant aquatic plants and poor water quality *[Action D1 – page 72]*.

2.3 Management Objective #2:

Develop wild rice management principles in Consultation

BACKGROUND:

- Southern Pigeon Lake has prolific aquatic plant growth. The southern half of Pigeon Lake, south of Gannon's Narrows, is naturally prone to aquatic plant growth because it is shallow (typically less than 2m), is relatively sheltered from high winds, waves and currents, and has soft substrates. Over the last several years, the growth of one specific aquatic plant, wild rice, has increased significantly across southern Pigeon Lake. The exact reason(s) for its proliferation has not been scientifically characterized, but is likely due to a combination of factors including changes to the aquatic ecosystem (e.g., increased water clarity and growing conditions), and human activity (e.g., direct planting and harvesting). Wild rice is a native aquatic plant to the Kawartha Lakes region and has several positive implications associated with its presence, including environmental (e.g., providing high quality habitat for fish and wildlife) and cultural (e.g., highly valued by First Nations) importance. Aquatic plants are beneficial to the lake ecosystem as they provide cover and food for fishes and wildlife, stabilize sediments, uptake nutrients and provide other benefits.

ISSUES:

- There are varying perspectives on wild rice in Southern Pigeon Lake. Several waterfront communities in Southern Pigeon Lake have expressed concern with respect to wild rice because they consider these plants as having negative impacts on lake-based recreation, aesthetics, and economic values. Wild rice, also known as Manomin, is an aquatic plant that has special importance to First Nations communities for its ceremonial, dietary, and other cultural purposes. Consultations are currently underway between the Government of Canada and Williams Treaties First Nation, regarding wild rice.

IMPLEMENTATION ACTIONS:

Strategic Planning

- Complete consultations with stakeholders and continue to work with First Nations toward the development of wild rice management principles to address all user interests to the extent possible while recognizing First Nations rights *[Action B3 – page 62]*.

2.3 Management Objective #3:

Enhance swimming opportunities at public beaches

BACKGROUND:

- There are three public beaches within the planning area. Active beaches include Emily Provincial Park (south-east shore of the lake on the outlet of Pigeon River), Omemee Peace Park Beach (Omemee Mill Pond, Pigeon River), and Crowes Beach (north shore of the lake, near the outlet of Eels Creek). The beaches at Emily Provincial Park are particularly popular during the summer months, whereas the other two are not as intensively used. Additionally, there are two sand bars within the mid-section of the lake that are also popular public swimming destinations for boaters.

- All public beaches are routinely tested to determine if safe for swimming. The local Health Units and Provincial Park staff (Emily Provincial Park Beach only) test the water at all beaches in June, July, and August to advise swimmers whether the beach is deemed safe for swimming at that particular time. If the water at the beach is found to contain high *E. coli* levels, it is considered potentially hazardous to human health and posted as "unsafe for swimming."

ISSUES:

- High *E. coli* at certain beaches, leading to beach postings. Within the last five years, all beaches have been posted as unsafe for swimming at least once. Peace Park Omemee Beach is almost always posted due to *E. coli* contamination. High *E. coli* concentrations are likely the result of excessive feces from birds, particularly Canada Geese. Other contributing factors may include urban runoff contaminated with pet feces following storm events and/or shallow, warm waters with limited water circulation.

IMPLEMENTATION ACTIONS:

Urban and Rural Infrastructure

- Through stormwater management planning, improve the quality and control of stormwater in the urban settlement areas of Bobcaygeon and Omemee *[Action C1 - page 67]*.

- Increase community enjoyment of public beaches and waterfronts by deterring geese and conducting regular maintenance, and increase public access to shorelines *[Action C3 – page 69]*.

Research and Monitoring

- Undertake pilot projects to test the effectiveness of innovative approaches in identified priority areas that have abundant aquatic plants and poor water quality *[Action D1 – page 72]*.

2.4 Management Objective #4:

Maintain the biodiversity of the lake ecosystem

BACKGROUND:

- Biodiversity is what sustains healthy aquatic and terrestrial ecosystems. It includes all varieties of life and all habitats of the lakes and their watersheds. Biodiversity helps sustain the goods and services provided by the lake ecosystem, such as provisioning services (e.g., food and fresh water), regulating services (e.g., air quality regulation, erosion regulation, and pollination), and cultural services (e.g., educational values, inspiration, and sense of place). Native biodiversity, or life that is naturally occurring in an area, provides greater benefits to the lake ecosystem than non-native biodiversity. The north end of Pigeon Lake is located within a distinct ecoregion known as "The Land Between," which is known for supporting high levels of biodiversity. Similarly the south end of the watershed is located on the Oak Ridges Moraine, a sensitive hydrological landform.

ISSUES:

- Proliferation of non-native invasive species. The Trent-Severn system, due to its interconnectedness and heavy human use, is particularly prone to the introduction and spread of non-native species. Several non-native species are well established in Pigeon Lake including common carp, zebra mussels, Eurasian water-milfoil, curly-leaved pondweed, purple loosestrife, and rusty crayfish. More recently, yellow iris, Phragmites, and spiny water flea have been documented. A particularly immediate threat is the proliferation of northern pike which has lately been routinely captured in Balsam Lake, which is only separated from Pigeon Lake by three lock stations. This fish could have a negative impact on muskellunge, the largest native top predator fish species.

- Loss and fragmentation of natural habitats. Large expansive natural areas, with natural linkage corridors between them, are needed to sustain healthy landscape conditions. These conditions are met in the northern part of the planning areas but are lacking in the southern end due to land clearing for agriculture and urban purposes. Total forest cover in the planning area is just shy of meeting ecosystem benchmarks, which is considered a medium-risk approach that may not sustainably support healthy aquatic systems.

- Species at risk. Within the planning area, there are several documented wildlife species that are at risk. The species that particularly rely on aquatic habitat for persistence in Pigeon Lake include two bird species: black tern and least bittern, as well as several turtle species: Blanding's turtle, eastern musk turtle, northern map turtle, spotted turtle, wood turtle, and snapping turtle. Major threats to these species include loss of habitat (e.g., draining of wetlands for agricultural purposes), increased disturbance from urban encroachment, direct mortality and injury by road vehicles and boat propellers, and climate change.

IMPLEMENTATION ACTIONS:

Stewardship

- Implement a natural landscaping approach along shoreline properties, with particular focus on decommissioning hardened shorelines and addressing severely eroded/ice-damaged sections *[Action A2 – page 54]*.

- Implement measures such as boat and equipment sanitization to reduce the risk of transfer of invasive species between water bodies *[Action A3 – page 55]*.

- Develop a reforestation program to re-establish and manage natural cover on marginal rural lands, particularly in subwatersheds that do not meet forest cover benchmarks *[Action A4 – page 56]*.

- Implement measures such as vegetated buffer strips along streams, conservation tillage, and other practices that reduce nutrient and soil loss from farms, with assistance from cost–share programs *[Action A6 – page 58]*.

- Implement programs to educate lake users about proper boat maintenance, grey water disposal, and the locations of sensitive habitats to reduce the risk of pollution and lake ecosystem disturbance *[Action A7 – page 59]*.

Strategic Planning

- Amend and strengthen municipal Official Plans and Secondary Plans policy to require protection of the natural environment through specific measures, such as regulating development setbacks adjacent to shorelines or streams *[Action B1 – page 60]*.

- Undertake responsible development planning along the shoreline *[Action B2 – page 61].*

- Implement the *Fisheries Management Plan for Fisheries Management Zone 17,* Kawarthas, Naturally Connected Natural Heritage Systems Strategy, and Integrated Community Sustainability Plans *[Action B4 – page 63]*.

- Implement a strategic land acquisition program to identify and protect lands that are ecologically and/or culturally significant *[Action B6 – page 65].*

Research and Monitoring

- Implement a coordinated lake monitoring program that regularly tracks key indicators of lake watershed health including nutrients, aquatic plants, forest cover, fish communities, and oxygen levels *[Action D3 – page 74]*.

2.5 Management Objective #5:

Enhance and maintain the natural integrity of the shoreline

BACKGROUND:

- The zone between land and water is often referred to as the Ribbon of Life. Shoreline areas are extremely rich in biodiversity and provide multiple benefits to the lake ecosystem including filtering contaminants, preventing erosion, and providing fish and wildlife habitat. The shoreline around Pigeon Lake is approximately 100 km long, including Big (Boyd) Island and several smaller islands.

- The lake shoreline is a dynamic system. Natural forces such as currents, wave action, and ice movement can be a source of shoreline accumulation (that is, gaining land) or shoreline erosion (that is, losing land). A natural shoreline provides a stable waterfront in most instances, due to its ability to stabilize soil, absorb wave energy, and slow lot-level surface water runoff. Shoreline degradation is often accelerated by waterfront modifications such as removal of natural cover, hardening, infilling, and dredging.

ISSUES:

- Dense urban development along the lake shoreline. The shoreline Pigeon Lake is one of the most heavily developed of all the Kawartha Lakes. Artificial shorelines can cause reduced aquatic habitat potential, less water quality buffering capacity, greater wave action, land/water isolation, and other negative implications for the lake. Almost a third of the shoreline has been developed.

- Loss of shoreline property from erosion. Some areas of the lakes are prone to waterfront damage due to a number of factors including dense urban development near the water's edge, movement of lake ice back and forth on the shoreline, and above-average water levels in the spring.

Effects of ice heaving on a developed shoreline (Victoria Place, 2011)

IMPLEMENTATION ACTIONS:

Stewardship

- Implement lot-level measures such as reducing fertilizer use, increasing infiltration, capturing stormwater runoff, and other practices that conserve water and reduce pollution in targeted urban areas and waterfront communities *[Action A1 – page 53]*.

- Implement a natural landscaping approach along shoreline properties, with particular focus on decommissioning hardened shorelines and addressing severely eroded/ice-damaged sections *[Action A2 – page 54]*.

- Reduce potential pollution from septic systems into the lake by undertaking responsible management and maintenance *[Action A5 – page 57]*.

- Implement programs to educate lake users about proper boat maintenance, grey water disposal, and the locations of sensitive habitats to reduce the risk of pollution and lake ecosystem disturbance *[Action A7 – page 59]*.

Strategic Planning

- Amend and strengthen municipal Official Plans and Secondary Plan policy to require protection of the natural environment through specific measures, such as development setbacks within 30 metres of shorelines or streams *[Action B1 – page 60]*.

- Undertake responsible development planning along the shoreline *[Action B2 – page 61].*

- Undertake an enhanced level of coordination in the review of shoreline development projects between approval authorities *[Action B5 – page 64]*.

- Implement a strategic land acquisition program to identify and protect lands that are ecologically and/or culturally significant *[Action B6 – page 65].*

Urban and Rural Infrastructure

- Implement effective sediment and erosion control measures and other practices to prevent contaminants from reaching local watercourses during road work, agricultural drainage, and other construction projects *[Action C2 – page 68]*.

2.6 Management Objective #6:

Maintain healthy and productive sport fish populations

BACKGROUND:

- Recreational fishing is a big industry in the Kawartha Lakes. The Kawartha Lakes support one of the largest recreational fisheries in Ontario. Fishing for warmwater species on these lakes has traditionally been excellent due to the high productivity of the lake waters. According to an angling survey in 2005, Pigeon Lake ranked as the 14th most fished lake in Ontario. Within Pigeon Lake, the most sought-after fish species have traditionally been walleye (also known as pickerel), and to a lesser degree muskellunge, bass species (largemouth bass and smallmouth bass), and panfish (yellow perch and sunfish species). Since the early 2000's bass species and bluegill sunfish have been increasing targeted by anglers and currently surpass walleye. Angler activity on Pigeon Lake peaked in the late 1980's, and declined by 50% by the early 2000's from which time it has remained relatively stable. The season for yellow perch, black crappie, and sunfish became open all year in the Kawartha Lakes in 2010, which expanded angling opportunities.

- Shallow nearshore areas along the shoreline are important aquatic habitats. Most fish in Pigeon Lake use these productive areas for spawning and nursery. Due to its shallow depth, the southern portion of Pigeon Lake has some of the most extensive nearshore habitats of all Kawartha Lakes. Many of the areas immediately below dams, along rocky shallow areas, near wetlands, and at the outlets of lake tributaries are also known to be important areas for fish.

ISSUES:

- Potential decline in muskellunge due to northern pike range expansion. Northern pike is naturally occurring in many lakes within the Lake Ontario and Lake Huron basins however this species does not naturally occur in the Kawartha Lakes. The construction of the Trent-Severn Waterway facilitated the movement of this, and other non-native species, into the Trent-Severn Waterway. Due to its aggressive growth and preference for similar habitats, northern pike has the potential to cause population declines in the native muskellunge. Northern pike populations have been consistently expanding from the western lakes and rivers connected with the Trent-Severn Waterway, and they now have established populations in Balsam Lake.

- Loss and fragmentation of aquatic habitat along the shoreline and in small- to medium-sized tributaries. A significant portion of the Pigeon Lake shoreline has been altered through development. Much of this area has been hardened with concrete, armour stone, and other materials, creating non-natural shorelines which can impact the nearshore area and reduce aquatic habitat potential. Aquatic habitat loss and fragmentation are evident along most small- to medium-sized lake tributaries (particularly in their headwaters), due to the conversion of lands into agricultural production.

IMPLEMENTATION ACTIONS:

Stewardship

- Implement a natural landscaping approach along shoreline properties, with particular focus on decommissioning hardened shorelines and addressing severely eroded/ice-damaged sections *[Action A2 - page 54]*.

- Implement measures such as boat and equipment sanitization to reduce the risk of transfer of invasive species between water bodies *[Action A3 – page 55]*.

- Implement programs to educate lake users about proper boat maintenance, grey water disposal, and the locations of sensitive habitats to reduce the risk of pollution and lake ecosystem disturbance *[Action A7 – page 59]*.

Strategic Planning

- Amend and strengthen municipal Official Plans and Secondary Plan policy to require protection of the natural environment through specific measures, such as development setbacks adjacent to shorelines or streams *[Action B1 - page 60]*.

- Undertake responsible development planning along the shoreline *[Action B2 – page 61].*

- Implement the Fisheries Management Plan for Fisheries Management Zone 17, and Kawarthas, Naturally Connected Natural Heritage Systems Strategy *[Action B4 – page 63]*.

- Implement a strategic land acquisition program to identify and protect lands that are ecologically and/or culturally significant *[Action B6 – page 65].*

Urban and Rural Infrastructure

- Implement effective sediment and erosion control measures and other practices to prevent contaminants from reaching local watercourses during road work, agricultural drainage, and other construction projects *[Action C2 - page 68]*.

Research and Monitoring

- Implement a coordinated lake monitoring program that regularly tracks key indicators of lake watershed health including nutrients, aquatic plants, forest cover, fish communities, and oxygen levels *[Action D3 – page 74]*.

- Work towards quantifying and monitoring the economic values of Pigeon Lake [*Action D6 – page 77*].

2.7 Management Objective #7:

Ensure permit application process for development projects is transparent and efficient

BACKGROUND:

- Development projects in Pigeon Lake or along the shoreline typically need approvals from local planning authorities. Examples of works include shoreline grading, aquatic plant removal, boathouse construction, retaining wall creation, and other projects that occur close to the water's edge. Work permits are often required from Parks Canada, conservation authorities (Kawartha Conservation or Otonabee Conservation), and municipalities (City of Kawartha Lakes, Selwyn Township, or Municipality of Trent Lakes). As a general rule, works occurring above the high water mark require approval from a conservation authority; works below high water mark require approval from Parks Canada, and works that occur in both areas require approval from both organizations. Building permits for shoreline structures are typically required from the local municipality. Approvals are required to ensure human safety and maintain the integrity of the lake environment.

ISSUES:

- Confusion and frustration from shoreline owners and contractors. Due to the multi-jurisdictional nature of the lakes and shorelines, there is often confusion as to what types of projects require approvals, who to send information to for approval, and how long the wait times are for approvals.

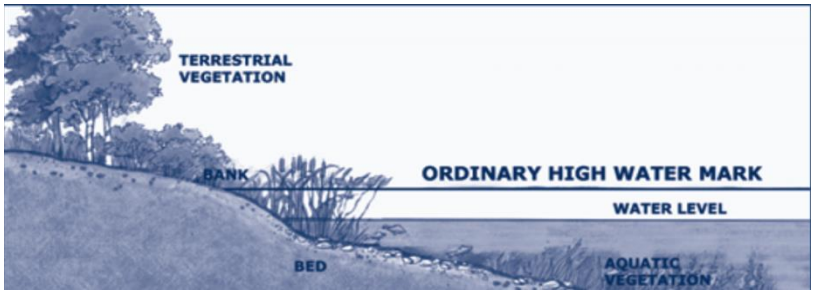


Diagram showing approximate location of ordinary high water mark in relation to water levels in the lakes. In Pigeon Lake, through water-level regulation, these levels are equal during summer navigation season.

IMPLEMENTATION ACTIONS:

Strategic Planning

- Undertake an enhanced level of coordination in the review of shoreline development projects between approval authorities *[Action B5 – page 64]*.

2.8 Management Objective #8:

Improve our understanding of how the lakes will respond to emerging pressures

BACKGROUND:

- Solid scientific understanding of lake-based pressures and how the lake ecosystem will respond to them are key elements in directing management decisions. Some of the important emerging pressures include:

    - Climate change. It is generally agreed that climate change is predicted to increase water temperatures and alter natural hydrological processes (e.g., more extreme weather events and changes to rainfall patterns). This will likely have impacts on multiple facets of the lake ecosystem including water quality, aquatic ecosystems including aquatic plant growth, and water levels and flows.

    - Cumulative development. It is unknown at what point development in the watershed/shoreline can cause serious negative implications for the lake aquatic ecosystem. Shoreline areas, in particular, are at risk of increasing development and urbanization. Cumulative draining of farmlands (e.g., through tile systems) and aggregate expansions may also warrant further investigation. There is a need to improve scientific understanding about the interactions of these stressors with the lakes to better manage the resource.

    - Non-point sources of pollution. These are diffuse sources of pollution that are not easily measured because there is no single "outlet." A particular area of focus should be quantifying nutrient inputs into the nearshore areas of the lakes (e.g., from septic systems and urban areas) because values are not well understood at this time.

    - Invasive species. Species introductions into areas outside their naturally occurring range can have profound impacts on lake dynamics. Zebra mussel proliferation in the Kawartha Lakes–resulting in increasing water clarity and leading to the proliferation of aquatic plants–is an example of the ecosystem-level impact of invasive species. Northern pike proliferation is of particular concern.

    - Emerging contaminants. There is a need to know the potential environmental impact of introducing into the lake environment certain non-traditional chemical compounds, such as nano-silvers, pharmaceuticals, micro-beads, hormones, antibiotics, and pesticides.

ISSUES:

- Lack of coordination of research and monitoring initiatives, and information management. Many different organizations and agencies are actively collecting data on various aspects of the lake ecosystem, e.g., the Kawartha Lake Stewards Association, Muskies Canada, several local municipalities, Kawartha Conservation, Otonabee Conservation, Ontario Ministry of Natural Resources and Forestry, etc. At this time, there is no coordinated approach to these efforts, and there is no collective information management system in place.

IMPLEMENTATION ACTIONS:

Research and Monitoring

- Implement a coordinated lake monitoring program that regularly tracks key indicators of lake watershed health including nutrients, aquatic plants, forest cover, fish communities, and oxygen levels *[Action D3 – page 74]*.

- Conduct research to more accurately identify shoreline sources of nutrients and potential impacts to nearshore areas of the lakes [*Action D4 – page 75*]**.**

- Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species *[Action D5 – page 76]*.

- Work towards quantifying and monitoring the economic values provided by Pigeon Lake [*Action D6 – page 77*].

3.0 Implementation Strategies

Official launch of the Pigeon Lake Management Plan
(Kawartha Settlers Village, Bobcaygeon, April 2012)

3.1 Introduction

The following Implementation Strategies provide a framework for a coordinated approach to maintaining a healthy Pigeon Lake. Integrated efforts are fundamental to improving the environment in and around the lakes. Everyone in the watersheds shares a responsibility for the current state of the lakes, so everyone is needed to participate in management efforts. A broad spectrum of partners, businesses, and residents is required in the implementation process in the watersheds. Working simultaneously, they can accomplish tasks in different areas. The more actions and strategies accomplished, the more likely that objectives for a healthy lake environment will be met.

Implementation Strategies provide a suite of actions to help achieve the management objectives outlined in Chapter 2. For greater on-the-ground applicability, actions are presented under the following strategies:

- Stewardship Strategy,
- Strategic Planning Strategy,
- Urban and Rural Infrastructure Strategy,
- Research and Monitoring Strategy, and
- Communications and Outreach Strategy.

Within each strategy, an introductory context is provided for approaches to implementation along with detailed actions. The format for each management action is as follows:

Action: A brief description of the management approach.

Urgency: The level of urgency for undertaking the particular action. A value was assigned for each action based on the five criteria listed below, and it was averaged to determine the overall urgency level for the action. Please refer to Appendix C for more detail.

CRITERIA	Level	Value	Details
#1. Action meets multiple objectives?	High	3	Meets many (over half of) objectives
	Medium	2	Meets a few objectives
	Low	1	Meets a single objective
#2. Action is affordable?	High	3	Cost < $5,000; easy to acquire local funding
	Medium	2	Cost >$5,000 and <$50,000; typical medium project proposal
	Low	1	Cost >$50,000; must acquire significant funding
#3. Action has support from community?	High	3	Overwhelming support
	Medium	2	Majority support
	Low	1	Localized support
#4. Action builds public support for implementation?	High	3	High profile; includes a large number of stakeholders
	Medium	2	Medium profile; includes a medium number of stakeholders
	Low	1	Low profile; includes a small number of stakeholders
#5. Action has timely environmental benefit?	High	3	Short term (5 years or less) improvement
	Medium	2	Long term (5 years or more) improvement
	Low	1	Maintain status quo

Rationale: A description of why the action is important and how it supports the level of urgency.

Priority Areas: A description of where the action is needed the most. It is most often geography based (e.g., specific subwatersheds or areas of development), but it is also based on other contexts (e.g., a specific industry or threats). Some priorities are to be determined at a later stage.

Lead and (Partner) Implementers: Organizations, groups, or individuals who have been identified during the planning process as potentially leading or partnering in the implementation of actions. Partners are in parentheses.

Deliverables: A description of specific details and/or project measurables leading to successful implementation of an action. In some cases, a specific numeric target is identified.

3.2 Stewardship Strategy

We must all understand our collective impact on the lakes and be informed as to *what we can do* to help sustain a healthy lake and its watershed. This strategy is comprised of core actions focused on farms and rural lands, towns and urban lands, shoreline areas, and lake users. The primary focus of this strategy is to develop an understanding of individual responsibility for effective land and soil stewardship practices at the property level. A second major focus of this strategy is to provide technical assistance and/or resources that result in positive stewardship actions.

Where necessary, financial incentives should be considered for projects with extraordinary cost or complexity (e.g., a large erosion remediation project extending across several properties). The Scugog WATER Fund, a successful incentive program currently offered to help protect Lake Scugog in the Durham Region, could be a model for this initiative. The stewardship strategy works in conjunction with the Communications and Outreach Strategy and incorporates other cost-sharing stewardship programs such as the Environmental Farm Plan.

Plantings are well established along the shoreline at Peace Park Omemee Beach, to deter geese. Note the invasive species *Phragmites* is present in centre. *(Omemee Mill Pond, September 2014)*

Action A1: Urban and waterfront lot-level measures

Undertake lot-level measures such as reducing fertilizer use, increasing infiltration, capturing stormwater runoff, and other practices that conserve water and reduce pollution in targeted urban areas and waterfront communities.

Urgency

- High

Rationale

- Developed areas account for approximately 7% of the Pigeon Lake planning area, yet contribute disproportionately high amounts of sediments, nutrients, and other contaminants typically through increased surface water runoff over fertilized lawns, parks, and hardened surfaces running into the lakes. In phosphorus loadings, it is estimated that urban areas contribute 19% (1,007 kg per year) to Pigeon Lake from all Local Subwatershed sources. Most urban areas within the watersheds of the lakes are located along shorelines. A 15% reduction in urban phosphorus loading is needed to achieve the water quality benchmark for the lake.

Priority areas

- Town of Bobcaygeon, Omemee, and other small urban communities along the shorelines

Lead and (partner) implementers

- Lake associations; urban residents; businesses; property managers; Emily Provincial Park; local municipalities; (Environmental Advisory Committees; Kawartha Conservation and Otonabee Conservation)

Deliverables

- Develop a program that provides educational and project management assistance, and financial assistance where possible, to urban and waterfront residents to support the uptake of lot-level measures for water stewardship action.
    - Within a five-year period, achieve a target of 50% of urban residential, commercial, and public properties implementing lot-level measures such as:
        - Maintain a buffer strip of natural vegetation along urban waterfronts and stream banks to filter runoff, prevent erosion, and provide wildlife habitat.
        - Capture and store storm runoff via rain barrels, grassed swales, vegetated depressions, rain gardens, splash pads or “roll up” attachments to downspouts, and private stormwater management ponds as applicable.
        - Maintain trees and other landscape plants that help slow surface water runoff and reduce soil erosion; replace at-risk, dying, or storm-damaged trees with trees and shrubs of appropriate species.
        - Mow lawns to no less than three inches in height to encourage healthier root development and help absorb more moisture.
        - Work toward a low or no phosphorus fertilizer and gradual reduction, then eliminate chemical fertilizer use on lawns; leave mulched clippings to decompose and use yard compost for soil amendments; avoid discarding of clippings in waterways.
        - Conduct soil testing to determine actual nutrient deficiencies.
        - Maintain permeable surfaces, such as porous asphalt or vegetated swales, as alternatives to hardened driveways, walkways, and parking lots.
        - Maintain septic systems with regular pump-outs.
        - Take advantage of hazardous waste and recycling programs.
        - Dispose of pet wastes in the garbage and discourage feeding of waterfowl.
    - Over the long term, achieve a 15% reduction in existing phosphorus loading from local urban sources to achieve a loading target of approximately 856 kg per year into Pigeon Lake.

Action A2: Natural landscaping along shorelines

Implement a natural landscaping approach along shoreline properties, with particular focus on decommissioning hardened shorelines and addressing severely eroded/ice-damaged sections.

Urgency

- High

Rationale

- Shoreline areas are often referred to as the Ribbon of Life around our lakes and are particularly sensitive to development. The Pigeon Lake shoreline is among the most heavily developed of the Kawartha Lakes; about 29% of the shoreline is in a developed state within 30 metres of the lake. In addition, much of the shore-water interface has been altered, which reduces the vegetative buffering benefits provided by natural shorelines. Pressures along the shoreline are expected to grow as waterfront lots are popular retirement destinations for an aging population and as lake water quality continues to improve.

Priority areas

- Densely populated waterfront communities and back lot developments adjacent to waterfronts

Lead and (partner) implementers

- Parks Canada: Trent-Severn Waterway; Emily Provincial Park; Cottage and Road Associations; shoreline property owners and managers; Kawartha Conservation and Otonabee Conservation; (Federation of Ontario Cottagers' Associations; local municipalities; local volunteer lake stewards; local nurseries)

Deliverables

- Develop a program to engage residents, providing technical assistance and expertise, supporting community volunteers, and encouraging business and industry to implement practices that protect the integrity of the shoreline.
    - Within a five-year period, achieve a target of 50% of residences with greater than 25% of their shoreline naturalized to a minimum of three metres (10 feet) from the water's edge.
    - Within a five-year period, achieve a target of 50% of shoreline properties practising lot-level measures such as:
        - Maintain a buffer strip of natural vegetation along the shoreline, the wider the better; establish a "no-mow" zone along the shoreline.
        - Minimize waterfront development of artificial structures (excluding erosion protection) to 25% or less of total frontage.
        - Select dock or boathouse sites where little or no vegetation currently exists.
        - Re-vegetate disturbed soil areas as soon as possible to stabilize loose soils.
        - Retain fallen trees and large rocks in the nearshore zone, unless they are a hazard to boats or swimmers.
- Develop a shoreline-focused incentive program that provides financial and/or project management assistance to encourage property owners with extraordinary issues to decommission hardened shorelines (e.g., vertical retaining walls) or repair severely eroded/ice- or wave-damaged sections and replace with natural materials.
    - Establish a Review Committee comprised of municipal staff, conservation authority staff, and cottagers' association representatives to provide program direction and review project applications on a confidential basis.
    - Every year, decommission vertical retaining walls or repair severely ice-damaged shorelines on three to five properties.
- Produce and distribute a non-technical guidance document that clearly illustrates practical approaches for improving existing non-natural shorelines.

Action A3: Prevention and Control of Invasive Species

Implement measures such as boat and equipment sanitization to reduce the risk of transfer of invasive species between water bodies.

Urgency

- High

Rationale

- The introduction and spread of non-native species throughout the aquatic and terrestrial environment is generating profound implications for ecosystem health throughout North America. These "invasive species" have significantly altered the Pigeon Lake ecosystem already, usually to the detriment of biodiversity and lake-based values. With its connection to the other Kawartha Lakes, the introduction and spread of invasive species can be aided by unimpeded transportation routes (e.g., the Trent-Severn Waterway) and recreational activities (e.g., boating).

Priority areas:

- Vessels and equipment that travel between lakes,
- Construction sites, and
- Recreation corridors.

Lead and (partner) implementers

- Invading Species Awareness Program - Ontario Ministry of Natural Resources and Forestry, and Ontario Federation of Anglers and Hunters; Federation of Ontario Cottagers' Associations; Muskies Canada; recreational boaters and anglers; City of Kawartha Lakes (Ontario Invasive Plants Council; Kawartha Conservation and Otonabee Conservation; Kawartha Lake Stewards Association; construction industry)

Deliverables

- Implement best management practices to reduce the risk of introducing and spreading invasive species, for example:
    - Inspect boats, trailers, boating equipment, fishing tackle and nets, and remove any visible plants or animals before leaving any water body.
    - Drain water from the motor, live well, and bilge and transom wells while on land, before leaving the water body.
    - Empty bait buckets on land before leaving the water body; avoid releasing live bait into a water body or transferring from one water body into another.
    - Wash and dry fishing tackle, nets, boat, and equipment to kill harmful species that may not be visible to the eye.
    - Install and utilize wash stations adjacent to public boat launch facilities. Appropriate runoff controls should be put in place at wash stations to prevent sedimentation and manage runoff.
- Report invasive species sightings through the Invading Species Hotline: 1-800-563-7711 and/or the Early Detection and Distribution Mapping System (EDD MapS Ontario): www.eddmaps.org/ontario
- Promote the use of existing "monitoring tool-kits"(e.g., https://foca.on.ca/ais-monitoring-toolkit/) to facilitate public education, with an emphasis to:
    - Learn how to prevent the spread of invasive species.
    - Learn how to identify existing invasive species and species that could potentially threaten watershed health.
    - Access information from organizations such as the Invading Species Awareness Program and the Invasive Plants Council to gain access and disseminate information to lake stakeholders.
    - Use best-bet control and management approaches.
- Host workshops and develop factsheets on emerging invasive species (e.g., emerald ash borer, *Phragmites*, etc.).

Action A4: Reforestation program

Develop a reforestation program to re-establish and manage natural cover on marginal rural lands, particularly in subwatersheds that do not meet forest cover benchmarks.

Urgency

- Medium

Rationale

- Forest cover in the Pigeon Lake core planning area is approximately 317 km^2, representing 48% of the total land area. This barely meets minimum threshold values, and it is a high-risk approach that may only support marginally healthy aquatic systems. There is a strong desire among lake stakeholders to maintain excellent ecological conditions in the lakes and their watersheds. Thus a threshold of 50% is desired because it represents a low-risk approach that is likely to support healthy conditions. This indicates a landscape deficit for the Pigeon Lake core management area of 2% (13.2 km^2 or 3,262 acres). Small stream corridors would particularly benefit from reforestation. It is not feasible to fully address the above deficit. The reforestation program should emphasize strategic tree planting of the highest priority sites, with natural succession attending to the reforestation and natural cover establishment of other areas.

Priority areas:

- Subwatersheds that do not meet minimum forest cover benchmarks or that are at a high-risk level: Pigeon Lake Tribs., Reforestation Creek, and Pigeon River; other areas identified in a Natural Heritage Strategy; and,
- Lands with marginal agricultural values or areas that can be effectively reforested through natural regeneration at no cost or by small-scale, strategic tree planting at lower densities.

Lead and (partner) implementers

- Trees Ontario; Kawartha Conservation and Otonabee Conservation; cottagers' associations; (Kawartha Chapter of the Ontario Woodlot Association; private landowners)

Deliverables

- Finalize the Kawarthas, Naturally Connected Natural Heritage Systems Strategy within the Pigeon Lake basin.
    - Use this strategy to identify priority sites that will be effectively reforested through natural regeneration at no cost, and field or open area sites appropriate for large-scale tree planting or small-scale, strategic tree planting at lower densities.
- Develop a reforestation program to undertake large-scale reforestation projects, focusing on the priority areas in the above subwatersheds. The program would provide assistance to participants in developing property-specific planting plans, obtaining trees at competitive prices, planting trees, and other resources.
    - Expand the existing bulk sales program for private landowners who pick up their own trees and do the planting on their own properties.
    - Engage youth by organizing tree planting opportunities for Scouts and other youth groups.
    - Within a five-year period, achieve a target of increasing forest cover in the core Pigeon Lake planning area by 1% (33 acres) of the current deficit, per year, by planting (50%) and natural regeneration (50%). This equates to planting approximately 10,000 to 15,000 trees and shrubs annually, with an emphasis on priority stream corridors.
    - Maintain the existing streamside vegetative cover at 83% in the core Pigeon Lake planning area.
- Develop an effective partnership with Trees Ontario to fully utilize provincial funding in support of the Fifty Million Tree program.

Action A5: Septic system maintenance

Reduce potential pollution from septic systems into the lakes by undertaking responsible management and maintenance.

Urgency

- Medium

Rationale

- Septic systems at shoreline residences and community properties on the strip of land around the lakes are estimated to contribute 19% (1,027 kg per year) of the phosphorus load from all Local Subwatershed sources. A 5% reduction in septic system loading is needed to achieve the water quality benchmarks for the lake. Ongoing studies may yet illustrate that this source of phosphorus has a potentially significant influence on nearshore algae blooms, because it is readily available for uptake (orthophosphate). In addition, bacteria from sewage is often ineffectively treated or contained by faulty septic systems. Human health should be a major consideration when faulty systems are in the vicinity of residential wells and beaches. Individual and communal waterfront septic systems must be properly installed and maintained. Leachate from septic systems is a likely factor contributing to the several algae blooms reported in the north end of the lake.

Priority areas

- Densely populated shoreline areas; older septic systems
- North shore of the lake

Lead and (partner) implementers

- Local municipalities; City of Kawartha Lakes; Haliburton, Kawartha, Pine Ridge District Health Unit and Peterborough City/County Health Unit; Ontario Ministry of Environment and Climate Change; shoreline property owners; (septic system businesses; Kawartha Conservation and Otonabee Conservation; Federation of Ontario Cottagers' Associations)

Deliverables

- Implement the recently approved City of Kawartha Lakes "Septic Rehabilitation Loan Program." This allows owners to enter into a longer-term payback agreement to access funds for improving their system.
- Develop regulatory means for legislating the upgrade of outdated or faulty septic systems (e.g., a municipal by-law requiring a certificate of approval prior to a property sale).
- Conduct periodic "dock talk" extension services and local workshops with a focus on helping homeowners understand, inspect, and manage septic systems.
- Create a comprehensive municipal or regional inventory of all septic systems in the Pigeon Lake watersheds, detailing type, location, and year of construction.
- Continue investigating official complaints of malfunctioning systems to address potential health hazards and determine corrective actions as required.
- Over the long-term, achieve a 5% reduction in existing phosphorus loading from shoreline septic systems to achieve a loading target of 979 kg per year into Pigeon Lake.
- Over the long term, rehabilitate 75 or more septic systems along the lake shoreline, given that currently 5% of septic systems are estimated failing and there are an estimated 1560 shoreline properties.

Action A6: Nutrient and soil loss from farms

Implement measures such as vegetated buffer strips along streams, conservation tillage, and other practices that reduce nutrient and soil loss from farms, with assistance from cost–share programs.

Urgency

- Medium

Rationale

- At 27% of the total land use, agriculture is the dominant element (after natural areas) within the Pigeon Lake planning area. The proper management of farmlands is essential in maintaining the environmental health of the watershed, in decreasing phosphorus and nitrogen loads, and in reducing sediment loss into the lake via drainage ditches and other small tributaries. Over the past 20 years, farmers have made significant gains in applying enhanced water quality protection measures through the Environmental Farm Plan. In terms of phosphorus loadings, it is estimated that local rural areas contribute 19% (1,049 kg per year) into Pigeon Lake from Local Subwatershed sources. Maintaining existing agricultural phosphorus loading, or lower, is needed to achieve the water quality benchmark. Since there is a recent trend towards conversion of marginal/pasturelands to croplands, a key consideration is not to impede the application of nutrients required for crop production, but rather to encourage the management practices that retain nutrients and soils onsite for crop utilization.

Priority areas

- Reforestation Creek; other localized high-risk sites

Lead and (partner) implementers

- Ontario Soil and Crop Improvement Association: delivery agent for the Environmental Farm Plan; farmers; (Ontario Ministry of Agriculture, Food and Rural Affairs; Kawartha Conservation and Otonabee Conservation; City of Kawartha Lakes; Peterborough County; Ontario Ministry of Environment and Climate Change; agri-businesses)

Deliverables

- Develop a local program to provide additional financial and project management incentives to landowners in the Pigeon Lake planning area to *top up* Environmental Farm Plan incentives, focusing on surface water and soil management improvements in high priority areas.
    - Establish a Review Committee comprised of municipal, provincial, and conservation authority staff, and agricultural representatives. It will provide program direction, collaborate on applications for external funding, and review project applications on a confidential basis.
    - Every year, conduct three to five agricultural improvement projects in priority subwatersheds such as:
        - Grassy waterways on erodible crop land sites;
        - Vegetated buffer strips adjacent to watercourses;
        - Grazing land management: fencing, crossings, alternative watering systems;
        - Improved manure storage;
        - Livestock yards/feedlot operation runoff management and diversion of upslope water;
        - Conservation tillage and cover crops that stabilize soils and reduce erosion;
        - Nutrient management planning: implementation of precision agricultural practices including the use of GPS and satellite navigation technology for more accurate application of nutrients; and
        - Wetland restoration and protection.
- Over the long term, achieve a 25% reduction in existing phosphorus loading from local agricultural sources to achieve a loading target of approximately 787 kg per year into Pigeon Lake.
- Over the long term, achieve an average phosphorus concentration of 30 ug/L or less at the outlet of Reforestation Creek by implementing better nutrient and sediment control measures on farms within its subwatershed.

Action A7: Boating awareness programs

Implement programs to educate lake users about proper boat maintenance, grey water disposal, and the locations of sensitive habitats to reduce the risk of pollution and lake ecosystem disturbance.

Urgency

- Medium

Rationale

- Pigeon Lake is a heavily used lake for recreational purposes, particularly for pleasure craft. The is especially true because it facilitates lock-free access between Pigeon Lake, Buckhorn Lake, Chemong Lake, Little Bald Lake, and Big Bald Lake. Further, the locks at Bobcaygeon and Buckhorn are two of the busiest (in terms of vessel traffic) on the Trent-Severn Waterway system. Due to the potential for lake contamination by chemicals (e.g., gas, oil, etc.), blackwater (e.g., sewage discharge), and grey water (e.g., used non-sewage discharge) from many larger vessels, there is a need to educate people about properly maintaining equipment and disposing of wastes. Further, there are several areas of the lake (e.g., provincially significant wetlands, etc.) where boating disturbance should be avoided during periods of increased sensitivity (e.g., fish spawning and bird nesting areas).

Priority areas

- Marinas; Lock 32 (Bobcaygeon) and Lock 34 (Fenelon Falls)
- Sensitive shoreline habitats (e.g., provincially significant wetlands)

Lead and (partner) implementers

- Recreational boaters; Boating Ontario; local marinas; Parks Canada (Kawartha Lake Stewards Association)

Deliverables

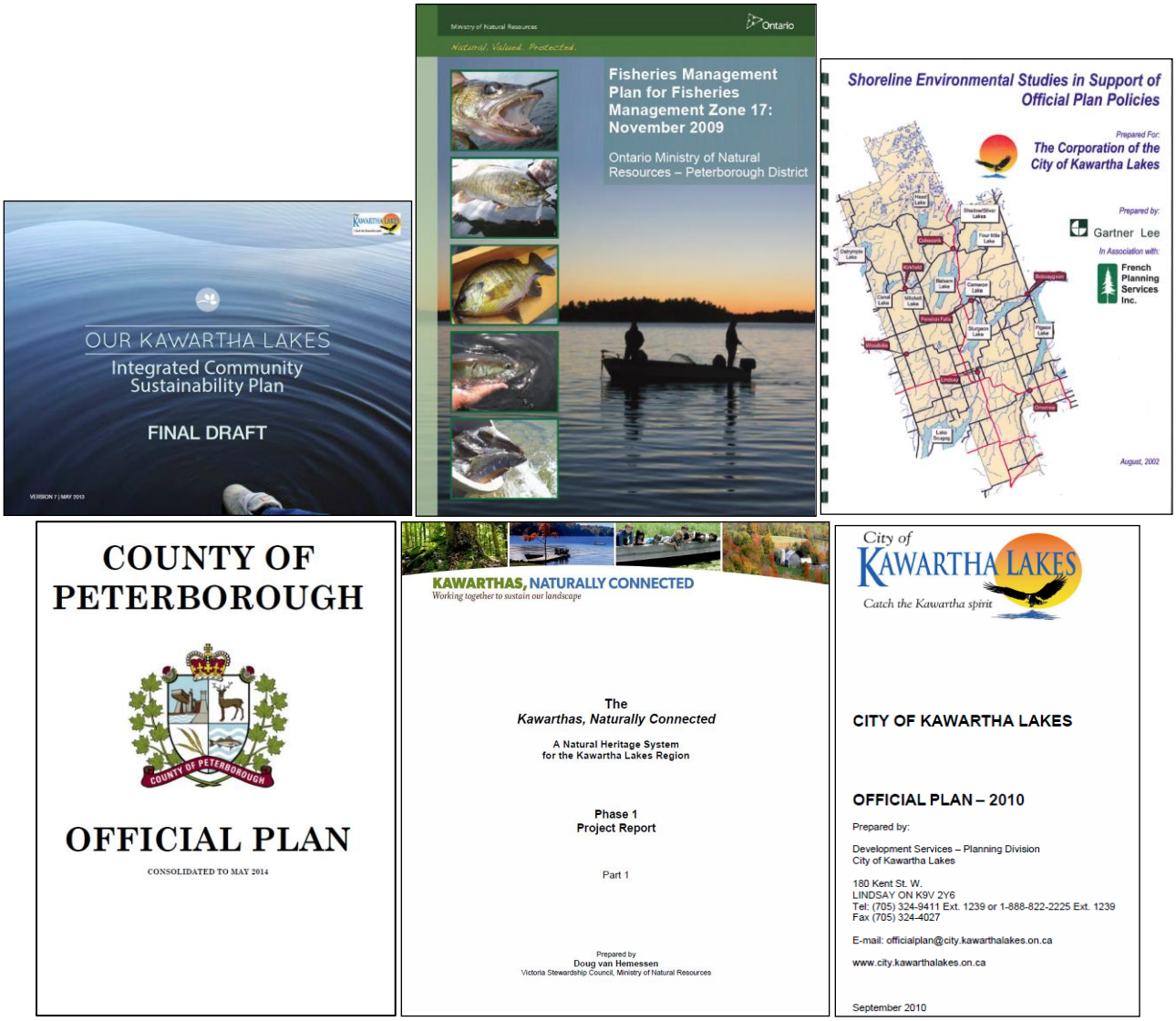
- Implement a Clean Boater campaign, to ensure a proactive approach to reducing risk of water contamination, through measures such as the following:
    - Practise preventative maintenance, including regular engine and equipment inspection and servicing.
    - Keep oil absorbent pads and containment pans or trays under the engine when it is not in water.
    - Know the fuel capacity prior to filling tanks; when possible, fill away from water over a spill containment system.
    - Store petroleum products carefully to reduce risk of spillage.
    - Minimize the use of harsh cleaners by rinsing boats regularly, or if a boat needs cleaning beyond the soft cleaning, first remove the boat from the water.
    - Dispose of grey water waste on land in appropriate facilities.
    - Use low-impact recreational practices (e.g., canoeing, kayaking, sailing, etc.) and technologies (e.g., four-stroke motors).
- Minimize disturbance to sensitive ecological features with measures such as the following:
    - Reduce your wake and ensure the boat is an appropriate distance from shore; this minimizes the turbidity (soil and sediment disturbance) and damage to nearshore areas.
- Minimize noise and speed levels when operating near populated waterfront communities.
- Marinas to voluntary obtain Clean Marine Program certification through Boating Ontario.

3.3 Strategic Planning Strategy

The primary focus of this strategy is to integrate proactive approaches for lake health and environmental protection measures into operational planning policies within a framework of existing planning tools and legislation. One area of focus is reviewing and strengthening the water protection and natural heritage policies in the *City of Kawartha Lakes Official Plan*. Any remedial implementation plans and actions must be supported by the official policies, plans, and relevant legislation. If necessary, these should be updated or newly developed.

It is important to enhance collaboration among municipal planning staff, federal and provincial regulating authorities, and Kawartha Conservation staff regarding shoreline regulations and permitting procedures. This will streamline processes and improve transparency for the general public.

The implementation of the *Pigeon Lake Management Plan* will be linked with existing strategic planning initiatives that further leverage efforts to improve the health of the lakes and watersheds.



Examples of recently developed planning initiatives that support the Lake Management Plan

Action B1: Official Plan

Amend and strengthen policies within municipal Official Plans and Secondary Plans to require protection of the natural environment through specific measures such as development setbacks adjacent to shorelines or streams.

Urgency

- High

Rationale

- Municipal Official Plans and Secondary Plans provide the structure for land use planning and development in the core Pigeon Lake planning area. There are five municipalities that have jurisdiction within this area: City of Kawartha Lakes, Peterborough County, Municipality of Trent Lakes, Selwyn Township, and Cavan-Monaghan Township. Following a recent review of the current City of Kawartha Lakes Official Plan, it was found to be lacking and requires stronger wording and specific policy to protect the lake environment. Important natural areas (e.g., wetlands, woodlands, and fish spawning areas) must be identified on maps and have appropriate policies to preserve and protect them. A comprehensive review of Official Plans of the remaining municipalities is necessary to ensure policies are rigourous in providing for lake protection.

Priority areas:

- Shoreline areas, and
- Areas to be determined, as defined by a natural heritage strategy (e.g., Kawarthas, Naturally Connected Natural Heritage Systems Strategy).

Lead and (partner) implementers

- City of Kawartha Lakes; Peterborough County; Selwyn Township; Municipality of Trent Lakes; Township of Cavan-Monaghan (Kawartha Conservation and Otonabee Conservation; Ontario Ministry of Natural Resources and Forestry; consultants)

Deliverables

- Review and amend Official Plans and Secondary Plans to include strong natural heritage policy (with corresponding maps) to protect the ecological function of important natural areas and improve water quality.
    - Strengthen shoreline protection provisions to ensure that the natural features and functions of shorelines and nearshore areas are maintained.
        - Review and integrate, where applicable, the shoreline-based policy recommendations in the document, *Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes* (Gartner Lee and French Planning Services, 2002).
        - Consider requiring new multi-lot residential, commercial, and/or industrial developments to achieve a "no-net-increase" in phosphorus inputs entering the lake from the pre-development compared to the post-development footprint.
        - Consider requiring natural treatments (e.g., native plantings and natural rock) to be integrated wherever feasible for shoreline alteration works.
    - Develop consistent policies among all local municipalities.
    - Work with partners to identify natural heritage areas to be protected and ensure the corresponding policy is in effect. For example ensure previously unevaluated natural heritage features (e.g., wetlands, woodlands) are evaluated by qualified professionals prior to permitting development to help prevent their loss.
    - Strengthen wording (e.g., "shall" instead of "should," and "require" instead of "encourage") for policies that apply to water quality and natural heritage protection measures.
    - Consider applying the enhanced lake protection provisions (e.g., vegetation protection zones, natural heritage evaluations, etc.) used in the Lake Simcoe watershed (as per the *Lake Simcoe Protection Plan*) to the Pigeon Lake planning area.
    - Integrate goals and objectives developed in the Our Kawartha Lakes Integrated Community Sustainability Plan initiative into the Official Plan strategic directions.
    - Provide for greater water quality protection measures (e.g., water quality and quantity control standards) for developments in back lots.
    - Conduct effective enforcement of policies through inter-agency coordination.

Action B2: Responsible shoreline development

Undertake responsible development planning along the shoreline.

Priority

- High

Rationale

- The intent of this action is to consider regulatory tools that would be best applicable to afford enhanced protection to the lake shoreline, given that this specific area of the lake is under significant current and future development pressure. The shorelines of Pigeon Lake are considered a sensitive area that contributes directly to the health of the overall lake ecosystem. The shoreline areas, particularly along the north shore, are quite heavily urbanized and these development pressures are expected to continue as local and Greater Toronto Area (GTA) urban communities expand and more seasonal dwellings are converted to permanent residences. This typically results in a loss of naturally functioning shorelines and the beneficial services they provide such as stabilizing soils, moderating temperatures, providing fish and wildlife habitat, reducing surface water runoff, utilizing nutrients, among others. There is a need to strengthen water quality and natural heritage protection policies around shorelines to mitigate land use impacts resulting from any increase in shoreline development and associated alterations.

Priority areas:

- Shorelines around Pigeon Lake, including island shorelines
- Large forested areas along the shoreline

Lead and (partner) implementers

- Local municipalities; (Kawartha Conservation and Otonabee Conservation; Parks Canada: Trent-Severn Waterway; Ontario Ministry of Natural Resources and Forestry)

Deliverables

- Ensure all new major structures (e.g., recreational dwellings, commercial properties, etc.) and infrastructure (e.g., cottage roads, etc.) are built above high water levels, and away from sensitive fish and wildlife habitats (e.g., wetlands, muskellunge spawning areas, etc.).
- Consider opportunities for harmonizing existing shoreline development policies of the Trent-Severn Waterway, conservation authorities, and local municipalities.
- Review and integrate, where applicable, the shoreline-based policy recommendations in the document Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes (Gartner Lee and French Planning Services, 2002).
- Consider opportunities to ensure new shoreline subdivisions are serviced by municipal wastewater systems.
- Consider various planning and regulatory approaches to prevent the clear-cutting of large forested areas along the shoreline, and to ensure the preservation of natural vegetation, enhanced stormwater management measures, development setbacks from key natural heritage features (e.g., wetlands), provision for natural shoreline structures, etc.
    - The scope and criteria would be determined through the municipal process, which should emphasize public consultation. Potential tools to consider include:
        - Official Plan policies;
        - Municipal bylaws (e.g., Forest Conservation, Site Alteration, etc.);
        - Shoreline Secondary Planning; and,
        - Other regulatory approaches.
- Conduct effective enforcement of the by-law through inter-agency coordination.

Action B3: Wild rice

Complete consultations with stakeholders and continue to work with First Nations toward the development of wild rice management principles to address all user interests to the extent possible while recognizing First Nations rights.

Urgency

- High

Rationale

- Wild rice (Manomin) and other aquatic vegetation are flourishing across much of southern Pigeon Lake. The character of this section of the lake has changed within the last decade, from one having a condition of open water dominated by submerged aquatic plants to one having a condition of a marsh dominated by emergent aquatic plants. The now abundant wild rice beds are likely due to a combination of natural and human related factors. There are conflicting perspectives among watershed residents and community stakeholders on wild rice in southern Pigeon Lake.

Priority areas

- Southern Pigeon Lake

Lead and (partner) implementers

- Government of Canada (Parks Canada); Williams Treaties First Nation; (local shoreline communities)

Deliverables

- Wild Rice management principles developed by Parks Canada and First Nations, considering stakeholder interests.

Action B4: Implement plans

Implement the following plans: *Fisheries Management Plan for Fisheries Management Zone 17*; Kawarthas, Naturally Connected Natural Heritage Systems Strategy; and Integrated Community Sustainability Plans.

Urgency

- Medium

Rationale

- Various resource planning initiatives (government, community, or industry-led plans) directly or indirectly support the enhancement of the lake environment. In most instances, successful implementation of these initiatives will assist in the long-term sustainability of Pigeon Lake.

Priority areas

- Protect important natural heritage areas.

Lead and (partner) implementers

- As per lead and partners identified in respective plans

Deliverables

- Finalize and implement the Kawarthas, Naturally Connected Natural Heritage Systems Strategy.
    - Focus on identification of priority areas in core *Pigeon Lake Management Plan* area for reforestation or areas of critical ecological significance that must be protected from incompatible development.
- Implement the Integrated Community Sustainability Plans.
    - Focus on integrating water-based objectives and targets into municipal planning and policy.
- Implement the *Fisheries Management Plan for Fisheries Management Zone 17*.
    - Focus on implementing actions identified in the Walleye Management Strategy, Muskellunge and Northern Pike Strategy, and Invasive Species Strategy.
- Update the *Emily Provincial Park Management Plan*.
    - Focus on shoreline water quality, natural heritage protection, and good recreational access to the lake.
    - Conduct natural heritage evaluations to support the identification of sensitive areas.

Action B5: Shoreline works

Undertake an enhanced level of coordination in the review of shoreline development projects between approval authorities.

Urgency

- Medium

Rationale

- Approval to undertake construction or maintenance for shoreline development projects (e.g., shoreline stabilization, boathouses, docks, etc.) is typically required prior to proceeding with the work. Since there are several authorities involved in obtaining approvals, the permitting process can be prone to delays and is, in general, not clearly understood by shoreline owners and contractors. The rationale for better coordination among all approval authorities is to provide enhanced client services and inter-agency coordination to ensure the permitting process is as efficient as is reasonable possible.

Priority areas

- Shoreline areas

Lead and (partner) implementers

- Kawartha Conservation and Otonabee Conservation, when the majority of works is along the shoreline; Parks Canada: Trent-Severn Waterway when the majority of works is in-water; (local municipalities)

Deliverables

- Make the approval process simpler, faster, and less confusing for the public as follows:
    - Support a more consistent application of shoreline policies.
    - Clarify the jurisdictional scope of permitting activities.
    - Improve public awareness about the use of the permitting processes.
- Conduct routine evaluations of the process.
- Conduct effective enforcement through inter-agency coordination.

Action B6: Land acquisition

Implement a strategic land acquisition program to identify and protect lands that are ecologically and/or culturally significant.

Urgency

- Medium

Rationale

- The long-term protection of ecologically and culturally important areas on the landscape contributes greatly to maintaining a healthy lake ecosystem. The recent securement of Big (Boyd) Island in the north end of Pigeon Lake is a testament to the strength of a coordinated approach towards identifying and protecting these areas. Several tools are available to assist in protecting these land from development including strategic planning, conservation easements, fundraising campaigns, and other mechanisms through which lands can be secured in perpetuity to benefit not only the lake ecosystem but to also provide several benefits to lake communities, organizations, and agencies.

Priority areas

- Areas of ecological and/or cultural significance.

Lead and (partner) implementers

- Kawartha Land Trust (conservation authorities; Trent University and Fleming College; local municipalities; provincial ministries; Parks Canada; private landowners).

Deliverables

- Develop a strategic plan for the acquisition of additional properties that contain important and/or sensitive ecological (e.g., rare ecosystems) and/or cultural features (e.g., archaeological sites).
    - Utilize the Kawarthas Naturally Connected Natural Heritage Systems Strategy as a tool to guide property acquisition prioritization.
- Develop stewardship plans for protected lands to ensure that human uses are compatible in terms of protecting the important features and functions of the lands.
- Utilize conservation easements (e.g., Conservation Lands Tax Incentive Program, Managed Forest Tax Incentive Program, etc.) and similar tools (e.g., Environmental Protection Land Use Zoning) to protect sensitive areas on private lands.
- Work with partners to secure additional properties that provide increased access to waterfront areas.

3.4 Urban and Rural Infrastructure Strategy

A significant focus of this strategy is to reduce impacts to the lakes resulting from urban and rural infrastructure maintenance. This is mainly a municipal responsibility, with emphasis on enhanced control of stormwater, water quality and quantity, soil erosion, and maintenance of public spaces. However, other stakeholders involved in the construction industry are similarly responsible for ensuring that their activities are not detrimental to the health of the lakes.

The recommended urban stormwater management strategy will provide an integrated, comprehensive stormwater management plan in all urban catchment areas. Implementation of this strategy can help reduce contaminants from urban runoff by using water quality and quantity treatment and by reducing or eliminating the sources of pollutants. The use of innovative 21st-century approaches should ensure that urban development is sustainable and minimizes impact to the lakes.

Erosion of sandy soils along the shoreline of Crowe's Line Beach (North shore of Pigeon Lake, September 2015)

Action C1: Stormwater management

Through stormwater management planning, improve the quality and control of stormwater in the urban settlement areas of Bobcaygeon and Omemee.

Urgency

- High

Rationale

- Bobcaygeon and Omemee are the largest urban centres on Pigeon Lake. Urban areas, although representing a relatively small part of the planning area, are significant contributors of sediments and contaminants, including nutrients and bacteria. This is mainly due to increased seasonal and stormwater runoff from hardened surfaces, typical of highly developed areas. Efforts should be focused on improving stormwater quality in priority areas based on calculated flow and nutrient loading; this includes the type of stormwater control, size, location, and cost estimate. Recent advances in the application of low impact development (LID) standards in Greater Toronto Area settings have proven to be extremely cost-effective in achieving enhanced stormwater quality and quantity control.

Priority areas

- Defined sewersheds (to be determined) in major urban settlement areas

Lead and (partner) implementers

- City of Kawartha Lakes; (Ontario Ministry of Environment and Climate Change; Centre for Alternative Wastewater Treatment; Kawartha Conservation)

Deliverables

- Undertake an urban stormwater management initiative that provides an integrated approach to master drainage planning, including water quality and quantity treatment, for all urban catchment areas.
    - Create an inventory of all urban storm drainage systems (including delineation of sewersheds), conduct regular inspections, and establish a maintenance schedule.
    - Identify those sewersheds that contribute the highest inputs of nutrients and sediments.
    - Identify opportunities to retrofit existing units or create new stormwater infrastructure to improve water treatment (in quality and quantity) where appropriate, with an emphasis on applying low impact development (LID) and other innovative technologies.

Action C2: Infrastructure maintenance and construction practices

Implement effective sediment and erosion control measures and other practices to prevent contaminants from reaching local watercourses during road work, agricultural drainage, and other construction projects.

Urgency

- High

Rationale

- Routine maintenance of drainage ditches along rural road networks is often needed to remove the build-up of silt and sediments. In the case of roadside ditches, the accumulation of sediments over time may impede the ability of the ditch to drain water efficiently during precipitation events and high-water periods. This is similar to agricultural drainage corridors, where it is also necessary to maintain unimpeded water conveyance during crop growth periods. These practices can potentially involve dredging or altering the channel for increased through-flow. This can damage the aquatic ecosystem, including the harmful alteration of in-stream habitat, destabilization of banks, introduction of excessive sediments into our lakes, etc. A number of cost-effective options incorporate the natural environment (e.g., vegetation and its root systems), which will help minimize maintenance costs while protecting the environment. In the case of roadside ditches and construction sites, the focus should be on reducing sediment loading into nearby (downslope) watercourses.

Priority areas:

- Road ditches with steep slopes and highly erodible soils,
- Road ditches that drain immediately into lake-connecting watercourses, and
- All construction worksites.

Lead and (partner) implementers

- Local municipalities; (Ontario Ministry of Agriculture, Food and Rural Affairs ; Kawartha Conservation and Otonabee Conservation; construction industry; Ontario Ministry of Environment and Climate Change)

Deliverables

- Avoid conducting construction projects during sensitive periods for fish and wildlife, where this is appropriate.
- Identify and install effective measures to prevent disturbed soils and sediments from migrating into the watercourses. Use standards outlined in the document, *Erosion and Sediment Control Guideline for Urban Construction* (Toronto and Region Conservation Authority, 2006). For example:
    - Focus on site-level containment of sediments, recognizing that advanced controls are often required to protect sensitive natural heritage features.
    - Plant disturbed areas with soil-stabilizing vegetation, preferably native species.
    - Use sediment blankets or matting for disturbed banks.
    - Work in low-flow periods; develop a back-up plan in case of heavy rains/melt.
- Host periodic workshops for contractors, consultants, project managers, and developers to ensure effective communications and knowledge of the most up-to-date measures for controlling the movement of sediments off-site.

Action C3: Improvement of public waterfront

Increase community enjoyment of public beaches and parks by deterring geese and conducting regular maintenance.

Urgency

- Medium

Rationale

- Public access to Pigeon Lake provides a primary connection to the lake. The Omemee Peace Park Beach, in particularly, is almost always posted during the swimming months as unsafe for swimming due to elevated bacteria concentrations. Beach postings at this location are almost certainly related to prolific geese feces along the beach and in the shallow nearshore area. Another factor is limited flushing rates and warm, shallow waters of southern Pigeon Lake are likely to continue to make some of the lake's beaches (e.g., Omemee Peace Park Beach, Emily Provincial Park Beach) more sensitive to bacterial contamination. It is anticipated that active management of these spaces will increase public enjoyment opportunities at our beaches and other waterfront parks.

Priority areas:

- Omemee Peace Park Beach, other beaches (Emily Provincial Park, Crowe's Line Beach) as necessary, and
- Public parks, and boat launches.

Lead and (partner) implementers

- City of Kawartha Lakes; Municipality of Trent Lakes; Selwyn Township; Kawartha Land Trust; beach stewards; (school students; volunteer organizations; local municipalities)

Deliverables

- Within a five-year period, achieve a target of 80% (approximately 40 postings) reduction in the amount of time that public beaches are posted as unsafe for swimming.
    - Conduct routine maintenance at public spaces, including beaches, such as regular garbage pick-up, clean-up of pet and bird feces, and provision of adequate feces disposal facilities.
    - Investigate the potential to implement higher levels of urban storm runoff management in beach areas.
    - Investigate the feasibility of beach stewards or volunteers (e.g., 40-hour commitments) doing clean-ups weekly during the summer months.
    - Implement ways to deter geese such as creating and maintaining tall vegetation or wider buffers, dog presence, bangers, falconry, oiling eggs, or consider expanding/providing waterfowl hunting opportunities.

Action C4: Sewage treatment facility

Operate Bobcaygeon sewage treatment facility at maximum efficiency for pollutant removal and capacity.

Urgency

- Medium

Rationale

- Two municipal wastewater treatment plants exist within the planning area, servicing the villages of Bobcaygeon and Omemee. The treatment lagoons in Omemee discharge effluents on-site away from the lake and likely have no impact on lake water quality. Bobcaygeon treatment plant empties treated water directly into Pigeon Lake, along the north-west shore. Over the years, all treatment plants in the City of Kawartha Lakes have improved treatment efficiency and reduced phosphorus input to the lake dramatically. Bobcaygeon wastewater treatment plant continues to function extremely well and its treated discharge into Pigeon Lake is negligible in terms of total phosphorus loadings. It is important to note that the current loading of 67 kg/year represents only a fraction of that approved as acceptable maximum loading by the province. Therefore, it is reasonable to expect that phosphorus loading from the Bobcaygeon sewage treatment facility will increase as the population served grows.
- Excessive water flow amounts entering the treatment plant (from heavy rainfall events) have not overloaded facility capacity in more than five years. Overloading can lead to partial by-pass events when some untreated wastewater enters the lake. It is important for the Bobcaygeon treatment plant to continue to be able to process large-flow events.

Priority areas

- Bobcaygeon Wastewater Treatment Plant

Lead and (partner) implementers

- City of Kawartha Lakes; (Centre for Alternative Wastewater Treatment; Ontario Ministry of Environment and Climate Change; urban residents)

Deliverables

- Identify opportunities to reduce the amount of stormwater entering the wastewater treatment conveyance system (e.g., disconnecting downspouts, low-impact development opportunities, etc.); identify storm vs. combined storm/sewage infrastructure, and investigate the options to mitigate.
- Monitor nitrates and nitrates in effluent, currently the form of nitrogen monitored is total ammonia.
- Eliminate partial bypass events at treatment plant when overloaded with stormwater.
- Ensure that pumping stations have back-up power supplies and/or other features to prevent spillage to waterways.

3.5 Research and Monitoring Strategy

All management decisions, as well as remedial and restorative actions, depend on sound scientific data and knowledge. Further lake-based research will shed light on the many information gaps identified by this planning process, including emerging 21st-century pressures. Further monitoring is crucial for determining the effectiveness of current lake-based programming and for identifying new opportunities to engage stakeholders. This adaptive management approach ensures that priorities remain relevant as new information becomes available.

A key component of this strategy is collaboration among groups and institutions already active on the lakes. There is great value in using the expertise of local community members, volunteers, and citizen scientists. We promote the sharing of local knowledge and expertise that, in some cases, spans generations. This will help build plan interest and lead to the increased "buy-in" of local people. As project partners create the momentum, the community will come on board.

Kawartha Conservation staff installing water flow monitoring equipment near the outlet of Nogies Creek (Bobcaygeon, September 2012)

Action D1: Innovative water quality management approaches

Undertake pilot projects to test the effectiveness of innovative management approaches to controlling abundant aquatic plants and poor water quality, in priority areas.

Urgency

- High

Rationale

- The purpose of this action is to test the effectiveness of a suite of projects at a relatively local scale that could be applied to a broader scale, if proven valid. These pilot projects will address many information gaps in innovative water management approaches and technology. With high profile, numerous small projects of a collaborative nature are likely to garner solid support for implementation efforts. It is essential that these projects contain a monitoring component to determine their effectiveness.

Priority areas

- Various, depending on the nature of the pilot project

Lead and (partner) implementers

- (Kawartha Lake Stewards Association; academia; industry; government agencies; and others, depending on project scope and location)

Deliverables

- Within the next two to three years, facilitate pilot projects or other study initiatives on the following:
    - Innovative approaches for enhancing the quality of urban stormwater before it enters the lake, for example:
        - Test constructed wetlands (e.g., floating islands).
        - Construct low-impact development techniques to control runoff, such as bioswales, infiltration trenches, and permeable pavement.
    - Innovative approaches for enhancing the quality of rural stormwater and/or drainage runoff, for example:
        - Use controlled tile drainage.
        - Use other farm-beneficial management practices.
    - Innovative approaches for controlling aquatic plants.
    - Ensure pilot projects have an integrated monitoring component to track and report on their effectiveness.

Action D2: Aquatic plants

Conduct research on aquatic plant distribution, composition, and their ecological and cultural significance to better inform aquatic plant management approaches.

Urgency

- High

Rationale

- Aquatic plants are valued components of the lake ecosystem and can have significant ecological value (e.g., habitat for fish and wildlife), socioeconomic value (e.g., reducing waterfront erosion), and cultural value (e.g., traditional First Nations food). Large expanses of aquatic plants exist in the shallow productive waters of southern Pigeon Lake, that in recent years have shifted to a more emergent, marsh-dominated system. These wetlands are often regarded as a negative feature on the lake by local communities, thought of as impeding recreational use and property values. As such, there is a strong willingness to active manage (reduce or eliminate) aquatic plants. Prior to any significant aquatic plant control undertakings, research should be undertaken to ensure that the ecological and cultural values of aquatic plants and wetlands are maintained.

Priority areas

- Southern Pigeon Lake.

Lead and (partner) implementers

- Parks Canada (First Nations; Trent University and other academic institutions; Fleming College; provincial ministries).

Deliverables

- Conduct research on aquatic plants in Pigeon Lake, including:
    - How aquatic plants and wetlands have changed over time, and changes that can be expected in the future.
    - Their distribution, composition, and ecological importance in the lake ecosystem.
    - Their cultural significance to local First Nations communities.
    - How various methods of aquatic plant control and management could impact the lake ecosystem (e.g., extensive removal of aquatic plants may contribute to undesirable changes in the aquatic community, such as an increase in algal blooms including cyanobacteria (blue-green algae) blooms, or increased turbidity).

Action D3: Lake monitoring

Implement a coordinated lake monitoring program that regularly tracks key indicators of lake watershed health, including nutrients, aquatic vegetation, forest cover, fish communities, and oxygen levels.

Urgency

- Medium

Rationale

- Routine collection of lake and watershed data provides critical information about the ongoing state of Pigeon Lake and its watersheds. It also helps to monitor progress on the planning targets, while allowing early detection of hot spots. Various agencies and groups are actively monitoring the Kawartha Lakes, including Pigeon Lake, and respective watersheds; coordination is key to reducing duplication and increasing efficiency. We need to support and take advantage of local monitoring, drawing on contributions from volunteers, community organizations, and local academia.

Priority areas

- Pigeon Lake and its watersheds

Lead and (partner) implementers

- Kawartha Conservation; (Otonabee Conservation; local municipalities; Kawartha Lake Stewards Association; Fleming College; Trent University; provincial ministries; First Nations; Muskies Canada; Parks Canada: Trent-Severn Waterway; Ontario Federation of Anglers and Hunters; Emily Provincial Park; citizen scientists)

Deliverables

- Develop a list of science-based lake and watershed health indicators that are practical enough to be understood by the general public. Example indicators include the following:
    - Water quality: nutrient status, contaminant inputs, temperature, oxygen, etc.;
    - Water quantity: lake water levels, flow inputs, etc.;
    - Aquatic ecosystems: biodiversity, primary production, fishes, aquatic plants, etc.; and
    - Terrestrial natural heritage: forest cover, natural shorelines, etc.
- Conduct routine monitoring of Pigeon Lake and its watersheds using appropriate lake and watershed health indicators.
    - Coordinate monitoring activities between academia and active groups.
    - Use a "pressure-state-response" feedback loop for monitoring, so that efforts are directed at (a) recognizing relevant pressures/threats to lake health, (b) determining to what degree these impact the state of lake health, and (c) determining the effectiveness of management response.
    - Integrate monitoring efforts into secondary and post-secondary institutions, where practical.
    - Increase data collection opportunities by volunteers, citizen scientists, and local stakeholders.
    - Identify priority lake sites with the greatest potential, over the short-term and medium-term, to be restricted in waterfront access due to aquatic plant proliferation, particularly wild rice.
- Develop a network to coordinate collaborative research opportunities; utilize the Bay of Quinte Restoration Council as a potential model.

Action D4: Sources of nutrients

Conduct research to more accurately identify shoreline sources of nutrients and potential impacts to nearshore areas of the lakes.

Urgency

- Medium

Rationale

- The purpose of the research is to determine how shoreline dwellings affect nearshore ecosystems in lakes by the release of nutrients. This requires the investigation of nutrient chemistry and ecological processes of the nearshore ecosystems of Pigeon Lake. Such studies will provide better insight into actual contributions from shoreline septic systems, since loading amounts have only been estimated at this time. The main objective of such research is to study the presence and quantity of nutrients in nearshore areas adjacent to shorelines (that vary in the amount and type of residential development), with a particular emphasis on better quantifying septic system impacts. The north shore of Pigeon Lake is prone to episodic cyanobacteria (blue-green algae) blooms, the drivers of which are currently not well understood. Excessive contributions of nutrients from nearshore areas, specifically malfunctioning septic systems, are a potential factor.

Priority areas

- Shoreline and nearshore areas; north shore of the lake

Lead and (partner) implementers

- Trent University; (Kawartha Lake Stewards Association; Kawartha Conservation; Fleming College; Ontario Ministry of Environment and Climate Change)

Deliverables

- Conduct nearshore zone sampling for source detection of nutrients.
- Quantify shoreline nutrient input from septic systems and other sources.
- Stimulate and support additional studies of advanced research that will produce more precise knowledge of septic system nutrient input.

Action D5: Understanding lake ecosystem stressors

Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species.

Urgency

- Low

Rationale

- The key driver for the proposed research is the anticipated increase of development along the shorelines of Pigeon Lake and in surrounding urban areas, and the consequent pressures on the lake ecosystem. There is an urgent need to improve scientific understanding about these interactions – particularly for climate change and invasive species in the lake watersheds – so that appropriate management responses may be developed.

Priority areas:

- Cumulative development along shorelines,
- Climate change, and
- Invasive species in aquatic ecosystems.

Lead and (partner) implementers

- (Kawartha Conservation and Otonabee Conservation; colleges and universities; Kawartha Lake Stewards Association; provincial ministries; Emily Provincial Park; local municipalities; First Nations)

Deliverables

- Conduct research on potential lake ecosystem changes resulting from climate change, invasive species, and cumulative shoreline development.
    - Investigate options for predictive modeling tools and decision-support systems to guide management efforts to mitigate any negative impacts of emerging pressures.
- Conduct research on how to protect and manage muskellunge populations from the significant threat of northern pike proliferation.
- Conduct ongoing research at Trent University's Oliver Centre property (north shore)
- Conduct a climate change vulnerability assessment.
- Conduct research to identify lake and watershed health thresholds and carrying capacity.
- Utilize traditional ecological knowledge from local First Nations communities.
- Identify various, minimally impacted "reference lakes" the data from which can be used to better understand the range of natural variability expected in healthy aquatic ecosystems.
- Conduct research and monitoring to assess any potential impacts from expanding aggregate operations on the water resources within Nogies Creek Watershed.
- Conduct research to assess the potential water quality impacts of greywater and blackwater discharge from marinas and large vessels.

Action D6: Socio-economic value

Work towards quantifying and monitoring the economic values of Pigeon Lake.

Urgency

- Low

Rationale

- Although the value of Pigeon Lake as an angling destination has been somewhat quantified, the socio-economic value of all aspects of Pigeon Lake – the direct and indirect monetary value to the municipality and local communities – is unknown. One information gap is the significance of the lake ecosystem services (e.g., providing clean water, fishing opportunities, recreational values, natural spaces, clean air, etc.) to the broader community. Recognition of the value of ecosystem services and the impact of human development on them is becoming more widespread through recent research (e.g., *Lake Simcoe Basin's Natural Capital: The Value of the Watershed's Ecosystem Services* (S. Wilson, 2008) and the *Value of Greenbelt Eco-Services Study* (S. Wilson, 2008) reports). However, public knowledge of the vital role of these services in quality of life is limited, so it is important that communities have information about the value of natural areas. The purpose of this action is to develop economic indicators that are relevant to Pigeon Lake and are routinely monitored and reported-on.

Priority areas

- To be determined

Lead and (partner) implementers

- Chamber of Commerce; local municipalities; local businesses (Trent University and other academic institutions; conservation authorities; provincial ministries; David Suzuki Foundation)

Deliverables

- Identify several key ecosystem goods and services provided to humans (Pigeon Lake users and stakeholders, in particular) from Pigeon Lake resources.
- Develop a list of "best-bet" list of economic indicators relevant to Pigeon Lake that are routinely monitored and reported-on. The following are potential steps towards achieving this:
    - Develop a list of potential indicators for consideration. Examples of relevant indicators include: recreational boating, angling and hunting, lake water quality, natural capital, shoreline real estate, local businesses, hydropower generation, public lake use and access, lake-based tourism, etc.
    - Obtain input from local stakeholders, communities, and organizations with emphasis on economics-related aspects.
    - Adjust list of indicators and associated information (e.g., targets) as necessary.
    - Develop a coordinated program that routinely monitors and reports on information.

3.6 Communications and Outreach Strategy

Communication and outreach help set the *Pigeon Lake Management Plan* in motion and provide the mechanisms for Plan updates and adjustments to meet changing community needs and environmental conditions. This involves communicating information about the lakes and watersheds; providing actions to sustain a healthy environment, community, and economy; receiving feedback from stakeholders about implementation of the Plan (including Plan updates and adjustments); and assisting collaboration on the Plan and related projects.

The Communication and Outreach Strategy supports the other strategies through these four objectives:

1. Enable informed decision making and actions that contribute to the goal of the Plan.
2. Motivate actions that protect Pigeon Lake.
3. Create the cultural conditions for long-term sustainability of the lakes.
4. Provide transparency and accountability for the Plan and its implementation.

Many people have a stake in the implementation of the *Pigeon Lake Management Plan*. They are grouped into target audiences by the different forms of communication and outreach required for implementing the Plan. Audience groups include shoreline property owners, First Nations communities, agricultural and rural landowners, urban residents, businesses, tourists and other visitors, municipal councillors and staff, lake associations, agencies and related organizations, developers, funders, and Kawartha Conservation staff and Board of Directors.

Barriers to implementation (which will be assessed by research in this strategy) include:

- Lack of knowledge of how to properly undertake actions;
- Poor understanding of watershed connections (e.g., the impact of urban residents on the lakes), including why specific actions are needed, and the corresponding benefits of those actions;
- Upfront costs and lack of agreement on who is responsible for watershed protection (e.g., landowners may see agencies as responsible, and agencies may see greater need for landowners to take responsibility);
- Good conditions may entrench a “business as usual” attitude;
- Challenges of keeping the brand and awareness of the plan at the forefront; and
- Competing interest for lake users and interpretation of “healthy lake” conditions.

Opportunities to support the implementation of this strategy include:

- Strong involvement from community leaders and representatives of the committees for lake management planning;
- Research and stewardship activities by groups in the watershed such as the North Pigeon Lake Ratepayers Association, Kawartha Lake Stewards Association, Fleming College, Federation of Ontario Cottagers’ Associations, and Trent University;
- Outreach such as the Blue Canoe Program, which provides information about lake management planning and collects information through surveys;
- Increasing attention towards aquatic plant growth, blue-green algae, and other symptoms of lake enrichment, as well as invasive species, climate change, and other issues identified in surveys;
- Science to back up the strategies;
- Emphasis in the community on the need for stewardship actions by individual property owners;
- Release of booklets and other communication materials;
- Establishment of a web page for the program and other communication mediums;
- In-house skills, such as online media, writing, and presentation;
- Media coverage surrounding lake management planning, the *2013 Kawartha Watershed Report Card* (Kawartha Conservation, 2013), open house events, and other Kawartha Conservation and partner activities.

Community Advisory Panel meeting
(Bobcaygeon, 2012)

Action E1: Aquatic plant management options

Make available to shoreline residents information that clarifies options for aquatic plant control.

Urgency

- High

Rationale

- Numerous waterfront residents have expressed their concern over abundant aquatic plant growth in Pigeon Lake and many are seeking information on the available options that exist to manage them. Parks Canada, Trent-Severn Waterway regulates aquatic plant control in Pigeon Lake given they have jurisdiction over the lake-bed, and as such as permit is typically required to undertake plant control. Currently, information relating to the existing aquatic plant control policies of Parks Canada are not well-understood by waterfront owners, such as: the type of plants that can be controlled and how much of an area can be controlled. Several communications approaches are needed to help shoreline residents better understand Parks Canada's aquatic plant management policies.

Priority areas

- Shoreline residents

Lead and (partner) implementers

- Parks Canada, Trent-Severn Waterway (Ontario Ministry of Natural Resources and Forestry; Ontario Ministry of the Environment and Climate Change; Kawartha Lake Stewards Association; Federation of Ontario Cottagers' Associations; conservation authorities; municipalities; shoreline contractors)

Deliverables

- Update the website of Parks Canada, Trent-Severn Waterway to include easy-to-find information on the following:
    - Regular updates on the consultation process between Government of Canada and Williams Treaties First Nation, as it pertains to aquatic plant and wild rice management.
    - Aquatic plant control permitting process, including the application process, aquatic plant policies and management options.
- Develop and distribute information relating to existing aquatic plant management policies to lake associations, shoreline contractors, and other affected stakeholders.

Action E2: Keeping stakeholders informed

Communicate the science, solutions, and outcomes of plan implementation.

Urgency

- High

Rationale

- A large amount of information and analysis has been generated through Plan development, providing a baseline for setting environmental targets. It enables informed decision-making and actions that contribute to the goal of the Plan. Through information sharing it will be possible to track any improvement or decline in conditions, measure the effectiveness of actions, and respond to emerging issues in a changing environment. Transparency and accountability to stakeholders are necessary for ongoing funding and support for Plan implementation.

Priority areas

- Kawartha Lakes wide

Lead and (partner) implementers

- Kawartha Conservation and Otonabee Conservation; local municipalities; Kawartha Lake Stewards Association; Federation of Ontario Cottagers' Associations; First Nations; (local agricultural organizations and other community groups)

Deliverables

- Distribute a report every two years on monitoring results, implementation of stewardship actions, impacts of actions, and other changes in the watershed. Main target audiences: municipal councillors and staff, lake associations, agricultural organizations, other related organizations and agencies, funders, provincial staff, First Nations, and Kawartha Conservation staff and Board of Directors.
- Provide updates via newsletters, social media, local media, and budgets. Main target audiences: shoreline property owners, agricultural and rural landowners, urban residents, developers, businesses, and First Nations.
- Maintain a web page for lake management planning to host reports, updates, and related resources. Main target audience: municipal councillors and staff, lake associations, agencies and related organizations, funders, and Conservation Authority staff and Board of Directors, First Nations, and shoreline property owners.
- Develop infographics and posters that include facts and findings about Pigeon Lake, issues and solutions, ecological connections, and human-environment relationships. The graphics will be professionally designed and suitable for hanging in cottages, offices, and other settings; for posting online; and for distributing through social media. Main target audiences: shoreline property owners, agricultural and rural landowners, urban residents, businesses, developers, municipal councillors and staff, and Conservation Authority staff and Board of Directors.
- Provide presentations by request, to contribute the latest information and updates, answer questions, and talk directly with people, agencies, organizations, and interest groups in the community.
- Use annual meetings of local organizations (e.g., Kawartha Lake Stewards Association Annual General Meetings) to review lake monitoring programs and discuss regional projects of interest to their membership.
- Showcase new technologies, innovations, and practices, where appropriate.
- Use the Blue Canoe program to distribute information to shoreline property owners and lake associations.
- Develop materials on cultural significance of the lake, in particularly with local First Nations communities, and distribute through online, print, and social media outlets.

Action E3: Community Advisory Panel

Maintain the Community Advisory Panel to ensure effective communication, agency support, and collaboration among lake stakeholders during Plan implementation.

Urgency

- High

Rationale

- With the implementation of the *Pigeon Lake Management Plan*, maintaining relationships among all project partners is essential for communicating with the watershed community. The Community Advisory Panel will continue to help provide this function. The panel will also evaluate various Plan implementation components by assessing whether actions are appropriate and meet targets, and by recommending responses.

Priority areas

- Kawartha Lakes wide

Lead and (partner) implementers

- Kawartha Conservation; local municipalities; (Kawartha Lake Stewards Association; Otonabee Conservation; Federation of Ontario Cottagers' Associations; agricultural groups; community organizations)

Deliverables

- Maintain the Community Advisory Panel membership, with an increasing focus on Plan implementation.
    - Maintain the partnerships from the lake study and research period.
    - Receive input on Plan implementation, and on changes in the landscape and in communities.
    - Assist with funding proposals and acquisition of resources for program delivery.
    - Stakeholder representatives: municipal councils and staff, industry leaders for farmers and businesses, shoreline and urban communities, community champions and organizations, and First Nations.
    - Take ownership of monitoring the completion of implementation actions.

Action E4: Science and Technical Committee

Maintain the Science and Technical Committee to ensure effective communication, support, and collaboration among monitoring and research-based organizations.

Urgency

- High

Rationale

- A Science and Technical Committee provided specialized input and leadership pertaining to the science and research processes during the development of the Pigeon Lake Management Planning project. The membership of the committee covers many areas of expertise and knowledge; it includes organizations with an interest in the outcomes of the lake management planning and in the scientific research of the lake ecosystem. Since research and monitoring are integral components of the lake management process, this technical forum should continue to provide input and support.

Priority areas

- Kawartha Lakes wide

Lead and (partner) implementers

- Kawartha Conservation; (Otonabee Conservation; Trent University, Fleming College and other academic institutions; municipalities; provincial ministries; First Nations; Parks Canada: Trent-Severn Waterway; Kawartha Lake Stewards Association)

Deliverables

- Maintain the Science and Technical Committee membership, with an increasing focus on supporting Plan implementation efforts.
    - Maintain and build on partnerships developed during the lake study and research period.
    - Receive input on Plan implementation and emerging issues.
    - Assist with funding proposals and acquisition of resources for science and research delivery.
- Consider expanding the membership and scope of the committee to a Kawartha Lakes-wide initiative.
- Communicate on a regular basis to ensure technical information sharing.

Action E5: Stakeholder Input

Create opportunities for stakeholder input through plan implementation, and assess stakeholder concerns, barriers, and knowledge gaps regularly.

Urgency

- High

Rationale

- This action helps evaluate the implementation of the *Pigeon Lake Management Plan* and encourages an open forum for updates to the Plan. This is important as the landscape changes demographically, climatically, ecologically, culturally, and in other ways. An understanding of community needs, values, concerns, interests, culture barriers, and knowledge gaps is critical to effective communication and program implementation.

Priority areas

- Kawartha Lakes wide

Lead and (partner) implementers

- Kawartha Conservation

Deliverables

- Participate in a multi-partner workshop regarding wild rice harvesting on the lake. The workshop, scheduled to be undertaken by Parks Canada in early 2019, will provide a forum for interested parties to discuss issues and information related to wild rice with the objective of providing advice and recommendations to Parks Canada for consideration in the development of a broadly supported wild rice management plan.
- Conduct a representative knowledge, attitudes, and behaviours (KAB) survey of the watershed population to create a baseline. Conduct future surveys to measure changes. Main target audience: shoreline property owners, agricultural and rural landowners, urban residents, businesses, developers, and First Nations communities.
- Obtain public and stakeholder feedback on reports (every two years) to gauge perceptions of the state of the lake and direction of the Plan, through a survey. Main target audience: municipal councillors and staff, lake associations, related organizations, other stakeholders, and Kawartha Conservation staff and Board of Directors, and First Nations communities.
- Compile and analyse other surveys and audience research undertaken in the priority area.
- Implement customer relations tracking/demographics mapping software to manage information collected about each target group through stewardship activities, surveys, and other sources.

Action E6: Profile Pigeon Lake

Profile the natural heritage features, social values, and economic values associated with Pigeon Lake, including a long-term vision for the lakes and a shared sense of responsibility to protect them.

Urgency

- High

Rationale

- Many outstanding natural and cultural features make up Pigeon Lake and the surrounding lands. Encouraging an ecological perspective involves recognizing connections between people and their actions on the landscape. This perspective highlights how ecological ties are also community and economic ties; what one does on the land has ecological implications for the local community and economy. This provides a foundation for stewardship activities and promotes Pigeon Lake as a desirable place to visit and invest.

Priority areas

- Kawartha Lakes wide, Ontario wide

Lead and (partner) implementers

- Kawartha Conservation; local municipalities; Chamber of Commerce; Federation of Ontario Cottagers' Associations; First Nations; Emily Provincial Park; lake associations; Kawartha Land Trust; Trent-Severn Waterway

Deliverables

- Contribute information about the lake and its natural features to tourism-focused and other communication sources that profile the City of Kawartha Lakes, Municipality of Trent Lakes, Selwyn Township, Peterborough County, and Pigeon Lake. Main target audience: tourists and other visitors, funders, businesses, shoreline property owners, and recreational groups.
- Contribute information about the lake, its natural features, and protection ideas to local school curricula, and other local environmental education programming. Main target audience: shoreline property owners, urban residents, agricultural and rural landowners, and local youth and teachers.
- Build a strong brand for the Plan that signifies shared responsibility, community effort, science-based programming, cultural significance, and ecological, community, and economic ties. Main target audience: shoreline property owners, agricultural and rural landowners, businesses, urban residents, municipal councillors and staff, lake associations, agencies and related organizations, developers, funders, and Kawartha Conservation staff and Board of Directors, and First Nations communities.
- Profile the cultural heritage of First Nations communities, including their strong linkages to Pigeon Lake and their connection to traditional significance of wild rice.
- Profile the natural and cultural heritage features of Nogies Creek.
- Utilize Emily Provincial Park activity programming (e.g., campfire talks) as a forum to profile the environmental, cultural, and socio-economic values of the lake, as well as active stewardship initiatives (e.g., Blue Canoe Program).

Action E7: Collaboration

Work collaboratively with people who and projects that contribute to the objectives of the lake Plan.

Urgency

- High

Rationale

- A large amount of information and analysis has been generated in the development of the *Pigeon Lake Management Plan* that may contribute to other related initiatives in the watersheds. Representatives of a wide range of stakeholders must collaborate on program aspects of the *Pigeon Lake Management Plan*, including science and research, funding proposals, and other project support. They also need to look for unique partnership opportunities for lake management projects.

Priority areas

- Kawartha Lakes wide

Lead and (partner) implementers

- Kawartha Conservation; Kawartha Lake Stewards Association; local municipalities; Otonabee Conservation; First Nations; Federation of Ontario Cottagers' Associations; community organizations; local businesses

Deliverables

- Provide research and information from the Plan and support objectives relevant to the Plan. With this goal, participate in working groups and committees, and work with organizations such as the following:
    - Business chambers;
    - Municipal Economic Development departments;
    - Cottage, lake, and rate payer associations and environmental groups;
    - Developers;
    - Educational institutions such as Fleming College, Trent University, the Trillium Lakelands District School Board, and the Peterborough Victoria Northumberland and Clarington Catholic District School Board;
    - International Centre of Excellence for Water Quality;
    - Regional Tourism Organization 8 (RTO8);
    - Water Management Advisory Council for the Trent-Severn Waterway; and,
    - Williams Treaties First Nation;
    - Otonabee Conservation.
- Provide assistance with the incorporation of plan research and analysis, and the implementation of best management practices to organizations. Main target audience: municipal councillors and staff, lake associations, agencies and related organizations, developers, funders, and Kawartha Conservation staff and Board of Directors.

Action E8: Community Outreach

Undertake Community Outreach to motivate shoreline residents and businesses to implement lake and watershed friendly lifestyles, and to make connections in the community.

Urgency

- Medium

Rationale

- Community Outreach is an important addition to our communications tools and strategies as it allows for direct in-person contact, effectively targets specific demographics, and also plays an educational role. Our outreach initiatives will allow us to touch base directly with shoreline residents and provide them with the tools that they need to implement lake and watershed friendly lifestyles. This outreach will also enable shoreline residents to ask questions about our programs and services, and about the ways that their property specifically can have a positive impact on the health of the lake.

Priority areas

- Kawartha Lakes wide

Lead and (partner) implementers

- Kawartha Conservation; (Federation of Ontario Cottagers' Associations)

Deliverables

- Maintain the Blue Canoe program, a communication initiative that provides waterfront property owners with information about the responsible management of shorelines; deliver Blue Canoe to adjacent lakes directly connected to Pigeon Lake (in particular Little Bald Lake, Big Bald Lake, and Crystal Lake).
- Place signs or stickers that serve as a reminder near a voluntary action location. Main target audience: shoreline property owners, agricultural and rural landowners, urban residents, and businesses.
- Publish stories featuring people who take action: online (website, interactive map), in social media and video, in stewardship presentations, and through traditional media. Main target audience: shoreline property owners, agricultural and rural landowners, urban residents, businesses, funders, developers, and municipal councillors and staff.
- Investigate and develop incentive programs for shoreline naturalization and best management practices on Pigeon Lake. Main target audiences: shoreline property owners, agricultural and rural landowners, and businesses.
- Attend public events such as lake association meetings to promote best management practices in lake stewardship and talk about the conditions impacting the lake and Plan milestones reached.

Action E9: Youth Engagement

Engage school youth in environmental programming and volunteer opportunities.

Urgency

- Medium

Rationale

- Youth will play a significant role in managing our water resources in the coming years. Early engagement is needed to help prepare youth for the management challenges ahead, especially in the sustainability of local waterways and solutions needed. Recent research suggests that Nature Deficit Disorder is a widespread occurrence among urban youth, and that more regular opportunities for appreciating the outdoors are needed. By taking advantage of internship and volunteer positions, youth will gain practical experience in the field of resource management while fulfilling required community-based volunteer hours.

Priority areas

- Primary and secondary schools

Lead and (partner) implementers

- Trillium Lakelands District School Board; Peterborough Victoria Northumberland and Clarington Catholic District School Board; Kawartha Conservation; Gamiing Nature Centre; First Nations (Kawartha Field Naturalists; Boys & Girls Clubs of Kawartha Lakes)

Deliverables

- Continue to develop curriculum linked formalized educational programs that integrate lake-based environmental communications, stewardship, and research for primary and secondary school aged students, through lessons, activities, and teaching tools.
- Make available youth internship, co-op, and/or volunteer opportunities at local businesses, organizations, and clubs involved in water resource management.
- Utilize and promote the Outdoor Classroom at Ken Reid Conservation Area to host youth programming and encourage other outdoor education opportunities.
- Integrate traditional knowledge from First Nations elders and communities into youth lesson plans and engagement opportunities.
- Promote greater youth involvement in lake stewardship volunteer opportunities including:
    - Shoreline and public park restoration projects, such as tree and garden plantings; and
    - Urban projects, such as the implementation of the Yellow Fish Road program to draw attention to storm sewers draining directly into a waterway.

3.7 Moving To Implementation

The *Pigeon Lake Management Plan* provides a solid framework for a coordinated approach to maintaining healthy lakes and watersheds for all uses. However, successful implementation will require ongoing commitments (financial and otherwise) from all identified partners to fully realize and sustain a healthy lake environment.

Creating and maintaining effective partnerships is essential to the success of this management plan. The more stakeholders, resources, and knowledge applied to each action item, the better the result. Everyone around the lake is accountable for responsible lake management. Early implementation efforts should highlight small successful projects from individuals and groups to build momentum.

Specific costs of action item deliverables were intentionally omitted from the *Pigeon Lake Management Plan*. At early stages of implementation, it is essential to develop a solid business plan to attract potential funders, sponsorships, and commitments from many sectors. Efforts should also emphasize the assembly of relevant expertise, even if those partners have not yet been identified in the plan implementation.

Many of the strategies and actions developed in this plan can be applied to other lakes as well. However, we have focused primarily on the priorities of stakeholders and ecosystem-based issues specific to Pigeon Lake. Careful consideration is needed in applying management approaches from this plan to other lakes, as each lake is unique with its own set of issues and community-based values.

To assess progress and remain accountable, the *Pigeon Lake Management Plan* should be reviewed and updated, if necessary, in a five- to 10-year time period. Reporting and evaluating the progress of project deliverables should be conducted more often, for example, on an annual basis. This will allow stakeholders to adjust priorities and assess targets and deliverables using an adaptive management approach.

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Appendix A: Key Communities and Stakeholders

Everyone has a role to play in maintaining a healthy Pigeon Lake. A wide range of communities, organizations, and individuals depends on healthy lake conditions to sustain their livelihoods. Successful implementation of the management actions identified in Chapter 3 relies heavily on a cooperative approach among these stakeholders for their support and direction. Table A provides a working list of key lake-based communities, stakeholders, and agencies.

Table A: Key lake management communities, stakeholders, and agencies

First Nations	Williams Treaties First Nation
Federal Government	Parks Canada, Trent-Severn Waterway (now Ontario Waterways); Fisheries and Oceans Canada; Transport Canada
Provincial Government	Ministry of Natural Resources and Forestry (Peterborough District, Bancroft District, Ontario Parks, Science and Research Branch); Ministry of the Environment and Climate Change (Eastern Region); Ministry of Municipal Affairs and Housing; Ministry of Transportation; Ministry of Agriculture, Food and Rural Affairs
Municipal Government	City of Kawartha Lakes; Peterborough County; Municipality of Trent Lakes; Selwyn Township; Township of Cavan-Monaghan; Haliburton, Kawartha, Pine Ridge District Health Unit; Peterborough County – City Health Unit
Stewardship Groups	Kawartha Lake Stewards Association; Ontario Soil and Crop Improvement Association (Environmental Farm Plan); Kawartha Field Naturalists; Ontario Federation of Anglers and Hunters; Ducks Unlimited; Kawartha Land Trust; Kawartha Conservation; City of Kawartha Lakes Environmental Advisory Committee; Lakeland Alliance; Gamiing Nature Area; Friends of the Osprey
Agriculture	City of Kawartha Lakes Agricultural Development Advisory Board; Victoria County Soil and Crop Improvement Association; Victoria-Haliburton Federation of Agriculture; Victoria Cattlemen's Association; and others
Lakeside Communities	Federation of Ontario Cottagers' Associations; North Pigeon Lake Ratepayers Association; Village of Bobcaygeon; Village of Omemee; Windward Sands; Victoria Place; The Glen; Lakeview Estates; Pigeon Lake Resort; Highview Acres; Alpine Village; Pigeon Lake Resort; and others
Academia	Trillium Lakelands District School Board; Kawartha Pine Ridge District School Board; Peterborough Victoria Northumberland and Clarington Catholic District School Board; Fleming College; Trent University and other academic institutions
Lake-related Businesses and Clubs	Happy Days Houseboats; Egan Houseboats; Gannons Narrows Marina; Elim Lodge; Scouts Canada, Lindsay Bassmasters, Muskies Canada, Boys & Girls Clubs of Kawartha Lakes, Tour Boat Operators; local Horticultural Society, and others

Appendix B: Existing Planning Initiatives

A number of current management planning initiatives relate to the *Pigeon Lake Management Plan* goal of maintaining a healthy and sustainable Pigeon Lake. To realize this goal, support for these initiatives is crucial. For maximum leverage, efforts should be integrated wherever possible. The following initiatives are particularly relevant:

- Our Kawartha Lakes Integrated Community Sustainability Plan (City of Kawartha Lakes, Draft, 2013). This plan, led by the local municipality, provides a framework for sustainable management for 10 key themes: Water, Agriculture, Natural Systems, Resource Consumption, Health and Education, Economy, Culture and Heritage, Active Communities, Accessibility, and Financial Filter. The plan recognizes lake management planning as a key step in achieving a sustainable municipality. As such, they should be integrated when seeking funding for implementation efforts.

- *Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes* (Gartner Lee and French Planning Services, 2002). This initiative resulted in a thorough list of shoreline-based planning advice and approaches, which were recommended to the City of Kawartha Lakes for integration into their Official Plan. Many of these were considered in the development of the Strategic Planning Strategy outlined in Chapter 3.

- *Offical Plans for City of Kawartha Lakes, Peterborough County, Selwyn Township, Municipality of Trent Lakes, and Township of Cavan-Monaghan*. The Official Plan is a policy document containing a statement of Council's commitments to guide development and land use within the municipality. The Official Plan contains a number of policies that address protection of water resources including lakes and water quality. It allows implementation for a number of planning tools including Secondary Plans (more detailed plans of a specific area), Zoning and other by-laws, Subdivision Control, Consent Applications (to sever land into a limited number of parcels), and Site Plan Control.

- Community Based Secondary Plans for the City of Kawartha Lakes (City of Kawartha Lakes, Draft, 2014). The City of Kawartha Lakes is studying the long-term growth and development of five settlement areas: Bobcaygeon, Fenelon Falls, Lindsay, Omemee, and Woodville. Secondary plans provide more detailed planning and policy approaches for these urban areas. Fenelon Falls is located on Cameron Lake and has the potential to directly influence land use, landscape changes, and water quality conditions.

- Kawarthas, Naturally Connected Natural Heritage Systems Strategy (Ontario Ministry of Natural Resources, Draft, 2013). This strategy identifies significant landscape features and functions in the Kawartha Lakes region that help maintain functioning ecosystems. Using a base set of ecosystem-based targets (e.g., maintaining 30% forest cover on the landscape), the strategy will determine which landscape-level features are priority areas for protection and/or restoration. All of the Pigeon Lake planning area is within the scope of this initiative. Accordingly, the completed strategy will be a valuable tool for the implementation of many action items outlined in Chapter 3.

- Water Research and Innovation Network (WRAIN). WRAIN assists the water and wastewater industry to accelerate market adoption of new technologies with collaboration and demonstration sites. The network consists of researchers, municipal service providers, and economic development professionals. Pigeon Lake, under pressure from a variety of land uses (e.g., urban wastewater, agricultural runoff, shoreline development, etc.), has potential as a location to pilot innovative approaches.

- *Fisheries Management Plan for Fisheries Management Zone 17* (Ontario Ministry of Natural Resources, 2009). This plan provides provincial direction for the management of fisheries resources within the Kawartha Lakes management zone, including recreational use as well as science and monitoring aspects. The plan presents management strategies for the following themes: Walleye, Largemouth and Smallmouth Bass, Panfish,

Muskellunge and Northern Pike, Coldwater Stream Fisheries, Other Fish Species, Invasive Species and Disease Management, Awareness and Education, and Monitoring and Assessment. Successful implementation of this plan will be crucial for achieving objectives identified in Chapter 2.

- Emily Provincial Park Management Plan. A park management plan defines the protected area's goal, objectives, and long-term direction for the protection, development, management, and use of its natural values. The plans also address such issues as permitted activities, site restoration, and resource management. Emily Provincial Park is managed as a multi-use recreational park. Currently, this plan is in need of updating.

- Relevant Provincial and Federal Legislation. Various pieces of legislation provide the foundation for planning, policy, and/or plan implementation. The federal statutes of most relevance include: the *Historic Canals Regulations, Fisheries Act, Navigation Protection Act* (formerly the *Navigable Waters Protection Act*), *Species at Risk Act, Migratory Birds Convention Act, Canadian Environmental Assessment Act,* and *Canadian Environmental Protection Act.* The provincial statutes of most relevance include: the *Planning Act, Clean Water Act, Conservation Authorities Act, Endangered Species Act, Environmental Assessment Act, Fish and Wildlife Conservation Act, Green Energy Act, Lakes and Rivers Improvement Act, Oak Ridges Moraine Conservation Act, Public Lands Act, Ontario Water Resources Act, Nutrient Management Act, Drainage Act, Pesticides Act,* and *Environmental Protection Act.*

Appendix C: Assessment of Action Urgency

The following provides more details with respect to the outcomes of evaluating each management action, contained within Chapter 3: Implementation Strategies, against five criteria.

CRITERIA	Level	Value	Details
#1. Action meets multiple objectives?	High	3	Meets many (over half of) objectives
	Medium	2	Meets a few objectives
	Low	1	Meets a single objective
#2. Action is affordable?	High	3	Cost < $5,000; easy to acquire local funding
	Medium	2	Cost >$5,000 and <$50,000; typical medium project proposal
	Low	1	Cost >$50,000; must acquire significant funding
#3. Action has support from community?	High	3	Overwhelming support
	Medium	2	Majority support
	Low	1	Localized support
#4. Action builds public support for implementation?	High	3	High profile; includes a large number of stakeholders
	Medium	2	Medium profile; includes a medium number of stakeholders
	Low	1	Low profile; includes a small number of stakeholders
#5. Action has timely environmental benefit?	High	3	Short term (5 years or less) improvement
	Medium	2	Long term (5 years or more) improvement
	Low	1	Maintain status quo

ACTIONS	Criteria Number					Summed	Average	Urgency
	# 1	# 2	# 3	# 4	# 5			
STEWARDSHIP STRATEGY								
A1: Implement lot-level measures such as reducing fertilizer use, increasing infiltration, capturing stormwater runoff, and other practices that conserve water and reduce pollution in targeted urban areas and waterfront communities.	2	2	3	3	3	13	2.6	**High**
A2: Implement a natural landscaping approach along shoreline properties, with particular focus on decommissioning hardened shorelines and addressing severely eroded/ice-damaged sections.	3	2	3	3	3	14	2.8	**High**
A3: Implement measures such as boat and equipment sanitization to reduce the risk of transfer of invasive species between water bodies.	2	3	3	3	2	13	2.6	**High**
A4: Develop a reforestation program to re-establish and manage natural cover on marginal rural lands, particularly in subwatersheds that do not meet forest cover benchmarks.	2	1	2	2	2	9	1.8	**Medium**
A5: Reduce potential pollution from septic systems into the lakes by undertaking responsible management and maintenance.	2	2	2	3	2	11	2.2	**Medium**

A6: Implement measures such as vegetated buffer strips along streams, conservation tillage, and other practices that reduce nutrient and soil loss from farms with assistance from cost–share programs.	2	2	3	3	2	12	2.4	**Medium**
A7: Implement programs to educate lake users about proper boat maintenance, grey water disposal, and the locations of sensitive habitats to reduce the risk of pollution and lake ecosystem disturbance.	1	3	3	1	3	11	2.2	**Medium**
STRATEGIC PLANNING STRATEGY								
B1: Amend and strengthen municipal Official Plans and Secondary Plans policy to require protection of the natural environment through specific measures such as development setbacks adjacent to shorelines or streams.	3	3	3	3	2	14	2.8	**High**
B2: Undertake responsible development planning along the shoreline.	3	3	3	3	2	14	2.8	**High**
B3: Complete consultations with stakeholders and continue to work with First Nations toward the development of wild rice management principles to address all user interests to the extent possible while recognizing First Nations rights.	2	3	3	2	3	13	2.6	**High**
B4: Implement the following plans: *Fisheries Management Plan for Fisheries Management Zone 17*; Kawarthas, Naturally Connected Natural Heritage Systems Strategy; and Integrated Community Sustainability Plans.	3	1	3	3	2	12	2.4	**Medium**
B5: Undertake an enhanced level of coordination in the review of shoreline development projects between approval authorities.	3	2	3	2	2	12	2.4	**Medium**
B6: Implement a strategic land acquisition program to identify and protect lands that are ecologically and/or culturally significant.	2	2	2	3	3	12	2.4	**Medium**
URBAN AND RURAL INFRASTRUCTURE STRATEGY								
C1: Through stormwater management planning, improve the quality and control of stormwater in urban settlement areas of Bobcaygeon and Omemee.	2	2	3	3	3	13	2.6	**High**
C2: Implement effective sediment and erosion control measures and other practices to prevent contaminants from reaching local watercourses during road work, agricultural drainage, and other construction projects.	2	3	3	2	3	13	2.6	**High**
C3: Increase community enjoyment of public beaches and parks by deterring geese and conducting regular maintenance, and increase public access to shorelines.	1	2	3	3	3	12	2.4	**Medium**
C4: Operate Bobcaygeon sewage treatment facility at maximum efficiency for pollutant removal and capacity.	1	1	3	2	2	9	1.8	**Medium**
RESEARCH AND MONITORING STRATEGY								
D1: Undertake pilot projects to test the effectiveness of innovative management approaches to overly abundant aquatic plants and poor water quality in priority areas.	2	2	3	3	3	13	2.6	**High**
D2: Conduct research on aquatic plant distribution, composition, and their ecological and cultural significance to better inform aquatic plant management approaches.	2	2	3	3	3	13	2.6	**High**

D3: Implement a coordinated lake monitoring program that regularly tracks key indicators of lake watershed health including nutrients, aquatic plants, forest cover, fish communities, and oxygen levels.	1	1	2	3	1	8	1.6	**Medium**
D4: Conduct research to more accurately identify shoreline sources of nutrients, such as septic systems, and potential impacts to nearshore areas of the lakes.	1	1	3	3	1	9	1.8	**Medium**
D5: Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species.	2	1	2	1	1	7	1.4	**Low**
D6: Work towards quantifying and monitoring the economic values provided by Pigeon Lake.	1	2	1	1	1	6	1.2	**Low**
COMMUNICATIONS AND OUTREACH STRATEGY								
E1: Make available to shoreline residents information that clarifies options for aquatic plant control.	2	3	3	3	2	13	2.6	**High**
E2: Communicate the science, solutions, and outcomes of plan implementation.	3	2	3	3	2	13	2.6	**High**
E3: Maintain the Community Advisory Panel to ensure effective communication, agency support, and collaboration among lake stakeholders during plan implementation.	3	2	3	3	2	13	2.6	**High**
E4: Maintain the Science and Technical Committee to ensure effective communication, support, and collaboration among monitoring and research-based organizations.	3	2	3	3	2	13	2.6	**High**
E5: Create opportunities for stakeholder input through plan implementation, and regularly assess stakeholder needs, concerns, barriers, and knowledge gaps regularly.	3	3	3	3	2	14	2.8	**High**
E6: Profile the natural heritage features, social values, and economic values of Pigeon Lake, including a long-term vision for the lakes and a shared sense of responsibility to protect them.	3	3	3	3	2	14	2.8	**High**
E7: Work collaboratively with people who and projects that contribute to the objectives of the lake plan.	3	3	3	3	2	14	2.8	**High**
E8: Undertake Community Outreach to motivate shoreline residents and businesses to implement lake and watershed friendly lifestyles, and to make connections in the community.	3	1	3	3	2	12	2.4	**Medium**
E9: Engage school youth in environmental programming and volunteer opportunities.	3	1	3	3	2	12	2.4	**Medium**

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