



# Hutchinson

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Environmental Sciences Ltd.

Review and Analysis of Existing  
Approaches for Managing  
Shoreline Development on Inland  
Lakes

Prepared for: Ontario Ministry of the Environment and Climate Change  
Job #: J140010

August 22, 2014

## Final Report

Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

August 22, 2014

HESL Job #: J140010

Eleanor Stainsby  
Ontario Ministry of the Environment and Climate Change  
125 Resources Road  
Etobicoke, ON M9P 3V6

Dear Ms. Stainsby:

Re: EMRB-BIO-1314-01 – Review and Analysis of Existing Approaches for Managing Shoreline Development on Inland Lakes – Final Report

We are pleased to submit our final report, "Review and Analysis of Existing Approaches for Managing Shoreline Development on Inland Lakes". This report addresses comments from the MOECC on our previous draft reports dated June 10, 2014 and July 31, 2014.

The report includes the results of a jurisdictional scan, and associated reference tables intended to summarize the details of various jurisdictions that were reviewed for our study and initial conclusions and recommendations. The approaches were generally focused on managing shoreline development through lake capacity assessment, mitigation by best management practices and/or lake classification. Each of these general approaches was described and analyzed for potential use to improve the management of shoreline development on inland lakes in Ontario to achieve a more holistic approach in Ontario's unique lake and planning environments.

It has been a pleasure working with you to complete this most interesting assignment.

Sincerely,  
Hutchinson Environmental Sciences Ltd.


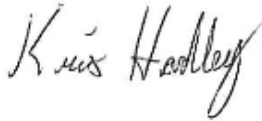




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## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

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## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

## Executive Summary

A jurisdictional scan was completed for fourteen jurisdictions located in Ontario, Nova Scotia, British Columbia and the USA to identify and describe technical and planning approaches to the management of shoreline development in order to guide future initiatives in the Province of Ontario. Common elements of the approach in each jurisdiction, including scientific tools and policy and regulatory approaches, were analyzed and evaluated in terms of their success and potential for application in Ontario through the following considerations:

- ❖ Application at various levels of planning organization (i.e., unorganized areas vs. organized municipalities),
- ❖ Application across a range of geographic conditions and lake characteristics,
- ❖ The focus of the policies and their supporting technical basis,
- ❖ Application within the context of Ontario's Provincial Policy Statement (PPS), and
- ❖ Resource requirements for implementation and follow up monitoring and performance measures.

The level of detail gathered for the scan varied substantially between jurisdictions and was largely dependent upon the availability of documentation online and direct correspondence with program staff responsible for the approach. In the end, the combined results of the jurisdictional scan were sufficient to provide an understanding of the variety of approaches used, the benefits of various shoreline management tools and their potential applicability in Ontario.

The jurisdictions reviewed in the scan employ a wide variety of approaches to managing shoreline development on inland lakes with unique combinations of technical and planning tools depending on the primary focus of their management approach. Elements of one or both of two broad approaches were generally used by each jurisdiction:

1. Shoreline Management by Capacity - approaches that manage shoreline development by placing limits on the number of lots or development units based on different thresholds and densities.
2. Shoreline Management by Mitigation – approaches that rely on the implementation of Best Management Practices (BMPs) including minimum development standards to mitigate impacts of shoreline development.

Lake classification has been successfully enforced through policy in many Ontario jurisdictions at a regional level as a screening tool to determine minimum development standards and BMPs that ultimately protect a wide variety of desired attributes. This approach is also used to identify lakes that are over capacity for phosphorus, but for which implementation of strict BMPs are used to reduce the risk of phosphorus related impacts instead of prohibiting additional shoreline development. Shoreline development is only prohibited if lakes are over capacity and are considered to be highly sensitive to additional phosphorus inputs based on results of modeling and monitoring.

Common elements used by jurisdictions in this review included:

- ❖ Capacity tools (Lakeshore Capacity Assessment, Lake Trout Policy and Recreational Carrying Capacity),



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

- ❖ Mitigation tools (e.g., stormwater management, shoreline buffers, septic system design and maintenance, minimum development standards and soils assessment),
- ❖ Screening and classification tools,
- ❖ Lake-specific management, and
- ❖ Planning, regulatory and implementation tools.

Recommendations were provided to suggest elements that could be incorporated into an approach for managing shoreline development aimed at protecting a wide range of desired attributes. Minimum development standards and associated BMPs as they are proven and accepted, are recommended to set a baseline of protection, but the implementation of additional lake management tools, including variants of the Lakeshore Capacity Assessment approach and the provincial Lake Trout policy, are also recommended to ensure that more stringent protection is achieved where the political will and financial resources permit or where more stringent control is required due to lake or watershed conditions (e.g., where development pressures are great and lake characteristics are particularly vulnerable to nutrient enrichment) and where the model can be validated. Lake classification/screening is strongly recommended as a potential approach to tailor capacity and mitigation tools to address the wide range of lake and watershed characteristics, local sensitivities and available resources and planning environments in the Province. A greater focus on mitigation would ensure that lakes are protected from impacts of shoreline development that cannot be addressed by Lakeshore Capacity Assessment alone, which is line with the focus of the new PPS.



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## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

## 1. Introduction

The Ontario Ministry of the Environment and Climate Change (MOECC) has been a pioneer in the science and planning application of the “Lakeshore Capacity” approach to the management of shorelines and density of development of Ontario’s many recreational lakes on the Precambrian Shield. In the 1980s, the Ministry of Municipal Affairs and Housing (MMAH), along with MOECC and the Ministry of Natural Resources (MNR), completed the “Ontario Lakeshore Capacity Study”. The study examined water quality (trophic status), human health (infections gained through swimming), fishing pressure, land use and wildlife habitat as factors that could, on their own, or when linked (the “Integration” module) determine a human and ecological carrying capacity for recreational lakes (Dillon et al., 1986). While the Lakeshore Capacity Study contained much valuable guidance on shoreline and capacity management, it was never formally implemented as planning policy. The trophic status component of the study, which considers changes in phosphorus concentrations from shoreline development on lake water quality, however, was revised over the years (Paterson et al., 2006) and the approach was used in practice by the Province until it was formally adopted as guidance for setting shoreline development limits on Precambrian Shield lakes in 2010 with the publication of the Lakeshore Capacity Assessment Handbook (the “Handbook”, Province of Ontario, 2010).

The Provincial approach provided in the Handbook is based on modelling phosphorus concentrations for lakes on a watershed basis and setting development capacities that limit phosphorus concentrations to a 50% increase above modelled background values. The Province does not support additional shoreline lot development on lakes that are over capacity for phosphorus except: a) to separate existing dwellings, as long as each can support a Class 4 sewage system, the land use would not change and there would be no net increase in phosphorus load to the lake, b) where municipal sewage service can be provided, c) where the septic effluent flows more than 300 m to the lake or inflowing tributary or to another lake that is not at capacity, or d) under site-specific circumstances that meet prescribed soil and water table conditions for septic systems and where municipal planning tools and agreements are in place to ensure appropriate septic system design, site planning, stormwater management and long-term monitoring.

Although the Handbook discusses and encourages the use Best Management Practices (BMPs) to mitigate some aspects of development, it provides no quantitative allowance for phosphorus reduction from overland runoff by BMPs such as site engineering, shoreline naturalization and vegetated buffer strips in the determination of shoreline development capacity. Similarly, phosphorus abatement technologies for septic systems are not yet acknowledged by the Province and all phosphorus from conventional septic systems within 300 m of a lake or inflowing tributary is considered in the capacity assessment. Some retention of septic system phosphorus by soils can be considered, however, if site-specific conditions meet prescribed soil and water table characteristics.

The Provincial Policy Statement (PPS) of 2005 issued under the *Planning Act* raised the bar in terms of compliance with Provincial interests for protecting water quality. It evolved from “having regard for” in the previous PPS, to “being consistent with” set provisions in the statement and required planning authorities to protect water quality by using a watershed approach and by minimizing the potential negative impacts of development including cross-jurisdictional and cross-watershed impacts. The Province’s Lakeshore Capacity Assessment guidelines satisfied many of the provincial interests of the PPS for Precambrian



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

Shield lakes. Changes reflected in the new PPS which came into effect April 30, 2014 further emphasize the Province's interest in protecting water quality through proper planning; namely environmental lake capacity must now be considered by planning authorities and water resource systems that require protection, improvement and restoration now include shoreline areas in addition to groundwater features, hydrologic functions, natural heritage features and areas, and surface water features.

With the experience gained over the years in development and application of the Lakeshore Capacity Assessment approach and with the provisions of the revised PPS for consideration of environmental lake capacity and shoreline areas, the Province recognizes the need to advance the practice of lake management with a more comprehensive, holistic approach for managing shoreline development that considers environmental, social and economic factors, and that is applicable to the wide range of lake characteristics, development pressures and planning environments across Ontario. The need for a more comprehensive approach in Ontario is compounded by the following factors:

- ❁ The existing approach addresses one aspect of lake capacity: the concentration of phosphorus, and resultant implications to water clarity, oxygenated hypolimnetic fish habitat and algal blooms, and does not specifically address other shoreline development concerns including:
  - Social crowding, boating, a “wilderness aesthetic” sought by recreational users, noise levels or light pollution, safe drinking water or pathogens, or
  - Protection of other lake attributes such as fish, wildlife, songbird or waterfowl habitat that are important ecologically and valued by lake residents,
- ❁ The existing approach requires accurate models of lake response to shoreline development and the models have become less reliable as we learn more about phosphorus and soil dynamics, the difficulty in providing accurate estimates of cottage usage and as watershed and lake dynamics change in response to a changing climate and invading species,
- ❁ BMPs have become increasingly important for reducing the impacts of urban and agricultural practices on runoff and water quality (i.e. CVC, 2010; Province of Ontario, 2010). As BMPs are proven and accepted they could also be implemented into lake management programs to minimize the impacts of shoreline development on water quality. Lakeshore capacity, if based on only one factor (such as total phosphorus), becomes less effective as a planning tool when BMPs are available to mitigate that factor. This concern is heightened by the emergence of phosphorus abatement technologies that could effectively remove phosphorus as a concern from domestic septic systems, should they be proven and accepted for this purpose by the Province.
- ❁ Land use planning policies in Ontario's recreational lake areas evolved over several decades prior to the 2010 Lakeshore Capacity Assessment Handbook (Province of Ontario, 2010), and so are not consistent. This has led to uncertainty in how lake capacity is managed province-wide. The guidance provided in the Lakeshore Capacity Assessment Handbook was intended to set a minimum provincial standard to address this through management of one aspect, namely phosphorus loading to a lake. The existing approach is specific to recreational lakes on the Precambrian Shield and is not widely applicable to the range of lake and watershed characteristics and variable development pressures that exist across the Province.
- ❁ Many municipalities and unorganized areas have limited planning staff and lack technical resources and funding to implement the existing provincial guidance.
- ❁ The existing approach relies on years of data and technical expertise that local planning authorities may not have when making their planning decisions.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

This study reviews existing approaches used by other jurisdictions in North America for managing shoreline development on inland lakes and analyzes those approaches and their technical and planning tools for their overall effectiveness and suitability for potential implementation in Ontario.

## 2. Approach

A comprehensive scan was completed for select jurisdictions in North America that have established approaches for managing shoreline development on inland lakes. The jurisdictions were selected by the consultant team, with input from the MOECC at the outset of the project to include jurisdictions that implement different, innovative approaches and that had a variety of scopes, priorities, and financial and technical resources so that an assortment of management tools could be assessed for potential use across the varied physical and planning landscape of Ontario.

The 14 jurisdictions selected for the jurisdictional scan<sup>1</sup> included:

- ❁ Cariboo Regional District (BC)
- ❁ City of Elliot Lake (ON)
- ❁ City of Kenora - Black Sturgeon Lake (ON)
- ❁ District Municipality of Muskoka (ON)
- ❁ Halifax Regional Municipality (NS)
- ❁ Lake Simcoe – Lake Simcoe Protection Plan (ON)
- ❁ Rideau Valley Conservation Authority (ON)
- ❁ Township of Muskoka Lakes (ON)
- ❁ Township of Seguin (ON)
- ❁ State of Maine (US)
- ❁ State of Minnesota (US)
- ❁ State of New Hampshire (US)
- ❁ State of Vermont (US)
- ❁ State of Wisconsin (US)

The jurisdictional scan aimed to answer a suite of questions regarding technical framework, planning, regulatory and implementation approaches and BMPs used by each jurisdiction for managing shoreline development (Table 1). These questions were answered based on a review of pertinent technical and planning documents and where possible, telephone or email correspondence with representatives from each jurisdiction. Answers to the questions from the scan are provided in a summary table (Appendix A). References to technical and planning documents reviewed in the scan and contact information for each jurisdiction is provided in an Overview Table (Appendix B). Appendix B also includes digital copies of these documents.

<sup>1</sup> The City of Greater Sudbury and the District Municipality of Muskoka were nearing the end of processes to develop (Sudbury) and revise (Muskoka) their lakeshore management policies during preparation of this review. The results of these exercises were known to the reviewers but are not discussed herein as they had not yet been approved or implemented. The approach described for Muskoka was that which was approved in 2005.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

Table 1. Jurisdictional Scan Questions

<b>Program Framework</b>
What does the jurisdiction seek to protect? (e.g., environmental, community, social and economic values)
Is this done through limiting development or use (capacity approach) or managing how lakes are developed and used (mitigation approach)?
What is the range of characteristics of the lakes that are managed? (e.g. geological setting, climate regime, fish communities, lake area, watershed size, lake depth, mixing regime, trophic state, wetland influence, proximity to population, population growth, shoreline development occupancy, level of development stress, sewage servicing, land use)
What is the indirect attribute managed? (e.g., water quality, algal blooms, boating capacity, fish and wildlife habitat)
What are the direct attributes managed? (e.g., phosphorus, shoreline availability, social density, boating activity, dissolved oxygen, buffer zones)
What is the management target/performance indicator?
How does the program accomplish this?
What information is required for the program? (e.g. planning information, lake attributes)
Are there monitoring requirements? If yes, what are they and who is responsible for monitoring?
What scientific support is provided for the approach and by whom?
What scientific and planning principles inform the program?
Does the program address its goal in a watershed context? If so, how is this achieved? What are the specific challenges?
Are landscape features and lake characteristics comparable to those in Ontario? What are the similarities/differences?
Has the original scientific merit been borne out in practice? What has worked and what has not? Are the intended attributes protected and stable?
What important attributes are not addressed by the program?
What indirect policies and programs might address these other issues?
Does this jurisdiction intend to change its approach? If so, what is the most pressing factor to address?



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

Table 1. (continued)

Planning, Regulation and Implementation Tools
What is the primary legislative authority governing shoreline development?
Are there implementation guidelines for the legislation?
What is the major thrust of the planning policy? (e.g., tree preservation, setbacks, density limitation, no development, natural areas preservation)
Is the Planning Policy currently under review?
What Implementation tools are used? (e.g., zoning, site plans, development permits, specialized bylaws)
What enforcement mechanisms are used?
Are there Special Purpose Bodies involved in the management of shoreline development?
What are the key decision making processes?
Has the program been adopted across the jurisdiction? If no, what barriers have been identified?
What levels of government are involved and what are their specific roles?
What mechanisms are used for inter-jurisdictional decision making and collaboration?
Is there a feedback mechanism to determine if implementation is successful? If not, what are the challenges?
Is there an appeal process to resolve disputes?
What was the initial cost to implement the program?
What are the annual costs of the program? (e.g., for planning, monitoring, program updates/revisions)
Who bears the costs? (e.g., government, developers, lake residents, non-government organizations)
What funding resources are available for implementation of programs?
What staff resources are available for implementation of programs? (e.g., in-house staff, consultants)
What are the key documents that describe or provide guidance for the program? Can these be provided?
Best Management Practices (BMPs)
How are BMPs specifically addressed in the approach?
What BMPs are considered and how are they chosen?
Are performance measures tracked?
What was the initial cost to implement the BMPs?
What are the annual costs? (e.g., maintenance, monitoring, inspection)
Who bears the costs? (e.g., government, developers, lake residents, NGOs)

The components of each jurisdiction's approach were analyzed and evaluated in terms of their success and potential for application in Ontario through the following considerations:

- Application at various levels of planning organization (i.e., unorganized areas vs. organized municipalities),
- Application across a range of geographic conditions and lake characteristics,
- The focus of the policies and their supporting technical basis,
- Application within the context of Ontario's Provincial Policy Statement, and
- Resource requirements for implementation and follow up monitoring and performance measures.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

### 2.1 Review Challenges

The successes and challenges of the approaches that were reviewed were difficult to characterize. Lakes are susceptible to a large variety of stressors beyond lakeshore development; lakeshore development can impart a wide variety of stressors on lakes; and monitoring cannot account for all of these causes and effects. While several programs have adopted monitoring programs to track program success, the results of the programs were not always clearly linked to program goals upon which to evaluate success.

One problem with the technical assessment of various approaches was the lack of good evidence of their success in protecting the desired attributes. Comprehensive and reliable lake monitoring programs have only been developed over the past 20 years as low level analytical techniques for phosphorus have become standard and available, or widespread regional programs have been implemented (i.e., Ontario's Lake Partner program). Recreational shoreline development in North America was most pronounced in the 1950s, 60s and 70s, prior to systematic monitoring initiatives, and has taken place against a background of multiple changes – regrowth of forests following timber harvest, conversion of farmland to recreational use, implementation of communal sewage treatment for rural lake municipalities and, more recently, climate change and invading species. Although several jurisdictions maintain policies to manage social capacity, the success of these policies is difficult to assess by objective processes. Shoreline protection (i.e., buffer strips, vegetation protection or setbacks) is not systematically monitored or enforced.

As such, our assessment of lakeshore management approaches was focussed on the technical merit and background information supporting the approaches of various jurisdictions and the planning tools available to implement their approaches, with the understanding that the implementation of effective and proven approaches is the key to protecting the desired lakeshore attributes.

Successes and challenges of the jurisdictional approaches were described, when possible, through correspondence with representatives from the various jurisdictions. In several instances, however, they could not provide an opinion for fear of upsetting their colleagues or programs, or they felt uncomfortable providing an overall opinion because of varying success that is dependent on local planning and environmental factors. Successes and challenges were included where possible, but in Section 3.0 an evaluation of the various approaches was also completed through an independent assessment of the merits of each approach from both a technical and planning perspective.

The level of detail gathered for the scan varied substantially between jurisdictions and was largely dependent upon the availability of documentation online and direct correspondence with program staff responsible for the approach. In the end, it was not always possible to answer many of the questions provided in Table 1, especially for jurisdictions located outside of Ontario that we were not as familiar with. The combined results of the jurisdictional scan, however, were sufficient to provide an understanding of the variety of approaches used, the advantages and disadvantages of various shoreline management tools and potential applicability of the approaches for use in Ontario.



### 3. Jurisdictional Approaches to Shoreline Management

The jurisdictions reviewed in the scan employ a wide variety of approaches to managing shoreline development on inland lakes (Figure 1). Many similarities were found in jurisdictions in proximity to each other (e.g. Ontario<sup>2</sup>, northeastern United States), but all approaches contained unique combinations of technical and planning tools. The following sections provide an overview of the approaches taken for each jurisdiction included in the scan highlighting the general characteristics of the lakes and their landscapes, the technical, planning and implementation tools that are employed, the use of BMPs where applicable and the overall success and challenges of the approach based on available documentation and opinion of program contacts.

#### 3.1 Cariboo Regional District

Cariboo Regional District (CRD), British Columbia (BC) was chosen for review because it provides an example of an approach that is used in a sparsely populated area, like several areas in Ontario, with limited municipal staff and services. The CRD's Shoreland Management Policies have been in place since 1983 and were updated in 2004 and are structured around six key objectives:

- ❁ Preservation of the water quality of lakes and watercourses within the district,
- ❁ Managing of shoreland development to preserve the integrity and capability of existing aquatic and shoreland environmental resources for wildlife habitat,
- ❁ Preserving the aesthetic quality of the natural setting by integrating shoreland developments with the natural surroundings,
- ❁ The protection of shorelands from erosion and degradation,
- ❁ To provide shoreland access to the general public where appropriate and to reduce conflict with adjacent landowners.
- ❁ To determine suitable areas for shoreland development. (CRD, 2004)

The CRD does not impose capacity limits to shoreline development but instead aims to meet these six objectives through the combination of site-specific design criteria for septic systems (see Section 3.1.1 below) established by a lake classification system, and mitigation through the use of BMPs (Section 3.1.3).

##### 3.1.1 Lake and Watershed Characteristics

The CRD is a large, sparsely populated (66,000) region in central BC that covers an area 80,629 km<sup>2</sup> from the Cariboo Mountains in the east to the Coastal Mountains in the west. The area is primarily forested (coniferous forests of the sub-boreal spruce and interior douglas fir biogeoclimatic zones) with pockets of agriculture and ranching, land clearance for logging, and minor development.

<sup>2</sup> Some similarities likely reflect bias in aspects of the approach – Ontario jurisdictions were selected, in part, based on personal knowledge of jurisdictions that had implemented shoreline development policies. HESL staff helped develop lakeshore development policies prior to 1998 while employed by MOECC and had worked with municipalities over the past fifteen years to develop their lakeshore development programs. As a result, many shared similar approaches or variants of a similar approach. These would include the District Municipality of Muskoka, Seguin Township, the City of Elliot Lake, and the City of Kenora.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

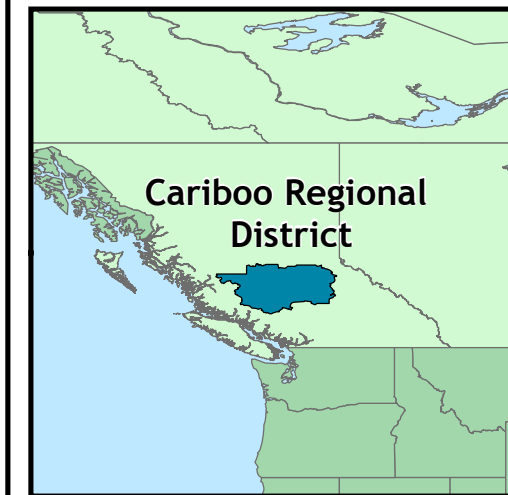
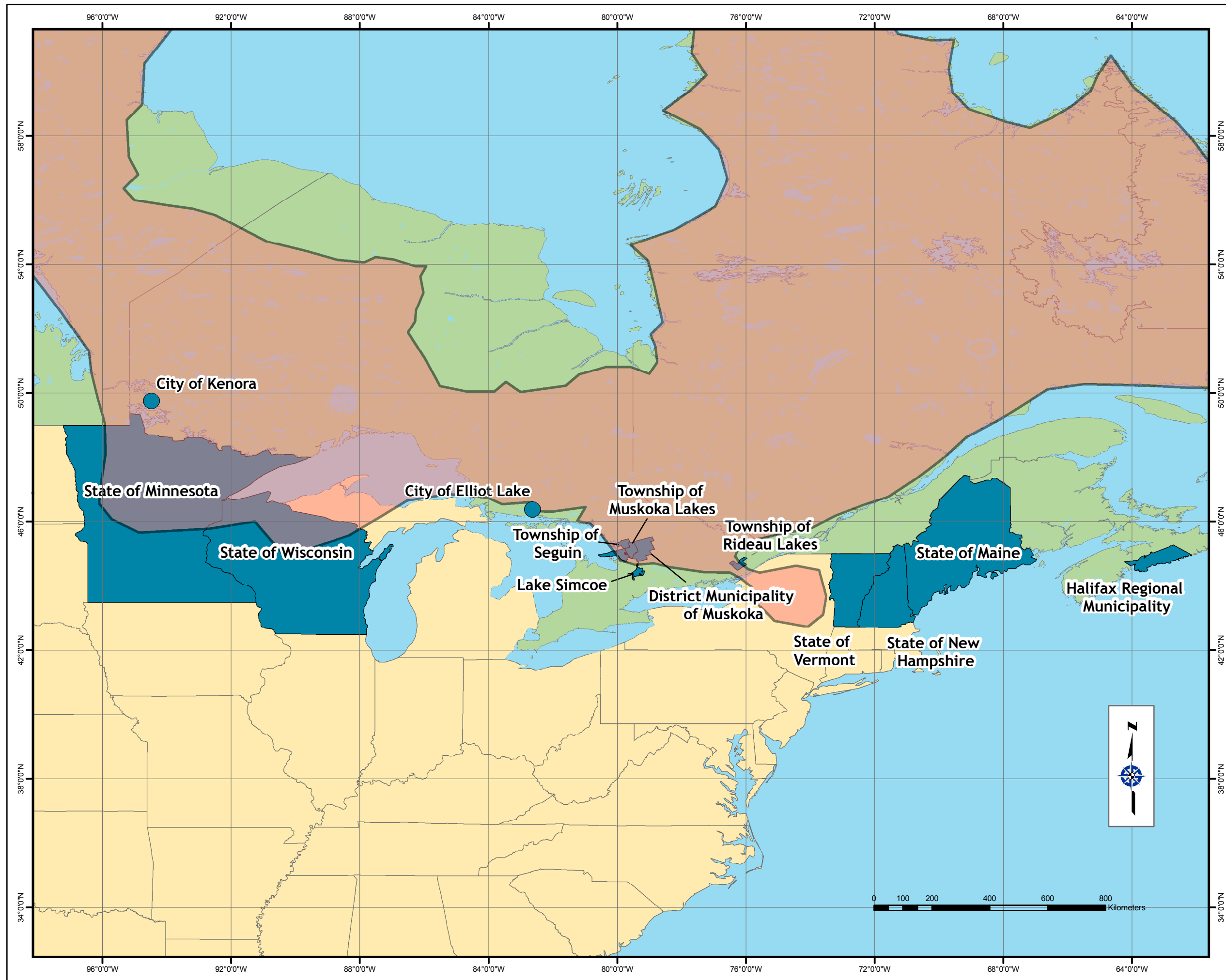
The CRD contains approximately 4,000 lakes that are >5 ha in surface area. Of these, CRD has classified 84 lakes for sensitivity to phosphorus, which range broadly in surface area (12.4 to 65,100 ha), maximum depth (1.7 to 66.2 m) and watershed area (1.9 and 2,240 km<sup>2</sup>) (CRD, 2004). These lakes also vary in water quality, but the majority of the lakes are mesotrophic to eutrophic (Chlorophyll *a* >3 µg/L, total phosphorus >15 µg/L) and alkaline (pH ≥8).

### 3.1.2 Technical Approach

The CRD's uses two classification systems in their technical approach. The Water Quality Sensitivity classification is used to define the "shoreland" area to which the Shoreland Management Policies apply and a Septic Design classification to determine the required depth of the unsaturated zone for septic systems.

Water quality sensitivity ratings are established for the lakes by a qualified limnologist based on flushing rate, mean lake depth/volume, physical/chemical indicators (e.g., pH, total dissolved solid, dissolved oxygen and water temperature), trophic state (as chlorophyll *a*), watershed characteristics, soil depth and taking into consideration the potential for localized zones of heightened sensitivity within a lake (i.e., resulting from shoreline irregularity or a shallow littoral zone, Table 2).





Jurisdictions Reviewed for  
Shoreline Management Approaches

Precambrian Shield

Project Lead: Tammy Karst-Riddoch  
Prepared by: Stuart Paul  
Data Source: Geological Association of Canada  
Data Source: Canadian Council on Geomatics  
Coordinate System: GCS North American 1983

C:\GIS\_HESL\Projects\Shoreline\_Management\_Approaches  
ArcMap\_Documents

**Figure 1: Jurisdictions  
Reviewed for Shoreline  
Management Approaches**

**Project - J140010**

**June 4, 2014**

## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

The Shoreland area is defined as the area within 150 m of a lake with low water quality sensitivity, 200 m of a lake with moderate water quality sensitivity, 250 m of a lake with high water quality sensitivity, or 100 metres of a watercourse, but may be increased or decreased at the discretion of the CRD under extenuating circumstances exist.

Table 2. Criteria for Water Quality Sensitivity Categories for Cariboo Region

Criteria	Low Water Quality Sensitivity	Moderate Water Quality Sensitivity	High Water Quality Sensitivity
Trophic State <sup>1</sup>	Highly oligotrophic and highly eutrophic (lakes which are sufficiently advanced into a eutrophic state such that only large amounts of additional nutrients will result in noticeable further deterioration in water quality)	Oligotrophic to eutrophic	Oligotrophic to slightly eutrophic
Flushing Period	Short (generally 0-2 years)	Average (generally 2-8 years)	Long (typically greater than 8 years)
Mean Depth	Deep (generally >15 m)	Average (5-15 m)	Relatively shallow (generally less than 5 m)
Watershed Characteristics	Watershed in natural state or large watershed for highly oligotrophic lakes	Larger watersheds than those under the "high" sensitivity with less activity	Small or with a significant degree of activity (agriculture, logging or other development)

<sup>1</sup>Trophic state is classified by concentration of chlorophyll *a* (Oligotrophic = 0-3 µg/L, Mesotrophic = 3-7 µg/L, Eutrophic = 7+ µg/L)

To determine the depth of the unsaturated zone for sewage treatment systems, the Water Quality Sensitivity classes are used in conjunction with proposed development density (as lot area) to qualitatively determine the level of treatment (i.e., Levels 1 to 4 where Level 1 requires the least amount of phosphorus 'removal' and Level 4 requires the greatest amount of phosphorus 'removal', and the minimum required vertical unsaturated distance is provided for each level of treatment for different soil groups (Table 4), which include:

- Soil Group A – Generally rapidly drained soil types comprising coarse uniform sands and gravel. Percolation rate = 2 to 5 minutes/inch (2.5 cm)
- Soil Group B – Moderately drained soil types comprising fine and medium sands and sands with some silt. Percolation rate: 5 to 15 minutes/inch (2.5 cm)
- Soil Group C – Slowly drained soil types comprising silts, silty sand, silt with some clay and loams. Percolation rate: 15 to 30 minutes/inch (2.5 cm)

The vertical unsaturated distance is defined as "the vertical soil distance from the base of the disposal field or mound to the groundwater table. Where no groundwater table exists, the vertical unsaturated distance shall be measured as the elevation difference from the base of field or mound to the highwater elevation of the lake or the natural boundary of a watercourse." (CRD, 2004).



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

Table 3. Phosphorus Removal Levels for Lake Sensitivity and Development Density Categories

Development Density	Low Sensitivity	Moderate Sensitivity	High Sensitivity
Very low (2 ha lots)	Level 1	Level 1	Level 2
Low (0.4 ha)	Level 1	Level 1	Level 3
Medium (0.2 ha)	Level 1	Level 2	Level 4
High (0.07 ha)	Level 2	Level 3	Level 4

Table 4. Vertical Unsaturated Distance Requirements for Septic Systems

Level of Phosphorus to be Removed	Minimum Vertical Unsaturated Distance		
	Soil A	Soil B	Soil C
Level 1	1.2 m	1.2 m	1.2 m
Level 2	9 m	3 m	1.6 m
Level 3	15 m	5 m	2 m
Level 4	Septic disposal not recommended	8 m	3.5 m

### 3.1.3 Planning, Regulatory and Implementation Tools

In BC, the Official Community Plan (OCP) is a bylaw of local government that provides objectives and policies to guide decisions on planning and land use management within a community or plan area. The requirements of an OCP are defined by the *Local Government Act* and the Community Charter and land division is the responsibility of BC's Ministry of Transportation and Infrastructure.

The requirements for management of shoreline development are described in the CRD's Shoreland Management Policy (CRD, 2004). The CRD requests that the Approving Officer of the BC Ministry of Transportation require applications for subdivision of shoreland property in the district be subject to a restrictive covenant on the title of the subject property in accordance with the Onsite Effluent Disposal Guidelines and Riparian Buffer Zone Guidelines set out in the policy. The applicant must provide proof of compliance with the guidelines in a Report of Soil Investigation Information signed by an accredited professional in BC and photographs of the riparian vegetation in their application for subdivision.

The district may endorse an Individual Shoreland Management Plan in cases where the shoreland area warrants special consideration or protection to meet the objectives of the policy, which is implemented by resolution or in OCPs. The district encourages the implementation of development guidelines on all shoreland properties and may consider conditional implementation of the guidelines through the rezoning process and development permit process within OCP areas and Individual Shoreland Management Plan areas.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

### 3.1.4 Best Management Practices

CRD requires implementation of a minimum 15-m shoreline vegetative buffer, but this can be reduced to 5 m in selected areas or increased if provincial or federal agencies have identified sensitive habitat that would require a greater setback (e.g., shoal spawning areas). A maximum of 25% vegetation removal is allowed within the buffer.

The Shoreland Management Policy does not provide minimum development standards and these are implemented in OCPs. For example, Section 4.2 of the Zoning Bylaw for the Williams Lake Fringe and 150 Mile House Planning Area provides a minimum building setback of 7.6 m and 30 m from the natural boundary of a lake or watercourse, respectively, with the exception of a fence, dock, boat launching facility, or waterworks facility.

### 3.1.5 Program Successes and Challenges

We were unable to correspond with representatives from the CRD directly and were therefore not able to ascertain the successes and challenges related to the Shoreland Management Policy (CRD, 2004).

## 3.2 City of Elliot Lake

The City of Elliot Lake received assent to acquire, market and sell Crown land for shoreline development on area lakes under the *City of Elliot Lake Act* (2001) as a means to increase the City's revenue base. To date, 244 cottage lots have been developed on three lakes under the first phase of the program. Since 2006, the City has been working to acquire additional lands under the *Act* for 668 shoreline lots on 11 lakes within its municipal boundaries. The approach for determining shoreline development capacity for the second phase of the program was developed by HESL (2012a) and aims to protect water quality and lake trout habitat following Provincial guidance and policy. The results of the capacity assessment have been reviewed by the Province, but the program is still pending approval. The following describes the approach for managing shoreline development for the second phase of the cottage lot program.

### 3.2.1 Lake and Watershed Characteristics

The lakes proposed for lot creation lie on the Precambrian Shield in the Serpent River watershed of northern Ontario within the city limits of the City of Elliot Lake. The watersheds of the lakes are primarily forested with a small proportion of wetlands (0 - 7% in each lake's watershed) and little to no existing development, but some disturbance from forestry activity and previous mining (i.e., tailings ponds) exists throughout the area. The population of the City of Elliot Lake is 11,348 and has decreased by 1.7% from 2006-2011 (Statistics Canada, 2012). The City, however, estimated that the population could increase to ~15,000 over the next 10 years pending success of the Cottage Lot Program and other programs aimed at increasing economic sustainability (HESL, 2012).

The lakes range from 30 to 20,700 ha in surface area with catchment areas of 2 to 93 km<sup>2</sup>. One of the lakes is shallow (mean depth = 2.8 m) and the others are thermally stratified with mean depths of 2 to 39 m. All of the lakes are oligotrophic with mean spring turnover phosphorus concentrations ranging from 2.8 to 6.7 µg/L. Six of the 11 lakes identified for shoreline lot development are MNR-designated natural



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

lake trout lakes. An additional 3 lake trout lakes lie downstream and could potentially receive phosphorus loads from proposed upstream development.

The Esten Lake Water Pollution Control Plant (WPCP) discharges treated effluent from the City of Elliot Lake to a small lake (the “Esten lagoon”). The lagoon outlets to Depot Lake, which is presently over capacity for phosphorus due to inputs from the WPCP. This has implications for proposed lot creation as Depot Lake is located near the bottom of the watershed downstream of all but one of the proposed development lakes. As such, no increase in phosphorus concentration from new lot creation on lakes upstream of Depot Lake would be permitted by the Province based on the Lakeshore Capacity Handbook (Province of Ontario, 2010) and the development capacity of one key downstream lake is also limited.

### 3.2.2 Technical Framework

The number of shoreline lots proposed for development was determined based solely on capacity with respect to a) phosphorus following the Provincial Lakeshore Capacity Assessment approach, and b) oxygen concentrations for MNR-designated lake trout lakes as per MNR’s Lake Trout policy (HESL, 2012).

For phosphorus, the Lakeshore Capacity Model (LCM) was used to assess development capacity and included all lakes in the Serpent River watershed with a surface area  $\geq 10$  ha (168 lakes). The model results were validated with measured phosphorus concentrations from a water quality monitoring program that was implemented by the City in 2008. The model performed well for 19 of 30 lakes predicting total phosphorus concentration to within 20% of measured values. Lakes that did not model accurately included four lakes influenced by urban development and WPCP inputs (over-predicted by the model), two lakes with very low phosphorus concentrations of  $< 3 \mu\text{g/L}$  (over- and under-predicted by the model) and a chain of four lakes with flow-through hydrology (under-predicted by the model) that were suspected of having little to no retention of phosphorus. Due to these issues with model performance and the over-capacity status of Depot Lake from existing WPCP inputs, the City plans to commit to reducing phosphorus loads from the WPCP to offset predicted loads from the proposed development upstream of Depot Lake.

Limits to shoreline development were determined for MNR-designated lake trout lakes to meet the Provincial policy that requires oxygen concentration to be maintained at 7 mg/L or greater (measured as mean volume-weighted hypolimnetic dissolved oxygen concentration (MVWHDO)). MVWHDO was determined using measured temperature and oxygen profiles and bathymetric data following Provincial guidance (MNR, 2009). Predicted losses in MVWHDO with the proposed development were then modeled following the approach of Molot et al. (1992) that uses elements of lake morphometry (lake bathymetry, fetch) and phosphorus concentration as input.

The City conducts water quality monitoring for spring overturn total phosphorus concentration ( $n=30$ ), monthly phosphorus upstream and downstream of the WPCP, and end-of-summer dissolved oxygen and temperature profiles for the lake trout lakes. These measurements are used to assess the phosphorus model predictions and lake trout habitat, and as input to the phosphorus and Molot models described above. The City plans to continue monitoring the development lakes to track changes in phosphorus or



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

oxygen concentrations, which can be used to assess and respond to future potential impacts from development.

In addition to the lake capacity and lake trout habitat assessment, detailed natural heritage assessments were conducted for areas proposed for lot development, including significant habitat of endangered and threatened species, wetlands, wildlife habitat, areas of natural and scientific interest, and fish habitat.

### 3.2.3 Planning, Regulatory and Implementation Tools

The second phase of the cottage lot program is still in the approval stage and development requirements (planning and policy) to be implemented by the City have not yet been established. It is likely that the program lots will be subject to existing Official Plan policies and the Zoning Bylaw 87-40 for the Shoreline Residential (RS) zone that permits shoreline residential uses on other lakes, or the City may follow the subdivision process to develop the land. Site plan control may also be imposed for single detached dwellings where required to protect Natural Heritage features under the authority of Section 41 of the *Planning Act* and the Official Plan, whereby Council may, by by-law, designate one or more areas as Site Plan Control Areas (see Section 4.3.4).

Severances of lots acquired through the program and any additional Crown Land lot acquisition on the proposed development lakes will be prohibited under the *Elliot Lake Act*.

### 3.2.4 Best Management Practices

Best Management Practices may apply to the proposed development include minimum development standards established under the exiting OP include:

#### Shoreline Buffer

- Each lot shall have a buffer area in which no trees, roots or root systems, herbs, grasses, or the duff layer shall be removed and where no lawn shall be established or maintained. The buffer area shall be a minimum of 15 metres from the High Water Mark, 10 metres from the rear lot line and 5 metres from any other lot line. Removal of shrubs and dead and decaying vegetation is permitted along with a maximum 2 metre wide pedestrian pathway from the dwelling to the shoreline and a maximum 4 metre wide utility access route including minimal removal of the duff layer for underground utility. No more than 20% of the trees within the Buffer Area may be removed.

#### Lot Area

- The minimum lot area permitted is 0.4047 ha and the minimum lot width is 45 m.

#### Setbacks

- For the building line from the lot line adjoining a lake or river, a minimum setback of 20 m is required from High Water Mark.

#### Lot Coverage

- The maximum permitted lot coverage is 15% for all buildings.

No provision for implementation of BMPs is being considered in the determination of capacity with the exception of reducing phosphorus loads from the WPCP as an offsetting strategy to protect Depot Lake



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

from potential future development loads (see Section 3.3.2). Enhanced septic systems that reduce phosphorus loads, however, are being considered by the City as added protection for potentially sensitive lakes.

### 3.2.5 Program Successes and Challenges

The program has not yet been implemented to evaluate its success at managing shoreline development.

## 3.3 City of Kenora – Lower Black Sturgeon Lake

Although Kenora is located in a popular recreational lake area, development pressure is focussed on two major lakes, Lake of the Woods and Lower Black Sturgeon Lake. Lake of the Woods is the primary recreational focus and because it lies within Ontario, Manitoba and the US State of Michigan, management is shared among municipal, provincial and US state jurisdictions. Lower Black Sturgeon Lake, however, is primarily used by Kenora residents and is located entirely within the City boundaries.

In 2009, the City implemented lake-specific shoreline development and management policies into their official plan for Lower Black Sturgeon Lake due to concerns over the rapid pace of shoreline and back lot development including proposals for relatively large developments (~20 lots) and the environmental and recreational sustainability of that development. These policies were based on recommendations from a lake management plan that was funded by the City (Gartner Lee Ltd. (GLL) and Kelli Saunders Environmental Management (KSEM), 2007a; b).

The Lower Black Sturgeon Lake Management Plan and resultant Official Plan policies aim to: a) guide future development at a controlled pace, and b) ensure that future development is managed to prevent detrimental impacts to water quality, fish and wildlife and their habitat, other aspects of the natural environment and the human amenity values associated with recreation at Lower Black Sturgeon Lake.

### 3.3.1 Lake and Watershed Characteristics

Lower Black Sturgeon Lake is located on the Precambrian Shield in northern Ontario in the headwater region of the Black Sturgeon River, west of Lake Nipigon and within the Lake Superior Drainage Basin. The watershed of the lake (area = 731 km<sup>2</sup>) is primarily Crown land dominated by Boreal forest with minimal wetland area that comprises <1% of the catchment. Pockets of rural residential areas exist within the watershed along with minor tourist commercial areas. The lake is within 10 km of the City of Kenora, which has a stable population of 11,306 with -0.1% growth from 2006-2011 (Statistics Canada, 2012).

The lake is large (surface area = 1,600 ha), deep (mean depth = 12 m, maximum depth = 30 m), mesotrophic (mean TP<sub>so</sub> = 15.6 µg/L) and dystrophic with highly coloured water (colour = TCU) and a relatively high concentration of dissolved organic carbon (8 mg/L). It supports a diverse and predominately warm water fish community that includes the sport fish walleye, northern pike, smallmouth bass, brown bullhead, yellow perch, black crappie and muskellunge.

Shoreline development on the lake includes ~215 residences that are primarily occupied seasonally with some very limited farm, tourist commercial and resource-based operations. The lots do not have municipal water and sewer services.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

## 3.3.2 Technical Framework

The technical framework for managing shoreline development on Lower Black Sturgeon Lake is a holistic approach that considers water quality, protection of natural heritage features, “views” (i.e., scenic views of natural shoreline areas) and social crowding.

For water quality, a variant of the Province’s Lakeshore Capacity Assessment and a target of 20 µg/L for phosphorus were used to set an upper limit to the number of shoreline lots. The assessment was completed prior to publication of the Provincial guidance (Province of Ontario, 2010) and so some of the input parameters used in the model vary slightly from that guidance, however, the model performance was acceptable with an error of 17% between predicted and measured phosphorus concentration. A conservative approach was taken to assess capacity, which assumed permanent occupancy of all existing and future residential development and no soil attenuation of septic system phosphorus. Other capacity approaches were also assessed for their potential use including a perimeter-based estimate (1 lot per 61 m of shoreline) and lake surface-area based estimate (1 lot per 1.6 ha of lake surface<sup>3</sup>), as is used in the Official Plan of Seguin Twp. (Section 3.9.2). The phosphorus-based capacity assessment provided the most conservative estimate (142 lots) a total of 1 and was therefore chosen as the most protective for management of lake water quality.

In addition to setting capacity limits, shoreline areas were designated as “Restricted Development Areas” to provide additional protection of natural heritage features and views and to limit social crowding. The selection of Restricted Development Areas was determined through detailed mapping of existing natural heritage features and development patterns, and in consultation with a steering committee and stakeholders at a public meeting, and include:

- ❁ Islands
  - Black Sturgeon Lake has 19 islands that are >2 ha that could potentially sustain development. These islands break up the expanse of water and block views of opposing shorelines and serve as “visual oases” on the lake scape. Restricted development on islands (1 lot per island) is meant to conserve natural views and to prevent congestion in narrow channels between islands and the mainland.
- ❁ Natural heritage areas
  - Mapping of Natural Values (wetland areas, wildlife habitat, nesting sites, fish spawning areas, etc.) were identified from NRVS mapping available from the Ministry of Natural Resources. Restricted development in areas with natural values is meant to provide added protection for these features by reducing potential for encroachment.
- ❁ Narrow channels and embayments
  - Restricted development in narrow channels and embayments is meant to conserve natural views of opposing shorelines and prevent congestion in these smaller areas.

<sup>3</sup> The original source of the 1 lot per 1.6 ha surface area used as a filter for recreational carrying capacity to estimate social crowding was based on work completed for the Lake Alert Program by the Ontario Ministry of the Natural Resources in the early 1970s (presentation to Seguin Council by Mr. Mario Buszynski, December 7<sup>th</sup>, 2009), but no documentation could be found that provides the rationale for this filter.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

A 2-year detailed monitoring program to establish baseline conditions in the lake was completed by the City (Ryan Haines Consulting, 2009; 2010) that included sampling for total phosphorus, chlorophyll a, phytoplankton taxonomy and dissolved oxygen and temperature profiles. Regular monitoring for total phosphorus concentration by the City is planned to commence in 2014 although the lake has been sampled annually by residents under the provincial Lake Partner Program.

### 3.3.3 Planning, Regulatory and Implementation Tools

The City of Kenora's Official Plan recognizes Black Sturgeon Lake as a Restricted Development area with specific management and protection policies that include:

- ❁ A commitment to work with local stakeholders and the MOECC to coordinate, conduct and report on water quality sampling, encourage septic system inspections and shoreline stewardship, and promote awareness of threats to water quality through education and best management practices,
- ❁ Consideration of bylaws to prohibit the use of fertilizers and pesticides on waterfront properties
- ❁ Restrictions to permitted uses that prohibit industrial uses, new marinas and public landings or docking facilities,
- ❁ Limited development to a total of 142 additional residential shoreline lots and only one lot per island over the life of the OP (20 years) as determined by the lakeshore capacity assessment approach (see Section 3.3.2),
- ❁ Limited 'back lot' development to the same or lesser density as shoreline development,
- ❁ A commitment to update Natural Values as new information comes available,
- ❁ Provisions to require Site Plan Control to protect natural values where necessary, and
- ❁ Requirement for an Environmental Impact Statement report for development that may affect wetlands.

The land use provisions of the Official Plan are implemented by a Zoning Bylaw, which provides for enhanced minimum development standards for lot sizes and densities in restricted development areas (see Section 3.1.4). Only a limited number of lots (17) are permitted for development each year. As of March 2014, there were 70 lots remaining of the original 142 that can be created. The City plans to review the management approach before the remaining lots have been taken up.

The City does not have personnel on staff responsible for management of the lake or to implement/do water quality monitoring. This work is contracted to consultants. The total cost to complete the lake management plan and the baseline monitoring study was not available. These costs, however, were being recovered by the City through fees added to development applications on the lake.

### 3.3.4 Best Management Practices

The City promotes the use of BMPs in their OP policies, but the only BMPs that are required and enforced through the zoning bylaw are minimum lot development standards (Table 5; FoTenn Consultants Inc., 2010).



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

Table 5. Zoning Provisions for Shoreline and Back Lots on Black Sturgeon Lake

Zoning Mechanism	Provision
Minimum Lot Area	0.8 ha
Minimum Back Lot Area	2 ha
Minimum Lot Frontage outside of Restricted Development Areas	61 m
Minimum Lot Frontage in Restricted Development Areas	122 m
Road Frontage for Back Lots	90 m
Minimum Side Yard	3 m
Minimum Rear Yard	8 m
Maximum Lot Coverage	10%
Minimum Setback from Shoreline	20 m
Maximum Building Height	7.5 m
Maximum Shoreline Disturbance	25% of lot frontage

### 3.3.5 Program Successes and Challenges

Overall, the City is very pleased with the outcome of the approach as development restrictions have controlled the pace of development on the lake and it has provided a strong technical backing to support their land use planning decisions (Tara Rickaby, Planning Administrator, City of Kenora, pers. comm.). The City has been challenged on a few occasions, mostly on the definition of ‘embayment’ for the restricted development area delineation that was established to protect natural views and reduce social crowding<sup>4</sup>.

While the approach was developed to protect environmental and social issues, several lake residents, however, are still not convinced that the approach will be effective and have called for a moratorium on all development due to concerns about social crowding. The planning department has denied this request.

An objective evaluation of the success of the program to protect water quality cannot be made at this time as there has not been sufficient time since the program was implemented to evaluate potential impacts from shoreline development. Given the very conservative approach to set capacity limits (Section 3.1.2), however, the proposed level of development is not likely to adversely affect water quality with respect to phosphorus concentration.

## 3.4 District Municipality of Muskoka

The District Municipality of Muskoka (DMM) adopted their “Lake System Health” program in 2005 as part of the Muskoka Water Strategy, which provides a number of initiatives to protect Muskoka’s water

<sup>4</sup> Additional Information was requested from the Kenora planning department on the number of challenges (OMB or other) and their success but was not provided.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

resources. The DMM approach is comprehensive and holistic and this reflects the maturity of the program (Muskoka began managing lakeshore capacity in the late 1970s), the resources available through the tax base associated with the demographics of seasonal residents and the associated economic importance of recreational water quality which is acknowledged in planning policies (DMM, 2010). The program aims to minimize impacts of human activities on water resources through policies that govern shoreline development, education and stewardship, water quality monitoring and lake-specific studies to identify wetlands and other sensitive natural areas that require protection. The approach for managing shoreline development is primarily focussed on controlling phosphorus and uses a combination a) capacity to identify a threshold, b) lake classification to define the sensitivity of lakes to phosphorus and c) development controls and BMPs that are tailored to mitigate phosphorus for each sensitivity class. The DMM is currently updating their approach and shoreline management policies. As the revised program has not yet been finalized, the following provides details of the 2005 program (GLL, 2005).

### 3.4.1 Lake and Watershed Characteristics

The DMM comprises a vast area spanning 6,277 km<sup>2</sup> in central Ontario and includes 4 major and 17 minor subwatersheds on the Precambrian Shield. The area is primarily forested with some small pockets of agriculture and eight relatively small urban centres with a combined permanent population of approximately 57,000 and additional seasonal population of 75,000.

There are 392 lakes greater than 8 ha within the municipal boundaries that range in size up to 11,914 ha and depth (<5 m to >60 m), as well as many smaller lakes. The lakes are oligotrophic to mesotrophic with a mean phosphorus concentration of 9.4 µg/L ± 3.7 µg/L, and several of the lakes are dystrophic (dissolved organic carbon = 3.8 – 17.3 mg/L). Wetland area is variable ranging from 0 to 43% of the lake catchments (average = 9.2%).

The majority of shoreline development is seasonal residential (~80%), largely due to the proximity to a large population (6,300,000) in the Greater Toronto Area, and servicing is provided by individual septic systems.

### 3.4.2 Technical Framework

The technical framework for managing shoreline development in the DMM was developed in a detailed study by Gartner Lee Limited (GLL, 2005) that combines lake capacity modelling, lake sensitivity assessment and analysis of water quality data to classify lakes.

Lakes are considered to be 'Over Threshold' if modeled and measured phosphorus concentrations exceed the provincial threshold of background plus 50%.

Lakes are also classified as having High, Moderate or Low Sensitivity to phosphorus loads. Sensitivity classes are based on lake 'responsiveness' to phosphorus loads and the 'mobility' of phosphorus from septic systems (Table 6). Lake responsiveness is the degree to which a lake will respond to the addition of phosphorus and is a function of such attributes as the lake size, shape, surface area and flow of water. Lake responsiveness was assessed by modeling the change in phosphorus concentration in each lake with the addition of a standard density of development equivalent to 1 lot/1.62 ha of lake surface area.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

This density was chosen as it has been used by several Ontario municipalities as a “crowding” or social density filter to reflect recreational use of lake surface areas. Mobility of septic system phosphorus is assumed to be ‘high’ if the measured phosphorus concentration in a lake is equal to or greater than 80% of the modeled concentration, and ‘low’ if less than 80%.

Table 6. Classification Matrix for District Municipality of Muskoka Lakes

Responsiveness	Mobility of Septic System Phosphorus	
	High	Low
<b>High</b> (>80% change to standard areal phosphorus load)	High Sensitivity	Moderate Sensitivity
<b>Moderate</b> (40-80% change to standard areal phosphorus load)	Moderate Sensitivity	Moderate Sensitivity
<b>Low</b> (<40% change to standard areal phosphorus load)	Moderate Sensitivity	Low Sensitivity

New lot creation is prohibited only on lakes that are classified as Over Threshold and High Sensitivity. Development proposals for lakes that are Under Threshold but have High Sensitivity are subject to a Water Quality Impact Assessment which requires the evaluation of a large number of site specific factors to determine the general site suitability to retain phosphorus and the requirement for BMPs. The terms of reference for Water Quality Impact Assessments is included in Appendix C. The degree of assessment and need for BMPs is scaled to lake sensitivity. These policies address the development of vacant lots in addition to newly created lots.

Development on a lot within the waterfront designation of Moderate and High Sensitivity, and Low Sensitivity (Over Threshold) waterbodies is subject to site plan control or development permitting. Where site plan control or a development permit is required, or where on site phosphorus management is required, the following matters must be addressed:

- ❁ Appropriate location of buildings, structures and sewage disposal systems;
- ❁ Retention or restoration of a natural vegetative buffer to prevent erosion, siltation and nutrient migration;
- ❁ Maintenance or establishment of native tree cover and vegetation on the lot wherever possible;
- ❁ Appropriate location and construction of roads, driveways and pathways, including use of permeable materials; and
- ❁ Implementation of stormwater management and construction mitigation techniques, including proper re-contouring, discharging of roof leaders, use of soak away pits and other measures to promote infiltration.

Recreational water quality monitoring is an important component of the District’s Lake System Health program. The program has been in place for over 25 years and includes approximately 192 sampling locations (DMM, 2014). The sampling program measures:



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- ❁ Secchi depth;
- ❁ Phosphorus concentrations;
- ❁ Dissolved oxygen and temperature; and
- ❁ A number of chemical parameters, including: pH, conductivity, dissolved organic carbon, alkalinity, nitrates, sulphuric acid, iron and chlorine.

The purpose of the program is to establish a long-term record of water quality parameters so that trends can be identified.

Shoreline Land Use Inventory and maps have been completed for numerous lakes in the District and can serve to monitor changes in the shoreline that may be of detriment to water quality as surveys are repeated over time. The District surveys the shorelines of approximately four to five lakes per year and has surveyed a total of 62 lakes since 2002 when the program began. Some lakes that were originally surveyed in 2002/03 have been re-surveyed in the last few years, but the District has no set schedule for the surveys.

### 3.4.3 Planning, Regulatory and Implementation Tools

The DMM employs a two-tiered planning system where a strategic plan is employed at the District level that is to be implemented at the local municipal level. To this end, the DMM requires the six area municipalities in its jurisdiction to adopt provisions in their Area Municipal official plans and zoning by-laws to meet the objectives of the District's official plan (e.g., see Township of Muskoka Lakes, Section 3.4). In addition, the district reviews and approves all development applications to ensure that the district policies are met.

### 3.4.4 Best Management Practices

The DMM Official Plan (2010) includes a number of policies that set minimum development standards for shoreline development which include:

- ❁ A setback of 20 m for structures and 30 m for leaching beds
- ❁ Lot frontage for newly created shoreline lots of 60 m
- ❁ A target of 75% natural shoreline (where this target cannot be met, a net improvement is required)
- ❁ The use of a septic system with soils that have a demonstrated ability to effectively eliminate phosphorus is required as part of Phase 2 Water Quality Impact Assessments on highly sensitive waterbodies, and
- ❁ A natural, substantially undisturbed buffer is recommended at the water's edge to a width of 8 m across 75% of the water frontage.

The District has implemented several programs to promote use of BMPs and stewardship including the "Water Web" and Dock Talks. The "Water Web" is an online resource to provide residents with information on water quality for individual lakes, as well as resource information on wide range of lake health topics (e.g., algae blooms, boating, erosion, lake planning, septic systems, stormwater management, and wetlands). The Muskoka Dock Talk program is a social networking communication



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platform. Its goal is to reach individuals at their property to distribute information on sustainable living within a lake environment. Practices that minimize impacts on water quality or enhance lake water quality are primary topics.

### 3.4.5 Program Successes and Challenges

One of the challenges faced by the DMM during the development of their lake management approach was that the water quality model used to estimate phosphorus concentration was not sufficiently accurate to support a capacity-only based approach to limit the number of shoreline lots. The classification of lakes according to their sensitivity to phosphorus and application of more protective development standards and BMPs for the more sensitive lakes provides a means to protect water quality from nutrient enrichment without prohibiting development.

The program has been in effect for 10 years, and is considered to have successfully protected water quality based on results of the District's water quality monitoring program that have shown no significant increase in phosphorus concentration over time in the monitored lakes. Moreover, the District has not received complaints regarding issues with water clarity. Algal blooms have occurred on a few of the lakes, but in all instances, the bloom activity has been attributed to factors other than impacts from shoreline development (i.e., weather patterns and internal phosphorus loading). Shoreline surveys have revealed that shorelines have remained stable except for some boating/shoreline structure disturbance.

## 3.5 Halifax Regional Municipality

Halifax Regional Municipality (HRM) uses the watershed as the basic planning unit for developing watershed planning policies based upon the Water Resources Management Study (Dillon Consulting Ltd. 2003). This approach is primarily used for areas outside of the current built and fully serviced sections of the City where development pressure is occurring for low density "rural commuter" developments. The 2006 Halifax Regional Municipal Planning Strategy (also called the Regional Plan) requires that watershed studies are undertaken before a Community Vision exercise and in advance of community design work undertaken through the secondary planning process. Policy E-17 of the Regional Plan requires that watershed studies be carried out as part of a comprehensive secondary planning process.

The primary objective of the watershed study, as expressed in Regional Plan Policy E-17, is to "determine the carrying capacity of the watersheds to meet the water quality objectives which shall be adopted following the completion of the studies." (HRM, 2006) Carrying capacity is a measure of the watershed's ability to accommodate inputs from both man-made and naturally occurring pollutant sources without experiencing a significant decline in water quality and ecological function. The ultimate objective of the study is to provide a number of guidelines and recommendations for the planning, design and implementation of new developments that will protect the water quality from further degradation. This approach does not differentiate between development in the shoreline area and in the wider watershed.

### 3.5.1 Lake and Watershed Characteristics

HRM occupies an area of 5,600 km<sup>2</sup> with more than 1,000 lakes that vary between 5.4 and 1,877 ha in size. A population of 372,000 resides within the HRM and the majority of waterfront residences are



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permanent homes. Two large watersheds, Birch Cove Lakes and Shubenacadie Lakes subwatersheds, were recently studied in detail from the perspective of Policy E17 (AECOM, 2013) and details from these studies are described below.

### 3.5.1.1 *Birch Cove Lakes Watershed*

Birch Cove Lakes watershed is located within the boundaries of HRM with a watershed surface area of approximately 34.6 km<sup>2</sup>. This watershed includes 17 lakes greater than 1.0 ha in surface area and numerous ponds, streams and wetlands. The watershed is situated on the southern edge of the Nova Scotia Southern Upland physiographic region. The rugged terrain is dominated by rolling granite bedrock that has undergone repeated cycles of glaciation. As in other parts of Canada where resistant rocks have been scoured by glaciers, the watershed has been left with little or no mineral soils resulting in significant amounts of exposed bedrock and irregular drainage patterns. With respect to the major land use classes, approximately 10% of the watershed consists of waterbodies (lakes, ponds, streams), 3% is wetland, 53% is soil-covered forested uplands, 4% is industrial and commercial, 12% is residential, 8% is roads and 3% is exposed bedrock.

Residences range from older homes and cottages to modern suburban homes and low rise apartment buildings. Generally, the shoreline areas were the first to be developed and most private residences, except in the small communities are un-serviced (i.e., depend on wells and septic systems). Commercial development areas are concentrated along the perimeter of the watershed. The commercial area may be serviced by sewers with small scale treatment plants discharging into the local lakes and watercourses.

### 3.5.1.2 *Shubenacadie Lakes Subwatershed*

The Shubenacadie Lakes subwatershed has an area of approximately 388 km<sup>2</sup>. Within the subwatershed, water level control structures of the historic Shubenacadie Canal are found at various. Most of the subwatershed is underlain by northeast-trending fractured and metamorphosed slate and quartzite of the Meguma Group of rocks overlain by flat to undulating glacial till that typically averages a few metres in thickness, but may exceed 20 m where drumlin hills are present (Jacques Whitford, 2009).

The subwatershed hosts a range of land uses from urban and commercial developments in the south to more rural settlements and open space / natural environments further north. Historical residential development in much of the subwatershed is associated with the numerous lakes which characterise this area. Residences range from older homes and cottages to modern suburban homes and low rise apartment buildings. The subwatershed has also experienced gold mining in the past (the Waverley and Montague Mines), although no mines are currently active within the subwatershed. Two golf courses are located within the subwatershed.

Over the past few decades, the subwatershed has experienced significant development pressure, mainly in the form of residential subdivisions, and continued growth unconnected to municipal water and sewer services is expected. Surface water quality in the area is vulnerable to the effects of development and declines in water quality have been documented over the past 30 years (Vaughan Engineering, 1993; Scott et al., 1991). Key issues related to water quality include poorly maintained and malfunctioning



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residential septic systems, depletion of groundwater resources and the impacts of stormwater runoff from suburban development.

### 3.5.2 Technical Framework

The Halifax Regional Municipality establishes water quality objectives for each lake for key water quality indicators including total phosphorus and the associated trophic state, total suspended solids, nitrate, ammonia, chloride and *E. coli*. In the majority of cases, development is proposed to be constrained by maintenance of trophic state of the lake based on predictions of the impact from development using a steady state mass balance model to assess development scenarios. In some watersheds, where urbanization is likely to be more intense, it was recognized that storm water management modeling was required to effectively assess the impacts on the lake. Ontario's Lakeshore Capacity Model (as modified for local conditions) was used for the steady state model while USEPA's Stormwater Management Model was employed to determine the impacts of proposed developments on TP and trophic state. A series of development scenarios with mitigation measures were evaluated to demonstrate how water quality objectives could be met. HRM has not yet determined how the model scenarios for Birch Cove and Shubenacadie watersheds will be specifically developed to constrain development in the watershed to protect the lakes.

### 3.5.3 Planning, Regulatory and Implementation Tools

Currently, HRM is attempting to constrain development within one specific area of the Shubenacadie Lakes watershed as part of the Secondary Planning Strategy for the River-lakes Area. One of the most important natural assets River-lakes Plan Area is the lakes. Lake Thomas and Fletchers Lake are located on the eastern side of the Plan Area, while Kinsac Lake is found on the western side. These lakes, together with other nearby streams and lakes, form part of the Shubenacadie Lakes System. It is the desire of the community to protect the relatively pristine nature of this lake system. To achieve this, controls will be established to limit the amount of phosphorus and pollutants entering the lakes through the retention of pervious surfaces, retention of natural vegetation on steep slopes, provision of landscaping, regulation on the amount and scale of development, the management of stormwater and sediment and erosion control.

Within the study area, groundwater conditions are limited (i.e. the capacity for individual wells and the maintenance of groundwater supplies) and the receiving waters of Lakes Thomas and Fletchers are nearing the threshold of desirable water quality objectives for the Shubenacadie Lakes. In order to determine if it is feasible to develop these Sites, studies shall be required before a Development Agreement is approved by Council to determine if the development can proceed without exceeding the limits for phosphorus export, pursuant to Policy RL-22. Policy RL-22 states that prior to approval, a study prepared by a Qualified Person shall be required for any proposed development pursuant to these policies to determine if the development will export any greater amount of phosphorus from the subject land area during or after the construction of the development than the amount of phosphorus determined to be leaving the Site prior to the development taking place. If the study reveals that the phosphorus levels predicted to be exported from the proposed development exceed the phosphorus levels currently exported from the Site, then the development will not be permitted to take place unless there are reductions in density or treatment of stormwater through natural systems to reduce phosphorus export



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levels to those current before the proposed development. In short, the policy requires demonstration of “no net increase in phosphorus export from a site as a result of development”. This is referred to as a Phosphorus Net Loading Assessment (PNLA).

The policy is intended to apply at the Development Agreement stage which in the case of HRM is for relatively large sites of many hectares. It does not apply to individual lots directly and is, at this time, focused on sites that are located approximately 300 m or more from the lake. The policy does not prescribe the models to be used in the PNLA but leaves this to the developer and qualified persons undertaking the work. In most cases, since the PNLA must be accompanied by a storm water management plan it is expected that storm water management models will be used.

### 3.5.4 Best Management Practices

A 20-m shoreline vegetated buffer is mandated through the Official Plan but other BMPs are largely dependent on stormwater modelling. The Land Use Bylaw for the Shubenacadie Lakes area, which is within the HRM, has provisions addressing setbacks from watercourses and buffers. Where average slopes within the 20-m buffer are greater than 20%, the buffer shall be increased by 1 m for each additional 2% of slope, to a maximum of 60 m. Development is limited to one accessory structure and a path with a maximum width of 3 m within the buffer. No excavation, infilling, tree, stump or other vegetation removal or any alteration of any kind in the buffer is permitted in relation to a development. Low Impact Development (LID) practices are being promoted in urbanizing areas such as the River-lakes Planning Area.

### 3.5.5 Program Successes and Challenges

The Halifax Regional Municipality Official Plan was introduced in 2006 but the watershed studies have only been completed in the last couple of years (e.g., Birch Cove Lakes Watershed Study (AECOM, 2013)) so the actual implementation details (as in policies for other lakes or areas such as has been implemented for River-lakes has not occurred. However, there is now recognition and acceptance that the status quo will result in continued deterioration of the lakes. The lake capacity modeling demonstrated that the most effective way to prevent further deterioration of the lake trophic state was to eliminate all septic systems within 300 m of the lake either through better communal systems or other alternatives and to connect existing small scale sewage treatment plants (municipal and private) to sanitary sewers and treatment plants discharging into Bedford Basin. However, jurisdiction over septic systems lies with the Province of Nova Scotia not HRM and the cost of servicing these areas is expensive.

## 3.6 Lake Simcoe

As part of the government's overall strategy to protect and restore the ecological health of the Lake Simcoe watershed, the *Lake Simcoe Protection Act*, 2008 was passed by the Ontario Legislature. This *Act* provided the authority for the establishment of the Lake Simcoe Protection Plan (MOE, 2009). The ecological health of the watershed including water quality is of paramount importance. A primary goal is restoration of a self-sustaining coldwater fish community through reduction of phosphorus inputs to 44



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tonnes/year in an effort to increase hypolimnetic oxygen to the MNR objective of 7 mg/L for the protection of Lake Trout habitat.

Lake Simcoe represents a unique case in shoreline management and its characteristics differ from those of the rest of Ontario's inland lakes. Although the lake is a popular recreational destination, recreational shoreline development is not the major stress on the lake. The *Lake Simcoe Protection Act* and Protection Plan were implemented to restore a lake in which water quality and the aquatic system are considered degraded from a variety of stressors and where future population allocations could threaten water quality. The focus is therefore on remediation and prevention whereas other jurisdictions surveyed are developing policies to prevent degradation of water quality. The plan is an integrated watershed management plan that addresses a variety of stressors, including nutrient enrichment, urban development, agricultural activities, climate change and invasive species. Domestic septic systems represent ~5% of the phosphorus loading to the lake and some of this comes from permanent residents in smaller communities that do not have municipal sewage servicing.

### 3.6.1 Lake and Watershed Characteristics

Lake Simcoe is the largest lake in southern Ontario (74,400 ha) with a maximum depth of 41 m (LSRCA, 2013). A population of approximately 400,000 resides within the watershed of 3,400 ha but it is subject to a much greater population of recreational users because of its proximity to the Greater Toronto Area (GTA). The watershed includes a rapidly growing population, as well as substantial urban and agricultural development.

### 3.6.2 Technical Framework

Key elements of the Lake Simcoe Protection Plan (MOE, 2009) include policies and plans to:

- ❁ Reduce phosphorus loadings to 44 tonnes/yr from current levels of ~72 tonnes/yr, to restore hypolimnetic dissolved oxygen levels through:
  - Caps to loadings from municipal Waste Water Treatment Plants
  - BMPs for agricultural areas such as buffer strip creation along riparian areas, improved manure storage facilities and technologically advanced cropping systems
  - Retrofits to storm water management systems to improve their effectiveness to reduce phosphorus in urban runoff
  - Requirements that future urban development strive for no increase in phosphorus runoff from existing levels
  - Mandatory septic system and storm water management system re-inspection programs
  - Review of standards that promote nutrient abatement in septic systems
  - Analysis of atmospheric phosphorus contributions and means to mitigate them
  - Assessment of water quality trading as a means to reduce loadings
  - Policies to encourage stewardship,
- ❁ Reduce levels of pathogens at recreational beaches,
- ❁ Maintain vegetation during construction activities,
- ❁ Enhance and maintain lake monitoring activities,
- ❁ Promote water conservation and maintain instream flow targets,



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- ✿ Restrict activities that may degrade the shoreline,
- ✿ Set and enforce shoreline protection zones of 30 m within settled areas and 100m outside of settled areas,
- ✿ Restrict construction of features such as boathouses or docks that impede nearshore water movement,
- ✿ Allow development of additional protective regulations (i.e., fertilizer bans, tree cutting bylaws), and
- ✿ Prevent the introduction of invasive species.

For some of these approaches and goals, the Plan speaks to the need for adaptive management rather than providing prescriptive approaches.

### 3.6.3 Planning, Regulatory and Implementation Tools

The *Lake Simcoe Protection Act* requires that decisions under the *Planning Act* must conform to the policies in the Lake Simcoe Protection Plan. Municipal Official Plans therefore must conform to the applicable “designated policies” during their five year Official Plan review. To date, only a few municipalities have updated their Official Plans.

Lake Simcoe Region Conservation Authority (LSRCA) has completed Subwatershed Plans, including one for Innisfil Creeks (LSRCA, 2012). This has been followed by an Implementation Plan (LSRCA 2012). Within the Implementation Plan, the following priorities were included:

- ✿ Review Best Management Practices and complete a report
- ✿ Develop a Best Management Practices Guide
- ✿ Monitoring and enforcement of tree cutting and site alteration
- ✿ Stormwater management
- ✿ Managing agricultural impacts

The Town of Innisfil has not yet updated their Official Plan to reflect the new legislation, but has revised the Comprehensive Zoning Bylaw (Town of Innisfil, 2013a). The bylaw stipulates that 50% of the Waterfront yard shall be maintained as a naturalized vegetation area. The Waterfront Yard setback is 15 m or the existing setback whichever is greater; this increases to 30 m where the lot depth exceeds 60 m.

The Town of Innisfil also utilizes a Site Plan Control Bylaw updated in 2013 and a Site Alteration Bylaw also passed in 2013. Specifically, for those areas of the municipality subject to site plan control, site plans showing drainage, stormwater management, and landscaping must be approved by the municipality prior to obtaining a building permit for development (Town of Innisfil, 2013b). The Site Alteration Bylaw was passed under the authority of the Municipal Act and applies to all lands within the boundary of the Town of Innisfil. The bylaw states in Section 4: “No Person shall place or dump, or cause or permit to be placed or dumped, fill or topsoil on land or alter, or cause or permit to be altered, the existing or finished grade of land within the Town, unless it is otherwise permitted by, or exempted from the provisions of, this By-law.” In addition to the detailing of an application process, and permit conditions that may be imposed, there are certain standards for the stabilization of fill (for example) outlined in the bylaw (Town of Innisfil, 2013a).



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### 3.6.4 Best Management Practices

The LSPP requires that all new substantial development in the Lake Simcoe watershed implement a stormwater management plan that demonstrates no net increase in phosphorus loads to Lake Simcoe. The MOECC's Phosphorus Budget Guidance Tool to Guide New Development in the Lake Simcoe Watershed (HESL et al., 2011) was developed to provide technically sound guidance for estimating phosphorus loading from stormwater runoff in the pre-, post- and construction phases of new development in the Lake Simcoe watershed. The tool recommends several BMPs that can be used to mitigate phosphorus loads along with suggested load reduction efficiencies for inclusion in stormwater management plans.

The LSPP also contains a variety of recommendations for shoreline and riparian management also aimed at reducing phosphorus loading to the lake.

### 3.6.5 Program Successes and Challenges

A detailed monitoring program is carried out by the LSRCA, in collaboration with the MOECC, in Lake Simcoe and its tributaries (LSRCA, 2013). Long-term trends indicate decreasing phosphorus concentrations at the majority of monitoring stations, but the trend does not hold in recent years. This suggests that the more easily achieved phosphorus reductions were successful soon after the initiation of the monitoring program, but further reductions are more difficult to achieve.

Given the size of the watershed, the lake's long retention time and the range of protection initiatives that have been implemented by watershed partners, it is too early to judge the overall success of the Lake Simcoe Protection Plan in restoring Lake Simcoe.

## 3.7 Rideau Valley Conservation Authority

The Rideau Valley Conservation Authority (RVCA) developed a unique site evaluation process in the early 1990s to determine general site suitability for shoreline development and establish appropriate setbacks (Michael Michalski Associates and Anthony Usher Planning Consultant (Michalski and Usher), 1992), which was adapted to various degrees by the four of the five municipalities in its jurisdiction. The key objective of the RVCA is to achieve "no net decline in water quality (no net increase in phosphorus loading)" associated with development (Michalski and Usher, 1992; RVCA, 2009). The following describes the site evaluation approach with an example of how the approach has been implemented in the Township of Rideau Lakes.

### 3.7.1 Lake and Watershed Characteristics

The Township of Rideau Lakes spans 3 watersheds including the Rideau River Watershed that flows north to the Ottawa River and the Great Cataraqui River and Gananoque River watersheds that drain to Lake Ontario. This area is located at the edge of the Precambrian Shield such that granitic Shield bedrock predominates in the western part of the township and dolomitic and sandstone rocks of the St. Lawrence Lowlands occur in the east.



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There are numerous lakes throughout the Township, including lakes that comprise the Rideau Waterway, which generally lie along the divide between the Canadian Shield and St. Lawrence Lowlands. Land cover is primarily natural with forest and woodland of the Woods Plain Ecozone with some agricultural lands. There are five municipalities and a number of smaller hamlets throughout the watershed. Specific lake and watershed characteristics are not provided for the Township lakes, but the watershed report cards for the Rideau Lakes Subwatershed by the RVCA indicate that the lakes in this area are mesotrophic to eutrophic (RVCA, 2009).

The Township of Rideau Lakes is within Lennox and Grenville United County and has a population of 10,207, which declined by 1.4% from 2006 to 2011 (2011 Census; Statistics Canada, 2012). Waterfront development in the township is generally seasonal residential and serviced by private septic systems but while there has been a stable population, there is a trend to increasing conversion of seasonal to permanent residences (RVCA, 2009). The nearest urban centres to the township are Ottawa (110 km) and Kingston (60 km) with populations of 1,236,324 and 159,161, respectively (2011 Census; Statistics Canada, 2012).

### 3.7.2 Technical Framework

The site evaluation approach includes an assessment of site parameters such as soils and slopes on a regional scale to determine general site suitability for shoreline development (Michalski and Usher, 1992). The approach identifies four classes of land development capability:

- ❁ Class 1: lands having predominantly good development capabilities, requiring no or little site modification (mainly level to gently sloping, well drained, and having deep (>1.5 m), sandy and/or loamy soils);
- ❁ Class 2: lands having fair development capability, requiring moderate amounts of site modification (characterized by the widespread occurrence of minor constraints such as imperfect site drainage, shallow but continuous soil cover over bedrock, or moderately steep slopes), or lands having good development capability moderately interspersed with areas of major constraints;
- ❁ Class 3: lands having poor development capability, requiring extensive site modifications (characterized by the widespread occurrence of two or more minor constraints and the local occurrence of major constraints); and,
- ❁ Class 4: lands generally unsuitable for development without excessive site modifications (dominated by major constraints, such as wetlands with moderate to deep organic deposits, or steep bedrock outcrops).

More specific biophysical criteria were assessed at the site level such as soil depth, soil texture, slope and vegetation (Michalski and Usher, 1992). These criteria were assigned scores based on their suitability for development and the scores used to identify a recommended horizontal setback distance.



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### 3.7.3 Planning, Regulatory and Implementation Tools

The Township of Rideau Lakes Official Plan (2010) includes various policies that incorporate the findings of the site evaluation guidelines produced in 1992 (Michalski and Usher, 1992) but the quantitative scoring system was not transposed into policies contained in the OP or Zoning Bylaw. The scoring is completed by the RVCA and provided to the municipality for specific planning applications (D. Maciver, personnel communication, April 29, 2014).

In relation to water setback, the following policy transposes the findings of Michalski and Usher (1992) most prominently, “Where lake-specific or site-specific conditions suggest that it would be appropriate, the minimum water setback may be increased. Examples of the latter would include sites with steep slopes, limited soil depth, sub-optimal (i.e. very high or very low) soil percolation rates or limited vegetative cover.” The Official Plan stipulates a minimum water frontage for any new waterfront lot of 60 m. This requirement may be increased where lake-specific or site-specific conditions suggest that it would be appropriate and shall be implemented through the Zoning By-law (Township of Rideau Lakes, 2010). The Township encourages the protection of existing natural vegetation through tree cutting by-laws and site alteration by-laws as authorized in the *Municipal Act*, and Site Plan Control.

In terms of boat capacity on the Rideau Canal, there are localized areas such as narrow channels, near existing marinas and in the vicinity of lock stations, where there is potential for boater conflicts. Proponents of large-scale water-oriented development projects are required to consult with the approval authority and Parks Canada during a planning application to assess the effect of development on safe and enjoyable navigation of the Rideau Canal.

The Official Plan also cites Section 37 of the *Planning Act* in which Council may authorize increases to the maximum height and density of development otherwise permitted by the Zoning By-law. These increases may be granted in return for the provision of facilities, services or matters set out in the by-law and could include, among other items, the conservation of cultural heritage or archaeological resources and the enhancement of natural heritage features

In the Waterfront Residential zones, the minimum lot frontage requirement is 60 m and a minimum lot area of 4,050 m<sup>2</sup>. The maximum lot coverage permitted on a lot is 10% based on the area of the lot within 60 m of the high water mark. In addition, there is also a maximum floor space index (total floor area) limit of 10% of the lot area within 60 m of the high water mark.

For major development, a lake impact study to assess the effect of development and additional nutrient loadings on lake water quality is required in the Township of Rideau Lakes. Development or site alteration such as filling, grading and excavating shall occur a minimum distance of 30 m from the normal high water mark of any water body. The quantitative element of this setback is implemented through the comprehensive Zoning By-law, while the qualitative elements are addressed through the Site Plan Control process. Stormwater Management is an important part of the Township's broader interest in protecting water quality.



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### 3.7.4 Best Management Practices

BMPs listed in the Township of Rideau Lakes OP (2010) include:

- ❁ A minimum frontage of 60 m
- ❁ A minimum 15 m substantially and naturally-vegetated shoreline buffer
- ❁ Ensuring wherever possible that buildings and structures along the shoreline do not generally occupy more than 25% of the water frontage of any lot
- ❁ Retaining as much native vegetation as possible
- ❁ Selecting stormwater management approaches that maximize natural infiltration and minimize runoff during and after construction.

### 3.7.5 Program Successes and Challenges

The RVCA Site Evaluation guidelines are considered to be an integral component of successful lake management in the Township of Rideau Lakes based on the opinions of planning staff and is supported by a general decline in phosphorus concentration in many local developed lakes (HESL, 2014).

The site evaluation guidelines created by RVCA are currently being reviewed and updated to reflect new scientific understanding related to waterfront development and associated BMPs since the early 1990s, but the report is not yet publically available.

## 3.8 Township of Muskoka Lakes

The Township of Muskoka Lakes (TML) is a lower-tier municipality in the District Municipality of Muskoka. The Township has recently updated their Official Plan (2010a), which adopts the district policies for shoreline development (see Section 3.4.2), but also includes policies and uses a variety of implementation tools to provide additional measures to protect water quality, social density and scenic amenity values that reflect local area values and 'lake character', as described in the following sections (TML, 2006; 2008a, b; 2009; 2010b, c).

### 3.8.1 Lake and Watershed Characteristics

Approximately 100 lakes are managed in the TML. Lake and watershed characteristics are similar to those described previously for the DMM (see Section 3.4.1).

### 3.8.2 Technical Framework

The TML's Official Plan (2010a) states that shoreline development should complement the existing natural and built form and should enhance and protect those qualities that contribute to character. To this end, lakes are classified to reflect 'Waterfront Character', based on a number of cultural and environmental factors that include:





- ❁ Lake size,
- ❁ Lake surface area,
- ❁ Access, and



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### History of development

The lake categories include:

-  Category 1 - Large Lakes
-  Category 2 - Medium-sized, High Development Lakes/Rivers
-  Category 3 - Small/Remote and Undeveloped Lakes
-  Category 4 - Lakes with Development Limits

Development standards are scaled to best protect the general character of lakes in each category including, for example, density of buildings and structures (docks, boathouses), setbacks, build height and size (Section 3.8.4).

### 3.8.3 Planning, regulatory and Implementation Tools

Shoreline vegetative buffers and building density limitations are the cornerstones of the Township's policy (see Section 3.8.3 for minimum standards). Retaining a shoreline vegetative buffer is cited in a number of policies in the Official Plan as it is considered to be of paramount importance in protecting lake water quality as well as scenic and visual aspects of the waterways.

Policies related to building density note limitations based on a lot frontage and lot area criteria as detailed in the implementing zoning bylaw. Only that portion of the lot within 60 metres of the shoreline is used in the calculation of maximum permitted lot coverage and there is strict adherence to the limitations as detailed in the implementation section of the Official Plan.

The Comprehensive Zoning Bylaw (TML, 2006) includes eight Waterfront Residential zones, with a separate zone for those properties fronting onto lakes that are Over Threshold for phosphorus according to the District Municipality of Muskoka's Lake System Health Program. The bylaw, however, will be updated to reflect the revisions to the new Lake System Health program, which is still under review by the District Municipality of Muskoka.

Site Plan Control (TML, 2008b) is used extensively to implement Water Quality Impact Assessments and Best Management Practices. Financial securities are collected to ensure the implementation of the Agreements made under the Site Plan Control.

The Township also has a Tree Preservation Bylaw and Site Alteration Bylaw passed under the *Municipal Act* rather than the *Planning Act* (TML, 2008a; 2009). These bylaws are used as educational tools as well as providing aggressive enforcement provisions which can be used if necessary.

### 3.8.4 Best Management Practices

Shoreline Vegetative Buffers must have a minimum depth of 15 m from the high water mark and extend across the entire lot frontage (in contrast to DMM target of 75% of the lot frontage).



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

### 3.8.5 Program Successes and Challenges

The overall implementation of the planning program at the Township has been very successful, which is largely attributed to the active use of Site Plan Control and the availability of a Tree Preservation Bylaw and Site Alteration Bylaw. Prior to these bylaws being in place, the Township was unable to address unauthorized tree removal or filling of wetland areas, for example.

The Township has gone beyond the DMM target for shoreline buffers and requires the entire frontage to be retained in its natural state. Limiting the density of development on waterfront lots has been very successful with Official Plan policies in place requiring strict adherence. The success rate at the Ontario Municipal Board has been very high owing to the strict Official Plan policies. The implementation of planning policies aimed at protection of the shoreline and water quality has been successful although the absolute success can only be judged by monitoring over time.

### 3.9 Township of Seguin

The Township of Seguin is a popular recreational area located in the District of Parry Sound to the north of the District Municipality of Muskoka and ~3 hours from the Greater Toronto Area. Seguin Township is the recent amalgamation (1998) of the Townships of Christie, Foley, Humphrey and the Village of Rosseau.

The Township, through its Official Plan (2012), has adopted an “Environment First” approach to managing shoreline development that aims to protect and preserve the quality of the water, protect the visual and aesthetic character of the lakes and rivers, protect the recreational, social, and environmental experiences, protect public safety by prohibiting development in areas subject to flooding or erosion, and respect the unique character of each lake. To achieve these goals, the Township uses an approach that combines elements of lake capacity assessment (based on phosphorus, lake trout habitat and social density), mitigation and education.

#### 3.9.1 Lake and Watershed Characteristics

Seguin Township lies on the Precambrian Shield and the majority of land is undeveloped forest with some rural residential influence. There are 186 lakes greater than 10 ha within the Township boundaries with a wide range of surface area (10 – 578 ha), catchment areas (22 to 56 km<sup>2</sup>) and depths (1.2 m to 42 m, n=54). There are many small lakes throughout the area. The lakes are primarily oligotrophic with a mean ice-free phosphorus concentration of 7.8 µg/L. Wetland area is variable and comprises an average of 5% of the lake catchments (range = 0 to 23%).

There are 2,931 shoreline lots of record in the Township, 81% of which are seasonal and 19% permanent. The level of development stress is considered to be moderate; for example, in 2012 with the Township received 32 applications for shoreline lot creation (18 cottages, 14 residences, 6 boat houses) and 34 applications in 2013 (22 cottages, 12 residences, 2 boathouses).

The lots are serviced by private septic systems.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

### 3.9.2 Technical Framework

A lakeshore capacity assessment was completed for all township lakes >10 ha using the provincial Lakeshore Capacity Assessment approach to identify lakes over threshold for phosphorus based on the revised PWQO (current development exceeds “Background + 50%”) (AECOM, 2010). Lakes were also classified as having High, Moderate or Low Sensitivity based on responsiveness to a standard areal load of phosphorus and mobility of phosphorus from septic systems following the same approach as the District Municipality of Muskoka (see Section 3.4.2). As with the DMM, new shoreline lot creation is prohibited for lakes that are Over Threshold for phosphorus and that are classified as ‘High Sensitivity’. For all other lakes, a Site Evaluation Report or Environmental Impact Study may be required to mitigate impacts of development through establishment of a shoreline buffer, limiting shoreline use area, meeting setback requirements, controlling stormwater and providing enhanced sewage treatment.

The Township, however, also prohibits new shoreline lot creation on lakes with a total phosphorus concentration >20 µg/L. The Township also takes a capacity approach for social density based on a density filter of 1 lot/1.6 ha of lake surface area and adheres to MNR policy for capacity limits for Lake Trout lakes. As a result, the Official Plan prohibits new shoreline lot creation where:

- ❁ Current development could increase phosphorus concentrations beyond “Background + 50%”, or
- ❁ Current concentrations of total phosphorus exceed 20 µg/L, or
- ❁ Current development exceeds 1 lot/1.6 ha of lake surface, or
- ❁ Volume weighted hypolimnetic concentrations of dissolved oxygen are <7 mg/L at the end of summer.

The Township implemented a water quality monitoring program (spring total phosphorus concentration and end-of-summer dissolved oxygen and temperature profiles) in 2009. The purpose of the program is two-fold. First, the monitoring data are intended to help refine and validate the phosphorus model as phosphorus data were lacking in 2009 to sufficiently validate the phosphorus model and other lake data (lake depth, oxygen status) were missing as input data for the majority of lakes. Second, the monitoring data, over time, will provide a long-term dataset to track changes in water quality over time. This information is necessary to assess the success of the program to protect water quality and respond as necessary if the change is due to impacts of shoreline development.

The Township has implemented a septic re-inspection program to limit the direct impacts associated with failing or undersized septic systems, which is conducted by summer students hired by the Township and in partnership with the North Bay-Mattawa Conservation Authority.

### 3.9.3 Planning, Regulatory and Implementation Tools

Management of shoreline development is implemented through various tools including the use of site plan control, monitoring requirements, site plan or development agreements, including the posting of securities, Zoning By-law performance standards, and other regulatory bylaws including tree cutting, site alteration, and a development permit system. The OP also contains numerous policies related to the waterfront design and landscaping to protect the aesthetic characteristics of shoreline areas.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

The Township of Seguin focuses on enforcement of shoreline management requirements through the Ontario Municipal Board (OMB), and laying charges under the *Provincial Offences Act* (POA) and Shoreline Protection Bylaws. The Township presently has 5 OMB files open dealing with shoreline development, and 3 POA cases going to trial in May 2014 on shoreline properties. In 2013, the Township initiated 20 investigations under the shoreline protection by-laws.

Seguin regularly sells Shore Road Allowances (SRAs) to abutting property owners who wish to acquire the lands in front of their property. In 2013, Seguin started to impose Restrictive Covenant Agreements on the purchases of SRAs as an additional control to help ensure that the shoreline lands would be used in a manner consistent with the Township's bylaws and environmental planning and development principles. This arose after a number of by-law contraventions occurred on recently sold SRAs. The Township expects that legal proceedings for contravention of a contract will be much more successful, focused and to the heart of the issue than relying upon the OMB or the POA Court for a decision.

In order to minimize the impact of development on the recreational carrying capacity of a lake, the Township may impose limitations on the size of docks through the zoning bylaw, and limit public access to the lake (no enforcement tool is provided in the OP) or seek voluntary restrictions on the power of boats using the lake. Larger lots may be required due to environmental or physical restraints, narrow channels, small waterbodies, deer wintering areas or sensitive fish habitat.

Council also encourages the preparation of lake plans and strategies by local lake associations as a tool to establish and improve communication and good land stewardship practices amongst those who share a lake community and to articulate lake-specific principles and goals. Council may consider amendments to the Official Plan or Zoning By-law where lake plans and strategies reveal new planning issues not already addressed by the Official Plan. This has not been done to date, likely because lake associations can achieve the goals of their lake plans without changing policies (i.e., by stewardship) or because the existing policies are adequate.

### 3.9.4 Best Management Practices

Maximum permitted lot coverages are on a sliding scale that encourages a natural landscape over the built form. A lot with a frontage of less than or equal to 30 m, for example, is permitted to have a lot coverage of 10% while a lot with 121 metres to 130 metres is permitted to have 6% of the lot covered by buildings. New lots shall have at least 90 m of shoreline frontage and a lot area of 1 ha and 120 m frontage and minimum lot are of 1.2 ha for island lots.

The Official Plan stipulates that development shall be set back a minimum of 20 metres from the high water mark. A greater setback may be required where necessary to address water quality, wetland, fish habitat or similar issues. Site alteration and disturbance of vegetation within the 20 metre setback shall be limited to minor alterations to accommodate access trails, docks, water pumping equipment or restoration work.

Best Management Practices are addressed through Site Evaluation Reports which are required as part of development applications in the Shoreline Area designation. The Site Evaluation Report requires a thorough site description, identification of potential impacts of the development and a description of how



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

mitigation such as BMPs can be utilized to minimize any impacts associated with development. Examples of BMPs include monitoring of the sewage system performance, the maintenance or restoration of the shoreline buffer, and the monitoring of stormwater management measures.

The Township also actively supports the use of Best Management Practices by residents. For example, in 2009, with the assistance a consultant, and input from shoreline residents and lake associations, a stewardship handbook “Living Sustainably in Seguin Township” was prepared for shoreline property owners. Copies were provided to the lake associations for their members, and can be found on the Township website at: <http://www.seguin.ca/en/news/index.aspx?FeedId=0B38D19B-0711-4F27-BF6D-568A7DB979DB&newsId=7b16317a-e583-4ec3-b8de-5cfce1423216>.

In 2011, the Township purchased metal speed limit signs from Transport Canada (compliant 10km/hr) for posting at near shore areas at all township boat launches. In addition, Lake Associations were provided with free signs to post on the shorelines of their lakes. A total of 90 signs were installed throughout the township.

### 3.9.5 Program Costs

The Township of Seguin is one of the only jurisdictions that was able to provide detailed information of costs associated with their lake management approach (Table 7).

Table 7. Summary of Costs Related to Managing Shoreline Development in Seguin Township

Item	Cost
Legal Costs for Enforcement of Shoreline Zoning and By-Law (e.g., OMB proceedings, Provincial Offences Court and Supreme Court of Ontario)	\$75,000 - \$100,000/yr (budget)
Water Quality Monitoring and Septic Re-inspection Program	\$30,000/yr
Water Quality Model Update (planned for 2014-2015)	\$25,000
Development and Publication of “Living Sustainably in Seguin Township”	\$25,000
Speed Limit Signs for Near Shore Areas	\$3,000

### 3.9.6 Program Successes and Challenges

The Seguin Township approach has a variety of policies and tools that address a wide range of shoreline development and lake capacity issues which have been successfully implemented and defended. The Township notes that legal actions and enforcement have proven to be an effective deterrent. The tools are all based on sound management techniques which were adopted because of their demonstrated effectiveness or sound technical grounding. The absolute effectiveness of the Seguin approach can only be judged by monitoring over time. Monitoring to-date, however has not identified any lakes with a significantly increasing trend in total phosphorus concentration that would suggest impacts from shoreline development with respect to phosphorus.



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### 3.10 State of Maine

The State of Maine manages shoreline development through classification of the shoreline zone and placing restrictions on the type of development (i.e., commercial, residential) that can occur within each zone. Minimum development standards including BMPs are scaled according to the zone. The stated purposes of this approach are to:

- ✿ Maintain safe and healthy conditions,
- ✿ Prevent and control water pollution,
- ✿ Protect fish spawning grounds, aquatic life, bird and other wildlife habitat,
- ✿ Protect building and lands from flooding and accelerated erosion,
- ✿ Protect archaeological and historic resources,
- ✿ Protect commercial fishing and maritime industries,
- ✿ Protect wetlands,
- ✿ Control building sites, placement of structures and land uses,
- ✿ Conserve shore cover and visual as well as actual points of access to inland and coastal waters,
- ✿ Conserve natural beauty and open space, and
- ✿ Anticipate and respond to the impacts of development. (Maine Department of Environmental Protection (MDEP, 2006a).

While Maine's approach to managing shoreline development is focused at the lake level, several state-wide programs operate at the watershed level to manage development in general to protect water quality in lakes and rivers under the federal *Clean Water Act* (2002). Maine's approach is primarily a planning approach and is described in Section 3.10.3, and a brief overview of technical components carried out by the State under the *Act* is provided in Section 3.10.2.

#### 3.10.1 Lake and Watershed Characteristics

Lake and watershed characteristics were obtained from the Knowledge Base database that is available online (Senator George J. Mitchell Center for Environmental and Watershed Research et al., 2014). There are 1,800 lakes in Maine with a surface area of 10 ha or more and over 4,000 smaller lakes and ponds. Lakes range from shallow (<1 m) to deep (96 m) and have variable watershed areas (3 to over 675,000 ha).

Total phosphorus concentrations range from 1 µg/L to 166 µg/L (mean = 12 µg/L, n=962 lakes) and 7% of the lakes are classified as oligotrophic, 58% as mesotrophic and 35% as eutrophic. Only 0.11% of the lakes are classified as dystrophic.

Twenty five percent of the lakes support a warmwater fishery, 43% support a coldwater fishery and an additional 14% of the lakes are characterized as having both warm and coldwater fisheries. The remaining 20% of the lakes are either remote with no data, or do not support a fishery.

Maine is located off the Precambrian Shield and has a complex bedrock geology due to a variety of geologic processes including erosion and sedimentation, mountain building, deformation, metamorphism and igneous activity (Marvinney, 2012). Bedrock is generally characterized as stratified with layered



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

sedimentary, metamorphic and volcanic rocks with intrusions of igneous rocks, primarily of the Paleozoic Era. The majority of the state is covered in deep glacial till deposits with a combination of marine and glacial tills in lower elevation coastal areas.

Maine lies in the Temperate Broadleaf and Mixed Forest Ecoregion with a humid continental climate. Land cover is predominantly forest, representing 83% of the land area and only 4% of the state is urbanized (Nowak and Greenfield, 2012). The population of Maine is approximately 1.3 million and the largest urban centre is Portland with a population of 66,194 (2010 US Census; United States Census Bureau, 2014). Population density is primarily focused in the southern coastal areas.

Waterfront development is mainly recreational and unserved.

In summary, Maine, like Ontario, has a high density of lakes with a wide range of lake and watershed characteristics. In general, water quality of the lakes is most comparable to that of Ontario lakes that are located off the Canadian Shield with naturally higher nutrient concentrations. The population demographics are similar in that there are large portions of the state with low population density where shoreline development is primarily recreational and unserved, as in northern and northeastern Ontario, as well as more densely populated urban centres with a mix of residential shoreline uses and servicing.

### 3.10.2 Technical Approach

Water quality monitoring in Maine and across the United States is completed in accordance with Sections 303(d) and 305(b) of the *Clean Water Act* (EPA, 2002). Waterbodies are assigned to one of five categories that describe water quality status. Categorization criteria are established by various groups, but Category 5 lakes, which are the most degraded lakes, require the development and submission of a Total Maximum Daily Load report (TMDL). Monitoring results are submitted to the State for review every two years.

A lake is considered to be “most at risk from new development” if it is a public water supply, in violation of water quality standards, has severe algal blooms, or is particularly sensitive to eutrophication based on:

- ❁ Current water quality,
- ❁ Potential for internal recycling of phosphorus,
- ❁ Potential as a cold water fishery,
- ❁ Volume and flushing rate, or
- ❁ Projected growth in the watershed. (MDEP, 2006b)

Specific ratings or thresholds for the above criteria to establish the sensitivity to eutrophication, however, are not provided in the literature reviewed for this study.

Large-scale proposed developments (>5 acres (2 ha)) in watersheds of lakes considered “most at risk from development” require a stormwater permit by rule and a phosphorus budget that proves that phosphorus generated by the proposed development will not be greater than the allowable per unit area (per-acre) phosphorus allocation as determined by the Maine Department of Environment Protection (MDEP, 2006b, MDEP, 2011). The State provides detailed guidance for BMPs to reduce impacts from



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stormwater including phosphorus loading (MDEP, 2013). Basically, phosphorus allocation for lake watersheds is calculated based on the following criteria:

- ✿ Direct watershed area in town (urban area)
- ✿ Area not available for development
- ✿ Area available for development
- ✿ Expected developed area
- ✿ Water quality category

The watershed area phosphorus allocation is then multiplied by the project area to determine the project phosphorus budget (e.g., MDEP, 2006c).

### 3.10.3 Planning, Regulatory and Implementation Tools

Maine utilizes a variety of tools to manage the impacts associated with shoreline development through the *Natural Resources Protection Act* and *Mandatory Shoreland Zoning Act* (MSZA). The MSZA was enacted in 1971 in response to increasing development pressure (MDEP, 2006a). The legislature concluded that strict regulation of land-use activities was necessary in the shoreland zone to include all land within:

- ✿ 250 feet (76 m) of the normal high-water line of any natural pond over 10 acres (4 ha), any river that drains at least 25 square miles (65 km<sup>2</sup>), and all tidal waters and saltwater marshes;
- ✿ 250 feet (76 m) of a freshwater wetland over 10 acres (4 ha) (except “forested” wetlands); and
- ✿ 75 feet (23 m) of a stream. Only outlet streams of great ponds, and streams below the confluence of two perennial streams depicted on a USGS topographic map are required to be zoned. (MDEP, 2006a)

The State, through the Department of Environmental Protection, oversees the administration of the municipal ordinances and assists towns and cities to meet requirements of the MSZA in four ways:

- ✿ Establishes minimum ordinance standards by publishing model ordinances (i.e., Guidelines for Municipal Shoreland Zoning Ordinances, “Guidelines”),
- ✿ Provides assistance to town officials and landowners in the form of workshops, publications and staff time;
- ✿ Monitors local compliance to ensure that the local ordinances are followed; and
- ✿ Reviews and approves (or disapproves) local ordinances to ensure compliance with the state Guidelines and statute. (MDEP, 2008)

In contrast to legislation in Canada, the MSZA requires all municipalities to enact, administer, and enforce a local ordinance. This means that local governments must:

- ✿ Adopt a shoreland zoning ordinance (and map) that, at a minimum, meets the state Guidelines, addresses all the statutory requirements of the *Act*, and has been approved by the Department of Environmental Protection Commissioner;
- ✿ Put administrative procedures in place to review applications and issue permits; and



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- ❁ Appoint a Code Enforcement Officer whose responsibility it is to enforce the ordinance provisions, collect permit fees, and record all transactions. (MEDP, 2008)

Districts are established in municipal zoning ordinances, generally Resource Protection Districts, Limited Residential Districts, Limited Commercial Districts, General Development Districts, Commercial Fisheries/Maritime Activities (CFMA) Districts and Stream Protection Districts based on current development, slopes, wetlands, erosion potential and other factors to help determine the appropriate type of development (MDEP, 2006a, Table 8). The State provides a host of data and mapping to facilitate zoning by municipalities. Residential development is only prohibited in the CFMA District.

There are certain standards established in the legislation that must be incorporated in the local municipal ordinances such as those related to lot sizes, expansion of non-conforming structures, stormwater runoff and erosion control (see Section 3.10.4 for minimum development standards). Municipal ordinances can provide additional enhanced requirements by expanding the regulated area, regulating in-water structures, protecting scenic views, and optional wetland zoning (MDEP, 2006a).



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Table 8. Description of Maine's Shoreland Zoning Districts (modified from MDEP (2006a))

Shoreland Zoning District	Description
Resource Protection (RP)	<ul style="list-style-type: none"> <li>• Areas where development would adversely affect water quality, productive habitat, biological ecosystems or scenic and natural values to include:               <ul style="list-style-type: none"> <li>○ Floodplains</li> <li>○ Areas with <math>\geq 2</math> acres (0.8 ha) of contiguous sustained slopes of <math>\geq 20\%</math>, or wetlands and hydric soils that not connected to a water body</li> </ul> </li> <li>• May also include:               <ul style="list-style-type: none"> <li>○ Important wildlife habitat,</li> <li>○ Natural sites of significant scenic or esthetic value</li> <li>○ Natural areas of significance designated by government</li> <li>○ Existing public access areas</li> <li>○ Archaeological and historic sites</li> <li>○ Areas within 250 ft. (76 m) of the upland edge of wetlands that are rated "moderate" or "high" value waterfowl and wading bird habitat</li> </ul> </li> </ul>
Limited Residential (LR)	<ul style="list-style-type: none"> <li>• Areas suitable for residential and recreational development that are outside of the RP and SP districts</li> <li>• Used less intensively than in the LC, GD or CFMA districts</li> </ul>
Limited Commercial (LC)	<ul style="list-style-type: none"> <li>• Areas of mixed, light commercial and residential uses, exclusive of the SP District</li> <li>• Should not be developed as intensively as the GD districts.</li> <li>• Contiguous areas of <math>\geq 2</math> acres (0.8 ha) of residential and low intensity business and commercial uses</li> <li>• Industrial uses are prohibited</li> </ul>
General Development (I and II) (GD)	<ul style="list-style-type: none"> <li>• Existing (GD I) or planned (GD II) intensively developed contiguous areas of <math>\geq 2</math> acres (0.8 ha) of commercial, industrial, or intensive recreational development</li> <li>• No new or expansion of, a GD district, is permitted adjacent to a river or lake</li> </ul>
Commercial Fisheries/Maritime Activities (CFMA)	<ul style="list-style-type: none"> <li>• Areas of functionally water-dependent uses</li> </ul>
Stream Protection (SP)	<ul style="list-style-type: none"> <li>• All land areas within 75 ft. (23 m) of a stream, excluding areas within 250 ft. (76 m) of a lake (i.e., where other Districts apply)</li> </ul>

## 3.10.4 Best Management Practices

Minimum lot standards including vegetation clearing required by the MSZA include:

- 200 ft. (61 m) of frontage and an area of 40,000 ft<sup>2</sup> (0.19 ha)
- Building setbacks are 250 ft (76 m) in the Resource Protection District, 100 ft. (30 m) from lakes and their inflowing streams in General Protection Areas and 75 ft. (23 m) for all other water bodies except in the General Development I District (commercial) (25 ft. (7.6 m) setback) and Commercial Fisheries/Maritime Activities District (no setback is required).
- A maximum 20% coverage by structures, driveways, parking areas, decks, patios, and other non-vegetated surfaces



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- ❁ Minimum setback for septic systems of 100 ft. (30 m) from the high-water line of a perennial water body and this distance may not be reduced by variance
- ❁ No openings greater than 250 ft.<sup>2</sup> (23 m<sup>2</sup>) in the forest canopy are allowed in the first 75 ft. (23 m) from the normal high-water mark, but 40% of the volume of trees four inches (10 cm) in diameter or greater can be removed in any ten year period. A well-distributed stand of trees must remain, however, and is defined by a points system based on tree diameters as follows:
  - 2 inches (5 cm) - 4 inches (10 cm) = 1 point
  - >4 - 12 inches (30 cm) = 2 points
  - >12 inches = 4 points

A rating of 12 or more within a 25 ft. (7 m) by 25 ft. (7 m) square must be maintained adjacent to waterbodies >4 ha in surface area. Smaller waterbodies must maintain a rating score of 8 per square.

- ❁ At distances greater than 100 ft. (30 m), cutting of more than 40% of trees greater than 4 inches (10 cm) is prohibited
- ❁ Cleared openings cannot exceed 25% or 10,000 ft.<sup>2</sup> (928 m<sup>2</sup>), whichever is greater, of the lot area within the shoreland zone for any purpose (structures, driveways, lawns, etc.)

### 3.10.5 Program Successes and Challenges

Representatives from the Department of Environmental Protection would not characterize the general program successes or challenges because of the variability between municipalities. Shoreland Zoning Ordinances have been developed for 54 municipalities so it is difficult to characterize the successes and challenges of the approach to meet the stated goals across all of the different municipalities.

## 3.11 State of Minnesota

The State of Minnesota's approach to managing shoreline development is based on a classification system of the shoreland and development restrictions, standards and BMPs are tailored to the different lake classes. The *Shoreland Management Act* was enacted in 1969, established the "shoreland district" (i.e., all land within 1,000 feet (305 m) of a lake and 300 feet (91 m) of a river and its designated floodplain) and compelled the MDNR to establish standards for the use and development of shorelands. Since then the *Act* has been amended several times, most notably in 1973 to include municipalities and in 1989, in response to increased development pressures including larger lakeshore developments. In 2005, the stricter, voluntary Alternative Shoreland Standards were developed to provide local governments with the tools necessary to address specific issues. The MDNR was directed to further update the minimum shoreland management rules in 2007, however this update remains incomplete.

### 3.11.1 Lake and Watershed Characteristics

Minnesota is a water-rich state with 11,842 lakes greater than 10 acres (4 ha) spread out across 81 major watersheds and 5,600 minor watersheds. Geology in northern portions of the State is dominated by the southern edge of the Precambrian Shield, overlain by thin, poor topsoils, while the south glacial river tills deposits are underlain by Paleozoic sedimentary rocks in the Southeast (containing a substantial carbonate component, i.e., limestone and dolomite) or by quartzite and mudstone in the Southwest. This



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diversity of natural landscapes result in diverse lake types of varying surface and watershed areas, depths and water quality conditions, similar to those observed across Ontario.

The population of Minnesota is 5,379,139 and it is projected to increase by 11% to 6 million by 2030. Like Ontario, a large portion of Minnesota consists of unincorporated areas. Shoreline development is variable, however, seasonal residential development is most common and shoreline areas are predominantly unserved.

### 3.11.2 Technical Framework

In the early 1970s Minnesota developed a shoreland classification system for lakes and streams. Lakes are classified as Natural Environment, Recreational Development, or General Development based on a combination of factors including surface area to shoreline length, existing development density and lake depth (MDNR, 2014, Table 9). Different minimum development standards such as lot width, lot area and setbacks are required for lakes depending on their classification (see Section 3.11.4) and apply to all lakes greater than 25 acres (or >10 acres within municipalities). Local governmental units are required by State Law to adopt these minimum state standards into their zoning ordinances (see Section 3.11.4).

Table 9. Description of Shoreland Management Lake Classifications (MDNR, 2014)

Classification	Description
Natural Environment Lakes	<ul style="list-style-type: none"> <li>⊗ &lt;150 acres (&lt;61 ha) of lake surface area</li> <li>⊗ &lt;60 acres of lake surface per mile (&lt;15 ha/km) of shoreline</li> <li>⊗ &lt;3 dwellings per mile (&lt;1.9 dwellings per km) of shoreline</li> <li>⊗ May be some winterkill of fish, may have shallow, swampy shoreline</li> <li>⊗ &lt;15 ft (&lt;4.6 m) deep</li> </ul>
Recreational Development Lakes	<ul style="list-style-type: none"> <li>⊗ 60 - 225 acres of lake surface area per mile (15 – 140 ha/km) of shoreline</li> <li>⊗ 3 - 25 dwellings per mile (1.9 - 16 dwellings per km) of shoreline</li> <li>⊗ &gt;15 feet (&gt;4.6 m) deep</li> </ul>
General Development Lakes	<ul style="list-style-type: none"> <li>⊗ &gt;225 acres of lake surface area per mile (&gt;140 ha/km) of shoreline</li> <li>⊗ &gt;25 dwellings per mile (&gt;16 dwellings per km) of shoreline</li> <li>⊗ &gt;15 feet (&gt;4.6 m) deep</li> </ul>

Most of the lakes and lake basins were classified in the 1970s although provisions exist for classifying additional basins or local governments may submit a resolution and supporting data to request the commissioner consider the reclassification of a water body within its jurisdiction. A complete list of the supporting data used in lake classification can be found in Section 6120.3000 subp. 2 of the Minnesota Administrative Rules (MDNR, 2014).



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## 3.11.3 Planning, Regulatory and Implementation Tools

Local governmental units are required to adopt the standards and lake categories of the *Act* into County Shoreland Management Ordinances. However, growing concern of the impacts of increased development on water quality led to the Governor's Clean Water Initiative, a pilot project in a five county area of North Central Minnesota. This project resulted in the development of the Alternative Shoreland Management Standards, a set of stricter voluntary standards which provide local governments the tools necessary to address specific local shoreland issues (MDNR, 2005). Briefly, these standards include an additional lake classification, special protection lakes, along with stricter minimum standards for all lake classes. Furthermore, in addition to these regulatory measures, the Minnesota Statutes also provide citizens the opportunity to petition counties in order to create a Lake Improvement District (LID). Briefly, an LID is a local government unit, established by a county board, city council or the commissioner of the MDNR, which is delegated specific authorities depending on its purpose, including:

- ✿ Applying for and comply with MDNR and other agency and local permits and policies required for specific lake management projects;
- ✿ Undertaking lake research projects;
- ✿ Conducting water improvement and conservation programs;
- ✿ Serving as local recipient for state and federal projects or grants;
- ✿ Maintaining public facilities;
- ✿ Regulating water surface use;
- ✿ Providing and financing local governmental services within the LID;
- ✿ Implementing monitoring programs.

## 3.11.4 Best Management Practices

Minimum shoreline development standards vary according to lake classification (Table 9 and 10).

Table 10. Statewide Minimum Shoreland Standards for Unsewered Lakes in Minnesota

Lake Class	Lakeshore				Non-Lakeshore	
	Lot Width ft. (m)	Lot Area sq. ft. (ha)	Structure Setback ft. (m)	Shore Impact Zone sq. ft. (ha)	Lot Width ft. (m)	Lot Area sq. ft. (ha)
Natural Environment	200 (60)	80,000 (0.74)	150 (46)	75 (23)	200 (60)	80,000 (0.74)
Recreational Development	150 (46)	40,000 (0.37)	100 (30)	50 (15)	150 (46)	40,000 (0.37)
General Development	100 (30)	20,000 (0.19)	75 (23)	37.5 (11)	150 (46)	40,000 (0.37)

Best Management Practices related to shoreland lots include building elevations a minimum 3 feet (0.9 m) above the highest known water elevation, sewage system elevation 3 feet above the highest groundwater level or bedrock, and impervious surfaces are not permitted to cover more than 25% of the



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total lot. Additional BMPs related to filter strips, sewage treatment, erosion and sediment, lawns and gardens, toxic chemicals, stormwater runoff, species habitat and eutrophication are encouraged by the Minnesota Department of Natural Resources. Other BMPs may be required and enforced at the County level. A recent, incomplete rules update attempted to include requirements and encouragements for further best management practices and the MDNR expects the next effort will also.

### 3.11.5 Program Successes and Challenges

According to the MDNR, no specific performance standards exist by which they rate the success of the Shoreland Management Program. However, they suggest that measures of the program's success could include the percentage of counties and cities having ordinances regulating development in shoreland zones, the extent to which the ordinances are enforced, and the percentage of public waters under management. Currently, all counties which have landuse and zoning authority have a shoreland ordinance, but not all cities do. The Shoreland Management Rules were updated in the late 1980s, aided by money allocated by the legislature, to cities and counties to adopt new ordinances. These funds were limited and therefore cities were prioritized based on the amount of shoreline and anticipated amount of future development, therefore cities with no public waters would be considered low priority, as would cities that were already fully surrounded with developed lots. Due to limited resources, very few low priority cities have adopted ordinances. This lack of sufficient resources continues to impede the progress of the MDNR and those cities without ordinances who wish to implement them.

One potential barrier to the success of the Shoreland Management Program is that the MDNR has no real authority to enforce its rules. While the MDNR is responsible for reviewing and approving shoreland ordinances, all enforcement is managed by the local governmental units. In the past, the MDNR has reviewed and occasionally overruled variances granted by local governments, however the authority to overturn a variance decision by a LGU was in a legal gray area, and in 2008 the Minnesota Supreme Court ruled that the MDNR did not have the authority to overturn variance decisions by local governments.

## 3.12 State of New Hampshire

The State of New Hampshire's approach for managing shoreline development is legislated under the *Shoreland Water Quality Protection Act* which was enacted in 1991 and states that "The shorelands of the state are among its most valuable and fragile natural resources and their protection is essential to maintain the integrity of public waters" (New Hampshire General Court, 2011).

To fulfill the State's role as trustee of its waters and to promote public health, safety, and general welfare, the State has declared that the public interest requires the establishment of standards for the subdivision, use, and development of the shorelands of the state's public waters. The development standards provided are minimum standards necessary to protect the public waters of the state of New Hampshire, but municipalities are encouraged to develop more stringent guidelines than those set by the State.

Two of the main principles of the legislation are to maintain a natural woodland buffer (including the shoreline buffer) and limit the size of impervious surfaces with the goals to protect and restore surface waters while achieving a balance between environmental and different human uses (social, economic).



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### 3.12.1 Lake and Watershed Characteristics

There are over 1,000 lakes in the State greater than 4 ha with a total surface area of 183,900 ha. Lakes vary in depth to 56 m and the majority of the lakes thermally stratify. Lakes span a productivity gradient from oligotrophic to eutrophic, but the majority of the lakes are mesotrophic (median total phosphorus = 11 µg/L).

The geological setting of New Hampshire is similar to that of Maine, as the state is also located within the Appalachian Highlands between the Precambrian Shield to the west and the Cretaceous and Cenozoic sediment of the Coastal Plain in the east towards the Atlantic Ocean. Bedrock is complex, comprised of folded and faulted Paleozoic metamorphosed sedimentary and volcanic rocks with intrusions of plutonic rocks (Billings, 1956).

The majority of waterfront residences are recreational and are serviced by septic systems.

The population of New Hampshire is approximately 1.3 million.

### 3.12.2 Technical Approach

The State of New Hampshire uses mitigation, primarily an array of BMPs that include minimum development standards, to limit the impact of shoreline development on lakes as described in Section 3.12.4 (New Hampshire General Court, 2010; 2011).

### 3.12.3 Planning, Regulatory and Implementation Tools

Unlike Canadian legislation, Minimum Shoreland Protection Standards are detailed in the State statute and include minimum development standards and BMPs. Municipalities enforce BMPs under a variety of Revised Statutes Online. Land use ordinances and regulations, including site plan review, subdivision review and stormwater regulations are enforced through cease and desist orders, citations, injunctive relief, civil fines, recovery of legal fees and through corrective action such as maintenance or repair of a stormwater structure (New Hampshire General Court, 2011).

The *Shoreland Water Quality Protection Act* establishes a Shoreland Advisory Committee that acts on a State-wide basis and a permit process and administration of the ordinance at the local level. Individual Lake Plans are encouraged, but they are generally spearheaded by lake residents and other interested parties and do not have the same legal/enforcement status as a municipal zoning ordinance. The importance of Individual Lake Plans when considering major development proposals varies across municipal jurisdictions.

As part of the Planning program outside of the *Shoreland Water Quality Protection Act*, Master Plans are completed on a local municipal basis. These are similar to what we know as Official Plans in Ontario. The Master Plan for the Town of Alton, for example, was focused on:

- Rural character
- Attractive new development
- Encourage small scale commercial and light industrial development



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- ❁ Economic viability and tourism
- ❁ Commercial development along roads

As with other U.S. states included in this review, implementation of approaches for managing shoreline development occurs primarily through local zoning ordinances. New Hampshire does not require local governments to adopt zoning, but if a local government chooses to zone it is required first to adopt a master plan. The master plan must include a vision section and a land use element. The zoning ordinance for the Town of Gilford, for example, has requirements similar to requirements in zoning bylaws in Ontario. The parameters they control are: minimum lot size, building area limitations, lot coverage, minimum lot frontage, minimum setback from Lake Winnepesaukee (and other lakes/rivers), prevention of erosion and sedimentation, replacement of any vegetation removed or implementation of BMPs for stormwater management, use of BMPs, and limitation of amount of shoreline for docks or similar structures.

### 3.12.4 Best Management Practices

The Minimum Development Standards set by the State dictate that minimum lot sizes should be dependent on soil type and lot size determinations as follows:

- ❁ Where soils downgradient of the leaching portion of a septic system are porous with a percolation rate faster than 2 min/inch (2.5 cm) the setback shall be at least 125 feet (38 m)
- ❁ For soils with restrictive layers within 18 inches of the natural soil surface, the setback shall be at least 100 feet (30 m)
- ❁ For all other soil conditions, the setback shall be at least 75 feet (23 m)

A minimum lot frontage of 150 feet (46 m) on public waters is enforced through the Minimum Development Standards (RSO 483-B:9).

Minimum Shoreland Protection Standards also include a host of BMPs including:

- ❁ A waterfront buffer must be protected for a depth of 50 ft. (15 m) from the water's edge,
- ❁ Scoring of waterfront buffer based on size and number of species to determine permissible amount of removal,
- ❁ Analysis of soil conditions to determine septic setbacks and minimum lot sizes (percolation rate),
- ❁ Detailed Erosion and Sediment Control Plans, and
- ❁ 20% maximum allowable area of impervious surfaces. If >20% but <30% a Storm Water Management (SWM) system must be implemented. If impervious surfaces are >30% of the lot, a stormwater management system shall be designed and certified by a professional engineer which demonstrates that the volume and peak flow rate based on the 10-year, 24-hour storm event shall not exceed the pre-development volume and peak flow rate for flow off the property within the protected shoreland.

The maintenance of a Waterfront Buffer is a major focus of the management of shoreline development in New Hampshire. Within the waterfront buffer, a number of prohibitions and limitations apply including the prohibition of the application of pesticides or herbicides of any kind unless applied by a professional,



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rocks and stumps and their root systems shall be left intact, and no natural ground cover shall be removed except as necessary for a foot path to water and access ways.

The waterfront buffer shall be divided into 50 ft. (15 m) by 50 ft. (15 m) segments. Owners of land within the waterfront buffer shall measure, calculate, and maintain the tree, sapling, shrub, and groundcover point score in each of these segments in accordance with the methods and standards described below:

- ❁ Scoring of waterfront buffer based on size and number of species to determine permissible amount of removal:
  - 50 ft (15 m) x 50 ft (15 m) segments of the waterfront buffer are divided up by landowners
  - Scoring is completed as follows:
  - Tree and sapling diameters are measured at 4.5 ft. (1.4 m) and are scored as follows:
    - 1 inch (2.5 cm) – 3 inch (7.6 cm) = 1 point
    - >3 inches and including 6 inches (15 cm) = 5 points
    - >6 inches to and including 12 inches (30 cm) = 10 points
    - >12 inches = 15 points
  - 4 ft.<sup>2</sup> (0.37 m<sup>2</sup>) of shrub area = 1 point
  - 50 ft.<sup>2</sup> (4.6 m<sup>2</sup>) Ground cover, not including mowed lawn = 1 point
- ❁ If scoring is >50, then trees, saplings and shrubs over 3 ft. (0.91 m) may be removed as long as the sum of the scores for the remaining vegetation is >50.

### 3.12.5 Program Successes and Challenges

Contacts at the State offered several comments related to challenges in implementation of the shoreland management program. Enforcement was noted as a challenge because there are few enforcement personnel at the State level and the zoning ordinances used to implement the *Act* are not mandatory. In addition, the State only becomes involved when there is a major development circulated for review and so decisions at the local level are not always reviewed by the State. In recent years, with a soft economy, approximately 90% of new development is single lot development which is approved entirely at the local level. Finally, staff at the local level do not always have the expertise to fully administer the *Shoreland Water Quality Protection Act*.

### 3.13 State of Vermont

A detailed review of Vermont's shoreline management approach was not completed after learning that the approach used has not been successful. The approach was redesigned in 2010 and some general challenges associated with the prior program are discussed. General downfalls of the program were discussed anecdotally with staff at the Vermont Department of Environmental Conservation – Watershed Management Division, but related details were not provided in time for the completion of this report. Challenges are discussed and solutions are noted so that similar challenges are avoided during the creation of a more holistic shoreline management approach in Ontario.



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## 3.13.1 Challenges

In Vermont management plans for 17 different basins are created with updates completed every 5 years. Basin planning is designed to integrate topics of local concern with topics of state importance and develop subsequent management recommendations on these topics. Basin plans were completed in accordance with the Vermont Watershed Initiative – Guidelines for Watershed Planning until 2010. The Vermont Agency of Natural Resources developed the Vermont Surface Water Management Strategy in 2010. The newer approach has reshaped the organizational structure and management with a greater focus on integrated resource management by altering the focus from broad-scale strategies to promote surface water protection to identifying actions needed to protect or restore specific waters and associated funding sources to complete the work.

The challenges associated with the pre-2010 approach and resulting solutions utilized to address the challenges in the updated approach are provided in Table 11.

Table 11. Challenges with pre-2010 Approach and Resulting Solutions

Challenge	Solution
A myriad of different plans such as basin plans, watershed plans and source protection plans were created throughout Vermont prior to 2010 and were considered in a standalone fashion. This resulted in protection and improvement projects which were not properly aligned in terms of priority.	Integration of the highest-priority items from the standalone plans into a collection of highest-priority actions to protect and restore surface waters.
Monitoring efforts were not sufficiently coordinated or as highly prioritized as needed.	Majority of monitoring and assessment geared towards the areas of highest need.
Water quality education geared towards many stakeholders in a watershed aimed to supply interested persons with technical information required to formulate strategies and develop the information needed to draft the plan. A different set of stakeholders would then be consulted during implementation resulting in inefficiency and a lack of common goals.	The process has been flipped where plans are developed initially to reflect State priorities that have been identified through monitoring and the approaches are communicated incrementally to broader stakeholder groups.
Water management typing (i.e. classification) was too coarse and difficult to implement resulting in only two of six approved basin plans which included water management typing.	An alternative or modification of water management typing has not yet been determined. Water management typing is not a major component of the updated approach.

## 3.14 State of Wisconsin

Wisconsin's Shoreland Zoning Program was initiated in 1968 as a partnership between the Wisconsin Department of Natural Resources (WDNR) and County governments to protect water quality, fish and



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wildlife habitat and aesthetics (WDNR, 1980). Based on our scan of this program, we found the Wisconsin program to be functionally identical to the Minnesota program described in Section 3.11. Therefore, rather than belabour the program description, we have instead chosen to briefly describe Wisconsin's shoreland management and highlight the similarities and the few areas where it differs from the State of Minnesota.

The Wisconsin Shoreland Protection Program (Chapter NR 115) is focussed around a series of minimum zoning standards, including lot sizes, building setbacks, and vegetation removal, which must be adopted by local governmental units via zoning ordinances (WDNR, 2014). Unsewered lots require the same minimum lot width, lot area, structure setback, as lakes under the "General Development Lakeshore" class in Minnesota (see Table 10). Furthermore, counties are required to establish impervious surface standards to protect water quality, fish and wildlife habitat, and against pollution of navigable waters from stormwater. Standards apply to the construction, reconstruction, expansion, replacement or relocation of any impervious surface within 300 feet (90 m) of the ordinary high-water mark of any navigable waterway.

To protect natural scenic beauty, fish and wildlife habitat, and water quality, the Statute requires a county to regulate removal of vegetation in shoreland areas. The county ordinance is required to designate land that extends from the ordinary high-water mark to a minimum of 35 feet (10.7 metres) inland as a vegetative buffer zone and prohibit removal of vegetation in the vegetative buffer zone except in certain circumstances (which were not described).

Minimum standards often fail to account for the inherent variation in chemical, physical and biological properties of lakes. Therefore, as we have seen in Minnesota, Wisconsin recognizes that it is advantageous to identify lakes that may be more susceptible to development pressures. In Wisconsin rather than requiring lake classifications, the State provides Lake Classification Grants to counties to develop Lake Classification systems (Chapter NR 191) to enhance mitigation requirements. Under this program, guidance is provided by the State, but the lake classification systems are crafted at the local level (WDNR, 2002).

## 4. Analysis and Recommendations

The following section summarizes goals (Section 4.1), key technical components (scientific techniques including BMPs; Section 4.2) and planning, regulatory and implementation tools (Section 4.3) used by the jurisdictions to manage shoreline development on inland lakes. Advantages and disadvantages are discussed for each component or tool and recommendations are provided for their potential use in Ontario considering, where applicable:

- Provisions of the Provincial Policy Statement
- Application in unorganized territories
- Ability to address the range of landscapes, lake types and development pressures that occur across the province,
- Resource implications to the province, municipalities or planning authorities
- Environmental monitoring and performance measurement requirements



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### 4.1 Goals for Managing Shoreline Development

A necessary consideration for developing a successful approach for managing shoreline development is a clear identification of desired attributes to protect. Currently the provincial approach is focused on managing total phosphorus concentrations in lakes on the Precambrian Shield (Lakeshore Capacity Assessment approach), oxygen concentrations for protection of lake trout habitat (Lake Trout Policy), and water quality parameters in general to meet Provincial Water Quality Objectives. The focus on phosphorus concentration for Precambrian Shield lakes is founded on the fact that:

- ✿ The greatest potential impact of shoreline development on lake water quality is increased phosphorus loading,
- ✿ Phosphorus is the limiting nutrient for aquatic plants and algae in most Precambrian Shield lakes, and
- ✿ Increased phosphorus concentration increases lake productivity that can result in nuisance growth of aquatic plants and algae and lowers oxygen concentrations that affect fish habitat.

While the provincial Lakeshore Capacity Assessment approach satisfies the PPS with respect to protection of phosphorus-related impacts on water quality (and lake trout habitat) and helps to provide some direction on the policy direction related to ‘environmental lake capacity’, the approach does not consider many other potential impacts of shoreline development on shoreline areas, which are considered in the PPS to be “surface water features” within the “water resource systems” that require protection, improvement and restoration.

For example, several jurisdictions sought to protect a combination of lake and shoreline attributes including social density (also referred to as recreational carrying capacity, or crowding), fish and wildlife habitat, aesthetics (e.g., views, scenic vistas, ‘character’), building density and form, drinking water sources and stormwater quality (total suspended solids and total phosphorus concentrations) (Table 12). Balancing protection of these attributes while protecting important economic resources was also commonly cited, particularly for jurisdictions that rely on lakes for tourism and recreation as a primary source of revenue (e.g., Seguin Township) or are planning to increase economic resources (e.g., City of Elliot Lake).

While many of the jurisdictions had stated goals to protect a wide range of attributes, the goals were mostly general in nature without specific management targets or a rationale for use of the various approaches to meet the stated goals. A lack of management targets hampers the ability to critically assess the success of the approach and to identify any potential need to modify the approach to improve success. Moreover, a solid rationale for an approach, its targets and its components provides a level of understanding that promotes buy-in by local governments, residents and developers. This is particularly important for management techniques that are voluntary, difficult to enforce or that work to mitigate a range of potential impacts.

#### Recommendations

Recommendations for consideration by the Province for an approach to managing shoreline development related to setting management objectives include:



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Table 12. Attributes Protected by Selected Management Tools

Tools	Attributes Protected						
	Phosphorus/ reduce or control algae	Other Water Quality Objectives	Lake Trout Habitat	Social Density	Riparian Habitat	Aesthetics (Visual)	Building Density
Lakeshore Capacity Assessment	✓			✓			
Lake Trout Policy			✓				
Recreational Carrying Capacity (Seguin)				✓			✓
Lake Sensitivity (Muskoka/Seguin)	✓			✓			✓
Stormwater Management Model (Halifax)	✓	✓		✓			✓
Shoreline Buffer	✓	✓			✓	✓	
Erosion and Sediment Control	✓	✓			✓	✓	
Impervious Surfaces	✓	✓			✓	✓	
Enhanced Septic System Design	✓	✓					
Soils Assessment	✓						
Building Setback					✓	✓	
Septic Setback	✓	✓			✓	✓	
Lot size	✓	✓				✓	✓

Notes: Determination of which attributes a given tool protects is subjective because many of the tools protect a number of desired attributes indirectly. For example, Lakeshore Capacity Assessment can limit development, which could potentially protect social density, but the approach is focused on phosphorus, so those desired attributes are directly managed and were therefore selected.



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- ❁ Specific attributes that are intended to be protected should be clearly defined in any Provincial policy or guidance on lake planning and these should consider the provincial interests as set out in the PPS while recognizing local concerns including economic and social factors,
- ❁ Specific management goals or targets for each attribute should be developed upon which to base the selection of management tools and to evaluate success of the approach, and
- ❁ A clear rationale for the selection of management tools to meet the intended goals for the desired attributes should be provided to promote uptake of the approach and reduce challenges.

### 4.2 Technical Approaches and Tools

The approaches to managing shoreline development varied by jurisdiction, but several common elements were used in different combinations to address the stated objectives. The following section describes the common technical tools, grouped as “Capacity” and “Mitigation” tools, where:

1. Capacity tools set limits to the amount of shoreline development allowed on a lake based on one or more factors, and
2. Mitigation tools including development standards and Best Management Practices are used to reduce the impacts of development.

The selection of management tools was guided in nearly all instances by a screening approach or lake classification method to identify lakes that are most susceptible to impacts from shoreline development and are addressed in Section 4.2.3. In many situations, lake specific management was used or was recognized by the jurisdiction as an approach that could be used to address locally-specific or lake-specific issues (Section 4.2.4).

#### 4.2.1 Capacity Tools

Capacity tools were used as part of the approach for managing shoreline development by the Ontario jurisdictions located on the Precambrian Shield (District Municipality of Muskoka, Seguin Township, City of Elliot Lake, City of Kenora (Black Sturgeon Lake) to determine the maximum amount of shoreline development that could occur on a lake without exceeding a threshold for a desired attribute, and included phosphorus, lake trout habitat and social density. This approach was not used by any of the jurisdictions outside of Ontario.

##### 4.2.1.1 Lakeshore Capacity Assessment

The Lakeshore Capacity Assessment approach, or a variant was used by four of the jurisdictions (Muskoka (and Muskoka Lakes), Elliot Lake, Kenora, Seguin) to set capacity limits for shoreline development based on phosphorus. In Ontario, capacity is assessed against the revised Provincial Water Quality Objective (PWQO) for lakes on the Precambrian Shield of modeled background total phosphorus concentration plus 50% to a maximum cap of 20 µg/L. In cases where phosphorus concentration cannot be reliably modeled (greater than 20% difference between modeled and measured values), capacity is then assessed against the interim PWQO of 10 µg/L for lakes naturally below this value, or 20 µg/L for lakes that have a natural total phosphorus concentration equal to or above 10 µg/L.



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Of the jurisdictions that use a capacity approach for phosphorus, shoreline development is only prohibited for over capacity lakes for Elliot Lake and Kenora (Lower Black Sturgeon Lake). For Muskoka and Seguin Township, where approaches were developed prior to the publication of the Handbook, shoreline development is only prohibited if a lake is over capacity for phosphorus and determined to have a 'High Sensitivity' to phosphorus loading (see section 4.2.3), or in the case of Seguin, if a lake exceeds the Provincial Water Quality Objective of 20 µg/L. Lakes that are over capacity but have 'Moderate Sensitivity' or 'Low Sensitivity' are subject to more stringent BMPs to mitigate phosphorus loads. This approach was taken in recognition that the accuracy of the LCM to predict phosphorus concentration may not support strict capacity-based decisions (i.e., one lot is acceptable and two lots is not acceptable) and that implementation of BMPs could be used to mitigate phosphorus loads. Both of these jurisdictions have well established water quality monitoring programs to identify and respond to issues (e.g., increasing trends in phosphorus) should they arise. To date, there have been no significant increasing trends in phosphorus concentration in any of the lakes monitored in these jurisdictions suggesting that the approach has been effective in mitigating phosphorus concentration. The assessment of shoreline development impacts, however, is complicated by other factors including natural variability and regional stressors (e.g., climate change and acid deposition) that influence phosphorus concentrations as illustrated by recent documented changes in undeveloped central Ontario lakes to both higher and lower phosphorus concentrations.

The Provincial Lakeshore Capacity Assessment approach has many notable advantages for managing phosphorus loads from shoreline development:

- ✿ It is developed using a well-studied scientific approach and long term records of phosphorus dynamics in lakes
- ✿ It is a watershed-based approach which meets the intent of the PPS for the protection of water quality
- ✿ It provides clear and quantitative capacities that are easily expressed (i.e., specific development counts)
- ✿ It is based on a measurable threshold (i.e., PWQO for phosphorus) that can be monitored to assess success
- ✿ It can be presented as stable requirements that are unlikely to change providing stability in planning
- ✿ It has a well-established history of implementation in OP policies

The disadvantages of Lakeshore Capacity Assessment were outlined in the Introduction (Section 1) and are not reproduced here.

### Recommendations:

- ✿ The Lakeshore Capacity Assessment approach could continue to be used as an element in the Provincial approach to manage shoreline development for lakes on the Precambrian Shield but a simplified version or alternative approaches (i.e. use of the model to screen for lake sensitivity instead of determining an absolute capacity) should be considered to a) address identified predictive capacities of the model and b) allow its use where technical and funding resources are lacking (e.g., unorganized territories)



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- ❁ Mitigation approaches and new technologies that reduce or eliminate phosphorus loads from septic systems should be investigated and, if approved, should be considered in the approach
- ❁ Lake sensitivity or other screening techniques should be considered in the approach recognizing uncertainties with model performance and emerging mitigation techniques that, if proven, can be effectively implemented to reduce phosphorus loads
- ❁ The assumption of 100% mobility of septic system phosphorus should be revisited (e.g., to incorporate potential for attenuation of phosphorus where soil conditions are suitable in shoreline areas) either in the calculation of capacity, as a factor in model validation, or as a criterion for assessing lake sensitivity to phosphorus

### 4.2.1.2 Lake Trout Policy

The provincial policy to protect lake trout habitat in MNR-designated lake trout lakes requires that oxygen concentration (measured as Mean Volume Weighted Hypolimnetic Dissolved Oxygen, MVWHDO) be maintained at or above 7 mg/L. A lake is therefore considered to be at capacity for additional development if MVWHDO is  $\leq 7$  mg/L and new lot creation would be prohibited. As provincial policy, all Ontario jurisdictions that were reviewed considered this measure of capacity in Official Plans.

Advantages of this approach is that it is based on strong science that clearly documents physiological responses of lake trout to oxygen concentrations, which has been published in the scientific literature. Furthermore, this capacity tool has been adopted by the Province as policy and the province has developed detailed guidance to calculate MVWHDO.

There are several disadvantages of the Lake Trout Policy with respect to prohibiting shoreline development. First, the policy requires long-term measured temperature and dissolved oxygen data (3 to 5 years) collected within a short window (within two weeks of September 1<sup>st</sup>), and these data are not available for all designated lake trout lakes and data may become outdated in the absence of a commitment to ongoing monitoring. Dissolved oxygen data can be highly variable between years (3-5 years of data may not adequately reflect long-term average conditions) as it is largely driven by weather patterns (e.g., timing of the onset of stratification, summer air temperatures). Personal experience of the author with Elliot Lake data, for example, showed that capacity determined for lakes based on 3 years of data was different than that calculated using 4 years of data, and different again if 5 years of data were used. Detailed lake bathymetry is also required to calculate MVWHDO and is often not available.

Prohibiting additional development on an at-capacity lake trout lake is based on the premise that additional development will increase phosphorus loading and lower dissolved oxygen concentrations. To the best of our knowledge there is no documented evidence, outside of Lake Simcoe, where shoreline development and associated septic service has resulted in harm to lake trout habitat in Ontario. If shoreline development can occur with no net increase in phosphorus loading, then the policy can be, and has been, successfully challenged, as has been shown by OMB hearings at Kushog Lake and Limerick Lake. The OMB settlements at Kushog Lake and Limerick Lake have resulted in additional development on these at-capacity lake trout lakes subject to the installation and monitoring of phosphorus abatement in septic systems. A small number of lots were approved on Limerick Lake with the approval of additional lots conditional on the demonstrated success of the phosphorus abatement technology through a long-



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term monitoring program. The data collected from these and other developments will contribute to the scientific knowledge about septic system phosphorus.

### Recommendations:

- ❁ The Provincial Lake Trout Policy is a protective tool that is well defined and scientifically supported and should continue to be included in the Province's approach to managing shoreline development,
- ❁ Implementation of long-term monitoring of dissolved oxygen and temperature profiles for lake trout lakes, and completion of bathymetric surveys are required to calculate accurate MVWHDO and to address the variability in MVWHDO calculations, necessary for assessing impacts of development according to the policy, and
- ❁ The Province should consider implications to the lake trout policy if an approach can be developed that would effectively result in no net increase in phosphorus loading to lake trout lakes.

#### *4.2.1.3 Recreational Carrying Capacity (Social Density)*

A development density of 1 lot/1.62 ha (social density filter) of lake surface area was used by Seguin Township as a measure of capacity to limit social crowding. Although the rationale for the specific threshold is not published or documented, the intent is that development capacities based on this approach will directly protect lakes from overall crowding, and will indirectly limit boat traffic.

Advantages of this approach is that it is easily computed for a large number of lakes if the surface areas of the lakes are known. A list of lakes considered 'at capacity' can be included in the Official Plan for easy reference by local stakeholders.

The Recreational Carrying Capacity approach, while proven to be effectively implemented in Seguin Township, may not be applicable for use across the Province given the subjective nature of what constitutes crowding. To the best of our knowledge, the social density filter was developed based on recreational patterns in central Ontario, which are unlikely to represent those in all areas of the Province. For example, crowding for an urban lake may have a very different meaning than crowding for a recreational lake in northern Ontario. Additional study would be warranted to develop filters that represent recreational activities and community values in other areas of the Province. Another disadvantage to this approach is that it may be difficult to defend against challenges because it prohibits development based on a threshold that could be considered arbitrary. Seguin Township, however, defends its use on the same planning principal as public park spaces, whereby a unit area of park space is required per population unit.

Resources required to determine Recreational Carrying Capacity are minimal as this metric is based on lake surface area. Additional resources, however, would be required to revise the social density filter from the value used by Seguin Township (Section 3.9.2) for application in other areas of the province.



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Given the minimal resources to determine Recreational Carrying Capacity (i.e., once a social density filter is decided upon), this tool would be easily applied in unorganized territories where technical and financial resources may be limited.

### Recommendation:

- ❖ Recreational Carrying Capacity can be an effective approach for controlling crowding but use of this tool as part of a provincial approach should consider the applicability of the social density filter for widespread use and may warrant further investigation

### 4.2.2 Mitigation Tools

Best Management Practices are not mandated across Ontario at the Provincial level but they are addressed effectively through the Lake Simcoe Protection Plan, and many Official Plans and Zoning Bylaws where municipalities have successfully made the planning argument that BMPs are used to achieve the PPS outcomes and/or their local policy objectives. Several of the American jurisdictions developed minimum development standards that included BMPs at the State level, and Counties were tasked with developing ordinances that adhere to or improve upon the minimum suite of BMPs. Shoreline buffers, Erosion and Sediment Control (ESC) Plans, the regulation of impervious surfaces and application of enhanced septic systems provide a host of direct benefits in the riparian zone and protect against water quality degradation through improvements to stormwater, riparian habitat and aesthetics.

Minimum development standards have been grouped with BMPs because of the prevalence of such grouping in the literature that was reviewed. Minimum development standards could be more easily mandated at the Provincial level than BMPs because enforcement isn't usually required. The challenge with identifying minimum development standards on a broad scale is the difference in social values and resulting development patterns of various regions in Ontario. Nonetheless, minimum standards can ensure a level of continuity across all incorporated and especially unincorporated regions in the province.

One problem with BMPs as was underscored with Vermont and alternatively, Seguin, is enforcement. In Vermont where enforcement has been poor, the program has not been successful and water quality has appeared to decline whereas in the Township of Seguin, enforcement has been used successfully and no significant increasing trends in phosphorus have been identified. Shoreline buffers, ESC Plans and limits to impervious surfaces could be delegated at the Provincial level, but it is unclear how such BMPs would be enforced. Where enforcement is not feasible, effective education and communication may promote voluntary use of BMPs. These types of mitigation measures do however parallel the focus of the new PPS on shoreline areas as water resource systems and each BMP provides a host of benefits in addition to water quality improvements.

Another concern with BMPs and LIDs is related to the rapid evolution of these techniques and lack of quantification of their proven effectiveness. This concern has emerged in this review for BMPs related to phosphorus abatement technologies for septic systems and for stormwater runoff and relates partly to the difficulty in monitoring, differences between applications and the need for proof of long term effectiveness. Nevertheless, recent reviews (HESL 2012) have shown that certain BMPs for stormwater phosphorus removal can achieve reliable and quantifiable performance standards and the research of Robertson and



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colleagues (1998, 2003, 2012), has documented the evidence, mechanisms and conditions under which mineralized tile fields can remove phosphorus from domestic septic effluent.

### Recommendations:

- ❁ The province should consider developing a set of minimum development standards for implementation by planning approval authorities
- ❁ Many BMPs are promoted without documented proof of their effectiveness and this is a barrier to implementation. The Province should therefore consider development of a handbook of accepted techniques and effectiveness for mitigation of runoff volumes, solids and nutrients to lakes,
- ❁ BMPs can be difficult and expensive to enforce, and the Province should therefore consider providing more specific guidance and education tools in addition to what is provided in the Lakeshore Capacity Assessment Handbook for use by planning approval authorities to further promote their use

The following sections describe common BMPs used by the jurisdictions and their usefulness for managing impacts from shoreline development.

#### *4.2.2.1 Stormwater Management*

Stormwater management was commonly included in the approaches to managing impacts of shoreline development on water quality of inland lakes. Stormwater management approaches ranged from complex modeling techniques that quantitatively estimate impacts of stormwater and mitigation requirement, to management plans (e.g., stormwater management and erosion and sediment control (ESC) plans) that provide details on the use of BMPs to be implemented to control stormwater, to simply placing limits on impervious surfaces.

Stormwater models can be utilized to assess the impacts that development has on stormwater. Best Management Practices and Low Impact Development techniques are often included in the models to determine what mitigation measures are required to ensure that water quality objectives of stormwater and the receiving waters are met, as was done by Halifax Regional Municipality (HRM). This type of assessment requires complex modeling and data (e.g., slopes, catchment areas, drainage divides and channel networks), which can typically be obtained from a Digital Elevation Model. This approach, however, is generally taken to control the impacts from urbanization in a watershed or for large developments. This is quite different from lake shore development one unit at a time which is commonly the case in Ontario.

Erosion and Sediment Control (ESC) plans, like those used by the US jurisdictions, can help mitigate the impacts of development in the short term (i.e., Construction Mitigation Plan) and long term (i.e., Stormwater Management Plan) by encouraging infiltration of stormwater to the subsurface. A construction mitigation plan should attempt to (Certified Inspector of Erosion and Sediment Control, 2012):

- ❁ Utilize a multi-barrier approach;
- ❁ Retain existing vegetation;



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- ❁ Minimize land disturbance area;
- ❁ Slow down and retain runoff to promote settling;
- ❁ Divert runoff from problem areas;
- ❁ Minimize slope length and gradient of disturbed areas;
- ❁ Maintain overland sheet flows and avoid concentrate flows; and
- ❁ Store/stockpile soil away from watercourses, drainage features, and tops of steep slopes.

A variety of best management practices (BMPs) can be employed to accomplish these goals depending on the site conditions. The effectiveness of BMPs is contingent on proper installation and maintenance, details of which should be monitored by a certified environmental professional.

A stormwater management plan includes provisions to maximize infiltration and limit stormwater runoff. The District Municipality of Muskoka Official Plan (2010) policies for example include proper re-contouring, discharging of roof leaders, use of soak away pits and other measures to promote infiltration. Other specific design options for consideration such as grassed and vegetated swales, filter strips, roof leaders and French drains have proven to be effective to reduce stormwater runoff (e.g., CVC, 2010). Site characteristics and the nature of the proposed development dictate the appropriateness of these and other stormwater management tools.

Limiting impervious surfaces is a common approach for controlling impacts of stormwater used by several of the jurisdictions. New Hampshire, Maine, Minnesota and Wisconsin all contain policies which limit the amount of impervious surface on a lot. Maximum allowable impervious surfaces were scaled based on a lake classification approach and ranged from 15% to 30% across the American jurisdictions with the latter percentage found in New Hampshire, which also requires the submission of a Stormwater Management Plan that ensures post-development volume and peak flow of stormwater remain at pre-development levels. The findings from over 225 research studies predict that most water quality indicators decline when watershed impervious cover exceeds 10 percent, with severe degradation expected beyond 25 percent impervious cover (Center for Watershed Protection, 2003).

### Recommendations:

- ❁ Stormwater modeling is most appropriately applied in urban settings and may be recommended for use by the Province for special consideration in high intensity urban areas or for large-scale shoreline development projects,
- ❁ For recreational and low intensity residential development, stormwater can be effectively controlled using minimum development standards that limit impervious surfaces,
- ❁ For situations where enhanced stormwater control is beneficial (e.g., a lake that is classified as High Sensitivity to phosphorus), more detailed stormwater control like that implemented by the District of Muskoka is recommended, and
- ❁ Sediment and erosion control for construction phase could be addressed by recommending appropriate BMPs



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### 4.2.2.2 Shoreline Buffers

A shoreline buffer is an area along the shoreline that is naturally vegetated or re-vegetated. Shoreline buffers are a well-studied mitigation measure associated with waterfront development. The availability of information results from the well-known and established effectiveness of shoreline buffers in mitigating the impacts of stormwater through filtering, infiltration and attenuation. Buffers filter sediment and other pollutants, and absorb nutrients from runoff, thereby helping to mitigate impacts of stormwater (Zhang et al., 2010; Beacon Environmental, 2012). Vegetative buffers can also mitigate visual density by screening the view of the shoreline from the lake, and providing a buffer for view and noise between lots and maintain a wilderness perspective. Shoreline vegetative buffers can also provide riparian protection and habitat for songbirds and wildlife. Zhang et al. (2010) found that buffer width can explain 35 - 60% of variance in removal efficacy for sediment, pesticides, nitrogen and phosphorus. Most studies demonstrate that buffers from 9 - 30 m provide more effective attenuation than smaller buffers and 30 m buffers provide effective water quality protective functions (Dillaha *et al.* 1985; Dillaha *et al.* 1986; Dillaha 1989; Magette *et al.* 1986; Environmental Law Institute 2008; Wenger 1999). The benefit of a 30 m buffer with subsequent ecological benefits is also supported by a thorough examination by Knutson and Naef (1997), who concluded that:

- ✿ Maintenance of 50 to 100% shading of the stream is assured at 30 m;
- ✿ Maintenance of large woody debris requires a 30 m to 50 m buffer strip;
- ✿ 90% sediment removal at a 2% grade requires a buffer strip of 30 m or more;
- ✿ Removal of nutrients and coliform bacteria requires buffer strips ranging from 4 m to 36 m (30 m is cited most often);
- ✿ Bank erosion control requires a minimum buffer strip of 30 m; and
- ✿ Aquatic invertebrates, salmonid fish and reptiles and amphibians all require a 30 m buffer strip.

New Hampshire and Maine contained buffer scoring schemes that are used to determine the amount of vegetation that can be removed; these approaches constituted the most in-depth buffer policies while buffer size recommendations varied across jurisdictions and within jurisdictions that employed lake classification schemes. A 30 m buffer was recommended for stream environments by Environment Canada and the Ministry of Natural Resources in "How Much Habitat is Enough?" (Environment Canada, 2013) and the Natural Heritage Reference Manual for "Natural Heritage Policies of the Provincial Policy Statement" (MNR, 2010) based on recommendations in the majority of literature reviewed.

#### Recommendation:

- ✿ Requirements for a 30-m vegetated buffer along the shoreline could be included in the approach to manage impacts from shoreline development in line with recommendations of Environment Canada and MNR.

### 4.2.2.3 Septic System Design and Maintenance

The impacts of sewage systems should be considered in terms of both design and maintenance. The latter is more difficult to enforce but is equally important when considering impacts of septic effluent on water quality. Some jurisdictions in Ontario contained policies relating to septic design (i.e., incorporation



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of mineral rich and non-calcareous soils) while other jurisdictions contained minimum soil requirements for installation of traditional systems, or based design (setbacks and minimum vertical saturation; see Sections 4.2.2.4 and 4.2.3) requirements on classification of soils and lake sensitivity to phosphorus.

Septic re-inspection programs are completed by many Municipalities and Conservation Authorities throughout Ontario, including Seguin Township and the Rideau Valley Conservation Authority, in order to identify septic systems with some benchmark of failure such as soft ground or ponding, or which are under-sized. The re-inspection programs are important in diagnosing failing septic systems, many of which were designed for much less use than they receive, and to increase awareness because it is ultimately the homeowner's responsibility to ensure their septic system is operating effectively (Ontario Building Code (OBC), 2006, Section 8.9.2.3 (2)) and is in compliance with the OBC regulations. Septic system inspections do not, however, directly address mobility of septic phosphorus and resultant impacts to water quality.

It has been shown that adsorption of phosphate on charged soil surfaces and mineralization of phosphate with iron and aluminum can immobilize septic phosphorus under certain conditions (Robertson et al., 1998; Robertson, 2003, Zurawsky, et al. 2004). The mineralization process is particularly effective in acidic and mineral rich groundwater in Precambrian Shield settings, leading to robust and long-term phosphorus removal when specific fill types are used for filter bed construction (Robertson, 2012), or considered in the native soils between the tile field and surface water.

Recently, work by Michael Michalski utilized "B" horizon Precambrian Shield soils which are orange/brown in colour and have appropriate characteristics (i.e. phosphorus adsorption, extractable iron, extractable aluminum, and percolation rate) to successfully retain sewage-related phosphorus through absorption and mineralization on a development on South Kushog Lake, a sensitive lake trout lake in Haliburton County. Water samples were collected from five locations in the leaching bed from 2003 to 2012 and phosphorus concentrations compared to concentrations at the outlet of the septic tank. Average annual reduction in phosphorus concentration ranged from 97 to 99.9%, leading the MOECC to accept the findings and release a financial security imposed by a decision of the Ontario Municipal Board (OMB) (letter Castro (MOECC) to Newhook (Algonquin Highlands), Oct. 29, 2013). These findings indicate long term adsorption or complexing of septic phosphorus in the tile field soils which is consistent with the research findings of Robertson et al. (see above) from other similar studies with septic systems constructed with imported and native acidic soils on the Precambrian Shield.

In light of the apparent success of various sewage treatment technologies, the Province has approved development applications on two at-capacity lake trout lakes in Ontario (Limerick Lake and Red Horse Lake) but with provisions for monitoring to test the efficacy of different sewage treatment technologies to mitigate phosphorus (Michalski, M. to K. Welch, April 8, 2014). Fewer than 10 lots were approved on each lake with the remaining lots subject to monitoring results collected over three years at the developed lots. The Province, however, has not accepted these sewage treatment technologies for widespread use as a measure to mitigate phosphorus.

There are a number of proposed changes to the Ontario Building Code, including the requirement for denitrification, phosphorus removal and tertiary treatment for on-site septic systems within vulnerable areas as described in Drinking Water Source Protection Assessments where septic systems are deemed



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to be significant threats<sup>5</sup>. These requirements would come into force on December 31, 2016. These proposed policy changes underscore the importance of tertiary treatment but acknowledge that high costs associated with some technologies and their maintenance make the proposed changes unpopular. The use or importation of “B” horizon Precambrian Shield soils, however, is not overly expensive if such soils are found on site or nearby.

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<sup>5</sup> (Appendix A: Potential Code Changes for the Second Round of Consultation, On-Site Sewage Systems; <http://www.mah.gov.on.ca/Page9297.aspx>).



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### Recommendations:

- ❖ The province has septic re-inspection programs in place for some jurisdictions (e.g., Lake Simcoe) and through the OBC, but OBC provisions for septic system inspections should be broadened to identify malfunctioning units in areas where there are presently no programs in place,
- ❖ Design options (e.g., setbacks, depth of the unsaturated zone, soil conditions that promote attenuation of phosphorus) should be considered in the Provincial approach to mitigate phosphorus from septic systems, with increased requirements based on the sensitivity of a lake to phosphorus loading. This has been used extensively by other jurisdictions and is supported by the scientific literature, and
- ❖ An approach for evaluating and eventually accepting new technologies should be considered by the Province, which would help to foster continued research and development of these technologies that in time, may become more readily available at reasonable costs and with greater assurance of their effectiveness.

#### 4.2.2.4 *Minimum Development Standards*

A variety of development standards are used by the majority of the jurisdictions that were reviewed including minimum building setbacks, septic setbacks, lot areas and lot frontages (Table 13). In the Ontario jurisdictions, these development standards are typically included in Official Plans and implemented in zoning bylaws.

Setbacks identify the minimum distance between water bodies and development. A shoreline buffer refers to the portion of land within the setback that is left in its natural state and provides a host of ecological benefits (see Section 4.2.3.2). While shoreline buffers and their application as a BMP as part of the management of shoreline development has been previously discussed the building setback is also an important planning tool to consider because it allows for the establishment of a shoreline buffer. Minimum building setbacks for the various jurisdictions ranged from 7.6 m in Cariboo Regional District to as much as 90 m in the Rideau Valley Conservation Authority technical guidance that uses scoring based on a variety of biophysical site criteria such as shallow soils, coarse soils, steep slopes and/or sparse vegetation.

The septic setback is an important planning consideration because the land between the septic and the adjacent water body can attenuate phosphorus from septic effluent if soil and hydrological characteristics are suitable (see Section 4.2.2.3). The Ontario Building Code requires a minimum setback of 15 m, but several jurisdictions require greater setbacks: The District Municipality of Muskoka and Township of Muskoka Lakes, for example, both include 30 m septic setbacks in their planning provisions, which is consistent with the Province's recommendations in the Handbook (Province of Ontario, 2010). New Hampshire utilizes a range of septic setbacks that are based on soil percolation rates.



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Table 13. Minimum Development Standards of the Jurisdictions Reviewed

Jurisdiction	Building Setback (m)	Septic Setback (m)	Lot Size (ha)	Lot Frontage (m)
Elliot Lake	20	-	0.4	45
Kenora - Black Sturgeon Lake	20	-	0.8	61 (122 for restricted development area)
Muskoka	20	30	-	60 (increased frontages to a maximum of 120 m may be required adjacent to narrow waterways)
Muskoka Lakes	20	30	-	60 (may be increased due to natural constraints)
Seguin	20 <sup>1</sup>	-	1 (1.2 for island lots)	90 (120 for island lots)
Lake Simcoe Protection Plan	15 (Town of Innisfil)	-	-	-
Rideau Valley CA	30 – 90 <sup>2</sup>	-	-	60 (Rideau Lakes)
Cariboo	7.6	35	-	46
Maine	23 - 76 <sup>3</sup>	30	0.19	61
New Hampshire	-	23 – 38 <sup>4</sup>	-	46
Minnesota	23 – 46 <sup>5</sup>	-	0.19 – 0.74 <sup>5</sup>	30 – 61 <sup>5</sup>
Wisconsin	23	-	0.19	30

<sup>1</sup> may be increased to address water quality, wetland, fish habitat or other similar issues

<sup>2</sup> with greater setback dependant on biophysical site criteria

<sup>3</sup> depending on shoreland zone classification

<sup>4</sup> depending on percolation rate of soil

<sup>5</sup> depending on lake classification

- indicates that standard was not provided in the documentation reviewed, but for Ontario jurisdictions the OBC requirement is 15 m.

Minimum lot size varies considerably across the jurisdictions from 0.19 ha in Maine, Wisconsin and Minnesota (depending on lake classification) to 1 ha in the Township of Seguin. The relationship between the area of disturbance as measured through the ground layer, shrub layer and tree layer was assessed per lot size in the Lakeshore Capacity Study (MMAH, 1983). The disturbed area around the cottages (0.13 ha) remained the same regardless of lot size. Therefore larger lot sizes generally result in a greater proportion of undeveloped area which increases wildlife habitat, pervious surfaces and vegetation that in turn provide a variety of benefits for the receiver.

Lot frontage is an important planning consideration of shoreline development. Larger frontages equate to larger lot sizes and these help to ensure that the natural landscape is maintained to protect riparian wildlife habitat and wildlife corridors (Euler, 1983), as well as to reduce crowding. Minimum lot frontages ranges from 30 m in Wisconsin and Minnesota (depending on lake classification) to 90 m in the Township



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of Seguin. Increasing lot frontages in narrow waterways and embayments and on islands (e.g., Township of Muskoka Lakes, Kenora - Black Sturgeon Lake, Seguin Township, District Municipality of Muskoka) has been used as a tool to reduce crowding and also protect scenic amenity.

### Recommendations:

- ❖ The Province has recommended a 30-m minimum setback for septic systems in the Handbook, however this standard exceeds the OBC requirement and has not been applied consistently across the Province. The documented role of soils in phosphorus attenuation (Robertson and et al., 1998; 2003; 2012) warrants a stronger requirement for this setback if the Province wishes uptake of its recommendation by local governments. Amendments to the OBC for shoreline septic systems would be a logical vehicle by which to increase the required setback.
- ❖ The Province could consider a set of minimum development standards scaled to lake and watershed characteristics for implementation Province-wide (e.g., Minnesota's approach)

#### 4.2.2.5 Soils Assessment

The 2006 Ontario Building Code and Guide for Sewage Systems (MMAH, 2006) includes a variety of site features to consider when locating infiltration fields, including soil characteristics.

Soil assessment criteria are also discussed in the "Lakeshore Capacity Assessment Handbook" (Province of Ontario, 2010). Assessment criteria are targeted for proposals on "at capacity" lakes and sites must contain the following characteristics for soils to justify development:

- ❖ Sufficient depth (>3 m);
- ❖ Native and undisturbed;
- ❖ Non-calcareous (<1% CaCO<sub>3</sub>);
- ❖ Acid-extractable concentrations of iron and aluminum of >1% by weight; and,
- ❖ Unsaturated zone of at least 1.5 m depth between the tile bed and the shallowest extent of the water table.

A soils assessment is an important component of management of shoreline development in the Cariboo Regional District, New Hampshire and the District Municipality of Muskoka. Results of the assessment are used to dictate septic setbacks, minimum lot sizes and sewage treatment requirements that aim to mitigate phosphorus loads to waterbodies. Soils assessments are typically required to be completed by an accredited professional and generally include analyses such as percolation rates, soil depth, water table depth, and soil texture and composition.

### Recommendation:

- ❖ Soils assessment could be used as an effective criterion for setting minimum development standards and septic design standards, or as a tool in lake classification (see Section 4.2.3)



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### 4.2.3 Screening and Classification Tools

The primary purpose of lake classification is to group lakes with similar characteristics or management needs so that appropriate management tools can be applied to protect desired attributes from the impacts of shoreline development. Lake classification was a key component of the approach used by all of the jurisdictions reviewed in this study for managing shoreline development, except for Elliot Lake, Vermont and Halifax Regional Municipality. The widespread use of lake classification across jurisdictions, the varying lake and watershed characteristics to which classification has been applied and the wide range of criteria that have been used to classify lakes illustrates the great flexibility of this tool (Table 14).

The complexity of the classification approaches and information requirements vary considerably among the jurisdictions from the use for complex models and data requirements (e.g., the provincial LCM used by District of Muskoka and Seguin to determine Lake Sensitivity) to more simple qualitative approaches (e.g., general lake characteristics, water quality and soil conditions used by Cariboo Regional District). Minnesota has a set classification system that uses general lake and development characteristics that are applied state-wide, but also allows more complex lake classification to address local needs and provides detailed guidance to assist in the formulation of the classification and setting of development standards and restrictions.

Lake classification is an effective management tool because it is not a “one size fits all approach” and individual characteristics of the lake, watershed, existing development and social factors can be accounted for across a large area. Classification allows for planning decisions or the scaling of minimum development standards/BMPs to be determined objectively even if the initial selection of classification criteria are subjective. Importantly, classification schemes can be tailored depending on information and resource availability, which is especially important when attempting to classify a large number of lakes over a large spatial scales, with variable data availability and often limited resources as is the case in Ontario.

A lake classification procedure would be beneficial in Ontario because minimum development standards and BMPs could be scaled to the classification results like the approach that has been used successfully in the Cariboo Regional District, Minnesota, Maine, Township of Muskoka Lakes and the District Municipality of Muskoka. Classifications could also be developed for individual jurisdictions based on local pressures and concerns and available resources lake management.

A challenge in completing the classification scheme is determining appropriate classification criteria that address the PPS. Criteria could include physical and biological lake characteristics (e.g. depth, flushing rate, shoreline irregularity, fishery, natural heritage features, past occurrences of algal blooms, invasive species, trends in concentrations of nutrients or other pollutants), “responsiveness” to phosphorus calculated using the Lakeshore Capacity Model, social factors (e.g. existing development and development pressure, distance to urban centres), and watershed characteristics (e.g., existing land use, soil conditions). The selection of classification criteria is dependent on several factors, including the information and resources that are available, the scale at which the classification is applied, and the intent of the classification (i.e., which attributes are being managed) and the available accepted management tools (e.g., minimum development standards, limits to amount and type of development, BMPs, etc.).



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### Recommendations:

- ❁ Lake classification/screening could be an effective method to appropriately scale mitigation measures for the wide range of lake and watersheds characteristics, resource availability and planning environments that exist in Ontario
- ❁ The selection of classification/screening criteria should be developed based on the attributes that are required to be protected
- ❁ Lake classification (e.g., using sensitivity to phosphorus loading or some other screening method) should be considered in Lakeshore Capacity Assessment, if used, for 'over-capacity' lakes to account for model uncertainties and in recognition of effective mitigation techniques that can be employed to reduce the risk of phosphorus-related impacts

#### 4.2.4 Lake-Specific Management

Individual lake plans that address shoreline development have been used by the City of Kenora and for Lake Simcoe (Lake Simcoe Protection Plan). The shoreline development plan for Black Sturgeon Lake was completed due to concerns of local stakeholders related to development pressure with an aim to guide future development at a controlled pace, protect natural heritage features, reduce crowding and protect scenic amenity. For Lake Simcoe, the Lake Simcoe Protection Plan was implemented to restore water quality and prevent impacts of future development.

Many other jurisdictions provide funding (e.g. Wisconsin, Minnesota), encourage or support municipalities or lake associations to complete individual lake management plans (e.g. Seguin Township) to include additional limits to shoreline development or mitigation requirements. While not reviewed in this study, the City of Greater Sudbury also includes lake-specific shoreline management policies in their Official Plan.

The primary advantage of lake-specific approaches to managing shoreline development is that local concerns and/or lake-specific issues can be addressed, which may not be possible with a provincial or local government approach designed to accommodate more general jurisdiction-wide issues.

Disadvantages of this approach include consensus of issues and resource requirements (technical and financial support). For the City of Kenora, for example, many local residents do not want additional development to occur on Black Sturgeon Lake regardless of whether water quality or other environmental concerns can be managed. Despite the implementation of shoreline development standards and controls on the amount and pace of development, the City still receives complaints and calls for a moratorium on development. Resource requirements can be substantial to conduct required studies, develop development standards to address concerns and implement the recommendations into planning. The City of Kenora addressed this issue by charging a fee on development applications to offset costs of the program.

Lake specific management plans, while they may be effective to manage shoreline development, are not likely suitable for inclusion in a province-approach, but are best implemented at a local level to address lake specific issues where resources and stakeholder support for the process are available. One exception may be for unorganized territories where lake specific issues need to be addressed, but where



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local government support cannot be provided. Educational tools, provision of data and technical guidance could however be provided by the province to assist local governments that wish to enhance their shoreline development policies.

### Recommendations:

- ❖ Individual lake plans to manage shoreline development can be an effective tool to address lake-specific issues that may not be adequately addressed by an approach focussed on more general jurisdiction-wide issues (e.g., natural heritage features, flood protection, rural character),
- ❖ Individual lake plans may be usefully applied by local governments where resources and stakeholder support are available, or by the Province to address lake-specific issues in unorganized territories,
- ❖ Individual lake plans can be developed as cooperative exercises between lake associations, local governments and other stakeholders and, being specific to the interests of the groups involved, can address issues associated with existing as well as new development, and
- ❖ The Province could provide educational tools, data and technical guidance to local governments that want to develop lake-specific shoreline development policies.



Table 14. Jurisdictional Approaches to Lake Classification

Jurisdiction	Purpose of Classification	Criteria for Classification	Lake and Watershed Characteristics
Cariboo	<ul style="list-style-type: none"> <li>To define the extent of the shoreline zone to which septic system and buffer guidelines will apply (i.e., land within 150 m of a Low Sensitivity lake, 200 m of a Moderate Sensitivity lakes and 250 m of a High Sensitivity lake (and 100 m of a watercourse)</li> <li>Sighting septic systems (vertical saturated depth) to mitigate phosphorus loads</li> </ul>	<u>Water Quality Sensitivity</u> <ul style="list-style-type: none"> <li>Lake Trophic State</li> <li>Lake Flushing Period</li> <li>Mean Lake Depth</li> <li>Watershed Characteristics</li> </ul> <u>Minimum Vertical Unsaturated Distance</u> (septic system design) <ul style="list-style-type: none"> <li>Water Quality Sensitivity</li> <li>Soil Characteristics</li> <li>Lot area</li> </ul>	<ul style="list-style-type: none"> <li>Shallow, unstratified to deep stratified lakes</li> <li>Mesotrophic to eutrophic</li> <li>Alkaline</li> <li>Variable lake surface and watershed areas</li> <li>Off the Precambrian Shield</li> <li>Primarily forested (coniferous) with pockets of agriculture, ranching, logging and minor rural development</li> <li>Unserviced</li> <li>Concern related to conversion of seasonal to permanent occupancy of shoreline residences</li> </ul>
Kenora – Lower Black Sturgeon Lake (shoreline)	<ul style="list-style-type: none"> <li>To establish ‘restricted development areas’ of the lake shoreline where larger frontages are required to:               <ul style="list-style-type: none"> <li>Limit crowding</li> <li>Protect scenic amenity</li> <li>Protect Natural Heritage features</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Narrow channels</li> <li>Islands</li> <li>Embayments</li> <li>Natural Heritage features including wetlands</li> </ul>	<ul style="list-style-type: none"> <li>Large lake (1,600 ha) and watershed (731 km<sup>2</sup>)</li> <li>Mesotrophic (TP = 15.6 mg/L)</li> <li>Dystrophic (DOC = 8 mg/L)</li> <li>Primarily warm water fishery</li> <li>On the Precambrian Shield</li> <li>Primarily forested with pockets of rural residential and minor tourist commercial land use</li> <li>Unserviced</li> <li>Concern related to rapid pace of development, impacts of development on water quality and scenic amenity</li> </ul>
Muskoka, Seguin	<ul style="list-style-type: none"> <li>To classify lakes according to their sensitivity to phosphorus loading so that:               <ul style="list-style-type: none"> <li>Prohibit development if High Sensitivity and over capacity for phosphorus</li> <li>Tailor BMPs to mitigate phosphorus according to ‘Sensitivity’</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Sensitivity as:               <ul style="list-style-type: none"> <li>modelled Responsiveness to a standard phosphorus load, and</li> <li>Mobility of septic phosphorus</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Shallow unstratified to deep stratified lakes</li> <li>Oligotrophic to eutrophic, predominantly oligotrophic</li> <li>Variable lake surface and watershed areas</li> <li>On the Precambrian Shield</li> <li>Primarily forested (coniferous) with pockets of agriculture, and minor rural development</li> <li>Unserviced</li> <li>Predominantly seasonal recreational shoreline residences</li> </ul>
Muskoka Lakes	<ul style="list-style-type: none"> <li>To scale BMPs (minimum development standards) to protect existing character of the shoreline</li> </ul>	<ul style="list-style-type: none"> <li>Lake Character (qualitative based on lake size lake surface area, access and history of development)</li> </ul>	
Maine	<ul style="list-style-type: none"> <li>To establish zoning districts for establishing shoreline development type and required minimum development standards and BMPs</li> </ul>	<ul style="list-style-type: none"> <li>Current Pattern and Intensity of Development</li> <li>Floodplains</li> <li>Slopes</li> <li>Wetlands</li> <li>Protected Resources (habitat, scenic values, public access)</li> <li>Streams</li> </ul>	<ul style="list-style-type: none"> <li>Shallow, unstratified to deep stratified lakes</li> <li>Oligotrophic to eutrophic, mostly mesotrophic</li> <li>Predominantly acidic to circumneutral (pH~6-7)</li> <li>Variable lake surface and watershed areas</li> <li>Off the Precambrian Shield</li> <li>Primarily forested (coniferous) with small urban centres</li> <li>Unserviced, recreational development of shoreline areas</li> <li>Generally low population density</li> </ul>
Minnesota	<ul style="list-style-type: none"> <li>To scale BMPs and minimum development standards to protect water quality and natural resources based on lake characteristics and existing development patterns</li> </ul>	(General Classification) <sup>1</sup> <ul style="list-style-type: none"> <li>Lake surface area</li> <li>Shoreline to lake area</li> <li>Amount and Type of Existing Development</li> <li>Water Depth</li> </ul>	<ul style="list-style-type: none"> <li>Shallow, unstratified to deep stratified lakes</li> <li>Oligotrophic to eutrophic</li> <li>Variable lake surface and watershed areas</li> <li>On and off the Precambrian Shield</li> <li>Mixed land use</li> <li>Unserviced, recreational development of shoreline areas</li> <li>Increasing population density and shoreline development pressure, in general</li> </ul>

<sup>1</sup>Minnesota has provisions for “Alternative Shoreland Standards” that allow for other factors and more detailed sets of voluntary provisions that local governments could use to address local conditions and concerns (MDMR, 2014).

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### 4.3 Planning, Regulatory and Implementation Tools

#### 4.3.1 American Jurisdictions

In the jurisdictions sampled in the United States, the approaches and authorities are very similar. There is specific legislation which applies to shorelands. Most commonly they are part of a statute of the particular State. The legislation is very specific especially in comparison to Ontario's *Planning Act*. One of the primary differences is that it is mandatory in some states (e.g. Maine) but not in others (e.g. New Hampshire, Wisconsin).

The State of Maine, for example, enacted a *Mandatory Shoreland Zoning Act* in 1971 in response to increasing development pressure and there have been amendments since. The legislature concluded that strict regulation of land-use activities was necessary in the shoreland zone. Today, Maine's law is recognized as a national model of responsible environmental regulation.

The *Shoreland Zoning Act* requires all municipalities to enact, administer, and enforce a local ordinance. This means that local government must:

- ❖ Adopt a shoreland zoning ordinance (and map) that, at a minimum, meets the state Guidelines, addresses all the statutory requirements of the Act, and has been approved by the DEP Commissioner;
- ❖ Put administrative procedures in place to review applications and issue permits; and
- ❖ Appoint a Code Enforcement Officer whose responsibility it is to enforce the ordinance provisions, collect permit fees, and record all transactions.

Mandatory legislation may be something to consider for Ontario but is not likely given the current Planning regime in the Province which is permissive with respect to zoning.

#### 4.3.2 Official Plans

Official Plans shape the way a municipality sees its management of growth and protection of the environment. Official Plans must also be consistent with the Provincial Policy Statement and must be updated every five years. This may not be accomplished consistently across the province, however, and many municipalities may have Official Plans that are out of date due to lack of funding for the process. In Ontario, the first place to look for planning policy related to shoreline management is the Official Plan.

The detail and complexity of the policy related to shoreline development are quite varied for the jurisdictions reviewed in this study. The simpler policies are generally related to approaches that focus on Best Management Practices as in the cases of Maine, New Hampshire, and Wisconsin where the Comprehensive or Master Plans only outlined the reason and need for such an approach. The most complex Official Plan policies were those that combined a number of approaches (e.g., capacity, classification and BMPs) where lakes are listed, and varying policies applied to lakes based on their sensitivity to phosphorus, and where a series of reports are required prior to the development of the land to demonstrate compliance with policy (e.g., District Municipality of Muskoka, Township of Muskoka Lakes, and Township of Seguin). Those jurisdictions utilizing primarily a classification approach such as



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in Minnesota and Cariboo Regional District were of moderate complexity. A combination of approaches to have a complete suite of policies addressing shoreline management was ultimately the most complex.

### 4.3.3 Zoning Bylaws

In both the Canadian and American context, zoning bylaws and municipal ordinances were critical implementation mechanisms. Zoning bylaws are proposed by local municipalities as they are the primary implementation tool of Official Plan policies. They convert general development related policies into precise enforceable restrictions. The *Planning Act* also requires that zoning bylaws are updated within three years of the approval of an updated Official Plan. Zoning ordinances are used in American jurisdictions for the same reasons and come about in the same manner as zoning bylaws do in the Province of Ontario's context. In some states, however, where it is not mandatory, local municipalities do not necessarily have a zoning ordinance (the city of Houston, for example, does not have a zoning ordinance).

Zoning bylaws and ordinances are used to implement Official Plans and Comprehensive/Master Plans by converting policies to quantitative provisions affecting land use, building location, density, and height. These provisions do not address shoreline development capacity directly, but serve to mitigate some of the less desirable elements of increased density. Some bylaws in recent years contain provisions related to shoreline buffers, lake classification and lakeshore capacity modelling which address stressors such as water quality directly.

All bylaws (and ordinances for that matter) provide for minimum setbacks for structures and maximum density of buildings based on lot coverage. The Ontario Building Code requires a 15-m minimum setback of septic systems from surface water but some jurisdictions (i.e., Muskoka, Muskoka Lakes, Seguin Township) require a further setback to 30 m. Although not yet challenged in court, the enhanced setback requirement for septic systems can override the Ontario Building Code provided that it is being imposed for planning reasons.

In some jurisdictions, the zoning bylaw provisions do not always implement the general intent and purpose of the Official Plan policies. A case in point would be the Cariboo Regional Municipality in British Columbia. There is concern for lot sizes in the Official Plan, but the bylaw only requires a minimum frontage of 45.5 m and the setback from the water is only 7.6 m. This may, however, be a reflection of locally acceptable standards and the focus of mitigation through design of septic systems and maintenance of a shoreline buffer. Bylaws become more focussed on shoreline management in the implementation of lake classification systems or lakeshore capacity by making different requirements for lakes depending on how the lakes are classified (e.g., Seguin Township, the District Municipality of Muskoka and The Township of Muskoka Lakes in Ontario).

People have the right to apply for a minor variance under Ontario's *Planning Act*. There are four tests of a minor variance as outlined in the *Act* and it is up to the Committee of Adjustment to make the determination as to whether an application meets the four tests. Applications are considered on their own merits and take into account only site-specific matters and rarely consider cumulative impacts. Minor variances, if used as standard practice, can undermine the use of bylaws as a tool to implement policies to manage shoreline development. This "permissive" approval system is best tempered by strict Official



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Plan policy where it is stated that cumulative impacts of planning decisions must be taken into account and requires that a municipal Council be committed to this notion. Cumulative impacts are included in the recently released PPS (April 2014) so there should be some consideration of this moving forward which may reduce the use of minor variances.

### 4.3.4 Site Plans

In shoreline management, site plans can be a very effective tool in implementing site specific best management practices. The process of site plan approval can occur in a number of different ways. In the American jurisdictions, site plans are built into the Municipal Zoning Ordinances. The Ordinance can also require compliance with certain Best Management Guidelines or Stormwater Management Guidelines. Depending on the municipality, the actual requirements can vary considerably. In the State of New Hampshire, for example, the Shoreland Zoning Ordinance is not mandatory and over 90% of shoreland development is single lot development carried out under the auspices of the local government. The performance of implementation through site plans (and the local Ordinance) is not known to the State.

In Ontario, administration of site plans and Site Plan Control falls under Section 41 of the *Planning Act*. The *Act* permits a municipality to require site plans for individual waterfront lot developments provided it has policies for such in the Official Plan. Drawings can be required detailing drainage, stormwater retention, landscaping, and vegetation. In addition, financial securities can be taken to ensure the works detailed in the plans are completed. The plans become part of an Agreement which is registered on title to bind future successors in title to the obligations in the plans and the Agreement. Although this can be a very effective tool even for those municipalities with limited staffing, it requires review of site plans to assure effectiveness, and enforcement after the fact. While the Province does not have oversight of the site plan process, it can play a role through provision of information to local municipalities and through review of implementation policies in Official Plans when a local municipality is doing its Official Plan update every five years.

All of the Ontario jurisdictions examined as part of this study employ Site Plan Control and have taken advantage of planning tools offered in Section 41 of the *Planning Act*.

### 4.3.5 Specialized Bylaws

Use of specialized bylaws can be beneficial when it comes to shoreline management. The bylaws that have been cited in this report are Tree Preservation and Site Alteration. Although these bylaws are all authorized by similar sections in Ontario's *Municipal Act*, they can be written quite differently. The enforcement of these bylaws may vary from jurisdiction to jurisdiction, and may be difficult to implement by some municipalities depending on staff resources and political will.

The nature of how the bylaws are written depends on the purpose and the goal of the bylaw. A municipality that wishes to regulate tree cutting and filling, for example, will mold their bylaw into one that creates a permit system along with fees and site inspections (e.g., see Seguin Township, Section 3.9.3). Different levels of fees can be levied based on the amount and nature of the work to be done. Detailed application forms along with site plans can also be required resulting in the issuance of permits with numerous conditions attached. This can apply to certain activities and apply to the entire municipality



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which captures anyone wishing to do work that is governed by the bylaws. Once such a permit system type bylaw is put in place, it is not always easy to deny applications and precedents could become standards. A permit system also requires staff to run the program although some of the costs would be offset by application fees. Only limited information on costs of administering and enforcing the bylaws were obtained in the review, but these can vary widely due to the variability of the use of these bylaws. In the case of the Township of Muskoka Lakes, for example, an application for Site Alteration is \$250.00. The Township rarely processes an application as the bylaw is used primarily for education and enforcement purposes. Only one or two applications are processed a year. On the other hand, the Township investigates an average of 20 complaints per year. The cost to administer the bylaw would be approximately 10% of the Senior Planner position (\$7,500 per year). The Township of Seguin actively enforces their bylaws and reported that their annual budget for legal costs (e.g., for OMB proceedings, Provincial Offences Court and Supreme Court of Ontario) ranges from \$75,000 to \$100,000.

In contrast to a permit system, a bylaw can be tailored towards enforcement wherein it lists the areas where certain activities are prohibited. Details related to "Stop Work Orders" and "Orders to Remedy" are provided in the bylaw including notice and appeal of such. With this approach, the municipality needs to know where its primary interest lies with such bylaws. If the interest lies along the shorelines of lakes and rivers, it can prohibit the removal of trees within a certain distance from the water's edge. The same could apply to wetland areas provided they are identified in a report, Official Plan or appropriate zoning category in the municipality's Comprehensive Zoning Bylaw. The Township of Seguin and the Township of Muskoka Lakes utilize this type of bylaw.

For small municipalities without the ability to administer a permit system, it would be better to consider an enforcement type bylaw. With that said, it takes effort to enforce the bylaw. People administering such a bylaw should have some knowledge of the natural environment. This is a matter that could fall under the auspices of a Conservation Authority where it is present.

#### 4.3.6 Enforcement

Official Plan policies and Implementation Guidelines are just that, policies and guidelines. They cannot be enforced through immediate remedies or the court system. In the Planning jurisdictions throughout Canada and the United States, enforcement is done through Bylaws and Ordinances.

Enforcement through bylaws passed under the *Planning Act* must be done through the court system which can be very frustrating due to:

- ❁ Time to get the matter to trial,
- ❁ Cost of court proceedings,
- ❁ Challenge of collecting evidence,
- ❁ End result of low fines and little retribution.

Many municipalities may not want to make the necessary significant expenditures to go through the court system to enforce their bylaws. Bylaws passed under other legislation, however, can be more easily enforced. A Site Alteration Bylaw passed pursuant to the *Municipal Act*, for example, can contain items of immediate response to a violation. Stop Work Orders and Orders to Remedy can be embedded in the



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bylaw and enforced immediately upon infraction. The Township of Seguin and the Township of Muskoka Lakes each enforce approximately 20 - 25 infractions every year. The Township of Seguin takes the approach that they need to go to court to prevent future contraventions and court cases.

### 4.3.7 Unorganized Territories

In unorganized areas there is no form of government and a very limited number of services are administered and delivered by Local Service Boards under the *Northern Services Boards Act* administered by the Ministry of Northern Development and Mines. Such Boards are elected by the residents of the area that is serviced. They administer many of the services an organized local municipality would: garbage, library, recreation, street lighting, and fire department. In many areas, roads are dealt with by a separate roads board. Local Roads Boards are established under the *Local Roads Boards Act* funded by the Ministry of Transportation.

Generally there are few Official Plans in Unorganized municipalities, building permits are not required and the planning function is largely carried out by the Ministry of Municipal Affairs and Housing or Planning Boards, guided by the PPS. Certain specific areas have Minister's Zoning Orders including areas of the District of Sudbury, District of Parry Sound and the District of Timiskaming. These are administered by the Province and amendments to them can be applied for, however, MMAH has undergone an exercise of revoking old Zoning Orders. The Province also administers most consents/severances.

Due to the lack of Official Plans and zoning, planning for development in shoreline areas is a challenge. Shoreline areas, however, could be subject to a Minister's Zoning Order by which provisions, which have been previously noted under Zoning Bylaws, could be established. Provincial personnel at various Ministries could potentially be consulted about planning issues.

A Planning Board could also be established under the *Planning Act*. Such a Board is required to establish an Official Plan. As a starting point, the Official Plan could include the basic policies as noted previously in this study, and a zoning bylaw would be required to establish standards set out in the plan. Areas of the Province would have to be prioritized based on development pressures and lakes that are sensitive to additional development. Staffing to review Planning applications could be contracted from organized municipalities or Conservation Authorities, where appropriate.

### 4.3.8 Advantages and Disadvantages

Advantages and disadvantages of the planning tools described above are summarized in Table 15.



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Table 15. Advantages and Disadvantages of Policy and Regulatory Approaches

Policy and Regulatory Approach	Advantages	Disadvantages
American Legislation	Can be mandatory	May not be priority for municipality
	Implements State priorities	
	Assists municipalities that lack technical expertise	Questionable enforcement
	Municipalities can be more restrictive	Lack of ownership of ordinance
	Minimum standards required	Lack of Official Plans to provide municipal vision and context
Ontario Legislation	Enabling type legislation	May not be priority for municipality
	Number of implementation tools	Even a minimum standard may not be achieved
	Provincial priorities set through policy statement	Differing standards throughout Province
	Flexibility for municipalities	Differing enforcement throughout Province
Official Plans	Can be tailored to municipality needs and interests	Policies not enforceable
	Provides vision for municipality	Differing policies depending on municipality
	Can permit flexibility due to general nature	Expensive for small municipalities to keep up to date
	Regional Plans can provide consistency over a region	
	Requires update every 5 years	
Zoning Bylaws	Enforceable	Court system is challenging
	Tailored to Official Plan	Policies cannot always be converted to numbers
	Flexible through amendment processes	Amendment process can be abused and not uphold the intent of the Official Plan
	Traditionally understood implementation tool	Enforcement can be expensive
Site Plans	Excellent implementation of best management practices	Refers only to the site in question and not the broader surrounding area (watershed, lakewide shoreline)
	Can be very specific to site	Should have qualified staff to administer
	Can require securities to ensure BMPs carried out	A challenge to enforce without securities
	Can bind future owners through registration on title	No long term site monitoring



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## 5. Conclusions

The jurisdictions reviewed in the scan employ a wide variety of approaches to managing shoreline development on inland lakes with unique combinations of technical and planning tools depending on the primary focus of their management approach. Elements of one or both of two broad approaches, however, was generally used by each jurisdiction:

1. Shoreline Management by Capacity - approaches that manage shoreline development by placing limits on the number of lots or development units based on different thresholds and densities.
2. Shoreline Management by Mitigation – approaches that rely on the implementation of Best Management Practices including minimum development standards to mitigate impacts of shoreline development.

Lake classification has been successfully enforced through policy in many Ontario jurisdictions at a regional level to determine minimum development standards and Best Management Practices that ultimately protect a wide variety of desired attributes. Minimum development standards and associated BMPs set a baseline of protection but the implementation of additional lake management tools, including the Lakeshore Capacity Approach, could be encouraged at the municipal level to ensure that more stringent protection is achieved where the political will and financial resources permit, where more stringent control is required due to lake or watershed conditions (e.g., where development pressures are great and lake characteristics are particularly vulnerable to nutrient enrichment) and where the accuracy and validity of the model and approach support its use. A greater focus on Best Management Practices is highly recommended as it would ensure that lakes are protected from impacts of shoreline development which is line with the focus of the new PPS.

These common approaches have been successfully mandated through policy to manage shoreline development and determine development with a variety of successes and challenges. Elements of these approaches could be combined and tailored to develop a more holistic approach for the Province to consider:

- ✿ Application at various levels of planning organization (i.e., unorganized areas vs. organized municipalities),
- ✿ Application across the wide range of geographic conditions and lake characteristics,
- ✿ Implementation using available planning tools,
- ✿ Application within the context of Ontario's Provincial Policy Statement, and
- ✿ Variable resource availability.

One problem with the technical assessment of various approaches was the lack of good evidence of their success in protecting the desired attributes. Comprehensive and reliable lake monitoring programs have only been developed over the past 20 years as low level analytical techniques for phosphorus have become standard and available, or widespread regional programs have been implemented (i.e., Ontario's Lake Partner program). Recreational shoreline development in North America was most pronounced in the 1950s, 60s and 70s, prior to systematic monitoring initiatives and has taken place against a background of multiple changes – regrowth of forests following timber harvest, conversion of farmland to



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recreational use, implementation of communal sewage treatment for rural lake municipalities and, more recently, climate change and invading species. Although several jurisdictions maintain policies to manage social capacity, the success of these are difficult to assess by objective processes. Shoreline protection (i.e., buffer strips, vegetation protection or setbacks) is not systematically monitored or enforced. As such, our assessment of lakeshore management approaches was focussed on the technical merit and background information supporting the approaches of various jurisdictions and the planning tools available to implement their approaches, with the understanding that the implementation of effective and proven approaches is the key to protecting the desired lakeshore attributes.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

## 6. References

- AECOM, 2010:  
Development Capacity of Recreational Lakes in Seguin Township. Report prepared for Seguin Township.
- AECOM, 2013:  
Shubenacadie Lakes Subwatershed Study - Final Report. Prepared for Halifax Regional Municipality.
- Beacon Environmental, 2012:  
Ecological buffer guidelines review. Prepared for Credit Valley Conservation.
- Billings, M.P., 1956:  
The Geology of New Hampshire. Part 2. Bedrock Geology. New Hampshire State Planning Commission. Reprinted by Division of Forests and Lands, Department of Resources and Economic Development, Concord, New Hampshire, 1980.
- Cariboo Regional District (CRD), 2004:  
Shoreland Management Policy 2004.
- Center for Watershed Protection, 2003:  
Impacts of impervious cover on aquatic systems. Watershed Protection Research Monograph No. 1. Center for Watershed Protection, Ellicott City, Maryland. 257 pp.
- Certified Inspector of Sediment and Erosion Control Training Manual, 2012:  
Revised Edition V4 – Canada, CISEC Canada.
- City of Elliot Lake Act, 2001:  
[http://www.ontla.on.ca/committee-proceedings/transcripts/files\\_pdf/2001-05-30\\_pdfT002.pdf](http://www.ontla.on.ca/committee-proceedings/transcripts/files_pdf/2001-05-30_pdfT002.pdf)
- Credit Valley Conservation 2010. Low Impact Development Stormwater Management Planning and Design Guide CVC Version 1, 2010
- Dillaha, T.A. 1989:  
Water quality impacts of vegetative filter strips. ASAE Paper No. 89-2043.
- Dillaha, T.A., Sherrard, J.H. and D. Lee. 1986:  
Long-term effectiveness and maintenance of vegetative filter strips. Virginia Water Resources Research Center, Bulletin 151.
- Dillaha, T.A., Sherrard, J.H., Lee, D., Mostaghimi, S. and V.O. Shanholtz. 1985:  
Long-term effectiveness and sediment and phosphorus transport in vegetative filter strips: phase 1, field studies. ASAE Paper No. 85-2043.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

Dillon Consulting Limited, 2003:

HRM Water Resource Management Study Report. File 00-8283-9000. Prepared for the Halifax Regional Municipality. December 2002, revised September 2003. 366 p.

Dillon, P.J., K.H. Nicholls, W.A. Scheider, N.D. Yan and D.S. Jeffries, 1986:

Lakeshore Capacity Study: Trophic Status. Ontario Ministry of Municipal Affairs and Housing. ISBN 0 7743 8078 0

Dillon, P.J., W.A. Scheider, R.A. Reid and D.S. Jeffries. 1994:

Lakeshore Capacity Study : Part 1 – Test of effects of shoreline development on the trophic status of lakes. Lake and Reserv. Manage. 8: 121 – 129.

District Municipality of Muskoka (DMM), 2010:

Office Consolidation of the Official Plan of the Muskoka Planning Area. Prepared by the Planning and Economic Department. Consolidation November 19, 2010.

District Municipality of Muskoka (DMM), 2014:

2013 Lake System Health Water Quality Monitoring Program. Year End Report.

Environment Canada, 2013:

How much habitat is enough? Third edition. Environment Canada, Toronto, Ontario.

Environmental Law Institute. 2008:

Planner's Guide to Wetland Buffers for Local Governments, ISBN 978-1-58576-137-1, ELI Project No.0627-01, 25 pp.

Environmental Protection Agency, 2002:

Federal Water Pollution Control Act (Clean Water Act, as amended through P.L. 107–303, November 27, 2002) 33 U.S.C. 1251 et seq.

Euler, D.L.1983:

Lakeshore Capacity Study - Wildlife. Ontario Ministry of Municipal Affairs and Housing. ISBN 0 7743 8078 0

FoTenn Consultants Inc., 2010:

City of Kenora Final Zoning By-Law. Report prepared for the City of Kenora.

[http://www.kenora.ca/media/77465/consolidated\\_zoning\\_by-law.pdf](http://www.kenora.ca/media/77465/consolidated_zoning_by-law.pdf)

Gartner Lee Limited (GLL), 2005:

Recreational Water Quality Management in Muskoka. Technical Report prepared for District Municipality of Muskoka.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

- Gartner Lee Ltd (GLL) and Kelli Saunders Environmental Management (KSEM), 2007a:  
Lake Capacity and Management Study for Black Sturgeon lake, City of Kenora. Technical Report prepared for the City of Kenora, October, 2007.
- Gartner Lee Ltd (GLL) and Kelli Saunders Environmental Management (KSEM), 2007b:  
Technical Synthesis and Management Plan in Support of the Lake Capacity and Management Study for Black Sturgeon lake, City of Kenora. Technical Report prepared for the City of Kenora, August, 2007.
- Halifax Regional Municipality, 2006:  
Municipal Planning Strategy. Amendments dated October 2013.
- Hutchinson Environmental Sciences Ltd. (HESL), 2012:  
Shoreline Development Capacity of Elliot Lake Area Lakes Based on Phosphorus and Lake Trout Habitat. Draft report prepared for the City Elliot Lake. October 15, 2012, with revisions April 2013.
- Hutchinson Environmental Sciences Ltd. (HESL) et al., 2011:  
Phosphorus Budget Tool in Support of Sustainable Development for the Lake Simcoe Watershed. Version 2 Report. Prepared for Ontario Ministry of the Environment and Climate Change.
- Hutchinson Environmental Sciences Ltd. (HESL), 2014:  
Assessment of Municipal Site Evaluation Guidelines for Waterfront Development in Eastern Ontario's Lake Country. Technical report prepared for Mississippi Valley Conservation Authority, Rideau Valley Conservation Authority and Cataraqui Region Conservation Authority. April 10, 2014.
- Jacques Whitford, 2009:  
Fall River-Shubenacadie Lakes Subwatershed Study. Report 1025549. July 2009. 99 p. + appendices.
- Knutson, K. L., and V. L. Naef. 1997:  
Management recommendations for Washington's priority habitats: riparian. Wash. Dept. Fish and Wildl., Olympia. 181pp.
- Lake Simcoe Region Conservation Authority (LSRCA), 2013:  
Lake Simcoe Watershed 2013 Environmental Monitoring Report (2007 – 2011 data).
- Magette, W. L, R. B. Brinsfield, R. E. Palmer and J. D. Wood. 1986:  
Vegetative filter strips for non-point pollution control: nutrient considerations. ASAE Paper No. 86-2024.
- Maine Department of Environmental Protection, 2006a:  
Chapter 1000: Guidelines for Municipal Shoreland Zoning Ordinances.  
[www.maine.gov/sos/cec/rules/06/096/096c1000.doc](http://www.maine.gov/sos/cec/rules/06/096/096c1000.doc)



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

- Maine Department of Environmental Protection, 2006b:  
06-096, Chapter 502: Direct watersheds of lakes most at risk from new development, and urban impaired streams. <http://www.maine.gov/dep/land/sitelaw/#rule>
- Maine Department of Environmental Protection, 2006c:  
Phosphorus Control Action Plan and Total Maximum Daily Annual Phosphorus Load Report.  
Prepared for Cross Lake and Square Lake Twp.  
[http://www.epa.gov/waters/tmdl/docs/30679\\_cross\\_lake.pdf](http://www.epa.gov/waters/tmdl/docs/30679_cross_lake.pdf)
- Maine Department of Environmental Protection, 2008:  
Maine Shoreland Zoning - A Handbook for Shoreland Owners.  
<http://www.maine.gov/dep/land/slz/citizenguide.pdf>
- Maine Department of Environmental Protection, 2011:  
06-96, Chapter 500: Stormwater Management. <http://www.maine.gov/dep/land/sitelaw/#rule>
- Maine Department of Environmental Protection, 2013:  
Maine Stormwater Best Management Practices Manual. Accessed on February 24, 2014 from  
<http://www.maine.gov/dep/land/stormwater/stormwaterbmpps/#manual>
- Nowak, D. G. and E. J. Greenfield, 2012:  
Tree and impervious cover in the United States. *Landscape and Urban Planning*, 107:21-30.
- Marvinney, R.G., 2012:  
Bedrock Geologic History of Maine. Available online from the Maine Department of Agriculture, Conservation and Forestry at: <http://www.maine.gov/dacf/mgs/explore/bedrock/facts/geol-hist.htm>
- Michael Michalski Associates and Anthony Usher Planning Consultant (Michalski and Usher), 1992:  
Rideau Lakes Basin Carrying Capacities and Proposed Shoreland Development Policies.  
Prepared for Rideau Conservation Authority.
- Minnesota Department of Natural Resources (MDRR), 2014:  
Shoreland Management Programs. Accessed online at:  
[http://www.dnr.state.mn.us/waters/watermgmt\\_section/shoreland/index.html](http://www.dnr.state.mn.us/waters/watermgmt_section/shoreland/index.html)
- Minnesota Department of Natural Resources (MDNR), 2005:  
Minnesota's Alternative Shoreland Management Standards. Prepared through the Shoreland Standards Update Advisory Committee, December 12, 2005.
- Molot, L.A., P.J. Dillon, B. Clark and B.P. Neary. 1992:  
Predicting end-of-summer oxygen profiles in stratified lakes. *Can. J. Fish. Aquat. Sci.* 49:2363-2372.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

New Hampshire General Court, 2010:

Title L - Water Management and Protection, Chapter 483-A New Hampshire Lakes Management and Protection Program. 1990, 118:2. 2010, 269:2, eff. July 6, 2010.

New Hampshire General Court, 2011:

Title L - Water Management and Protection, Chapter 483-B Shoreland Water Quality Protection Act. 1991, 303:1. 2002, 263:1. 2008, 171:15, eff. July 1, 2008.

<http://www.gencourt.state.nh.us/rsa/html/L/483-B/483-B-mrg.htm>

Province of Ontario, 2008:

Lake Simcoe Protection Act. S.O. 2008, Chapter 23.

Province of Ontario, 2010:

Lakeshore Capacity Assessment Handbook – Protecting Water Quality in Inland Lakes on Ontario's Precambrian Shield. Prepared by the Ministry of the Environment, Ministry of Natural Resources, and Ministry of Municipal Affairs and Housing. Queen's Printer for Ontario. PIBS 7642e.

Ontario Building Code (OBC), 2006:

[http://www.e-laws.gov.on.ca/html/regs/english/elaws\\_regs\\_120332\\_e.htm](http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_120332_e.htm)

Ontario Ministry of the Environment (MOE), 2009:

Lake Simcoe Protection Plan. Approved Amendments. Updated September, 2010. 103 pp.

Ontario Ministry of Environment (MOE), 2010:

Lake Simcoe Phosphorus Reduction Strategy. PIBS 7633e. Queens Printer for Ontario. 71pp.

Ontario Ministry of Environment and Energy (OMEE), 1994:

Water management: Policies, guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy. Queen's Printer for Ontario.

Ontario Ministry of Municipal Affairs and Housing (MMAH), 2014:

2014 Provincial Policy Statement

Ontario Ministry of Municipal Affairs and Housing (MMAH), 2005:

2005 Provincial Policy Statement

Ontario Ministry of Municipal Affairs and Housing (MMAH), 2006:

A guide to operating and maintaining your septic system. Toronto, ON.

Ontario Ministry of Municipal Affairs (MMA) 1983:

Lakeshore Capacity Study.

Ontario Ministry of Natural Resources (MNR), 2009:

Guidelines for the Application of a Dissolved Oxygen Criterion for the Protection of Lake Trout Habitat. 2009 Working Draft, version 2009.10. Fish and Wildlife Branch. Peterborough, ON.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

Ontario Ministry of Natural Resources (MNR), 2010:

Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005, Second Edition. Toronto: Queen's Printer for Ontario. 248 pp.

Paterson, A.M., P.J. Dillon, N.J. Hutchinson, M.N. Futter, B.J. Clark, R.B. Mills, R.A. Reid and W.A. Scheider. 2006:

A review of the components, coefficients and technical assumptions of Ontario's Lakeshore Capacity Model. *Lake and Reservoir Management* 22(1): 7 – 18.

Rideau Valley Conservation Authority, 2009:

Rideau Lakes Watershed Plan. Priorities and Recommendations. August, 2009.

Robertson, W.D., Schiff, S.L. and C.J. Ptacek, 1998:

Review of phosphate mobility and persistence in 10 septic system plumes. *Ground Water*, 36, 1000-1010.

Robertson, W.D. 2003:

Enhanced attenuation of septic system phosphate in noncalcareous sediments. *Ground Water* 41:48-56.

Robertson, W.D. 2012:

Phosphorus retention in a 20-year-old septic system filter bed. *Journal of Environmental Quality, Technical Reports, Groundwater Quality*.

Ryan Haines Consulting, 2009:

Black Sturgeon Lakes Water Quality Monitoring. 2009 Report. Technical report prepared for the City of Kenora.

Ryan Haines Consulting, 2010:

Black Sturgeon Lakes Water Quality Monitoring. 2010 Report. Technical report prepared for the City of Kenora.

Scott, R.S., Hart, W.C., and D.H. Waller, 1991:

Water Quality in Headwaters of the Shubenacadie River System. Prepared for County of Halifax Municipality. April 1991. 18 p. + appendices.

Senator George J. Mitchell Center for Environmental and Watershed Research, U.S. Gulf of Maine Association, Canadian Gulf of Maine Association, et al., 2014:

Knowledge Base Science & Information Management for the Gulf of Maine & Its Watershed. Database available online at: <http://www.gulfofmaine.org/kb/2.0/search.html>

Statistics Canada, 2012:

Focus on Geography Series, 2011 Census. Statistics Canada Catalogue no. 98-310-XWE2011004. Ottawa, Ontario. Analytical products, 2011 Census. Last updated October 24, 2012.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

Town of Innisfil, 2013a:

Comprehensive Zoning Bylaw 080-13.

Town of Innisfil, 2013b:

Site Plan Control Guide and Application.

Township of Muskoka Lakes (TML), 2006:

By-Law to Designate a Site Plan Control Area. By-Law 2006-100

Township of Muskoka Lakes (TML), 2008a:

Comprehensive Zoning By-Law 87-87. Consolidation June, 2008

Township of Muskoka Lakes (TML), 2008b:

Site Alteration By-Law. By-Law 2008-56

Township of Muskoka Lakes (TML), 2009:

Tree-cutting By-Law. By-Law 2009-55

Township of Muskoka Lakes (TML), 2010a:

Committee of Adjustment - Application for Consent. January, 2010.

Township of Muskoka Lakes (TML), 2010b:

The Corporation of the Township of Muskoka Lakes Official Plan. Consolidation June, 2010

Township of Muskoka Lakes (TML), 2010c:

Zoning By-Law Amendment Procedure.

Township of Seguin, 2012:

Township of Seguin Official Plan Office Consolidation.

Township of Rideau Lakes, 2010:

Official Plan of the Township of Rideau Lakes (Consolidated).

United States Census Bureau, 2014:

State and County QuickFacts. Online at: <http://quickfacts.census.gov/qfd/states/23000.html>

Vaughan Engineering Associates Ltd., 1993:

Shubenacadie Lakes Planning/Pollution Control Study. Prepared for County of Halifax  
Shubenacadie Planning/Pollution Control Task Force.

Wisconsin Department of Natural Resources (WDNR), 1980:

Wisconsin's Shoreland Protection Program. Chapter NR 115.

Wisconsin Department of Natural Resources (WDNR), 2002:

Lake Protection and Classification Grants. Chapter NR 191.



## Review of Existing Approaches for Managing Shoreline Development on Inland Lakes

Wenger, S. 1999:

A Review of the Scientific Literature on Riparian Buffer Width, Extent and Vegetation. Office of Public Service and Outreach, Institute of Ecology, University of Georgia.

Zhang, X., X. Liu, M. Zhang, M., R. A. Dahlgren and M. Eitzel. 2010:

A review of vegetated buffers and a meta-analysis of their mitigation efficacy in reducing nonpoint source pollution. *Journal of Environmental Quality*, Vol. 39, pp. 76-84.

Zurawsky, M.A., W.D. Robertson, C.J. Ptacek and S.L. Schiff. 2004:

Geochemical stability of phosphorus solids below septic system infiltration beds. *J. Contaminant Hydrology* 73: 129-143.



## Appendix A. Answers to Jurisdictional Scan Questions



Legend:	NA - information was not available or was not able to be determined from available information	n/a - not applicable to the jurisdiction
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Jurisdiction:		City of Kenora (Black Sturgeon Lake)	City of Elliot Lake (Cottage Lot Program-Phase 2; program under review)	Seguin Township	Halifax Regional Municipality/Shubenacadie and Birch Cove Lakes Subwatersheds	Lake Simcoe (Lake Simcoe Protection Plan)
Program Framework						
1	What does the jurisdiction seek to protect?					
	Environmental	<ul style="list-style-type: none"><li>Water quality (i.e., impacts from phosphorus, bacteria, pesticides)</li><li>Fish and wildlife values</li><li>Natural shorelines</li><li>Wetlands</li></ul>	<ul style="list-style-type: none"><li>Water quality (phosphorus concentrations)</li><li>Lake Trout habitat</li></ul>	<ul style="list-style-type: none"><li>Protect, improve or restore water quality</li></ul>	<ul style="list-style-type: none"><li>Groundwater resources, receiving waters, native plants and soils, terrestrial and aquatic species, species at risk</li></ul>	<ul style="list-style-type: none"><li>Restore self-sustaining coldwater fish community</li><li>To protect and restore the ecological health of the Lake Simcoe watershed</li></ul>
	Community	<ul style="list-style-type: none"><li>Public access</li></ul>	<ul style="list-style-type: none"><li>No explicit protection noted</li></ul>	<ul style="list-style-type: none"><li>No explicit protection noted</li></ul>	<ul style="list-style-type: none"><li>No explicit protection noted</li></ul>	NA
	Social	<ul style="list-style-type: none"><li>Viewscales</li><li>Recreational value</li><li>Aesthetic quality</li><li>Social crowding</li></ul>	<ul style="list-style-type: none"><li>No explicit protection noted</li></ul>	<ul style="list-style-type: none"><li>Recreational quality</li><li>Visual and Aesthetic character</li></ul>	<ul style="list-style-type: none"><li>Monitor growth and development to ensure that current objectives and policies reflect changing national and regional economic environments.</li></ul>	NA
	Economic	<ul style="list-style-type: none"><li>No explicit protection noted, but shoreline lot development is of economic value to the city</li></ul>	<ul style="list-style-type: none"><li>recreation and tourism, economic future of the City as an increase to the tax base</li></ul>	<ul style="list-style-type: none"><li>recreation and tourism</li></ul>	<ul style="list-style-type: none"><li>Encourage economic climate conducive to development and the growth of employment opportunities.</li></ul>	<ul style="list-style-type: none"><li>Population expected to increase significantly and a lot of money invested into Lake Simcoe recreation.</li></ul>
2	Is this done through limiting development or use (capacity approach) or managing how lakes are developed and used (mitigation approach)?	<ul style="list-style-type: none"><li>Both - Lakeshore Capacity Assessment approach to limit development based on phosphorus and increased lot frontages in 'restricted areas' to protect natural features and social crowding, and controls on rate of development</li></ul>	<ul style="list-style-type: none"><li>Capacity approach based on phosphorus and oxygen for Lake Trout habitat, with some mitigation approaches to be developed as part of individual lake management plans</li><li>Position of lots are pre-determined based on lake-specific studies to avoid natural heritage features and steep slopes</li><li>Minimum frontage size and setbacks tlikely o be established</li><li>Shoreline vegetation disturbance/removal limits likely to be established</li></ul>	<ul style="list-style-type: none"><li>Capacity approach for a few lakes that are deemed "Over Threshold" for phosphorus (and with high sensitivity), social density or Lake Trout habitat</li><li>Mitigation approach for all other lakes which may include submission of a Site Evaluation Report and Environmental Impact Study where required, which will address the maintenance or improvement of shoreline vegetation, limiting shoreline use areas, meeting setback requirements, controlling storm water runoff and erosion, and providing enhanced sewage treatment</li></ul>	<ul style="list-style-type: none"><li>Not yet established, but potentially capacity limits for lakes over threshold for phosphorus or other water quality parameter, and general mitigation requirements</li></ul>	<ul style="list-style-type: none"><li>Mitigation</li></ul>
3	How many lakes do you manage in your jurisdiction?	<ul style="list-style-type: none"><li>Lake-specific management for Black Sturgeon Lake</li></ul>	<ul style="list-style-type: none"><li>11 lakes that are being considered for the expanded program</li></ul>	<ul style="list-style-type: none"><li>128 lakes</li></ul>	<ul style="list-style-type: none"><li>&gt;1000</li></ul>	<ul style="list-style-type: none"><li>1</li></ul>
4	What is the range of characteristics of the lakes that are managed?					
	Geological Setting	<ul style="list-style-type: none"><li>Precambrian Shield, thin soil cover</li></ul>	<ul style="list-style-type: none"><li>Precambrian Shield, thin soil cover</li></ul>	<ul style="list-style-type: none"><li>Precambrian Shield, thin soil cover</li></ul>	<ul style="list-style-type: none"><li>Variable, generally glacial till</li></ul>	<ul style="list-style-type: none"><li>Limestone</li></ul>
	Climate Regime	<ul style="list-style-type: none"><li>Temperate</li></ul>	<ul style="list-style-type: none"><li>Temperate</li></ul>	<ul style="list-style-type: none"><li>Temperate</li></ul>	<ul style="list-style-type: none"><li>Humid continental</li></ul>	<ul style="list-style-type: none"><li>Temperate</li></ul>
	Fish Communities	<ul style="list-style-type: none"><li>Mix of cold/cool/warmwater, primarily warmwater</li><li>Common species include Iowa darter, blacknose shiner, yellow perch, pumpkinseed, bluntnose minnow and black crappie</li><li>Sport fish include walleye, northern pike, smallmouth bass, brown bullhead, yellow perch, black crappie and muskellunge</li></ul>	<ul style="list-style-type: none"><li>6 of the proposed program lakes are MNR designated Lake Trout lakes, several other lake trout lakes are present upstream and downstream of the development lakes</li><li>Mix of cold/cool/warmwater</li></ul>	<ul style="list-style-type: none"><li>Variable warm and cold water fish communities</li><li>15 MNR-designated Lake Trout lakes (of 128 lakes &gt;10 ha)</li></ul>	<ul style="list-style-type: none"><li>Centrarchids, Trout spp.</li><li>Mix of cold/cool/warmwater, primarily warmwater</li></ul>	<ul style="list-style-type: none"><li>Lake trout, whitefish major considerations</li></ul>
	Lake Area	<ul style="list-style-type: none"><li>1,600 ha</li></ul>	<ul style="list-style-type: none"><li>30 - 20,700 ha</li></ul>	<ul style="list-style-type: none"><li>10 - 578 ha</li></ul>	<ul style="list-style-type: none"><li>5.4-1,877 ha</li></ul>	<ul style="list-style-type: none"><li>74,400 ha</li></ul>
	Watershed Size	<ul style="list-style-type: none"><li>731 km<sup>2</sup></li></ul>	<ul style="list-style-type: none"><li>2 to 93 km2</li></ul>	<ul style="list-style-type: none"><li>22 - 56 km<sup>2</sup></li></ul>	<ul style="list-style-type: none"><li>Halifax Regional Municipality = 5,600 km<sup>2</sup></li></ul>	<ul style="list-style-type: none"><li>3,400 km<sup>2</sup></li></ul>
	Lake Depth	<ul style="list-style-type: none"><li>average depth = 12 m</li><li>maximum depth = 30 m</li></ul>	<ul style="list-style-type: none"><li>average depth = 4.8 to 39 m</li></ul>	<ul style="list-style-type: none"><li>at least 24 known shallow lakes &lt;5 m deep</li><li>maximum depth range from 1.2 to 42 m (n=54)</li></ul>	<ul style="list-style-type: none"><li>1 - 27 m</li></ul>	<ul style="list-style-type: none"><li>41 m</li></ul>
	Mixing Regime (dimictic, polymictic)	<ul style="list-style-type: none"><li>Dimictic</li></ul>	<ul style="list-style-type: none"><li>Dimictic, one polymictic lake</li></ul>	<ul style="list-style-type: none"><li>Dimictic and polymictic, but not known for more than half of the lakes, data are being collected to resolve this issue</li></ul>	<ul style="list-style-type: none"><li>Generally dimictic</li></ul>	<ul style="list-style-type: none"><li>Dimictic</li></ul>
	Trophic State (oligotrophic, mesotrophic, eutrophic, dystrophic)	<ul style="list-style-type: none"><li>Mesotrophic (mean TPso = 15.6 ug/L)</li><li>Dystrophic (colour = 30 TCU; dissolved organic carbon = 8 mg/L)</li></ul>	<ul style="list-style-type: none"><li>Oligotrophic (mean TPso = 2.8 to 6.7 ug/L)</li></ul>	<ul style="list-style-type: none"><li>Oligotrophic to eutrophic (mean TP = 3.4 to 21.0 mg/L), but primarily oligotrophic (mean TPif = 7.8 ug/L)</li><li>several lakes with large wetland influence are suspected as being dystrophic, but DOC and colour data are lacking</li></ul>	<ul style="list-style-type: none"><li>Eutrophic to oligotrophic but generally mesotrophic</li></ul>	<ul style="list-style-type: none"><li>Mesotrophic</li></ul>
	Wetland Influence	<ul style="list-style-type: none"><li>Minimal wetland areas (&lt;1% of the watershed)</li></ul>	<ul style="list-style-type: none"><li>0 to 7% of the watershed)</li></ul>	<ul style="list-style-type: none"><li>Variable (mean wetland area = 5.3%, range = 0 - 23%)</li></ul>	<ul style="list-style-type: none"><li>Highly influential, 186 km<sup>2</sup></li></ul>	<ul style="list-style-type: none"><li>7% of watershed</li></ul>
	Proximity to Population	<ul style="list-style-type: none"><li>Within 10 km of the City of Kenora (population of 15,348)</li></ul>	<ul style="list-style-type: none"><li>Within 10 km of the City of Elliot Lake (population of 11,449)</li></ul>	<ul style="list-style-type: none"><li>2+ hours to Greater Toronto Area: 6.3 million</li></ul>	<ul style="list-style-type: none"><li>~372,000 for region, lakes within within ~70 km of the urban centre of Halifax (population of 297,943 in 2011),</li></ul>	<ul style="list-style-type: none"><li>~400,000 for watershed, &lt;1 hr from greater Toronto area</li></ul>
	Projected Population Growth	<ul style="list-style-type: none"><li>Stable population (1.1% growth from 2006-2011)</li></ul>	<ul style="list-style-type: none"><li>Stable population, projected increase to 15,000 over the next 10 years</li></ul>		<ul style="list-style-type: none"><li>2006-2036 = +65,300 (18%)</li></ul>	<ul style="list-style-type: none"><li>2010 (350,000) - 2031 (500,000) = (+43%)</li></ul>
	Shoreline Development Occupance (seasonal vs. permanent)	<ul style="list-style-type: none"><li>215 shoreline lots (within 100 m)</li></ul>	<ul style="list-style-type: none"><li>Planned for recreational use, but conversion to permanent occupancy possible for lots with road access</li></ul>	<ul style="list-style-type: none"><li>2,931 shoreline lots (within 100 m), 19% permanent and 81% seasonal</li></ul>	<ul style="list-style-type: none"><li>~95% permanent</li></ul>	<ul style="list-style-type: none"><li>Mix of seasonal and permanent</li></ul>
	Level of Development stress (# of building permits per year within the jurisdiction)	<ul style="list-style-type: none"><li>~17 severances per year (shoreline)</li></ul>	<ul style="list-style-type: none"><li>Severances will not be permitted under program, no additional lot creation under the <i>Elliot Lake Act</i> to occur on the lakes proposed for development</li></ul>	<ul style="list-style-type: none"><li>2012 = 347 applications (18 cottages, 14 residences, 6 boat houses), 2013 = 341 applications (22 cottages, 12 residences, 2 boathouses)</li></ul>		
	Sewage Servicing (served, non-served)	<ul style="list-style-type: none"><li>Non-served</li></ul>	<ul style="list-style-type: none"><li>Non-served</li></ul>	<ul style="list-style-type: none"><li>Non-served</li></ul>	<ul style="list-style-type: none"><li>Majority are not serviced</li></ul>	<ul style="list-style-type: none"><li>Both</li></ul>
	Land Use Type (urban, recreational)	<ul style="list-style-type: none"><li>Mix of low-density residential development, waterfront residential and very limited farm, tourist commercial and resource-based operations</li><li>Pockets of residential areas within the watershed, but primarily forested watershed, which is mostly Crown Land</li><li>Majority of the patent lands are zoned Rural and subdivisions are zoned Rural Residential, with a few small pockets of Open Space and Tourist Commercial</li></ul>	<ul style="list-style-type: none"><li>Majority of land is undeveloped forest with some small urban influence from the City of Elliot Lake, no or very limited existing shoreline development</li></ul>	<ul style="list-style-type: none"><li>Majority of land is undeveloped forest with some rural residential influence</li></ul>	<ul style="list-style-type: none"><li>Urban and recreational</li></ul>	<ul style="list-style-type: none"><li>Urban and recreational</li></ul>
5	What is the indirect attribute managed? (e.g., water quality, algal blooms, boating capacity, fish and wildlife habitat)	<ul style="list-style-type: none"><li>water quality (i.e., impacts from phosphorus, bacteria, pesticides)</li><li>Fish and Wildlife values</li><li>Natural Shorelines</li><li>Wetlands</li></ul>	<ul style="list-style-type: none"><li>Water quality</li><li>Lake Trout habitat</li></ul>	<ul style="list-style-type: none"><li>water quality</li><li>Lake Trout habitat</li><li>Boating capacity</li><li>Wetlands</li></ul>	<ul style="list-style-type: none"><li>Water quality</li></ul>	<ul style="list-style-type: none"><li>Water quality, algal blooms major consideration</li></ul>

Jurisdiction:		City of Kenora (Black Sturgeon Lake)	City of Elliot Lake (Cottage Lot Program-Phase 2; program under review)	Seguin Township	Halifax Regional Municipality/Shubenacadie and Birch Cove Lakes Subwatersheds	Lake Simcoe (Lake Simcoe Protection Plan)
6	What are the direct attributes managed? (e.g., phosphorus, shoreline availability, social density, dissolved oxygen, buffer zones)	<ul style="list-style-type: none"> <li>phosphorus, shoreline availability, social density, dissolved oxygen, buffer zones, viewscales, natural heritage features (wetlands, fish and wildlife habitat)</li> </ul>	<ul style="list-style-type: none"> <li>phosphorus, shoreline suitability (slopes), dissolved oxygen, natural heritage features (wetlands, fish and wildlife habitat)</li> </ul>	<ul style="list-style-type: none"> <li>phosphorus</li> <li>social density</li> </ul>	<ul style="list-style-type: none"> <li>Various water quality objectives, namely measures of eutrophication (e.g. TP)</li> </ul>	<ul style="list-style-type: none"> <li>Phosphorus</li> <li>dissolved oxygen</li> </ul>
7	What is the management target/performance indicator?	<ul style="list-style-type: none"> <li>Target for total phosphorus concentration of 20 ug/L (which is &lt;background plus 50% for this lake)</li> </ul>	<ul style="list-style-type: none"> <li>Total phosphorus concentration &lt;background plus 50%</li> <li>mean volume-weighted hypolimnetic dissolved oxygen &gt;7 mg/L for Lake Trout lakes</li> </ul>	<ul style="list-style-type: none"> <li>total phosphorus concentration &lt;background plus 50% to a maximum cap of 20 ug/L</li> <li>maintenance of Lake Trout habitat as per MNR policy</li> <li>maintenance of density that is less than 1 residential unit per 1.6 ha of lake surface area and 1 tourist accomodation for every 0.8 ha of lake surface area</li> </ul>	<ul style="list-style-type: none"> <li>Various watershed specific water quality objectives</li> </ul>	<ul style="list-style-type: none"> <li>Phosphorus = 44 tonnes/yr</li> <li>Dissolved oxygen = 7 mg/L</li> </ul>
	How does the program accomplish this?	<ul style="list-style-type: none"> <li>Limit development to predicted increase in total phosphorus concentration of 20 ug/L</li> <li>education</li> </ul>	<ul style="list-style-type: none"> <li>Limit lot development to predicted increase in total phosphorus concentration of background plus 50%</li> <li>No development on Lake Trout lakes with MVVHDO &lt; 7 mg/L</li> <li>Positioning of development lots away steep slopes</li> <li>Enhanced septic system technologies that reduce phosphorus load are being considered for sensitive lakes</li> <li>City plans to commit to reducing phosphorus loads from the wastewater treatment plant to offset predicted loads from lakes that did not model sufficiently well</li> </ul>	<ul style="list-style-type: none"> <li>Lakes classified as 1) "Over or Under Threshold" for phosphorus following Provincial Lakeshore Capacity Assessment approach, and 2) as "High, Moderate or Low Sensitivity" (based on responsiveness to a standard load of phosphorus and mobility of phosphorus from septic systems) to phosphorus inputs</li> <li>New lot creation is not permitted on lakes that: 1) are "Over Threshold" (over background total phosphorus concentration plus 50%) and that have "High Sensitivity", 2) exceed a total phosphorus concentration of 20 ug/L, 3) are deemed at Capacity for Lake Trout in accordance with MNR policy, or 4) exceed the recreational carrying capacity</li> <li>remaining lakes can sustain additional development, but are subject to controls established in the Official Plan that are dependant on lake Sensitivity</li> <li>education</li> </ul>	<ul style="list-style-type: none"> <li>Compare water quality results to water quality objectives</li> <li>Utilize Lakeshore Capacity Models and Stormwater Management Models.</li> </ul>	<ul style="list-style-type: none"> <li>Utilize TP tool during major developments</li> <li>stormwater management plans</li> <li>stewardship</li> </ul>
8	What information is required for the program? (e.g. planning information, lake attributes)	<ul style="list-style-type: none"> <li>the maximum number of lots and shoreline areas where lot development is prohibited were determined based on a detailed investigation of lake and watershed characteristics and planning principles in Kenora, which included: <ul style="list-style-type: none"> <li>lakeshore capacity assessment (following MOE Lakeshore Capacity Assessment guidance)</li> <li>land use/land cover characteristics</li> <li>natural heritage values</li> <li>shoreline availability (considering islands and narrow channels to protect viewscales and manage density)</li> <li>water quality data (nutrients, oxygen and temperature profiles)</li> <li>shoreline characteristics (slopes)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Lake and watershed characteristics to support Lakeshore Capacity Assessment and MVVHDO determinations for Lake Trout habitat assessment</li> <li>Fish and wildlife habitat, species at risk along shoreline and within proposed lot areas</li> </ul>	<ul style="list-style-type: none"> <li>Detailed information to model phosphorus concentration for each lake (lake and watershed attributes, phosphorus concentration, development)</li> <li>program to monitor water quality</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring results</li> </ul>	<ul style="list-style-type: none"> <li>Biophysical site information</li> <li>Overarching monitoring program results inform TP reductions required</li> </ul>
9	Are there monitoring requirements?	<ul style="list-style-type: none"> <li>Yes, to track changes in water quality (total phosphorus) but formal water quality monitoring program to be implemented in 2014</li> </ul>	<ul style="list-style-type: none"> <li>Yes, to track changes in water quality and lake trout habitat (spring overturn total phosphorus, monthly total phosphorous concentration for select lakes, end-of-summer dissolved oxygen and temperature profiles)</li> </ul>	<ul style="list-style-type: none"> <li>Yes, to track changes in water quality (total phosphorus) and to improve model predictions (collection of oxygen profiles, stratification patterns, lake depth, water colour for lakes where these data were not known)</li> <li>Septic re-inspection program since 2000</li> </ul>	<ul style="list-style-type: none"> <li>Yes</li> </ul>	<ul style="list-style-type: none"> <li>No</li> </ul>
	If yes, what are they and who is responsible for monitoring?	<ul style="list-style-type: none"> <li>total phosphorus concentrations to be monitored by City of Kenora, encouragement of participation in MOE's Lake Partner Program</li> </ul>	<ul style="list-style-type: none"> <li>City of Elliot Lake</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring program implemented and conducted by Seguin Township (summer student program),</li> <li>Program direction and review of monitoring results by consultants</li> </ul>	<ul style="list-style-type: none"> <li>Qualified persons financed in whole or in part by developers proposing large-scale developments</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring completed by LSRCA and MOE, but too big of a receiver to monitor site impacts related to individual developments.</li> </ul>
10	What scientific support is provided for the approach and by whom?	<ul style="list-style-type: none"> <li>Environmental and planning consultants to develop the recommendations for lake specific management. No personnel or staff responsible for lake management or water quality monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental consultants for capacity assessments, monitoring, identification of natural heritage features and preparation of lake-specific management plans</li> </ul>	<ul style="list-style-type: none"> <li>Environmental consultants developed the approach and provided recommendations for policy development</li> </ul>	<ul style="list-style-type: none"> <li>Historical technical document, <i>HRM Water Resource Management Study Report, Dillon Consulting Ltd.</i></li> </ul>	<ul style="list-style-type: none"> <li>Lake Simcoe Science Advisory Committee</li> <li>Lake Simcoe Coordinating Committee</li> <li>Ministry of Environment</li> </ul>
11	What scientific and planning principles inform the program?	<ul style="list-style-type: none"> <li>Holistic approach that uses the Province's Lakeshore Capacity Assessment guidance, other provincial guidance and policy (Species at Risk), protection of Natural Heritage Features (Natural Values Information System of the MNR)</li> <li>Implementation of specific policies in the Official Plan for the lake as a "Restricted Development Area"</li> </ul>	<ul style="list-style-type: none"> <li>Province's Lakeshore Capacity Assessment guidance and Lake Trout policy</li> </ul>	<ul style="list-style-type: none"> <li>Province's Lakeshore Capacity Assessment guidance</li> <li>Lake Trout policy</li> <li>calculated recreational carrying capacity of the lakes based on a residential unit to surface area criterion</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring results based on national guidelines (CCME), namely Canadian Guidance Framework for TP</li> </ul>	<ul style="list-style-type: none"> <li>Assimilative capacity study</li> </ul>
12	Does the program address its goal in a watershed context?	<ul style="list-style-type: none"> <li>Yes - for water quality, the recommended capacity limits considered upstream development</li> </ul>	<ul style="list-style-type: none"> <li>Yes - for water quality, the recommended capacity limits considered upstream development</li> </ul>	<ul style="list-style-type: none"> <li>Yes - "Threshold" evaluation considers all upstream development</li> </ul>	<ul style="list-style-type: none"> <li>Yes</li> </ul>	<ul style="list-style-type: none"> <li>Yes</li> </ul>
	If so, how is this achieved?	<ul style="list-style-type: none"> <li>The recommended capacity limits based on phosphorus concentrations considered phosphorus load from upstream development</li> </ul>	<ul style="list-style-type: none"> <li>The recommended capacity limits based on phosphorus concentrations and lake trout habitat considered phosphorus load from upstream development</li> </ul>	<ul style="list-style-type: none"> <li>Lakeshore Capacity Model was developed using all lakes &gt;10 ha in the watershed</li> </ul>	<ul style="list-style-type: none"> <li>Studies are completed through secondary plans at the sub-watershed scale</li> </ul>	<ul style="list-style-type: none"> <li>Subwatershed-specific targets and related actions related to phosphorus reduction</li> </ul>
	What are the specific challenges?	<ul style="list-style-type: none"> <li>Existing residents want a moratorium on development despite assurances of planning policies that protect environmental and social issues</li> </ul>	<ul style="list-style-type: none"> <li>Program is still in development, but challenges have included difficulties with measured data (quality and quantity) to establish MVVHDO for adherence to Lake Trout policy</li> <li>Lakeshore Capacity Model did not accurately predict phosphorus concentrations for lakes with rapid flushing rates (riverine-type flow through lakes) or lakes where the inlet and outlet were closely positioned</li> </ul>	<ul style="list-style-type: none"> <li>Minimal monitoring data were available at time of program development</li> </ul>		<ul style="list-style-type: none"> <li>Variety of phosphorus inputs to control apart from new development applications</li> </ul>
13	Are landscape features and lake characteristics comparable to those in Ontario?	<ul style="list-style-type: none"> <li>Yes, for lakes situated in rural areas of Northern Ontario on the Precambrian Shield</li> </ul>	<ul style="list-style-type: none"> <li>Yes, for lakes situated in rural areas of Northern Ontario on the Precambrian Shield</li> </ul>	<ul style="list-style-type: none"> <li>Yes, for lakes situated in rural areas of central Ontario on the Precambrian Shield</li> </ul>	<ul style="list-style-type: none"> <li>Lakes in HRM generally small, high DOC, high flushing rate, underlain by rock</li> <li>similar to some Shield lakes in Ontario with exposed granitic bedrock but climatic differences (maritime influence)</li> </ul>	<ul style="list-style-type: none"> <li>Different than Precambrian Shield lakes in that higher CaCO3</li> <li>relatively shallow for a large lake</li> </ul>

Jurisdiction:		City of Kenora (Black Sturgeon Lake)	City of Elliot Lake (Cottage Lot Program-Phase 2; program under review)	Sequin Township	Halifax Regional Municipality/Shubenacadie and Birch Cove Lakes Subwatersheds	Lake Simcoe (Lake Simcoe Protection Plan)
14	Has the original scientific merit been borne out in practice?	<ul style="list-style-type: none"> <li>Results of water quality monitoring since implementation of the program have not been reviewed; awaiting information from the City</li> </ul>	<ul style="list-style-type: none"> <li>Program is still in development, and no lots have yet been developed under the Phase 2 program</li> </ul>	<ul style="list-style-type: none"> <li>results of water quality monitoring since implementation of the program have not identified any significant increasing trends in phosphorus concentrations over time</li> <li>awaiting additional information re. success at the OMB from the Town contact</li> </ul>	<ul style="list-style-type: none"> <li>Too early to tell</li> </ul>	<ul style="list-style-type: none"> <li>Phosphorus has declined but modelling methods have utilized reduction in atmospheric inputs</li> </ul>
	What has worked and what has not?	<ul style="list-style-type: none"> <li>Policies implemented have controlled the pace of development</li> <li>City has been challenged with definition of "embayment"</li> <li>residents still concerned about social crowding</li> </ul>	<ul style="list-style-type: none"> <li>n/a - program is under development</li> </ul>	<ul style="list-style-type: none"> <li>challenges at OMB on lakes considered "over Threshold" for phosphorus and for "Social Density"</li> <li>having multiple tools upon which to limit shoreline development is beneficial</li> </ul>	<ul style="list-style-type: none"> <li>Removal rates of 80% or higher for TSS and 50% for phosphorus is difficult to achieve if enhancements to public SWM system is required because Nova Scotia Environment does not recommend advanced treatment methodologies.</li> <li>removal of septic difficult because of issues with landowners.</li> </ul>	NA
	Are the intended attributes protected and stable?	<ul style="list-style-type: none"> <li>Formal assessment has not been completed, but development of shoreline and back lots has proceeded within the limits set out in the Official Plan and as recommended in the lake management plan</li> </ul>	<ul style="list-style-type: none"> <li>n/a - program is under development</li> </ul>	<ul style="list-style-type: none"> <li>Formal assessment has not been completed, planned program review for spring of 2015</li> </ul>	<ul style="list-style-type: none"> <li>Too early to tell</li> </ul>	<ul style="list-style-type: none"> <li>Phosphorus has declined</li> <li>health of coldwater fish communities has improved</li> </ul>
15	What important attributes are not addressed by the program?	<ul style="list-style-type: none"> <li>Climate change was not directly addressed in the management plan beyond sensitivity analysis of model predictions under different runoff scenarios</li> </ul>	<ul style="list-style-type: none"> <li>n/a - program is under development</li> </ul>	<ul style="list-style-type: none"> <li>No specific gap noted but there are provisions in the Official Plan to address issues or concerns that may arise</li> </ul>	NA	NA
16	What indirect policies and programs might address these other issues?	<ul style="list-style-type: none"> <li>None have been recommended</li> </ul>	<ul style="list-style-type: none"> <li>n/a - program is under development</li> </ul>	<ul style="list-style-type: none"> <li>Council supports the preparation of Lake Plans and Strategies that address emerging issues and remedial actions related to recreational carrying capacity, shoreline development, lake level management, fisheries, vegetation retention and health, shoreline erosion, cottage conversion and septic system maintenance and re-inspection, and other issues important to lake communities. Such Plans are also encouraged to establish monitoring programs and/or remediation programs to be primarily implemented by local residents and stakeholders such as the Municipality and the Province.</li> </ul>	NA	NA
17	Does this jurisdiction intend to change its approach?	<ul style="list-style-type: none"> <li>No, the approach was adopted in the Official Plan and Zoning By-law (2009/2010), but the City intends to review the approach before all of the remaining available lots are developed</li> </ul>	<ul style="list-style-type: none"> <li>No</li> </ul>	<ul style="list-style-type: none"> <li>Possibly, based on results of the program review in spring of 2015</li> </ul>	NA	NA
	If so – what is the most pressing factor to address?	n/a	n/a	n/a	NA	NA
<b>Planning, Regulation and Implementation Tools</b>						
18	What is the primary legislative authority governing shoreline development?	<ul style="list-style-type: none"> <li>Planning Act</li> </ul>	<ul style="list-style-type: none"> <li>Elliot Lake (City of) Act</li> </ul>	<ul style="list-style-type: none"> <li>Planning Act</li> </ul>	<ul style="list-style-type: none"> <li>Municipal Government Act</li> <li>Halifax Regional Municipality Charter</li> <li>Environment Act</li> <li>Water Resources Protection Act</li> </ul>	<ul style="list-style-type: none"> <li>Planning Act</li> <li>Municipal Act</li> <li>Conservation Authorities Act</li> </ul>
19	Are there implementation guidelines for the legislation?	<ul style="list-style-type: none"> <li>MOE Lakeshore Capacity Assessment Handbook</li> </ul>	<ul style="list-style-type: none"> <li>MOE Lakeshore Capacity Assessment Handbook</li> <li>MNR Lake Trout Policy</li> </ul>	<ul style="list-style-type: none"> <li>MOE Lakeshore Capacity Assessment Handbook</li> <li>Lake Trout Policy and draft MNR guidelines (2009)</li> </ul>	<ul style="list-style-type: none"> <li>No</li> </ul>	<ul style="list-style-type: none"> <li>MOE Lakeshore Capacity Assessment Handbook</li> <li>Lake Trout Policy and draft MNR guidelines (2009)</li> </ul>
20	What is the major thrust of the Planning policy (eg. tree preservation, setbacks, density limitation, no development, natural areas preservation)?	<ul style="list-style-type: none"> <li>Number of shoreline lots</li> <li>Frontage size</li> <li>Setbacks</li> <li>Restricted development areas including areas of significant natural heritage, islands and narrow channels to protect views</li> <li>Shoreline vegetation disturbance/removal limits</li> <li>No industrial, new marinas, waterfront landings or other public docking facilities are permitted</li> </ul>	n/a - program is still under review, planning elements are not yet established for this program	<ul style="list-style-type: none"> <li>Limiting new lot creation on lakes with water quality issues (Over Threshold and Highly Sensitive lakes for phosphorus, at-capacity Lake Trout Lakes)</li> <li>Variety of mitigation approaches described above</li> <li>Municipality may impose limitations on the size of docks, public access to the lake or seek voluntary restrictions on the power of boats using the lake</li> </ul>	<ul style="list-style-type: none"> <li>Shoreline Best management Practices</li> <li>Water Quality Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Shoreline Best Management Practices</li> </ul>
21	Is the Planning Policy currently under review?	<ul style="list-style-type: none"> <li>No</li> </ul>		<ul style="list-style-type: none"> <li>Yes - OP review is currently underway scheduled for completion in 2014</li> </ul>	<ul style="list-style-type: none"> <li>Revised Regional Plan currently before Council</li> </ul>	<ul style="list-style-type: none"> <li>Yes Provincial Policy Statement</li> <li>Local Official Plan updates</li> </ul>
22	What Implementation tools are used (eg. zoning, site plans, development permits, specialized bylaws)?	<ul style="list-style-type: none"> <li>Site Plan Control</li> <li>Zoning Bylaw</li> </ul>		<ul style="list-style-type: none"> <li>site plan control, monitoring requirements, site plan or development agreements including the posting of securities, Zoning By-law performance standards, and other regulatory by-laws including tree cutting, site alteration, and a development permit system</li> <li>Restrictive Covenant Agreements on sales of Shore Road Allowances</li> </ul>	<ul style="list-style-type: none"> <li>Secondary Plans</li> <li>Water Quality Objectives</li> <li>Watershed Planning</li> <li>Zoning (land Use Regulations)</li> <li>Development Agreements</li> <li>Site Plans</li> </ul>	<ul style="list-style-type: none"> <li>Zoning</li> <li>Site Plan Control</li> </ul>
23	What enforcement mechanisms are used?	<ul style="list-style-type: none"> <li>Lower Tier: Bylaw Enforcement</li> </ul>		<ul style="list-style-type: none"> <li>Lower Tier: Bylaw Enforcement</li> <li>5 OMB files open dealing with shoreline development</li> <li>3 Provincial Offenses Act cases going to trial in May 2014</li> <li>Investigated 20 cases under the shoreline protection By-Laws in 2013</li> <li>Lake Associations (education)</li> </ul>	<ul style="list-style-type: none"> <li>Halifax Charter, Breach of Agreements, Apply to Supreme Court</li> </ul>	<ul style="list-style-type: none"> <li>Lower Tier: Bylaw Enforcement</li> <li>Conservation Authority Regulations</li> </ul>
24	Are there Special Purpose Bodies involved in the management of shoreline development?	<ul style="list-style-type: none"> <li>A steering committee was formed for the development of the lake plan, which included: the President (and Vice-President) of the Black Sturgeon Lake Property Owners' Association, a senior representative of the Ministry of Natural Resources, a member of Council, a resident of the Lawton Drive subdivision, an employee of the Department of Fisheries and Oceans, a resident of the Peterson Road area, and a representative of the Kenora Planning Advisory Committee.</li> </ul>			<ul style="list-style-type: none"> <li>Regional Watershed Advisory Boards</li> </ul>	<ul style="list-style-type: none"> <li>Conservation Authority</li> </ul>
25	What are the key decision making processes?	<ul style="list-style-type: none"> <li>Development Application Review</li> </ul>		<ul style="list-style-type: none"> <li>Development Application Review</li> </ul>	<ul style="list-style-type: none"> <li>Development Application Review</li> <li>Regional Council through Planning Strategies and Zoning Bylaws</li> </ul>	<ul style="list-style-type: none"> <li>Development Application Review</li> </ul>
26	Has the program been adopted across the jurisdiction?	<ul style="list-style-type: none"> <li>No - specific to Lower Black Sturgeon Lake</li> </ul>	<ul style="list-style-type: none"> <li>n/a - Lakeshore Development Program Lakes Only</li> </ul>	<ul style="list-style-type: none"> <li>Yes</li> </ul>	<ul style="list-style-type: none"> <li>Unknown</li> </ul>	<ul style="list-style-type: none"> <li>No</li> </ul>
	If no, what barriers have been identified?	n/a	n/a	n/a		<ul style="list-style-type: none"> <li>Timing with Official Plan Updates</li> <li>Cost</li> </ul>

Jurisdiction:		City of Kenora (Black Sturgeon Lake)	City of Elliot Lake (Cottage Lot Program-Phase 2; program under review)	Seguin Township	Halifax Regional Municipality/Shubenacadie and Birch Cove Lakes Subwatersheds	Lake Simcoe (Lake Simcoe Protection Plan)
27	What levels of government are involved and what are their specific roles?	<ul style="list-style-type: none"> <li>Provincial: MMAH review and acceptance of Official Plan policies, MNR provision of NRVS, land use data and shoreline survey data, MOE (Thunder Bay Regional Office) conducted water quality monitoring</li> <li>Municipal: <ul style="list-style-type: none"> <li>review development applications with regard to provision in the Official Plan, Zoning Bylaws,</li> <li>promote awareness of threats to water quality through education and best management practices with local and provincial cottager associations.</li> <li>update, and monitor, the water quality of Black Sturgeon Lake by: <ul style="list-style-type: none"> <li>(i) the establishment of a water quality monitoring program,</li> <li>(ii) encouraging landowners to take part in MOE's Lake Partner program,</li> <li>(iii) Coordinate water quality testing with MOE on a regular basis,</li> <li>(iv) work with citizen groups to coordinate water clarity and bacterial testing; and,</li> <li>(v) report water quality monitoring results in the City website</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Provincial: MOE, MMAH and MNR technical input for lot numbers and lake selection, MNR to prepare the Memorandum of Understanding (MOU) with the City under the Elliot Lake Act for disposition of Crown Land</li> <li>Municipal (with funding only from proceeds of the Cottage Lot Program): <ul style="list-style-type: none"> <li>conduct water quality monitoring,</li> <li>develop individual lake management plans</li> <li>preparation of the program information needed for the MOU</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Provincial: overall guidance (Provincial Policy Statement), approval of Official Plan policies</li> <li>Municipal: <ul style="list-style-type: none"> <li>review development applications with regard to provision in the Official Plan, Zoning Bylaws,</li> <li>provide education to residents on use of best management practices to protect water quality and natural values</li> <li>implementation of a water quality monitoring program in support of the approach,</li> <li>septic system inspection program</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Provincial: overall guidance and legislation</li> <li>Regional Municipality: policy framework and strategic policy</li> </ul>	<ul style="list-style-type: none"> <li>Provincial: overall guidance (Provincial Policy Statement),</li> <li>Upper Tier: Strategic Policy, Local Official Plan and OPA Approvals, Plan of Subdivision/Condominium Approvals, input into local Planning applications</li> <li>Lower Tier: Development Control including Official Plan Amendments (adoption only), Zoning Bylaw Amendments, Consents/Severances, Minor Variances, Site Plans, Tree Preservation Bylaw, Site Alteration Bylaw</li> </ul>
28	What mechanisms are used for inter-jurisdictional decision making and collaboration?	n/a	n/a	<ul style="list-style-type: none"> <li>included as a policy in the Official Plan to work with other jurisdictions to protect and preserve or protect water quality of lakes that cross municipal boundaries (e.g., with the District Municipality of Muskoka)</li> </ul>	<ul style="list-style-type: none"> <li>Halifax Government Relations and External Affairs Office</li> </ul>	<ul style="list-style-type: none"> <li>Conservation Authority</li> </ul>
29	Is there a feedback mechanism to determine if implementation is successful? If not, what are the challenges?	<ul style="list-style-type: none"> <li>No</li> </ul>	n/a	<ul style="list-style-type: none"> <li>No</li> <li>No mechanism was considered</li> </ul>	<ul style="list-style-type: none"> <li>Performance indicators in Regional Plan</li> <li>n/a</li> </ul>	<ul style="list-style-type: none"> <li>Water Quality Monitoring</li> <li>n/a</li> </ul>
30	Is there an appeal process to resolve disputes?	<ul style="list-style-type: none"> <li>Ontario Municipal Board</li> <li>Application for amendment to the Official Plan</li> </ul>	n/a	<ul style="list-style-type: none"> <li>Ontario Municipal Board</li> <li>Application for amendment to the Official Plan</li> </ul>	<ul style="list-style-type: none"> <li>Nova Scotia Utility and Review Board</li> </ul>	<ul style="list-style-type: none"> <li>Ontario Municipal Board</li> </ul>
31	What was the initial cost to implement the program?	\$45,557 for completion of the Black Sturgeon Lake Management and Capacity Report	Information not available	<ul style="list-style-type: none"> <li>Budgeted \$25,000 to update model in 2014-15</li> <li>Stewardship handbook = \$25,000</li> <li>Speed limit signs for nearshore areas = \$3,000</li> </ul>	<ul style="list-style-type: none"> <li>Difficult to determine</li> </ul>	NA
32	What are the annual costs of the program? (e.g., for planning, monitoring, program updates/revisions)	Information not available	Information not available	<ul style="list-style-type: none"> <li>Budget \$75,000 to \$100,000 per year for enforcement (OMB proceedings, Provincial Offences Court and the Supreme Court of Ontario)</li> <li>\$30,000 for water quality monitoring program and septic re-inspection program</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring \$100,000/year</li> </ul>	NA
33	Who bears the costs? (e.g., government, developers, lake residents, NGOs)	<ul style="list-style-type: none"> <li>Cost of the initial program to be paid through collection of a levy associated with new development (\$275 per lot, 142 lots allowed)</li> </ul>	<ul style="list-style-type: none"> <li>all costs associated with the program must be funded by the sale of lots (no municipal funding is permitted)</li> </ul>	<ul style="list-style-type: none"> <li>Township</li> </ul>	<ul style="list-style-type: none"> <li>Municipal government, small amount through development agreements</li> </ul>	NA
34	What funding resources are available for implementation of programs?	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>All costs associated with the program must be funded by the sale of lots (no municipal funding is permitted)</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>General Municipal Revenues</li> </ul>	NA
35	What staff resources (e.g., in-house staff, consultants) are available for implementation of programs?	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>oversight and program planning by staff employed inhouse staff department for development and oversight of the program (employed by hired through a non profit Commission established for oversight</li> </ul>	<ul style="list-style-type: none"> <li>One dedicated staff member to oversee monitoring, planning staff review applications</li> </ul>	<ul style="list-style-type: none"> <li>Studies and monitoring done by consultants</li> <li>Implementation by in-house staff</li> </ul>	NA
36	What are the key documents that describe or provide guidance for the program? Can you provide these, or provide a reference?	<ul style="list-style-type: none"> <li>City of Kenora Official Plan</li> <li>Black Sturgeon Lake Management and Capacity Report (GLL and KSEM, 2007)</li> </ul>	<ul style="list-style-type: none"> <li>Shoreline Development Capacity of Elliot Lake Area Lakes Based on Phosphorus and Lake Trout Habitat (HESL, 2013)</li> </ul>	<ul style="list-style-type: none"> <li>Seguin Township Official Plan</li> <li>Development Capacity of Recreational Lakes in Seguin Township (AECOM, 2010)</li> </ul>	<ul style="list-style-type: none"> <li>River Lakes Secondary Municipal Planning Strategy</li> <li>Halifax Regional Charter</li> <li>Shubenacadie Lakes Land Use Bylaw</li> </ul>	<ul style="list-style-type: none"> <li>County of Simcoe Official Plan</li> <li>Town of Innisfil Official Plan</li> <li>Lake Simcoe Protection Plan</li> <li>Township Zoning Bylaw</li> </ul>
Best Management Practices						
37	How are BMPs specifically addressed in the approach?	<ul style="list-style-type: none"> <li>not specifically included other than provision of education and outreach regarding BMPs by the City</li> </ul>	<ul style="list-style-type: none"> <li>not yet determined, but may include direction under specific policies of the Official Plan once the program is approved</li> </ul>	<ul style="list-style-type: none"> <li>not specifically included other than provision of education and outreach regarding BMPs by the Township</li> </ul>	<ul style="list-style-type: none"> <li>20 m buffers in OP policy</li> <li>stormwater management to meet water quality objectives</li> </ul>	<ul style="list-style-type: none"> <li>BMPs, LID to reduce phosphorus loading from new development</li> </ul>
38	What BMPs are considered and how are they chosen?	n/a	<ul style="list-style-type: none"> <li>not yet determined, but likely to include setback requirements, shoreline vegetation maintenance and use of enhanced septic system technologies to reduce phosphorus on sensitive lakes</li> </ul>	n/a	<ul style="list-style-type: none"> <li>HRM Stormwater Management Guidelines for application of a subwatershed-specific or development-specific SWMM</li> </ul>	<ul style="list-style-type: none"> <li>Decision tree in HESL report</li> <li>Ability to reduce TP post-construction</li> <li>Site plan agreements include ESC</li> <li>LSRCA - 15 m min buffer, slope stability plan, ESC plan</li> </ul>
39	Are performance measures tracked?	n/a	n/a	n/a	<ul style="list-style-type: none"> <li>Yes, indirectly through water quality monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Yes, ESC and BMPs are monitored and revised to best capture sediment with results entered into phosphorus tool</li> </ul>
40	What was the initial cost to implement the BMPs?	n/a	n/a	n/a		<ul style="list-style-type: none"> <li>Variable</li> </ul>
41	What are the annual costs? (e.g. maintenance, monitoring, inspection)	n/a	n/a	n/a		<ul style="list-style-type: none"> <li>Variable</li> </ul>
42	Who bears the costs? (e.g. government, developers, lake residents, NGOs)	n/a	n/a	n/a	<ul style="list-style-type: none"> <li>Developers</li> </ul>	<ul style="list-style-type: none"> <li>Developers</li> </ul>

Jurisdiction:		New Hampshire	Vermont **not completed as program not successfully implemented**	Township of Rideau Lakes	District Municipality of Muskoka	Township of Muskoka Lakes
<b>Program Framework</b>						
1	What does the jurisdiction seek to protect?					
	Environmental	• Protect and restore surface water including lakes ponds rivers streams and public bathing facilities		• Conserve, restore and manage the natural resources of the watershed; • achieve "no net decline in water quality (no net increase in phosphorus loading)" associated with development	• Water clarity and algal blooms, natural shorelines, wetlands	• Water clarity and algal blooms, natural shorelines, wetlands
	Community	• Recreational opportunities		NA	• Narrow waterbodies	• Narrow waterbodies
	Social	• Achieve balance between different human uses		• Protect against property damage and social disruption	• Crowding, aesthetics (do not consider boating)	• Crowding, aesthetics (do not consider boating), lake character
	Economic	• Recreational, aesthetic, historic, cultural, tourism		NA	• Recreational property values, tourism	• Recreational property values, tourism
2	Is this done through limiting development or use (capacity approach) or managing how lakes are developed and used (mitigation approach)?	• Mitigation		• Both - no new lot creation is recommended where site suitability is not appropriate (slopes), mitigation approaches for sites scaled to shoreline suitability; capacity for lake trout lakes	• Mitigation approach primarily, • Capacity approach for a few lakes that are deemed "Over Threshold" and that are classified as 'High Sensitivity' based on responsiveness to phosphorus loads and a measure of phosphorus mobility from septic systems	• Mitigation approach primarily, Capacity approach for a few lakes that are deemed "Over Threshold", • Lake Classification system
3	How many lakes do you manage in your jurisdiction?	• ~1000 over 10 acres (4 ha)		• 25 major lakes	• 392 lakes have policy, remaining are considered "moderate sensitivity" and can be further developed	• ~100 lakes, most are "moderately sensitive" and can be further developed
4	What is the range of characteristics of the lakes that are managed?					
	Geological Setting	• Off the Precambrian Shield: complex bedrock of Paleozoic metamorphosed sedimentary and volcanic rocks with intrusions of plutonic rocks • Overlain by glacial tills		• Located at the edge of the Precambrian Shield such that granitic Shield bedrock predominates in the western part of the township and dolomitic and sandstone rocks of the St. Lawrence Lowlands occur in the east	• Precambrian Shield, thin soil cover	• Precambrian Shield, thin soil cover
	Climate Regime	• Humid continental	• Humid continental	• Temperate	• Temperate	• Temperate
	Fish Communities	• Trout spp., Atlantic salmon, lake whitefish		• Small panfish commercial fishery on Upper and Big Rideau Lake • mix of cold/cool/warmwater, primarily warmwater • some MNR-designated lake trout lakes	• Warm and cold water, MNR-designated "Lake Trout Lakes"	• Warm and cold water, MNR-designated "Lake Trout Lakes"
	Lake Area	• >1,000 lakes in the State greater than 4 ha, total area of lakes is 183,900 ha		NA - but variable	• 8 - 11,914 ha	
	Watershed Size	• 28,490 km² (Connecticut River), local watershed sizes variable		NA - but variable	• 6,277 km² in 4 major and 17 minor subwatersheds	
	Lake Depth	• Variable from shallow to 56 m deep		NA - but variable	• shallow (<5 m) to very deep (>60m)	• shallow (<5 m) to very deep (>60m)
	Mixing Regime (dimictic, polymictic)	• Generally dimictic		NA - but variable	• dimictic and polymictic	• dimictic and polymictic
	Trophic State (oligotrophic, mesotrophic, eutrophic, dystrophic)	• Generally mesotrophic (median phosphorus = 0.011 mg/L)		NA - but variable, watershed report card describes the lakes as primarily mesotrophic	• oligotrophic to mesotrophic (TP = 9.4+/- 3.7 ug/L), some dystrophic lakes (DOC = 3.8-27.3 ug/L)	• oligotrophic to mesotrophic (TP = 9.4+/- 3.7 ug/L), some dystrophic lakes (DOC = 3.8-27.3 ug/L)
	Wetland Influence	NA		6% wetland	• 0 - 43% of watershed area, average = 9.2%	• 0 - 43% of watershed area, average = 9.2%
	Proximity to Population	• 1.3 million for state, largest urban centres include Manchester (population of 109,565), Nashua (population of 86,494); other urban centres have population <50,000		• 620,000 within the CA jurisdiction; Township of Rideau Lakes is within Lennox and Grenville United County and has a population of 10,207 and the nearest urban centres to the Township are Ottawa (110 km) and Kingston (60 km) with populations of 1,236,324 and 159,161, respectively	• 2 hours to Greater Toronto Area: 6.3 million	• 2 hours to Greater Toronto Area: 6.3 million
	Projected Population Growth	NA		• Intensification of "use" is noted as a concern (conversion to permanent occupancy) • Declined by 1.4% from 2006 to 2011	• 2006 - 2031: permanent +%38; seasonal +%19	• 2006 - 2031: permanent +%38; seasonal +%19
	Shoreline Development Occupance (seasonal vs. permanent)	• Predominantly seasonal		• primarily seasonal, but increased conversion to permanent	• both: ~ 80% seasonal, 20% permanent	• both: ~ 80% seasonal, 20% permanent
	Level of Development stress (# of building permits per year within the jurisdiction)	NA		• 525 consents to sever in 2012	• See District Growth Strategy, confirmation from DMM	• See District Growth Strategy • High development stress, 800-1200 Building Permits per year, value can exceed \$100 million per year
	Sewage Servicing (serviced, non-serviced)	• Generally not serviced		• Non-serviced	• 8 communities serviced, no shoreline service	• 2 serviced communities, no shoreline service
	Land Use Type (urban, recreational)	• Predominantly recreational		• Recreational	• mostly recreational	• mostly recreational
5	What is the indirect attribute managed? (e.g., water quality, algal blooms, boating capacity, fish and wildlife habitat)	• Water quality, fish and wildlife habitat		• Algae blooms • Lake Trout habitat	• water quality, algae blooms, wetlands, visual, fish/wildlife habitat	• water quality, algae blooms, wetlands, visual, fish/wildlife habitat, overcrowding

Jurisdiction:		New Hampshire	Vermont  **not completed as program not successfully implemented**	Township of Rideau Lakes	District Municipality of Muskoka	Township of Muskoka Lakes
6	What are the direct attributes managed? (e.g., phosphorus, shoreline availability, social density, dissolved oxygen, buffer zones)	<ul style="list-style-type: none"> <li>• Buffer zones</li> <li>• Lot vegetation</li> </ul>		<ul style="list-style-type: none"> <li>• Phosphorus, dissolved oxygen, shoreline suitability (soils, slopes, vegetation)</li> </ul>	<ul style="list-style-type: none"> <li>• Phosphorus concentration via mitigation of shoreline development, setting limits for total phosphorus, lot size, shoreline development density, vegetation cover</li> </ul>	<ul style="list-style-type: none"> <li>• Phosphorus concentration via mitigation of shoreline development, setting limits for total phosphorus, lot size, shoreline development density, vegetation cover</li> </ul>
7	What is the management target/performance indicator?	<ul style="list-style-type: none"> <li>• None, but lake specific management plans encouraged</li> </ul>		<ul style="list-style-type: none"> <li>• Phosphorus = background + 50% for lake capacity modelling</li> <li>• MVWHO &gt;7 mg/L</li> </ul>	<ul style="list-style-type: none"> <li>• Total phosphorus &lt; Background + 50% (revised PWQO), maintenance of 75% of shoreline vegetation</li> <li>• 60m minimum lot frontage</li> <li>• no development in wetlands</li> </ul>	<ul style="list-style-type: none"> <li>• Total phosphorus concentration &lt; background plus 50% (revised PWQO), maintenance of 100% of shoreline vegetation</li> <li>• 60m minimum lot frontage</li> <li>• no development in wetlands</li> <li>*preservation of Lake Character</li> </ul>
	How does the program accomplish this?	<ul style="list-style-type: none"> <li>• Minimum Shoreland Protection Standards (development standards and BMPs)</li> <li>• New Hampshire Lakes Management and Protection Program</li> </ul>		<ul style="list-style-type: none"> <li>• Biophysical site criteria scores used to determine appropriate shoreline setbacks</li> <li>• capacity for Lake Trout lakes</li> </ul>	<ul style="list-style-type: none"> <li>• Scoping development controls in the OP to "Lake Sensitivity" and phosphorus status</li> <li>• education</li> <li>• Planning Act approvals</li> </ul>	<ul style="list-style-type: none"> <li>• Scoping development controls in the OP to "Lake Sensitivity" and phosphorus status</li> <li>• education</li> <li>• Planning Act approvals</li> <li>• Classification of lakes</li> </ul>
8	What information is required for the program? (e.g. planning information, lake attributes)	<ul style="list-style-type: none"> <li>• Soil type and percolation rates</li> <li>• Size and number of trees, and areas of shrubs and other ground cover</li> <li>• Impervious surface area</li> <li>• Erosion and sediment control factors</li> </ul>		<ul style="list-style-type: none"> <li>• Soil, slope, vegetation</li> </ul>	<ul style="list-style-type: none"> <li>• Detailed information to model phosphorus concentration for each lake (lake and watershed attributes, phosphorus concentration, development)</li> <li>• program to monitor water quality</li> <li>• lake specific planning controls</li> <li>• site specific attributes and biophysical studies for new development</li> </ul>	<ul style="list-style-type: none"> <li>• Detailed information to model phosphorus concentration for each lake (lake and watershed attributes, phosphorus concentration, development)</li> <li>• program to monitor water quality</li> <li>• lake specific planning controls</li> <li>• site specific attributes and biophysical studies for new development</li> <li>*existing development character</li> <li>*lake surface to lot ratios</li> </ul>
9	Are there monitoring requirements?	<ul style="list-style-type: none"> <li>• None were noted</li> </ul>		<ul style="list-style-type: none"> <li>• Monitoring program completed by RVCA, MOE Lake Partner Program and through surveys through Algae Watch</li> </ul>	<ul style="list-style-type: none"> <li>• Yes - ~163 lakes monitored every 2 years for TP, water clarity and dissolved oxygen</li> </ul>	<ul style="list-style-type: none"> <li>• Yes - lakes monitored every 2 years for TP, water clarity and dissolved oxygen</li> </ul>
	If yes, what are they and who is responsible for monitoring?	n/a		<ul style="list-style-type: none"> <li>• RVCA, volunteers</li> </ul>	<ul style="list-style-type: none"> <li>• District Municipality of Muskoka</li> </ul>	<ul style="list-style-type: none"> <li>• District Municipality of Muskoka</li> </ul>
10	What scientific support is provided for the approach and by whom?	<ul style="list-style-type: none"> <li>• Shoreland Advisory Committee</li> <li>• State Department of Environmental Services</li> </ul>		<ul style="list-style-type: none"> <li>• Ministry of Environment</li> <li>• Ministry of Natural Resources for Lake Trout lakes</li> </ul>	<ul style="list-style-type: none"> <li>• Municipal Consultants develop and review program</li> <li>• Provincial government scientists update scientific background and provide guidance</li> <li>• Severn Sound Environmental Association (monetary support)</li> <li>• District staff provide GIS support</li> </ul>	<ul style="list-style-type: none"> <li>• Municipal Consultants develop and review program</li> <li>• Provincial government scientists update scientific background and provide guidance</li> <li>• District staff provide GIS support</li> </ul>
11	What scientific and planning principles inform the program?	NA		<ul style="list-style-type: none"> <li>• Provincial Policy Statement</li> <li>• Provincial Guidelines (PWQO for phosphorus)</li> <li>• MNR policy for Lake Trout habitat)</li> <li>• Site suitability assessment (Michalski and Usher, 1992)</li> </ul>	<ul style="list-style-type: none"> <li>• Science: Provincial Model and Standards - Modified Dillon-Rigler mass balance lake capacity model</li> <li>• comparison with monitoring data.</li> <li>Planning: District Official Plan</li> <li>• Provincial Policy Statement</li> <li>• Provincial Guidelines (PWQO for phosphorus)</li> <li>• MNR policy for Lake Trout habitat)</li> <li>• Lakeshore Capacity Assessment Handbook</li> <li>• Wetland Values</li> <li>• Cautionary Approach</li> </ul>	<ul style="list-style-type: none"> <li>• Science: Provincial Model and Standards - Modified Dillon-Rigler mass balance lake capacity model</li> <li>• comparison with monitoring data.</li> <li>Planning: District Official Plan</li> <li>• Provincial Policy Statement</li> <li>• Provincial Guidelines (PWQO for phosphorus)</li> <li>• MNR policy for Lake Trout habitat)</li> <li>• Lakeshore Capacity Assessment Handbook</li> <li>• Wetland Values</li> <li>• Cautionary Approach</li> <li>*PropertyAssessment data on lot development</li> </ul>
12	Does the program address its goal in a watershed context?	<ul style="list-style-type: none"> <li>• No</li> </ul>		<ul style="list-style-type: none"> <li>• No - for Site Suitability Assessment</li> </ul>	<ul style="list-style-type: none"> <li>• Yes</li> </ul>	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
	If so, how is this achieved?	n/a		n/a	<ul style="list-style-type: none"> <li>• Water and phosphorus loads for all lakes in the watershed are modelled and linked in a spreadsheet model</li> </ul>	<ul style="list-style-type: none"> <li>• Water and phosphorus loads for all lakes in the watershed are modelled and linked in a spreadsheet model</li> </ul>
	What are the specific challenges?	<ul style="list-style-type: none"> <li>• Enforcement is a challenge because there are few enforcement personnel at the State level</li> <li>• Staff at the local level do not always have the expertise to fully administer the program</li> </ul>		n/a	<ul style="list-style-type: none"> <li>• Model accuracy to support development controls</li> <li>• size of watersheds</li> <li>• watershed outside area of jurisdiction</li> <li>• availability of data, cost, technical capabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Model accuracy to support development controls</li> <li>• size of watersheds</li> <li>• watershed outside area of jurisdiction</li> <li>• availability of data, cost, technical capabilities</li> </ul>
13	Are landscape features and lake characteristics comparable to those in Ontario?	<ul style="list-style-type: none"> <li>• Large variability in lake characteristics similar to Ontario, but lakes tend to be more productive</li> <li>• Similar to Ontario with respect to large remote areas with little population density</li> <li>• Bedrock conditions are quite different, climate is more humid</li> </ul>		<ul style="list-style-type: none"> <li>• Yes, for lakes in eastern Ontario located off the Precambrian Shield</li> </ul>	<ul style="list-style-type: none"> <li>• Yes, for recreational lakes located on the Precambrian Shield</li> </ul>	<ul style="list-style-type: none"> <li>• Yes, for recreational lakes located on the Precambrian Shield</li> </ul>

Jurisdiction:		New Hampshire	Vermont <b>**not completed as program not successfully implemented**</b>	Township of Rideau Lakes	District Municipality of Muskoka	Township of Muskoka Lakes
14	Has the original scientific merit been borne out in practice?	NA		• Site Evaluation Assessment considered to be an integral component of successful lake management in the Township of Rideau Lakes based on the opinions of planning staff	• Scientific principles are borne out but model accuracy does not support provincial capacity approach and DMM moved to a sensitivity-based approach in 2005.	• Scientific principles are borne out but model accuracy does not support provincial capacity approach and DMM moved to a sensitivity-based approach in 2005.
	What has worked and what has not?	NA	• Through correspondence with an employee with the Lakes and Ponds Management and Protection Program it was confirmed that protection and enforcement was poor and nothing was really working. Issues with septic regulations, especially overuse.	NA	• Capacity approach is not supported by model accuracy, sensitivity assessment is • shoreline buffers and views have been protected	• Capacity approach is not supported by model accuracy, sensitivity assessment is • shoreline buffers and views have been protected • Lake character has been preserved by limiting amount of development depending on lake classification
	Are the intended attributes protected and stable?	NA		• supported by a general decline in phosphorus concentration in many local developed lakes	• Yes - no increasing trend in phosphorus • no complaints on water clarity • algal blooms related to internal load or lake characteristics and not development • shoreline is stable, except some boating/shoreline structure disturbance	• Yes - no increasing trend in phosphorus • no complaints on water clarity • algal blooms related to internal load or lake characteristics and not development • shoreline is stable, except some boating/shoreline structure disturbance
15	What important attributes are not addressed by the program?	NA		NA	• Boating • water levels	• Boating • water levels
16	What indirect policies and programs might address these other issues?	NA		NA	• Education	• Education
17	Does this jurisdiction intend to change its approach?	• Shoreland Advisory Committee looking at amendments for 2016, including classifying of lakes and applying different standards		• Currently updating Site Evaluation Guidelines from those developed based on study completed in 1992.	• Program is currently under 10 year review - Lake System Health will remain as focus	• Program is currently under 10 year review - Lake System Health will remain as focus
	If so – what is the most pressing factor to address?	NA		NA	• Public perception: consistency of policies including lake specific policies over time • justification of the science	• Public perception: consistency of policies including lake specific policies over time • justification of the science
<b>Planning, Regulation and Implementation</b>						
18	What is the primary legislative authority governing shoreline development?	• Land Use Enabling Act • Shoreland Water Quality Protection Act		• Planning Act • Conservation Authorities Act	• Planning Act (Secondary: Municipal Act, Conservation Authorities Act)	• Planning Act (Secondary: Municipal Act, Conservation Authorities Act)
19	Are there implementation guidelines for the legislation?	• Yes • Fact Sheets • Best Management Guidelines		• MOE Lakeshore Capacity Handbook • Lake Trout Policy and draft MNR guidelines (2009) • N. Heritage Manual	• MOE Lakeshore Capacity Handbook (limited as it only addresses phosphorus) • Lake Trout Policy and draft MNR guidelines (2009) • Natural Heritage Reference Manual	• MOE Lakeshore Capacity Assessment Handbook (limited as it only addresses phosphorus) • Lake Trout Policy and draft MNR guidelines (2009) • Natural Heritage Reference Manual
20	What is the major thrust of the Planning policy (eg. tree preservation, setbacks, density limitation, no development, natural areas preservation)?	• Tree Preservation, Stormwater Management • Erosion and Sediment Control • Shoreline Best Management Practices		• Stormwater Management • Development limits for Lake Trout Lakes as required • setbacks, frontages • tree preservation • boating (canal), must consult Parks Canada for applications near marinas and lock stations	• Lot Creation (with initial Water Quality Model) • now Tree Preservation and Best Management Practices in Lake System Health Program	• Lot Creation (with initial Water Quality Model) • now Tree Preservation and Best Management Practices in Lake System Health Program • Density limitation based on lake classification
21	Is the Planning Policy currently under review?	• Shoreland Advisory Committee looking at amendments for 2016, including classifying of lakes and applying different standards		• Yes Provincial Policy Statement	• Yes: Province (Provincial Policy Statement) • Upper Tier • Lower Tier (Georgian Bay Township, Lake of Bays Township)	• Yes: Province (Provincial Policy Statement) • Upper Tier
22	What Implementation tools are used (eg. zoning, site plans, development permits, specialized bylaws)?	• Shoreland Zoning Ordinances		• Stormwater Management • Site Plan Control • Zoning Bylaw • Tree Cutting Bylaw	• Zoning • Site Plans Control • Development Permits (Lake of Bays Township) • Agreements • Tree preservation Bylaws • Site Alteration Bylaws • Education	• Zoning • Site Plans Control • Agreements • Tree Preservation Bylaws • Site Alteration Bylaws • Education
23	What enforcement mechanisms are used?	• Lower Tier: Bylaw Enforcement		• Lower Tier: Bylaw Enforcement • Conservation Authority Regs.	• Lower tier: Bylaw Enforcement	• Lower tier: Bylaw Enforcement
24	Are there Special Purpose Bodies involved in the management of shoreline development?	• Lake Region Planning Commission • Local Planning Boards • Local Zoning Boards		• Rideau Valley Conservation Authority	• Watershed Council (education) • Severn Sound Environmental Association • Lake Associations (education)	• Watershed Council (education) • Lake Associations (education)
25	What are the key decision making processes?	• Development Application Review		• Development Application Review	• Official Plan Amendments • Plans of Subdivision • Zoning Bylaws • Site Plans (i.e. approvals under the Planning Act)	• Official Plan Amendments • Plans of Subdivision • Zoning Bylaws • Site Plans (i.e. approvals under the Planning Act)
26	Has the program been adopted across the jurisdiction?	• No		• Yes	• Yes	• Yes
	If no, what barriers have been identified?	• Zoning ordinances are not mandatory across the State and so those centres without an ordinance do not implement provisions under the Act		n/a	n/a	

Jurisdiction:		New Hampshire	Vermont  **not completed as program not successfully implemented**	Township of Rideau Lakes	District Municipality of Muskoka	Township of Muskoka Lakes
27	What levels of government are involved and what are their specific roles?	<ul style="list-style-type: none"> <li>State: Legislative Authority</li> <li>Lower Tier: Shoreland Zoning</li> </ul>		<ul style="list-style-type: none"> <li>Provincial: overall guidance (Provincial Policy Statement),</li> <li>Upper Tier: Strategic Policy, Local Official Plan and OPA Approvals, Plan of Subdivision/Condominium Approvals, input into local Planning applications</li> <li>Lower Tier: Development Control including Official Plan Amendments (adoption only), Zoning Bylaw Amendments, Consents/Severances, Minor Variances, Site Plans, Tree Preservation Bylaw, Site Alteration Bylaw</li> </ul>	<ul style="list-style-type: none"> <li>Provincial: overall guidance (Provincial Policy Statement),</li> <li>Upper Tier: Strategic Policy, Local Official Plan and OPA Approvals, Plan of Subdivision/Condominium Approvals, input into local Planning applications</li> <li>Lower Tier: Development Control including Official Plan Amendments (adoption only), Zoning Bylaw Amendments, Consents/Severances, Minor Variances, Site Plans, Tree Preservation Bylaw, Site Alteration Bylaw</li> </ul>	<ul style="list-style-type: none"> <li>Provincial: overall guidance (Provincial Policy Statement),</li> <li>Upper Tier: Strategic Policy, Local Official Plan and OPA Approvals, Plan of Subdivision/Condominium Approvals, input into local Planning applications</li> <li>Lower Tier: Development Control including Official Plan Amendments (adoption only), Zoning Bylaw Amendments, Consents/Severances, Minor Variances, Site Plans, Tree Preservation Bylaw, Site Alteration Bylaw</li> </ul>
28	What mechanisms are used for inter-jurisdictional decision making and collaboration?	Regional Planning Commission		Conservation Authority	Watershed Council, M.O.U. with Dorset Research Station	Watershed Council
29	Is there a feedback mechanism to determine if implementation is successful?	NA		NA	<ul style="list-style-type: none"> <li>Water Quality Monitoring</li> <li>Watershed Report Card</li> <li>Lake Specific Data Sheets</li> </ul>	<ul style="list-style-type: none"> <li>Water Quality Monitoring</li> <li>Watershed Report Card</li> <li>Lake Specific Data Sheets</li> </ul>
	If not, what are the challenges?	NA		NA		
30	Is there an appeal process to resolve disputes?	NA		Ontario Municipal Board	Yes - Ontario Municipal Board - but no challenges in past 10 years	Yes - Ontario Municipal Board
31	What was the initial cost to implement the program?	NA		NA	Unknown	Unknown
32	What are the annual costs of the program? (e.g., for planning, monitoring, program updates/revisions)	Fee based program, largley pays for itself		NA	\$770,000 over 10 years	<ul style="list-style-type: none"> <li>Costs have not been separated out in budget</li> <li>Official Plan review cost \$100,000-150,000 every five years</li> </ul>
33	Who bears the costs? (e.g., government, developers, lake residents, NGOs)	Developers, residents		RVCA conducts the scoring for the Site Suitability assessment	<ul style="list-style-type: none"> <li>Municipal government at upper tier level</li> <li>developers at local level</li> </ul>	<ul style="list-style-type: none"> <li>Municipal government at upper tier level</li> <li>developers at local level</li> </ul>
34	What funding resources are available for implementation of programs?	Self-funded through development fees		NA	MOE (indirect funding)	MOE (indirect funding)
35	What staff resources (e.g., in-house staff, consultants) are available for implementation of programs?	Staff at the local level do not always have the expertise to fully administer the program		NA	2 permanent part time staff at DMM	less than one permanent staff member
36	What are the key documents that describe or provide guidance for the program? Can you provide these, or provide a reference?	<ul style="list-style-type: none"> <li>Shoreland Water Quality Protection Act</li> <li>Town of Gilford Zoning Ordinance</li> </ul>		<ul style="list-style-type: none"> <li>Township Official Plan</li> <li>Township Comprehensive Zoning Bylaw</li> </ul>	<ul style="list-style-type: none"> <li>Gartner Lee Ltd. 2005</li> <li>District Official Plan</li> <li>local Official Plans</li> </ul>	<ul style="list-style-type: none"> <li>Gartner Lee Ltd. 2005</li> <li>District Official Plan</li> <li>local Official Plans</li> <li>Site Alteration Bylaw</li> <li>Tree Preservtion Bylaw</li> </ul>
Best Management Practices						
37	How are BMPs specifically addressed in the approach?	<ul style="list-style-type: none"> <li>Waterfront buffer is required 50 feet from the reference line</li> <li>Homeowners shall calculate and maintain vegetation through complex scoring system</li> <li>Septic setbacks and minimum lot sizes based on soil conditions</li> <li>ESC plans stringent</li> <li>Regulations regarding maximum amount of impervious surfaces (20%)</li> </ul>		Biophysical site criteria scores used to determine appropriate shoreline setbacks	Standardized requirements for BMPs for new or redevelopment that are scaled to lake sensitivity	Standardized requirements for BMPs for new or redevelopment that are scaled to lake sensitivity
38	What BMPs are considered and how are they chosen?	Minimum development standards including septic system setbacks and buffer zones are mandatory		Minimum development standards prescribed through Municipalities Official Plans while shoreline setback determined through biophysical site scoring	<ul style="list-style-type: none"> <li>Buffers</li> <li>maximum shoreline disturbance</li> <li>sediment and erosion control</li> <li>soils assessment</li> <li>enhanced septic system design - see OP</li> </ul>	<ul style="list-style-type: none"> <li>Buffers</li> <li>maximum shoreline disturbance</li> <li>sediment and erosion control</li> <li>soils assessment</li> <li>enhanced septic system design - see OP</li> </ul>
39	Are performance measures tracked?	NA		No	No	No
40	What was the initial cost to implement the BMPs?	NA		NA	Highly variable, can be \$8000 for study/plan and peer review	Highly variable, can be \$8000 for study/plan and peer review
41	What are the annual costs? (e.g. maintenance, monitoring, inspection)	NA		NA	<ul style="list-style-type: none"> <li>Generally no monitoring by municipalities</li> <li>short term monitoring by a few (eg. Township of Muskoka Lakes)</li> </ul>	<ul style="list-style-type: none"> <li>Generally no monitoring by municipalities</li> <li>short term monitoring</li> </ul>
42	Who bears the costs? (e.g. government, developers, lake residents, NGOs)	Developers, residents		Developers	Cottage/home owners pay for assessment and implementation of BMPs	Cottage/home owners pay for assessment and implementation of BMPs

Jurisdiction:		City of Greater Sudbury (program under development) *DRAFT*	Cariboo Regional District	Minnesota	Maine
Program Framework					
1	What does the jurisdiction seek to protect?				
	Environmental	• water quality (i.e., impacts from phosphorus, algal bloom activity)	• Preserve water quality • Protect integrity and capability of existing aquatic and shoreland environmental resources for wildlife habitat • Protect shorelands from erosion and degradation	• none specified	• Prevent and control water pollution • Protect fish spawning grounds, aquatic life, bird and other wildlife habitat • Protect wetlands
	Community	• No explicit protection noted	• Provide shoreland access to the general public	• none specified	• Protect buildings and land from flooding and erosion • Maintain safe and healthy conditions
	Social	• Recreational value • Aesthetic quality	• Preserve aesthetic quality by integrating shoreland developments with their natural surroundings	• Make Minnesota's shoreland management options more understandable and responsive to citizens by coordinating DNR Waters shoreland-related programs with other DNR disciplines, agencies, boards, committees, associations and public groups involved in comprehensive shoreland management/watershed efforts	• Protect archaeological and historic resources • Conserve natural beauty and open space • Conserve access
	Economic	• property values	• Determine suitable areas for shoreland development	• Preserve the natural environmental and economic values.	• Protect commercial fishing and maritime industries
2	Is this done through limiting development or use (capacity approach) or managing how lakes are developed and used (mitigation approach)?	• Mitigation approach • Lakes are classified based on phosphorus loads and 'responsiveness' to phosphorus loads (determined using the Lakeshore Capacity Model) • Different management requirements will be developed for each class of lake and could include limits to development and mitigation approaches • Measured 'triggers' including increasing trends in phosphorus concentration, water clarity or oxygen concentration and documented occurrences of algal blooms would result in further study to determine the cause and increase the level of mitigation required	• Mitigation • Lakes are classified by 'water quality sensitivity' based on trophic state, flushing period, mean depth and watershed characteristics (size and land use) • Shoreland area to which mitigation applies is determined based on sensitivity • Mitigation includes minimum development standards, vegetative buffers, lot clearance standards and septic system design • minimum verticle unsaturated distance requirements for septic systems determined based on lake sensitivity classes, lot area and soil characteristics (texture and percolation rates)	• Mitigation	• Mitigation
3	How many lakes do you manage in your jurisdiction?	• 310 lakes	• 4,000 >5 ha, 84 lakes have been classified	• 11,842 lakes over 10 acres	• 1,800 lakes > 10 ha, over 4,000 smaller lakes and ponds
4	What is the range of characteristics of the lakes that are managed?				
	Geological Setting	• Precambrian Shield, thin soil cover • Exposed bedrock, strongly acidified catchments	• Off the Precambrian Shield • Interior Plateau between Cariboo Mountains in the east and Coastal Mountains in the west • sedimentary and meta-sedimentary rocks • deep, gray luvisols	• sterile, rock basin lakes to naturally fertile, shallow lakes • on the Precambrian Shield in the north with tin, poor topsoils • Glacial river tills overlay Paleozoic sedimentary rocks in the south (carbonate rich in the east, quartzite and mudstone in the west)	• Off the Precambrian Shield: complex bedrock of Paleozoic metamorphosed sedimentary and volcanic rocks with intrusions of plutonic rocks • Overlain by glacial tills
	Climate Regime	• Temperate	• Temperate, precipitation is variable (~500 mm/yr to 1000 mm/yr)	• Continental (hot summers, cold winters)	• Humid continental
	Fish Communities	• Variable warm and cold water fish communities • 36 MNR-designated Lake Trout lakes (of 310 lakes >10 ha)	• Salmon spp., Bull Trout, Trout spp. • Mix of cold/cool/warmwater	• 158 species, including: Trout spp., Salmon spp., walleye, sturgeon • Mix of cold/cool/warmwater	• Trout spp., Atlantic salmon, lake whitefish, blueback char • 25% warmwater fishery, 43% coldwater fishery, 14% warm & coldwater fishery
	Lake Area	• 10 - 132,490 ha	• 12.4 - 65,100 ha	• up to 116,873 ha	• up to 30,500 ha
	Watershed Size	• 0.2 - 2,109 km <sup>2</sup>	• 1.9 - 2,240 km <sup>2</sup>	• 81 major watersheds, 5600 minor watersheds	• up to 1,129 km <sup>2</sup>
	Lake Depth	• unknown for most lakes but ranges from shallow (<5 m) to deep	• 1.7 - 66.2 m	• up to 73 m	• up to 96 m
	Mixing Regime (dimictic, polymictic)	• Dimictic and polymictic, but not known for most of the lakes, data are being collected to resolve this issue	• Generally dimictic	• Generally dimictic	• Generally dimictic
	Trophic State (oligotrophic, mesotrophic, eutrophic, dystrophic)	• of 66 monitored lakes, 61% are oligotrophic (TP < 10 mg/L), 27% are mesotrophic (TP = 10 - 20 ug/L), and 12% are eutrophic (TP > 20 ug/L) • several lakes with large wetland influence are suspected as being dystrophic, but DOC and colour data are lacking	• Eutrophic to oligotrophic but generally mesotrophic (Chlorophyll a > 3 µg/L, total phosphorus > 15 µg/L) • 14 lakes sampled in 1998-99, phosphorus = 0.004 - 0.007 mg/L.	• pristine lakes 10-50 ppb	• Average mesotrophic (mean TP = 12 ug/L; n=962 lakes) • 7% oligotrophic, 58% mesotrophic, 35% eutrophic, 0.11% dystrophic
	Wetland Influence	• Variable (mean wetland area = 7.8%, range = 0 - 60%)	NA	• 10.6 million acres (~5x total area covered by lakes and rivers)	NA
	Proximity to Population	• All lakes lie within the City of Greater Sudbury: population of 160,274 (2011 Census)	• Regional population is 66,000, no major urban centres in proximity	• State population is 5,379,139 (2013) • Major urban centres include Twin Cities with over 60% of the state's population and 17 cities with population >50,000 • proximity to population varies but northern portion of the state is less densely populated	• State population is 1.3 million • Largest urban centre is Portland (66,194) • Low population density, mostly focused in southern coastal areas
	Projected Population Growth	• Dependent on mining sector, projected to increase by 6.3% to 13.2% over the next 20 years	• Solid growth projected in the mining and oil and gas sectors of 0.2%	• 5.4 million (2013) - 6 million (2030) (+11%), primarily in urban centres	• 0.2% by 2020
	Shoreline Development Occupance (seasonal vs. permanent)	• Primarily permanent	• Primarily seasonal, but concern noted for conversion to permanent	• Variable but primarily seasonal • Concern noted for conversion to permanent	• Primarily seasonal, but permanent occupancy for lakes near urban centres
	Level of Development stress (# of building permits per year within the jurisdiction)	• To be determined	NA	NA	NA
	Sewage Servicing (serviced, non-serviced)	• serviced near urban centres, non-serviced in rural recreational areas	• Majority are not serviced	• Majority are not serviced	• Generally not serviced
	Land Use Type (urban, recreational)	• Large mix depending on location within the watershed including high intensity urban, low-density residential, rural, agricultural, and mining • Large areas are primarily forested in locations away from urban centres	• Recreational	• Predominantly recreational	• Predominantly recreational • Temperate Broadleaf and Mixed Forest Ecoregion • predominantly forested (83%) with low urbanization (4%) mostly in the southern coastal areas
5	What is the indirect attribute managed? (e.g., water quality, algal blooms, boating capacity, fish and wildlife habitat)	• Water quality • Lake Trout habitat	• Water quality - nutrient enrichment • Fish and wildlife habitat	• Water quality - nutrient enrichment • Natural values	Shoreland: • Water quality • Fish and wildlife habitat Watershed (TMDL): • Water quality

Jurisdiction:		City of Greater Sudbury (program under development) *DRAFT*	Cariboo Regional District	Minnesota	Maine
6	What are the direct attributes managed? (e.g., phosphorus, shoreline availability, social density, dissolved oxygen, buffer zones)	• Phosphorus	• Phosphorus • Buffer zones	• Minimum Development Standards • Buffer zones • Amount of impervious surface	Shoreland: • Buffer zones • Vegetation cover of lot Watershed (TMDL): • Phosphorus
7	What is the management target/performance indicator?	• No measured target specified, but intent is to maintain total phosphorus concentration <background plus 50% to a maximum cap of 20 ug/L	• No measured target specified	• No performance standards exist to rate the success of the program	Shoreland: • None provided with respect to shoreland management Watershed (TMDL): • Post phosphorus export needs to be less than project phosphorus budget (applies only to large scale development)
	How does the program accomplish this?	• Approach not yet adopted in the Official Plan, which is under review, but draft policies for creation of new unserviced shoreline lots should be available in April 2014 • The existing Official Plan includes several policies for development controls (no development on lakes 'at capacity' or small lakes <50 ha), and for mitigation such as buffer zone requirement, limits to development density, setbacks, minimum lot areas and frontages, etc.) that are generally applied to all lakes or specially tailored for specific lakes (under Site and Area Specific Policies and Schedules). These tools will likely be incorporated in the new approach.	• Develop individual lake management plans where required (i.e. large development, known water quality problems) • Water quality sensitivity rankings, lot area and soil conditions inform BMPs	• Shoreland Management Program - Lakes are classified as natural environment, recreational development, general development (special protection class has been proposed but not yet implemented). Land uses based on classification. • Local Zoning Ordinances establish minimum lot size, setbacks, sewage treatment requirements. • Nonpoint Source Management Protection Plan per Clean Water Act requirements (applied to the entire watershed).	Shoreland: • Districts developed that determine allowable land uses and minimum development standards including Watershed (TMDL): • Lakes are ranked per sensitivity to development • Stormwater permit if > 1 acre of disturbed area and lake most at risk • Phosphorus budget if development is a certain size • Determination of water quality goal and TP allocation and individual project review • Shoreland Zoning Ordinance • Subdivision Ordinance requirements if >3 lots • Phosphorus budget if > 5 lots or development area is >5 acres (anywhere in the watershed)
8	What information is required for the program? (e.g. planning information, lake attributes)	• Detailed information to model phosphorus load and responsiveness for each lake (lake and watershed attributes, phosphorus concentration, development, land use) • program to monitor water quality and to assess 'triggers' for enhanced management	• Trophic state (chlorophyll a) • Flushing period • Mean lake depth • Lake volume • Water quality indicators • Watershed area and land use • Development density, lot area • Soil depth, texture and percolation rate at septic location	• Establishment of Shoreland Management Classes based on lake area, lake area:shoreline length, density of development and lake depth.	Shoreland: • Lakes classified into 5 categories (1 category is for rivers) called Shoreland Zoning Districts based on existing development (type and density) and where development could pose a risk to water quality, natural values, biological ecosystems or scenic values (floodplains, wetlands, public access areas, habitat, or other) Watershed (TMDL): • Lake are considered most at risk from development is it is a public water supply, particularly sensitive to eutrophication based on water quality, potential for internal recycling of phosphorus, potential as a cold water fishery, volume or flushing rate, or projected growth in the watershed. Severely blooming lakes are most at risk. • Allowable increase in annual TP load and per acre TP budget • Lakes are classified into 5 categories based on water quality status and per U.S. Clean Water Act, impaired waters require a Total Maximum Daily Load report
9	Are there monitoring requirements?	• Yes, to track changes in water quality (total phosphorus) and to improve model predictions (collection of oxygen profiles, stratification patterns, lake depth, water colour for lakes where these data were not known)	• No	NA	Shoreland: No Watershed (TMDL): • Yes
	If yes, what are they and who is responsible for monitoring?	• Monitoring program implemented and conducted by the City, • Program direction and review of monitoring results by consultants	n/a	n/a	Watershed (TMDL): • Water quality monitoring and identification of non-point and point sources of phosphorus in the watershed • State is responsible
10	What scientific support is provided for the approach and by whom?	• Environmental consultants developed the approach and provided recommendations for policy development • City planning department is developing policies for the approach	• Ministry of Environment is circulated Lake Sensitivity ratings for review	• Minnesota Department of Natural Resources	Watershed (TMDL): • US Environmental Protection Agency administers the TMDL program under the Clean Water Act, provides guidance, reviews TMDL reports • State conducts TMDL studies • Local government implements required ordinances to meet conditions of the Act
11	What scientific and planning principles inform the program?	• Comparison with monitoring data • Provincial Policy Statement • Provincial Guidelines (PWQO for phosphours • Lakeshore Capacity Assessment Handbook • Cautionary Approach	• Lake sensitivities based on characteristics • BMPs based on known functionality to reduce water quality impacts • Low sensitivity - very oligotrophic or very eutrophic (no hope), properties within 150 m • Moderate sensitivity - slightly eutrophic or oligotrophic, properties within 200 m • Highly sensitive - oligotrophic to slightly eutrophic, properties within 250 m • Sewage disposal design objectives a function of density (as lot area), lake sensitivity, and soil characteristics	• State's <i>Shoreland Mangement Act</i> • Minnesota Administrative Rules • Governor's Clean Water Initiative (Alternative Shoreland Management Standards - proposed in 2005 but not yet adopted)	Shoreland: • Mandatory Shoreland Zoning Act • Natural Resources Protection Act Watershed (TMDL): • Five categories of lakes in Maine and those in Category 5 are impaired and per the U.S. <i>Clean Water Act</i> Section 303(d) require a Total Maximum Daily Load report to the EPA
12	Does the program address its goal in a watershed context?	• Yes	• Not directly but includes watershed characteristics in the 'water quality sensitivity' classification	• No, but other programs address watershed level issues (e.g., federal <i>Clean Water Act</i> , federal Nonpoint Source Control Program, state's Lake Improvement District program)	Shoreland: • No Watershed (TMDL): • Yes
	If so, how is this achieved?	• Lakeshore Capacity Model was developed using all lakes >10 ha in the watershed		n/a	Watershed (TMDL): • lakes assessed for water quality and those considered 'impaired' are subject to TMDL regulations that control watershed level pollution
	What are the specific challenges?	• Lakeshore Capacity Model does not provide sufficiently accurate predictions of phosphorus concentrations to follow Provincial guidance for setting capacity numbers	n/a	n/a	NA
13	Are landscape features and lake characteristics comparable to those in Ontario?	• Yes, for lakes situated in rural and urban areas of northern Ontario on the Precambrian Shield, • Differences include acidified lakes and watersheds, exposed bedrock and lack of vegetation for several lakes influenced by mining activity, several urban lakes receive point-source discharges from WWTPs	• No. Lakes have a low flushing rate and are generally quite different because of climate, elevation, soils, bedrock, etc.	• Yes, northern part of the state is on the Shield with similar soil and vegetation characteristis as Ontario Shield lakes • Lakes in the south are more similar to off Shield Ontario lakes • Similarly large variability in lake and watershed characteristics and large areas of unorganized planning territories	• Yes with respect to high density of lakes with wide range of lake characteristics, large low population density areas with primarily recreational unserviced development and some more densely populated urban centres • Most similar to Ontario lakes that are off the Shield with higher nutrients and alkalinity

Jurisdiction:		City of Greater Sudbury (program under development) *DRAFT*	Cariboo Regional District	Minnesota	Maine
14	Has the original scientific merit been borne out in practice?	• n/a - program is under development	NA	• See answer to Question 17	• Not known as no monitoring or assessment program is in place • Contacts would not comment
	What has worked and what has not?	• n/a - program is under development • Approach in the existing Official Plan that prohibits development on 'at capacity' lakes has been challenged at the OMB	NA	• See answer to Question 17	NA
	Are the intended attributes protected and stable?	• n/a - program is under development	NA	• See answer to Question 17	NA
15	What important attributes are not addressed by the program?	• No specific gap noted but there will be provisions in the Official Plan to address issues or concerns for specific lakes based on individual lake management plans (Lake Specific Policies)	NA	• See answer to Question 17	• Intent is that controls on development type and minimum development standards will address a wide range of environmental, social, community and economic attributes • Lack of monitoring or assessment to determine whether this is the case
16	What indirect policies and programs might address these other issues?	• n/a - program is under development	NA	• See answer to Question 17	• Several other programs are administered by the federal government and the State (e.g., under the Clean Water Act) that also address water quality issues
17	Does this jurisdiction intend to change its approach?	• program is currently under development	NA	• Not at present, but State implemented the Shoreland Update Project in 1983. Surveys and reports confirmed the effectiveness of the rules and provided suggested improvements to address emerging issues (increasing development pressure, conversion of seasonal to permanent homes) • also developed Alternative Shoreland Standards process in 2005 as voluntary provision for local governments to address local conditions and concerns not sufficiently address by the program	• No intent noted in the review
	If so – what is the most pressing factor to address?	n/a	NA		n/a
<b>Planning, Regulation and Implementation</b>					
18	What is the primary legislative authority governing shoreline development?	• <i>Planning Act</i>	• <i>Local Government Act</i>	• <i>County Planning Act</i>	• Planning and Land Use Regulation • <i>Mandatory Shoreland Zoning Act</i>
19	Are there implementation guidelines for the legislation?	• MOE Lakeshore Capacity Assessment Handbook • Lake Trout Policy and draft MNR guidelines (2009)	• CRD Shoreland Management Policy • Onsite Effluent Disposal Guidelines • Riparian Buffer Zone Guidelines	• Shoreland Management Program • Minimum standards in regulation	• Yes, requires local governments to implement a zoning Ordinance • Guidelines for Municipal Shoreland Zoning Ordinances, example ordinance
20	What is the major thrust of the Planning policy (eg. tree preservation, setbacks, density limitation, no development, natural areas preservation)?	• n/a - policy development is under way	• Septic system design (depth of unsaturated zone) • Buffer zones	• Lot area and width • Setbacks from water and bluffs • Imperious surfaces • Other BMPs encouraged (filter strips, erosion and sediment control)	• Shoreland Development Districts • Minimum development standards (frontage, setbacks, lot coverage) • Tree Preservation • Vegetative buffer
21	Is the Planning Policy currently under review?	• Yes - OP review is currently underway scheduled for completion in 2014	• No	• No	• No
22	What Implementation tools are used (eg. zoning, site plans, development permits, specialized bylaws)?	• n/a - policy development is under way	• Zoning Bylaw • Restrictive Covenant on title of the property	• Shoreland Management Ordinance at County Level	• Shoreland Zoning by ordinance • development permits
23	What enforcement mechanisms are used?	• n/a - policy development is under way	• Lower Tier: Bylaw Enforcement	• Lower Tier: Bylaw Enforcement	• Lower Tier: Bylaw Enforcement - Code Enforcement Officer issues permits, reviews and approves applications • State monitors local compliance
24	Are there Special Purpose Bodies involved in the management of shoreline development?	• A Lake Advisory Panel, which includes City staff, Conservation Authority representatives and representatives from local lake associations have provided feedback on program plans • Nickel District Conservation Authority provides input on planning applications, undertakes some monitoring and administers regulations related to the alteration of watercourses, filling and construction in floodplains and along shorelines	• Advisory Planning Commission	• Generally none	• Unknown
25	What are the key decision making processes?	• n/a - policy development is under way	• Development Application Review	• Development Application Review (by local government) • Review and approval of shoreland ordinances (by State)	• Development Application Review • Permit application Review
26	Has the program been adopted across the jurisdiction?	• the intent is to adopt the program throughout the CGS	• Policy is directed at the entire District but successful adoption is not known	• All Counties have shoreland ordinances, but not all Cities	• Yes
	If no, what barriers have been identified?	n/a	n/a	• Lack of funding to adopt new ordinances	n/a

	Jurisdiction:	City of Greater Sudbury (program under development) *DRAFT*	Cariboo Regional District	Minnesota	Maine
27	What levels of government are involved and what are their specific roles?	<ul style="list-style-type: none"> <li>Provincial: overall guidance (Provincial Policy Statement), approval of Official Plan policies</li> <li>Municipal: <ul style="list-style-type: none"> <li>review development applications with regard to provision in the Official Plan, Zoning Bylaws,</li> <li>provide education to residents on use of best management practices to protect water quality and natural values</li> <li>implementation of a water quality monitoring program in support of the approach</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Provincial: overall guidance, review and approval of development applications (Ministry of Transportation and Infrastructure)</li> <li>Upper Tier: Planning Policy</li> <li>Lower Tier: zoning bylaws</li> </ul>	<ul style="list-style-type: none"> <li>State: Legislative Authority, provision of guidance (e.g., Minnesota Shoreland Management Resource Guide), funding when available</li> <li>Lower Tier: Shoreland Management Ordinance, enforcement of the ordinance</li> </ul>	<ul style="list-style-type: none"> <li>State: Legislative Authority, establishes minimum ordinance standards and guidelines, provides technical assistance to local governments and land owners including workshops, publications and staff time, reviews and approves local ordinances</li> <li>Lower Tier: adopts Shoreland Zoning Ordinance, administration to review applications and issuance of permits, enforcement of local ordinance</li> </ul>
28	What mechanisms are used for inter-jurisdictional decision making and collaboration?	n/a	NA	NA	NA
29	Is there a feedback mechanism to determine if implementation is successful? If not, what are the challenges?	<ul style="list-style-type: none"> <li>A program has been recommended for implementation to track changes in water quality</li> </ul>	NA	<ul style="list-style-type: none"> <li>No formal mechanism</li> </ul>	NA
		n/a	NA	n/a	NA
30	Is there an appeal process to resolve disputes?	<ul style="list-style-type: none"> <li>Ontario Municipal Board</li> <li>Application for amendment to the Official Plan</li> </ul>	NA	Board of Adjustment	NA
31	What was the initial cost to implement the program?	To be determined	NA	<ul style="list-style-type: none"> <li>\$200,000 to 300,000 to first develop</li> <li>\$300,000-400,000 in first four years to assist local government with ordinances</li> </ul>	NA
32	What are the annual costs of the program? (e.g., for planning, monitoring, program updates/revisions)	To be determined	NA	\$100,000 to 200,000 for State	NA
33	Who bears the costs? (e.g., government, developers, lake residents, NGOs)	City	<ul style="list-style-type: none"> <li>Applicant bears costs for all necessary studies to meet the policy (Report of Soil Investigation, photographs of shoreline area)</li> </ul>	State and local government	State and local government
34	What funding resources are available for implementation of programs?	None	NA	NA	NA
35	What staff resources (e.g., in-house staff, consultants) are available for implementation of programs?	<ul style="list-style-type: none"> <li>One dedicated staff member to oversee monitoring, planning staff review applications</li> </ul>	NA	<ul style="list-style-type: none"> <li>State (Dept. of Natural Resources) Central Office and Field Staff throughout state</li> </ul>	<ul style="list-style-type: none"> <li>State (Dept. of Environmental Protection)</li> <li>Local (Code Enforcement Officer)</li> </ul>
36	What are the key documents that describe or provide guidance for the program? Can you provide these, or provide a reference?	<ul style="list-style-type: none"> <li>Development and Application of a Water Quality Model for Lakes in the City of Greater Sudbury (HESL, 2014)</li> </ul>	<ul style="list-style-type: none"> <li>CRD Shoreland Management Policy (CRD, 2004)</li> </ul>	<ul style="list-style-type: none"> <li>Administrative Rules Section 6120.3000 subp. 2 (MDNR, 2014)</li> <li>Hubbard County Shoreland Management Ordinance</li> <li>Shoreland Management Act (MDNR, 2014)</li> </ul>	<ul style="list-style-type: none"> <li>Mandatory Shoreland Zoning Act</li> <li>Guidelines for Municipal Shoreland Zoning Ordinances (State)</li> <li>E.g., Shoreland Zoning Ordinance for the Municipality of Bristol, Maine</li> </ul>
<b>Best Management Practices</b>					
37	How are BMPs specifically addressed in the approach?	<ul style="list-style-type: none"> <li>not yet determined, but may be provision for specific policies in the Official Plan</li> </ul>	<ul style="list-style-type: none"> <li>Buffer zones and minimum unsaturated soil depth required for shoreland areas defined by Water Quality Sensitivity Class (within 150m of a low sensitivity lake, 200 m of a moderate sensitivity lake, and 250m of a high sensitivity lake)</li> </ul>	<ul style="list-style-type: none"> <li>Minimum shoreland standards (i.e., lot width, lot area, structure setback, shore impact zone) for seweraged and unsewered lakes based on lake classification</li> <li>Impervious surfaces cannot cover more than 25% of the total lot</li> <li>Other BMPs are 'encouraged'</li> </ul>	<ul style="list-style-type: none"> <li>Minimum development standards and BMPs required for all shoreland development</li> </ul>
38	What BMPs are considered and how are they chosen?	n/a	<ul style="list-style-type: none"> <li>Buffer strips required within 150m of a low sensitivity lake and 250m of a high sensitivity lake</li> <li>Minimum 15m buffer and maximum 25% vegetation removal of lot</li> <li>Minimum parcel size of 0.4 ha and 45.7 m of frontage</li> <li>Tertiary sewage treatment where required</li> </ul>	<ul style="list-style-type: none"> <li>Lot area, width, setbacks determined by lake classifications</li> <li>Removal or alteration of shoreline vegetation is regulated</li> </ul>	<ul style="list-style-type: none"> <li>Minimum residential lot size 40,000 ft² (0.19 ha)</li> <li>Building setbacks are 250 ft (76 m) in the RPD, 100 ft. (30 m) in GPA and 75 ft. (23 m) for all other water bodies except in the GD I (commercial) (25 ft. (7.6 m) setback) and CFMA (no setback is required)</li> <li>20% max of non-vegetated surfaces</li> <li>Septics must have 100 ft (30 m) setback perennial waterbodies</li> <li>Tree cutting (max clearance of 40% of trees, max opening of 23 m² within 23 m, must maintain trees within a point system range</li> <li>LID designs encouraged</li> </ul>
39	Are performance measures tracked?	n/a	No	No	No
40	What was the initial cost to implement the BMPs?	n/a	NA	NA	NA
41	What are the annual costs? (e.g. maintenance, monitoring, inspection)	n/a	<ul style="list-style-type: none"> <li>Costs for determining Lake Sensitivity Rating are: ~\$4,700 for lake sampling and collection of lake bathymetry (2002)</li> </ul>	NA	NA
42	Who bears the costs? (e.g. government, developers, lake residents, NGOs)	n/a	Developers, lot owners	Developers, lot owners	Developers, lot owners

## Appendix B. Overview Table and Document Library (digital)



Jurisdiction	Area	Document Reference	Type	Web Link	Contacts
District Municipality of Muskoka	District of Muskoka	District Municipality of Muskoka (DMM), 2010. Office Consolidation of the Official Plan of the Muskoka Planning Area. Prepared by the Planning and Economic Department. Consolidation November 19, 2010	Planning & Policy	<a href="https://muskoka.civicweb.net/Documents/DocumentDisplay.aspx?Id=16892">https://muskoka.civicweb.net/Documents/DocumentDisplay.aspx?Id=16892</a>	Judi Brouse, Director of Watershed Programs, 705-646-0111, jbrouse@muskokawatershed.org Samantha Hastings, Acting Commissioner of Planning and Economic Development, (705) 645-2100 Ext. 260, SHastings@muskoka.on.ca
		District Municipality of Muskoka (DMM), 2014. 2013 Lake System Health Water Quality Monitoring Program. Year End Report.	Technical-Monitoring	<a href="https://muskoka.civicweb.net/Documents/DocumentDisplay.aspx?ID=22919">https://muskoka.civicweb.net/Documents/DocumentDisplay.aspx?ID=22919</a>	
		Gartner Lee Limited (GLL), 2005. Recreational Water Quality Management in Muskoka. Technical Report prepared for District Municipality of Muskoka.	Technical-Approach	<a href="https://muskoka.civicweb.net/Documents/DocumentDisplay.aspx?Id=4833">https://muskoka.civicweb.net/Documents/DocumentDisplay.aspx?Id=4833</a>	
		Gartner Lee Limited (GLL), 2008. Review of Long-Term Water Quality Data for the Lake System Health Program. Technical Report prepared for the District Municipality of Muskoka	Technical-Approach	<a href="https://muskoka.civicweb.net/Documents/DocumentDisplay.aspx?Id=5808">https://muskoka.civicweb.net/Documents/DocumentDisplay.aspx?Id=5808</a>	
	Township of Muskoka Lakes	Township of Muskoka Lakes (TML), 2006. By-Law to Designate a Site Plan Control Area. By-Law 2006-100	Planning & Policy	<a href="http://www.muskokalakes.ca/files/%7B1FBF4E3D-0BF2-4BF5-9B77-E474D76D3728%7D2006-100%20(Site%20Plan%20Control).pdf">http://www.muskokalakes.ca/files/%7B1FBF4E3D-0BF2-4BF5-9B77-E474D76D3728%7D2006-100%20(Site%20Plan%20Control).pdf</a>	David Pink, Director of Planning, (705) 765-3156 ext. 231, DPink@muskokalakes.ca
		Township of Muskoka Lakes (TML), 2008a. Comprehensive Zoning By-Law 87-87. Consolidation June, 2008	Planning & Policy	<a href="http://www.muskokalakes.ca/files/%7B5F7EC071-A0E3-48CA-B143-1375481A3C69%7DBY-LAW%2087-87%20ConsolidationJune-08.pdf">http://www.muskokalakes.ca/files/%7B5F7EC071-A0E3-48CA-B143-1375481A3C69%7DBY-LAW%2087-87%20ConsolidationJune-08.pdf</a>	
		Township of Muskoka Lakes (TML), 2008b. Site Alteration By-Law. By-Law 2008-56	Planning & Policy	<a href="http://www.muskokalakes.ca/files/%7BA4A09B7A-FEAA-470A-B941-26DA71887C0D%7D07-11-2008%20%20By-law%202008-56%20Site%20Alteration%20By-law.pdf">http://www.muskokalakes.ca/files/%7BA4A09B7A-FEAA-470A-B941-26DA71887C0D%7D07-11-2008%20%20By-law%202008-56%20Site%20Alteration%20By-law.pdf</a>	
		Township of Muskoka Lakes (TML), 2009. Tree-cutting By-Law. By-Law 2009-55	Planning & Policy	<a href="http://www.muskokalakes.ca/files/%7B8BA3DEBA-44C7-45A5-AD5B-B0F3C8264508%7D07-11-2008%20%20By-law%202008-55%20Tree%20Preservation%20By-law.pdf">http://www.muskokalakes.ca/files/%7B8BA3DEBA-44C7-45A5-AD5B-B0F3C8264508%7D07-11-2008%20%20By-law%202008-55%20Tree%20Preservation%20By-law.pdf</a>	
		Township of Muskoka Lakes (TML), 2010a. The Corporation of the Township of Muskoka Lakes Official Plan. Consolidation June, 2010	Planning & Policy	<a href="https://muskokalakes.civicweb.net/Documents/DocumentDisplay.aspx?ID=50399">https://muskokalakes.civicweb.net/Documents/DocumentDisplay.aspx?ID=50399</a>	
		Township of Muskoka Lakes (TML), 2010b. Committee of Adjustment - Application for Consent. January, 2010.	Planning & Policy	<a href="http://www.muskokalakes.ca/files/%7BAB2FAE24-1AB6-47DA-9BB3-0B951F009777%7DConsent%20Application%20APRIL%201.pdf">http://www.muskokalakes.ca/files/%7BAB2FAE24-1AB6-47DA-9BB3-0B951F009777%7DConsent%20Application%20APRIL%201.pdf</a>	
		Township of Muskoka Lakes (TML), 2010c. Zoning By-Law Amendment Procedure.	Planning & Policy	<a href="http://www.muskokalakes.ca/files/%7BD3E7FAEF-6B7F-4BF8-B48A-888CFE25466E%7D1.%20Zoning%20By-law%20Amendment%20Application.pdf">http://www.muskokalakes.ca/files/%7BD3E7FAEF-6B7F-4BF8-B48A-888CFE25466E%7D1.%20Zoning%20By-law%20Amendment%20Application.pdf</a>	
City of Kenora (Black Sturgeon Lake)	City of Kenora (Black Sturgeon Lake)	FoTenn Consultants Inc., 2010. City of Kenora Final Official Plan, May 10th, 2010	Planning & Policy	<a href="http://listview.kenora.ca/Files/ByLaws%5C2010/097-2010%20Final%20Official%20Plan.pdf#navpanes=0&amp;view=FitH">http://listview.kenora.ca/Files/ByLaws%5C2010/097-2010%20Final%20Official%20Plan.pdf#navpanes=0&amp;view=FitH</a>	Tara Rickaby, Planning Services at 807-467-2059 or trickaby@kenora.ca
		Gartner Lee Ltd (GLL) and Kelli Saunders Environmental Management (KSEM), 2007a. Lake Capacity and Management Study for Black Sturgeon Lake, City of Kenora. Technical Report prepared for the City of Kenora, October, 2007.	Technical Approach	Not available online	
		Gartner Lee Ltd (GLL) and Kelli Saunders Environmental Management (KSEM), 2007b. Technical Synthesis and Management Plan in Support of the Lake Capacity and Management Study for Black Sturgeon lake, City of Kenora. Technical Report prepared for the City of Kenora, August, 2007.	Technical Approach	Not available online	
		Ryan Haines Consulting, 2009. Black Sturgeon Lakes Water Quality Monitoring. 2009 Report. Technical report prepared for the City of Kenora.	Technical Approach	Not available online	
		Ryan Haines Consulting, 2010. Black Sturgeon Lakes Water Quality Monitoring. 2010 Report. Technical report prepared for the City of Kenora.	Technical Approach	Not available online	
City of Greater Sudbury	City of Greater Sudbury	Hutchinson Environmental Sciences Ltd. (HESL), 2014. Development and Application of a Water Quality Model for Lakes in the City of Greater Sudbury. Prepared for the City of Greater Sudbury. <b>Document not released for circulation.</b>	Technical Approach	Not available online	Mr. Stephen Monet, Manager – Environmental Planning Initiatives, (705) 674-4455 ext. 4297, Stephen.monet@greatersudbury.ca
City of Elliot Lake (Cottage Lot Program)	City of Elliot Lake (Cottage Lot Program)	Hutchinson Environmental Sciences Ltd. (HESL), 2012. Shoreline Development Capacity of Elliot Lake Area Lakes Based on Phosphorus and Lake Trout Habitat. Draft report prepared for the City Elliot Lake. October 15, 2012, with revisions April 2013.	Technical Approach	Not available online	Rob deBortoli, CAO, City of Elliot Lake, (705) 848- 2287 ext 2132
Seguin Township	Seguin Township	AECOM, 2010. Development Capacity of Recreational Lakes in Seguin Township. Report prepared for Seguin Township.	Technical Approach	Not available online	Mr. Chris Madej, Director of Planning, (705) 732-4300, cmadej@seguin.ca
		Township of Seguin, 2012. Township of Seguin Official Plan Office Consolidation.	Planning & Policy	<a href="http://www.seguin.ca/en/live/resources/SeguinOfficialPlanandSchedules.pdf">http://www.seguin.ca/en/live/resources/SeguinOfficialPlanandSchedules.pdf</a>	
Halifax Regional Municipality	Halifax Regional Municipality	Dillon Consulting Limited, 2003. HRM Water Resources Management Study Report. Prepared for the Halifax Regional Municipality. December 2002, revised September 2003. 366 pp.	Technical Approach	<a href="http://www.halifax.ca/environment/documents/wrms_report.pdf">http://www.halifax.ca/environment/documents/wrms_report.pdf</a>	Mr. Paul Morgan, Planner, HRM Regional & Community Planning, 490-4482, morgpanp@halifax.ca
		Halifax Regional Municipality, 2006. Municipal Planning Strategy. Amendments dated October 2013.	Technical Approach	<a href="http://www.halifax.ca/regionalplanning/documents/Regional_MPS.pdf">http://www.halifax.ca/regionalplanning/documents/Regional_MPS.pdf</a>	
	Shubenacadie Lakes Subwatershed	AECOM, 2013. Shubenacadie Lakes Subwatershed Study - Final Report. Prepared for Halifax Regional Municipality.	Technical Approach	<a href="http://www.halifax.ca/planhrm/documents/2013041660221657FINALShubie_Report.pdf">http://www.halifax.ca/planhrm/documents/2013041660221657FINALShubie_Report.pdf</a>	
Lake Simcoe	Lake Simcoe	Ontario Ministry of the Environment (MOE), 2010. Lake Simcoe Phosphorus Reduction Strategy.	Technical Approach	<a href="http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079876.pdf">http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079876.pdf</a>	Mike Walters, General Manager, Watershed Management, Lake Simcoe Region Conservation Authority, 905-895-1281 x 234, m.walters@lsrca.on.ca
		Province of Ontario, 2008. Lake Simcoe Protection Act. S.O. 2008, Chapter 23.	Planning & Policy	<a href="http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_08l23_e.htm">http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_08l23_e.htm</a>	
		Ontario Ministry of the Environment (MOE), 2009. Lake Simcoe Protection Plan.	Technical Approach	<a href="http://www.ene.gov.on.ca/environment/en/resources/STD01_076301.html">http://www.ene.gov.on.ca/environment/en/resources/STD01_076301.html</a>	Ian Walker, Environmental Planner, Lake Simcoe Region Conservation Authority, 905-895-1281 x 287, i.walker@lsrca.on.ca
		Town of Innisfil, 2013a. Comprehensive Zoning Bylaw 080-13.	Planning & Policy		
		Town of Innisfil, 2013b. Site Plan Control Guide and Application.	Planning & Policy		Robin Skeates, Senior Lake Simcoe Engineer, 416-326-1862, Robin.Skeates@ontario.ca
		Hutchinson Environmental Sciences Ltd. (HESL) et al., 2011. Phosphorus Budget Tool in Support of Sustainable Development for the Lake Simcoe Watershed. Version 2 Report. Prepared for the Ontario Ministry of the Environment.	Technical Approach	<a href="http://www.downloads.ene.gov.on.ca/files/ptool/P%20Budget%20Guidance%20Ver2.pdf">http://www.downloads.ene.gov.on.ca/files/ptool/P%20Budget%20Guidance%20Ver2.pdf</a>	
New Hampshire	New Hampshire	New Hampshire General Court, 2011. Title L - Water Management and Protection, Chapter 483-B Shoreland Water Quality Protection Act. 1991, 303:1. 2002, 263:1. 2008, 171:15, eff. July 1, 2008.	Planning & Policy	<a href="http://www.gencourt.state.nh.us/rsa/html/L/483-B/483-B-mrg.htm">http://www.gencourt.state.nh.us/rsa/html/L/483-B/483-B-mrg.htm</a>	Ted Diers, Watershed Management Bureau Administrator NH Department of Environmental Services, 603- 271-3289, ted.diers@des.nh.gov
		Billings, M.P., 1956. The Geology of New Hampshire. The Geology of New Hampshire. Part 2. Bedrock Geology. New Hampshire State Planning Commission. Reprinted by Division of Forests and Lands, Department of Resources and Economic Development, Concord, New Hampshire, 1980.	Technical Approach (Lake & Watershed Characteristics)		
		New Hampshire General Court, 2010. Title L - Water Management and Protection, Chapter 483-A New Hampshire Lakes Management and Protection Program. 1990, 118:2. 2010, 269:2, eff. July 6, 2010.	Planning & Policy	<a href="http://www.gencourt.state.nh.us/rsa/html/L/483-A/483-A-mrg.htm">http://www.gencourt.state.nh.us/rsa/html/L/483-A/483-A-mrg.htm</a>	Jacquie Colburn, Rivers Coordinator, 603-271-2959, jacquie.colburn@des.nh.gov (Lakes Management and Protection)

Rideau Valley Conservation Authority	Rideau Valley Conservation Authority	Michal Michalski Associates and Anthony Usher Planning Consultant, 1992. Rideau Lakes Basin Carrying Capacities and Proposed Shoreland Development Policies. Prepared for Rideau Conservation Authority.	Technical Approach	Not available online	Don Maciver, Director, Planning and Regulations, 613-692-3571 ext. 1105, don.maciver@rvca.ca
		Rideau Valley Conservation Authority, 2009. Rideau Lakes Watershed Plan. Priorities and Recommendations. August, 2009.	Technical Approach	<a href="http://www.rvca.ca/watershed/subwatershed_reporting/rideau_lakes/RLW_P_2009.pdf">http://www.rvca.ca/watershed/subwatershed_reporting/rideau_lakes/RLW_P_2009.pdf</a>	
	Township of Rideau Lakes	Township of Rideau Lakes Official Plan (2004)	Planning & Policy	<a href="http://www.twprideaulakes.on.ca/plan/trl-official-plan-2004-web.pdf">http://www.twprideaulakes.on.ca/plan/trl-official-plan-2004-web.pdf</a>	
Cariboo Regional District	Cariboo Regional District	Cariboo Regional District, 2007. Shoreland Management Policy 2004.	Technical Approach	<a href="http://www.friendsofbridgelake.org/documents/landuse/ShorelandMgmtPolicy.pdf">http://www.friendsofbridgelake.org/documents/landuse/ShorelandMgmtPolicy.pdf</a>	Rick Brunridge, Director of Planning, rbrunridge@cariboord.bc.ca
Minnesota	Minnesota	Minnesota Department of Natural Resources (MDNR), 2014. Shoreland Management Programs. Online resource.	Technical Approach, Planning & Policy	<a href="http://www.dnr.state.mn.us/waters/watermgmt_section/shoreland/index.html">http://www.dnr.state.mn.us/waters/watermgmt_section/shoreland/index.html</a>	Kathleen Metzker, Land Use Hydrologist, Department of Natural Resources 651-259-5694 Kathleen.Metzker@state.mn.us
		Minnesota Department of Natural Resources (MDNR), 2004. A Guide for Buying and Managing Shoreland. Section 7: Sustaining Shoreland Ecosystems.	Technical Approach, Planning & Policy	<a href="http://www.dnr.state.mn.us/shorelandmgmt/guide/ecosystems.html">http://www.dnr.state.mn.us/shorelandmgmt/guide/ecosystems.html</a>	
		Minnesota Department of Natural Resources (MDNR), 2005. Minnesota's Alternative Shoreland Management Standards. Prepared through the Shoreland Standards Update Advisory Committee, December 12, 2005.	Technical Approach	<a href="http://files.dnr.state.mn.us/waters/watermgmt_section/shoreland/Alt6120_12_12_2005.pdf">http://files.dnr.state.mn.us/waters/watermgmt_section/shoreland/Alt6120_12_12_2005.pdf</a>	
		Minnesota Pollution Control Agency (MPCA), 1994. Minnesota Lake and Watershed Data Collection Manual. Accessed February 24, 2014 from <a href="http://www.shorelandmanagement.org/depth/manual.pdf">http://www.shorelandmanagement.org/depth/manual.pdf</a>	Technical Approach, Planning & Policy	<a href="http://www.shorelandmanagement.org/depth/manual.pdf">http://www.shorelandmanagement.org/depth/manual.pdf</a>	
Maine	Maine	d'Hemecourt, L., Patel, B. and Sarkar, P. 2011. The State of Lakes in Maine. Accessed February 24, 2014 from <a href="https://wiki.colby.edu/display/stateofmaine2011/The+State+of+Lakes">https://wiki.colby.edu/display/stateofmaine2011/The+State+of+Lakes</a>	Technical-Characteristics	<a href="https://wiki.colby.edu/display/stateofmaine2011/The+State+of+Lakes">https://wiki.colby.edu/display/stateofmaine2011/The+State+of+Lakes</a>	Colin Clark, Shoreland Zoning Coordinator, Maine Department of Environmental Protection 207-441-7419 Colin.A.Clark@maine.gov
		Maine Department of Environmental Protection, 2006a. 06-096, Chapter 502: Direct watersheds of lakes most at risk from new development, and urban impaired streams.	Planning & Policy	<a href="http://www.maine.gov/dep/land/sitelaw/#rule">http://www.maine.gov/dep/land/sitelaw/#rule</a>	
		Maine Department of Environmental Protection, 2006b. Chapter 1000: Guidelines for Municipal Shoreland Zoning Ordinances.	Planning and Policy	<a href="http://www.maine.gov/sos/cec/rules/06/096/096c1000.doc">www.maine.gov/sos/cec/rules/06/096/096c1000.doc</a>	
		Maine Department of Environmental Protection, 2006c. Phosphorus Control Action Plan and Total Maximum Daily Annual Phosphorus Load Report. Prepared for Cross Lake and Square Lake Twp.	Technical Approach	<a href="http://www.epa.gov/waters/tmdl/docs/30679_cross_lake.pdf">http://www.epa.gov/waters/tmdl/docs/30679_cross_lake.pdf</a>	
		Maine Department of Environmental Protection, 2008. Maine Shoreland Zoning - A Handbook for Shoreland Owners.	Planning & Policy	<a href="http://www.maine.gov/dep/land/slz/citizenguide.pdf">http://www.maine.gov/dep/land/slz/citizenguide.pdf</a>	
		Maine Department of Environmental Protection, 2011. 06-96, Chapter 500: Stormwater Management.	Planning & Policy	<a href="http://www.maine.gov/dep/land/sitelaw/#rule">http://www.maine.gov/dep/land/sitelaw/#rule</a>	
		Maine Department of Environmental Protection, 2013. Maine Stormwater Best Management Practices Manual. Accessed on February 24, 2014 from <a href="http://www.maine.gov/dep/land/stormwater/stormwaterbmps/#manual">http://www.maine.gov/dep/land/stormwater/stormwaterbmps/#manual</a>	Technical Approach	<a href="http://www.maine.gov/dep/land/stormwater/stormwaterbmps/#manual">http://www.maine.gov/dep/land/stormwater/stormwaterbmps/#manual</a>	
		Marvinney, R.G., 2012. Bedrock Geologic History of Maine. Available online from the Maine Department of Agriculture, Conservation and Forestry. <a href="http://www.maine.gov/dacf/mgs/explore/bedrock/facts/geol-hist.htm">http://www.maine.gov/dacf/mgs/explore/bedrock/facts/geol-hist.htm</a>	Technical Approach (Lake & Watershed Characteristics)	<a href="http://www.maine.gov/dacf/mgs/explore/bedrock/facts/geol-hist.htm">http://www.maine.gov/dacf/mgs/explore/bedrock/facts/geol-hist.htm</a>	
		Nowak, D. G. and E. J. Greenfield, 2012. Tree and impervious cover in the United States. Landscape and Urban Planning, 107:21-30.	Technical Approach (Lake & Watershed Characteristics)		
		Senator George J. Mitchell Center for Environmental and Watershed Research, U.S. Gulf of Maine Association, Canadian Gulf of Maine Association, et al., 2014. Knowledge Base Science & Information Management for the Gulf of Maine & Its Watershed.	Technical Approach (Database)	<a href="http://www.gulfofmaine.org/kb/2.0/search.html">http://www.gulfofmaine.org/kb/2.0/search.html</a>	
Wisconsin	Wisconsin	Wisconsin Legislature, 2014. Wisconsin's City and Village Shoreland-Wetland Protection Program. No. 697.	Planning & Policy	<a href="http://docs.legis.wisconsin.gov/code/admin_code/nr/100/117/02">http://docs.legis.wisconsin.gov/code/admin_code/nr/100/117/02</a>	Heidi Kennedy, Shoreland policy coordinator, Bureau of Watershed Management, 608-261-6430 Heidi.Kennedy@wisconsin.gov
		Wisconsin Department of Natural Resources (WDNR), 1980. Wisconsin's Shoreland Protection Program. Chapter NR 115.	Technical Approach, Planning & Policy	<a href="http://docs.legis.wisconsin.gov/code/admin_code/nr/100/115.pdf">http://docs.legis.wisconsin.gov/code/admin_code/nr/100/115.pdf</a>	
		Wisconsin Department of Natural Resources (WDNR), 2002. Lake Protection and Classification Grants. Chapter NR 191.	Planning & Policy	<a href="http://docs.legis.wisconsin.gov/code/admin_code/nr/100/191.pdf">http://docs.legis.wisconsin.gov/code/admin_code/nr/100/191.pdf</a>	
		Summary of Wisconsin's Lakes (website document, no citation)	Technical Approach	<a href="http://images.library.wisc.edu/EcoNatRes/EFacs/DNRBull/DNRBull138/referece/econatres.dnrbull138.i0004.pdf">http://images.library.wisc.edu/EcoNatRes/EFacs/DNRBull/DNRBull138/referece/econatres.dnrbull138.i0004.pdf</a>	
US Federal	Environmental Protection Agency	Environmental Protection Agency (EPA), 2002. Federal Water Pollution Control Act (Clean Water Act, as amended through P.L. 107–303, November 27, 2002) 33 U.S.C. 1251 et seq.			

## Appendix C. Water Quality Impact Assessment Terms of Reference (District Municipality of Muskoka)



APPENDIX 'J'  
LAKE SYSTEM HEALTH  
TERMS OF REFERENCE  
WATER QUALITY IMPACT ASSESSMENTS  
June 7, 2007

Water Quality Impact Assessments will be carried out by a professional who can be qualified by the Ontario Municipal Board as an expert witness on these matters, if required, on the basis of education and experience in one or more of the following disciplines: soils science, hydrogeology, or limnology and with demonstrated experience working in Precambrian Shield environments. Water Quality Impact Assessments consist of three main steps. Firstly, a site condition analysis is required. Should this analysis determine that site conditions exist such that development can proceed without affecting water quality, the second step would involve the identification of a suitable building envelope and any required mitigation measures. As a third step, the final report will be reviewed by municipal staff and may also be subjected to a peer review.

**Phase 1: Site Condition Analysis**

A site condition analysis will be undertaken to determine if the required conditions exist on site so that development can occur in a manner that will ensure the protection of water quality. This analysis will include:

**a. Site and Surrounding Area**

A plan will be provided that identifies the physical features associated with the site and surrounding lands including land use, topographic features, watercourses, ponds, designated protected areas, and wetlands.

**b. Site Description**

A Plan will be provided showing a detailed description of the site including:

- Lot size including frontage, depth, area and general shape.
- Location of public and private access roads.
- Location of significant features, both geological and man-made, including such features as wetlands, off-site streams and other surface water.
- Site contours at an interval not more than 5 metres (OBM).
- Areas of slope between 0 to 9%; 10 to 25%; and over 25%.
- The location of all depressions and gullies that will channel stormwater toward the lake.
- The location of all permanent and seasonal or intermittent streams as well as details concerning observations of the amount of flows experienced within the streams at various times of year (minimum of spring freshet and summer drought periods) and an outline of the expected path of surface runoff from the development site to the lake of interest.
- Areas of aquatic vegetation and ecological description (dominant species, emergent/submergent/floating leaved).
- A description of the terrestrial vegetation community – size, composition, age and general health, as detailed below.

**c. Soil Characteristics**

The Impact Assessment will include a documentation and mapping of soil conditions in order to characterize the soils to be used in the construction of septic system leaching beds as well as the native soils in the mantle between the leaching beds and any surface water receptors.

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The location of the proposed septic system leaching bed and the expected pathway of the subsurface nutrient flow (septic plume) in relation to the ultimate receptor (waterbody) of the nutrient flow must be delineated on the Plan submitted. The proponent will also:

- Undertake manual auguring to map soil depth along the flow path of each septic plume within 30m of the tile field, with soil depths inferred from a minimum of twenty (20) points, or as many as required to ensure the integrity of the soil mantle.
- Document the location of sources of suitable soil to construct the partially or totally raised tile fields.
- Provide descriptions of soil characteristics –type, texture and colour for any soils (native or off site) used to construct the tile field and present in the mantle, as determined from soil profiles taken at the site of the tile field or source of the soil, as appropriate, and the mantle area.
- For lakes which are either highly sensitive or over the water quality threshold - provide an analysis of soil chemistry (lab analyses of phosphorus adsorption capability, mineral content and particle size) for any soils proposed for use in the tile field, and from the native soil mantle.
- Map the location of all on-site sample locations, and off-site locations of soils that are to be imported.

**d. Vegetation cover**

The Impact Assessment will map the location and characteristics of shoreline and upland vegetation communities and provide an explanation of the site characteristics that will provide natural buffer protection for the adjacent waterbody from overland and subsurface flow of sediment, nutrient and other potential pollutants. The Impact Assessment will include a photographic documentation of the property showing vegetative cover. The record shall include the following photographs, at a minimum:

- The shoreline across the entire width of the lot as viewed from the lake,
- The tile field and mantle areas, along the direction of subsurface flow towards the lake
- The building envelope, along the shortest distance between the envelope and the lake

**e. Findings**

A determination of the suitability of the site conditions to ensure development will not adversely impact water quality will be provided.

**Phase 2: Identification of Recommended Building and Septic Envelope and Mitigation Measures**

Where a site has been determined to have the conditions required to permit development based on the findings of the Site Condition Analysis, a Plan will be provided showing a detailed description of the manner in which development should occur to protect water quality, including:

- Building location, septic system location, paths, decks, accessory buildings, shoreline structures, parking areas and any other hard surfaces;
- Proximity to significant features, both geological and man-made, including such features as wetlands, off-site streams and other surface water.

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- The location of proposed leaching beds in relation to permanent and intermittent streams or other drainage courses.

Specific mitigation measures necessary for the effective elimination of the impacts of nutrient and sediment loading on water quality should also be identified, including:

- Detailed construction mitigation plans including methods to deal with sediment and nutrient loading. Map the proposed location of all proposed facilities.
- Detail and map stormwater mitigation measures including methods to deal with sediments and nutrient loading during construction and occupation.
- The location, design and construction of septic systems and leaching beds.
- Shoreline setbacks and buffer areas.
- The delineation of building envelopes for proposed building structures and uses, including septic systems for each lot. Building envelopes are defined as the area bounded by the minimum setback from the shoreline and minimum yard setbacks for all development.
- Measures for protecting the natural vegetation, slopes and soil mantle for the area located outside of the building envelopes. Design criteria (including size and construction materials) for uses, buildings and structures that may be permitted within this area. (e.g. boat docks, meandering walkways to the shoreline, and driveways).

**Step 3: Municipal Review**

The District of Muskoka and/or the Local Municipality will review the Impact Assessment, or submit it to peer review to establish:

- The completeness of the assessment regarding the requirements herein,
- Interpretation of the assessment by the proponent,
- The effectiveness of the mitigation measures proposed
- The likelihood that the assessment supports a conclusion of no nutrient impact to the subject water body.

The assessment will be maintained on file for the possibility of re-assessment of the site to ensure that mitigation measures have been implemented and maintained over time.