

Head Lake and Rush 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: Colonial water bird colony on Armstrong Island, Head Lake

Acknowledgements

This plan was facilitated by Kawartha Conservation and developed with significant input from local communities, stakeholders, and agencies, including: the Head Lake Stewardship Group (which includes representatives from all lake associations: North Shore, High Shores, Sunset Beach, Hiltons Point, and Rush Lake), local shoreline and watershed residents, members of the Community Advisory Panel, and members of the Science and Technical Committee

Funding for this project was provided by the municipality of the City of Kawartha Lakes



Head Lake and Rush Lake Management Plan

Executive Summary

Head Lake and Rush Lake are small peaceful lakes within the municipality of City of Kawartha Lakes that are highly valued by local residents and other users for their excellent water quality and natural scenery. The *Head Lake and Rush Lake Management Plan* was developed by Kawartha Conservation, under contract from City of Kawartha Lakes, to provide several suggested actions for local individuals and groups to undertake to maintain, and wherever possible enhance, lake health.

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 Head Lake and Rush Lake to maintain a peaceful and natural setting for living, boating, swimming, fishing, and access to water for household uses.”

Lake ecosystems are complex, with many interrelated components. They also change through time, mirroring changes in land use practices and naturally occurring processes in its drainage basin. Head Lake and Rush Lake are considered to be in a relatively healthy state, but there remain several challenges facing the lakes. Water level management, intense shoreline development, invasive species, and other stressors (including proposed quarry operations) if not responsibly managed do pose a legitimate threat to the future environmental or socioeconomic health of the lakes.

The content of the *Head Lake and Rush Lake Management Plan* includes a summary of science-based information relevant to the lake health (Chapter 1), key management objectives and issues related to maintaining healthy lakes (Chapter 2), and several management recommendations to maintain or enhance lake health that can be undertaken by the various parties that are active on the lakes (Chapter 3). The Plan is the culmination of a four-year planning project, initiated in 2014, whereby the City of Kawartha Lakes provided funding to Kawartha Conservation to lead its development. This included studying various components of the lake, for example water quality, water quantity, land use, aquatic and terrestrial resources, and consulting with community members, organizations, and other stakeholders to document and address their values and concerns with respect to lake health. 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 *Head Lake and Rush Lake Management Plan* and associated materials.

Goals:

To ensure the *Head 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 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 *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.

State of the Lakes

Water quality within Head Lake, Rush Lake, and their connecting watercourses is considered to be in a good state. Data on Rush Lake are limited, however important water quality parameters such as nutrient concentrations, dissolved oxygen, and clarity indicate no significant water quality deterioration of the lakes from human use. This is important given a significant amount of the shoreline is occupied by developments. Exceptional amounts of natural vegetative cover remain on lands and along watercourses draining into the lakes, which helps to prevent water quality impacts from the minimal residential, business, and agricultural activities that do exist within the watershed. Any water quality issues are likely to be localized and exist in nearshore areas adjacent to shoreline developments, or in waters adjacent to large bird colonies. One identified area of water quality deterioration and management concern is the occasional high bacterial levels at the public beach.

The Queen Elizabeth II Wildlands Provincial Park extends along the north shore of Head Lake and covers the entirety of the Fishog River Subwatershed, Head Lake’s largest water input source. This large protected area contains several unique and significant ecosystems of exceptional quality.

The Head River dam exists downstream of Head Lake and functions to stabilize water levels in the lake during low flow periods in the summer. The aquatic ecology within the lake and its connecting watercourses is considered to be in a good state. There has been no apparent and significant deterioration of aquatic habitats within the lake. Resident fish communities are dominated by native species which include several top native predators that contribute to a recreational fishery for walleye, smallmouth bass, and muskellunge. There are several colonial water bird nesting sites on Head Lake, including locally nuisance double-crested cormorants and regionally significant common terns. The biodiversity of the lake is under threat from invasive species, as several non-native plant and invertebrates have proliferated throughout the lake.

The water and natural resources of Head Lake watershed are influenced by various stressors that are expected to remain ongoing and perhaps even intensify into the future, including: the intensification of existing shoreline development, climate change, the threat of additional non-native aquatic and terrestrial organisms, among others. The cumulative impacts of these stressors could deteriorate water quality and aquatic ecology within the lake if responsible management is not undertaken in a collaborative manner.

Objectives:

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

Objectives	Issues Addressed
1. Maintain excellent water quality conditions	<ul style="list-style-type: none"> • Pollutants from shoreline development and activities • Potential contamination from other sources
2. Improve the water level management regime	<ul style="list-style-type: none"> • Head Lake dam management

3. Maintain the biodiversity of the lake ecosystem	<ul style="list-style-type: none"> • Proliferation of non-native invasive species • Wildlife species of conservation concern • Increased popularity of QEII Wildlands Provincial Park
4. Maintain the natural integrity of the shoreline	<ul style="list-style-type: none"> • Significant residential development along the lake shoreline • Potential for aggregate operations • Clear-cutting of shoreline vegetation
5. Maintain safe access to and from shoreline properties	<ul style="list-style-type: none"> • Occasional posting of public beach as unsafe from <i>E.coli</i> • Annual flooding of Baker Rd. • Crowded parking adjacent to boat launch on Suter Dr. • Lack of standardized and highly visible in lake hazards markers.
6. Improve our understanding of how the lake will respond to emerging pressures	<ul style="list-style-type: none"> • Expansion of colonial water bird populations • Limited monitoring programs and data on lake ecosystem

Management Actions:

Upon synthesizing and analysing all available science-based information, as well as through extensive stakeholder consultations, 18 "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 the lakes as possible by identifying priority areas for our management actions. Given the similar management pressures on lakes in south-central Ontario (e.g., intense shoreline development, invasive species, climate change, etc.), many of these management actions are transferable to other lakes in the region as well.

For each recommended action, these details are provided: level of priority, 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 shoreline landowners and lake users for voluntarily implementing best management practices on their properties for the benefit of all and the future health of the lake.

Actions	Priority
A1: Undertake responsible management of septic systems, including routine inspections, along shoreline properties.	High
A2: Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lake and its watershed.	High

A3: Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties.	High
A4: Maintain the natural features along the shoreline.	High
A5: Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats.	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.	Low

Strategic Planning Strategy:

Actions that give profile to pro-active land use policy and natural resource planning initiatives.

Actions	Priority
B1: Establish thresholds/criteria for acceptable water levels and identify ecological and socio-economic impacts associated with water level management.	High
B2: Undertake responsible development planning within the watershed, and particularly along the shoreline.	High
B3: Undertake actions within the Fisheries Management Plan for Fisheries Management Zone 17, and develop a management plan for Queen Elizabeth II Wildlands Provincial Park.	Medium

Urban and Rural Infrastructure Strategy:

Actions that focus on voluntarily maintaining sustainable public areas and construction works including lake-access areas, roads, and all construction sites.

Actions	Priority
C1: Maintain safe and accessible public lake-access locations by improving water quality at the beach, addressing flooding along Baker Rd., and managing parking near the boat launch.	High
C2: Ensure that construction projects, particularly road maintenance and waterfront property development works, are conducted in a manner that does not degrade water quality or sensitive habitats.	Medium

Research and Monitoring Strategy:

Actions focused on addressing, through collaboration, science-based information gaps to better understand the response of the lake to emerging pressures, and tracking environmental health and plan effectiveness through time.

Actions	Priority
D1: Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species.	High
D2: Conduct research on local populations of cormorants, common terns, and herring gulls to better inform management approaches for colonial water birds.	High

D3: Undertake routine monitoring of, and establish a relationship between, water levels and flows in Head Lake and Rush Lake to better characterize their hydrological regime.	High
D4: Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations.	Medium
D5: Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species.	Medium

Communications and Outreach Strategy:

Actions that encourage dialogue and information sharing among all communities, agencies, and stakeholders and promote sustainable practices to maintain a healthy lake environment

Actions	Priority
E1: Communicate the science, solutions, and outcomes of plan implementation among all active stakeholders in the Head Lake watershed.	High
E2: Profile the natural heritage features, social values, and economic values associated with Head Lake, including a long-term vision for the lake and a shared sense of responsibility to protect it.	Medium

Effective Implementation

Even though Kawartha Conservation is responsible for leading the development of this Plan, the undertaking of the recommended action items is a shared responsibility among all Head Lake watershed stakeholders. Watershed residents, shoreline residents, local businesses, agencies, and organizations have a role to play, and as such have been identified wherever possible within the *Head Lake and Rush Lake Management Plan* as most appropriate to lead, or partner, on one or more of the recommended actions. All of the actions recommended in the Plan are voluntary and not mandated to be undertaken by watershed stakeholders. A healthy Head Lake watershed will likely only be maintained in perpetuity if reasonable efforts are made among all watershed stakeholders towards successful collaboration, communication, and accountability.

Table of Contents

About Kawartha Conservation	i
Acknowledgements	ii
Head Lake and Rush Lake Management Plan	iii
Executive Summary	iii
Acronyms and Unit Conversions.....	ix
1.0 Setting the Context	1
1.1 Introduction	2
1.2 Lake Management Drivers, Values, and Concerns.....	5
1.3 Management Vision and Goals	9
1.4 Roles and Responsibilities	10
1.5 Lake Background Characterization.....	12
2.0 Management Objectives	29
2.1 Introduction	30
2.2 Management Objective #1: Maintain excellent water quality conditions.....	31
2.3 Management Objective #2: Improve the water level management regime	33
2.4 Management Objective #3: Maintain the biodiversity of the lake ecosystem	35
2.5 Management Objective #4: Enhance and maintain the natural integrity of the shoreline.....	37
2.6 Management Objective #5: Maintain safe public swimming and lake access opportunities.....	39
2.7 Management Objective #6: Improve our understanding of how the lake will respond to emerging pressures.....	41
3.0 Implementation Strategies	43
3.1 Introduction	44
3.2 Stewardship Strategy	46
3.3 Strategic Planning Strategy	53
3.4 Urban and Rural Infrastructure Strategy	57
3.5 Research and Monitoring Strategy	60
3.6 Communications and Outreach Strategy	66
3.7 Moving To Implementation	69
References	70
Appendix A: Key Communities and Stakeholders	72
Appendix B: Existing Planning Initiatives	73
Appendix C: Assessment of Action Priority	75

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)

km²: Square kilometres (1 km² = approx. 0.386 miles² = 100 hectares = approx. 250 acres)

ha: Hectares (1 ha = 0.01 km² = approx. 2.47 acres)

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

m³: Cubic metres (1 m³ = approx. 35 cubic feet)

1.0 Setting the Context



Head Lake Dam, located downstream of Head Lake along the Head River
(August 2016)

1.1 Introduction

Head Lake and Rush Lake are situated within the municipality of the City of Kawartha Lakes, located west of the Village of Norland. Waters from Head Lake flow through the Head River into the Black River, and eventually into the Severn River into Georgian Bay (**Figure 1.1**). The main focus area of this Plan (i.e., the Planning Area) is defined as all lands and waters upstream of where Head Lake outlets into the Head River at Baker Rd. in the north-west shore of the lake (**Figure 1.2**). This area, also called the Head Lake watershed, is approximately 130 km² and includes Rush Lake and the Fishog River catchment areas. The planning area encompasses two municipalities, City of Kawartha Lakes and Township of Minden Hills. A large area in the northern portion of the planning area is encompassed by Queen Elizabeth II Wildlands Provincial Park.

The *Head Lake and Rush Management Plan* is the culmination of a four-year study (2014-2017) coordinated by Kawartha Conservation and funded by the municipality of the City of Kawartha Lakes. The Plan is a community-driven endeavour, providing a framework for the voluntary implementation of collaborative strategies for maintaining the health of Head Lake and its watershed for all uses. Kawartha Conservation's role in the development of the *Head Lake and Rush Lake Management Plan* is one of a facilitator and lead author. Their focus is to build consensus among a broad spectrum of watershed partners, organizations, and residents whom will ultimately share responsibility (on a voluntary basis), for undertaking the recommended management actions.

Document Layout

Chapter 1 provides the foundation upon which the *Head Lake and Rush 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 the previous chapter. 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.

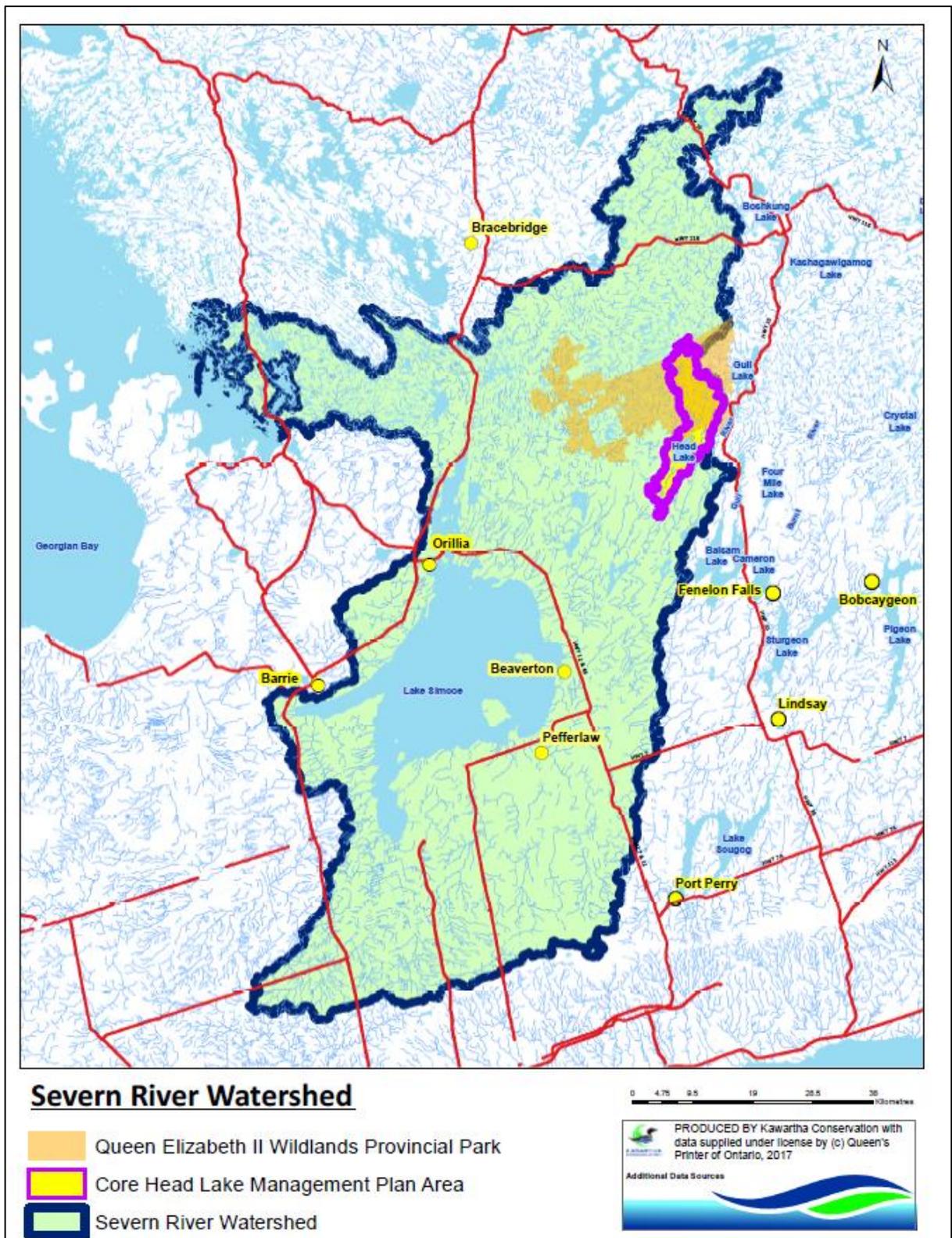


Figure 1.1: Map showing the Head Lake and Rush Lake Planning Area, in relation to the entire Severn River drainage basin

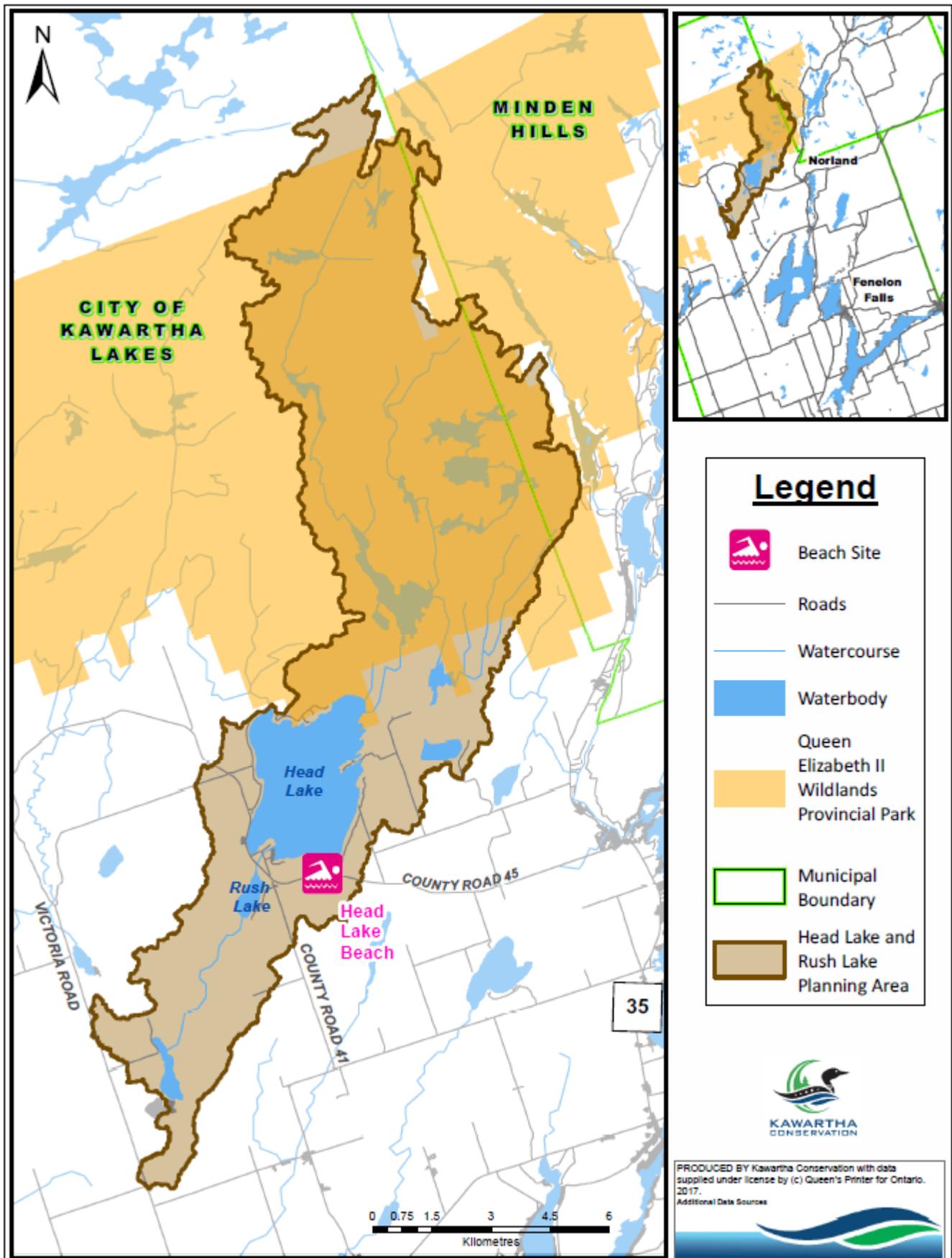


Figure 1.2: Map showing the Head Lake and Rush Lake Planning Area

1.2 Lake Management Drivers, Values, and Concerns

Head Lake is a water resource of the utmost value to the local municipalities, First Nations, shoreline residents, seasonal visitors, and local businesses. Surrounding communities benefit from its economic, environmental, and recreational enjoyment opportunities. For many people, particularly shoreline residents, the lake is 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, including Head Lake and Rush Lake:

- In the early 1970's, Head Lake was considered an important lake resource and water quality was studied by the Ontario government (MOE, 1972). This report was the first comprehensive study of the lake and concluded that *"the lake had fair bacteriological water quality and was generally within the Ministry of Environment recreational use criteria. However, there were several indications of minor bacterial pollution sources... generally within the areas of the inlets (Head River and the stream from Rush Lake) as well as along the east shore."*
- 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 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. Kawartha Conservation entered into a four-year partnership (2014 to 2018) with the City of Kawartha Lakes to lead the development of the *Head Lake and Rush Lake Management Plan*.
- 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 *Head Lake and Rush Lake Management Plan* was initiated in response to a request from the Head Lake Stewardship Group, which consists of all active Associations on Head Lake and Rush Lake.
- Beginning in 2014, several lake-specific management plans have been developed by Kawartha Conservation, including *Sturgeon Lake Management Plan, Balsam Lake and Cameron Lake Management Plan, Canal Lake and Mitchell Lake Management Plan, and Four Mile Lake Management Plan*. These plans helped to guide the development of the *Head Lake and Rush Lake Management Plan*.

Community-Based Values and Concerns

Throughout the development of the *Head Lake and Rush Lake Management Plan*, significant effort was placed on gathering input from local stakeholders, agencies, and organizations. Particularly, guidance was received from local

Lake Associations who provided insight into “what the community wants for their lake”, and the Community Advisory Panel, a group of committed individuals that met on a routine basis and provided invaluable project support.

The following provides a list of key values (Table 1.1) and concerns (Table 1.2) identified by the lake community as priorities for lake management. These were obtained from consultations with public and lake-specific stakeholders, agencies, and organizations primarily through the Strategic Visioning process undertaken by the City of Kawartha Lakes in support of their Official Plan, as well as Kawartha Conservation Blue Canoe shoreline communication program (summers of 2013 to 2016), a series of public open houses (summer 2016), several Community Advisory Panel meetings and Science and Technical Committee meetings, and conversations at Head Lake Annual General 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

Values	Details
Excellent Water Quality	Of utmost importance for lake stakeholders is to maintain excellent water quality, particularly to support recreational use and aquatic communities within the lake. Further, there are numerous private water intakes along the shoreline that provide water for domestic purposes.
Unique Alvar Areas, Fish and Wildlife Habitat	Head Lake and Rush Lake are located in an ecologically significant area known as "The Land Between," which supports a high diversity of environmental, geologic, and cultural elements. Functioning and abundant habitat support healthy populations of fish and wildlife that provide ample viewing and fishing opportunities. Several features are considered important on a provincial level, including the Rush Lake Duck Lake Wetland Complex and inland breeding populations of common tern.
Peaceful and Quiet Ambience	Most individuals value the lake as a place of clean water, relaxation, and beautiful scenery. Head Lake and Rush Lake, due to its relatively remoteness and not being navigably-connected to the Trent-Severn Waterway provides a unique lake setting, offering natural beauty within close proximity to urban and agricultural areas.
Lack of Commercial, Industrial, and Residential Cluster and Backlot Development	Most of the development within the planning areas exists along the shoreline of Head Lake and Rush Lake in single residential lots. A protected and naturally functioning landscape is a key characteristic of the landscape and helps to maintain its unique identity.
Good Fishing and Recreational Opportunities	Recreational fishing is particularly popular and the lake supports several desirable sportfish such as: Smallmouth Bass, Walleye, and Muskellunge.
Functioning Head Lake dam	The overwhelming majority of residents benefit from water level regulation afforded by the long-existing dam. Further, local knowledge suggests that without the dam the north shore could not have been developed.
Queen Elizabeth II Wildlands Provincial Park	The close proximity of the Park to Head Lake offers enhanced water quality and ecosystem protection, while also offering extended local recreational opportunities.

Table 1.2: Head Lake concerns identified by community stakeholders

Concerns	Details
Water Level Management	When the Head River dam was in a state of disrepair (repaired in Spring 2017) several lake associations were concerned that water levels would be too low during the summer season, preventing boating access from their shorelines to the lake. There are a small number of individuals (mostly on Sunset Beach) who are concerned about high water levels, particularly in the spring.
Cormorants and Gull populations	Local residents have observed that Double Crested Cormorant and Seagull populations on several islands are increasing and suggest they are deteriorating quality of the lake through denuding islands/shorelines, degrading water quality through feces, and loud noises. There is a desire for undertaking population control (e.g., oiling, scaring, etc.).
Wildlife Populations in decline	Concerned about suggested population declines regarding the following wildlife: frogs, Whip-Poor-Will, American Eel, bats
Poorly Functioning Septic Systems	Potential for faulty or inadequate septic systems/tanks from aging shoreline dwellings, resulting in high nutrient inputs and/or contamination.
Shoreline Alterations	Changes to the natural features and functions of the shoreline and nearshore environments, including installing artificial structures, hardening, and manicured landscaping. The clear-cutting of large swaths of shoreline vegetation prior to shoreline development approvals is also a significant concern.
Carrying Capacity of Lake	How much development can Head Lake handle along shoreline or in watershed before water quality and lake health deteriorates.
Acid Rain	Concerned about impacts (legacy or ongoing) of acid rain on lake water.
Quarry Operations	Concerned about potential impacts associated with new quarry operations (e.g., Squire Proposal).
Invasive Species	The introduction and potential proliferation of non-native species (plants, fishes, and invertebrates) that could outcompete or displace native species and impair recreational use of the lake. Priority concerns including: increase in abundance of exotic dead snails washing into shore, increase in Eurasian Watermilfoil, and detection of zebra mussels in 2016 (Sunset Beach area).

1.3 Management Vision and Goals

The *Head Lake and Rush Lake Management Plan* seeks to solidify a common respect for the lakes and their watersheds, 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.

The Vision of Head Lake and Rush Lake is to

“Ensure the long-term sustainability of Head Lake and Rush Lake through ongoing stewardship to maintain a peaceful and natural setting for living, boating, swimming, fishing, and access to water for household uses.”

The Goals of the *Head Lake and Rush Lake Management Plan* are as follows:

- Maintain excellent water quality in Head 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 subwatersheds.

Management actions are guided by the following principles:

- Promote an ecological approach to the use of land and water as a fundamental perspective to a healthy lake and as the foundation for effective land use planning within the lake’s 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 basin as a whole.
- Recognize that management is a shared responsibility and requires a shared approach to coordination and implementation of actions.
- Utilize lessons learned from management planning exercises conducted on other local lakes to help better inform management recommendations.

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 (Head Lake included) within the City of Kawartha Lakes. 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 the Planning Area (Table 1.3). These parties (including local residents, lake associations, 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 Head Lake and Rush Lake.

Partner	Typical Role	Role in Plan Development	Role in Plan Implementation
Kawartha Conservation	<ul style="list-style-type: none"> 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. Note Kawartha Conservation does not regulate development within the Head Lake and Rush Lake Planning Area, as it is outside the Regulated Areas of any conservation authority. 	<ul style="list-style-type: none"> Hired by City of Kawartha Lakes to study the lake, meet with local stakeholders, and produce a Plan in 2018 that provides several recommendations towards maintaining a healthy lake. Undertake a multi-year (2014-2017) 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. 	<ul style="list-style-type: none"> Partner on undertaking several recommendations within Stewardship, Research and Monitoring, and Communications and Outreach strategies. Implementation role after 2018 to be determined on an annual basis.
City of Kawartha Lakes	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Hired Kawartha Conservation on a 4-year project basis to study the lake, meet with local stakeholders, and produce a Plan in 2018 that provides several recommendations towards maintaining a healthy lake. Provide input into the process and review key documents. 	<ul style="list-style-type: none"> Lead on undertaking some recommendations within Strategic Planning strategy. Co-lead on undertaking several recommendations within Stewardship, and Urban and Rural Infrastructure strategies. Partner on undertaking several recommendations within Stewardship, Communications and Outreach, and Research and Monitoring strategies. Develop policies that support the Lake Plan and incorporate these in by-laws and secondary plans as appropriate.
Head Lake Stewardship Group, and other residents and community members residing along Head Lake and Rush shoreline and in Head Lake watershed.	<ul style="list-style-type: none"> Routine sampling of Head Lake water quality as per volunteer-based Lake Partner Program. Recent initiation of invasive species sampling as per volunteer-based Invading Species Watch Program. Manage Head Lake dam (when functional), including adjusting stop logs and collecting water level measurements. Install floating markers/buoys to demarcate in-water hazards. Live, work, socialize, and recreate. 	<ul style="list-style-type: none"> 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 between 2014-2018. 	<ul style="list-style-type: none"> Lead on undertaking some recommendations within Stewardship strategy. Co-lead on undertaking several recommendations within Stewardship, Strategic Planning, Urban and Rural Infrastructure, Research and Monitoring, and Communications and Outreach strategies. Partner on undertaking several recommendations within Stewardship, Strategic Planning, Research and Monitoring, and

Partner	Typical Role	Role in Plan Development	Role in Plan Implementation
			Communications and Outreach strategies.
Ontario Ministry of Natural Resources and Forestry	<ul style="list-style-type: none"> Administer land use policies as per <i>Public Lands Act</i> and <i>Lakes and Rivers Improvement Act</i>, which includes reviewing and approving most development proposals along the shoreline and in the lake. 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. Manage Queen Elizabeth II Wildlands Provincial Park. Advise and approve technical operations relating of the Head Lake dam. 	<ul style="list-style-type: none"> Provide input into the process and review key documents. Co-present at public information sessions. Active participant on the Community Advisory Panel during lake studies and plan preparation. 	<ul style="list-style-type: none"> Co-lead on undertaking some recommendations within Strategic Planning, and Research and Monitoring strategies. Partner on undertaking several recommendations within Stewardship, Research and Monitoring, and Communications and Outreach strategies.
Haliburton Kawartha Pine Ridge District Health Unit	<ul style="list-style-type: none"> Monitor water quality at the public beach during the swimming season for safe swimming. 	<ul style="list-style-type: none"> Provide input into the process and review key documents. 	<ul style="list-style-type: none"> Co-lead on undertaking some recommendations within Stewardship strategy. Partner on undertaking some recommendations within Urban and Rural Infrastructure strategy.
Fisheries and Oceans Canada	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Minimal, provide input into the process and review key documents. 	<ul style="list-style-type: none"> Not listed as lead, co-lead, or partner.

1.5 Lake Background Characterization

To provide background information on the current environmental state of Head Lake and its subwatersheds (including Rush Lake) a companion report was developed alongside the *Head Lake and Rush Lake Management Plan* that characterizes current lake conditions. This report, the *Head Lake and Rush Lake Watershed Characterization Report* (Kawartha Conservation, 2018), 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 Head Lake and Rush 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

The history of human activities on the landscape around Head Lake is linked to the progression of events occurring in other areas in south-central Ontario. First Nations Peoples have been documented as residing in the area in and around the Kawartha Lakes for thousands of years, owing in large part to the abundance of lakes and connecting corridors for hunting, fishing, and transportation routes.

Archeological evidence has found early tools and weapons in this region and four early First Nations communities were identified in the former townships of Laxton (to the south of Head Lake) and Digby (to the north of Head Lake). According to Kirkconnel (1921) these communities were located: on the southern shore of Beech Lake 3-4 km east of Head Lake (in Laxton), adjacent to Oak Lake 1-2 km east of Head Lake (in Laxton), 250 m east of Head Lake on a portage route from the Gull River (in Laxton), and 3 km North of Head Lake on the Head River (in Digby).

European settlement expanded into the area in the early-to-mid 1800's, with the surveying of the local townships.

Over the years there was a gradual but steady shift from exploiting the lake's watershed resources for commercial purposes to non-intensive agricultural use and using the lake for recreational purposes. Supported by the lumber industry thanks to the regions vast forests, and access to markets through running logs along the Trent Waterway and later the Victoria Railway, the landscape was exploited for its forests resources until the end of the century (LeCraw, 1967). These natural lands are regrowth areas that were cleared for logging, succumbed to wildfires, too wet or rocky to farm productively, or abandoned as non-productive farmland.

Almost the entire land area north of Head Lake became designated as Queen Elizabeth II Wildlands Provincial Park and consists of shallow lakes, wetlands, and forests. There are no large communities located near Head Lake, though numerous cottages and homes are located by the lakeshore.

Today, the major land use types in the planning area draining into Head Lake are: natural areas (96%), agriculture (3%), and development (2%), (**Figure 1.3**). The majority of the watershed is natural cover, owing in large part to large expanses of forest and wetlands, and large tract of protected areas within the Queen Elizabeth II Wildlands Provincial Park. Due to the relatively shallow soils, farmland occurs sparingly and is dominated by pasture lands.

Census information from 2011 (ESRI, 2016) indicates a permanent human population of 286 people occupying 135 private dwellings within the Head Lake and Rush Lake planning area. Most of the developed areas in the planning area are located as residential properties along the western, eastern, and norther shoreline of Head Lake, the eastern shoreline of Rush Lake, and scattered in rural residential settings.

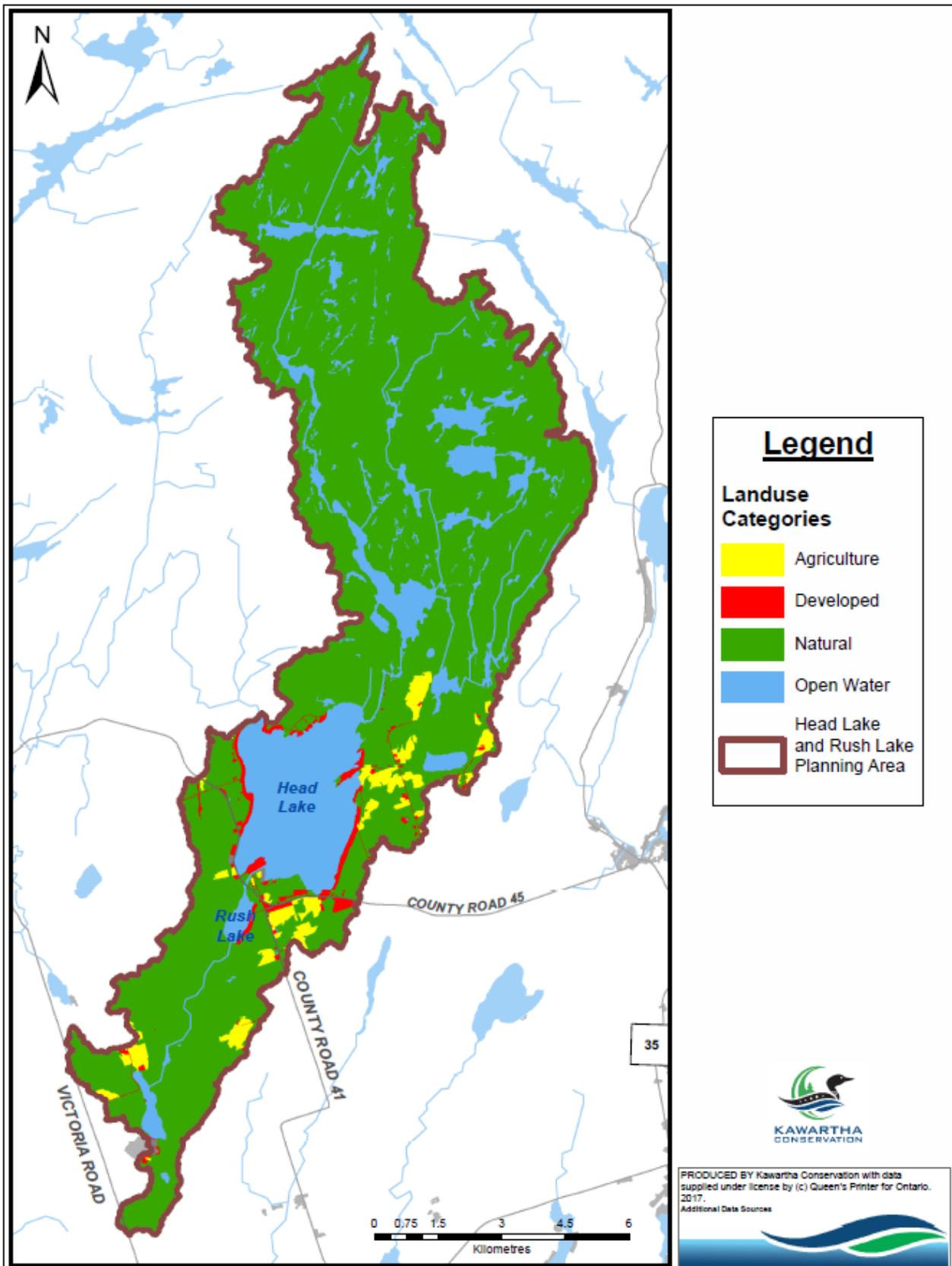


Figure 1.3: Map showing major land use types within the Head Lake and Rush Lake Planning Area

Shoreline

The shoreline of Head Lake is approximately 19 km in length. As shown in **Figure 1.3**, and **Table 1.4**, development within the planning area is heavily concentrated along the shoreline of Head Lake, and to a lesser extent Rush Lake. As of 2013, approximately 68% of the shoreline on Head Lake and 29% on Rush Lake has been developed within a 30-metre distance from shore. Natural shoreline vegetation within this settled area in many cases has been altered and/or cleared to accommodate cottage or residential property development.

There are two trailer parks located in close proximity to the shore of the lakes. The residents of Rockcliffe Trailer Park are heavy users of the public boat launch and beach on Monck Rd. There is a significant summer influx of seasonal residents along the shoreline due to cottage, tourism, and recreational opportunities. Anecdotal information suggests approximately 1000 people are active in-and-around the lakes in the summer.

As of 2016 there are approximately 373 shoreline residences within 75m of the lake, and approximately 20% of these are seasonal. In recent years, anecdotal evidence suggests the shoreline 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. This trend is expected to continue, and as such will likely lead to even more land use pressures affecting the environmental and socio-economic health of the lakes. As a consequence of increased development intensity, several sections of the shoreline have been significantly altered at the water's edge (that is, the shore/water interface), with the addition of artificial land use including concrete, wood, manicured lawn, armour stone, and other materials.

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

Distance from Shore:		15m	30m	100m	500m	1km
Head Lake	Developed	67	68	59	19	12
	Natural	32	31	38	73	80
	Agriculture	2	2	4	8	8
Rush Lake	Developed	28	29	27	12	9
	Natural	72	71	73	83	84
	Agriculture	0	0	0	4	7

Tourism and Recreation

The lake provides ample opportunities, particularly for local shoreline residents, for swimming, boating (power, canoe, and sailboat), and fishing, all of which are key recreational activities on the lake.

Historically, lakes within the Kawartha Lakes region 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, including Head Lake), 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 is one active public beach on Head Lake, existing at the south shore of the lake along Monck Rd. (CKL Rd. 45). Compared to many other beaches within the municipality, this beach has relatively good water quality although within the last five years it is usually posted as potentially unsafe for swimming due to high *E.coli* levels at least once per year. This area is the primary public boat launch along the lake.

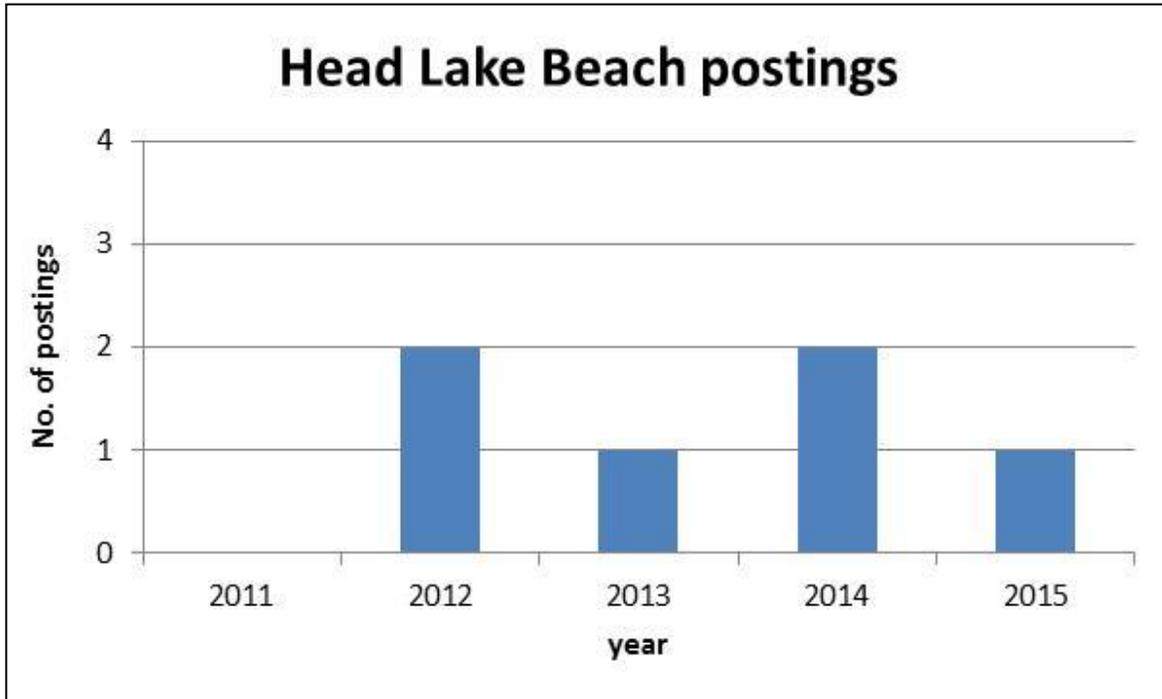


Figure 1.4: The amount of time (in percent) the public beach has been posted during the swimming season (June, July, and August), between 2011 and 2015.

The seasonal influx of vacationers in the City of Kawartha Lakes in the summer months is approximately 17,500 (which equals an increase of 25% of the population), who mostly visit cottages and lakeside communities including Head Lake and Rush Lake. The total seasonal population within the municipality 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.

Drinking Water and Wastewater

There are no municipal intake systems that draw water from Head Lake or Rush Lake. Private residences along the shoreline obtain their water from groundwater wells and personal surface water intakes. In terms of wastewater, all residents along both lakes are on private septic systems.

1.5.2 Water Levels and Flows

The surface area of Head Lake is approximately 9.1 km², and Rush Lake is 0.4 km² making them two of the smaller but still important lakes within the City of Kawartha Lakes. Head Lake contains approximately 38,220 cubic metres (m³) of water, and has an average depth of 4.2 metres and a maximum depth of 7.0 metres. Comprehensive water depths or water volumes are not available for Rush Lake, however local residents indicate a maximum depth of 4.6 metres.

Water levels in Head Lake are regulated by a dam that exists approximately 5.5 km downstream of the lake, on the Head River. This dam is situated on Crown land (Queen Elizabeth II Wildlands Provincial Park) and has been maintained by the North Shore Cottagers Association. The dam functions to maintain a minimum water level in Head during the summer seasons, and has negligible impact on regulating high water levels. Under normal operations, two sets of the stop-logs are taken out before the winter to prepare for the spring freshet. During summer, the stop-logs are put back in place to hold/maintain the water in Head Lake for recreational purposes. In recent years the dam was non-functional and Ontario Ministry of Natural Resources and Forestry initiated a Hydro-Technical Study (Aqua Geomatics Consulting Ltd., 2017) to evaluate various management scenarios. In the spring of 2017, the dam was repaired to a functioning state according to the pre-existing design, and now resumes its function to maintain stable minimum summer water levels. Water levels in Rush Lake are not regulated but are periodically influenced by beaver activity in the downstream waters of Rush Creek, which can cause backwatering and a subsequent rise in lake levels.

Water levels in the lakes, even though they are regulated to a certain degree, remain prone to natural fluctuations in the hydrological regime. Water levels tend to be highest in the lakes during early spring from spring snowmelt and tend to gradually decline through the summer as water inputs are reduced and evaporation is high. The tributaries, as indicated by Rush Lake outlet data, entering Head Lake also 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.

Head Lake, on average, receives 59.9 million m³ of water flow every year. Most of this water (71%) comes from Fishog River subwatershed which outlets into the lake at its north-east end (**Figure 1.7**). The remaining water inputs include direct precipitation onto the surface area of the lake (15%), drainage from Rush Lake subwatershed (13%), and drainage from the land area in and around the lake (1%), referred to as Head Lake Central subwatershed. Water exits Head Lake the lake at its north-west end through Head River into Black River, and eventually continues in a general western direction eventually draining into Georgian Bay through the Severn River. The locations of all defined subwatershed areas of Head Lake are shown in **Figure 1.8**.

Lake flushing rate is an average rate at which water enters and leaves a lake relative to lake volume. It is usually expressed as time needed to replace the lake volume with inflowing water. Using inflow volumes, calculated as part of the lake water budget the flushing rate of Head Lake is 1.5 times per year. Therefore, on average, the water mass in Head Lake changes approximately every 243 days. Flushing rate for Rush Lake is unknown, given there are no water depth available and consequently no water volume data available.

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

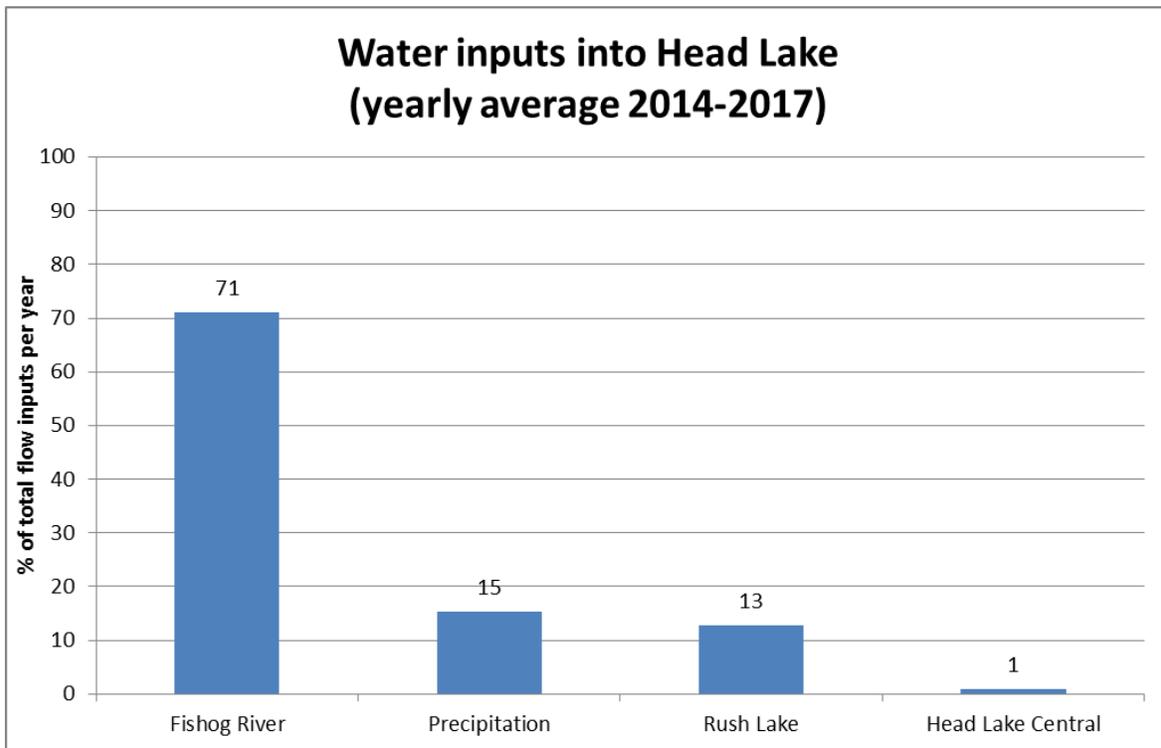


Figure 1.7: The major sources of water, by volume, entering Head Lake on an average yearly basis (2014-2017)

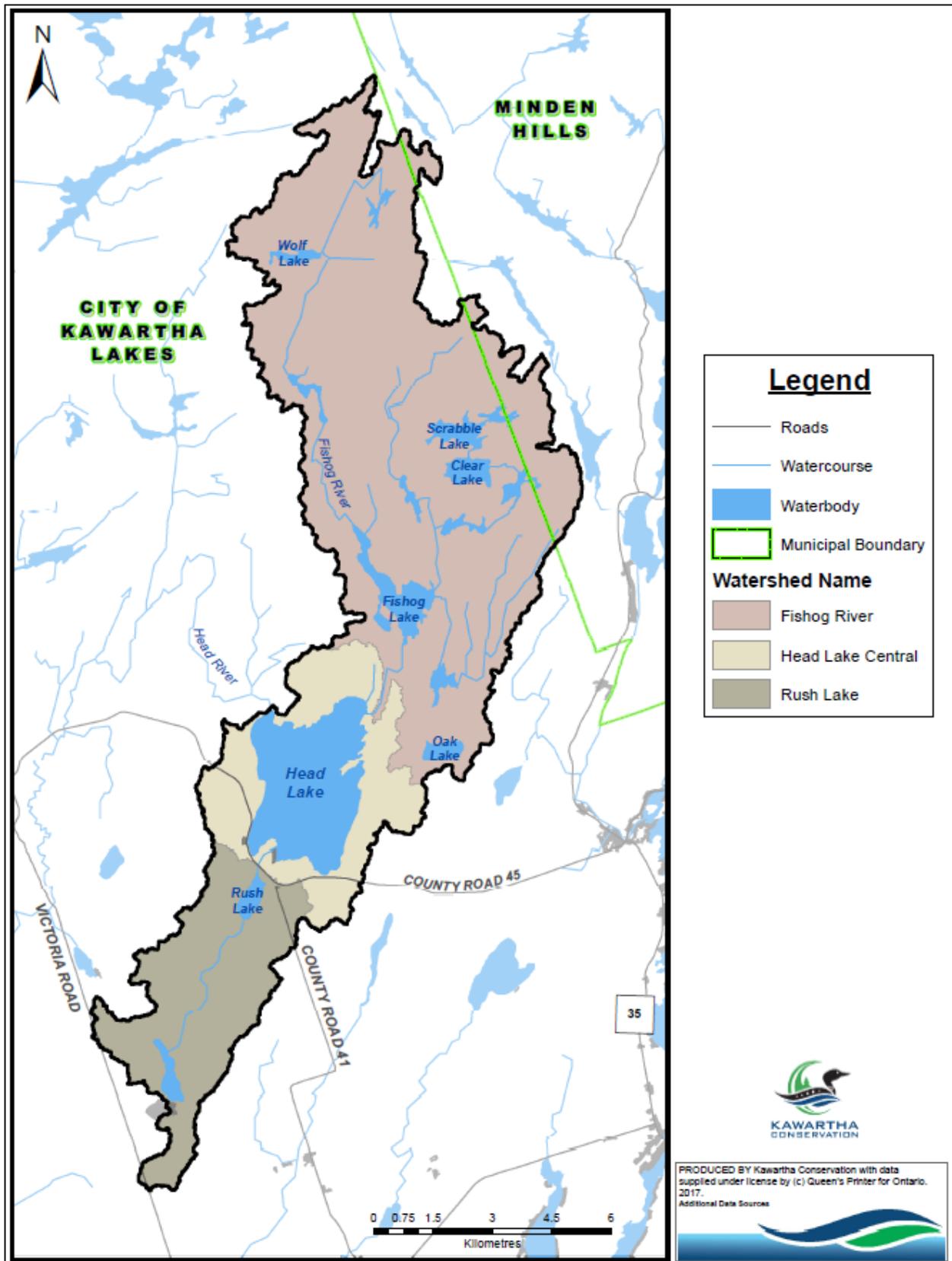


Figure 1.5: Major subwatersheds and their flow direction within the Head Lake and Rush Lake Planning area

1.5.3 Water Quality

The need to maintain excellent water quality conditions in Head Lake and Rush Lake a major trigger for development of the *Head Lake and Rush Lake Management Plan*. Exceptional water quality is important to maintaining the environmental, economic, and socio-cultural benefits provided by the lake.

At present, Head Lake is characterized as being a mesotrophic (moderate productivity) water body with excellent water quality. According to the *Provincial Water Quality Objectives* (Ontario Ministry of Environment and Energy, 1994), to avoid nuisance concentrations of algae in these types of 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**, phosphorus data has been collected on an annual basis since 2002 by local lake stewards through the Lake Partner Program (administered by the Ontario Ministry of Environment and Climate Change). According to these data, in general every year Head Lake meets the provincial objective and has been relatively stable over the past 15 years at approximately 10 ug/L. These values are equivalent or even somewhat lower than in the 1970's water quality sampling range of 11-31 ug/L (MOE 1972). No lake-wide deteriorations in water quality over time have been noted in Head Lake or Rush Lake by local residents.

Water quality within the tributaries draining into and out of Head Lake is also considered to be in an excellent state. 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 watercourses have phosphorus concentrations that meet this objective. Further, values have significantly decreased since sampling in the early 1970's (MOE 1972).

As indicated by calcium concentrations (relatively high) and pH levels (relatively low), Head Lake and Rush Lake are considered well-buffered from the effects of acid rain, given that their underlying bedrock is predominantly limestone. Residents are concerned about the potential for proliferation of zebra mussels (*Dreissenidae*) and freshwater jellyfish (*Holopodium glacialis*). These are aquatic invertebrates that can proliferate when conditions (particularly calcium concentrations) are favourable, leading to widespread and often negative ecological changes. Data indicate a low-to-moderate risk for aggressive proliferations of these species based on calcium concentrations within Head Lake.

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 Head Lake, the phosphorus loading data from 2014 to 2017 indicate that approximately 723 kg of phosphorus enters 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 1.8**. The following provides a summary of current phosphorus loadings into Head Lake each year by water source.

- Fishog River subwatershed accounts for 66% (480.8 kg) of the total. This value is relatively high compared to the other subwatersheds and is due to its relatively higher annual flow contribution to the lake (approximately 71% of total flow entering Head Lake).
- Atmospheric deposition accounts for 16% (115.1 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 surface area of the lake compared with its upstream drainage areas, the contribution from atmospheric deposition is relatively moderate.

- Rush Lake subwatershed accounts for 9% (64.2 kg) of the total. This total includes nutrients within all waters entering and leaving Rush Lake such as from all shoreline septic systems, local surface water drainage areas, as well as atmospheric deposition. This value represents phosphorus that is entering Head Lake from the watercourse at Monck Road.
- Head Lake Central subwatershed accounts for 9% (62.9 kg) of the total. This total includes measured loading from the unnamed tributary entering the east shore of the lake, estimated loadings from surface water runoff from several unnamed tributaries flowing into the lake, as well as all of the estimated inputs from shoreline septic systems around the lake.

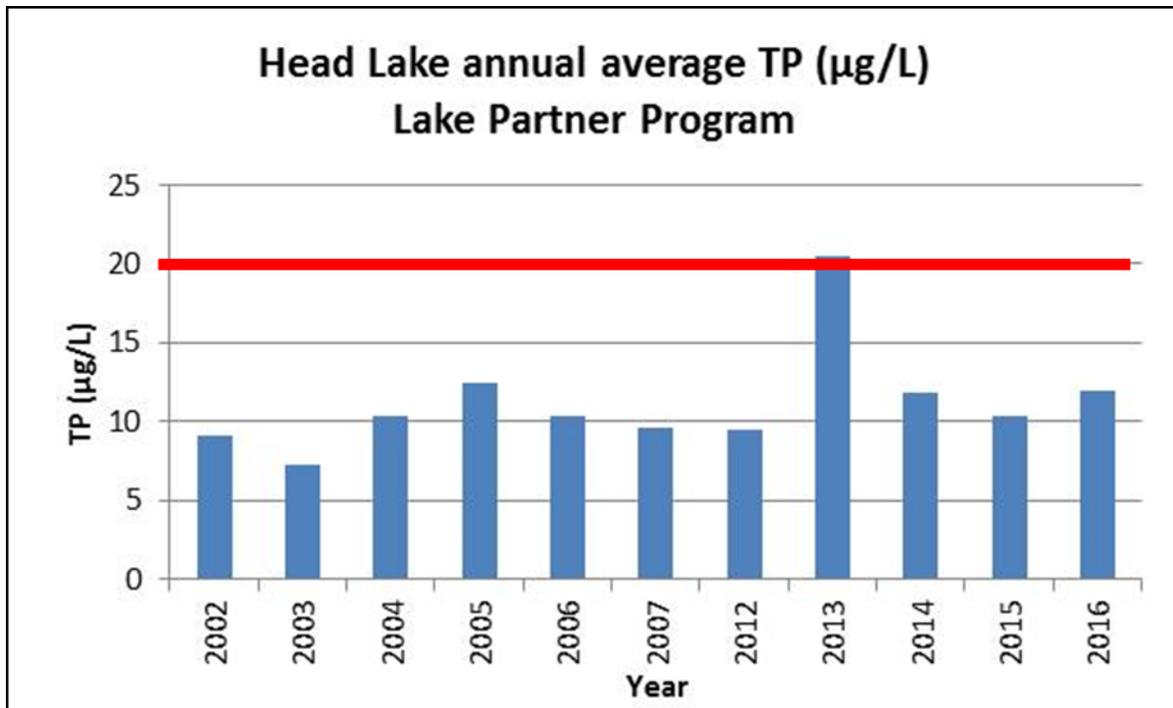


Figure 1.6: Average phosphorus concentrations (2010-2015) in Head Lake during the ice-free period, in relation to provincial water quality objectives

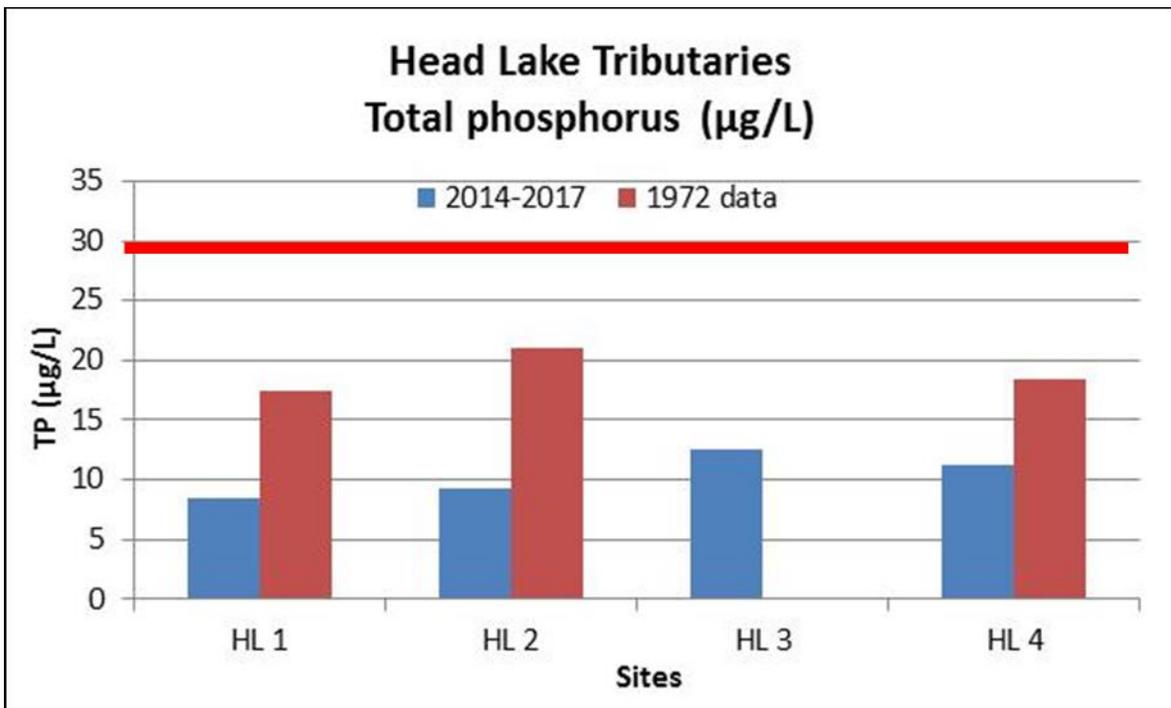


Figure 1.7: Average phosphorus concentrations (2013-2016) in subwatersheds draining into, and out of, Head Lake, in relation to provincial water quality objectives

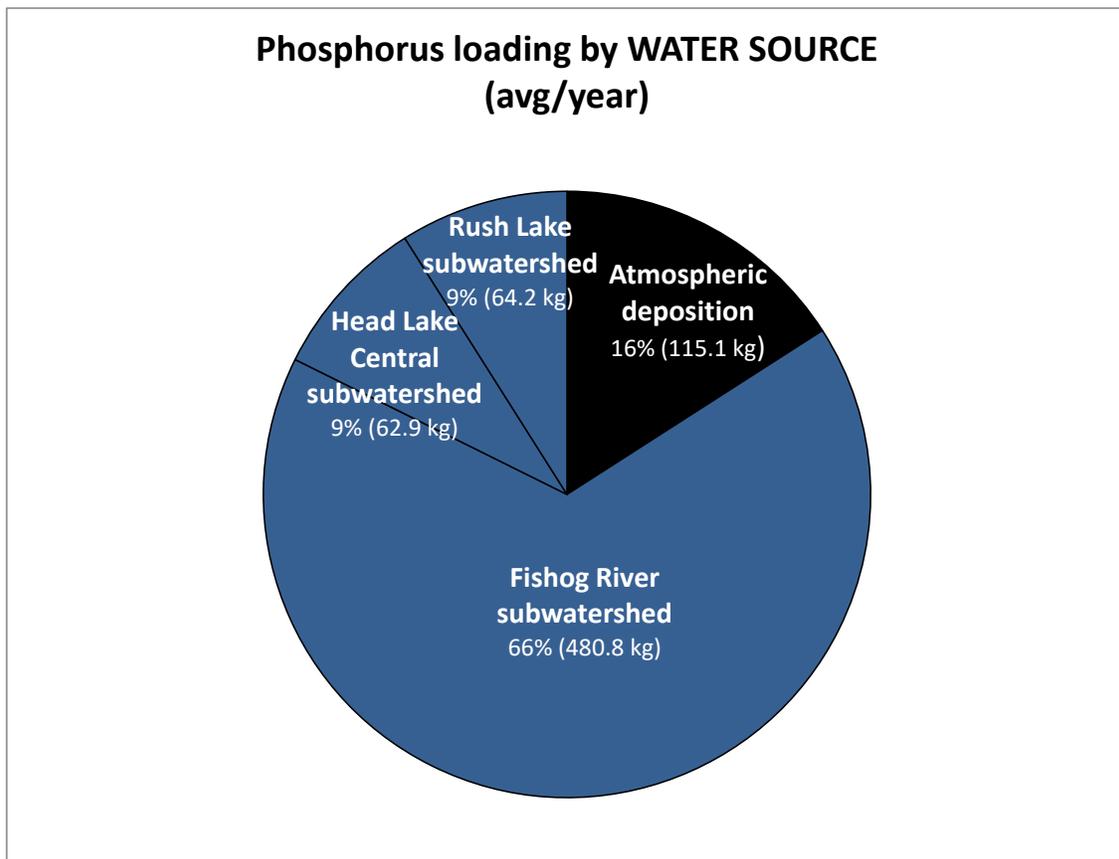


Figure 1.8: Average annual phosphorus loadings into Head Lake, by major water source (2014-2017)

Phosphorus Loading by Sector

To determine the amount of phosphorus loadings into the lake by sector, inputs from all local subwatersheds of Fishog River, Rush Lake, and Head Lake Central (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 identifying human-derived sources of nutrients that could have management potential.

The following provides a summary of current phosphorus loadings into Head Lake, by sector, in the three local subwatersheds that drain into the lake (**Figure 1.13**). These account for 84% (607.9 kg) of the total inputs into the lake from the subwatersheds of Fishog River, Rush Lake, and Head Lake Central water sources.

- Urban Runoff accounts for an estimated 41% (294.2 kg) of the total phosphorus entering Head Lake. This represents the phosphorus generated from developed areas around the lake shoreline and within its watershed that enters the lake through stream overland flow. Examples of phosphorus inputs from shoreline development and activities include lawn fertilizers and pet wastes.
- Shoreline Septic Systems account for an estimated 16% (117.5 kg) of the total phosphorus entering Head Lake. This value includes estimated inputs from systems (e.g., holding tanks, tile beds, etc.) in close proximity to the Head Lake shoreline. There are approximately 373 residences with private septic systems within 75 m of the lake. To calculate phosphorus loading from septic systems, 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.
- Natural Sources account for an estimated 16% (114.2 kg) of the total phosphorus entering Head 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 11% (82.7 kg) of the total phosphorus entering Head Lake. This represents the farm-generated phosphorus estimated to come from crop lands (rare) and pasture fields (more common) 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.

Phosphorus Benchmarks

All subwatersheds have phosphorus concentrations that meet the *Provincial Water Quality Objectives* (Ontario Ministry of Environment and Energy, 1994). In striving to maintain, and where possible enhance, the existing healthy water quality conditions, there is a need to maintain or reduce these levels 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 4 major water sources that load phosphorus into Head Lake: Fishog River, Atmospheric Deposition, Rush Lake, and Head Lake Central (**Figure 1.12**). Sector-specific benchmarks have been developed for the sources of phosphorus considered manageable within the Local Subwatersheds category. Atmospheric Deposition is excluded 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 septic inspection findings from lakes within Ontario (e.g., B.M. Ross Associates and Township of Huron-Kinloss, 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 Head Lake is a maximum loading rate of approximately 651 kg per year. This equals a reduction of existing average annual phosphorous loadings by approximately 72.7 kg (minus 15% of current loading from manageable sources) from the subwatersheds that drain into Head Lake (Table 1.5). Sector-specific phosphorus benchmarks are
 - 250.1 kg/year (minus 15% of current loading) or less, from Urban Runoff;
 - 60.0 kg/year (minus 25% of current loading) or less, from Agricultural Runoff; and
 - 111.6 kg/year (minus 5% of current loading) or less, from Shoreline Septic Systems.

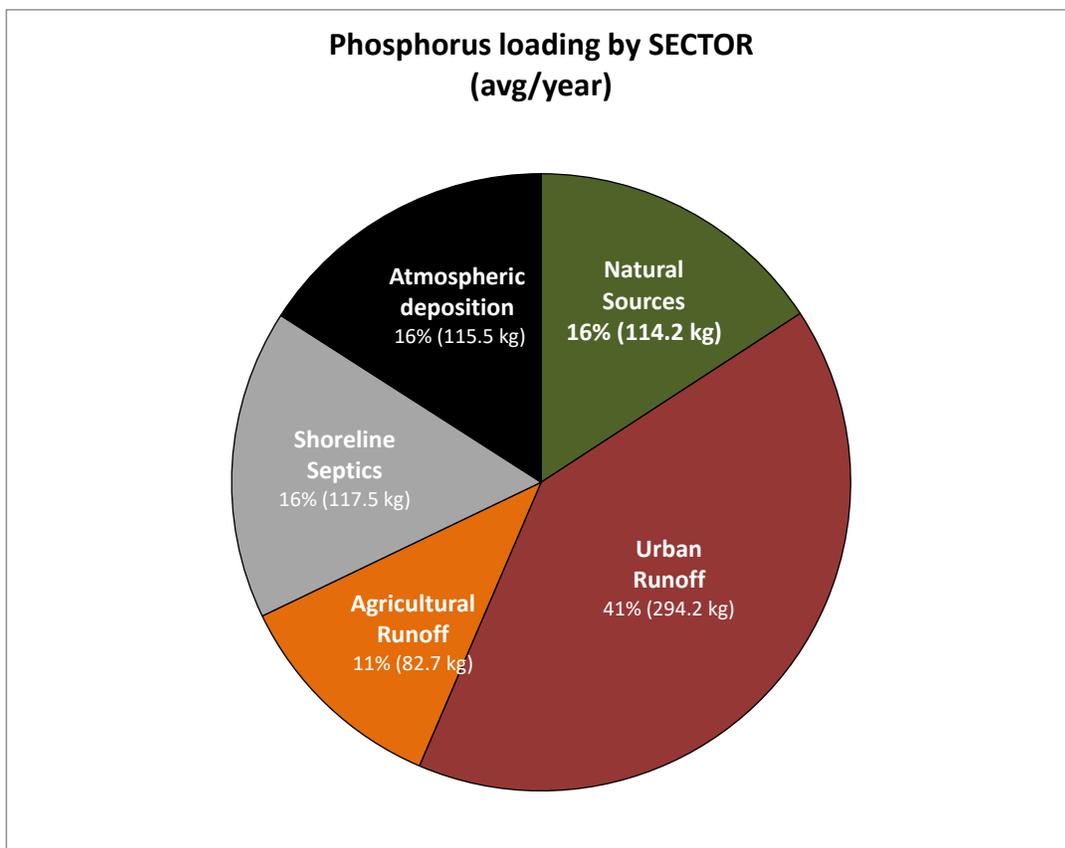


Figure 1.9: Average annual phosphorus loading into Head Lake, by sector (2013-2016).

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)
Head Lake	Urban Runoff	294.2	250.1	44.1 (15%)*
	Agricultural Runoff	82.7	60.0	20.7 (25%)**
	Shoreline Septic Systems	117.5	111.6	5.9 (5%)***
	Subtotal: Manageable Sectors	494.4	421.7	72.7 (15%)
	Natural Sources	114.2	114.2	0 (0%)****
	Atmospheric Deposition	115.5	115.5	0 (0%)****
	Total: All phosphorus inputs	723	651.4	-

*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 shoreline development 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 system inspection findings from lakes within Ontario (e.g., B.M. Ross Associates and Township of Huron-Kinloss, 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 6 kg per year of phosphorus going into Head Lake. Therefore, a 5% reduction from existing loading values is needed to make up this difference.

**** Benchmarks for natural sources and atmospheric deposition 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 Head 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 lakes is dependent upon multiple components connected at a broader ecosystem level.

Head Lake and Rush Lake are relatively shallow lakes (less than 8m deep) that do not thermally stratify, and are considered warmwater lakes (i.e., they do not support sensitive coldwater fish, such as Lake Trout and Lake Whitefish). Water chemistry sampling indicates the lakes are low-to-moderately productive, and aquatic habitats are not deteriorated to any significant degree. There are relatively limited long-term aquatic community data available for Head Lake and Rush Lake, given they have not traditionally been routinely monitored through a standardized approach by any given agency or organization. Available fisheries data for Head Lake is from Ontario Ministry of Natural Resources and Forestry sampling in the late 1980's to support walleye stocking programs, and from sampling

in 2008 and 2015 as part of a new and re-occurring Broad-scale Monitoring program. This information helps to characterize the fish community and aquatic habitat conditions in the lake but data are limited to characterize long-term changes.

Head Lake support diverse fish communities that contribute to a functioning warmwater recreational fishery. Approximately 13 fish species have been documented within Head Lake (Table 1.6), most of which are large-bodied fishes recorded through 2 sampling events within the last 10 years. There are no fish community data for Rush Lake. According to the most recent available data (2015), the large-bodied fish community in Head Lake consists of warm- and cool-water species dominated by walleye, yellow perch, white sucker, pumpkinseed, rock bass, and muskellunge. No known fish species listed as Special Concern, Threatened or Endangered have been documented.

Walleye, smallmouth bass, and muskellunge are particularly important in supporting a small but apparently viable recreational fishery. Walleye are not native to Head Lake (they were purposely introduced historically into several lakes in the region), but they remain the most targeted fish for the recreational fishery. Walleye populations are considered one of the most significant of all similar-sized lakes within the management zone (Zone 17). Angler effort for all species on Head Lake is considered average for its lake size class during the summer and below average during the winter.

Head Lake and (likely) Rush Lake have been exposed to a variety of non-native aquatic species. Records are limited but do indicate that European frog-bit, Eurasian watermilfoil, European common reed, and banded mystery snail are invasive species present in the watershed. In addition to these existing non-native species, there are others that are at immediate risk of becoming established (e.g., zebra mussels, round goby). The hydrological interconnectedness of Head Lake with QEII Wildlands Provincial Park makes both systems vulnerable. Zebra mussels have been recently observed within Head Lake, and could proliferate given calcium concentrations are sufficient to sustain local populations.

Lake tributaries provide important ecological pathways to and from the lake. There are two main tributaries that drain directly into Head Lake, Fishog River and Rush Lake. Both of these are low gradient watercourses that support spawning habitat for fishes that live in Head Lake and Rush Lake. Several sections along these tributaries are particularly ecologically significant, including the outlet of the Fishog River and the provincially significant Rush Lake Duck Lake wetland. Generally, there is unimpeded access (i.e., no man-made dams or barriers) along the lake-tributary aquatic pathways. Aquatic resource sampling at the outlets of Rush Lake and Head Lake suggests that aquatic habitat conditions are not disturbed to any significant degree.

Table 1.6: Fish species present or recorded historically in Head Lake and connecting tributaries.

Fish by Common Names	
Yellow perch	Blackchin shiner
Walleye	Bluntnose minnow
Smallmouth bass	Largemouth bass
Rock bass	Spottail shiner
White sucker	Golden shiner
Pumpkinseed	Brown bullhead

Bold indicates important species to the recreational fishery

1.5.5 Terrestrial Natural Heritage

Head Lake lies within 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.

Approximately 53% of the shoreline area around Head Lake and Rush Lake remains in a natural state, with forests being the dominant natural cover type. The subwatersheds, on the other hand, contain large tracts of natural lands. Most of this cover is upland forests. The Fishog River has many small inland lakes, interspersed among rock barrens and wetland environments. Rush Lake is part of the large and provincially significant Rush Lake Duck Lake wetland complex. The Queen Elizabeth II Wildlands Provincial Park is an extensive tract of relatively unimpacted natural area in the northern part of the planning area. This is a popular low-impact use recreational area, particularly for hiking and nature viewing.

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 1.7 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. Owing to the extensive areas of natural cover, the subwatersheds of Head Lake meet all guidelines except for Head Lake Central, which is slightly lacking in wetland and forest cover.

Head Lake has a small population of colonial birds nesting on Armstrong Island and some of the smaller islands, consisting of primarily ring billed gulls, double crested cormorants, and common terns. Generally, little is known about the colonies found on Head Lake and their place in the local ecology. Recently, biologists from Environment Canada and Ontario Parks visited Head Lake to inventory common tern nests and identified 4 breeding islet clusters on the lake (Arnold and Oswald, 2017). The common tern breeding colonies represent an important component of tern ecology and tern populations since Great Lake populations have declined by an average of 18% over the last 40 years.

The Head Lake planning area is known to provide natural habitat that supports the following locally or provincially rare wildlife species including: three bird species (eastern meadowlark, eastern whip-poor-will, and loggerhead shrike), and two turtle species (Blanding's turtle, and snapping turtle).

Table 1.7: Table summarizing existing forest, wetland, and streamside vegetation cover within the Head Lake and Rush Lake Planning area, in relation to ecosystem health benchmarks

Subwatershed	<u>Forests</u> Benchmark = >50%	<u>Wetlands</u> Benchmark = >10%	<u>Streamside Vegetation</u> Benchmark = >75%
Fishog River	64%	17%	100%
Head Lake Central	35%	8%	88%
Rush Lake	51%	15%	94%
Total Head Lake Planning Area	56%	15%	98%

Red highlight: existing amount does not meet benchmark

Green highlight: existing amount meets benchmark

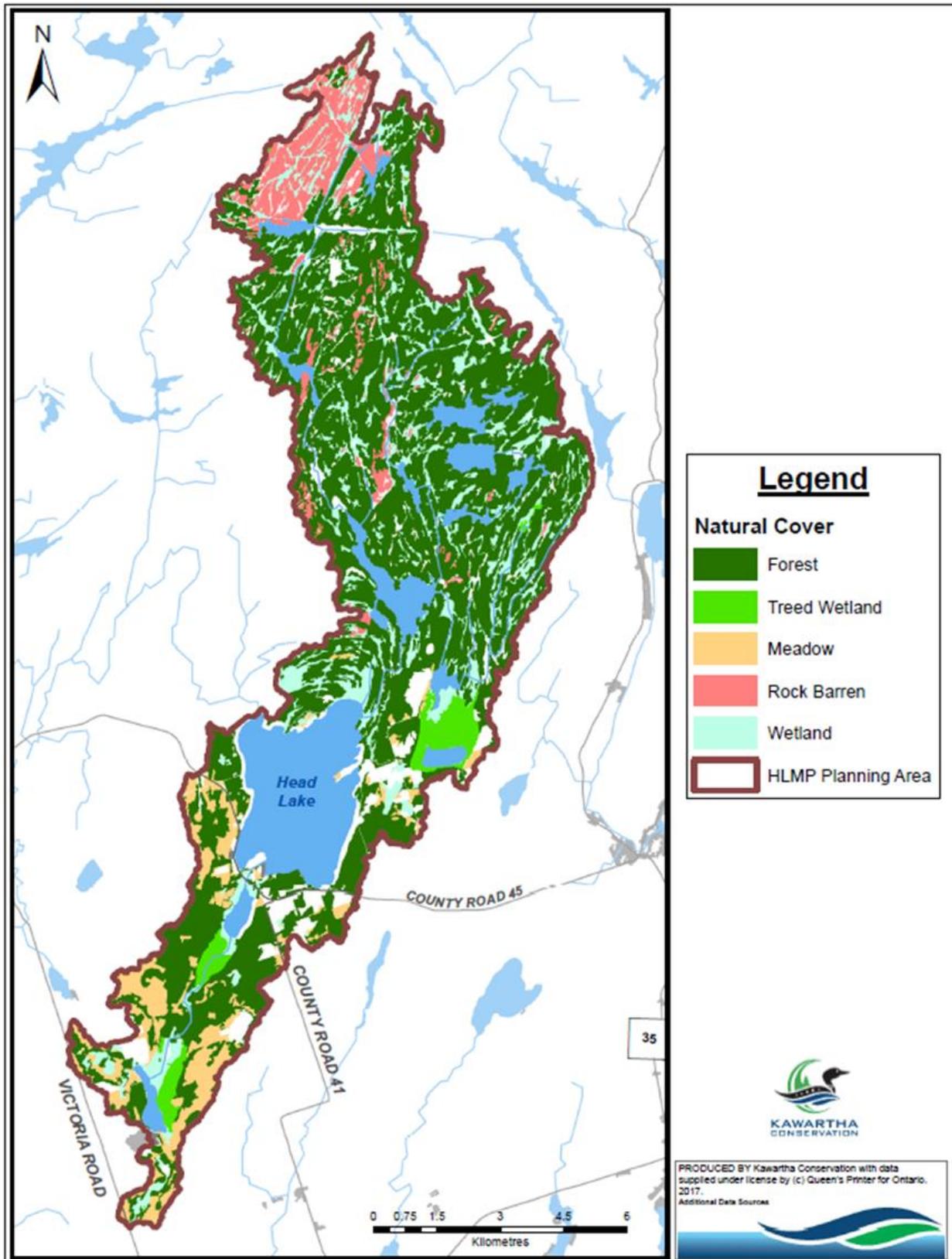


Figure 1.10: Map showing natural cover types within the Head Lake and Rush Lake Planning area

2.0 Management Objectives



*Outlet of Fishog River into Head Lake
(North-east shore of Head Lake, July 2017)*

2.1 Introduction

This chapter provides a summary of the management objectives of the *Head Lake and Rush Lake Management Plan*. Objectives are "*what we want to achieve*" through a coordinated approach to managing the lake. 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 six 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 *Head Lake and Rush Lake Management Plan*.

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 shoreline landowners and lake users to voluntarily undertake best management practices on their properties for the benefit of all and the future health of the lake
- **Strategic Planning:** Actions that give profile to pro-active land use policy and natural resource planning initiatives.
- **Urban and Rural Infrastructure:** Actions that focus on voluntarily maintaining sustainable public areas and construction works including lake-access areas, roads, and all construction sites.
- **Research and Monitoring:** Actions focused on addressing, through collaboration, science-based information gaps to better understand the response of the lake to emerging pressures, and 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 excellent water quality conditions

BACKGROUND:

- Head Lake and Rush Lake have excellent water quality. There is overwhelming community support for maintaining excellent water quality conditions. Data indicate that waters in Head Lake and Rush Lake are considered clear and clean, and do not impair fish and wildlife populations. Water quality in Head Lake has remained in a relatively stable state, and no long term data exists for Rush Lake. Nutrient concentrations within Head Lake and all its major subwatersheds (including Rush Lake) meet provincial water quality guidelines.
- 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 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 from shoreline development and activities. The shoreline is heavily developed in Head Lake (along the east, west, and north shores), and in Rush Lake (along the east shore), and consists of mostly residential properties. Developed shoreline properties tend to contain significant amounts of hardened surfaces such as concrete, asphalt, and patio stones where pollutants (such as pet feces, oil, fertilizers, salt, etc.) accumulate. After a rain, these harmful substances tend to be washed directly into the lake instead of being purified by gradually filtering through vegetation into the ground. Furthermore, all shoreline properties are on private septic systems. Research suggests that in areas of shallow soil depths (as is the case along Head Lake), there is a greater risk for leaching of contaminants into the lake if septic systems are not functioning optimally. High nutrient loadings into the nearshore can deteriorate water quality and lead to increased aquatic plant growth.
- Potential contamination from other sources. The potential for oil and/or gas spills from power boats, oil spills from shoreline properties, and other disturbances are areas of concern. Many local residents are concerned of local water quality degradation from large colonies of water birds (e.g., gulls, cormorants) on certain shoreline areas.

IMPLEMENTATION ACTIONS (Objective #1):

Stewardship

- Undertake responsible management of septic systems, including routine inspections, along shoreline properties [Action A1 - page 47].
- Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties [Action A3 - page 49].
- Maintain the natural features along the shoreline [Action A4 – page 50].
- Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats [Action A5 – page 51]
- 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 52].

Strategic Planning

- Undertake responsible development planning within the watershed, and particularly along the shoreline [Action B2 - page 54].

Urban and Rural Infrastructure

- Maintain safe and accessible public lake-access locations by improving water quality at the beach, addressing flooding along Baker Rd., and managing parking near the boat launch [Action C1 – page 58].
- Ensure that construction projects, particularly road maintenance and waterfront property development works, are conducted in a manner that does not degrade water quality or sensitive habitats [Action C2 – page 59].

Research and Monitoring

- Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species [Action D1 – page 61].
- Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations [Action D4 – page 64].

2.3 Management Objective #2:

Improve the water level management regime

BACKGROUND:

- Water levels on Head Lake are influenced by a dam that was constructed on the Head River approximately 50 years ago, several kilometres downstream of Head Lake. This dam exists on crown land within the Queen Elizabeth II Wildlands Provincial Park and is managed privately by the Head Lake North Shore Association. In recent years (2016) the dam fell into a state of disrepair and Ontario Parks therefore commissioned a Hydrotechnical Study of the Head River dam to evaluate how dam management scenarios (i.e., repair, remove, upgrade structure) may impact water level fluctuations and consequently shoreline properties around the lake. It has subsequently been repaired to its pre-existing state and is again operational between the spring and fall seasons to maintain a minimum water level for recreational purposes.

ISSUES:

- Management of Head River dam. There are varying perspectives among local Lake Associations in terms of acceptable water level regime resulting from dam management alternatives. The overwhelming majority of residents are satisfied with the existing dam, given it has maintained stable water levels in the summer navigation season for several decades. Some residents, however, are concerned about potential for flooding from the dam operations. According to the Hydrotechnical Study the influence of the dam on causing high water levels within Head Lake is negligible. A key recommendation of the Study was to undertake an assessment of acceptable water levels that meets the needs of all (or most) shoreline residents, other stakeholders, and the natural environment.

IMPLEMENTATION ACTIONS (Objective #2):

Strategic Planning

- Establish thresholds/criteria for acceptable water levels and identify ecological and socio-economic impacts associated with water level management [Action B1 – page 54].

Urban and Rural Infrastructure

- Maintain safe and accessible public lake-access locations by improving water quality at the beach, addressing flooding along Baker Rd., and managing parking near the boat launch [Action C1 – page 58].

Research and Monitoring

- Undertake routine monitoring of, and establish a relationship between, water levels and flows in Head Lake and Rush Lake to better characterize their hydrological regime [Action D3 – page 63].

2.4 Management Objective #3:

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 Head Lake and its subwatersheds. Biodiversity helps sustain the goods and services provided by the Head 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. Head Lake and Rush Lake are located within a distinct ecoregion known as “The Land Between,” which is known for supporting high levels of biodiversity.

ISSUES:

- Proliferation of non-native invasive species. Head Lake and Rush Lake are prone to the introduction and spread of non-native species, in large part because: its shorelines have significant development, the presence of a Provincial Park nearby, a popular angling destination, and its hydrological connection to the Trent-Severn Waterway. Several non-native species have been documented in the Head Lake watershed including Eurasian water-milfoil, European Common Reed, and Banded Mystery Snail. Invasive species have been demonstrated to impact native biodiversity in Ontario lakes, and can have the potential to cause lake-wide ecosystem changes (e.g., the clearing of the water column from zebra mussel filter-feeding results in a deeper sunlight penetration depth, which in turn results in an increase in aquatic plants). The potential for Zebra Mussels and freshwater jellyfish populations to proliferate is of particular concern to local residents.
- Wildlife species of conservation concern. Within the planning area, there are several documented wildlife species that are considered at risk on a provincial level. These species rely on functioning aquatic and terrestrial habitat for persistence, and the following have been noted as occurring in the planning area: Blanding’s turtle, snapping turtle, common five-lined skink, wood thrush, Eastern meadowlark, Eastern wood pewee, and Eastern whip-poor-will. In addition, there exists a colony of inland breeding common terns on Head Lake that is deemed significant in terms of sustaining Great Lakes populations. Major threats to species of conservation concern include loss of habitat (e.g., removal of nearshore vegetation), increased disturbance from development activities and boating, direct mortality and injury by road vehicles and boat propellers.
- Increased popularity of Queen Elizabeth II Wildlands Provincial Park. The Park exists along the north shore of Head Lake and encompasses the majority of lakes and lands within the Fishog River Watershed. This park is operated as a non-functioning Park (i.e., limited camping infrastructure) with a primary focus to preserve the integrity of ecosystems that are in relatively pristine condition. There has been a recent (within the last 15 years) increase in public visitation of the Park, in part because its close proximity to the Greater-Toronto-Area and its receiving profile on the internet. There are concerns that increased pressure on the park could degrade local ecosystems.

IMPLEMENTATION ACTIONS (Objective #3):

Stewardship

- Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lake and its watershed [*Action A2 – page 48*].
- Maintain the natural features along the shoreline [*Action A4 – page 50*].
- Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats [*Action A5 – page 51*].

Strategic Planning

- Establish thresholds/criteria for acceptable water levels and identify ecological and socio-economic impacts associated with water level management [*Action B1 – page 54*].
- Undertake responsible development planning within the watershed, and particularly along the shoreline [*Action B2 – page 55*].
- Undertake actions within the Fisheries Management Plan for Fisheries Management Zone 17, and develop a management plan for Queen Elizabeth II Wildlands Provincial Park [*Action B3 – page 56*].

Urban and Rural Infrastructure

- Ensure that construction projects, particularly road maintenance and waterfront property development works, are conducted in a manner that does not degrade water quality or sensitive habitats [*Action C2 – page 59*].

Research and Monitoring

- Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species [*Action D1 – page 61*].
- Conduct research on local populations of cormorants, common terns, and herring gulls to better inform management approaches for colonial water birds [*Action D2 – page 62*].
- Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species [*Action D5 – page 65*].

2.5 Management Objective #4:

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 Head Lake is approximately 19.3 km and contains significant residential development.
- The lake shoreline is a dynamic system. Natural forces such as water currents, wave action, and ice movement can be a source of shoreline accumulation (e.g., gaining land) or shoreline erosion (e.g., 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:

- Significant residential development along the lake shoreline. The west, east, and north shorelines of Head Lake, and the east shore of Rush Lake are heavily developed. This development is mostly consisting of individual residential or cottage properties that occupy approximately 42% of land area adjacent to both lakes. Developed 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. The land/water interface along the shoreline, as well as shallow nearshore areas (less than 2m deep) are particularly prone to alterations from development and other activities associated within shoreline living. Significant areas of the shorelines of both lakes are considered artificial, for example concrete, armoustone, etc.
- Potential for aggregate operations. Approval is currently being sought and submitted under the *Aggregate Resources Act* for a dimensional rock quarry (known as the Squire Proposal) to be located at 2460 Monck Road, directly adjacent to Head Lake and Rush Lake. The applicant is seeking a Class "B" below water license over a 32 hectare portion of the site that would allow the extraction of up to 20,000 tonnes annually. Local residents have expressed concerns about the impact of the proposed quarry on residents and the surrounding environment, including: noise, preserving air quality, preserving the natural environment, Impact on the adjacent lakes, and truck traffic.
- Clear-cutting of shoreline vegetation. Shoreline residents have expressed concern regarding the removal of vegetated areas to accommodate several shoreline property developments. Anecdotal observations suggest that some land developers may be attempting to circumvent shoreline protection policies by removing large swaths of shoreline vegetation prior to applying for approvals.

IMPLEMENTATION ACTIONS (Objective #4):

Stewardship

- Undertake responsible management of septic systems, including routine inspections, along shoreline properties [Action A1 - page 47].
- Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lake and its watershed [Action A2 – page 48].
- Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties [Action A3 - page 49].
- Maintain the natural features along the shoreline [Action A4 – page 50].
- Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats [Action A5 – page 51]

Strategic Planning

- Establish thresholds/criteria for acceptable water levels and identify ecological and socio-economic impacts associated with water level management [Action B1 – page 54].
- Undertake responsible development planning within the watershed, and particularly along the shoreline [Action B2 – page 55].
- Undertake actions within the Fisheries Management Plan for Fisheries Management Zone 17, and develop a management plan for Queen Elizabeth II Wildlands Provincial Park [Action B3 – page 56].

Urban and Rural Infrastructure

- Ensure that construction projects, particularly road maintenance and waterfront property development works, are conducted in a manner that does not degrade water quality or sensitive habitats [Action C2 – page 59].

Research and Monitoring

- Conduct research on local populations of cormorants, common terns, and herring gulls to better inform management approaches for colonial water birds [Action D2 – page 62].
- Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations [Action D4 – page 64].
- Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species [Action D5 – page 65].

2.6 Management Objective #5:

Maintain safe public swimming and lake access opportunities

BACKGROUND:

- The public space along the south shore of Head Lake is the primary public access location. This property along Monck Rd. (CKL Rd. 45), is designated a municipal beach and boat launch area. The beach is routinely tested by the Haliburton Kawartha Pine Ridge District Health Unit 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." A secondary boat launch access location exists at the end of Suter Dr.
- Safe access and egress along public and private roads is essential, particularly for emergency response services. Road access to shoreline properties along the west and north shore is through Baker Rd. This road is the only access route for dozens of residents, including those along North Shore Rd.

ISSUES:

- Occasional posting of public beach as unsafe due to *E. coli*. Over the past five years the public beach has been posted as potentially unsafe for swimming on average once a year, due to elevated *E. coli* levels. The reason for high *E. coli* remains unclear but are likely the result of a combination of factors including feces from birds, stormwater runoff over developed areas containing contaminants following storm events and/or shallow, warm waters with limited water circulation.
- Annual flooding of Baker Rd. Typically in the spring on an annual basis, road flooding occurs across Baker Rd. during spring high water events. This has temporarily provided a barrier that restricts road access to several properties along the north shore of Head Lake. The causes of flooding (e.g., poor drainage, high lake levels, etc.) are not well understood at this time. This issue should be addressed, along this private road, particularly to maintain Emergency Management Services access.
- Crowded parking adjacent to boat launch on Suter Dr. This public road allowance is a secondary boat launch access location, and consequently has limited space to accommodate vehicle and trailer parking. Local residents have expressed their concern of over-crowding along the roadway and potential for restricted access and egress of Emergency Management Services.
- Lack of standardized and highly visible in lake hazards markers. No one organization takes responsibility for marking hazard areas within Head Lake with floating markers/buoys. The limited number of markers that do exist do not meet the minimum standards outlined by Transport Canada, for example by using easy-to-find floating materials that can be confused as swimming buoys and/or are not highly identifiable as hazard markers.

IMPLEMENTATION ACTIONS (Objective #5):

Stewardship

- Undertake responsible management of septic systems, including routine inspections, along shoreline properties [Action A1 - page 47].

Strategic Planning

- Establish thresholds/criteria for acceptable water levels and identify ecological and socio-economic impacts associated with water level management [Action B1 – page 54].

Urban and Rural Infrastructure

- Maintain safe and accessible public lake-access locations by improving water quality at the beach, addressing flooding along Baker Rd., and managing parking near the boat launch [Action C1 – page 58].

Research and Monitoring

- Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species [Action D1 – page 61].

2.7 Management Objective #6:

Improve our understanding of how the lake 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. There is a need to improve scientific understanding about the interactions of these stressors within the lake 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 lake (e.g., from septic systems, and shoreline development and activities) because these 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.
 - Colonial water birds. Populations of double-crested cormorants, herring gulls, and ring-billed gulls have significantly increased in recent years according to local residents. These birds are part of a functioning ecosystem but there is a perception among local residents that their recent proliferation (particularly cormorants) is decreasing lake enjoyment and is detrimental to the ecosystem. There is a need to know what impacts these species have on lake health to inform management options. There are localized areas where residents consider Canada Geese a nuisance as well.

ISSUES:

- Limited monitoring programs and data on lake ecosystem. There is a general lack of data for Head Lake, and in particular Rush Lake, compared to other large lakes within the City of Kawartha Lakes. Further, there is limited routine monitoring of key indicators of lake(s) health, such as invasive species, water quality, and biodiversity.

IMPLEMENTATION ACTIONS (Objective #6):

Research and Monitoring

- Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species [*Action D1 – page 61*].
- Conduct research on local populations of cormorants, common terns, and herring gulls to better inform management approaches for colonial water birds [*Action D2 – page 62*].
- Undertake routine monitoring of, and establish a relationship between, water levels and flows in Head Lake and Rush Lake to better characterize their hydrological regime [*Action D3 – page 63*].
- Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations [*Action D4 – page 64*].
- Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species [*Action D5 – page 65*].

3.0 Implementation Strategies



Head Lake public beach and boat launch
(South shore of Head Lake, Monck Rd., August 2017)

3.1 Introduction

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

Implementation Strategies provide a suite of actions to help achieve the management objectives outlined in the previous chapter. 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 recommended management approach.

Priority: The level of priority 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 priority 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 priority.

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 the lake), but it is also based on other contexts (e.g., a specific threat).

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

Stewardship refers to the voluntary care of resources. In the context of this strategy, stewardship refers to the voluntary care by lakeshore property owners and lake users in a collective effort to meet the goals and objectives of the *Head Lake and Rush Lake Management Plan*.

We must all understand that our individual actions contribute to a collective impact on the health of the lakes and their watershed. With this knowledge, associated shoreline and lake users can take actions that contribute to sustaining the health of this valuable resource.

The actions outlined in this strategy contribute to maintaining excellent water quality and enhancing natural habitats. Emphasis is on privately-owned shoreline property, with a primary focus of creating awareness about effective land and water stewardship practices. A second major focus is to provide technical assistance and other resources to private landowners in order to initiate positive stewardship actions.

The stewardship strategy works in conjunction with the Communications and Outreach Strategy.



Head Lake main boat launch
(South shore of Head Lake, Monck Rd., August 2017)

Action A1: Septic system maintenance

Undertake responsible management of septic systems, including routine inspections, along shoreline properties.

Priority

- High

Rationale

- Septic systems at shoreline residences on the strip of land around the lake are estimated to contribute approximately 16% of the phosphorus load from all sources. This is the largest manageable source of phosphorus that enters the lake. A 5% reduction in septic system loading is needed to achieve the water quality benchmarks for the lake. This source of phosphorus has a potentially significant influence on nearshore water quality and aquatic plant proliferation, 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 swimming areas. Individual septic systems should be responsibly maintained.

Priority areas

- Densely populated shoreline areas; older septic systems
- Septic systems in close proximity to the public beach

Lead and (partner) implementers

- Head Lake residents; City of Kawartha Lakes; Haliburton, Kawartha, Pine Ridge District Health Unit; (Head Lake Associations; septic system businesses; Federation of Ontario Cottagers' Associations)

Deliverables

- Conduct periodic inspections of septic system to determine if functioning as designed or if pump-outs, repairs, or replacement is needed.
 - Require the septic system to be inspected by a licenced installer as a condition of property sale/purchase.
- Conduct regular pump-outs, every 3 to 5 years depending on use or when scum and sludge occupy more than one-third of capacity, to ensure septic system is functioning as designed.
- Take advantage, if necessary, of 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 to repair or improve their system.
- Host periodic "dock talk" extension services and local workshops with a focus on helping homeowners understand, inspect, and manage septic systems.
- Continue investigating official complaints of potentially malfunctioning systems to address potential health hazards and determine corrective actions as required.

Action A2: Invasive species management

Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lake and its watershed.

Priority

- 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. Several “invasive species” have established populations within Head Lake ecosystem already (e.g., European common reed, Eurasian water milfoil), and are near impossible to eradicate once established to the detriment of biodiversity and lake-based values. Due to its hydrological connection with Queen Elizabeth II Wildlands Provincial Park, close proximity to popular Kawartha Lakes region, and intense shoreline usage, Head Lake is susceptible to the introduction and spread of more aquatic species (e.g., round goby, zebra mussels) and terrestrial species (e.g., emerald ash borer, dog strangling vine). Probable pathways for spreading are through recreational activities (e.g., boating, hiking) and natural dispersal through the Black River Watershed.

Priority areas:

- Vessels and in-water equipment that travels to and from Head Lake
- Public boat launch on Monck Rd.
- QEII Wildlands Provincial Park access points

Lead and (partner) implementers

- Watershed residents; Invading Species Awareness Program - Ontario Ministry of Natural Resources and Forestry and Ontario Federation of Anglers and Hunters; Ontario Parks; (Federation of Ontario Cottagers’ Associations; Head Lake Associations; recreational boaters and anglers; City of Kawartha Lakes; Ontario Nature; Kawartha Field Naturalists; Ontario Invasive Plants Council; Kawartha Conservation; 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.
- Consider the feasibility of installing a voluntary boat and trailer wash station near the public boat launch. Appropriate runoff controls should be put in place at wash stations to prevent entry of potential exotic species into the lake.
- 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 on emerging invasive species (e.g., emerald ash borer, *Phragmites*, etc.).

Action A3: Stormwater runoff management

Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties.

Priority

- High

Rationale

- Although developed areas only account for approximately 2% of the Head Lake planning area, they are concentrated along the shoreline. More than half (59%) of the shoreline length has been developed within 100m of the lake. These areas contribute disproportionately high amounts of sediments, nutrients, and other contaminants typically through increased surface water runoff over fertilized lawns and hardened surfaces (e.g., concrete, pavement, etc.) running into the lake. In terms of phosphorus loading into the lake, it is estimated that surface water runoff that flows over developed shoreline areas contribute X% from all sources.

Priority areas

- Areas of dense urban shoreline development (e.g., western and eastern shore of lake)

Lead and (partner) implementers

- Head Lake residents; (Head Lake Associations; City of Kawartha Lakes; Kawartha Conservation)

Deliverables

- Develop a program that provides educational and project management assistance, as well as financial assistance where possible, to waterfront residents to support the uptake of lot-level measures for water stewardship action including:
 - 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 and diffuse storm runoff via rain barrels, grassed swales, vegetated depressions, rain gardens, splash blocks 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.
 - Transition to the use of a low-or zero-phosphorus fertilizer or to the reduction and elimination of chemical fertilizers on lawns. Instead eave mulched clippings to decompose and use yard compost for soil amendments; do not discard of clippings in waterways.
 - Conduct soil testing to determine actual nutrient deficiencies, and adjust soil amendments accordingly.
 - Maintain permeable surfaces, such as porous asphalt or vegetated swales, as alternatives to hardened driveways, walkways, and parking lots.
 - Dispose of pet wastes in the garbage and discourage feeding of waterfowl.
-

Action A4: Naturalization along shorelines

Maintain the natural features along the shoreline.

Priority

- High

Rationale

- Shorelines are transitional areas from water to land, and are often referred to as the 'Ribbon of Life' around a lake because they are the most important areas in lakes for fish and wildlife production. Within the Head Lake Planning Area, development is concentrated along the shoreline through mostly single residential lots, and as such this area around the lake is particularly vulnerable to human disturbance. At present a significant amount of the shorelines of Head Lake and Rush Lake have been modified into artificial structures (e.g., concrete, armourstone, manicured lawn, etc.) that do not provide optimum fish and wildlife habitat nor the runoff filtering capacity that are otherwise provided by natural features (e.g., trees, rocks, stumps, aquatic plants, etc.). There are numerous opportunities along existing waterfront properties as well as during property upgrade developments to maintain or increase fish and wildlife habitat.

Priority areas

- Areas immediately adjacent to the shoreline along residential properties

Lead and (partner) implementers

- Head Lake residents; (Ontario Ministry of Natural Resources and Forestry; Head Lake Associations; Federation of Ontario Cottagers' Associations; Kawartha Conservation; City of Kawartha Lakes; local nurseries)

Deliverables

- Provide more education and marketing to shoreline residents on what to consider when undertaking shoreline improvements (i.e., who to contact for support, what options are available, etc.) that protect or enhance the integrity of the shoreline including:
 - 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 boathouses sites where the least amount of vegetation currently exists, keeping safety in mind at all times.
 - 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.
- Produce and distribute a non-technical guidance document that clearly illustrates practical approaches for improving existing non-natural shorelines.

Action A5: Responsible boating

Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats.

Priority

- Medium

Rationale

- Head Lake is an important body of water for recreation, particularly for private pleasure craft. Due to the potential for lake contamination by chemicals (e.g., gas, oil, etc.), there is a need to educate people about properly maintaining equipment and what actions to take in an emergency spill situation. Further, there are several areas of the lake (e.g., marsh wetlands, etc.) where boating disturbance should be avoided during periods of increased sensitivity (e.g., fish spawning and bird nesting areas).

Priority areas

- Sensitive shoreline habitats (e.g., marsh wetlands, fish spawning habitats)

Lead and (partner) implementers

- Recreational boaters; (Head Lake residents; Head Lake Associations; Boating Ontario)

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.
 - Whenever possible, use low-impact recreational practices (e.g., canoeing, kayaking, sailing, etc.) and technologies.
- 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 areas.

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.

Priority

- Low

Rationale

- Agriculture represents 3% of the total land use within the Head Lake and Rush 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 11% (82.7 kg per year) into Head Lake from Local Subwatershed sources. Slight reductions in agricultural phosphorus loading are needed to achieve the water quality benchmark.

Priority areas

- Head Lake Central subwatershed

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; City of Kawartha Lakes)

Deliverables

- Conduct agricultural improvement projects, through the Environmental Farm Plan in priority subwatershed 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.

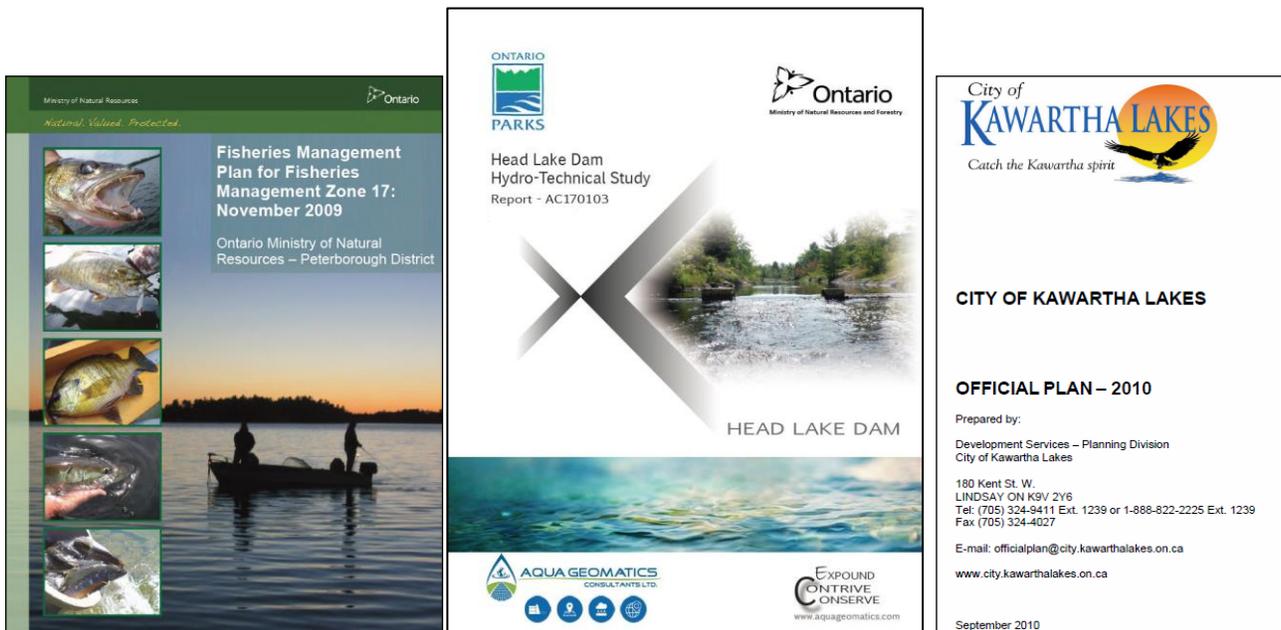
3.3 Strategic Planning Strategy

The primary focus of this strategy is to undertake proactive approaches for lake health and environmental protection measures within land use policy and natural resource planning.

The existing provincial and municipal regulatory tools that apply to lands and waters within the Head Lake and Rush Lake planning area provide some degree of protection in maintaining good water quality and natural heritage, however there are several opportunities to consider. Some lakes within the municipality, Four Mile Lake for example, have extended protection measures that provides more stringent rules for new developments put in place through Special Policy Area designations within the City of Kawartha Lakes Official Plan. Another enhancement to consider in terms of the municipal planning approach is to explore mechanisms through which the large-scale removal of shoreline forested areas can be regulated.

Further, given a significant number of shoreline properties are potentially affected by fluctuating water levels, emphasis is placed on working with Ontario Parks and Head Lake High Shores to continuously review their water management regime to mitigate impacts.

Strategic natural resources planning and management is also emphasized within this strategy, through profiling the several actions within the Fisheries Management Plan for Fisheries Zone 17 and planning for Queen Elizabeth II Wildlands Provincial Park.



Examples of recently developed planning initiatives that contribute to the objectives of the Head Lake Management Plan

Action B1: Lake level management planning

Establish thresholds/criteria for acceptable water levels and identify ecological and socio-economic impacts associated with water level management.

Priority

- High

Rationale

- Water levels on Head Lake are moderated by a dam that exists downstream of the lake on the Head River. This structure exists on crown lands within the boundary of the Queen Elizabeth II Wildlands Provincial Park, and is managed by the Head Lake North Shore Association. The dam was recently in a state of disrepair and as such Provincial Park staff commissioned a Hydro-technical Study of the Head River Dam to evaluate management scenarios in terms of replacing structure, removing structure, or other options. The dam has since been repaired to a functioning state, whereby it maintains minimum water levels in the summer months for recreational purposes. One of the recommendations of the Study was to undertake an assessment of acceptable water levels that meets the needs of all (or most) shoreline residents, and other stakeholders (e.g., road infrastructure) while maintaining the ecological integrity of the lake ecosystem.

Priority areas:

- Head River dam and Head Lake shoreline lands affected by its management
- Sensitive and/or important fish and wildlife habitats

Lead and (partner) implementers

- Ontario Ministry of Natural Resources and Forestry; Head Lake North Shore Association; (City of Kawartha Lakes; Head Lake Associations; shoreline residents)

Deliverables

- Consider findings and recommendations in the Head Lake Dam Hydrotechnical Study (Aqua Geomatics Consultants Limited, 2017).
- Maintain the dam according to its original specifications, or facilitate an agreement with shoreline residents and other stakeholders on an appropriate water levels management regime, for example:
 - Establish a range of water levels that suits the needs and interests of the majority of the users.
 - Establish a range of water levels that are optimal for fish and wildlife habitats, and to maximize lake resilience to water quality pollution.

Action B2: Responsible shoreline and watershed development

Undertake responsible development planning within the watershed, and particularly along the shoreline.

Priority

- High

Rationale

- Municipal Official Plans provide the structure for land use planning and development in the Head Lake planning area. A significant section of the shoreline around Head Lake and Rush Lake are considered in a developed state, many of which are seasonal dwellings. Therefore the potential exists not only for new development proposals on existing natural lands, but also the intensification (i.e., re-development and/or upgrading into more permanent residences) of existing developed areas. The intent of this action is to consider regulatory tools that would be best applicable to afford enhanced protection to large tracts of natural lands in the watershed and along the shoreline. These areas along the lake shoreline maintain the integrity of the lake ecosystem by stabilizing soils, moderating temperature, providing fish and wildlife habitat, reducing surface water runoff, utilizing nutrients, among other functions. Head Lake and Rush Lake residents are particularly concerned about the clear-cutting of forested areas along the shoreline, low water levels affecting summer recreation, and recent applications for aggregate operations.

Priority areas:

- Shoreline lands within 1km around the lake
- Large forested areas along the Head Lake shoreline
- Aggregate proposals in watershed

Lead and (partner) implementers

- City of Kawartha Lakes

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 updating land use policies specific to Head Lake, for example by applying restrictions similar to Four Mile Lake Special policy area. These may include: requiring minimum lot frontages, restricting cluster developments, restricting aggregate operations, requiring minimum setbacks from roads, etc.
 - In particular advocate for a buffer zone for any industrial operation that will impact sensitive receptors to be incorporated.
- Review various regulatory approaches to preventing the clear-cutting of forested areas along the Head Lake shoreline. The scope and criteria of the by-law (e.g., to which projects it applies) 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.
- Review and integrate where applicable guidance from the document Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes (Gartner Lee and French Planning Services, 2002).

Action B3: Fisheries and Provincial Park Management Planning

Undertake actions within the *Fisheries Management Plan for Fisheries Management Zone 17*, and develop a management plan for Queen Elizabeth II Wildlands Provincial Park.

Priority

- Medium

Rationale

- The Fisheries Management Plan for Fisheries Management Zone 17 was released in 2009 by the Ontario Ministry of Natural Resources and Forestry. The Plan outlines several challenges in maintaining healthy fisheries resources and provides several management strategies that apply to local watercourses, including Head Lake. Strategies within the Plan include: Walleye, Largemouth and Smallmouth Bass, Panfish, Muskellunge and Northern Pike, Coldwater Streams Fisheries, Additional Species (forage fish and species at risk), Invasive Species and Fish Pathogens, Fisheries Awareness and Education, and Monitoring and Assessment. A Fisheries Advisory Council comprised of several key stakeholders including angling clubs, First Nations, tourist associations, academia, and stewardship groups, played a large role in developing the Plan by identifying goals, objectives, and management actions. Implementation of several action items in the Plan would benefit the fishery within Head Lake.
- The Queen Elizabeth II Wildlands Provincial Park is a 33,505 hectare natural environment class park (meaning non-operating Park with no maintained public facilities or services), that exists along the north shore of Head Lake. This park has increased in popularity in recent years thus there is a need to ensure that visitors and human disturbances are managed to maintain the ecological integrity of the ecosystem. A proactive plan is needed to manage expectations for these lands.

Priority areas

- Fishes that important to the recreational fishery (walleye, smallmouth bass, and muskellunge), and invasive fish species.
- Queen Elizabeth II Wildlands Provincial Park boundaries, including Head Lake access points.

Lead and (partner) implementers

- Ontario Ministry of Natural Resources and Forestry; (local anglers; local residents)

Deliverables

- Implement the *Fisheries Management Plan for Fisheries Management Zone 17* on Head Lake, specifically the actions listed below:
 - Identification of critical spawning locations for Walleye, Muskellunge, and Smallmouth Bass.
 - Monitor the fisheries and aquatic ecosystems as they continue to change in response to environment variables.
 - Monitor angler harvest and effort through creel surveys or other means.
 - Monitor for the presence of aquatic invasive species and pathogens as a component of the Broad-scale monitoring program.
 - Report on the State of the Resource based on results of the Broad-scale Monitoring program and other monitoring initiatives.
 - Develop plain-language information materials associated with management actions that can be taken and their potential effectiveness.
- Develop a management plan for the crown lands of Queen Elizabeth II Wildlands Provincial Park to ensure that human uses are compatible in terms of protecting the important features and functions of the lands. Strategies are need for the following:
 - Managing visitor access locations.
 - Maintaining healthy and unique biological features and ecosystems within the park.

3.4 Urban and Rural Infrastructure Strategy

A significant focus of this strategy is the ongoing management of public lake-access areas and minimizing the potential impacts associated with construction projects, including road maintenance. These are primarily municipal responsibilities, with emphasis on enhanced control of stormwater, water quality and quantity, soil erosion, and maintenance of public spaces. Shoreline residents involved in construction projects (e.g., undertaking home and property upgrades) are similarly responsible for ensuring that their activities are not detrimental to the health of the lake.



*Annual spring flooding along an access road to the northwest shoreline of Head Lake
(Baker Rd., adjacent to the Head Lake outlet, May 2017)*

Action C1: Management of public lake-access areas

Maintain safe and accessible public lake-access locations by improving water quality at the beach, addressing flooding along Baker Rd., and managing parking near the boat launch.

Priority

- High

Rationale

- Public access to Head Lake provides a primary connection to the lake. There are two public road-access locations. The primary access is at the south shore of Head Lake along Monck Rd. (CKL Rd. 45). This public property has a launch and a public beach. The public beach is, on average, posted as unsafe for swimming approximately once every year due to high *E.coli* levels. The specific cause of occasional high *E.coli* levels are not well understood, but likely include a combination of factors including bird feces, pet feces, stormwater runoff over developed areas, and warm, shallow waters. Active management of this public space is needed to increase public safety and enjoyment. The other public launch access exists along Suter Dr. Local residents have expressed their concern regarding crowding parking along the access road and potential safety concerns (e.g., access and egress of EMS). Further, sections of Baker Rd. are periodically flooded during spring high water events. This road provides the only passage to properties along the west and north shore of Head Lake and being unpassable is of serious concern.

Priority areas:

- Public beach along Monck Rd.
- Baker Rd. along west shore of Head Lake.
- Public boat launch along Suter Dr.

Lead and (partner) implementers

- City of Kawartha Lakes; local residents (Haliburton, Kawartha, Pine Ridge District Health Unit)

Deliverables

- Within a five-year period, achieve a target of 100% (no postings in any given year) reduction in the amount of time that public beach is posted as unsafe for swimming.
 - Conduct routine maintenance 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 for waters that drain into the swimming area.
 - Implement ways to deter birds in the beach vicinity, such as creating and maintaining tall vegetation or wider buffers.
- Consider various means to mitigate the flooding risk of Baker Rd., by identifying and addressing the causes of flooding (e.g., poor drainage, lake level increases, etc.), to ensure year-round access. Undertake emergency response planning in case of stranded property owners.
- Consider various means to manage congestion along public access road to Suter Dr. launch, for example:
 - Onsite signage to control parking.
 - Upgrading road infrastructure to accommodate expected usage.
 - Decommissioning public launch.
 - Directing users to primary access location along Monck Rd.
- Inventory all navigation aids on Head Lake that are intended to mark in-water hazards, and address deficiencies in terms of meeting Transport Canada policy standards.

Action C2: Responsible construction practices

Ensure that construction projects, particularly road maintenance and waterfront property development works, are conducted in a manner that does not degrade water quality or sensitive habitats.

Priority

- Medium

Rationale

- Routine maintenance of drainage ditches along road networks is often needed to remove the build-up of silt and sediments and to upgrade aging culverts. 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 lake, 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:

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

Lead and (partner) implementers

- City of Kawartha Lakes; watershed residents; (construction industry)

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.

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 lake. 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 is more likely to come on board.



*Kawartha Conservation staff sampling aquatic invertebrates at the outlet of Rush Lake
(Monck Rd., July 2016)*

Action D1: Citizen science and volunteer-based lake monitoring

Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species.

Priority

- High

Rationale

- Routine collection of lake and watershed data provides critical information about the ongoing state of Head Lake and Rush Lake, and also helps to monitor progress on achieving the planning objectives while allowing early detection of water quality or aquatic health improvements and/or deterioration. Citizen science refers to the collection of lake data by members of the general public, typically as part of a collaborative project with professional scientists. Two programs are particularly relevant in tracking lake health over time including the Lake Partner Program (administered by Ontario Ministry of Environment and Climate Change), and Invading Species Watch Program (administered by Ontario Federation of Anglers and Hunters and Ontario Ministry of Natural Resources and Forestry). Another opportunity is to establish a nearshore water chemistry monitoring program in partnership with Kawartha Conservation to track nutrients and other important parameters closer to shore. These programs are no charge, or low-cost, and are valuable in terms of providing public engagement opportunities while obtaining meaningful data on lake health.

Priority areas

- The open waters of Head Lake and Rush Lake
- Waters of Head Lake and Rush Lake that are adjacent to public access points and developed areas

Lead and (partner) implementers

- Head Lake Associations; Head Lake residents; (Ontario Federation of Anglers and Hunters; Ontario Ministry of Natural Resources and Forestry; Federation of Ontario Cotters' Associations; Ontario Ministry of Environment and Climate Change)

Deliverables

- Undertake routine sampling of key water quality parameters (e.g., nutrients and water clarity) by participating in the Lake Partner Program.
 - Maintain Lake Partner Program sampling on Head Lake. There is currently an active sampling location (routine data collection since 2007).
 - Establish Lake Partner Program sampling on Rush Lake. There is currently no active sampling (most recent data is from 2006).
- Undertake routine sampling of aquatic invasive species (e.g., zebra mussels, spiny water flea, etc.) by participating in the Invading Species Watch Program.
 - Establish multiple sampling locations on Head Lake and Rush Lake, particularly in waters adjacent to public access locations and developed shorelines.
 - Invasive species monitoring as per Invading Species Awareness Programs (program administered by Ontario Federation of Anglers and Hunters).
- Establish a monitoring program to sample water quality (e.g., nutrients, productivity, etc.) in the nearshore waters adjacent to developed shorelines along Head Lake and Rush Lake.

Action D2: Colonial water bird research and monitoring

Conduct research on local populations of cormorants, common terns, and herring gulls to better inform management approaches for colonial water birds.

Priority

- High

Rationale

- Active management of existing colonial water bird colonies is of particular interest to stakeholders. Shoreline residents have noted population increases in double-crested cormorant, herring gulls, and ring-billed gulls, and many consider them a nuisance. For example they are concerned about large congregations of water birds can contaminant the lake with their guano, about cormorants diminishing fish populations, about loud noises from gulls, among others. At present, there are limited data available on existing population of these species and therefore control efforts are not informed. Recent field investigations by Arnold and Oswald (2017) provided an initial insight into existing populations. These authors also noted an important finding that Head Lake supports healthy inland breeding populations of Common Tern, a species of regional importance. There is a need to improve scientific understanding of water bird colonies in Head Lake to inform management approaches to either promote conservation (e.g., common terns) or active control (e.g., cormorants).

Priority areas:

- Armstrong Island
- Other islands, and shorelines, with established water bird colonies

Lead and (partner) implementers

- (Colleges and universities; Ontario Ministry of Natural Resources and Forestry; Ontario Parks; Head Lake residents; Head Lake Associations; Environment Canada; Bird Studies Canada)

Deliverables

- Undertake collaborative research on feeding habits, nesting chronology, and productivity of cormorants and common terns, and to a lesser degree herring gulls and ring-billed gulls.
- Undertake routine monitoring of water bird populations, nesting and roosting sites, and reproductive success.
- Use data to inform management decisions that determine thresholds for acceptable natural population sizes and habitats for cormorants and common terns.

Action D3: Flow and water level monitoring

Undertake routine monitoring of, and establish a relationship between, water levels and flows in Head Lake and Rush Lake to better characterize their hydrological regime.

Priority

- High

Rationale

- Water levels in Head Lake and Rush Lake are of primary interest to shoreline residents and associations. Water level regime data is available for both lakes but have a limited period of record. Data are currently being recorded by Head Lake High Shores Association at Head River Dam and Head Lake High Shores Association at the outlet of Rush Creek subwatershed, and by Kawartha Conservation at the outlet of Rush Lake (2014-2017 only). More data is needed to better characterize water level regime (e.g., high/low water levels, amount of time in acceptable water levels, etc.) to inform management approaches including: keeping development away from flood-prone shorelines, Head River dam management, and climate change vulnerability assessments. A Hydro-technical evaluation of the Head River Dam provided the most recent data towards modelling variations in water levels from various dam management and hydrological scenarios.

Priority areas

- Head Lake
- Head River dam (Head River)
- Rush Lake

Lead and (partner) implementers

- Head Lake Associations; Head Lake residents; Ontario Ministry of Natural Resources and Forestry; Ontario Parks

Deliverables

- Maintain routine monitoring of water levels at the Head Lake dam on Head River; enhance data quality by establish a permanent benchmark/reference point.
- Establish a monitoring program to routinely collect data on water levels in Head Lake and Rush Lake, for example:
 - Install a fixed water level monitoring device (e.g., staff gauge, level logger, etc.) with a known benchmark along public property, for example on Baker Rd. (Head Lake outlet; note already one present) and on Monck Rd. (Rush Lake outlet).
 - Record water levels continuously or during various hydro-periods of interest (e.g., high levels, low levels, average levels, etc.) into a secure database that has some QA/QC;
- Establish relationships between water levels and water flows (also known as a rating curve) by periodically measuring flow discharge passing through water level monitoring sites during various hydro-periods of interest (e.g., high flows, low flows, average flows, etc.).
- Use water level and flow data to characterize acceptable water level and flow conditions, and to inform management thresholds.
- Refine existing maps showing flood-prone areas along Head Lake and Rush Lake; consider refining digital elevation mapping to better estimate extent of inundated areas.

Action D4: Septic system questionnaires

Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations.

Priority

- Medium

Rationale

- Septic systems around the lake are estimated to contribute approximately X%, or X kg/year, of the total nutrient (phosphorus) loading into Head Lake, and is considered a manageable source of pollution. This value is estimated based on generalized values from research undertaken in Ontario on key inputs such as: number and type of dwellings along the shore, age and type of septic system, average dwelling occupancy and water usage per year, among others. Local data is lacking and is needed to refine these estimates to obtain more accurate loading estimates that are specific to Head Lake.

Priority areas

- All septic systems within 100m of Head Lake and Rush Lake

Lead and (partner) implementers

- Head Lake Associations; Head Lake residents; (City of Kawartha Lakes; Kawartha Conservation)

Deliverables

- Distribute a questionnaire to all property owners around Head Lake and Rush Lake, to obtain information specific to septic systems, including detailing:
 - Septic system type, proximity to lake, year of construction, and other information related to the functioning of the structures.
 - Water use rates, dwelling occupancy, and other information related to wastewater usage.
 - Soil composition, soil depth, property slopes, and other information related to nutrient pathways to the water.
- Use the results of the questionnaire to refine nutrient loading calculations to obtain a better estimation of nutrient inputs from shoreline septic systems.

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.

Priority

- Medium

Rationale

- The key driver for the proposed research is the anticipated increase of intensification, of development along the shorelines of Head Lake and Rush Lake and the consequent pressures on the lake ecosystem. There is an urgent need to improve scientific understanding about the influence of shoreline development on lake health - particularly within the context of other stressors such as climate change and invasive species - so that appropriate management responses may be developed.

Priority areas:

- Potential impacts of expanding cormorant colonies
- Cumulative development along shorelines,
- Climate change, and
- Invasive species in aquatic ecosystems.
- Proposals for industrial development (within 1km of the lake).

Lead and (partner) implementers

- (Colleges and universities; Ontario Ministry of Natural Resources and Forestry; Ontario Ministry of Environment and Climate Change; Ontario Parks; watershed residents; City of Kawartha Lakes; Kawartha Conservation; First Nations; watershed residents)

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 a climate change vulnerability assessment.
- Conduct research to identify lake and watershed health thresholds and carrying capacity.
 - An example is the Lakeshore Capacity Handbook (Province of Ontario, 2010), a modelling tool applicable to Ontario lakes on the Canadian Shield that predicts lake water quality based on the amount of shoreline development. Note this tool was tested on neighbouring Four Mile Lake, but unfortunately it was not successful in predicting existing water quality conditions based on existing shoreline development, thus this tool may also not be suitable for Head Lake or Rush Lake.
- 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.

3.6 Communications and Outreach Strategy

Communication and outreach help set the Head Lake and Rush 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 lake and its subwatersheds; 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.

Many people have a stake in the implementation of the Head Lake and Rush 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, lake associations, road monitors, 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.



*Head Lake Management Plan public open house
(Coboconk, 2017)*

Action E1: Keeping stakeholders informed and engaged

Communicate the science, solutions, and outcomes of plan implementation among all active stakeholders in the Head Lake watershed.

Priority

- 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

- Watershed residents, and groups active around/on the lake

Lead and (partner) implementers

- Head Lake residents; Head Lake Associations; (watershed Residents; Kawartha Conservation; City of Kawartha Lakes; Ontario Parks; Ontario Ministry of Natural Resources and Forestry; developers and contractors; Federation of Ontario Cottagers' Associations)

Deliverables

- Ongoing liaising with all active stakeholders (e.g., various Lake Associations, OMNRF Bancroft – Minden, Ontario Parks, City of Kawartha Lakes, among others).
- Make available all relevant report and studies that are related to Head Lake to local residents; consider digitally compiling reports and posting online within a central location (e.g., Head Lake Associations websites, etc.).
- Distribute lake-based information to new lakeshore residents, for example through a “new residents’ package”.
- Distribute reports on monitoring results, implementation of stewardship actions, impacts of actions, and other changes in the watershed.
- Provide updates via newsletters, social media, local media, and budgets.
- Maintain a web page for lake management planning to host reports, updates, and related resources.
- Develop infographics and posters that include facts and findings about Head Lake, issues and solutions, ecological connections, and human-environment relationships. The graphics should be professionally designed and suitable for hanging in cottages, offices, and other settings; for posting online; and for distributing through social media.
- Host periodic workshops, with subject experts, on specific areas of focus that are of significant interest to local residents, for example:
 - Invasive species management.
 - Septic system management.
 - Colonial water bird management.
 - Water well and water intake management.
- Use annual meetings of local organizations (e.g., meeting of various Head Lake Associations) to review lake monitoring programs and discuss regional projects of interest to their membership.
- Maintain representation from Head Lake on the Community Advisory Panel membership.

Action E2: Profile the ecological significance of the watershed

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

Priority

- Medium

Rationale

- Many significant natural and cultural features make up Head 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 Head Lake as a desirable place to visit and invest.

Priority areas

- Queen Elizabeth II Wildlands Provincial Park public access locations
- Head Lake public launches and beach

Lead and (partner) implementers

- City of Kawartha Lakes; Head Lake Associations; (watershed residents; Kawartha Conservation; Federation of Ontario Cottagers' Associations; First Nations)

Deliverables

- Use interpretive signage along public access areas and within Queen Elizabeth II Wildlands Provincial Park to profile various issues of interest, including: unique biological values and ecosystems, habitat stressors, access locations, among other items
- Contribute information about the lake and its natural features to tourism-focused and other communication sources that profile the City of Kawartha Lakes and Head Lake and Rush 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.
- Build a strong brand for the Plan that signifies shared responsibility, community effort, science-based programming, cultural significance, and ecological, community, and economic ties.
- Profile the connections between protected lands (e.g., Queen Elizabeth II Wildlands Provincial Park) and maintaining healthy lakes.
- Communicate to residents the need to not disturb the Common Tern populations during nesting season.

3.7 Moving To Implementation

The *Head Lake and Rush Lake Management Plan* provides a solid framework for a coordinated approach to maintaining a healthy lake and subwatersheds 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. Fortunately Head Lake Associations' are well-coordinated group of individuals that have a keen interest in taking an active role in managing their lake resources.

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 *Head Lake and Rush 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 Head Lake and Rush 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 *Head Lake and Rush 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.

References

- Aqua Geomatics Consultants Limited. 2017. Head Lake Dam Hydro-Technical Study. Prepared for Ontario Parks.
- Arnold, J.M., and S.A. Oswald. 2017. Common terns (*Sterna hirundo*): regional context and survey of colonies on Head Lake, City of Kawartha Lakes. Technical Paper. Available from Ontario Parks staff.
- B.M. Ross Associates and Township of Huron-Kinloss. 2014. Huron-Kinloss Community Septic Inspection Program Cycle 1 Report. BM Ross and Associates Ltd.
- City of Kawartha Lakes. (2012). *City of Kawartha Lakes Official Plan*. Lindsay, Ontario. Retrieved from http://www.city.kawarthalakes.on.ca/property-development-by-law/planning/official-plans-zoning-by-law/CKL_2012_Official_Plan_Text_With_Appeals_Noted.pdf
- City of Kawartha Lakes. (Draft, 2013). Our Kawartha Lakes Integrated Community Sustainability Plan. Lindsay, Ontario. Retrieved from https://www.city.kawarthalakes.on.ca/environment/our-kawartha-lakes-sustainability-plan/Kawartha_ICSP_Final_Draft.pdf
- Environment Canada. 2013. *How Much Habitat is Enough?* (Third Edition). Toronto, Ontario. Retrieved from http://www.ec.gc.ca/nature/E33B007C-5C69-4980-8F7B-3AD02B030D8C/894_How_much_habitat_is_enough_E_WEB_05.pdf
- ESRI Canada. 2016. Business Analyst GIS Desktop Tool. Data from 2013 census information.
- Gartner Lee and French Planning Services. (2002). *Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes*. Lindsay, Ontario. Retrieved from <https://www.city.kawarthalakes.on.ca/property-development-by-law/planning/studies-reviews/report.pdf>
- Kawartha Conservation. (2017 DRAFT). Head Lake and Rush Lake Watershed Characterization Report. Lindsay, Ontario. Retrieved from <http://www.kawarthaconservation.com/library>
- Kirkconnell, W. 1921. Victoria County Centennial History. Watchman-Warder Press.
- Le Crow, F.V. 1967. The Land Between. A History of the United Townships of Laxton, Digby and Longford. 247 pages. Privately published.
- Makarewicz, J.C., T. W. Lewis, M. Winslow, E. Rea, L. Dressel, D. Pettenski, B.J. Snyder, P. Richards, and J. Zollweg. 2015. Utilizing intensive monitoring and simulations for identifying sources of phosphorus and sediment and for directing, siting, and assessing BMPs: The Genesee River example. *Journal of Great Lakes Research*. 41(3): pp. 743-759.
- MOE (Ministry of the Environment). 1972. Report on water quality in Head Lake 1972.
- Ontario Ministry of Natural Resources. (2009). *Fisheries Management Plan for Fisheries Management Zone 17*. Peterborough District. Peterborough, Ontario. Retrieved from <https://www.ontario.ca/travel-and-recreation/fisheries-management-zone-17-fmz-17>
- Ontario Ministry of Natural Resources. (Draft, 2013). Kawarthas, Naturally Connected Natural Heritage Systems Strategy. Retrieved from <http://www.kawarthasnaturally.ca/wp-content/uploads/2012/04/KNC-Phase1-Report.pdf>

Ontario Ministry of Environment and Energy. (1994). *Water Management: Policies, Guidelines, Provincial Water Quality Objectives*. Toronto, Ontario. Retrieved from <https://dr6j45jk9xcmk.cloudfront.net/documents/3016/moe provincial water quality objectives en.pdf>

Province of Ontario. 2010. *Lakeshore Capacity Assessment Handbook - Protecting Water Quality in Inland Lakes on Ontario's Precambrian Shield*. Prepared by Ministry of the Environment, Ministry of Natural Resources, and Ministry of Municipal Affairs and Housing.

Steinman, A. D., E. S. Isely, and K. Thompson. 2015. Stormwater runoff to an impaired lake: impacts and solutions. *Environmental Monitoring & Assessment*. 187(9).

The Panel on the Future of the Trent-Severn Waterway. (2008). *It's All About The Water: Report of The Panel on the Future of the Trent-Severn Waterway, A National Historic Site of Canada*. Peterborough, Ontario. Retrieved from <http://www.tswpanel.ca/english/report.asp>

Toronto and Region Conservation Authority. (2006). *Erosion and Sediment Control Guideline for Urban Construction*. Toronto, Ontario. Retrieved from <http://www.trca.on.ca/dotAsset/40035.pdf>

Appendix A: Key Communities and Stakeholders

Everyone has a role to play in maintaining a healthy Head Lake and Rush 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 Treaty First Nations
Federal Government	Fisheries and Oceans Canada; Transport Canada
Provincial Government	Ministry of Natural Resources and Forestry (Bancroft District, Science and Research Branch); Ontario Parks (Queen Elizabeth II Wildlands Provincial Park); 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; Haliburton, Kawartha, Pine Ridge District Health Unit; County of Haliburton; Township of Minden Hills
Stewardship Groups	Kawartha Lake Stewards Association; Soil and Crop Improvement Association (Environmental Farm Plan); Ontario Nature; Kawartha Field Naturalists; Ontario Federation of Anglers and Hunters; Ducks Unlimited; Kawartha Land Trust; Kawartha Conservation; City of Kawartha Lakes Environmental Advisory Committee; 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	Head Lake Stewardship Group (Head Lake North Shore Association; Hilton Point Cottage Association; Sunset Beach Cottage Association; Head Lake High Shores Association; Rush Lake residents); Head Lake watershed residents; Rush Lake watershed residents; Federation of Ontario Cottagers' Associations
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	Scouts Canada, Lindsay Bassmasters, Head Lake airport, Muskies Canada, Boys & Girls Clubs of Kawartha Lakes, and others

Appendix B: Existing Planning Initiatives

A number of current management planning initiatives relate to the *Head Lake and Rush Lake Management Plan* goal of maintaining a healthy and sustainable Head 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.
- Official Plans for City of Kawartha Lakes. 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. Currently Head Lake is listed as a Special Policy Areas within the Official Plan, with accompanying unique land use policy.
- 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 Head 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.
- Report on Water Quality in Head Lake (MOE, 1972). This comprehensive evaluation of water quality conditions, and nutrient enrichment status of Head Lake was undertaken by the provincial government. This report provided multiple recommendations to lessen water quality contaminants including nutrients and bacteria.
- 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.
- 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*, *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 Priority

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	Priority
	#1	#2	#3	#4	#5			
STEWARDSHIP STRATEGY								
A1: Undertake responsible management of septic systems, including routine inspections, along shoreline properties.	2	3	3	3	2	13	2.6	High
A2: Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lake and its watershed.	3	3	3	3	1	13	2.6	High
A3: Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties.	3	3	3	2	2	13	2.6	High
A4: Maintain the natural features along the shoreline.	3	3	3	3	2	14	2.8	High
A5: Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats.	2	3	3	2	1	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	1	1	1	7	1.4	Low
STRATEGIC PLANNING STRATEGY								
B1: Establish thresholds/criteria for acceptable water levels and identify ecological and socio-economic impacts associated with water level management.	2	3	3	3	3	14	2.8	High
B2: Undertake responsible development planning within	3	3	3	2	2	13	2.6	High

the watershed, and particularly along the shoreline.								
B3: Undertake actions within the Fisheries Management Plan for Fisheries Management Zone 17, and develop a management plan for Queen Elizabeth II Wildlands Provincial Park.	2	3	3	2	2	12	2.4	Medium
URBAN AND RURAL INFRASTRUCTURE STRATEGY								
C1: Maintain safe and accessible public lake-access locations by improving water quality at the beach, addressing flooding along Baker Rd., and managing parking near the boat launch.	2	3	3	3	2	13	2.6	High
C2: Ensure that construction projects, particularly road maintenance and waterfront property development works, are conducted in a manner that does not degrade water quality or sensitive habitats.	3	2	3	2	1	11	2.2	Medium
RESEARCH AND MONITORING STRATEGY								
D1: Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species.	3	3	3	3	2	14	2.8	High
D2: Conduct research on local populations of cormorants, common terns, and herring gulls to better inform management approaches for colonial water birds.	2	3	3	3	2	13	2.6	High
D3: Undertake routine monitoring of, and establish a relationship between, water levels and flows in Head Lake and Rush Lake to better characterize their hydrological regime.	3	3	3	3	1	13	2.6	High
D4: Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations.	2	3	3	3	1	12	2.4	Medium
D5: Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species.	3	2	2	2	2	11	2.2	Medium
COMMUNICATIONS AND OUTREACH STRATEGY								
E1: Communicate the science, solutions, and outcomes of plan implementation among all active stakeholders in the Head Lake watershed.	3	3	3	3	3	15	3	High
E2: Profile the natural heritage features, social values, and economic values associated with Head Lake, including a long-term vision for the lake and a shared sense of responsibility to protect it.	2	3	3	3	1	12	2.4	Medium