NBMCA Integrated Watershed Management Strategy

Final Report

Prepared for:
North Bay-Mattawa
Conservation Authority

Prepared by:
Stantec Consulting Ltd.

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Executive Summary

The North Bay-Mattawa Conservation Authority (NBMCA) has prepared an Integrated Watershed Management Strategy (IWMS), to plan and coordinate the management of the subwatersheds within NBMCA's jurisdiction for the next 20 years.

The IWMS evaluates the needs of 20 NBMCA subwatersheds that fall within 11 municipalities and 15 unorganized townships. These watersheds are assessed from a variety of perspectives to define environmental, social and economic needs in recognition of their interconnectedness.

The recommendations provided in the IWMS on key projects, studies and information gaps that need to be fulfilled are intended to guide the successful management of these watersheds and the future actions of the NBMCA and its partners in a collaborative manner.

This IWMS has followed an open process to foster multiagency and stakeholder awareness and support. It was developed with the guidance of a multi-stakeholder Steering Committee and community consultations at key stages of the process. Management strategies are designed to meet strategic objectives that flow from mandated responsibilities under the *Conservation Authorities Act* and NBMCA mission and vision statements. General research and broad programs are delivered at a full watershed scale while concentrated research and specific programs are applied at a subwatershed or tributary scale. Many subwatersheds still lack sufficient baseline inventory data to accurately determine management needs at this time. Part of the implementation framework recommends actions to address these gaps.

Two documents both inform and support this IWMS: a Technical Background Report (which reviews and updates relevant background watershed information including impacts of climate change and land use change, and assesses past management efforts) and a Map Atlas (which graphically displays NBMCA physical characteristics and resources). This strategy considers the latest information available, identifies information gaps, and evaluates whether subwatershed management frameworks are meeting current needs.

Priorities

Priorities to address future watershed management needs, champion new research, steer policy development and advance new leadership roles are integrated into an implementation framework at the document's conclusion. Five-year action strategies are designed to guide the NBMCA until 2034. Actions not completed in a 5-year window will be carried into the next 5-year cycle for reprioritization. At each 5-year review assumptions for pending priorities should be examined to confirm they are still relevant. Guidelines for evaluating and reporting IWMS progress have been included. Review and reprioritization should be completed with stakeholder input. The success of NBMCA management endeavors in the future will continue to rely on multiagency collaboration and stakeholder support. Identifying and engaging partnerships are important in successful integrated watershed management, and each

recommended action has identified federal, provincial, municipal, non-government organizations and/or stewardship groups as partners to be engaged in completing the action.

From a "Protection of People and Property" core mandate perspective, the NBMCA relies on accurate hazard land information for developed and developing areas. As well as preparing new hazard land mapping for some areas, updated mapping will be needed in other basins in the future as assumptions become outdated or as new information is made available. The NBMCA should regularly review and update information critical to the protection of people and property. Expanded policies which support Development, Interference with Wetlands and Alteration to Shorelines and Watercourses (DIA) regulations and the update of the NBMCA's flood forecasting/flood warning system are highlighted as internal action strategies to improve the consistency of service delivery. Addressing actions under this core responsibility is considered urgent relative to other core responsibilities.

From a "Conservation" core mandate perspective, the NBMCA identifies and protects significant watershed features. Further wetland inventories and the delineation of critical habitats that support species at risk are outlined as priority actions for satisfying this responsibility. Actions that support this function have less overall urgency compared to actions under other core responsibilities. Stewardship can play a critical function in advancing this core mandate.

From a watershed "Sustainability" core mandate perspective, the NBMCA meets this responsibility through most of its program initiatives. Overall the priority to meet this responsibility is rated as moderately urgent. Watershed sustainability is met through diverse actions including the protection of hydrologic water balances, protection of cool and cold water aquatic habitats, protection of recreational and drinking water quality and preservation of lakes and streams from the impacts of eutrophication which includes the proliferation of blue green algae. The evaluation of five new integrated roles has determined that climate change and resource sector monitoring are essential functions to maintaining watershed sustainability. The sustainability core function is a major driver to developing an integrated management framework.

In addition to NBMCA's core mandates, it is recognized that effective, collaborative watershed management relies on additional strategies, including a broader "stewardship" perspective. This IWMS has singled out the need to enhance public stewardship within the NBMCA. This can be accomplished through the development of a new Stewardship Strategy. This IWMS tasks the NBMCA to study its "human" resource base and to identify new ways to motivate people to assist in meeting targeted management activities. This strategy will be complemented by the NBMCA's recent venture into community based social marketing.

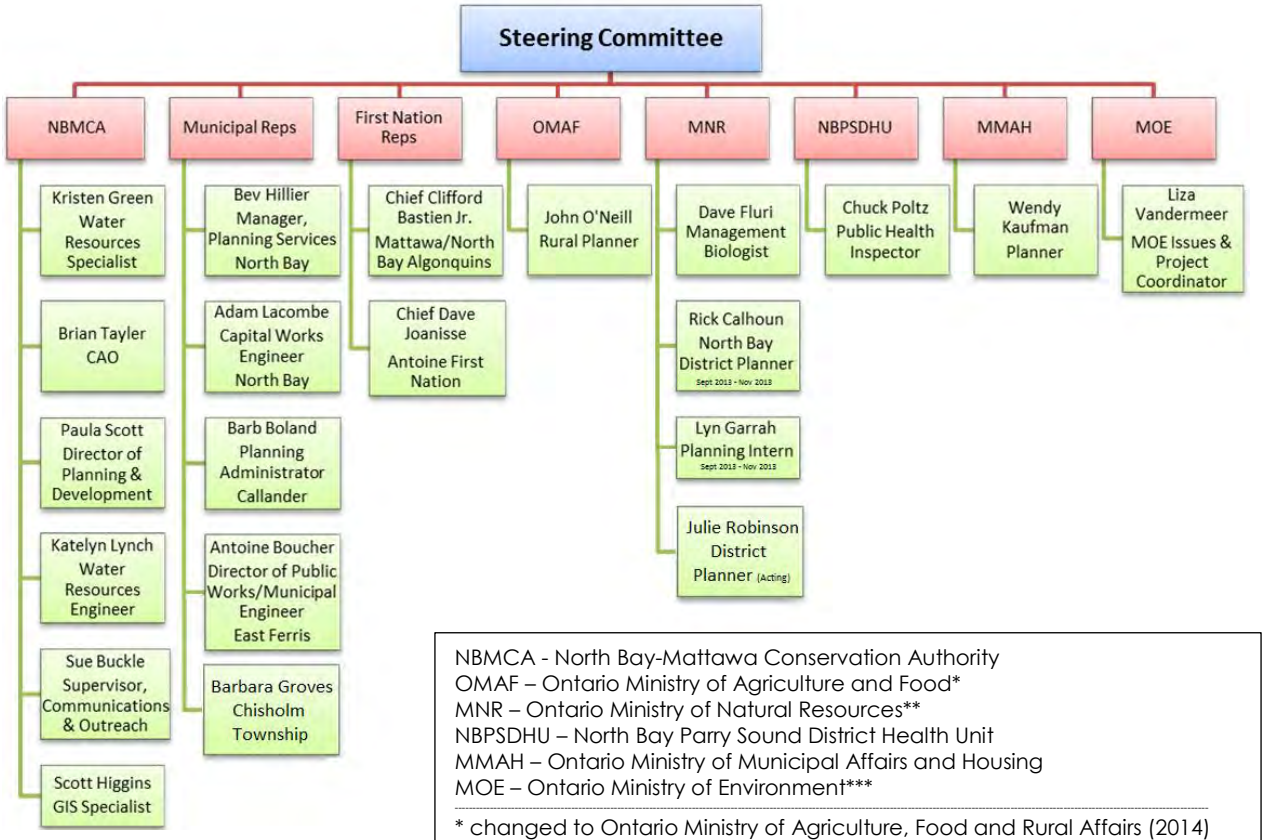
NBMCA management effectiveness is being inhibited by gaps in information. Addressing information gaps is ranked as a top priority and will enhance NBMCA's ability to consistently meet its core mandate responsibilities across all subwatersheds.

Prioritization of information gaps has identified that improved hydrologic and meteorological monitoring is needed. Storm intensity-duration-frequency (IDF) data should be evaluated once new information is released to determine if event probabilities are being impacted by climate change. Floodplain and/or updated "Approximate Regulated Area" mapping is outstanding or requires updating in some subwatersheds. Delineation of critical habitats that support local species at risk are high on the priority list as is refining Ecoregion information into Ecodistricts and Ecoareas. Evaluating overburden aquifer protection needs near rural growth nodes (hamlets) also received a priority ranking.

1.0 ACKNOWLEDGEMENTS AND PROCESS

This North Bay-Mattawa Conservation Authority (NBMCA) Integrated Watershed Management Strategy (IWMS) was developed with the assistance of many stakeholders, which included a Steering Committee made up of representatives from various government agencies and First Nation groups. **Table 1** identifies the Steering Committee membership.

Table 1 - NBMCA Integrated Watershed Management Strategy Steering Committee



NBMCA - North Bay-Mattawa Conservation Authority
OMAF – Ontario Ministry of Agriculture and Food*
MNR – Ontario Ministry of Natural Resources**
NBPSDHU – North Bay Parry Sound District Health Unit
MMAH – Ontario Ministry of Municipal Affairs and Housing
MOE – Ontario Ministry of Environment***

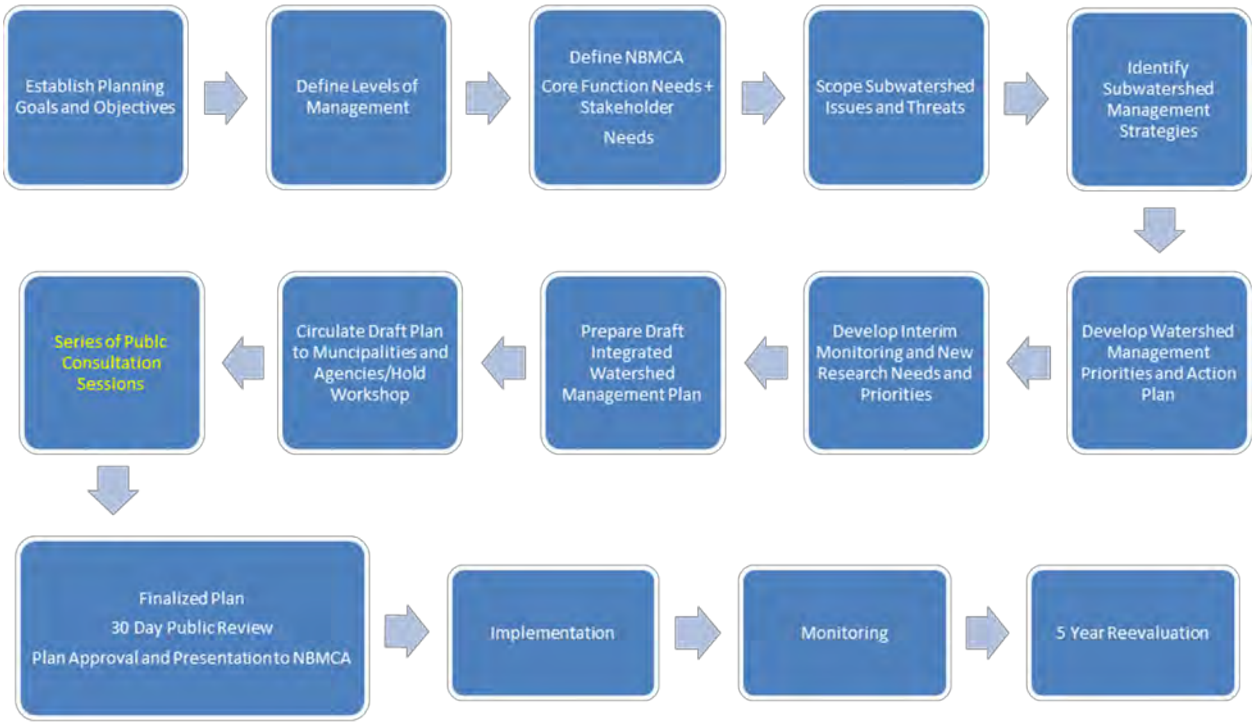
* changed to Ontario Ministry of Agriculture, Food and Rural Affairs (2014)
** changed to Ontario Ministry of Natural Resources and Forestry (2014)
*** changed to Ontario Ministry of Environment and Climate Change (2014)

It is also noted that other NBMCA staff contributed at a Working Committee level, which helped to keep the project on track and ensure that comprehensive concerns were considered. The efforts and contributions of all committee members and staff are greatly appreciated.

The North Bay-Mattawa Conservation Authority Integrated Watershed Management Strategy was prepared in two phases. The first Phase I developed a Technical Background Report and Atlas. The second Phase developed the Integrated Watershed Management Strategy. Work was initiated in mid-2012 and the Strategy was finalized in early 2015. The steps followed in each phase to develop this strategy are identified in **Table 2** and **Table 3**.

Table 2 - Phase I Process to Prepare the Technical Background Report

Table 3 - Phase II Process to Develop the Integrated Watershed Management Strategy



2.0 INTRODUCTION

2.1 THE NORTH BAY-MATTAWA CONSERVATION AUTHORITY

The North Bay-Mattawa Conservation Authority (NBMCA) has prepared this Integrated Watershed Management Strategy to guide watershed management within its jurisdiction over a 20-year period. The NBMCA is a community-based not-for-profit organization mandated to conserve, restore, develop and manage renewable natural resources on a watershed basis. Core responsibilities are derived from the Ontario *Conservation Authorities Act*. Specialty roles have been delegated to the NBMCA through other legislation including the Ontario Building Code, the Ontario Clean Water Act and the Federal Fisheries Act. The NBMCA is 1 of 36 Conservation Authorities in Ontario and 1 of 5 located in Northern Ontario. The NBMCA's mission and vision statements are provided in **Table 4.**

Conservation Authorities in Ontario operate in an evolving provincial/municipal partnership. Conservation Authorities' responsibilities are rooted in the management of water and the protection of people and property from water-related natural hazards. Traditional responsibilities, supported through provincial financial assistance, have reflected provincially led priorities. As Provincial support for traditional responsibilities has diminished, Conservation Authorities have shifted focus to local priorities. Individual CA's have assumed niche responsibilities in response to local watershed needs as well as community and municipal interests. At the same time CAs have developed an increased appreciation for the complexity of the environment and have broadened their management perspectives over time. Management interests now extend to a full range of environmental concerns; they can include consideration of economic and social watershed interests, and now look to adaptive approaches that respond to development and climate change pressures. Conservation Authorities are enablers and often assume a coordination role on behalf of watershed partners. Conservation Authorities have watershed jurisdictions that cut across political boundaries; they survive in a provincial/municipal relationship that fosters inter-agency collaboration and operate with a degree of public sector autonomy that is unique. Conservation Authorities are renowned for grass roots problem solving and a bottom-up approach to defining and coordinating management approaches.

Table 4 - North Bay-Mattawa Conservation Authority Mission and Vision Statements

MISSION: The North Bay- Mattawa Conservation Authority provides leadership through coordination of watershed planning, implementation of resource management programs and promotion of conservation awareness and stewardship with others
VISION: Providing effective leadership in the management of our watersheds where partners and communities are actively engaged in balancing human needs with the needs of the natural environment

2.2 PRINCIPLES OF INTEGRATED WATERSHED MANAGEMENT

This Integrated Watershed Management Strategy is a tactical guidance document that investigates watershed and subwatershed management needs and formulates a framework to address issues based on a ranking of priorities. The strategy is intended to guide NBMCA management activities for its next management cycle (20 years). Management actions have been formulated based on a number of factors including the consequences of doing nothing, consideration of stakeholder and municipal interests, fiscal realities, resource availabilities and partner capacities. The transparency offered through contemplated actions of the NBMCA in this document enhances the possibility of coordinating research, personnel and other resources with partners in future endeavors. This strategy endeavors to apply emerging integrated subwatershed management concepts. Some emerging Integrated Watershed Management concepts are outlined in **Table 5.**

Table 5 - Emerging Concepts in Integrated Watershed Management

Watershed management may be enhanced by applying the following emerging concepts:

- Improve linkages between ecological health and human health, wellbeing and/or quality of life;
- Improve linkages between hazard land management and the protection of people's financial assets/investments/economic wellbeing;
- Improve people's awareness of their greater watershed communities (so people can associate a relationship with other people in the same drainage system);
- Improve the understanding of linkages between watershed management needs and an individual's riparian responsibilities/behaviour and/or obligations to downstream users;
- Improve the understanding of people taking the measurements and collecting the data of the broader watershed management needs and initiatives of the CA and others;
- Improve coordination between all (or various) management agencies involved in the watershed management – for example to better share information, resources and to coordinate activities to pursue comprehensive benefits;
- Improve integration between watershed planning and municipal planning (municipal planning can evolve to consider land uses from a watershed perspective or be asked to better reflect or integrate watershed management interests within their OP's);
- Improve the link between watershed management interests with those expressed by the Province through the Provincial Policy Statement under the Planning Act; and;
- Improve Forest Management Sustainability Practices by introducing assessment based on subwatersheds that consider cross boundary impacts

This strategy also encourages the engagement of the public in Integrated Watershed Management through a variety of strategies, including Community Based Social Marketing (CBSM). The NBMCA employs CBSM to foster environmentally sustainable behaviour that can support the objectives of the IWMS. Community based social marketing recognizes that education alone does not necessarily lead to sustainable behaviour. By targeting desired behaviour that can support watershed management, and identifying barriers and benefits related to such behaviour, an effective public engagement strategy can be developed utilizing a variety of proven tools including obtaining personal commitments, resetting of social norms, establishing prompts and developing effective messaging. The result is public engagement in watershed management as *de facto* partners because they not only understand the reasons for stewardship behaviors but they are encouraged to honour it through peer pressure and prompts and are engaged because they appreciate the benefit to the watershed. Much of integrated watershed management is about human behaviour and public engagement is an integral component of this IWMS.

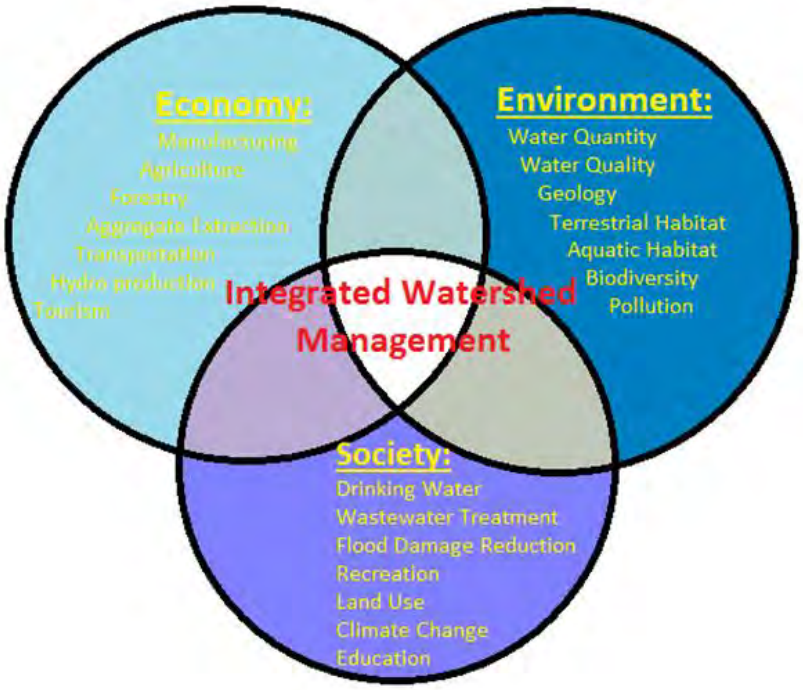
To support a quest to improve subwatershed management effectiveness and to have greater influence over public behaviour, the depiction of environmental benefits can be enhanced. People may be more willing to modify their behaviour or respect riparian obligations if a more fulsome appreciation of subwatershed functions and features are portrayed. Watersheds/ subwatersheds provide a diverse array of "natural services and benefits" to society and to the economy. The diversity of services and benefits provided by the environment has been explored in "Selected Tools to Evaluate Water Monitoring Networks for Climate Change Adaptation" (CCME, 2011). This information has been modified to apply to NBMCA subwatersheds in **Table 6**. Future planning can combine community based social marketing strategies with more holistic visions of watershed values to stimulate public appreciation and support for watershed protection.

Figure 1 depicts how subwatershed interests are integrated for IWM assessment purposes. This model, also used to promote the principle of sustainability, is problematic in that it suggests that only trivial overlaps exist between these often conflicting interests. A variation of this model, presented in **Figure 2**, suggests that subwatershed interests have greater co-dependencies. The "three-nested-dependency model" suggests that society is a subsidiary of its surrounding environment which supplies food, clean water, fresh air, fertile soils, natural resources, etc.; and which, if absent, would significantly impair the supported quality of life. It further suggests that society when making economic decisions (how goods and services are exchanged) significantly influence local economic conditions. In making economic choices society also influences environmental qualities that sustain life and determines environmental

Table 6 - Identification of Enhanced Watershed Services and Benefits

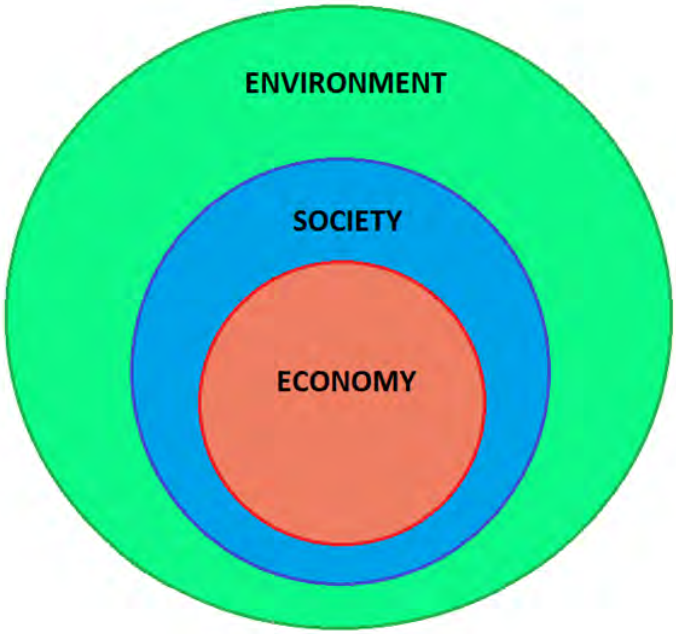
Subwatershed Function	Ecosystem Services and Benefits
Atmospheric Gas Regulation	Production of oxygen/Protection from ultraviolet UV radiation /Improvements to air quality
Climate Regulation	Albedo of land surfaces, sequestration of carbon in plants, regulation of rates of evapotranspiration, impact on cloud formation
Disturbance Prevention	Storm protection, flood and erosion control, drought protection
Water Regulation and Energy Production	Control of runoff rates, natural irrigation, transportation, production of hydroelectricity
Soil Retention	Protection against soil loss, entrapment of sediments in lakes and wetlands, protection of arable lands
Soil Formation	Breakdown of rock and sediment into arable soils, maintenance of productivity
Nutrient Recycling	Maintenance of nutrient availability/cycling and regulation of nitrogen and phosphorous
Waste & Wastewater Treatment	Absorption/detoxification, natural attenuation, biofiltration, abatement of pollution
Pollination	Pollination of wild plants and crops
Biological Control	Control of pests/diseases/invasive species
Habitat	Biological and genetic diversity, nurseries, refugia, foraging, hibernating, overwintering, nesting/breeding, etc; habitat for fish, wildlife and plant species
Food Production	Provision of direct food from agriculture (honey, maple syrup), hunting, fishing, gathering edible plants such as berries, etc. and indirect food such as plants and animals, which support fish and wildlife
Raw Materials	Supply of lumber, energy and fuel, fodder, peat and fertilizer, water, aggregates etc.
Genetic Resources	Improved resistance to pathogens and pests
Medicinal Resources	Healthy environments, drugs and pharmaceuticals, chemical resources, traditional medicines
Recreation	Wildlife viewing, hunting, fishing, swimming, water sports, canoeing, winter outdoor sports, ecotourism, adventure tourism
Education/Culture/Spirituality	Environmental awareness and consciousness, scenery, artistic stimulation and expression, spiritual values, cultural history and appreciation, Areas of Natural and Scientific Interest (ANSI's), scientific knowledge

Figure 1 - Integration Framework for Often Competing Subwatershed Interests



Adapted from: Conservation Ontario, An Integrated Management Approach to Great Lakes Protection, April 2012

Figure 2 - Three-Nested-Dependency Model of Watershed Interests



Source: Sustainability Advantage, Bob Willard's Resources for Sustainability Champions, http://sustainabilityadvantage.com/2010/07/20/3-sustainability-models/

management needs and issues. This updated model suggests that society and the local economy, to be sustainable, must exist within the carrying capacity of the environment that supports it. This concept endorses the philosophy that human and economic health depends on a healthy environment. The three-nested-dependency model better represents the symbiotic relationship that exists between often conflicting watershed interests.

In following sections emerging concepts are put into practical application. Subwatershed issues and needs are portrayed from environmental, social and economic perspectives. A social evaluation attempts to visualize needs and issues from the public's perspective. The economic perspective considers local economic needs and issues related to continued growth, development and access to resources.

2.3 OBJECTIVES OF INTEGRATED WATERSHED MANAGEMENT IN THE NBMCA

This Integrated Watershed Management Strategy flows from the NBMCA's mission and vision statements (as expressed in **Table 4** above) and is guided by three Integrated Watershed Management Strategic Objectives as set out in **Table 7.**

Table 7 - North Bay-Mattawa Conservation Authority's IWM Strategic Objectives

1. **It is the strategic objective of the NBMCA Integrated Watershed Management Strategy to establish balance between environmental, economic and social interests in a sustainable manner.**

   This will be achieved by:
   - *Developing a sound technical and scientific understanding of issues and solutions;*
   - *Developing an effective watershed management framework;*
   - *Translating watershed management issues and solutions into understandable land use planning terminology;*
   - *Identifying and deploying the necessary tools and methodologies to achieve desired outcomes;*
   - *Advancing a public consciousness to appreciate the environment and act responsibly.*

2. **It is the strategic objective of the NBMCA Integrated Watershed Management Strategy to provide effective management direction for the NBMCA and its partners.**

   This will be achieved by:
   - *Conducting sound planning;*
   - *Building a collaborative management framework with other agencies and stakeholders;*
   - *Being consultative, collaborative and engaging;*
   - *Collecting reliable data and completing credible data interpretation;*
   - *Developing clear, concise and transparent written policies;*
   - *Having effective communication strategies.*

3. **It is the strategic objective of the NBMCA Integrated Watershed Management Strategy to assist the NBMCA in defining its roles, responsibilities, capacity needs and priorities for watershed and subwatershed management.**

   This will be achieved by:
   - *Studying issues within its jurisdiction at a subwatershed level;*
   - *Identifying baselines from which a balance between environmental, economic and social interests can be found;*
   - *Identifying and studying watershed stresses;*
   - *Identifying and bridging information gaps;*
   - *Identifying and bridging resource gaps.*

The NBMCA has defined its next management cycle as a period of 20 years starting in 2015 to be effective until 2034. Within this management cycle action strategies are defined in 5 year segments. The NBMCA will review and update its action priorities on a 5-year cyclic basis. This strategy includes implementation recommendations designed to keep the NBMCA aware of changing conditions and to obtain early feedback on the effectiveness of deployed initiatives. This IWMS has established a formal review process that involves setting management targets and timelines, tracking implementation progress and reporting back on successes and failures of management actions taken. Five-year reviews will be used to reset management strategies based on the experiences and knowledge gained over time.

2.4 NEED FOR AN INTEGRATED WATERSHED MANAGEMENT STRATEGY

A number of compelling factors have influenced the NBMCA to complete an Integrated Watershed Management Strategy at this time including:

- The NBMCA as an organization has evolved and is seeking new direction;

- The first Watershed Management Plan, prepared in 1984, is outdated; most strategies have been acted upon and the effectiveness of management efforts can now be evaluated;
- The NBMCA has expanded its area of jurisdiction to include new basins flowing through the Municipality of Callander that have limited information;
- Watershed management approaches are continuously evolving and new options are emerging for consideration;
- The capacities of organizations and agencies that contribute towards watershed management are also evolving and the NBMCA may be required to take on new roles in some instances;
- More data, advancements in the understanding of resource values and new technologies to monitor and assess watershed features are now available;
- Climate change has emerged as a new watershed stress factor;
- Watersheds are experiencing continuous growth and development and municipal planning policies are evolving, many having gone through recent updates.

2.5 STUDY AREA

The Integrated Watershed Management Strategy is formulated for a study area based on the NBMCA's core jurisdictional area with several adjustments. In 2003 the NBMCA's core area was expanded to include all of the Municipality of Callander (the NBMCA previously only had jurisdiction within the Wistiwasing (Wasi) River watershed that drains through Callander). The expansion was based on the legal description of the Municipality of Callander and excluded parts of newly added drainage areas. The study area for this strategy has been expanded to include the full drainage systems that flow through the Municipality of Callander. The NBMCA's jurisdiction also includes a small portion of the Little Sturgeon River watershed within the limits of the City of North Bay. The Little Sturgeon River subwatershed has not been included within the IWMS because the area captured (4.7 km^2) is too small for the NBMCA to provide any effective management. The NBMCA's core jurisdictional area totals just over 2,900 km^2 (including the Little Sturgeon River) and the IWMS area of study totals 2,996 km^2. An accounting of the NBMCA's core jurisdictional area and the IWMS study area is provided in **Figure 3** and **Table 8**.

Figure 3 - IWMS Study Area and NBMCA Area of Jurisdiction

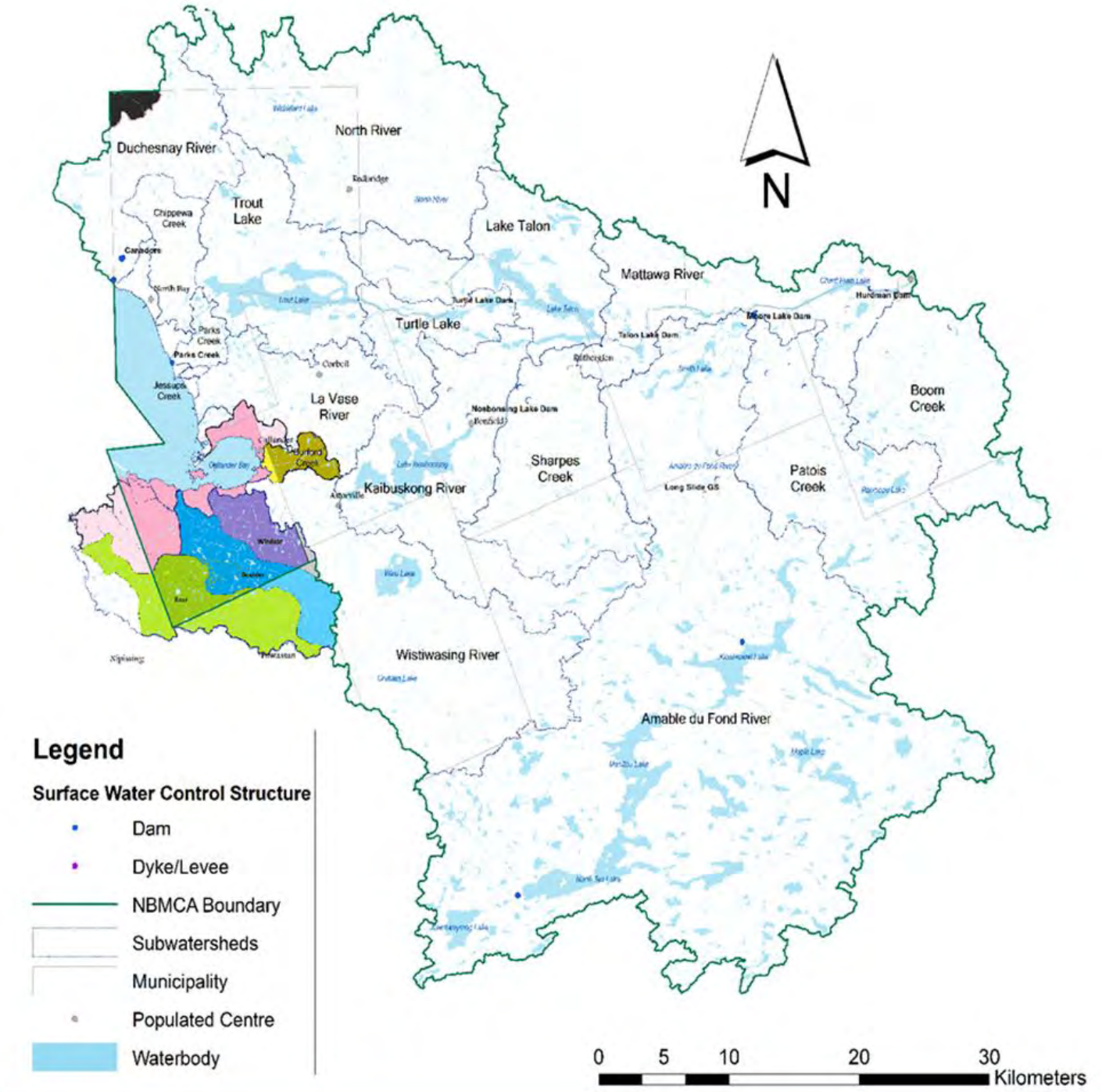


Table 8 - Identification of the Study Area Relative to the NBMCA's Core Jurisdictional Area

#	Subwatershed	NBMCA Jurisdiction (km^2)	IWMS Study Area (km^2)	Outside NBMCA Core Area (km^2)
1	Duchesnay Creek	101.65	101.65	
2	Chippewa Creek	37.77	37.77	
3	Park Creek	14.01	14.01	
4	Jessups Creek	1.31	1.31	
5	La Vase River	90.76	90.76	
6	Lake Nipissing/North Bay	16.61	16.61	
7	Windsor/Boulder/Bear Cr's	67.12	126.73	59.61
8	Burford Creek	1.22	12.89	11.67
9	Callander Bay/South Shore	30.03	64.86	34.83
10	Wistiwasing River	234.38	234.38	
11	North River	247.77	247.77	
12	Trout Lake	131.67	131.67	
13	Turtle Lake	45.08	45.08	
14	Kaibuskong River	181.88	181.88	
15	Lake Talon	130.09	130.09	
16	Sharpes Creek	136.88	136.88	
17	Amable du Fond River	964.41	964.41	
18	Pautois Creek	175.78	175.78	
19	Boom Creek	137.86	137.86	
20	Lower Mattawa River	143.39	143.39	
	Total Area	**2889.67***	**2995.78**	**106.11**

* excludes Little Sturgeon River

2.6 NBMCA MANDATED RESPONSIBILITIES AND MANAGEMENT TOOLS

The NBMCA uses a suite of administrative and regulatory "tools" under the Conservation Authorities Act as well as delegated tools under other legislation to meet watershed management obligations within the study area. These "tools" allow the NBMCA to deliver a broad range of programs. The NBMCA uses its suite of tools to meet the following mandated responsibilities:

- Regulation of Development, Interference with Wetlands, Alterations to Shorelines and Watercourses;
- Flood Forecasting and Warning Services;
- Municipal Plan Review/Planning Support;
- Septic Program;

- Watershed Management;
- Drinking Water Source Protection;
- Conservation Areas and Trails;
- Watershed Stewardship;
- Communications, Outreach and Education;
- Geographic Information Systems (GIS).

Specifically, the *Conservation Authorities Act* provides the NBMCA with administrative powers pursuant to Section 21(1) to do the following activities:

- Ability to conduct research to identify watershed management needs;
- Ability to enter onto private property for the purposes of undertaking site investigations;
- Ability to own land and to buy and sell, lease or expropriate lands;
- Ability to own personal property and to buy and sell personal property;
- Ability to purchase material and labour and to enter into legal agreement to undertake work;
- Ability to enter into agreements with owners of private land for the purposes of carrying out a project;
- Ability to apportion costs to benefiting participating municipalities;
- Ability to construct structures and works such as dams and create reservoirs;
- Ability to control the flow of water, to prevent flooding and pollution and adverse effects;
- Ability to alter the course of a water system either temporarily or permanently and to alter the location/position of any roadway or utility;
- Ability to use land owned or controlled by the Conservation Authority to meet its objects;
- Ability to use land owned or controlled by the Conservation Authority for parks and recreation; to erect buildings, booths and facilities for such purpose and to charge a fee for the use of such land or facilities;
- Ability to charge fees for provincially approved services;
- Ability to collaborate and enter into agreements with ministries and agencies of the government, municipal councils, local board and other organizations;
- Ability to plant and produce trees on Crown and private land with the consent of the minister/owner;
- Ability to cause research to be done; and
- Ability to generally do any action necessary for the purpose of carrying out any project.

The NBMCA has legislative powers derived from Ontario Regulation 177/06 North Bay-Mattawa Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses, approved pursuant to Section 28 (1) of the *Conservation Authorities Act* which allows it to:

(a) restrict and regulate the use of water in or from rivers, streams, inland lakes, ponds, wetlands and natural or artificially constructed depressions in rivers or streams;

(b) prohibit, regulate or require the permission of the authority for straightening, changing, diverting or interfering in any way with the existing channel of a river, creek, stream or watercourse, or for changing or interfering in any way with a wetland;
(c) prohibit, regulate or require the permission of the authority for development if, in the opinion of the authority, the control of flooding, erosion, dynamic beaches or pollution or the conservation of land may be affected by the development;
(d) provide for the appointment of officers to enforce regulations;
(e) provide for the appointment of persons to act as officers with all of the powers and duties of officers to enforce any regulation made under this section.

The types of development controlled pursuant to O Reg 177/06 as defined by Section 28 (25) of the Conservation Authorities Act include:

(a) the construction, reconstruction, erection or placing of a building or structure of any kind;
(b) any change to a building or structure that would have the effect of altering the use or potential use of the building or structure, increasing the size of the building or structure or increasing the number of dwelling units in the building or structure;
(c) site grading; or
(d) the temporary or permanent placing, dumping or removal of any material, originating on the site or elsewhere.

2.7 ROLE OF THE NBMCA IN INTEGRATED WATERSHED MANAGEMENT

The NBMCA, in pursuing its objectives, through the administration of its responsibilities at a watershed or subwatershed level, can fulfill one or more of the following roles:

- Act for or on behalf of senior levels of government through delegated responsibilities;
- Act as a Regulatory Body pursuant to Specific Legislation passed by Order In Council;
- Act as a Regional Resource Manager under the *Conservation Authorities Act*;
- Act as a Regional Public Commenting Body under *Planning Act*, *Aggregates Resources Act*, *Environmental Assessment Act*, etc.;
- Act as a Regional Service Provider under special agreements;
- Act as a Trustee to meet its fiduciary obligations such as the duty to consult with local First Nations; and
- Act as a property owner (CAs can have both resource protection and land use interests)

Integrated Watershed Management is principally undertaken by the NBMCA in fulfilling its role as a Resource Manager. However, in its quest to manage watersheds under its jurisdiction, all roles are engaged from time to time in the interest of fulfilling its mandated responsibilities.

2.8 ROLE OF WATERSHED MANAGEMENT PARTNERS

2.8.1 Public Sector Partners

The NBMCA has an extensive list of public sector partners that it works with in the administration of its responsibilities. Partnerships and cooperation are cornerstones of the CA's mission and vision statements. The NBMCA has developed complex relationships with most environmental management or resource protection agencies in the region. The NBMCA's direct partners include the Province through the Ontario Ministry of Natural Resources and the Ontario Ministry of Environment as well as ten member municipalities. Direct partners provide financial support and municipalities appoint members to the Board of Directors. The NBMCA also has agreement relationships with a number of agencies to provide delegated services. The NBMCA has a collaborative relationship with all organizations involved in aspects of watershed management. The NBMCA has a fiduciary duty to engage regional First Nation communities. Also, in its capacity as a public commenting body, the NBMCA has a Plan Review Agreement with member municipalities and/or planning boards to identify "Provincial Interests" related to Natural Heritage Features and to provide comments that are viewed to be in the public's best interest. The NBMCA's relationship with various government organizations are listed in **Table 9.**

2.8.2 Non-Government Organization Partners

The NBMCA also has a collaborative relationship with a number of Non-Government Organizations (NGOs). The NBMCA shares environmental protection and resource management interests with local groups and associations. Periodically the NBMCA partners with NGOs to achieve commonly held objectives. The NGOs within the regions that the CA interacts with are identified in **Table 10**.

Table 9 - NBMCA Partners and Relationships - Public Partners

Level	Government Agency	Program/Linkages	Applicable Legislation	Type of Relationship
Fed	**Environment Canada**	•HYDAT data base		**Collaborative**
		•Hydrologic Station Maintenance		**Collaborative**
	Department of Fisheries and Oceans	•Level II Screening of Development Application for Fisheries Concerns*	Federal Fisheries Act	Delegated Role via Service Agreement*
	Public Works and Government Services Canada	•Water Level Regulation - Dam Operations on Lake Nipissing		**Collaborative**
	Transport Canada	•Navigation Controls Lake Nipissing	Navigable Waters Protection Act	**Collaborative**
Prov	**Ontario Ministry of Natural Resources**	•Financial Assistance	Conservation Authorities Act	Direct Partnership
		•Flood Forecasting	Conservation Authorities Act	Direct Partnership
		•Flood and Erosion Control	Conservation Authorities Act	Direct Partnership
		•Low Water Response	Conservation Authorities Act	Direct Partnership
		•Snow Course Data Management	Conservation Authorities Act	Direct Partnership
		•Hazard land Management	Conservation Authorities Act	Direct Partnership
		•Watershed Management	Conservation Authorities Act	Direct Partnership
		•Shoreline Management	Conservation Authorities Act	Direct Partnership
		•Water Resources Information/GIS	Conservation Authorities Act	Direct Partnership
		•Sturgeon River/Lake Nipissing/French River Advisory Committee		**Collaborative**
		•Lake Nipissing Fisheries Management Advisory Committee		**Collaborative**
		•Water Level Regulation/Dam operations within NBMCA	Lakes and Rivers Improvement Act	**Collaborative**
		•Wetland Evaluation		**Collaborative**
		•Fish and Wildlife Management	Fish and Wildlife Conservation Act	**Collaborative**
		•Species at Risk	Species at Risk Act (Fed) Ontario Endangered Species Act (Prov)	**Collaborative**
		•Invasive Species		**Collaborative**
		•Crown Land/Forestry	Public Lands Act	**Collaborative**
		•Aggregates	Aggregate Resources Act	**Collaborative**
	MNR & Ministry of MMAH	•Plan Review/Identification of Provincial Interests related to Natural Hazards	Planning Act	Delegated Provincial Role via MOU
		•Natural Heritage Resource Features	Planning Act	**Collaborative**
	Ministry of Municipal Affairs and Housing	•Septic System Inspection and Approval	Ontario Building Code	Delegated Role via Service Agreement
	Ontario Ministry of the Environment	•Drinking Water Source Protection/Source Protection Authority	Ontario Clean Water Act	Delegated Role via Service Agreement
		•Class Environmental Assessment	Environmental Assessment Act	Delegated Approval Process
		•Large Septic System Regulation	Ontario Water Resources Act	**Collaborative**
		•Surface Water Quality Monitoring	Environmental Protection Act	**Collaborative**
		•Groundwater Monitoring	Environmental Protection Act	**Collaborative**
		•Spill Action Center Reporting & Regulations	Environmental Protection Act	**Collaborative**
		•Water Sustainability	Water Opportunities Act	**Collaborative**
		•Spring Phosphorus Monitoring		**Collaborative**
		•Lake Partners Program Sampling		**Collaborative**
		•Lake Shore Capacity Assessment	Planning Act	**Collaborative**
	Ontario Ministry of Agriculture Food and Rural Affairs	•Nutrient Management	Nutrient Management Act	**Collaborative**
		•Agricultural Drainage	Drainage Act	Public Commenting Body
	Ministry of Tourism Culture and Sport & MMAH	•Cultural Heritage	Ontario Heritage Act	**Collaborative**
Regional	**North Bay Parry Sound District Health Unit**	•Public Beach Monitoring	Health Protection and Promotion Act	**Collaborative**
		• Small Drinking Water Systems	Safe Drinking Water Act	**Collaborative**
		•Blue Green Algae/Waterborne Health	Health Protection and Promotion Act	**Collaborative**
First Nations	**Dokis First Nation**	•Cultural Heritage and Resource Mgmt		Fiduciary
	Nipissing First Nation	•Cultural Heritage and Resource Mgmt		Fiduciary
	Antoine First Nation	•Cultural Heritage and Resource Mgmt		Fiduciary
	Mattawa/North Bay Algonquins	•Cultural Heritage and Resource Mgmt		Fiduciary
Metis	**Metis Council of Ontario**	•Cultural Heritage and Resource Mgmt		Fiduciary
Mun	**Member Municipalities**	•Board of Directors Appointment	Conservation Authorities Act	Direct Partnership
		•Financial Agreements	Conservation Authorities Act	Direct Partnership
		•Parks and Conservation Areas	Conservation Authorities Act	Direct Partnership
		•Flood and Erosion Control	Conservation Authorities Act	Direct Partnership
		•Hazardland Management	Conservation Authorities Act	Direct Partnership
		•Emergency Response	Emergency Management and Civil Protection Act	**Collaborative**
		•Stormwater Management	Ontario Water Resources Act	**Collaborative**
		•Water and Waste Water Treatment	Ontario Water Resources Act	**Collaborative**
		•Source Protection Implementation Bodies	Ontario Clean Water Act	**Collaborative**
		•Planning Policy Development	Planning Act	Public Commenting Body
		•Development Application Review	Planning Act	Public Commenting Body
		•Planning Support (Sections 2 & 3 of the Provincial Policy Statement)**	Planning Act	Contracted Role via Service Agreement
		•Environmental Assessment Review	Municipal Class Environmental Assessment	Public Commenting Body

* The service agreement for this responsibility was discontinued in November 2013 ** with individual municipalities

Table 10 - NBMCA Partners and Relationships - Non-Government Organizations

Type of Organization	Non-Governmental Organizations	Common Interests	Type of Relationship
Educational Institutions	Canadian Ecology Center	Environmental Education/Research	**Collaborative**
	Canadore College	Environmental Education/Research	**Collaborative**
	Nipissing University	Environmental Education/Research	**Collaborative**
Forest Resource Management Licensees	Algonquin Forestry Authority	Sustainable Forest Practices	**Collaborative**
	Nipissing Forest Resource Management Inc.	Sustainable Forest Practices	**Collaborative**
	West Wind Stewardship Forestry Inc.	Sustainable Forest Practices	**Collaborative**
Economic Development Corporations	Mattawa-Bonfield Economic Development Corporation	Sustainable Resource Use	**Collaborative**
	NECO Community Futures Development Corporation	Sustainable Resource Use	**Collaborative**
Tourism/ Recreation Organizations	Tourism Northern Ontario	Regional Tourism	**Collaborative**
	Northern Ontario Tourist Outfitters Association	Regional Tourism	**Collaborative**
	Discovery Routes	Tourism, Recreation, Regional Trails	**Collaborative**
	Mattawa Voyager Country	Tourism, Recreation, Regional Trails	**Collaborative**
	Laurentian Ski Hill	Tourism, Recreation	**Collaborative**
Conservation Groups/ Associations/ Councils	Lake Nipissing Stakeholders Association	Lake Nipissing Fisheries	**Collaborative**
	Lake Talon Conservation Association	Lake Management	**Collaborative**
	Trout Lake Conservation Association	Lake Management	**Collaborative**
	Lake Nipissing Partners in Conservation	Lake Management	**Collaborative**
	Greater Nipissing Stewardship Council	Regional Sustainability	**Collaborative**
Environmental/ Gardening Groups	Friends of the La Vase Portage	Heritage Conservation	**Collaborative**
	Friends of Laurier Woods	Environmental Stewardship	**Collaborative**
	Friends of Mattawa River Provincial Park and Camp Island	Environmental Stewardship	**Collaborative**
	Wasi Lake Property Owners and Friends	Environmental Stewardship	**Collaborative**
	Greening Nipissing	Environmental Stewardship	**Collaborative**
	Nipissing Naturalists	Environmental Stewardship	**Collaborative**
	Nipissing Environmental Watch	Environmental Stewardship	**Collaborative**
	North Watch	Environmental Stewardship	**Collaborative**
	Heritage Gardeners	Horticulture and Environmental Education	**Collaborative**
	Nipissing Botanical Gardens	Horticulture and Environmental Education	**Collaborative**
Community/ Business Groups	Transition Town North Bay	Sustainable Communities	**Collaborative**
	Callander Community Enhancement Group	Sustainable Communities	**Collaborative**
	North Bay Chamber of Commerce	Sustainable Communities	**Collaborative**
Provincial Interest Groups	Ontario Federation of Hunters and Anglers	Sustainable Wildlife	**Collaborative**
	Ontario Federation of Agriculture	Sustainable Agriculture	**Collaborative**
	Ontario Onsite Wastewater Association	Sustainable Private Wastewater Treatment	**Collaborative**

2.9 INITIATIVES OF OTHER AGENCIES THAT MAY INFLUENCE MANAGEMENT NEEDS

Planning actions or management activities carried out by other agencies provide basin management protection or fulfill management interests that can influence the level of management carried out by the NBMCA at a subwatershed level. Sections 2.9.1 to 2.9.4 outline the types of planning/management activities that other agencies carry out within the NBMCA which can influence management needs and affect priorities at a subwatershed level.

2.9.1 Official Plans

Municipalities develop Official Plans to manage growth and steer development within their respective jurisdictions and play an important role in meeting protection of people and property, sustainable watershed practice and conservation of natural resource objectives. Official Plans reflect local interests and also reflect regional and provincial interests which are either adopted or imposed. Official Plans usually carry hazard land and/or floodplain policies as well as environmental protection, resource management and sustainability policies. Official Plans can also offer stormwater management and source water protection guidance. Relevant Official Plan policies of NBMCA member municipalities have been listed in the Technical Background Report (Section 12).

In the context of watershed management, controls available through Official Plans (and Implementing Zoning By-laws) can be applied by municipalities to achieve watershed management objectives. The NBMCA seeks to harmonize policies between municipalities when watersheds spill into multiple jurisdictions. All organized municipalities within the study area have Official Plans and Implementing Zoning By-laws, administer a range of environmental policies and act to control land uses for environmental protection purposes. The sophistication of controls offered by municipalities is subject to their size and the administrative capabilities.

2.9.2 Pollution Prevention Plans

Pollution Prevention Plans have historically been completed by the Ministry of Environment to mitigate contamination caused by combined sewers, cross connections (between separated sanitary or stormwater systems) or from septic loading. Plans have been completed for tributaries, storm sewersheds or drainage basins contributing to lakes that focus on maintenance and repair of underground conveyance or treatment infrastructure. End-of-pipe diversion or treatment solutions are often identified. Pollution from pet and bird feces, lawn maintenance practices, and illegal discharges and spills that enter stormwater systems can also be considered as loading factors that are targeted. Pollution Control Plans within the NBMCA area of jurisdiction have been completed to reduce bacteriological loading to public beaches or to surface water used for public consumption. These plans however are old and management activities recommended have either been implemented or are now outdated.

2.9.3 Drinking Water Source Protection Plans

Drinking Water Source Protection Plans, completed by locally-based Source Water Protection Committees, contain policies that focus on primary protection (first order barriers) of municipal drinking water sources (surface and ground water) by eliminating or reducing threat(s) posed by certain specific activities identified through local Assessment Reports. Surface water protection is mainly assessed on a watershed basis. Some Source Protection plans also consider water quantity limitations through conceptual water budgets and water quantity risk assessments. The *Clean Water Act* empowers Source Protection Plans to activate a variety of tools to reduce or eliminate threats including prescribed instruments, land use planning, risk management plans, prohibition of activities, specific actions, and education and outreach. While the North Bay – Mattawa Assessment Report did not identify specific threats to water quantity, it did identify threats to quality. The North Bay – Mattawa Source Protection Plan (NBM SP Plan) contains policies intended to reduce water quality risk factors (threats) including the management of nutrient loading to source waters vulnerable to algal blooms. The need for subwatershed or tributary management will be influenced by the policies and controls offered by the new NBM SP Plan that was approved in 2014 and will start to be implemented in 2015.

2.9.4 Provincial Park Plans

Large tracts of land within the NBMCA are protected through Provincial Park and Conservation Reserve designations. A total of 836 km^2 or 29% of the NBMCA falls within a Provincial Park that is subject to a Provincial Park Plan. Provincial Park Plans control land uses and protect resources and park uses on Crown land deemed to be in the best interests of the public. Some subwatersheds are located substantially within a Provincial Park and park protection will influence the need for additional basin management activities. It is noted that Algonquin Park is distinguishable from other Provincial Parks as logging is a permitted use.

Each subwatershed in Section 3 considers the level of protection offered by other agencies when assessing issues and needs.

2.10 WATERSHED MANAGEMENT OPTIONS

Sections 2.10.1 through 2.10.6 identify the range of management approaches that are available to address management needs of subwatersheds within the NBMCA.

2.10.1 Ad Hoc Management

In subwatersheds where significant issues have not been identified, problems are perceived to be minimal and new development is not occurring; the basin can likely be managed adequately in an ad hoc fashion. Basins with no tailored management programs rely on:

- Existing Legislative and Administrative tools
- Generic Policies and Programs
- General Education/Stewardship Approaches

Basin stress factors need to be periodically reviewed (i.e., every 5 years) to ensure that issues and stress conditions remain stable.

2.10.2 Stormwater Management Plans/Master Drainage Planning

Stormwater Management Plans, often tributary based (in part of a subwatershed), focus on storm conveyance and storage requirements to protect the immediate development and downstream interests from lower magnitude storm events. Stormwater management plans are principally developed by municipalities but rely on subwatershed design criteria established by a Conservation Authority or through generic guidelines established by the Province. Stormwater management objectives identified in the 2003 MOE Stormwater Management Planning and Design Manual include: "maintaining the hydrologic cycle, protection of water quality, and preventing increased erosion and flooding". Stormwater Management Plans advocate urban design strategies that minimize hardened surfaces, maintain or enhance natural infiltration rates and preserve or enhance natural runoff characteristics including peak flows and volumes. New development has the potential to affect stormwater quantity and quality and mitigation may be required to preserve natural or existing tributary characteristics. Mitigation usually requires the implementation of individual lot, conveyance and/or end-of-pipe management strategies. Water quality control features are prerequisites for systems that drain to cold water habitats or to aquatic environments with rare or endangered species. Levels of water quality protection are based on characteristics of the receiving watercourse aquatic habitat. An "enhanced" level of protection is required by the Province where sensitive aquatic habitat may be impacted by stormwater discharge.

The Municipal Engineers Association Class Environmental Assessment defines stormwater management as: "The selection of Best Management Practices, the specifics for design of control facilities and the details of protection measures and/or enhancement of rehabilitation programs to meet the objectives set by the Watershed and Subwatershed Plans."

More comprehensive long-term municipal stormwater management planning is accomplished through master drainage plans. Master drainage plans are formulated at a regional scale often in conjunction with municipal secondary plans. Master drainage plans are often developed for rural areas at the fringes of settlement areas that are under development pressure, which may have competing land values and settlement interests. These studies usually focus on stormwater conveyance and water quality controls for first or second order systems and may focus on specific management interests such as nutrient control. Master drainage plans are often supported by a broader watershed or subwatershed management plan that establishes basin management design criteria. Master drainage plans are uncommon within the NBMCA and most stormwater approaches are carried out at a tributary level.

It should be noted that the 2003 Stormwater Management Planning and Design Manual developed by the Ministry of Environment requires updating. Stormwater management guidelines were developed before the current understanding of climate change impacts and consequently guidelines lack adaptation considerations. There has been a shift to favour source (lot level) control practices with more emphasis on applying landscape and vegetative controls. Stormwater management also requires a more in-depth understanding of impacts to groundwater including changes to water tables and impacts to base flow, alterations to recharge and discharge functions, impact to wetlands and potential impact to wells, ground water takings and surface water takings.

The NBMCA relies on the preparation of stormwater management plans for tributaries within subwatersheds to protect main channel functions from long term development impacts. In some cases stormwater management may be the highest level of protection needed (i.e., Jessups Creek). The CA can influence stormwater management by identifying tributary design criteria when preparing subwatershed or watershed plans. Stormwater management planning is usually carried out at a municipal level with minimal public consultation. The NBMCA would usually sit on a steering committee when municipalities preparing Stormwater Management Plans and would monitor plan implementation to ensure that broader subwatershed interests are being met.

2.10.3 Subwatershed Flood an Erosion Control Study

Flood and Erosion Control Studies are carried out to identify the limits of regulatory flooding as well as areas prone to erosion along watercourses usually at a subwatershed level. Hydrology is studied to identify how regional or higher magnitude flood events move through a watershed. Studies can identify stream hydrology and hydraulics; measure basin responses times and define limits or conditions for new development. Information generated through flood and erosion control studies can be used to size structures such as bridges and culverts or to set standards for stormwater management in tributaries. Hydrology is also used to evaluate remedial actions that can limit the extent of flooding or damages through channelization or removal of obstructions. Hydrology is often studied in conjunction with erosion to consider how the scouring forces of flowing water affect the stream's morphology. Safe setbacks are established near steep or unstable stream banks or in relation to meander belt zones. Older hydrologic and erosion control studies completed by the NBMCA may be affected by evolving land uses in the watershed or changes to water balances caused by climate change. Flood and erosion control studies can include public consultation depending on the magnitude of issues being experienced. Hydrologic/ hydraulic models developed for regulatory flood events are used to support other programs including flood monitoring, forecasting and warning. Flooding and erosion issues are often encompassed into more comprehensive management options discussed below.

2.10.4 Shoreline Management Planning

Usually undertaken for shorelines of large lakes that have dynamic beach environments; shoreline management combines knowledge and understanding of water impacts such as wind tilt, wave uprush and sediment movement with the identification of the damage potential from ice, waves and flooding on shoreline structures and property. Mitigation can include guidelines for lot drainage, slope protection, revetment design, building setbacks and vegetation buffers. Shoreline management plans are developed to ensure sound land use decisions are made that consider both land and water impacts and factors. Other management concerns can also include fish spawning and other aquatic habitat protection needs, recreation and navigation uses of shorelines. Shoreline Management Plans are usually prepared with stakeholder consultation and input.

2.10.5 Comprehensive Subwatershed Management Planning

A Comprehensive Subwatershed Management Plan is usually carried out for quaternary systems that have complex management issues that require inter-agency coordination and greater stakeholder awareness. Water quantity and quality are issues that are usually addressed simultaneously and there are often competing land and water uses to consider. Mitigation opportunities are identified that work with natural features and functions within the subwatershed. Comprehensive subwatershed planning can branch into multijurisdictional issues that affect other agencies and it is possible to have competing stakeholder interests. There is need to develop a common understanding of the complexity of problems and to coordinate management approaches. If significant lakes are involved, planning can include strategies that deal with development capacity limits of water bodies usually for new shoreline lots and other shoreline management needs. Comprehensive watershed management plans require deliberate stakeholder and public consultation strategies as well as implementation collaboration and coordination between agencies.

2.10.6 Integrated Subwatershed Management Planning

An Integrated Subwatershed Management Plan is a new strategy that applies to subwatersheds or higher order systems that face very complex issues, barriers and/or competing interests that limits the probability of achieving management objectives. Integration implies that comprehensive needs will be evaluated with the objective of establishing balance between natural/environmental goals and human (social and economic) goals. Stakeholders may not be sufficiently aware or have a full understanding of complex issues or may be disenfranchised from strategies that offer the stakeholder no direct benefit. The main objective consequently is to examine issues and concerns from a variety of perspectives and to identify implementation strategies that define benefits in environmental, social and economic terms that provide greater meaning to target audiences. Integrated Subwatershed Management may require a more in-depth understanding of resource sector industries, business and/or social institutions operating within a watershed to better understand and define solutions that stakeholders are

more likely to embrace. Integrated Subwatershed Management requires significant interagency coordination and commitment. Integrated Watershed Management also needs a deliberate stakeholder and public consultation strategy and may require special efforts to reach targeted interest groups and stakeholders. This approach might strive to link "watershed health" to public and economic health, growth and prosperity. Integrated watershed management can engage a continuous cycle of identifying watershed issues and concerns; planning and implementing management strategies, monitoring and reporting on the impacts of efforts taken, reviewing and evaluating strategy effectiveness, and then modifying strategies to improve management outcomes.

The hierarchy of management identified in this Integrated Watershed Management Strategy is summarized in **Table 11**. The highest level of management achieved in each subwatershed is illustrated in **Figure 4** and is summarized in **Table 12.**

Table 11 - Hierarchy of Watershed Management

Management Hierarchy	Intended Application Level	Lead Agency	Management Plan Participants
Ad Hoc/No Plan	N/A	N/A	N/A
Stormwater Management Plan[1]	Tributaries	Municipality	Municipalities Con Authority Developers
Subwatershed Hydrology/Flood & Erosion Control Study	Tributaries/Subwatersheds	Conservation Authority	Municipalities Prov Agencies Con Authority
Shoreline Management Plan	Shoreline Subwatershed	Conservation Authority	Municipalities Prov Agencies Con Authority Public
Comprehensive Management Plan	Subwatersheds/Watersheds	Conservation Authority	Municipalities Prov Agencies Con Authority Public
Integrated Management Plan	Subwatersheds/Watersheds	Conservation Authority	Municipalities Prov Agencies Con Authority Public

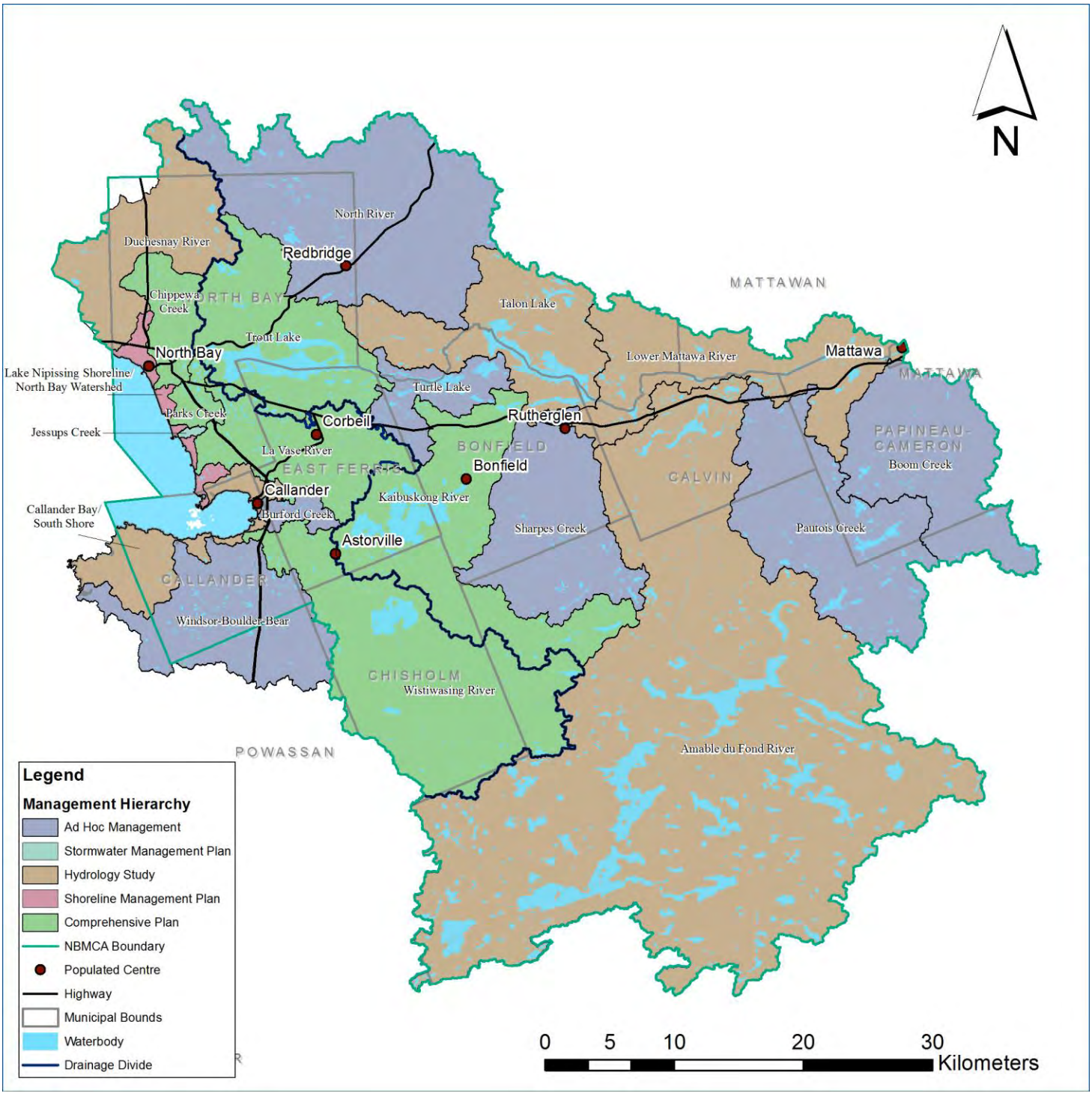
1 This is distinguished from a Stormwater Management Study prepared by a developer for a subdivision

Table 12 - Current Management Hierarchy for NBMCA Subwatersheds/Threatened Tributaries

Hierarchy of Existing Watershed Management			
Subwatershed and Significant Tributaries	**Highest Level of Management**	**Studies for Significant Tributaries**	**Existing Secondary Protection**
Duchesnay Creek	Hydrology Study		
Canadore Trib			
Chippewa Creek	Comprehensive Plan		Pollution Prevention Plan
Eastview Trib		Hydrology Study	
Johnson Trib		Hydrology Study	
Golf Club Trib		Stormwater Mgmt Plan	
North Airport Trib			
Park Creek	Comprehensive Plan[1]		Pollution Prevention Plan
Jessups Creek	Stormwater Mgmt Plan		Pollution Prevention Plan
La Vase River	Comprehensive Plan		Pollution Prevention Plan
Cooks Creek Trib		Hydrology Study[6]	
Lake Nipissing/North Bay	Shoreline Mgmt Plan		Pollution Prevention Plan
Pinewood Parkway Trib		Hydrology Study	
Bond Street Trib			
Gauthier Trib			
Windsor/Boulter/Bear			
Windsor			Source Water Protection
Boulder			
Bear			
Burford Creek			Source Water Protection
Callander Bay/South Shore	Hydrology Study		
Cranberry Trib			Source Water Protection
Trib #1			Source Water Protection
Trib #2			Source Water Protection
Wistiwasing River	Comprehensive Plan		Source Water Protection
Graham Cr Trib			
Wasi Lake Trib			
North River			
Balsam Trib			
Trout Lake	Comprehensive Plan		Pollution Prevention Plan Source Water Protection
Armstrong Trib			
Lees Trib		Stormwater Mgmt Plan	
Dorans Trib			
Four Mile Trib/Bay			
Long Lake Trib			Provincial Park Plan
Turtle Lake			Provincial Park Plan
Kaibuskong River	Comprehensive Plan[2]		Pollution Prevention Plan[2]
West end of L Nosbonsing			
Depot Trib			
Lake Talon	Hydrology Study[3]		Provincial Park Plan
Kaibuskong Bay			
Upper Mattawa Trib			Provincial Park Plan
Sharpes Creek			
Blueseal Trib			
Amable du Fond River	Hydrology Study[4]		Provincial Park Plan[8]
Kelly Creek			
Pautois Creek			
Headwater Lakes			
Boom Creek			
Lower Mattawa River	Hydrology Study[5]		Provincial Park Plan
Earls Lake Trib		Hydrology Study[7]	

1. Parks Creek has a Comprehensive Inventory but recommendations are restricted to flood damage reduction strategies
2. Lake Nosbonsing watershed only
3. Lake Talon only
4. Smith Lake only
5. Lake Chant Plein and Lower Mattawa River below Hurdam Dam including Town of Mattawa
6. As part of lower La Vase and Cooks Creek Hydrology Study
7. Earls Lake only
8. Forestry is a permitted Land Use in Algonquin Park

Figure 4 – Management Hierarchy in NBMCA Subwatersheds/Threatened Tributaries



3.0 SUBWATERSHED MANAGEMENT ISSUES AND NEEDS

3.1 INTRODUCTION

Integrated subwatershed management issues and needs can be determined from an understanding of current subwatershed health, recent subwatershed trends, the current level of management being provided, and the successes of management actions to affect improvements. These characterizations are only possible if adequate information is available. Impacts anticipated within the planning horizon are identified for each system. Subwatershed needs and issues are presented from multiple perspectives to explore a more holistic understanding of their environmental, societal and economic values.

At a full watershed scale, the Technical Background Report, completed in Phase I, has aggregated a list of information gaps or deficiencies for the various subjects evaluated. Refining the understanding of NBMCA features, conditions, processes, resource values and stresses over time will aid in refining the description of protection needs. **Table 13** lists the aggregated information gaps and deficiencies as well as the implications that gaps have to watershed management at a tertiary scale.

Many information gaps and deficiencies at a subwatershed scale are identified below. Significant baseline data gaps exist in many subwatersheds that hamper the identification of management needs. Subwatersheds that have been within the NBMCA's jurisdiction since its inception have received preliminary assessment work including preliminary hydrologic and erosion evaluations. Some subwatersheds have received preliminary resource evaluation work such as wetland evaluation, stream habitat characterization or basic water quality data collection; or have benefited from regional studies. Subwatersheds added to the NBMCA in 2002 have significant information deficits. All subwatersheds lack social and economic information. An environmental baseline data collection guide has been included in **Table 14**.

The remainder of this section identifies needs and issues and determines the level of management in place for each subwatershed. The perceived success of management efforts to date is evaluated and strategies for managing each subwatersheds or major tributaries in the near term are discussed. Subwatershed needs and issues are advanced from the three integrated perspectives. The social evaluation portrays public needs and issues related to access and appreciation for subwatershed attributes. The economic perspective considers local economic needs and issues surrounding continued economic growth, development and access to resources. Subwatershed social and economic representations are crude, due to an absence of reliable information, and refinement through additional research is recommended as part of the preparation for implementation of recommendations, if necessary. Key findings are summarized at the conclusion of the section.

Table 13 - Information Gaps and Needs for Tertiary Watersheds

Watershed Component	Gap or Information Need	Issue	Benefit or Outcome Achieved	Potential Applications
Bedrock	More comprehensive evaluation including formation and implications of faults, plate boundaries, slip zones and dykes to deep groundwater movement	Groundwater	Interpretive, refinement of regional deep groundwater movement and yields	Ecotourism, hydrogeological interpretation (potential for higher yielding bedrock aquifers)
Quaternary Features	Inventory, evaluate and determine significance of surface features	Natural and Cultural Heritage	Resource identification and interpretation, refinement of understanding of the role that the Mattawa Lowlands played in the early stages of Great Lakes Evolution including the Lake Nipissing Great Lake Phase.	Ecotourism, interpretation will lead to an understanding of location of significance of watershed features that help to explain the evolution of the Great Lakes and use of the area by indigenous peoples
Soils	Geomorphological evaluation of potential for erosion/sedimentation	Aquatic Habitat	Improvement of understanding or risk associated with erosive forces	Improved understanding of needs associated with development and Land Use change including standards for Stormwater Management
Groundwater	Inventory and evaluate significant regional aquifers in unconsolidated overburden including recharge/ discharge importance	High Yield Aquifers and Stream Base Flow	Improved understanding of water balance, aquifer protection needs and aquifer utilization opportunities	Advanced understanding of the importance of a resource feature and potential for rural economic development
Climate	Evaluate climate change impacts to Intensity Duration Frequency (IDF) curves when sufficient data becomes available	Stormwater and flood design criteria become outdated	Stormwater and flood design criteria is updated so that it remains effective	Sizing of conveyance systems so they are effective through their life expectancy, protection of property
	Improve watershed monitoring for Intensity Duration Frequency (IDF) of isolated storm events	The IDF of large isolated storms are not being recorded and integrated into regional risk assessment	Improved understanding of risk associated with climate change	Better public awareness of risks and protection needs
Water Quantity	Expand flow monitoring network to more subwatersheds	Not detecting water management issues	Establishing accurate baseline information for subwatersheds	Better public awareness of risks and protection needs
	More accurately measure contributing areas to gauges and refine subwatershed water balance information	Water Availability/Water Use/Flooding	Establishing accurate baseline information for subwatersheds	Better able to evaluate new water taking proposals & understand flood risks
	Expand coverage of fill line mapping to additional areas to flag floodplains, erosion zones, meander belts, unstable soils, hazard lands	Natural Hazards	Provides a red flag for issues that could potentially threaten public safety or put property at risk	Fill line mapping is used in municipal planning documents as an early warning mechanism for development
Water Quality	Complete Lake Capacity Assessment using 50% of pristine criteria for large waterbodies with development potential	Lake Protection	Establishing accurate baseline information for large lakes to be used to control new development	Improved understanding of natural lake characteristics and lake management needs
	Expand sampling locations and restrict parameters to useful data to include areas with limited information available (potentially on a temporary basis)	Aquatic Health	Establishing accurate baseline information for subwatersheds	Improved understanding of needs associated with development and Land Use change including standards for stormwater
Ecology	Inventory and refine Ecodistrict 411 and 413 details for the NBMCA area of jurisdiction	Terrestrial Characterization	Establishing and refine accurate baseline information for NBMCA Ecodistricts/Ecoregions	Improved understanding of regional living environment and relationship to other parts of Ontario and Canada
	Improve understanding of linear habitat/corridors protection needs	Terrestrial Health/Linkages	Improved understanding of the relationship between habitat and wildlife	Improved understanding of needs associated with development, land use planning and resource industry uses
Significant Features	Undertake more wetland evaluations and assess other significant features	Aquatic and Terrestrial Health and Protection needs	Improved understanding of the function and values of wetland areas and protection needs	Improved understanding of needs associated with development, land use planning and resource industry uses and to establish a northern baseline that can help the province understand northern wetland policy needs
Natural Heritage	Identify the components of natural infrastructure	Natural Heritage Features	Improved understanding or relationships between natural features and management needs	Improved understanding of needs associated with development, land use planning and resource industry uses
Cultural Heritage	Complete a Regional Cultural Heritage Master Plan in conjunction with inventory of Quaternary features and develop probability rankings for natural features	Cultural Heritage	Improved understanding/ protection of the indigenous and early historic uses of the area and site evaluation needs	Improved understanding of needs associated with development, land use planning and resource industry uses
Benthic Macroinvertibrates	No baseline data base	Aquatic Health and Sensitivities	Improved understanding of aquatic habitats and tolerance levels to impacts	Better understanding of ecological health and tolerance levels
Fish	Improve understanding of spawning areas and rehabilitate underutilized spawning areas	Aquatic Health/Natural Regeneration	Improve baseline information and enhance spawning areas to improved natural reproduction	Improved understanding of needs associated with development, land use planning and resource industry uses and improved fishing opportunities
Wildlife	Monitor habitat changes and vulnerable population shifts	Terrestrial and Aquatic Health	Improved baseline information on wildlife	Better understanding of ecological health
Species at Risk	Evaluate and identify critical habitat areas for locally significant species at risk	Regional Biodiversity	Improved baseline information on critical habitats	Improved understanding of needs associated with development, land use planning and resource industry uses
Invasive Species	Monitor provincial trends of species migrations, stay alert to risks and develop protection strategies for probable invasions	Regional Biodiversity/Public Health	Early detection and management of threats before they become unmanageable	Protection of existing resource base, possible marketing opportunity to vacation or live in the region and enjoy less risks
Lake Nipissing Specific	Update flood and wave damage estimates for the two shoreline subwatersheds. Assessment should include changing lake management capacity assessment from dam reconstruction and flood limit interpretation and impact of climate change.	Potential Shoreline Property Damage	The evaluation of flood and wave damage potential can reposition priorities that MNR/PWGSC places on determining risk in lake management policies	Improved public awareness of risks associated with flood and wind damage on the Lake Nipissing shoreline can help with implementation of protection programs
	Better understand International Joint Commission (IJC) Great Lakes needs and local implications	Great Lakes Health	Positive contribution to higher management interests and with local benefits	Ecotourism, public awareness of riparian obligations
Mattawa River Specific	Establish Mattawa River baselines to measure management success at a tertiary watershed scale	Mattawa and Ottawa River Health	Monitoring Mattawa River baseline conditions is a comprehensive evaluation tool to determine how all subwatershed management activities are working in combination	Improved evaluation criteria and use of information for ecotourism, public awareness and improved stewardship

Table 14 - Base Line Inventory Data Collection Guide

Baseline Data
Development of Large Scale Hydrology Mapping for Watersheds (GIS)*
Digital Elevation Modelling for each Subwatershed (GIS)
Refinement of Other Data/Layers
Approximate Regulated Areas
Flood Hazards
Erosion Hazards
Climate Stations (Meteorology)
Air Temperature; Precipitation
Groundwater Quality
Provincial Groundwater Monitoring Network
Groundwater Quantity
Piezometers
Provincial Groundwater Monitoring Network
Surface Water Quality
Provincial Water Quality Monitoring Network
Benthic Surveys
Lake Capacity Assessment
NBMCA Monitoring
Other
Surface Water Quantity
Hydrometric Stations
Staff Gauges
Temporary Flow Gauges
Base flow
Snow Course
Flood Debris and Damage
Regional IDF Curve
Cultural Heritage Features
Aquatic Resources
Fish
Benthic Invertebrates
Macro Invertebrates
Terrestrial Natural Heritage
Species at Risk
Invasive Species
Field verification of vegetation communities
Land cover change

*Large Scale hydrology is the process of generating a 1:2000 scale dataset of hydrological features across subwatershed landscapes based on recent and highly accurate orthophotography. In practice this means correcting stream meanders, digitizing man made adjustments to streams, and capturing shorelines, also to a 1:2000 scale. Large scale hydrology editing creates a holistic and accurate dataset, in that the attribute data attempts to capture features not currently in existing provincial datasets for hydrological features. So ditches that flow intermittently or year round, agricultural-based drainage and irrigation, culverts, storm water drains. Large scale hydrology datasets, when combined with 1:2000 digital terrain models, allow for highly accurate drainage and flow models (or input into archydro, hec-ras, etc) and allows decision makers to have a detailed and accurate source of information to affect planning decisions, regulatory decisions and to communicate these with confidence to public and other stakeholders. Also, combining 1:2000 terrain with accurate large scale hydrological features provides a time and economically efficient way to begin to generate regulatory floodlines for conservation authorities.

3.1.1 Duchesnay Creek Subwatershed

The Duchesnay Creek subwatershed was subject to regional hydrologic assessment when the NBMCA was first established (by Dillon, 1975) but this subwatershed has subsequently been managed in an ad hoc fashion. The understanding of subwatershed management issues and concerns has consequently remained relatively rudimentary. The Duchesnay Creek subwatershed is in a state of equilibrium with slightly degraded conditions. Forecasted impacts that may affect this subwatershed within the planning horizon of this IWMS can be summarized as follows:

- Encroachment of serviced development and expansion of the College/University Complex within the Canadore tributary
- Expansion of unserviced development along the Highway 11 North Corridor
- Fishing pressure on its cold water fishery (brook trout)
- Possible recreational pressure impact in the vicinity of Duchesnay Falls and on small watershed lakes
- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)

Duchesnay Creek subwatershed management needs and issues have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- An enhanced baseline inventory is required to determine current conditions, trends and resource protection needs (see **Table 14** for guidelines)
- Assess and protect hydraulic conditions within the Canadore Tributary to prevent downstream erosion/property damage (including assessing the impact of a possible inter-tributary transfer from Pinewood Parkway Creek)
- Monitor the protection of Duchesnay Creek Provincially Significant Wetland
- Assess and develop protection needs for the overburden aquifer in the middle of the subwatershed
- Assess the impacts of extreme low flow conditions
- Protect walleye spawning grounds at the mouth of Duchesnay Creek
- Re-evaluate erosion potential and further investigate brook trout spawning areas of the main channel and upstream tributaries
- Assess the benefit of re-activating a discontinued stream flow gauge (or establishing a new gauge) for this system (if long term hydrologic/hydraulic modeling is anticipated)
- Consider developing floodplain mapping for upper reaches of this system
- Inventory and assess cultural heritage features and values

- Re-vegetate abandoned pits/aggregate extraction areas

2. Social Needs and Issues:

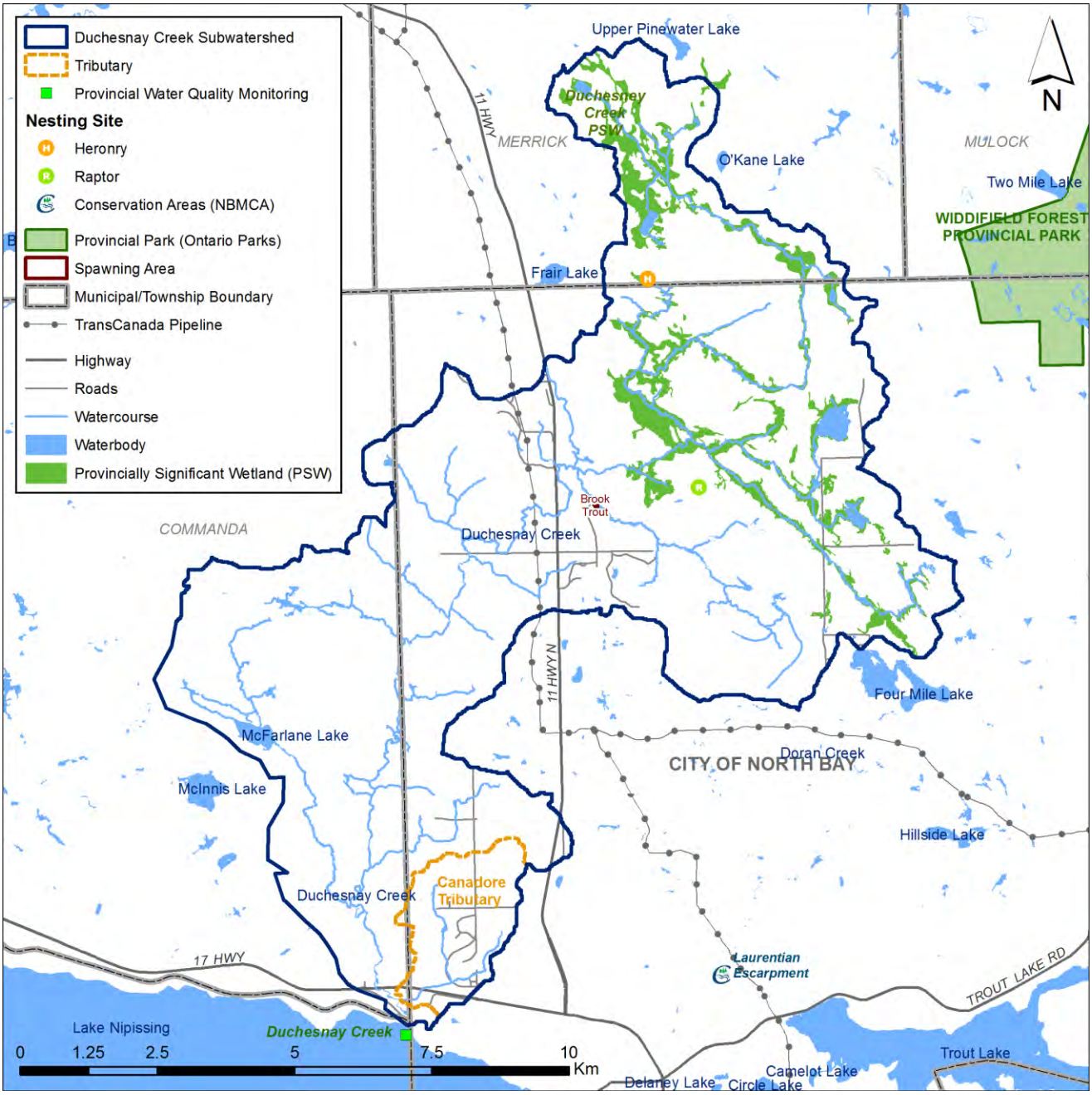
- Continued public access to Duchesnay Falls/lower stream corridor and to the North Bay Escarpment (and connect with linear trails across the North Bay Escarpment)
- Maintain or improve fishing opportunities for brook trout
- Identification and protection of cultural heritage features

3. Economic Needs and Issues:

- Continued growth and expansion of the College University Complex within the Canadore Tributary
- Gradual extension of municipal servicing and urbanization into the Canadore tributary above the escarpment as per new direction from the City of North Bay Official Plan
- Industrial, institutional and commercial growth and infilling in the lower Canadore tributary below the North Bay escarpment including the former Nordefibre property
- Rural industrial growth along Highway 11 N corridor with reliance on private servicing
- Conversion of TransCanada gas pipeline to carry crude oil

Duchesnay Creek has been evaluated to have moderate to high vulnerability/sensitivity to climate change and low vulnerability to land use change impacts. The current ad hoc approach should provide adequate protection for the next 20 years with the exception of the Canadore tributary. Conditions are stable but continue to be slightly degraded based on water quality data presented in the Technical Background Report. Improvements to baseline conditions are possible. Risks posed by the conversion of a natural gas pipeline to carry crude oil within this subwatershed are not fully known at the time of preparing this IWMS. A Stormwater Management Plan for the Canadore tributary will likely be required to protect natural functions and features within this tributary as well as at the mouth of Duchesnay Creek. A review of the management approach should be conducted once baseline conditions are evaluated.

Figure 5 - Duchesnay Creek Subwatershed



3.1.2 Chippewa Creek Subwatershed

The Chippewa Creek subwatershed is managed pursuant to a Comprehensive Watershed Management Study developed in 1996. Known management issues and concerns have been relatively well investigated. Most cultural heritage, hydrological/stormwater and recreational recommendations made within the Chippewa Creek Watershed Management Study have not

been implemented. Further technical analysis and an implementation framework would be required and the relevancy of some of the recommendation may require review. Most resource features within the Chippewa Creek subwatershed are considered stable (its environment and resource features are maintaining their current qualities and characteristics); however, many watershed conditions remain in a degraded state and improved baseline conditions are possible. Forecasted impacts that may affect this subwatershed within the planning horizon of this IWMS can be summarized as follows:

- Continued urban expansion/infilling within the Golf Club Creek Tributary, the Eastview Tributary and the Johnson Creek tributary
- Continued expansion of unserviced development along the Highway 11 North Corridor
- New serviced industrial growth planned for the North Bay Airport may encroach into the Chippewa Creek headwaters on the north side of the Airport within the horizon of this strategy (long term)
- New unserviced industrial growth may occur along the proposed extension of Marsh Drive to Four Mile Lake Road through the Chippewa Creek headwaters
- General infilling and redevelopment in the existing settlement area
- Continued aggregate extraction and quarrying in headwaters
- Development impacts created by the construction of the North Bay bypass (long term)
- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)

Chippewa Creek subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Re-assess flood damages in flood damage centers along the lower Chippewa Creek main channel that may still be exposed to storm events greater than the 25 year return period. Flood risks in the lower main channel should be addressed before upper watershed development or intensification occurs
- Consider updating floodplain mapping for remaining flood damage centers
- Review floodplain standards used for regulatory control purposes (1:100 year vs Timmins Storm) and interpretation of provincial two zone floodplain policies
- Update intensity-duration-frequency (IDF) curves (when data is available) and project changes that that may result from climate change impacts
- Update policies and screening maps used for development control and integrate new information into the City of North Bay's Official Plan and Zoning By-law

- Establish stormwater management objectives (including managing and coordinating peak flows) from Johnson Creek and Golf Club Creek tributaries (near term) and Airport tributary (long term) to protect downstream flood and erosion control interests
- Sediment loads to the main channel remain high. Sources of sediment above the North Bay escarpment should be identified and mitigated
- The size and purpose of stormwater management ponds recommended in the Chippewa Creek 1996 Management Plan should be reviewed. An implementation framework is required to determine when these structures will be required
- Protect Chippewa Creek Provincially Significant Wetland and locally significant wetlands identified in the Chippewa Creek Watershed Management Study
- Protect cold water habitat in headwater streams
- Identify and protect critical habitat for identified species at risk
- Improve the understanding of the value of the overburden aquifers in the headwaters
- Headwater management including the control of deforestation will be long term issues. Headwater protection is needed in the Airport tributary as well as in the Golf Club and Johnson Creek tributaries. A Master Drainage Plan for Airport Heights is identified in the North Bay Infrastructure Background Study (see Section 4.5.2) in part to address this issue in the vicinity of the North Bay Airport (Master Drainage Plans are discussed on pg. 14).
- In the long-term, water quality has generally improved but it still doesn't conform to all Provincial Water Quality Objectives. Further mitigation is required (total phosphorous and bacteriological management objectives should be established)
- Improve recreational water quality at creek outlet to Lake Nipissing

<u>2. Social Needs and Issues:</u>

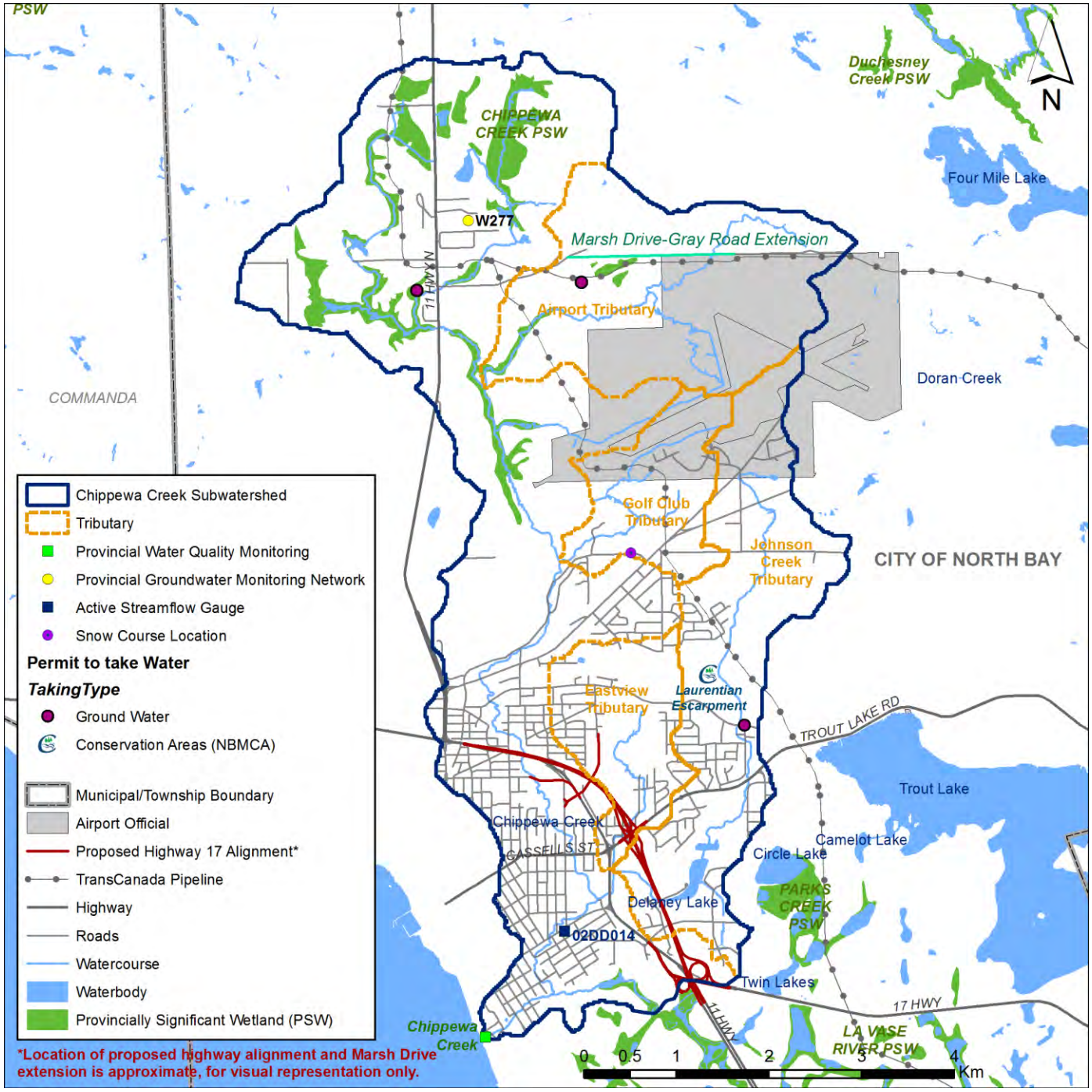
- Protection of homes, businesses and property in remaining flood fringe areas
- Continued access to Lake Nipissing at mouth
- Continued enjoyment and expanded interpretation of the main creek valley corridor used for recreation and non-motorized transportation
- Access to upper stream valley corridor with connections to other trail systems across the escarpment
- Improved access for fishing opportunities in the headwaters (for Brook Trout)
- Identification and protection of cultural heritage features

3. Economic Needs and Issues:

- Growth and Sustainability of the North Bay Airport and associated uses
- Extension of urban services into the upper Chippewa Creek valley and into the lands north of the North Bay Airport
- Reliance on groundwater and septic servicing along Highway 11 North and along Marsh Drive/Four Mile Lake Road to meet servicing needs of development in these areas
- Sustainable aggregate production in headwaters
- Conversion of TransCanada gas pipeline to carry crude oil

Chippewa Creek has been evaluated to have high vulnerability/susceptibility to climate change and a moderate vulnerability to land use change impacts. Recent channel improvements on the lower main channel may not provide adequate protection to surrounding properties from future climate change impacts. Growth on the north side of the North Bay Airport and along a new extension of Four Mile Lake Road was not anticipated in the Chippewa Creek Watershed Management Study. Erosion control efforts have reduced sediment sources on the main channel but sources still persist in the headwaters and sediment load is still relatively high. Current management strategies may lack sufficient details or technical justifications and may no longer adequately address future needs due to climate change. The preparation of a Master Drainage Plan for the Airport Heights Industrial Park was recommended in the City of North Bay Infrastructure Study (Stantec, 2008). Risks posed by the conversion of a natural gas pipeline to carry crude oil are not fully known at the time of preparing this IWMS. An Integrated Watershed Management Plan for the Chippewa Creek subwatershed that includes headwater management strategies may be warranted to accommodate new headwater development initiatives and to protect downstream interests.

Figure 6 – Chippewa Creek Subwatershed



3.1.3 Parks Creek Subwatershed

The Parks Creek subwatershed is managed pursuant to a Flood Damage Reduction Study completed in 1992. This study included a comprehensive review of subwatershed environmental characteristics. Consequently management issues and concerns are fairly well understood. Study recommendations however have only addressed flood damage reduction strategies. Backflood protection from Lake Nipissing has been implemented but recommendations such as establishing foundation drainage collection systems and flood proofing of structures in the floodplain below the CP railway tracks in the West Ferris Planning District of North Bay are outstanding. Comprehensive management recommendations have not been developed for this subwatershed. A lack of hydrologic gauging information may affect the precision to which hydrologic models can be calibrated for this drainage system. Conditions in the Park Creek subwatershed are considered stable (its environment and resource features are maintaining their current qualities and characteristics); however, there is considerable room to improve many baseline conditions such as water quality, which remains outside of Provincial Water Quality Objectives for a number of parameters. The anticipated impacts that may influence this subwatershed within the planning horizon of this strategy can be summarized as follows:

- Headwater urbanization and intensification on full municipal services
- Possible exacerbation of the flood spillage from Delaney Lake to Circle Lake due to climate change impacts
- Unserviced highway commercial/industrial development along the Highway 17 corridor.
- Continued infilling/redevelopment within the lower urban settlement area and within the currently defined floodplain
- A newly identified interchange for Highways 11 and 17 at eastern fringe of the Parks Creek subwatershed may resurrect an interest of the City of North Bay to establish a highway connection into the West Ferris Planning Area of the City (long term)

Parks Creek subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Protection of headwater lakes (primarily from stormwater impacts)
- Monitor the protection of Parks Creek Provincially Significant Wetland (including protection of its hydrologic functions)
- Establishment of a stream flow gauge to generate data needed to refine flood damage calculations and to revise floodplain mapping
- Preservation of lower main channel hydraulics and wetland storage functions

- Improve the quality of water discharged to Lake Nipissing (establish total phosphorous and bacteriological management objectives)

2. Social Needs and Issues:

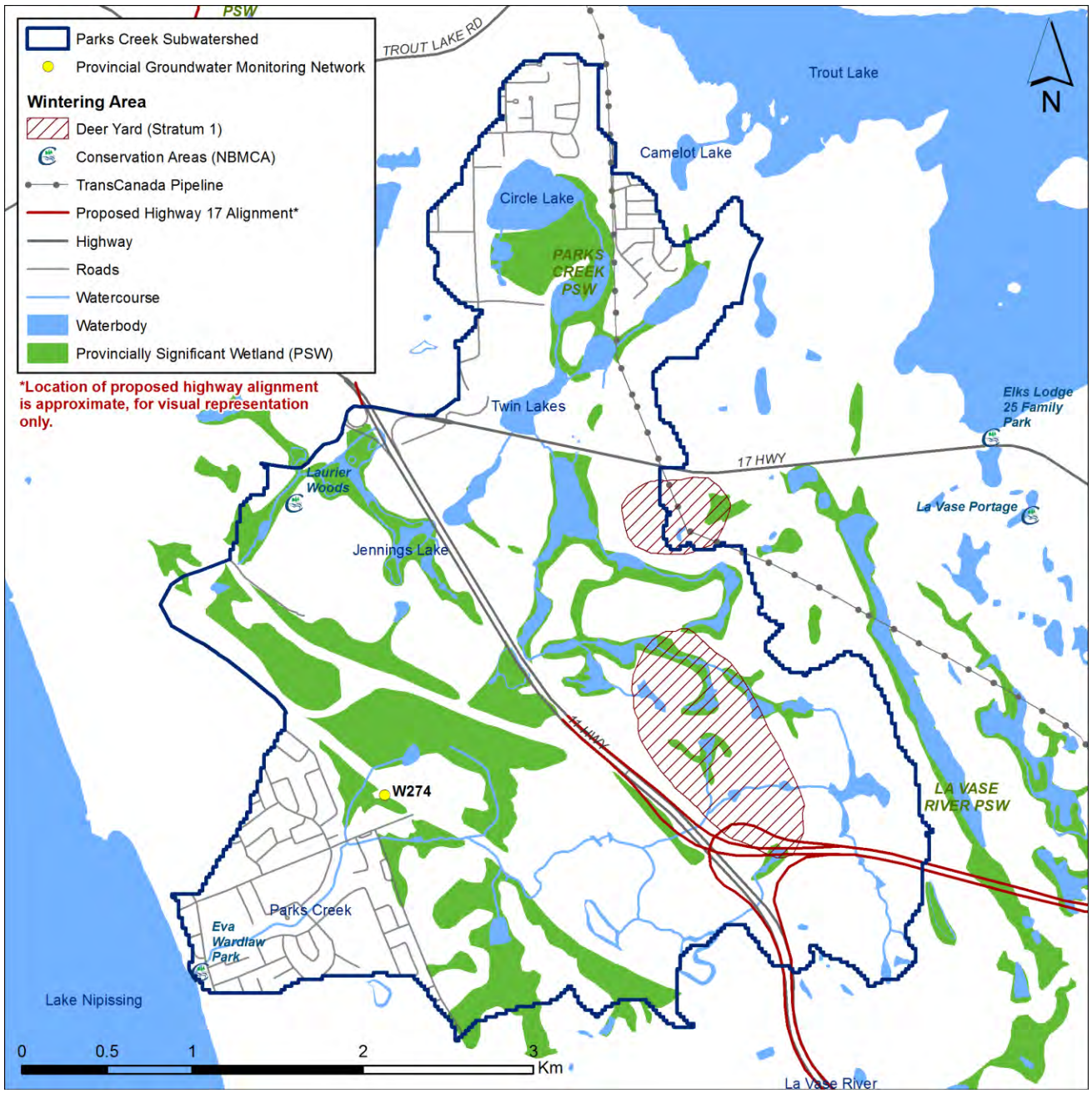
- Protect homes, businesses and properties subject to flooding from Parks Creek, primarily along the lower channel near Lake Nipissing (current flood damage reduction strategies seem to be inactive)
- Continued public access and wildlife viewing opportunities in Parks Creek Provincially Significant Wetland/Laurier Woods Conservation Area
- Improved public access to headwater lakes (i.e. ensure access is provided through Plans of Subdivision and consider requesting shorelines property as parkland dedication)
- Continued public access to Lake Nipissing and the lower main channel of Parks Creek
- Further assessment and interpretation of cultural heritage features

3. Economic Needs and Issues:

- Extension of urban services into Parks Creek headwaters
- Infilling and intensification within the existing settlement area
- Potential renewed interest in improved access to West Ferris from the planned Highway 11/17 interchange (long term)

Parks Creek has been evaluated to have mixed vulnerability/susceptibility to climate change and land use change impacts. The current floodplain management strategy offers limited protection of resource features within the Parks Creek subwatershed such as headwater lakes. Some resource features have been protected through the Provincially Significant Wetland designation. At a minimum Stormwater Management objectives are required to guide headwater development. Parks Creek currently has a significant flood damage center along the lower main channel. Hydrologic analysis would benefit from stream flow data to more accurately calibrate hydrologic models and a hydrologic update may be warranted to factor in climate change impacts. A Comprehensive Watershed Management plan may be warranted in the long term to consider additional resource management needs if baseline monitoring detects resource degradation.

Figure 7 – Parks Creek Subwatershed



3.1.4 Jessups Creek Subwatershed

The Jessups Creek subwatershed is currently managed pursuant to a Subwatershed and Stormwater Management Plan prepared by the City of North Bay in 2000. The plan includes comprehensive basin management considerations. This plan was developed in recognition that this subwatershed was subject to imminent development pressures. Historic flood risks near the

mouth have been mitigated through channel improvements and enlargement of a bridge on Lakeshore Drive. Additional channelization and berm reinforcement has been identified to permit further encroachment of development into flood prone areas in the lower watershed. The level of awareness of management issues and concerns in this small catchment area are fairly well defined. Recent data for environmental conditions and resource features are not available but are presumed to be stable as basin conditions have not changed significantly since the plan was completed. This subwatershed has degraded baseline conditions including poor water quality which does not meet Provincial Water Quality Objectives for many parameters. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Urban residential and industrial growth on full municipal services (water and sewer)

Jessups Creek subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Protection of important wetland functions (including hydrologic functions)
- Preservation of main channel hydraulics (including maintenance of sedimentation)
- Water quality improvements (establish total phosphorous and bacteriological management objectives)
- Protection of critical habitat
- Construction of stormwater management infrastructure in advance of development

2. Social Needs and Issues:

- Protection of wildlife viewing opportunities
- Public access to Lake Nipissing at mouth

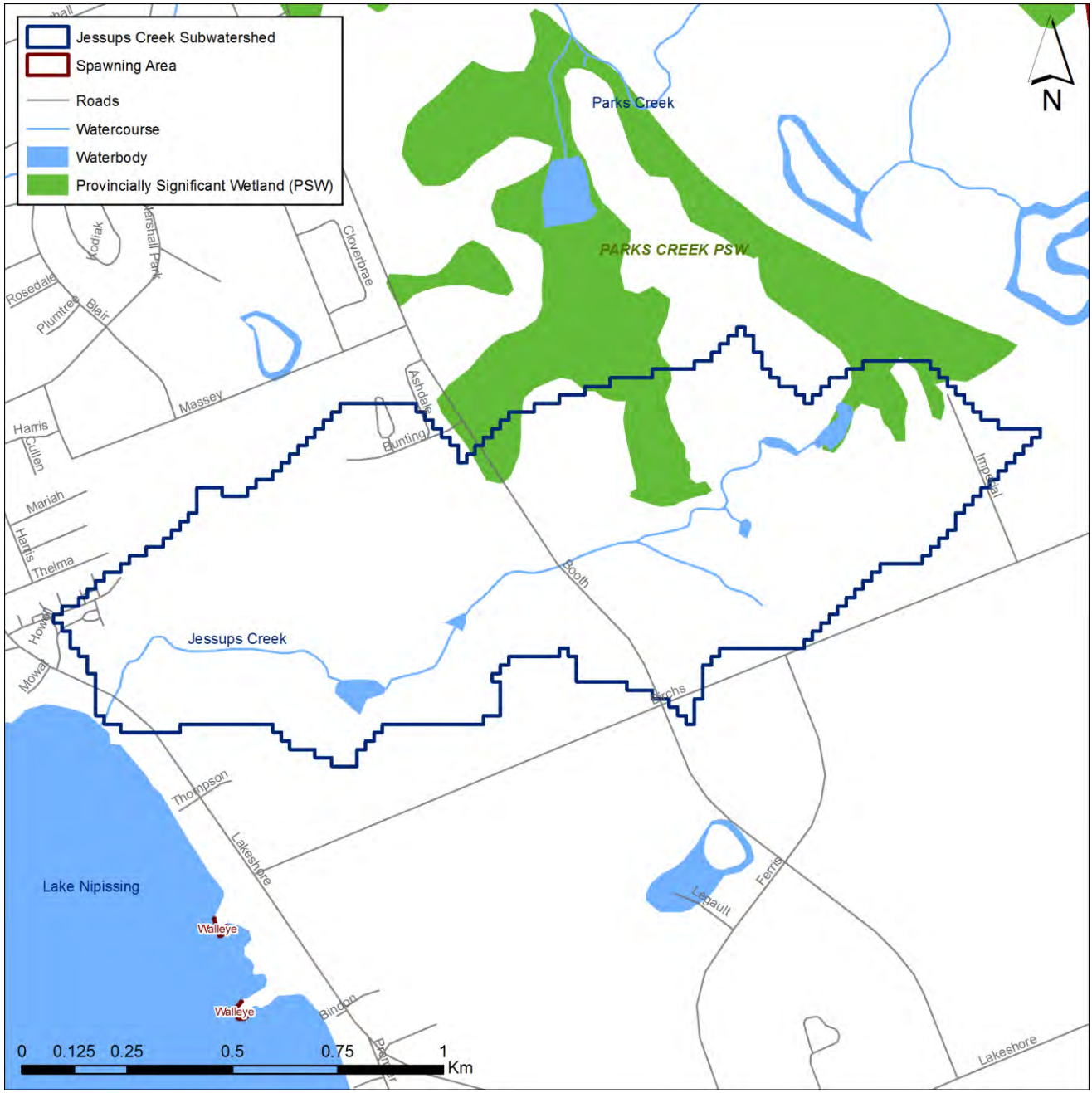
3. Economic Needs and Issues:

- Extension of urban services into subwatershed
- Expansion of Industrial development along Birchs and Booth Road

Jessups Creek subwatershed has low vulnerability and moderate susceptibility to climate and a low vulnerability to land use change. The current management approach provides sufficient flood protection near the stream outlet. The Subwatershed and Stormwater Management Plan recommends that detention ponds be added as the watershed is developed to maintain natural flows and existing water quality. New information concerning species at risk habitat was not anticipated when the current management plan was completed. Stormwater management practices have also shifted to favour source controls that preserve natural infiltration and base

flow conditions. Hydrologic assessment of this system should be reviewed once new intensity-duration-frequency (IDF) information for the area is released. Any re-evaluation of management needs should consider protection needs for critical habitat and strategies and to improved water quality. This additional work is not sufficient to necessitate new planning at this time. Resource conditions should be closely monitored.

Figure 8 – Jessups Creek Subwatershed



3.1.5 La Vase River Subwatershed

The La Vase River subwatershed is managed pursuant to the La Vase River Watershed Management Study completed in 1997. This study included a comprehensive assessment of the subwatershed and consequently the understanding of management issues and concerns seem well advanced. Comprehensive study recommendations deal with flooding and erosion, water quality and resource protection including protection of wetland and heritage features. Recommendations such as repair of stream bank erosion along the lower La Vase below Riverbend Road, protection of wetlands not deemed provincially significant, strategies to improve water quality and further development of heritage information including interpretation for tourism and recreational benefits remain outstanding and their current relevancy in unknown. Resource features and conditions of the La Vase River subwatershed are considered stable (its environment and resource features are maintaining their current qualities and characteristics) however there is room to improve baseline conditions. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Infilling of headwaters with low density rural development including hobby farms
- Intensification of highway commercial development along Pinewood Park Drive and along Highway 17
- General infilling and extension of urban services between Highway 11 and Lake Nipissing
- Development of a Highway 17 four lane highway (long term)

La Vase River subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Review lower main channel stream banks stabilization needs including anticipated impacts from climate change
- Monitor protection of La Vase River/Dreany Lake Provincially Significant Wetland and establish protection needs of non-provincially significant wetlands to be impacted by development including highway development
- Further assess and protect cultural heritage features
- Investigate the impact of the numerous liquid depot dumps identified within this subwatershed
- Evaluate new strategies to improve Water Quality (establish total phosphorous and bacteriological management objectives)
- Consider updating hydrology/hydraulic models and floodplain mapping. The water levels on Lake Nipissing have a large influence on flooding in the lower reaches of this system.

Lower floodplain mapping may require reevaluated based outcomes identified in two shoreline subwatersheds to review Lake Nipissing operational guidelines

- Review floodplain standards used for regulatory control purposes (1:100 year vs Timmins Storm) and interpretation of provincial two zone floodplain policies
- Update intensity-duration-frequency (IDF) curves (when data is available) and project changes that that may result from climate change impacts
- Assess the impact of extreme low flows on aquatic habitat and water use
- Identify and protect critical habitat for identified species at risk

2. Social Needs and Issues:

- Maintain navigability of the mouth of the La Vase River/access to Lake Nipissing
- Protect properties from stream bank erosion below Riverbend Road
- Continued assessment and interpretation of heritage values and associated wilderness/wildlife viewing opportunities
- Re-establishment of the use of the La Vase portages for canoe use
- Increased access, appreciation for and protection of the portion of the River with a Canadian Heritage Rivers Designation (including increased public land ownership)

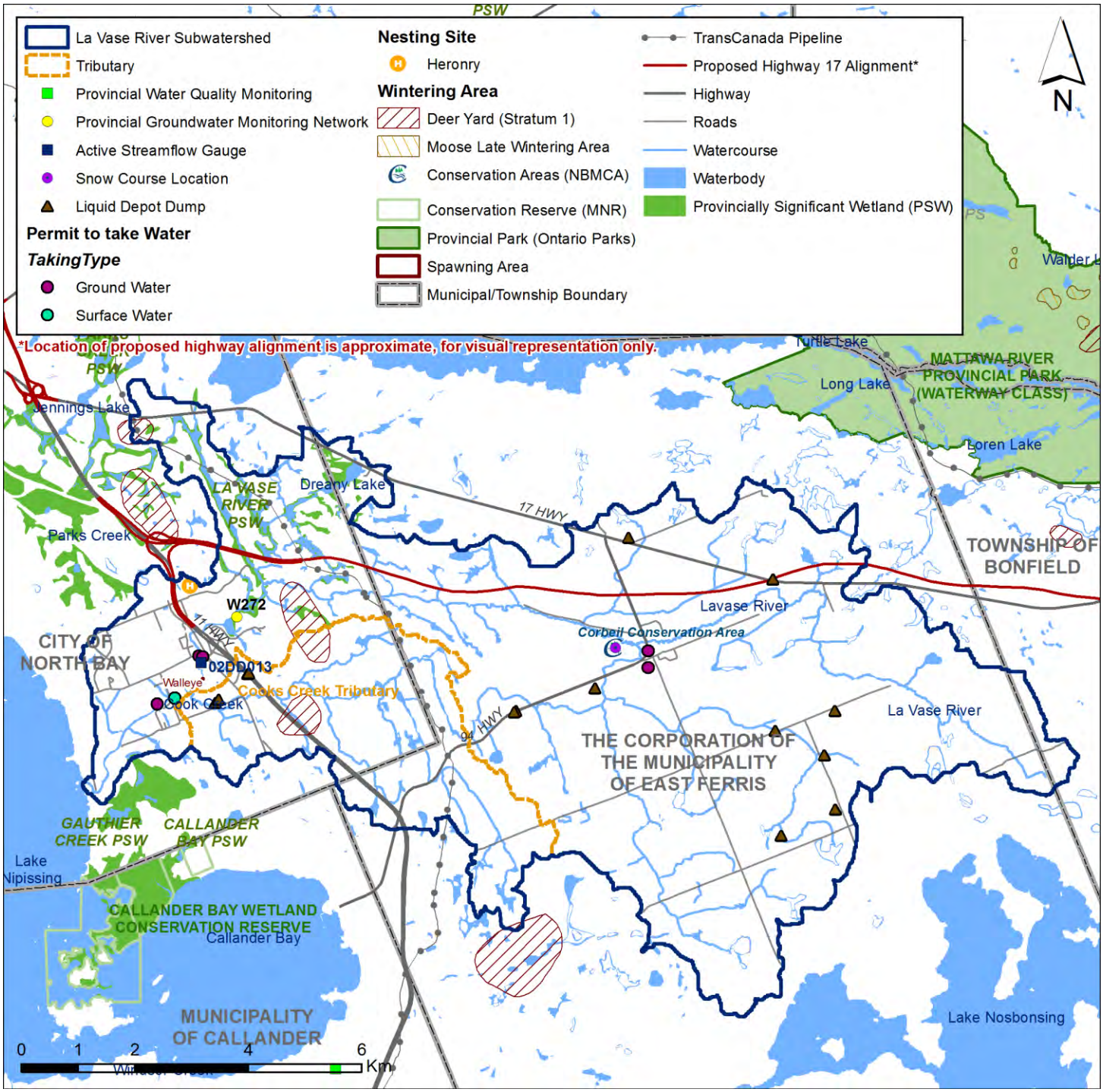
3. Economic Needs and Issues:

- Continued low density rural growth in East Ferris
- Redevelopment of lands along Pinewood Park Drive once fully serviced (servicing currently being installed)
- Urban growth and intensification along Lakeshore Drive
- Eventual development of a new four lane Highway 17

The La Vase River subwatershed has been evaluated to have moderate to high vulnerability/ susceptibility to climate change and moderate vulnerability to land use change impacts. The current comprehensive management approach (Totten Sims Hubicki, 1997) offers a range of management recommendations however many remain outstanding. The validity of recommendations should be reviewed to ensure that new issues and concerns are considered. Also an implementation framework is required to advance reviewed recommendations. The Study did not contemplate extension of services into Pinewood Park Drive, protection needs of habitat critical to Species at Risk or plans to replace Highway 17 with a new four lane highway through the watershed (the La Vase system potentially has a higher probability of impacts from four laning than other systems within the NBMCA). Cooks Creek is also now considered to be at capacity and under significant development restrictions. Stormwater management objectives (primarily to control water quality and quantity) may be required for small catchments within the City of North Bay Settlement Area that are subject to development pressures. Resource conditions should be

monitored and a new watershed management plan may be prompted if Highway 17 four laning is initiated within the horizon of this strategy to address new uses and protection needs.

Figure 9 – La Vase River Subwatershed



3.1.6 Lake Nipissing/North Bay Shoreline Subwatershed

The Lake Nipissing/North Bay Shoreline subwatershed is managed pursuant to a number of studies including a Shoreline Management Strategy developed in 1991 and a Pinewood Parkway Hydrology Study completed in 1997. Other Lake Nipissing tributaries flowing from North Bay have benefited from the "Lake Nipissing Pollution Control Plan" recommendations prepared in 1991. Shoreline subwatershed management is complex in that drainage from small catchments, risks to properties at the immediate shoreline, protection of the dynamic beach environments at the water's edge, and the recreational and aquatic importance of the shallow near shore lake environment are all combined as management interests. Risks to shoreline structures and properties from the lake hazards (flooding, erosion (caused by wave action) and ice) and the quality of water used for bathing continue to be major management concerns. The potential for flood damages within the Pinewood Parkway system are also outstanding concerns. The NBMCA's jurisdiction includes only a small portion of Lake Nipissing so its ability to serve broader lake interests is restricted. Management efforts within its jurisdiction, however, provide overall benefits to the entire lake. The recreational quality of water in the near shore area of Lake Nipissing, especially adjacent to the North Bay Waterfront, is degraded and water quality improvements are highly desirable (some public beaches are permanently closed while others experience periodic exceedances of recreational water quality standards). Conditions along the Lake Nipissing/North Bay shoreline currently appear to be stable (its environment and resource features are maintaining their current qualities and characteristics). The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- The Pinewood Parkway system may be increasingly susceptible to significant damages from flooding. The current management recommendations will increase the capacity of the major system to accommodate the 1:25 year storm. Recommendations are not sensitive to urban intensification in the existing settlement area, growth above the North Bay escarpment or impacts from climate change
- Numerous residential structures along the North Bay shoreline continue to be subject to inundation during the 1:100 year flood
- Severe winds when Lake Nipissing is experiencing high water or flood conditions continue to pose wide spread risk of significant damage to waterfront properties and structures from wave action
- Sediment movement during high wind storm events on Lake Nipissing influences the natural protection provided by sand accumulations at any given location along the waterfront (the level of risk is continuously changing due to beach dynamics)
- The largely urbanized catchment areas that flow to Lake Nipissing (mostly storm sewersheds) are subject to infilling and redevelopment pressures that may experience intensified urban runoff over time. Their capacity is also being affected by a changing climate

- The supporting infrastructure that conveys stormwater in urban North Bay is aging and the risk of cross contamination between storm and sanitary sewers increases as pipe integrity declines and illegal cross connections are made which tends to increase loading to Lake Nipissing over time
- The North Bay Sewage Treatment Plant and sewage conveyance system experience occasional surcharges during wet weather periods, which are relieved to Lake Nipissing through bypasses (usually in the spring)

Lake Nipissing/North Bay shoreline management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Protection of near shore water quality (total phosphorous and bacteriological management objectives should be established for individual public swimming areas)
- Protection of Walleye Spawning grounds
- Review of the risks posed by high water events on Lake Nipissing to shoreline structures and property including economic quantification of potential damages from flooding, waves and ice
- Re-evaluation of Pinewood Parkway Creek protection needs based on a more thorough assessment of flood damages and consideration of growth and climate change impacts
- Further development of the understanding of the cultural heritage of Lake Nipissing, identification of the archaeological significance of existing and ancient shorelines (consider the need for a regional Archaeological and Cultural Master Plan)
- Reduction in the potential for sewage bypasses to Lake Nipissing from the North Bay sanitary sewer system
- Review of North Bay infrastructure maintenance and repair strategies. Conveyance systems should be regularly inspected and clean-outs routinely maintained. Pipes should be relined or replaced when nearing their life expectancies to reduce opportunities for sewage contamination of stormwater
- Monitor protection of wetlands including the Gauthier Creek Provincially Significant Wetland
- Review Lake Nipissing operating policies to consider more complex impacts including updated damage information from impact centers in North Bay and Callander, water level impacts on dynamic beaches and sediment movement, impacts from waves and ice on shoreline structures and property and long term adjustment required to accommodate climate change and/or isostatic rebound. The historic evaluation of water level changes over time resulting from construction of dams and improvements to discharge capacities

may also provide important clues as to how changes to coastal morphological processes have affected shoreline erosion, sediment movement and lake water quality.

- Identify the broader management obligation for this subwatershed in conjunction with the Callander Bay/South Shore subwatershed to meet broader Lake Nipissing, French River and Great Lakes management objectives.

2. Social Needs and Issues:

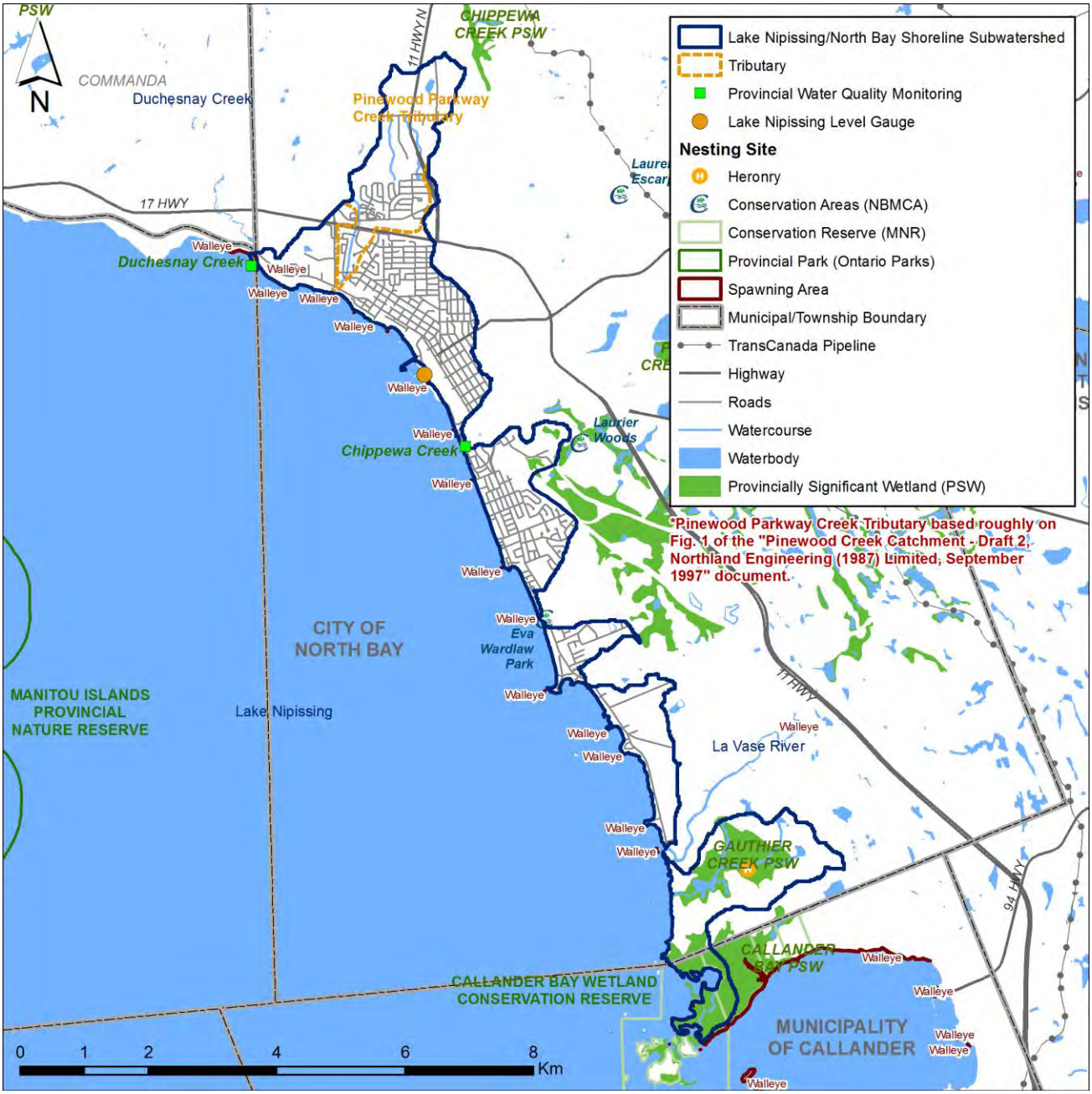
- Improved water quality at public beaches
- Maintaining public access to Lake Nipissing for recreation/navigation/fishing/winter use
- More rapid protection of shoreline properties from potential flood, erosion (caused by waves) and ice damage from Lake Nipissing
- Protection of properties from flood damages in the Pinewood Parkway system
- Protection of vistas and viewing opportunities along the North Bay Waterfront

3. Economic Needs and Issues:

- Extension of urban services above the North Bay escarpment in the Pinewood Parkway Creek headwaters (long term)
- Redevelopment and intensification of waterfront properties along the serviced shoreline
- Protection and/or expansion of North Bay Waterfront/tourism opportunities
- Redevelopment of lands adjacent to the North Bay Waterfront and revitalization of the Central Business District

The Lake Nipissing/North Bay shoreline has been evaluated to have moderate to high vulnerability/susceptibility to climate change and land use change impacts. Current shoreline flood and wave damage protection strategies offer long term protection however implementation is slow and many properties are left exposed in the interim. The quality of runoff from urban catchments has experienced long term improvements however water quality is still degraded and improvements are still possible. Stormwater management plans for larger stormwater catchment areas in urban North Bay should be considered to develop strategies to meet provincial water quality management objectives and to accommodate new risks posed by climate change. Methods to accelerate shoreline property protection should be investigated to reduce risks at a faster pace. Flood, wave and ice damage potential along the Lake Nipissing shoreline within the NBMCA's jurisdiction should be reassessed so that the magnitude of the risk can be properly reflected in damage reduction strategies and in lake management protocols. Flood damages may be a significant issue in the Pinewood Parkway tributary. Flood damage assessment should be completed to quantify damages and justify remedial actions. Current recommended flood damage reduction strategies, to accommodate the 1:25 year flood, do not account for urban intensification, future growth above the escarpment or climate change impacts.

Figure 10 – Lake Nipissing/North Bay Shoreline Subwatershed



3.1.7 Windsor/Boulder/Bear Creek Subwatershed

The Windsor/Boulder/Bear Creek subwatershed is currently managed in an ad hoc manner and management issues are not well understood. Portions of this catchment within the Municipality of Callander were added to the NBMCA's area of jurisdiction in 2003 and baseline conditions and assessment of issues have not been advanced. Windsor Creek is part of the Drinking Water Source Protection Area for Callander Bay and work is currently underway to protect Callander's drinking

water source. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Infilling with low density rural development including hobby farms
- Potential for expansion of traditional agricultural practices
- Expansion of aggregate operations

The Windsor/Boulder/Bear Creek subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Complete a baseline inventory to establish current conditions, trends and resource protection needs (see **Table 13** for guidelines)
- Specifically hydrologic assessment is required to identify hazard lands, development constraint areas and hydrologic improvement opportunities (such as the elimination of undesirable constrictions). Hydrologic assessment would benefit from collection of flow data. At least one basin should be considered for hydrologic monitoring
- The relationship of each tributary to Callander Bay and the South Shore of Lake Nipissing requires further investigation in terms of water quantity, water quality, sediment movement and aquatic habitat
- Water takings from these systems should be reviewed (there appears to be recent water takings likely for highway construction that have not been evaluated in the background report)
- Windsor Creek has a relatively steep stream gradient and an assessment of its erosion potential should be evaluated

2. Social Needs and Issues:

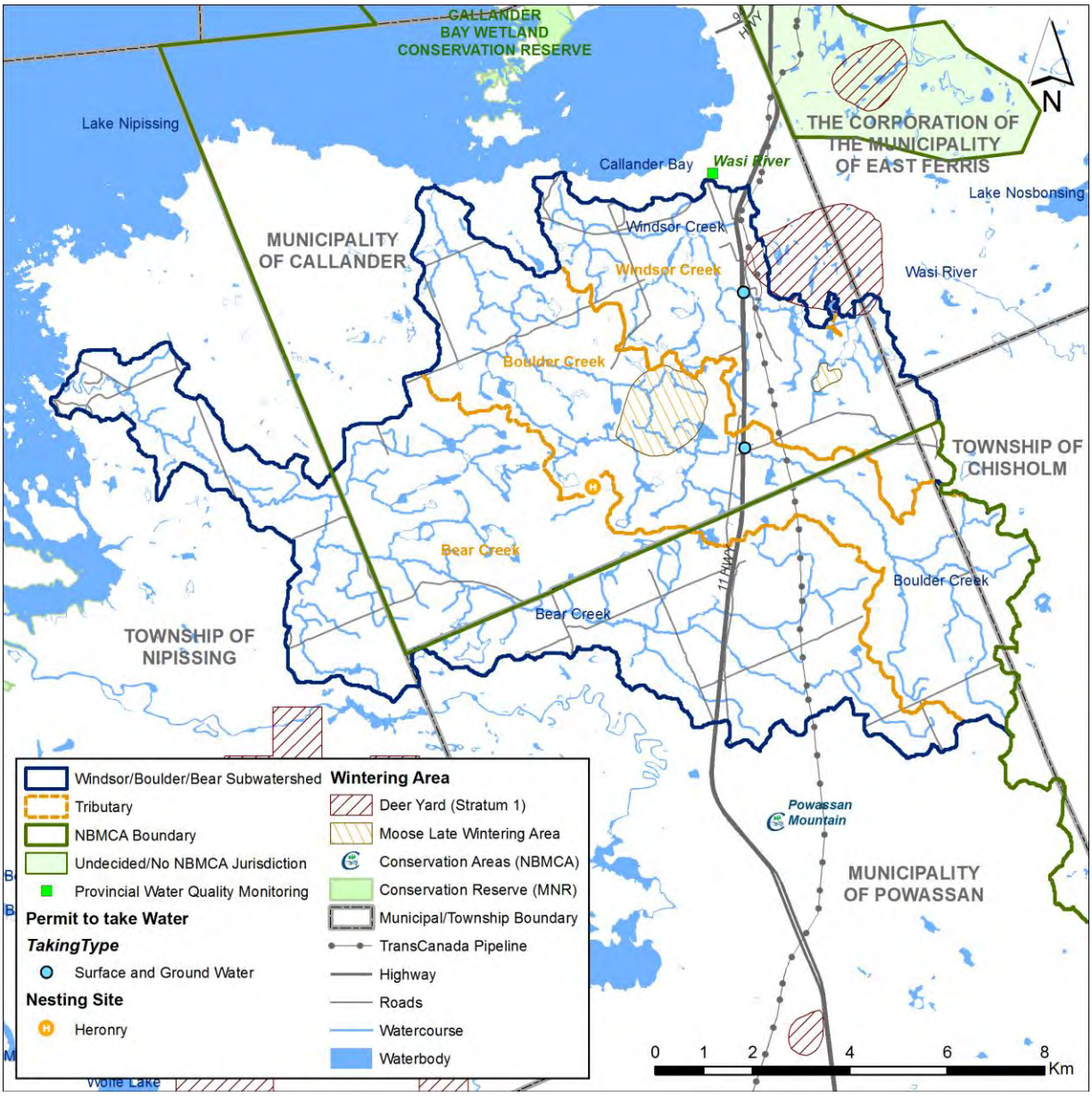
- Assessment of public uses and interests within these catchment areas is required as part of the baseline inventory
- Identify properties subject to flooding and erosion hazards
- Access to Lake Nipissing at stream outlets needs to be evaluated
- Improved access to Bear Creek for angling (brook trout)

3. Economic Needs and Issues:

- Rural infilling and establishment of hobby farms
- Sustainable Aggregate production

The Windsor/Boulder/Bear Creek subwatershed has been evaluated to have low to moderate vulnerability/susceptibility to climate change and land use change impacts. While these catchments have similar topographies and basin characteristics, they likely require individual management strategies. Bear Creek is distinguished from the others because of its cold water habitat and Windsor Creek has a steeper stream gradient which flows directly to Callander Bay with higher potential for erosion. Water quality management objectives for the Windsor Creek system needs to be defined to protect Callander Bay so that effective management strategies can be identified. The ad hoc management approach for these systems should be reevaluated once baseline conditions are established.

Figure 11 – Windsor/Boulder/Bear Subwatershed



3.1.8 Burford Creek Subwatershed

Burford Creek is currently managed based on a narrow range of management issues identified through the Drinking Water Source Protection Plan developed for Callander Bay. Most of this catchment is outside of the NBMCA's core jurisdictional area. The lower portion, within the Municipality of Callander, was added to the NBMCA in 2003. Consequently this subwatershed has not been assessed and baseline conditions are not well understood. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Peripheral infilling with low density rural development including hobby farms
- The mouth of the system is within the Municipality of Callander's Settlement Area and could be subject to serviced development within the horizon of this strategy.

Burford Creek subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Complete a baseline inventory to establish current conditions, trends and resource protection needs (see **Table 13** for guidelines)
- Specifically hydrologic assessment is required to identify hazard lands, development constraint areas and hydrologic improvement opportunities (such as the elimination of undesirable constrictions). Floodplain mapping may be required in its lower reaches
- The importance of Burford Creek wetlands and habitat critical to species at risk requires further evaluation
- The impact of this system on Callander Bay from a nutrient loading perspective is being evaluated through Drinking Water Source Protection work. Beach protection needs should also be considered (total phosphorous and bacteriological management objectives should be established for individual public swimming areas)

2. Social Needs and Issues:

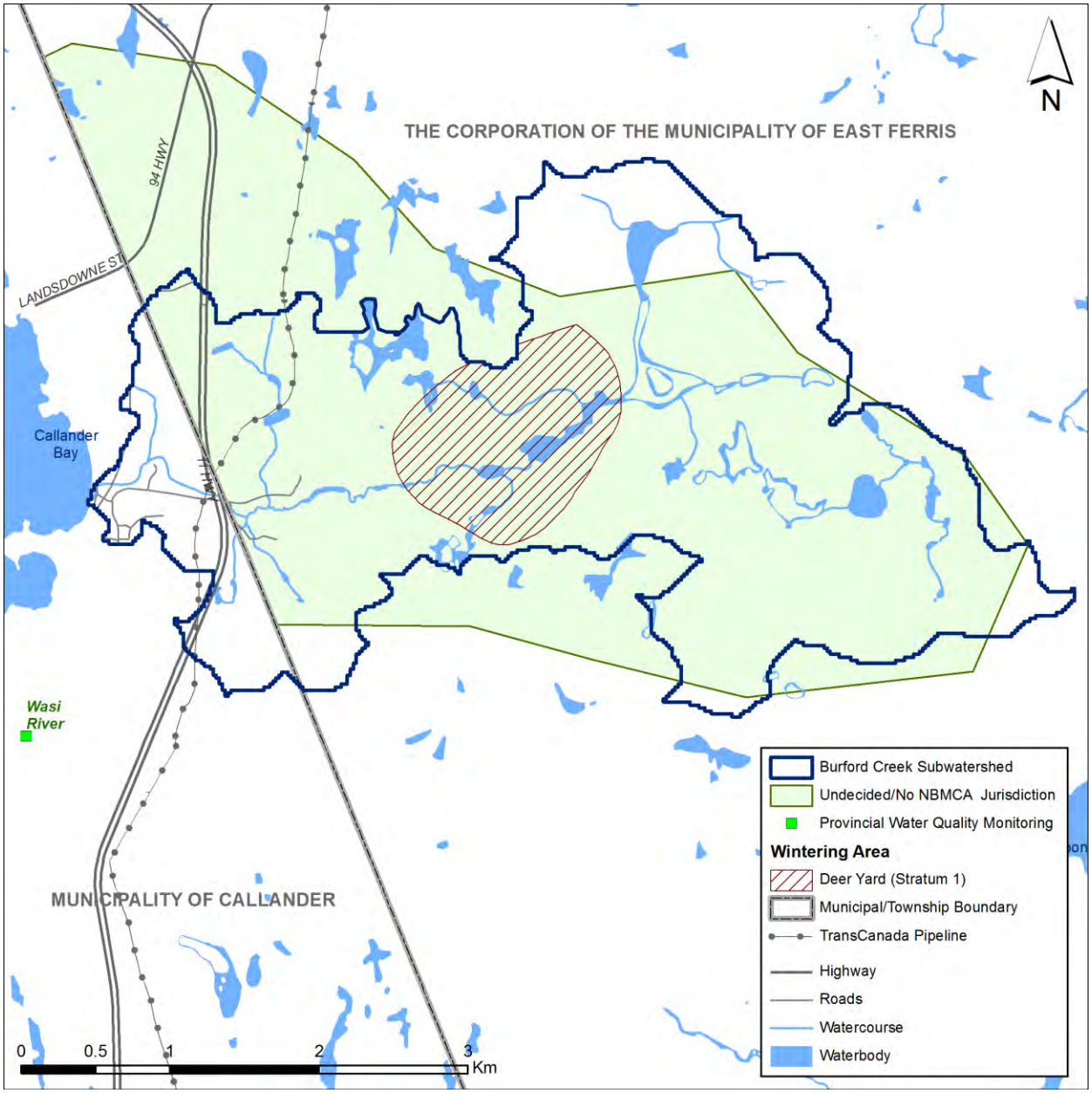
- Public interests and uses within this subwatershed requires further investigation
- Access to/swimming at the streams outlet to Lake Nipissing

3. Economic Needs and Issues:

- Economic interests in this subwatershed are unknown
- There is a possibility of serviced development occurring within the small section of this subwatershed that is within the Callander Settlement Area

The Burford Creek subwatershed has low vulnerability/susceptibility to climate change and land use change impacts. Burford Creek has a steep channel gradient that increases the risk of erosion. Water quality management targets for this system are required to meet Callander Bay protection interests so that effective management strategies can be defined. The current ad hoc approach would appear to be appropriate at this time and should be re-evaluated once baseline conditions have been established. Development of further baseline inventory information or other management considerations to be carried out by the NBMCA may necessitate the consideration of expanding its jurisdictional boundaries to include all of the Municipality of East Ferris.

Figure 12 – Burford Creek Subwatershed



3.1.9 Callander Bay/South Shore Subwatershed

The full Callander Bay/South Shore subwatershed is currently managed in an ad hoc manner. As well as management of small catchments, the shoreline and the immediate near shore of Lake Nipissing; the water quality of Callander Bay has also evolved as a major issue for this subwatershed. Blue-green algae blooms in the last decade have resulted in health warnings and use restrictions. Assessments of the water quality of Callander Bay (by MOE as part of a full lake assessment in 2004 and more recently for Drinking Water Source Protection) indicate that this meso-eutrophic basin is experiencing a gradual decline. Drinking Water Source Protection has a specific focus on the management of threats to municipal drinking water supply sourced from Callander Bay; however Callander Bay and the South Shore have much broader resource significance to the regional economy. The quality of the experiences associated with Callander Bay and the South Shore are vital to the continued growth and economic development as well as the tourism and recreational potential for the entire Callander community. In acknowledgement Callander has established strict shoreline development controls in its Official Plan and has highlighted other management strategies to protect Callander Bay. Not all of the Callander Bay/South Shore subwatershed functions and feature have been adequately evaluated. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Continued expansion of the Callander Settlement Area
- Increased generation and deterioration of the quality of stormwater runoff from the Callander Settlement Area
- Increased pressure on the capacity of the Callander sanitary sewage system including treatment capacity at the Callander Wastewater Treatment facility
- Continued pressure for shoreline development/redevelopment/cottage conversion to permanent home
- Continued high use of Callander Bay/South Shore for tourism and recreation
- Increased rural development outside of the Callander Settlement Area including potential for increased hobby farming and a resurgence in traditional farming
- The impact of invasive species on the biology of Callander Bay and Lake Nipissing

Callander Bay/South Shore management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Enhance the baseline inventory to establish current conditions, trends and resource protection needs beyond those currently defined in Source Water Protection work (see **Table 14** for guidelines)

- Hydrologic assessment to identify hazard lands, development constraint areas and hydrologic improvement opportunities (such as the elimination of hydraulic constrictions) within significant catchment areas
- Quantification of flood, erosion (from waves) and ice damage potential from Lake Nipissing
- Continue to monitor Callander Bay water quality
- Monitor the success of Source Water Protection work as it is implemented
- Assessment of the dynamics of shoreline sediment movement along the Lake Nipissing/ Callander Bay shoreline
- Identification of recreational protection needs and water quality targets for public beaches and swimming area
- Correlate biological changes of Callander Bay and Lake Nipissing which are suspected to be affecting Lake fisheries with impacts to algal blooms and nutrient concentrations
- Consideration of a broad range of infrastructure initiatives that can be undertaken to reduce nutrient loading from the Callander Settlement Area. Actions include better definition of stormwater catchment areas, development of specific stormwater management criteria for each storm sewershed (including establishment of nutrient control and bacteriological targets), review of infrastructure inspection, maintenance and renewal practices to emphasize reduction of groundwater and stormwater infiltration into sanitary sewers, conducting find and fix activities to address cross connections and to evaluate strategies to extend sanitary sewer to unserviced shorelines within the Settlement Area.
- Protection of walleye spawning areas
- Monitor the protection of the Callander Bay Marsh Provincially Significant Wetland and other wetlands within this subwatershed (additional wetland evaluation may be warranted)
- Investigate the role that Callander Bay/South Shore plays in waterfowl staging and provision of critical habitat for species at risk
- Review Lake Nipissing operating policies to consider more complex impacts including updated damage information from impact centers in North Bay and Callander, water level impacts on dynamic beaches and sediment movement, impacts from waves and ice on shoreline structures and property and long term adjustment required to accommodate climate change and/or isostatic rebound. The historic evaluation of water level changes over time resulting from construction of dams and improvements to discharge capacities may also provide important clues as to how changes to coastal morphological processes have affected shoreline erosion, sediment movement and lake water quality.
- Identify the broader management obligation for this subwatershed in conjunction with the North Bay Lake Nipissing subwatershed to meet broader Lake Nipissing, French River and Great Lakes management objectives.

2. Social Needs and Issues:

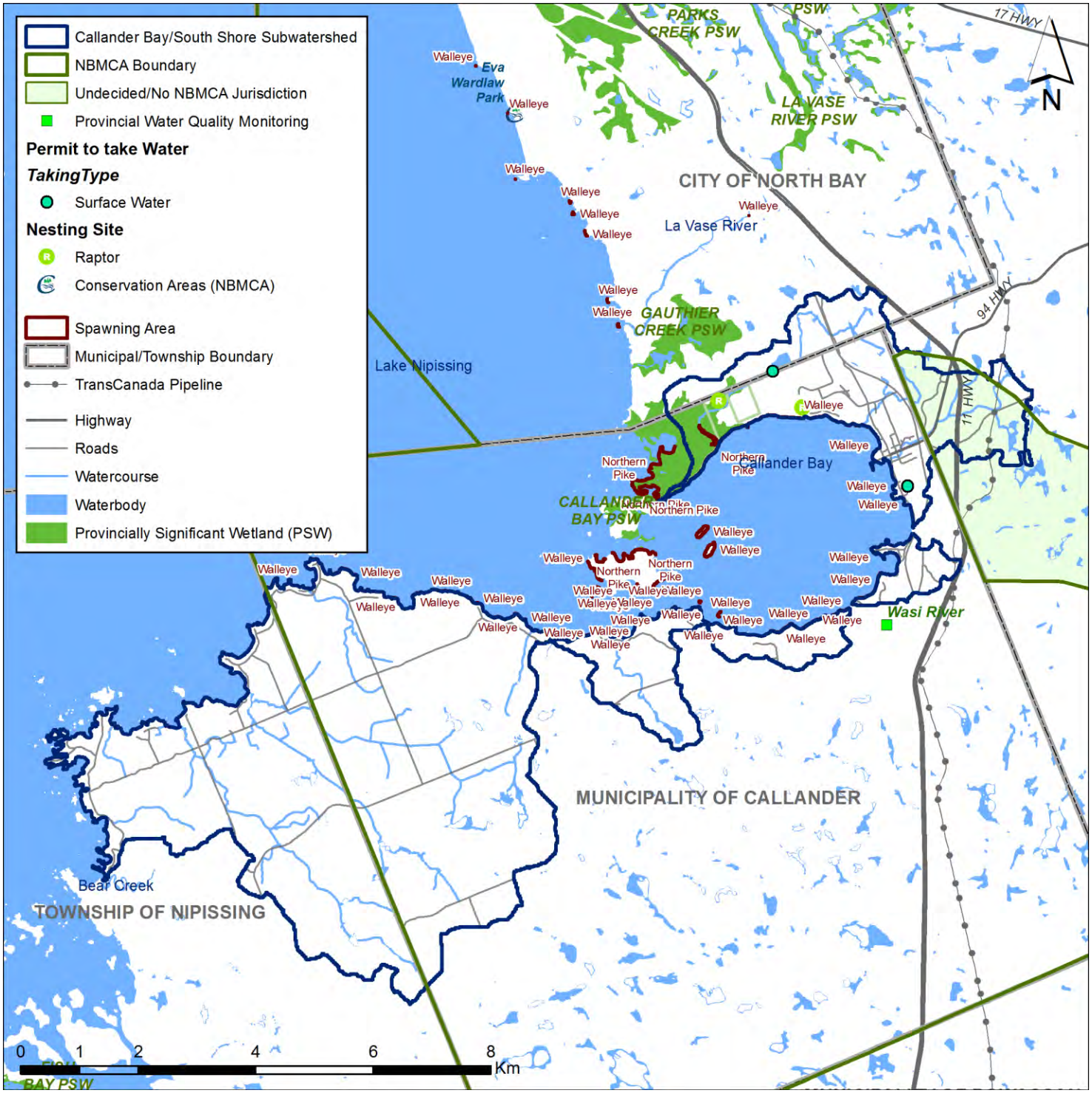
- Reduce the potential for blue-green algae blooms through Source Water Protection and other controls
- Continued access to Callander Bay and Lake Nipissing for fishing and recreation
- Continue to protect shoreline properties and structures from lake related hazards (flooding, erosion/wave and ice damages)
- Identify properties subject to flooding and erosion hazards in tributaries
- Continued access to Cranberry Trail and Callander Bay Marsh
- Other recreational uses within this subwatershed requires further evaluation
- Identify and protect cultural heritage features and values

3. Economic Needs and Issues:

- Protection of Lake Nipissing fishery
- Urban growth and intensification the Callander Settlement Area in response to high development pressures and in support of high growth rates
- Success of efforts to address capacity and treatment limitations of municipal wastewater conveyance and treatment infrastructure to accommodate future growth and resource protection needs
- Sustain tourism and recreational opportunities within the subwatershed

The Callander Bay/South Shore subwatershed has been evaluated to have high vulnerability/ sensitivity to climate change and land use change impacts. This subwatershed, newly added to the NBMCA's area of jurisdiction in 2003, has not had a comprehensive evaluation of baseline conditions, trends and resource protection needs. While Drinking Water Source Protection is pursuing management solutions to a very important aspect of this subwatershed (total phosphorous loading to Callander Bay), a more comprehensive strategy is likely warranted to address the broader range of issues. Drinking water source protection needs should be combined with needs driven by other factors including tourism, recreation and economic development. An integrated management approach can also address complementary infrastructure improvements needs. Water quality issues in this subwatershed are complex and require an advanced understanding of aquatic biology, impacts from changing water levels, and risks posed by climate and land use change within the greater catchment area. The Drinking Water Source Protection Plan should be supplemented with a Master Drainage Plan for the Callander Settlement Area. A Shoreline Management Plan should be developed within the horizon of this strategy to advance the understanding of shoreline and near shore protection needs which may drive the need to extend municipal water and sanitary services along the Callander Bay shoreline.

Figure 13 – Callander Bay/South Shore Subwatershed



3.1.10 Wistiwasing (Wasi) River Subwatershed

Needs and issues within the Wasi River subwatershed were originally assessed through a Comprehensive Watershed Management Study prepared in 1986. The Wasi River Watershed Management Study made comprehensive recommendations to address water quality, flooding and erosion, wetland protection and fisheries management issues. The Drinking Water Source Protection Plan has identified nutrient reduction strategies for Callander Bay that includes mandatory maintenance inspections of septic systems (under the Building Code) and nutrient management education within the Wasi River watershed. Despite the development of a comprehensive watershed management plan in 1986, recommendations have not led to significant improvements, mainly because most recommendations were never enacted. Some resource features are now protected because of provincially significant designations (Upper Wasi Wetland and several ANSIs). Water quality has continued to deteriorate in this system and recent blue-green algae blooms in Wasi Lake have resulted in health warnings and water use restrictions. Additional research is being carried out for drinking water source protection purposes to determine nutrient sources and to understand the natural assimilate capacities of the system. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Slow infilling with low density rural development including hobby farms
- Potential for expansion of traditional agricultural practices
- Expansion of aggregate operations
- Minor headwater forestry activity
- Success of Drinking Water Source Protection efforts

Wasi River subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Develop Wasi River subwatershed nutrient management objectives to meet Callander Bay water quality criteria. Management strategies should also consider Wasi River sub-watershed management needs in addition to those required to protect Callander Bay
- Investigate the practice and impact of liquid depot dumps identified within the Technical Background Report (the use of liquid wastewater dumping sites may no longer be occurring but there still may be nutrient loading occurring from historic use – necessitating consideration of clean up)
- Continued monitoring of Wasi Lake water quality
- Review strategies that will protect the fishery of Wasi Lake from oxygen depletion
- Protect Walleye spawning grounds on Wasi and Graham Lakes

- Reassessment of erosion conditions in Graham Creek and the need for recommended controls
- Monitor the protection of the Upper Wasi River Swamp Wetland (Provincially Significant) and review protection needs of non-provincially significant wetlands
- Quantification of water taking from the lower Wasi River, which appears to be for highway construction, was not evaluated in the Technical Background Report
- Establishment of Floodplain Mapping for Wasi Lake

2. Social Needs and Issues:

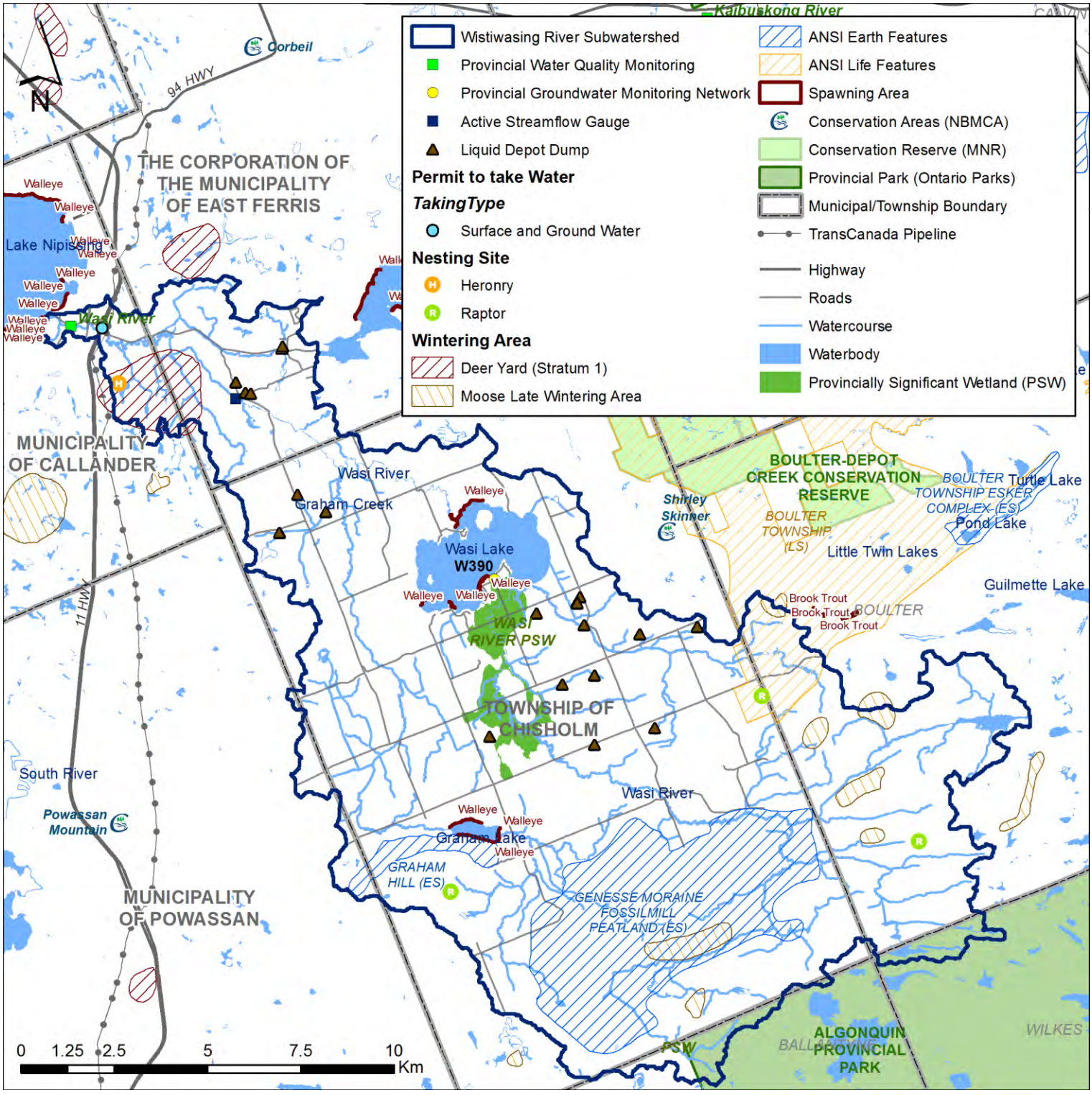
- Reduce the potential for blue-green algae occurrences in Wasi Lake
- Continued public access to Wasi Lake for recreation, navigation and fishing
- Public access and interpretation of cultural and heritage features for Wasi Falls and access to Lake Nipissing at its outlet (potential Conservation Area?)
- Access to headwater fisheries (brook trout)
- Identification and protection of cultural heritage resource features
- Interpretation and improved appreciation for ANSI resource features

3. Economic Needs and Issues:

- Rural infilling and establishment of hobby farms
- Sustainability of traditional agriculture
- Sustainability of aggregate production
- Sustainability of Wasi Lake tourism

The Wistiwasing (Wasi) River subwatershed has been evaluated to have high vulnerability/ susceptibility to climate and land use change impacts. The existing Comprehensive Watershed Management Study is not meeting current management expectations. Drinking Water Source Protection work is considering additional strategies to reduce nutrient loading from this system to Callander Bay. Nutrient reduction management objectives for this system to protect Callander Bay need to be further defined. Recommendations of the Comprehensive Watershed Management Study should be reviewed in conjunction with Drinking Water Source Protection goals and an integrated implementation strategy should be considered. A scoped Integrated Watershed Management Plan for Wasi Lake and its contributing area may be warranted in the future if current management initiatives fail to achieve the desired nutrient controls. This plan might investigate natural attenuation and resuspension characteristics within this tributary. Participation by all stakeholders would be essential to find effective nutrient management strategies that will garner public support.

Figure 14 – Wistiwasing River Subwatershed



3.1.11 North River Subwatershed

The North River subwatershed is currently managed in an ad hoc manner. This subwatershed has only received minimal assessment work. Consequently, the understanding of management issues and concerns is still very rudimentary. Environmental inventory work has been completed for Otter Lake and City of North Bay owned lands that surround it. Most of the North River subwatershed drains from unorganized territory in which the NBMCA has no local partner. Phelps and French Townships have pockets of settlement with population densities comparable to organized rural areas. The lack of an effective structure to communicate with these communities restricts the NBMCA from delivering significant projects or administering programs. Conditions in the North River subwatersheds are largely unknown. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Low density rural development along existing roadways. The rate and nature of this growth is undetermined
- The impacts of agricultural uses are unknown. MPAC (Municipal Property Assessment Corporation) mapping show scattered agricultural uses, which could be active farm land or tree plantations
- This subwatershed has several pits and considerable aggregate reserves, and there is potential for future aggregate extraction activities
- Forestry activity is planned in isolated areas mainly in the headwaters

North River subwatershed management needs and issues have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Inventory baseline conditions (see **Table 13** for guidelines), trends and resource/cultural heritage protection needs
- Specifically identification of flooding and erosion hazards in this system are required to allow the NBMCA to implement effective development controls through planning and regulation enforcement
- Protect Area of Natural and Scientific Interest including the Widdifield Forest* and parts of the Doule Forest, the Balsam Creek Esker and the Rice Bay Blue Mountain Delta* (* Provincially Significant)
- Further identify and protect cold water habitat (supporting brook trout)
- Improve the understanding of protection needs for overburden aquifers and the role that groundwater recharge has to maintaining base flow and cold water habitat
- Recognize the North River management obligations to downstream systems including Lake Talon and the Lower Mattawa River. Consider installing a gauge on North River (at Songis

Road) to improve the understanding of hydrologic and water balance contributions to lower systems
- Monitor forestry activity reporting (mainly in the headwaters) to ensure that sustainable forest management is being practiced

2. Social Needs and Issues:

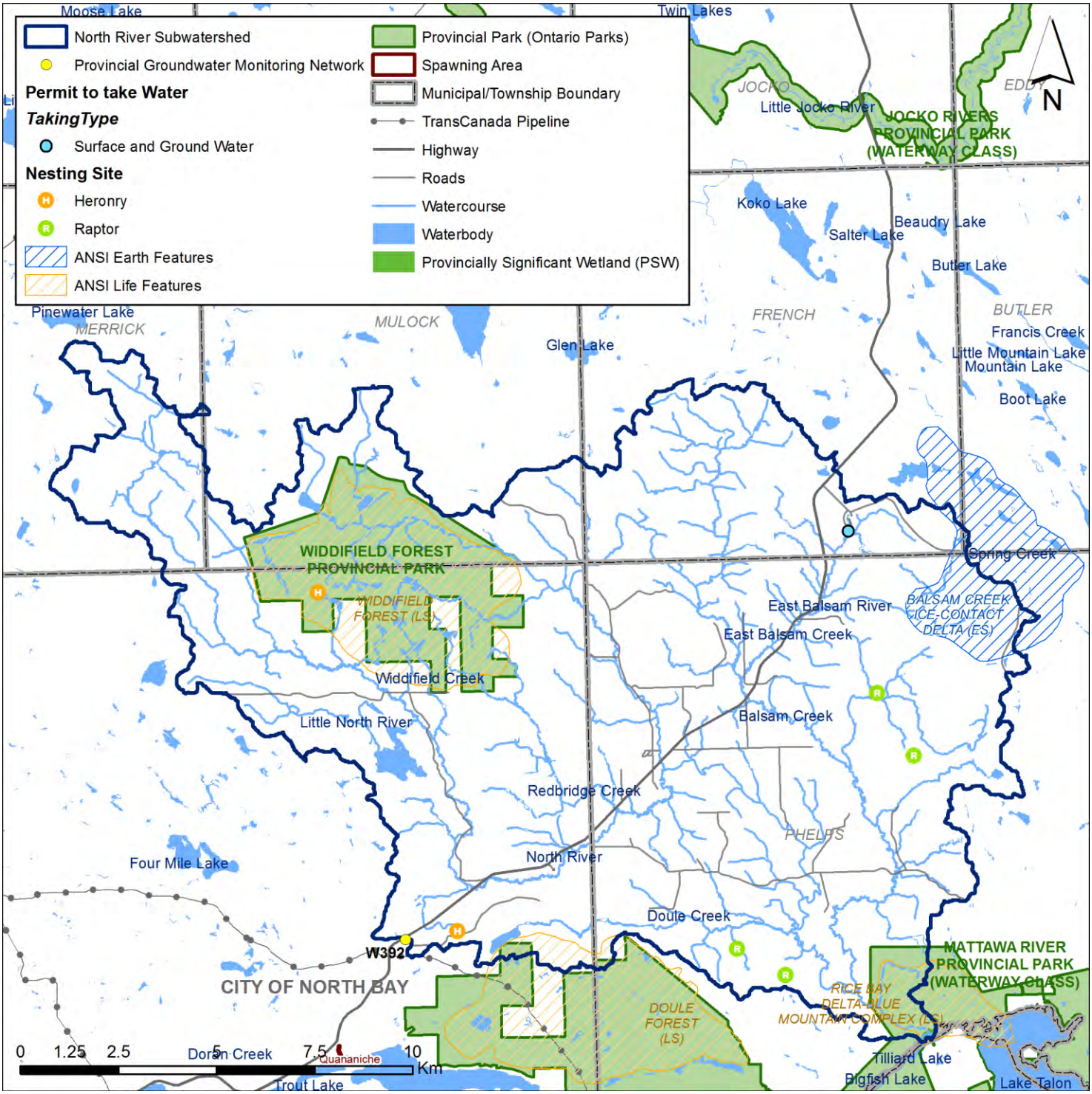
- Further assessment of public uses and interests within the North River system are required. This area likely has considerable hunting, fishing, informal camping and off road motorized uses on crown land (note: hunting is permitted in the Widdifield and Mattawa River Provincial Parks but not permitted within the City of North Bay)
- Improved appreciation for ANSI resource features

3. Economic Needs and Issues:

- Not fully known due to unorganized status of the majority of the subwatershed
- Access to Crown land for harvesting of wood
- Support for minor aggregate mining and agricultural uses
- Sustainment of the Fish Hatchery/access to overburden aquifer

The North River subwatershed has been evaluated to have low to moderate vulnerability/ susceptibility to climate change and land use change impacts. The current ad hoc approach should provide adequate protection for the next 20 years unless an assessment of baseline condition uncovers significant issues.

Figure 15 – North River Subwatershed



3.1.12 Trout Lake Subwatershed

The Trout Lake subwatershed is currently managed through a Comprehensive Watershed Management Plan. The Trout Lake Watershed Management Study was one of the first management plans developed by the NBMCA in the mid-1980s. Significant advancements have been made in the understanding of resource features and management needs in this subwatershed since this plan was developed and extensive controls are now in place particularly along the Trout Lake shoreline. Since the Comprehensive Plan was completed a Pollution Control Study and a Drinking Water Source Protection Plan have been completed for the watershed and a Stormwater Management Plan has been developed for Lees Creek. Most management initiatives are focused on the protection of Trout Lake (rather than its watershed). Lake protection has been driven by the need for the City of North Bay to protect its domestic water supply. The City of North Bay and the Municipality of East Ferris have adopted Total Phosphorous and Dissolved Oxygen management targets in their Official Plans (minimum water quality target of 7.0 µg/L measured ice-free seasonal Total Phosphorous concentration combined with a late summer volume weighted dissolved oxygen measure of 8.0 mg/L). The recently developed Drinking Water Source Protection Plan has identified only moderate and low threats to the City of North Bay's water source which have necessitated a number of mitigation strategies. Most strategies target the protection of Delaney Bay, which is at the headwaters of Trout Lake. The Trout Lake shoreline continues to be popular for residential development. Limited new lot creation potential is possible on Trout Lake however redevelopment of existing lots, including the conversion of seasonal properties to permanent uses has potential larger loading impacts based on total lots. Rural development pressures exist in North Bay and East Ferris including development on the shorelines of smaller accessible lakes. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Intensification within the North Bay Settlement Area including infilling in Birchaven/Ski Club Road area and encroachment in the upper Lees Creek system. Encroachment into the Doran Creek subwatershed at the North Bay Airport is possible within the horizon of this strategy
- Stormwater runoff from Settlement Areas
- Continued pressure for shoreline development/redevelopment/cottage conversion to permanent home
- Continued high use of Trout Lake for recreation/boating/marinas/snowmobiling
- Pressure for rural development within the watershed, particularly in Municipality of East Ferris. There may be shoreline development pressure on accessible smaller watershed lakes
- Long term increase in potential water takings for domestic water supply purposes
- Algonquin Land Claim impacts

- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)

Trout Lake subwatershed management needs and issues have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Identify resource/cultural heritage protection needs of the land portion of the subwatershed
- Assess protection needs for small lakes (Four Mile Lake, Hillside Lake, High Lake, Long Lake)
- Monitor the development capacity of the Trout Lake to accommodate shoreline development and redevelopment which is nearing its maximum capacity (both modelled limits established by MOE and observe limits established by municipalities)
- Protection of the Doule Forest, which is the only ANSI within this subwatershed (now within Mattawa River Provincial Park)
- Protection of cold water habitat of inflowing streams (brook trout)
- Evaluation of wetland protection needs, mainly located in the southern half of the subwatershed
- Protection of Ouananiche (unique landlocked fish species) in Trout Lake
- Comprehensive evaluation of water takings from Trout Lake is warranted (current impact assessment is narrowly defined and was restricted to only considering sustainability of water supply to meet long term needs of the City of North Bay. Potential watershed and downstream impacts include water quality, fisheries and aquatic habitat, recreation, navigation and canoeing, private water intakes, docks and marinas impacts. Impacts may reverberate through Lake Talon and the lower Mattawa systems. These impacts should be evaluated in the context of climate change stresses. Impacts are likely downstream of the Turtle Lake dam, which may encounter extended periods with zero discharge.
- Recognition of other management obligations to downstream systems including Turtle Lake, Lake Talon and the lower Mattawa River subwatershed
- Establishment of a water level monitoring gauge for Trout Lake
- Protection of fish/fish spawning areas/sanctuaries (Lake Trout and Ouananiche)
- Continued monitoring of Trout Lake water quality
- Monitor sediment loading due to erosion issues of steep tributaries (e.g. Four Mile Creek, Doran Creek)
- Develop water quality targets for streams and outfalls that discharge to Trout Lake

2. Social Needs and Issues:

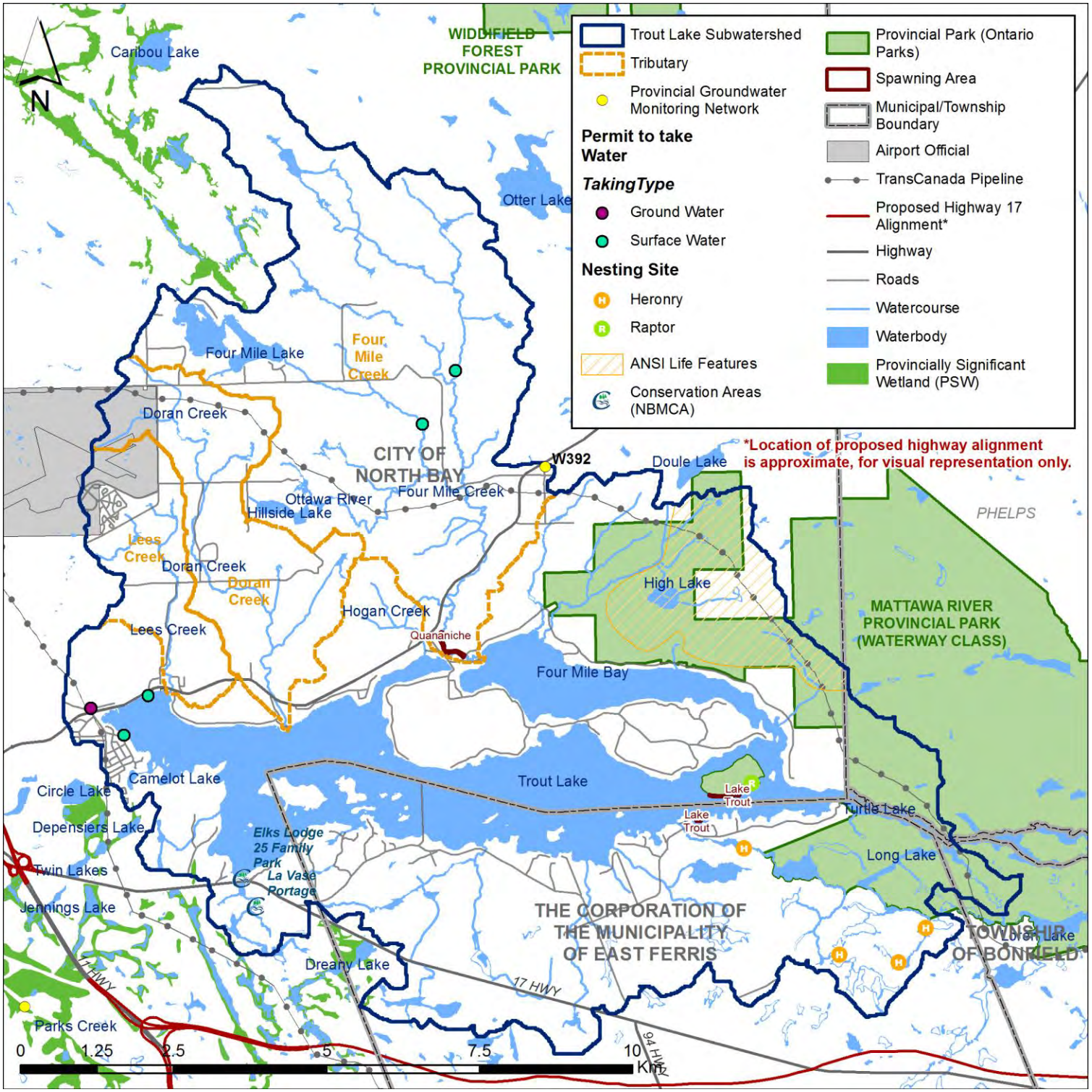
- Maintain public access to Trout Lake for Recreation/Navigation/Fishing/Winter Use (including appropriate access to Camp Island in light of the Algonquin land claim)
- Public use of the land portion of the watershed and smaller lakes requires further research
- Improve public understanding of cultural heritage values
- Interpretation and improved public appreciation for the Doule Forest
- Better understanding of risks posed by pipeline conversion and Algonquin land claims

3. Economic Needs and Issues:

- Rural Residential growth
- Industrial growth around the North Bay Airport
- Sustainment of marinas and associated businesses on Trout Lake
- Sustainability of a small tourism market within the subwatershed
- Sustainable aggregate and peat production
- Sustainability of the small agricultural community
- Upgrading of TCPL gas pipeline to carry crude oil

Trout Lake subwatershed has been evaluated to have moderate vulnerability/susceptibility to climate and land use change impacts. The existing management framework which is supported by a number of technical bodies of work seems to be successfully maintaining the stability of most resource features in the Trout Lake subwatershed. There are a number of new risk factors that were not included in assessment work including gas pipeline conversion to crude oil and impacts from land claim negotiations. Risks posed by these new initiatives are currently unknown. Four Mile Bay is lumped into the overall Trout Lake management framework but it has distinct characteristics and there is evidence that the level of management for this Bay may be greater than the main lake and other bays. Water quality data for Four Mile Bay suggests that it receives higher nutrient inputs and/or has a lower capacity to assimilate loading. A Four Mile Bay Comprehensive Water Management Strategy may be warranted in the future if water quality exceeds thresholds established in the North Bay Official Plan. Doran Creek may be vulnerable to increasing rural residential growth, aggregate and peat mining, minor agricultural activities and the future expansion of the Industrial Park at the North Bay Airport. Storm water management criteria may be required for this tributary as a prerequisite to manage headwater development. The remainder of the lake seems to be well served by the existing management structure at this time. Assessment of new risk factors may necessitate re-evaluation of management strategies to maintain subwatershed health.

Figure 16 – Trout Lake Subwatershed



3.1.13 Turtle Lake Subwatershed

The Turtle Lake subwatershed is currently managed in an ad hoc manner. This subwatershed has only experienced minor assessment work and consequently the understanding of management issues and concerns are not well advanced. Most of the Turtle Lake subwatershed is protected by the Mattawa River Provincial Park designation. Pine Lake is accessible from Pine Lake Road but development is restricted by limited private lands. The Loren Lake tributary extends south into settled portions of East Ferris and Bonfield. Settlement in the upper Loren Creek tributary is sparse. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Rural Residential Growth along existing roadways
- Four Laning of Highway 17 (development is likely beyond the strategy horizon)
- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)

Turtle Lake subwatershed management needs and issues have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Inventory baseline conditions (see **Table 13** for guidelines), trends and resource/cultural heritage protection needs
- Develop a better understanding of the impacts of the Trout and Turtle Lake hydrologic water balances on downstream management interests (including Lake Talon and the lower Mattawa systems)
- Monitoring of Turtle Lake water quality
- Recognition of the Turtle Lake management obligation to lower systems including Lake Talon and the Lower Mattawa River
- Establish water level monitoring in conjunction with the Trout Lake subwatershed

2. Social Needs and Issues:

- Continued access to Turtle Lake for navigation, recreation, informal camping and fishing
- Access to Crown land for hunting, fishing (brook trout in Depot Creek), informal camping and off road recreational pursuits (Hunting is permitted in Mattawa River Provincial Park)
- Identification and protection of Cultural Heritage features

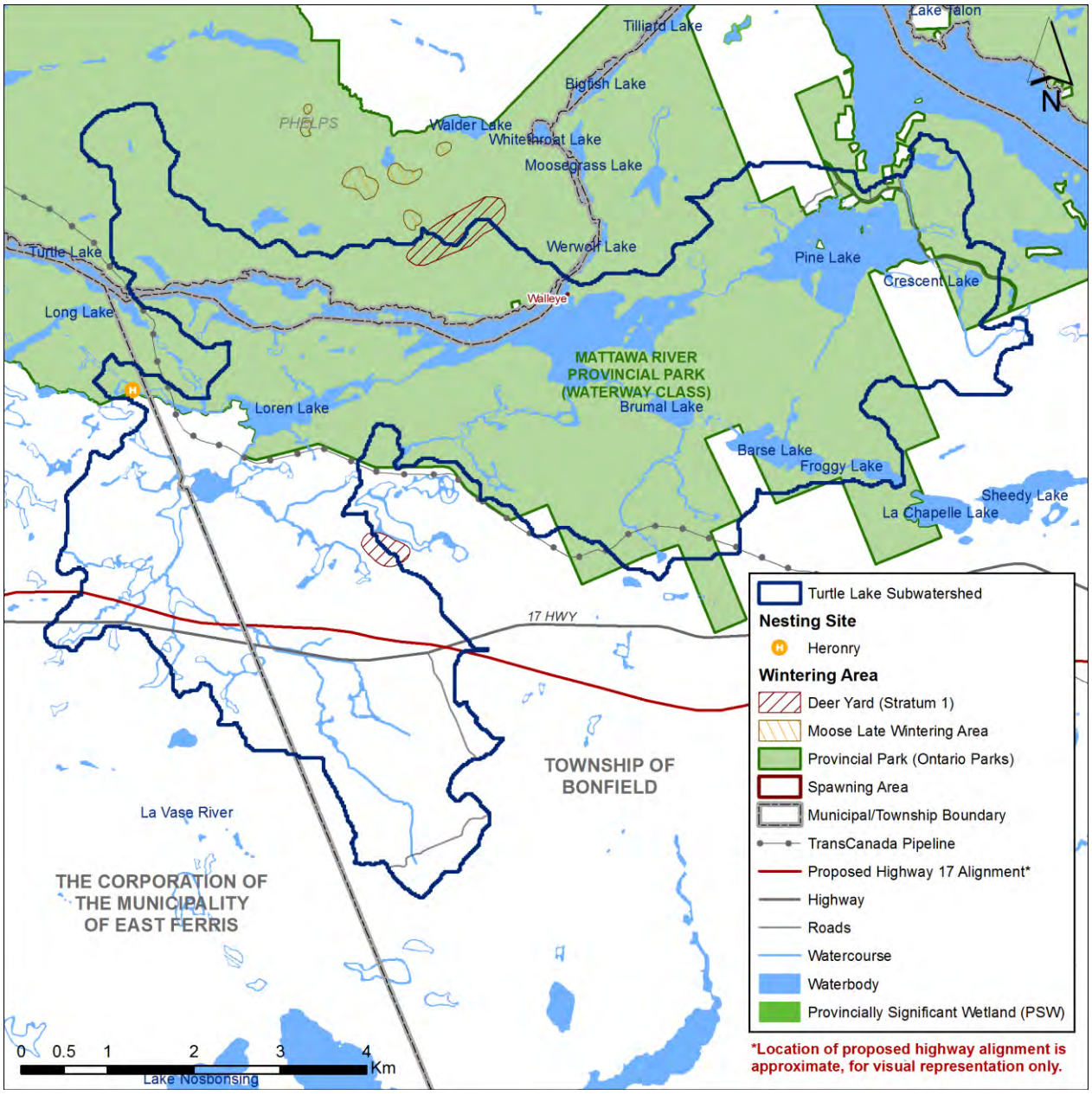
3. Economic Needs and Issues:

- Sustainment of peripheral agricultural uses

- Conversion of TransCanada gas pipeline to carry crude oil

Turtle Lake subwatershed has been evaluated to have low vulnerability/susceptibility to climate change and land use change impacts. This system can be adequately managed in an ad hoc manner with reliance on the Provincial Park designation to protect resource features. This status should be reviewed after assessment of baseline conditions. Risks posed by the proposed conversion of the TransCanada gas pipeline to carry crude oil through the watershed are not fully known at the time of preparing this IWMS.

Figure 17 – Turtle Lake Subwatershed



3.1.14 Kaibuskong River Subwatershed

The Lake Nosbonsing portion of the Kaibuskong River subwatershed is managed pursuant to a Comprehensive Watershed Management Plan prepared in 1993 and management issues for Lake Nosbonsing have been fairly well defined. The Lake Nosbonsing Watershed Management Plan focuses on the protection of Lake Nosbonsing, which is the dominant resource feature in the subwatershed. Lake Nosbonsing is mesotrophic (Astorville Bay is meso-eutrophic), which means that elevated nutrient levels threaten its recreational qualities. Recent blue-green algae blooms have caused North Bay Parry Sound District Health Unit to issue a permanent health warning and placement of restrictions on water use. Restrictions affect Lake Nosbonsing, the Kaibuskong River and Kaibuskong Bay of Lake Talon. Lake Nosbonsing has historically been subject to high shoreline development pressures and is considered to be at capacity west of Shield Point. The remainder of the lake is nearing capacity limits. Non lake features and management needs have not been assessed in detail. The importance of regional overburden aquifers to sustain base flows and meet the protection needs of cold water habitat in Depot Creek are unknown. Impacts from forestry, aggregate extraction, and farming in the subwatershed need further assessment. The anticipated impacts that may influence this subwatershed within the planning horizon can be summarized as follows:

- Continued shoreline development on existing lots including conversion to permanent uses
- Slow infilling within the subwatershed of rural development including hobby farms
- Intensification of mixed development in the hamlets of Astorville and Bonfield
- Aggregate extraction activities
- Minor headwater forestry and agricultural activity in the Depot Creek tributary
- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)
- The potential four laning of Highway 17

Kaibuskong River subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Further implementation of nutrient reduction strategies and/or development of new strategies (new strategies must be developed with stakeholders) to control eutrophication and the proliferation of blue-green algae
- Protection of Walleye spawning grounds on Lake Nosbonsing
- Continued monitoring of Lake Nosbonsing water quality
- Reassessment of erosion conditions in Depot Creek
- Protection of wetlands
- Assessment of regional overburden aquifer protections needs

- Potential sediment deposition issues due to flat stream gradient
- Recognize the Kaibuskong River management obligations to downstream systems including Lake Talon and the Lower Mattawa River. Consider installing a gauge on the Kaibuskong River (at Highway 17) to improve the understanding of hydrologic and water balance contributions to lower systems
- Extension of floodplain mapping may be warranted along the Lower Kaibuskong River

2. Social Needs and Issues:

- Investigation of strategies to control blue-green algae
- Public access to Lake Nosbonsing for recreation, navigation, fishing, winter uses
- Public access to crown land for hunting, fishing (brook trout in Depot Creek), informal camping and off road recreational pursuits
- Identification and protection of cultural heritage resource features
- Interpretation and improved appreciation for ANSI resource features

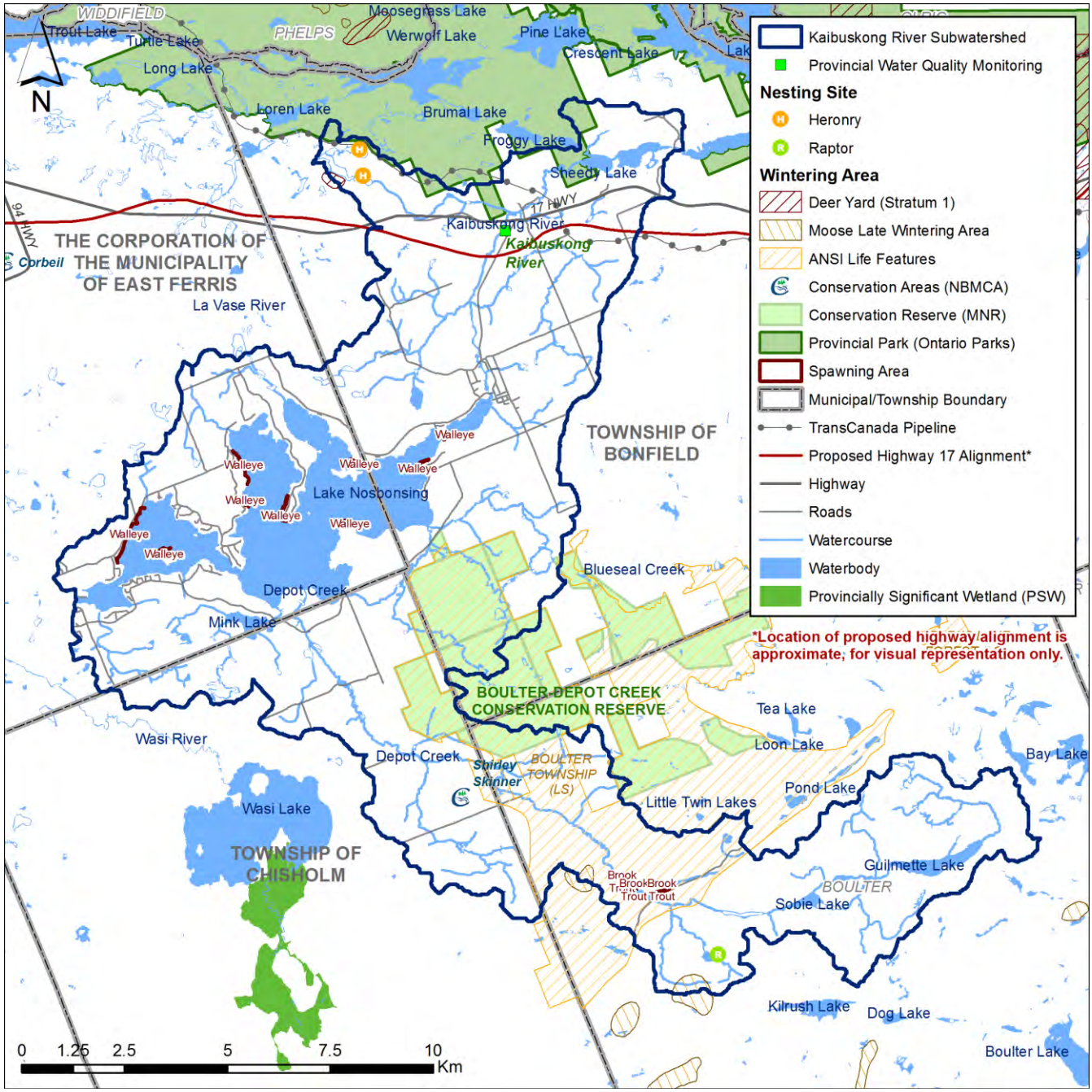
3. Economic Needs and Issues:

- Sustained growth in the municipalities of Bonfield and East Ferris
- Agricultural sustainability
- Sustainable aggregate production
- Sustainability of tourism on Lake Nosbonsing
- Conversion of TransCanada gas pipeline to carry crude oil
- Four laning of Highway 17

The Kaibuskong River subwatershed has been evaluated to have moderate to high vulnerability/susceptibility to climate change and land use change impacts. Existing controls will not meet public expectations to manage nuisance algae in Lake Nosbonsing and downstream which has emerged as a new issue. Future conditions will be impacted by further shoreline conversions, watershed infilling and climate change. There are outstanding management recommendations within the existing Comprehensive Watershed Management Study including non-shoreline nutrient controls in tributaries, establishment of septic tank pump out bylaws in Bonfield and potential establishment of municipal water and sewer services in the Hamlets of Astorville and Bonfield. As nonstructural control options aimed at addressing eutrophication and now algae proliferation are exhausted, there will be increased pressure to add municipal wastewater collection and treatment. Municipal servicing may be the only effective way to address serious water quality issues at the west end of Lake Nosbonsing (which has poor circulation and limited natural attenuation capabilities). With outstanding Comprehensive Watershed Management recommendations still available, existing options should be pursued before initiating new studies. The advancement of additional strategies will require implementation direction and structural options, if pursued, will require Environmental

Assessment approval. Risk posed by the conversion of TCPL gas line to carry crude oil or the establishment of a new four lane highway through the lower watershed are unknown at the time of preparing the IWMS. An Integrated Subwatershed Management Plan may be required in the long term to evaluate new resource protection needs and to abate nuisance algal blooms.

Figure 18 – Kaibuskong River Subwatershed



3.1.15 Lake Talon Subwatershed

The Lake Talon subwatershed is currently managed in an ad hoc manner. This subwatershed has undergone only minor assessment including hydrologic analysis and consequently the understanding of management issues and concerns are not well developed. The body of work that supports the Mattawa River Provincial Park provides supporting resource information for this system including cultural heritage information. This subwatershed is directly affected by upstream subwatershed management activities including more concentrated management efforts in the Trout Lake and Kaibuskong subwatersheds. Protection of Lake Talon, the dominate lake, is expected to be the principle management issue in this basin. Lake Talon may come under increasing shoreline development pressures as other accessible lakes reach their capacities for development. Kaibuskong Bay has distinctions from the main body of Lake Talon and is more sensitive to development and upstream impacts. It has been affected by recent blue green algae restrictions in conjunction with Lake Nosbonsing and the Kaibuskong River. The main body of Lake Talon has remaining waterfront development capacity. A substantial portion of Lake Talon's shoreline is protected by the Mattawa River Provincial Park designation. The anticipated impacts that may influence this subwatershed within the planning horizon are summarized as follows:

- Shoreline development on Lake Talon through the creation of new lots and conversion of seasonal uses to permanent uses
- Rural Residential Growth along existing roadways including hobby farming
- Continued agricultural uses in close proximity to Lake Talon
- Aggregate extraction activities
- Forest management activities in headwater areas
- Impacts from upstream subwatersheds

Lake Talon subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Identify baseline conditions (see **Table 14** for guidelines), trends and resource/cultural heritage protection needs
- Continued monitoring of Lake Talon water quality
- Protection of Area of Natural and Scientific Interest including Doule Forest and Rice Bay-Blue Mountain Delta (Provincially Significant)
- Assessment of Lake Talon's capacity to accommodate new shoreline development
- Monitor protection of wetlands including Delta Bay Marsh (Provincially Significant Wetland)
- Protection of cold water habitat (supporting brook trout and lake trout)

- Protection of fish spawning areas including Lake Trout and Walleye
- Assessment of upstream water taking impact on the upper Mattawa River system
- Assessment of management efforts within and upstream of Kaibuskong Bay to control Blue-green algae
- Improvements in the understanding of hydrologic balance and its role in the hydrologic balance of the lower Mattawa systems (establish water level control gauge at the Lake Talon Dam at Talon Chutes)
- Monitor forestry and aggregate extraction reporting (forestry is mainly in occurring in headwater areas) to ensure that sustainable practices are being followed

2. Social Needs and Issues:

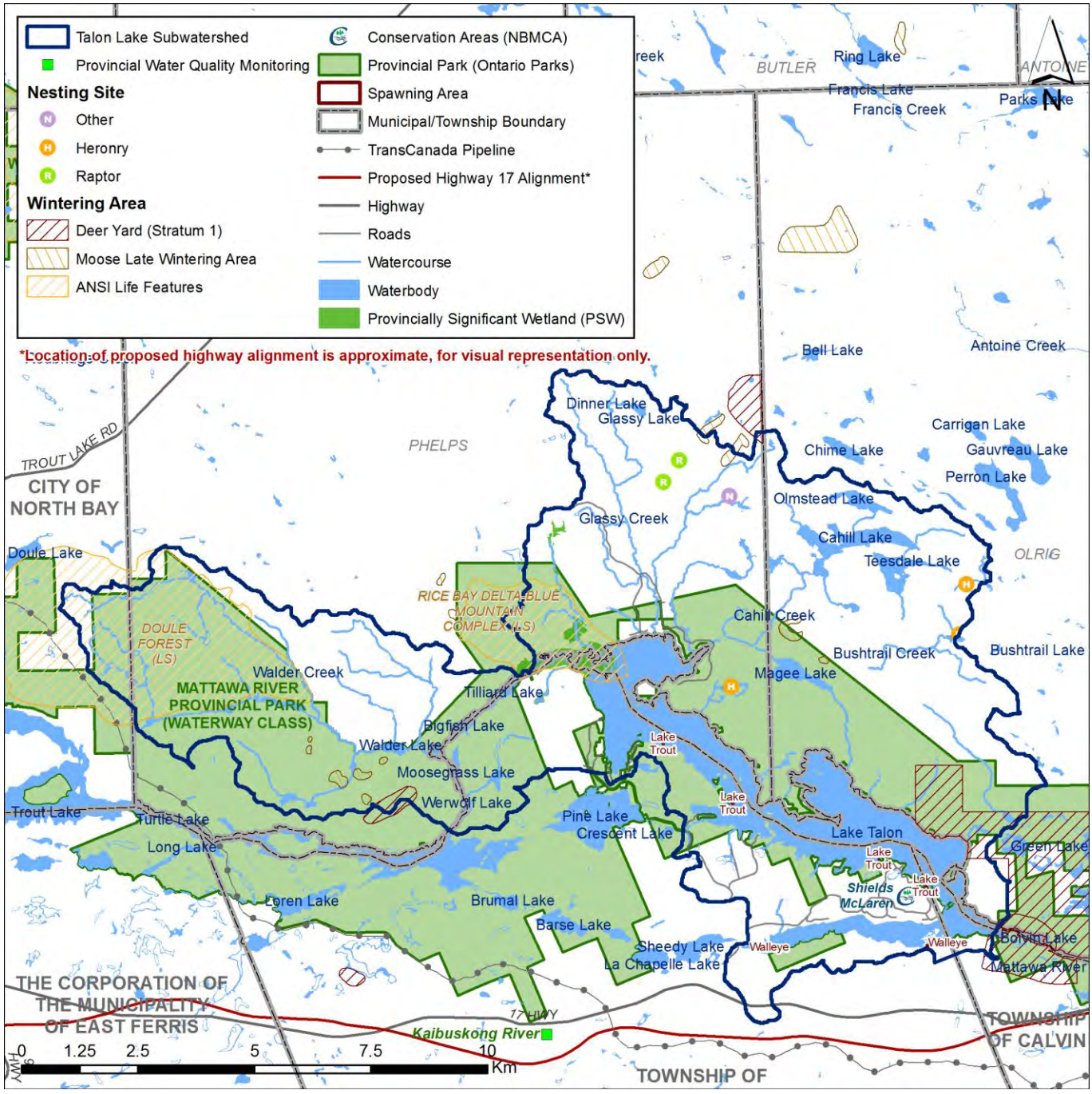
- Investigation of strategies to control blue-green algae
- Public Access to Lake Talon for recreation, navigation, fishing, winter uses
- Public access to Crown land for hunting, fishing (including many brook trout tributaries), informal camping and off road recreational pursuits
- Further identification and protection of cultural heritage resource features
- Interpretation and improved appreciation for ANSI resource features (Rice Bay Delta-Blue Mountain Complex is a provincially significant life science feature)

3. Economic Needs and Issues:

- Rural growth in Bonfield Township
- Agricultural sustainability
- Sustainment of aggregate extraction activities
- Sustainability of tourism on Lake Talon

The Lake Talon subwatershed has been evaluated to have low vulnerability and moderate susceptibility to climate change with high vulnerability to land use change. The existing ad hoc approach (with reliance on the Provincial Park designation for partial protection) will meet short term management needs of this system with the exception of issues in Kaibuskong Bay (which needs to be addressed in conjunction with approaches for the Kaibuskong subwatershed). Development pressure within the Lake Talon subwatershed in combination with stresses inherited from upstream systems will likely necessitate the development of a more formal management structure in the longer term. A Comprehensive Watershed Management Plan will likely be required within the planning horizon of this IWM Strategy that will need to examine and quantify issues in the context of its immediate subwatershed and from contributing subwatersheds.

Figure 19 – Lake Talon Subwatershed



3.1.16 Sharpes Creek Subwatershed

Sharpes Creek is currently managed in an ad hoc manner. This subwatershed has received minimal assessment work. Consequently management issues and needs are not well understood. Sharpes Creek is surrounded by significant overburden aquifers that are likely important to the

sustainment of base flows and cold water habitat conditions. Sharpes Creek flows are also sustained by a large headwater wetland. This subwatershed contains richer soils that have evolved in Glaciolacustrine deposits, which are preferred agricultural lands. This subwatershed consequently has retained a higher number of family farming operations and it has been popular for rural development and the creation of hobby farms. The lower Sharpes Creek subwatershed is largely settled while its headwaters remain forested. The Sharpes Creek headwaters have several significant resource features; some are recognized as ANSI's which provides resource harvesting restrictions. The anticipated impacts that may influence this subwatershed within the planning horizon are summarized as follows:

- Slow infilling within the subwatershed of rural development including increase in hobby farming
- Potential for intensification of mixed development in the hamlet of Rutherglen (growth in Rutherglen has been slow)
- Significant aggregate mining potential exists along subwatershed boundaries
- Headwater forestry activities
- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)
- The potential four laning of Highway 17

Sharpes Creek subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Identify baseline conditions (see **Table 14** for guidelines), trends and resource/cultural heritage protection needs
- Protection of Areas of Natural and Scientific Interest (ANSIs) including the Rutherglen Moraine, Boulter Township Esker Complex and Blueseal Creek Hill (all are Provincially Significant)
- Protection of headwater wetlands
- Protection of cold water habitat (supporting brook trout)
- Assessment of overburden aquifer importance to base flow and cold water habitat
- Recognize the Sharpes Creek management obligations to downstream systems including Lake Talon and the Lower Mattawa River. Consider installing a gauge on Sharpes Creek (at Highway 17) to improve the understanding of hydrologic and water balance contributions to lower systems

- Monitor forestry and aggregate extraction reporting (forestry is mainly occurring in headwater areas) to ensure that sustainable practices are being followed and pit closure work is being completed promptly
- Abandoned pit rehabilitation and vegetative replanting

2. Social Needs and Issues:

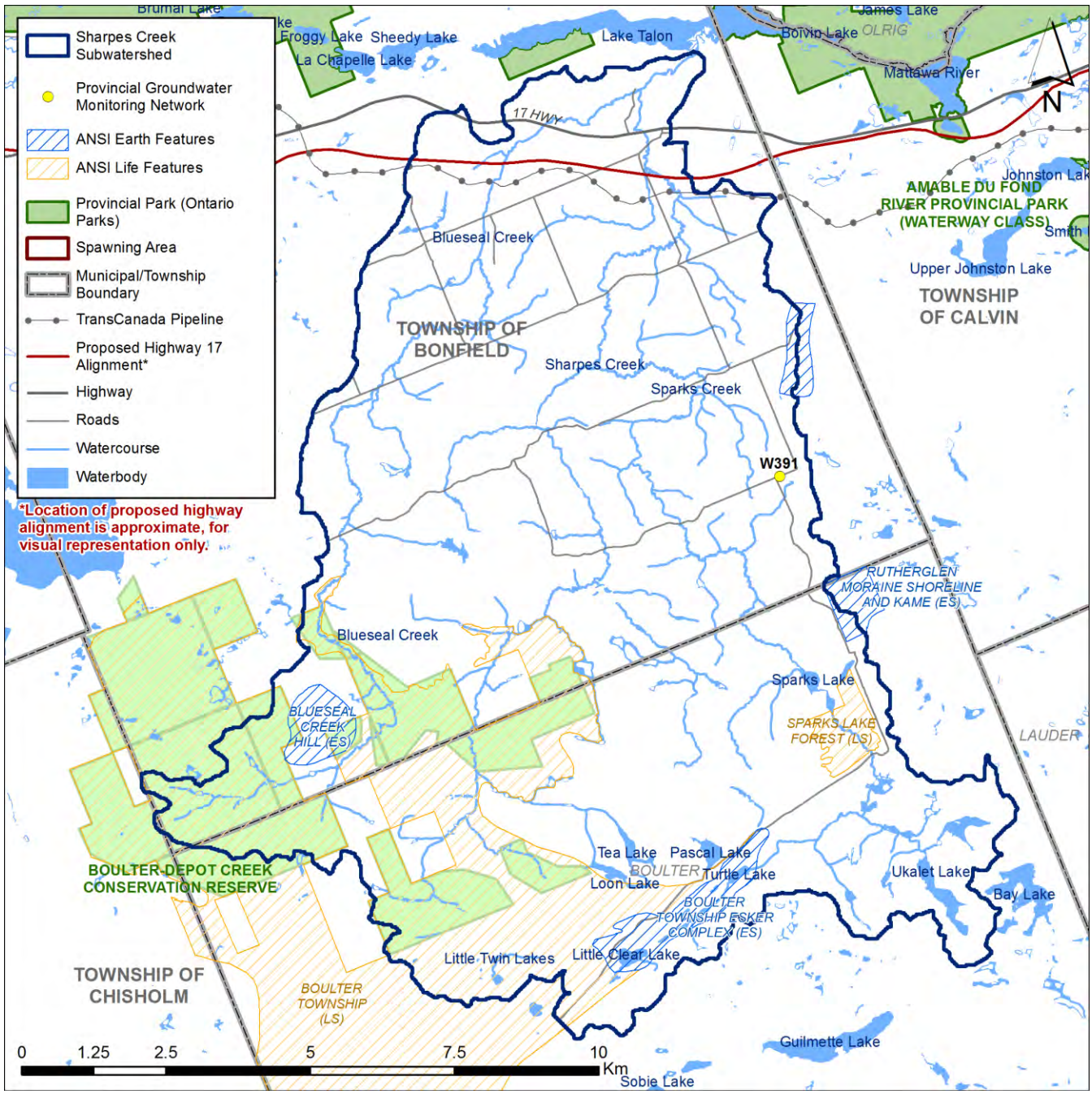
- Public access to crown land for hunting, fishing (brook trout), informal camping and off road recreational pursuits
- Interpretation and improved appreciation for ANSI resource features

3. Economic Needs and Issues:

- Rural development
- Agricultural sustainability
- Sustainment of aggregate extraction activities
- Conversion of TransCanada gas pipeline to carry crude oil
- Four laning of Highway 17

The Sharpes Creek subwatershed has been evaluated to have low vulnerability and moderate susceptibility to climate change as well as moderate vulnerability to land use change impacts. The current ad hoc approach to subwatershed management is sufficient to meet the short term needs of this system. A Comprehensive Management Plan may be warranted in the long term to address emerging management needs (including management actions to protect Kaibuskong Bay). Baseline water quality characterization will be important to assess the impact of rural and agricultural land uses on the cold water habitat within the Shapes Creek basin and for Lake Talon.
Risk posed by the conversion of TCPL gas line to carry crude oil or the establishment of a new four lane highway through the lower watershed are unknown at the time of preparing the IWMS.

Figure 20 – Sharpes Creek Subwatershed



3.1.17 Amable du Fond Subwatershed

The Amable du Fond River subwatershed is the largest subwatershed within the NBMCA that is managed in an ad hoc manner. Management of this subwatershed can logistically be divided into two areas. The headwaters, above Kiosk, which makes up 62 % of the total drainage area, is almost entirely located within Algonquin Provincial Park and is managed pursuant to an umbrella

of management plans designed to protect sensitive zones, recreational interests, research interests and heritage features (note: the western headwaters are outside of Algonquin Provincial Park and are not subject to the same level of management). The NBMCA relies on the Province to balance environmental and economic interests of the upper Amable du Fond system. Forestry activity poses the greatest threat to Amable du Fond headwaters. Forestry activity within Algonquin Provincial Park is under the stewardship of the Algonquin Forest Authority, which has more advanced sustainable forest management practices compared to other Forest Management Units in the area in part due to higher protections needs within the park. A portion of the western headwaters outside of the Park is within the French/Severn Forest Management Unit. Forest management plans have allocated as much as 40 percent of the total forest for harvest in the current 10 year management cycle.

The lower Amable du Fond River subwatershed, below Kiosk, also has protection afforded by Provincial Park designations, as well as the NBMCA's principle Conservation Area at the Eau Claire Gorge. Provincial Park designations apply to Crown land along the Amable du Fond River and in Samuel de Champlain Provincial Park. Settlement within the lower subwatershed is somewhat remote from urban centers and growth pressures are minimal. The largest development pressures may be expected on the shores of smaller lakes in the lower watershed. In terms of the entire subwatershed, this system has large deer yards in both Algonquin and Champlain Provincial Parks. Considerable logging activity is also identified in the Nipissing and Trent Severn Forests outside of Algonquin Park. The anticipated impacts that may influence this subwatershed within the planning horizon are summarized as follows:

- Logging activity within and outside of Algonquin Provincial Park
- Slow rural development outside of Provincial Park designations along existing roadways or on the shorelines of small water bodies in the lower subwatershed. There seems to be minimal interest in hobby farming
- Aggregate extraction activities
- Continued agricultural activities
- Impacts from small scale hydroelectric power production
- Algonquin land claim impacts
- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)
- The potential four laning of Highway 17

Amable du Fond River subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Monitoring the quality, quantity and temperature of water discharging into the lower Amable du Fond system to track logging and climate change impacts in headwaters
- Establish subwatershed baseline conditions, trends and resource/cultural heritage protection needs below Kiosk
- Monitor forestry, aggregate extraction and hydro production reporting (Forestry is occurring in three different Forest Management Units) to ensure that sustainable practices are being met
- Protect walleye spawning grounds and water quality of Smith Lake
- Protection of ANSIs (Rutherglen Moraine)
- Fill in some of the resource information gaps in the headwaters (soils and groundwater interpretation)
- Consider re-establishing hydrologic monitoring for the lower Amable du Fond River
- Consider floodplain mapping for Smith and Crooked Chutes Lake
- Recognition of Amable du Fond's management obligations to the Lower Mattawa River system

2. Social Needs and Issues:

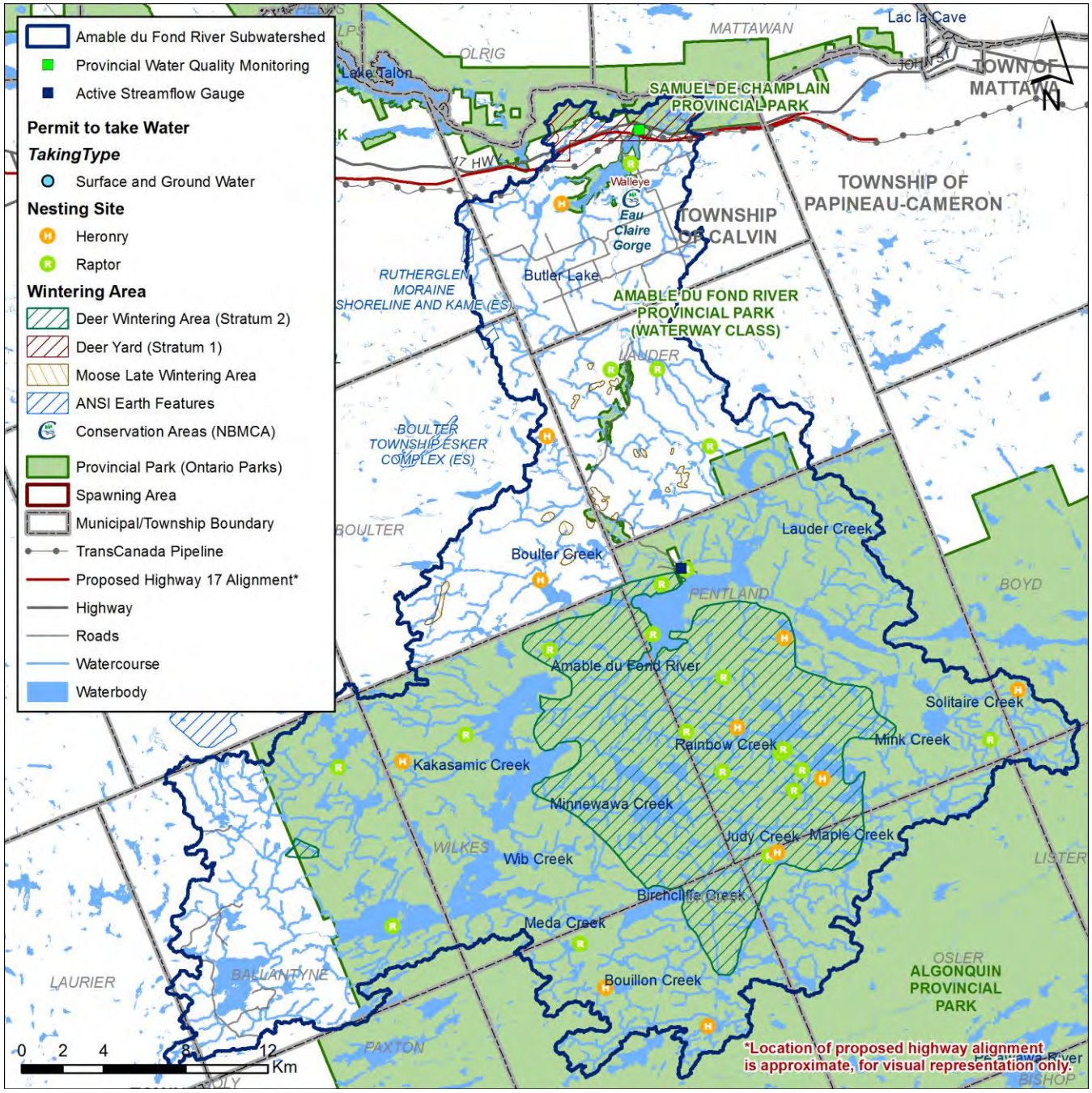
- Preservation of recreational value and remote wilderness experience of Algonquin Provincial Park
- Continued public access to crown land for hunting, fishing (brook trout), informal camping and off road recreational pursuits outside of Algonquin Park
- Interpretation and improved appreciation for ANSI resource features
- Further identification and protection of cultural heritage resource features

3. Economic Needs and Issues:

- Rural development including intensification of shoreline development on the main river and small lakes within municipal boundaries
- Agricultural Sustainability
- Sustainability of aggregate production
- Sustainability of forestry
- Sustainable hydro power production
- Conversion of TransCanada gas pipeline to carry crude oil
- Four laning of Highway 17

The Amable du Fond River subwatershed has been evaluated to have moderate vulnerability/ susceptibility to climate and land use change impacts. Risk posed by the conversion of TCPL gas line to carry crude oil or the establishment of a new four lane highway through the lower watershed are unknown at the time of preparing the IWMS. The overall resource quality of this system is good and conditions are stable or improving. This subwatershed can continue to be managed in an ad hoc manner for the foreseeable future.

Figure 21 – Amable du Fond River Subwatershed



3.1.18 Pautois Creek Subwatershed

The Pautois Creek Subwatershed is currently managed in an ad hoc manner. This subwatershed has been subject to an inventory of aquatic habitat conditions in streams however subwatershed protection and resource management issues are not well understood. This subwatershed has high habitat importance for raptor nesting and moose wintering relative to other systems. The headwaters of this system are earmarked for considerable logging activity both inside and outside of Algonquin Provincial Park. In excess of 50% of the headwaters are earmarked for harvest within the current 10-year harvest cycle. Most logging is planned within the Nipissing Forest, which is not as advanced in sustainable forest management practices compared to forestry activities in Algonquin Park. This subwatershed has valuable headwater lakes that are important to residents in the surrounding municipalities for recreation and fishing. These lakes could be subject to additional stress within the horizon of this strategy if the Algonquin land claims settlement is ratified in its current form. Crown land parcels on Thompson Lake, outside of Algonquin Provincial Park, and on Papineau Lake, are identified for transfer to the Algonquins of Ontario as part of their land claims settlement. It is assumed that these lands are being sought for development purposes. Settlement occupies the lower third of this subwatershed however development pressures are low due to distances from urban centers. The anticipated impacts that may influence this subwatershed within the planning horizon are summarized as follows:

- Logging activity in the headwaters both within and outside of Algonquin Park
- Increasing pressure on headwater lakes resulting from Algonquin Land Claim Impacts including improved access, development and increased recreational use
- Slow rural development along existing roadways with some interest in hobby farming
- Minor aggregate extraction activities
- Continued agricultural activities
- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)
- The potential four laning of Highway 17

Pautois Creek subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Further develop baseline conditions (see **Table 14** for guidelines), trends and resource/cultural heritage protection needs
- Focused research on conditions and hazards related to Thompson and Papineau Lakes (including identification of floodplains and carrying capacities)
- Monitoring of forestry management unit reporting (forestry is occurring in two different Forest Management Units) to ensure that sustainable forest management practices are

being followed and to establish whether forest management units coordinate management efforts between units in the same drainage basin
- Protection of cold water habitat
- Protection of moose winter habitat
- Protection of raptor nesting in Pautois Creek headwaters
- Recognition of Pautois Creek's management obligations to the lower Mattawa River system

2. Social Needs and Issues:

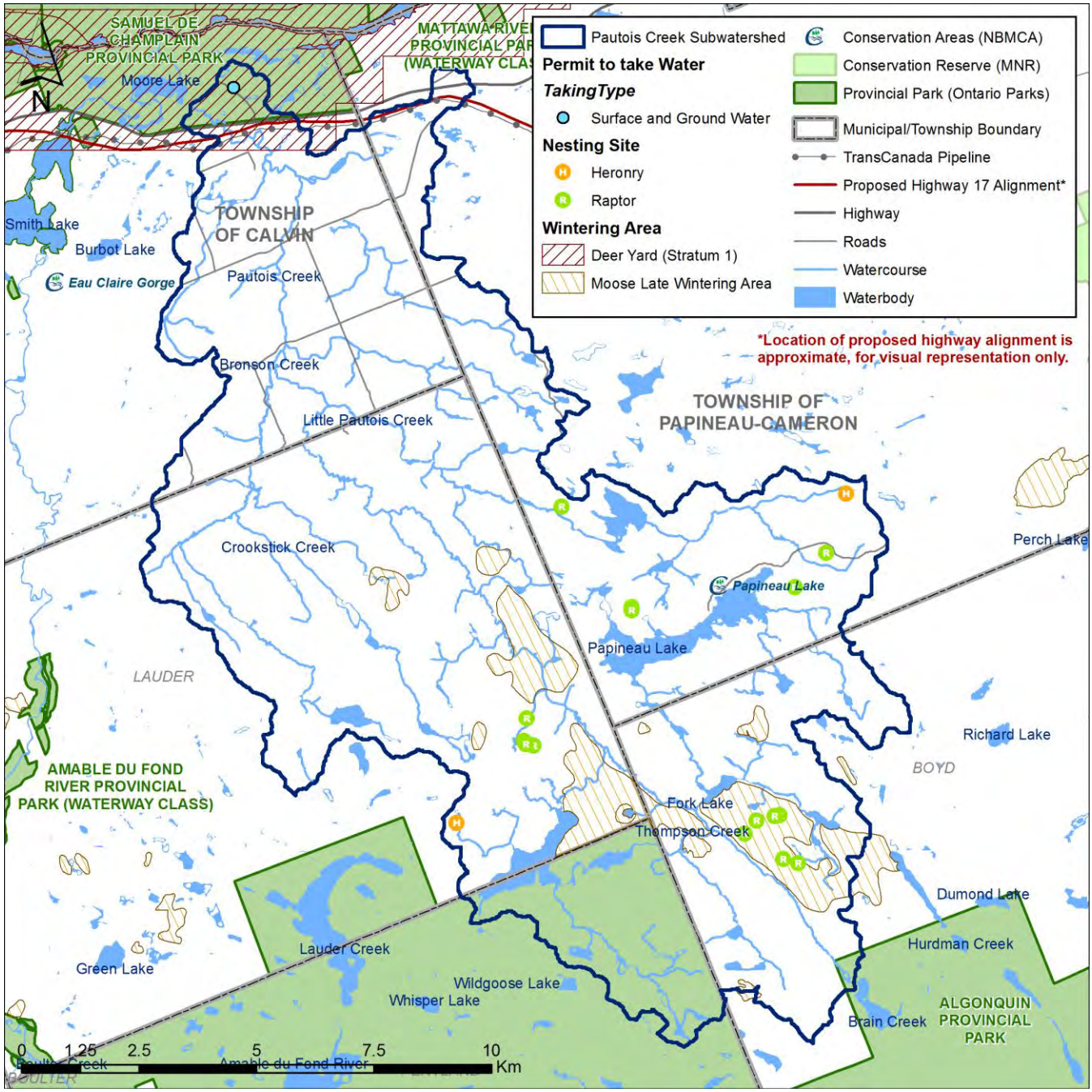
- Protection of public access to crown land and upper watershed lakes for hunting, fishing (brook trout), informal camping and off road recreational pursuits outside of Algonquin Provincial Park
- Continued access to headwater lakes
- Development on headwater lakes may precipitate interest for water level control structures to maintain recreational water levels

3. Economic Needs and Issues:

- Rural development
- Agricultural sustainability
- Sustainment of aggregate extraction activities
- Forestry sustainability
- Conversion of TransCanada gas pipeline to carry crude oil
- Four laning of Highway 17

The Pautois Creek subwatershed has been evaluated to have moderate vulnerability/ susceptibility to climate and high vulnerability to land use change impacts. Risk posed by the conversion of TCPL gas line to carry crude oil or the establishment of a new four lane highway through the lower watershed are unknown at the time of preparing the IWMS. This subwatershed can continue to be managed in an ad hoc manner in the short term. Management efforts should be focused on establishment of baseline conditions for Thompson and Papineau Lakes and protection of the cold water habitat in these lakes and receiving streams. Hydrology and lake capacity assimilation studies may be required for these upper lakes if development pressures materialize.

Figure 22 – Pautois Creek Subwatershed



3.1.19 Boom Creek Subwatershed

The Boom Creek subwatershed is currently managed in an ad hoc manner. This subwatershed has received basic inventory work however subwatershed protection and resource management issues are not well understood. The headwaters of this system are earmarked for logging however due to fairly heavy past logging activities the intensity of logging in the current management cycle

is less than in neighbouring subwatersheds. A relic old growth forest on the eastern boundary of this subwatershed is protected through a Provincial Conservation Reserve (this level of protection seems to be less than for other resource features with provincial significance within the NBMCA). Boom Creek has two small warm water lakes with limited recreational potential due to their size and poor quality characteristics. The lower third of the Boom Creek basin is settled with rural land uses. Rural development pressures are moderate given its close proximity to Mattawa. The anticipated impacts that may influence this subwatershed within the planning horizon are summarized as follows:

- Logging activities in the upper watershed
- Rural development along existing roadways with some interest in hobby farming
- Continued agricultural activities
- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)
- The potential four laning of Highway 17

Boom Creek subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Identify baseline conditions (see **Table 14** for guidelines), trends and resource/cultural heritage protection needs
- Protection of cold water habitat (Landis Creek)
- Monitor forestry reporting to ensure that sustainable forest management targets are being met
- Identify Boom Creek's management obligations to the Lower Mattawa River system

2. Social Needs and Issues:

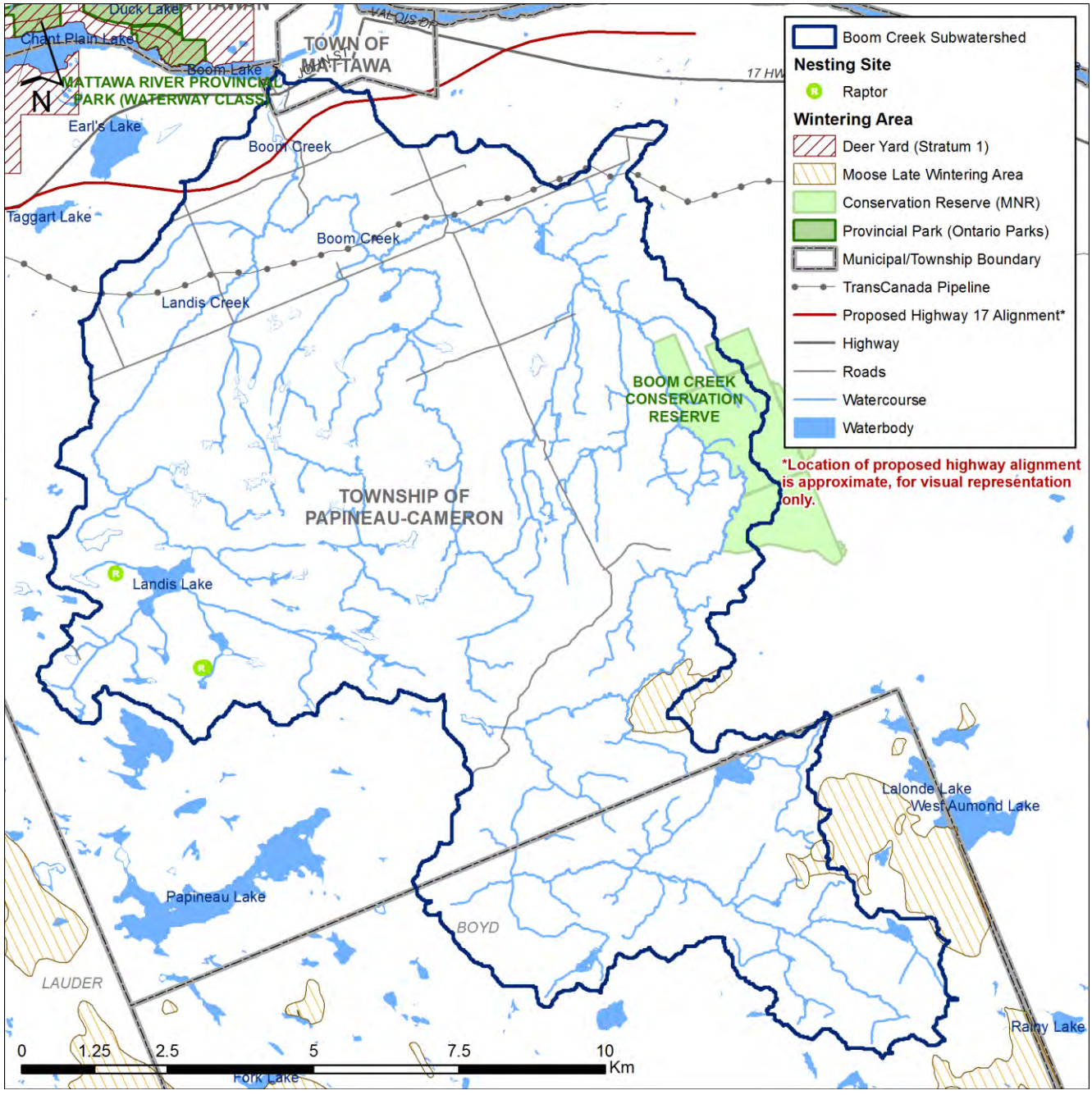
- Public access to crown land for hunting, fishing, informal camping and off road recreational pursuits
- Interpretation and improved appreciation for the old growth forest

3. Economic Needs and Issues:

- Rural development
- Agricultural sustainability
- Forestry sustainability
- Conversion of TransCanada gas pipeline to carry crude oil
- Four laning of Highway 17

The Boom Creek subwatershed has been evaluated to have low vulnerability/susceptibility to climate change and moderate vulnerability to land use change impacts. Risk posed by the conversion of TCPL gas line to carry crude oil or the establishment of a new four lane highway through the lower watershed are unknown at the time of preparing the IWMS. The current ad hoc approach to subwatershed management is sufficient to meet the long term needs of this system unless assessment of baseline conditions uncovers significant issues.

Figure 23 – Boom Creek Subwatershed



3.1.20 Lower Mattawa River Subwatershed

The Lower Mattawa River subwatershed is currently managed in an ad hoc manner. A substantial portion of this subwatershed is protected by Provincial Park designations (Mattawa River Provincial Park and Samuel de Champlain Provincial Park) which were planned based on considerable inventory and assessment work. Consequently subwatershed management issues are better understood here than in other subwatersheds near Mattawa. The lower Mattawa River provides a unique wilderness experience as a canoe route in remote and picturesque terrain which also has considerable heritage significance. This subwatershed harbours a significant deer yard that encompasses a substantial portion of the system. Development pressures are limited to between Pimisi Bay and Rutherglen and the eastern fringes near the Town of Mattawa which has full urban services (Mattawa is experiencing infilling as well as commercial and institutional development pressures). This subwatershed is encountering high demand for shoreline development outside of lands protected by Provincial Parks including on Lake Chant Plein, along the lower Mattawa River, and in the vicinity of Earls and Taggart Lakes. Lower Mattawa River subwatershed conditions are largely inherited from upstream systems. Consequently, this subwatershed is dependent on upstream management efforts. The Earls Lake tributary may be subject to increased development pressure within the horizon if resource sectors experience a boom (including development in Papineau Industrial Park) and/or highway improvements from North Bay are advanced earlier than expected. The anticipated impacts that may influence this subwatershed within the planning horizon are summarized as follows:

- Shoreline development on Lake Chant Plein, the lower Mattawa River and Earls and Taggart Lakes including the creation of new lots and conversion of seasonal uses to permanent uses
- Rural residential growth along existing roadways including hobby farming
- Forest management activities in headwater areas
- Aggregate extraction activities
- Production of hydro electricity
- Industrial development in the Papineau/Cameron Industrial Park off of Highway 17 East
- Algonquin land claim impacts
- TransCanada Pipeline is seeking approval to repurpose one of its natural gas pipelines to a crude oil pipeline (products will include diluted bitumen) (recently emerged issue)
- The potential four laning of Highway 17
- Impact from upstream subwatersheds

Lower Mattawa River subwatershed management issues and needs have been examined from three perspectives as follows:

1. Environmental Needs and Issues:

- Develop baseline conditions for the entire subwatershed (see **Table 14** for guidelines) including trends and resource/cultural heritage protection needs outside of Provincial Parks
- Monitor forestry, aggregate and hydro production reporting to ensure that sustainable management is being practiced
- Improved flood monitoring procedures for the Town of Mattawa
- Protection of a significant Deer Yard (deer yard information may require updating)
- Protection of walleye spawning areas on Lake Chant Plein and lower Mattawa River
- Develop flood elevations for Taggart Lake and preparation of floodplain mapping for Earls Lake and Taggart Lake (through a hydrology study)
- Improvements in the understanding of management needs that may affect upstream systems
- Establishment of baseline monitoring for the entire Mattawa River system by monitoring flows, water quality and water temperature at the mouth of the River as part of a report card (note flows may be best monitored at Hurdman Dam)
- Consider the entire Mattawa River watershed management obligations to the Ottawa River

2. Social Needs and Issues:

- Public access to Lake Chant Plein, the lower Mattawa River for recreation, navigation, canoeing, swimming and fishing
- Preservation of recreational value and remote wilderness experience of Mattawa River Provincial Park
- Protection of public access to crown land and upper watershed lakes for hunting, fishing (brook trout), informal camping and off road recreational pursuits outside of Provincial Parks (note Hunting is permitted in the Mattawa River Provincial Park)

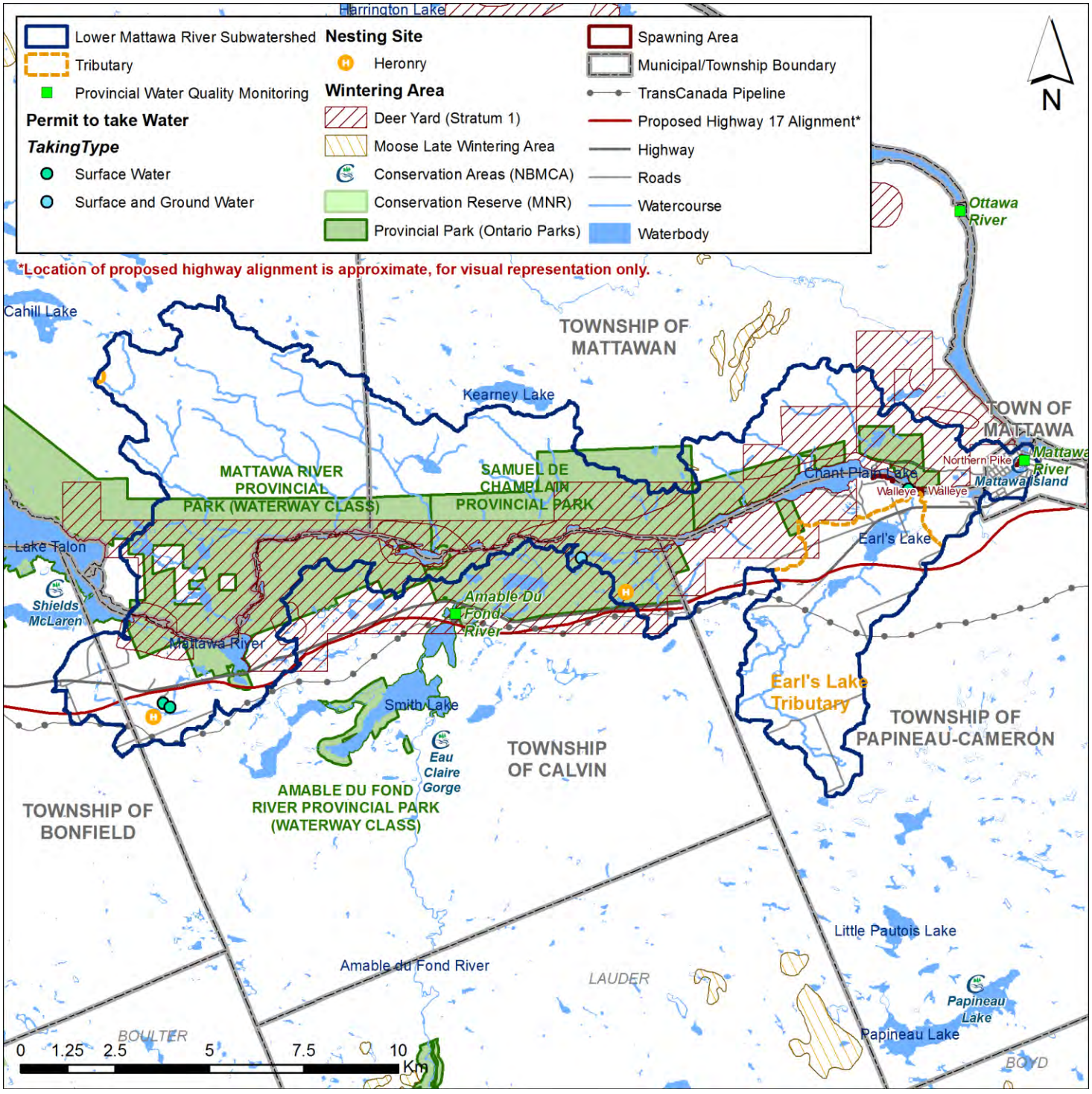
3. Economic Needs and Issues:

- Urban development and intensification in the Town of Mattawa
- Rural development in surrounding townships
- Industrial Development with the Papineau/Cameron Industrial Park
- Sustainment of aggregate extraction activities
- Forestry sustainability
- Sustainable hydro electricity production
- Conversion of TransCanada gas pipeline to carry crude oil

- Four laning of Highway 17

The Lower Mattawa River subwatershed has been evaluated to have moderate vulnerability/ susceptibility to climate change and a high vulnerability to land use change impacts. Risk posed by the conversion of TCPL gas line to carry crude oil or the establishment of a new four lane highway through the lower watershed are unknown at the time of preparing the IWMS. The current ad hoc approach to subwatershed management with reliance on Provincial Park designations is sufficient to meet the long term needs of this system unless baseline inventory work identifies significant needs or issues. A hydrology study for the Earls Lake tributary may be required if the economy experiences a boom cycle or if a highway bypass is constructed.

Figure 24 – Lower Mattawa River Subwatershed



3.2 SUMMARY OF SUBWATERSHED NEEDS AND ISSUES

The identification of subwatershed management needs for 20 NBMCA subwatersheds reveals that there is still considerable work to be done. In order to be able to determine what can be accomplished and in what order, information needs to be organized and summarized. Prioritization will be based on many factors including the current health status and recent trends in each basin. Are currently unmanaged systems in need of management? For those systems with management strategies; are current management efforts successful in meeting management expectations? Current management expectations may not be met because a study's recommendations are now too narrowly focused, recommendations are proving not to be effective, or they may be advancing too slowly. Expectations may have shifted due to newly emerging problems or updated knowledge of potential risks. For example, management expectations for a number of area lakes have recently shifted due to the identification of blue green algae blooms. The public now has a growing expectation that such events can be controlled. Some subwatersheds appear to be stable but have unknown risk factors that may create future uncertainty. Future management needs may be driven by a subwatershed sensitivity/vulnerability (threats) from climate or land use change. These considerations are summarized in

Table 15.

Table 15 suggests that Lake Nipissing subwatersheds have greater management needs possibly driven by a higher sensitivity to climate change. A summary of management needs for each subwatershed and their significant tributaries are provided in **Table 16**.

Table 15 - Summary of Subwatershed Management Needs and Threats

	Subwatershed	Stable in Good Conditions with limited Risks	Stable in Degraded Conditions with limited Risks	Stable with Uncertainty due to Numerous Unevaluated Risks	Level of Management not meeting Current Expectations	High Climate Change Sensitivity Scoring	High Climate Change Vulnerability Scoring	High Land Use Change Vulnerability Scoring	Management Limitations
Lake Nipissing Watershed	Duchesnay Creek		☑			High			
	Chippewa Creek			☑		High	High		
	Park Creek				☑	High			Too Narrowly Focused
	Jessups Creek		☑						
	La Vase River		☑			High		High	
	Lake Nipissing/North Bay				☑	High			Implementation Too Slow
	Windsor/Boulter/Bear			≥☑≤					
	Burford Creek			≥☑≤					
	Callander Bay/South Shore				≥☑≤	High	High	High	Too Narrowly Focused
	Wistiwasing River				☑	High	High	High	Implementation Too Slow
Mattawa River Watershed	North River		≥☑≤						
	Trout Lake	☑							
	Turtle Lake	≥☑≤							
	Kaibuskong River				☑		High	Very High	Implementation Too Slow
	Lake Talon	☑						High	
	Sharpes Creek		≥☑≤						
	Amable du Fond River	☑							
	Pautois Creek			≥☑≤				High	
	Boom Creek		≥☑≤						
	Lower Mattawa River		☑					High	

☑ Based on Subwatershed Information

≥☑≤ Presumed; Subwatershed Information is absent

Table 16 - Summary of Management Needs for Subwatersheds and Significant Tributaries

Subwatershed and Significant Tributaries	Key Subwatershed Management Need	Major Tributary Need	Downstream Driven Need
Duchesnay Creek	Baseline Inventory to Identify Management Needs		
Canadore Trib		Stormwater Management Plan	
Chippewa Creek	Integrated Watershed Management Plan		
Eastview Trib			
Johnson Trib			
Golf Club Trib			
North Airport Trib		Master Drainage Plan	
Park Creek	Comprehensive WMP	Headwater Stormwater MP	
Jessups Creek	Status Quo		
La Vase River	Develop Implementation Framework	Stormwater Management Plans - Lower Tributaries facing Development	
Cooks Creek Trib			
Lake Nipissing/North Bay	Status Quo	Reassess Flood/Wave Damages	
Pinewood Parkway Trib		Reassess Hydrologic Strategy	
Bond Street Trib			
Gauthier Trib			
Windsor/Boulter/Bear	Baseline Inventory to Identify Management Needs		
Windsor		┌ May need	Support Info for Callander Bay
Boulder		| Individual	
Bear		└ Management Plans	
Burford Creek	Baseline Inventory to Identify Management Needs		Support Info for Callander Bay
Callander Bay/South Shore	Shoreline Management Plan	Reassess Flood/Wave Damages	
Cranberry Trib		┌ Master Drainage	Support Info for Callander Bay
Trib #1		| Plan for Settlement	Support Info for Callander Bay
Trib #2		└ Area	Support Info for Callander Bay
Wistiwasing River	Integrate CWMP/SWP Recommendations & Develop Implementation Framework		Support Info for Callander Bay
Graham Cr Trib			
Wasi Lake Trib		Future Integrated WMP	
North River	Status Quo		Support Info for Lake Talon Sub
Balsam Trib			
Trout Lake	Status Quo		Support Info for Lake Talon Sub
Armstrong Trib			
Lees Trib			
Dorans Trib		SWM Plan	
Four Mile Trib/Bay		Comprehensive WMP	
Long Lake Trib			
Turtle Lake	Status Quo		Support Info for Lake Talon Sub
Kaibuskong River	Consider IWMP		Support Info for Lake Talon Sub
West End of L Nosbonsing		Investigate Strategy for Municipal Servicing/Sewage Treatment	
Depot Trib			
Lake Talon	Future Comprehensive Watershed Management Plan		
Kaibuskong Bay			
Upper Mattawa Trib			
Sharpes Creek	Baseline Inventory to Identify Management Needs		Support Info for Lake Talon Sub
Blueseal Trib			
Amable du Fond River	Status Quo		
Kelly Creek			
Pautois Creek	Status Quo		
Headwater Lakes			
Boom Creek	Status Quo		
Lower Mattawa River	Status Quo		
Earls Lake Trib		Hydrology Study	

4.0 INTEGRATED WATERSHED MANAGEMENT PRIORITIES

4.1 INTRODUCTION

This section explores the hierarchy of watershed management and evaluates NBMCA core and discretionary functions. The three-nested-dependency model in Section 3 generates new management implications that are investigated. Priorities for new NBMCA research and program advancements, pursing new leadership roles and tackling management needs at a subwatershed/ tributary level are identified. Longer term monitoring needs are assessed. Priorities are integrated into 5-year implementation strategies to guide NBMCA actions until 2034.

In preparing this section barriers faced by Conservation Authorities when planning and undertaking watershed management initiatives have been considered. Suggestions to minimize pitfalls and roadblocks are evaluated and can be found in **Section 5**.

4.2 MANAGEMENT APPROACHES AND SCALE

The management hierarchy as set out in Section 2 signifies that watershed management is structured in layers that correspond to orders of drainage. General research and broad program needs are carried out at a full watershed scale and more concentrated research and specific program initiatives are pursued at a subwatershed/tributary level. Management can also be considered at a tertiary level (i.e. for the Mattawa River and Lake Nipissing basins). Tertiary management could be added as a new layer or could replace full scale management. The merits of structuring management at a tertiary level are evaluated below.

At a tertiary level the NBMCA jurisdiction encompasses the entire Mattawa River system but only a portion of the Lake Nipissing basin. The NBMCA thus is in a position to formulate strategies that could target watershed outputs in the Mattawa system but not for the Lake Nipissing basin. Tertiary management would allow the NBMCA to contrast differences that exist on either side of the major watershed divide.

In this regard the Mattawa River basin harbours most of the NBMCA larger lake systems and most of its cold water habitat. Land uses are dominantly rural or are undeveloped and are less impacted by climate change based on vulnerability and susceptibility scoring. Most resource features within the Mattawa basin are stable or improving. New threats relate to regional initiatives including the conversion of a TransCanada gas pipeline to carry crude oil, the development of a new four lane highway along the Highway 17 corridor and the Algonquin land claim which all have the potential to impact many subwatersheds. The three-nested-dependency model applies well to this basin. The economy is reliant on the resource sector and economic downturns result in negative growth and social disruption. Significant protection is already afforded through Parks and Park Reserves and the main channel of the Mattawa River

is largely under public ownership as crown land. Lakes facing development pressure, subject to hazards such as flood and erosion or under new risks posed by blue-green algae are largely subwatershed issues best approached at subwatershed level (note that potential flood damages in Mattawa are driven by the management of the Ottawa River system). The Mattawa River's obligations to Ottawa River are unknown because the Ottawa River is not subject to comprehensive management and Ottawa River management needs are largely undefined.

The NBMCA's jurisdiction within the full Lake Nipissing basin is restricted but contains a significant portion of the watershed population as well as significant management issues (such as degraded water quality or flood and wave damages along exposed shorelines). The Lake Nipissing basin contains most of the NBMCA's significant wetlands and is dominated by warm water aquatic habitat. The economy in the Lake Nipissing basin is not as dependent on area resources and the three-nested-dependency model is less applicable. Natural balances are more at risk from urban growth in individual subwatersheds than from major regional initiatives. The NBMCA's small jurisdictional coverage limits the NBMCA's ability to significantly influence full watershed outputs. The NBMCA, however, is in a position to exert influence over the full Callander Bay drainage system; which has already been partially exercised through Drinking Water Source Protection. The NBMCA's obligation to the full Lake Nipissing watershed is undefined as Lake Nipissing's full basin needs have not been assessed. Lake Nipissing however, as part of the Great Lakes basin, and under the purview of the International Joint Commission, has obligations to meet Great Lakes management interests. As previously identified the NBMCA should monitor IJC initiatives and contribute to any that may apply.

The potential benefits of replacing full watershed management with management at a tertiary level are limited by the restricted area of jurisdiction in the Lake Nipissing basin and by the difficulty in defining overall management objectives because receiving systems lack management structure. A benefit is derived by contrasting management issues between systems. Adding additional management layers may generate unnecessary complexity. The NBMCAs existing broad approach at a full area of jurisdiction and concentrated approach at a subwatershed or tributary level has served it well in the past. It is recommended that the NBMCA continue to approach broad responsibilities at a full watershed scale and specific management needs at the subwatershed or tributary level for the next management cycle.

4.2.1 Full Watershed Management Needs

NBMCA management needs for its full jurisdiction are mainly information based (information needs are summarized in **Table 13)** or are policy driven intended to interpret how the NBMCA should administer its mandate across its jurisdictional area. Previous to initiating this IWMS, the NBMCA evaluated broad policy needs and it is currently working to expand policies that will guide development regulation and planning controls. The NBMCA's policy development strategy and time table are provided in **Appendix A**. In determining future watershed research and management priorities there is benefit in understanding how activities relate to core functions.

4.2.1.1 Core Functions:

i) Public Safety and Protection of Property

It is a core role of the NBMCA to protect people and property from natural hazards such as flooding and erosion. This role also includes protection from the hazards of dynamic beaches, wave impacts, the dynamics of ice and unstable soils.

The NBMCA protects the public and property by developing a detailed understanding of environmental conditions and risks. Protection levels specified by the province are interpreted by the NBMCA at local level. Protection is provided through long term observation of trends that permits the delineation of areas prone to natural hazards and includes real time monitoring and warning, the preparation of risk mapping, the use of regulations and planning controls and the use of engineered controls when necessary. Public safety and property protection responsibilities are met through the NBMCA's *Development, Interference with Wetlands, and Alteration to Shorelines and Watercourses (DIA)* regulation, flood monitoring and warning, municipal planning and watershed management programs.

ii) Conservation

It is a core role of the NBMCA to identify and protect significant natural or heritage features within its jurisdiction. Natural features can be deemed significant due to regional or provincial uniqueness (i.e., old growth forest or rare geologic feature), functions related to maintaining natural balances (such as the role a large wetland plays in water quality and quantity control) or due to high social values (such as an often visited waterfall, lookout or popular beach). Heritage features include archeological sites or areas with high natural or scientific interest. Important features, as well as the need for long term preservation, may also have recreational, interpretive and public education qualities that can be exploited in ways that do not degrade the significance of the resource (through sustainable use practices).

iii) Sustainable Development

It is a core role of the NBMCA to manage watersheds in a sustainable manner. Sustainability as defined by the three-nested-dependency model is achieved when a watershed is able to sustain the social and economic uses it supports. This means preserving natural and ecological functions critical to maintaining stability. From the NBMCA's perspective natural systems provide natural infrastructure critical to the maintenance of hydrologic and ecologic functions which must be recognized and preserved to avoid the need for engineered controls that carry long term liabilities and costs. It also means that resource use intensity and extraction are managed at safe levels so that renewable resources can recover and non-renewable resources are conserved to meet long term needs.

4.2.1.2 Optional Watershed Management Functions

The NBMCA has examined several optional integrated functions as defined through this IWMS process which could become potentially "nested" within its jurisdictional responsibilities. These responsibilities were discussed at a working committee meeting held in January 2014. Staff considered whether the NBMCA should lead, support or not be involved with the following management functions:

- Climate Change Adaption
- Climate Change Mitigation
- Demographic Change Adaptation
- Resource Sector Monitoring
- Economic Development

These optional functions are further discussed below:

i) Climate Change Adaptation

Evolving climatic conditions as evaluated in the Technical Background Report may become increasingly stressful on drainage systems due to changes that are affecting hydrologic balances. Climate change assessment suggests that there is increasing potential to face extremes including flooding and droughts, evolving geomorphological conditions that destabilize river and stream beds, evolving recharge/discharge impacts to groundwater storage, shifts in vegetation species composition and shrinkage of cold water habitats. Flood risk may shift from spring freshet to severe summer storms due to mini freshets through the winter and increasing tropospheric energy over the summer period. Climate change stress assessment, completed as part of this strategy, is the first step in adaptation planning. Not all changes will lead to stress as positive implications of climate change will also be experienced. Adaptation means recognizing and preparing for the negative impacts as well as recognizing and taking advantage of new opportunities. In a regional context the NBMCA has identified that it ought to perform a leadership role in climate change adaptation planning.

ii) Climate Change Mitigation

Watersheds are increasingly being impacted from external influences and, as well as climate change adaptation, discussed above, the NBMCA could pursue a role in climate change mitigation. Recent concepts of "peak oil" suggested that society would move away from energy sources that generate greenhouse gases and shift to more sustainable forms that do not cause global warming. However, new discoveries and enhanced extraction techniques now mean that hydrocarbon sources previously unknown or considered inaccessible can be exploited. Supply reassessment now suggests that reserves are sufficient to meet long term needs. Consequently the expectation that climate change mitigation would evolve on its own in

Canada is no longer a reality and mitigation leadership is needed at all levels. Mitigation means reducing carbon emissions through a variety of strategies including the use of renewable energy, the advancement of energy conservation and the improvement of public awareness. Advancing mitigation strategies regionally can be linked to lowering watershed threats in the long term. Watershed management choices may also have carbon emission or carbon sink implications. The NBMCA could expand its decision making process to include an evaluation of climate change impacts from its decisions. With respect to the pursuit of mitigation of global environmental issues the NBMCA has indicated it should perform a supporting role.

iii) Demographic Change Adaptation

As baby boomers age and overload the top of the population pyramid, increasing numbers of seniors in the short term will stress social programs and place high demands on health care. Unless managed, as boomers move through the top of the pyramid, the population will begin to shrink from increased death rates. Youth are moving away from the region to seek work and education and thus birth rates continue to decline. Without retaining youth to start new families or attracting new people to make up for migration losses, increasing death rates will lead to negative growth. The City of North Bay is aware of this issue and has devised strategies to support and assist new immigrants moving to the area in an attempt to stimulate additional immigration to the region. Also research suggests that the NBMCA population will become increasingly more transient as more people choose to live outside the region (and regularly visit due to recreational interests) or live here but vacate their roosts for significant periods during the winter (snowbird impact). Broad strategies for dealing with an aging population, facilitating youth retention/attracting new immigration and accommodating transient interests are desirable to help maintain healthy watershed populations. In this broad initiative the NBMCA has identified that it should perform a supporting role.

iv) Resource Sector Monitoring

The study area has been under the influence of resource exploitation since before the region was settled. Early forest exploitation and the proliferation of agricultural (once rail transportation reached the region) significantly transformed the area and undoubtedly regional lakes and streams were impacted. Resource utilization has been in continuous evolution ever since. Traditional agriculture, originally an economic mainstay is currently in decline, forestry has experienced a decline from recessional impacts and aggregate extraction is stable but the location is shifting to more distant sources as resources near populated centers are exhausted. This sector is driven by economic conditions and thus recent downturns may only be temporary. Some subwatersheds may be at risk because as much as 50% of the forest is slated for harvesting in a single 10-year cycle and assessment of impacts at a subwatershed level have not been conducted. Significant aggregate reserves exist in rural areas in key headwater recharge/discharge areas. Forestry is evolving to follow and report sustainable practices, traditional agricultural practices now follow environmental farm plans and aggregate extraction activities, now subject to the *Aggregate Resources Act*, must undertake and report closure work

annually. Observation of combined impacts in most subwatersheds is absent. In this broader initiative the NBMCA identified that it ought to perform a leadership role within its area of jurisdiction.

v) Economic Development

Economic conditions within the study area, as observed in the Technical Background Report are stronger in the regional center than in outlying less diversified areas due to weaknesses in resource sectors that have traditionally been economic mainstays. In an attempt to sustain economic growth, particularly in remote areas, municipalities may be urged to consider lowered standards or relaxed land use restrictions to attract growth. Reduced standards and controls can place subwatersheds at higher risk because controls and standards usually are designed to protect the people and the environment. Municipal Economic Development Departments and Corporations are seeking new niche area to diversify local economies. The Ontario government has identified a Growth Plan for Northern Ontario to assist with market diversification. The NBMCA may be in a position to facilitate or support green niche areas such as eco-tourism, the supply of local organic products or the production of renewable energy. In this broad initiative the NBMCA has identified that it should perform a supporting role.

4.3 NBMCA PROGRAM PRIORITIES

The NBMCA expanded and ranked program needs at a Working Committee meeting held in January 2014. Information gaps identified in the Background Inventory Report have been organized into individual program areas which generated the identification of new information gaps that are incorporated into **Table 17**. Needs consider scale of implementation and how each need/want relates to core functions. Program priorities have been developed from this broad list. Initial prioritization, determined through voting, distinguishes between program needs (information considered essential) and wants (information that would be beneficial if there were no constraints). Priorities based on total votes are summarized in **Table 18**.

Assessing **Table 17** from a core mandate perspective suggests that information gaps are affecting the NBMCA's ability to consistently exercise its protection of people and property function including in the Municipality of Callander where new drainage systems were added in 2002. Priorities identified to improve the effectiveness of administering DIA regulations and to carry out flood forecasting/flood warning functions are considered more urgent than activities for other core functions based on priority scoring. Priorities suggest that the greatest need is for improved mapping and monitoring. The existing information base that the NBMCA relies on for this function generally requires review and update. Several field monitoring enhancements are specifically identified to improve the NBMCA's ability to pinpoint risks and better track hydrologic changes over time. The NBMCA should adopt strategies to ensure that critical information used for the protection of people and property is reviewed and updated at regular intervals and that policy interpretation is consistent across all subwatersheds.

Table 17 – NBMCA Program Priorities

Program	Program Need[1]	Need Priority[2]	Want Priority[2]	Watershed Scale[3]	Core Functions Evaluation		
					PPP[4]	Cons[5]	Sustain[6]
Development, Interference	Expand Coverage of Mapping of "Approximate Regulated Areas"	4		S	✓		
with Wetlands, Alteration to	Development Policy Support for DIA Regulations	3		F	✓		
Shorelines and Watercourses	Define, Identify and Evaluate Riparian Areas	1	1	F	✓		
(DIA)	Geomorphological Approaches to Study Erosion/Sedimentation	1		F			✓
Flood Forecasting/Warning	Improve Metorological Monitoring including Snow Courses	4	1	F	✓		
	Evaluate Climate Change Impacts to IDF[7] Curves	4		F	✓		✓
	Improve Monitoring to Gather Regional IDF[7] data for Storm Events	4		F	✓		
	General Update of Floodplain Mapping	3		S	✓		
	Update Flood and Wave Damages Estimates for Lake Nipissing (within NBMCA)	3		S	✓		
	Update Flood Forcasting/Flood Warning Plan	N/A[7]		F	✓		
Municipal Plan Review/	Carry Out New Capacity Assessment for Large Lakes (apply 50% over pristine)	4		S			✓
Support	Identify Critical Habitat for Species at Risk	3		F		✓	✓
	Undertake Additional Assessment of Significant Features including Wetlands	1	1	F		✓	✓
	Evaluate and Rate Overburden Aquifers	1		F			✓
	Carry Out a Regional Cultural Heritage Master Plan	1		F			✓
	CA to be a Resource to Municipalities for Resource Information		1	F	✓	✓	✓
Septic Program	Apply New Research on Phosphorous Removal Technologies for Septics	1		S			✓
	Develop Land Serviceability Ratings for Septic Systems			F			✓
Watershed Management	Expand Water Quantity Monitoring Network	3	1	F	✓		✓
	Formalize Water Quality Monitoring Network	3		F			✓
	Study Cumulative Impacts of Septic System on Drainage Systems	2		S			✓
	Research Significant Quaternary Features Related to Great Lakes History	1	1	F		✓	✓
	Develop Maroinvertebrate Baselines for Aquatic Environments	1	1	S			✓
	Better Measure Contributing Areas to Hydrologic Gauging Sites	1		S	✓		✓
	Continue to Breakdown Ecoregions into Ecodistricts and Ecoareas	1		F		✓	✓
	Reforest Disturbed Areas/Restore Wetland Functions	1		S			✓
	Evaluate Impact of Invasive Species Already Present in Region		1	F			✓
	Identify Natural Heritage Features and Natural Infrastructure			F	✓		✓
	Identify Spawning Grounds/Rehab Underutilized Areas			S			✓
	Monitor Habitat Changes and Vulnerable Wildlife Poplulation Shifts			F			✓
	Invasive Species - Monitor Provincial Trends and Develop Local Controls			S			✓
	Identify Linear Habitats/Wildlife Corridors			S			✓
	Improved Understanding of Groundwater Movement through Bedrock			F			✓
	Develop Mattawa River Baselines			S			✓
Drinking Water Source Protection	Evaluate Capability of Rural Growth Centers to Supply Water (Groundwater)	1	1	F			✓
Conservation Areas/Trails	Inventory/Evaluate Important Watershed Features that Require Protection		1	F		✓	✓
Communications, Outreach	Identify Activities to be Managed Through Stewardship	3		F		✓	✓
and Education/Watershed	Improve Understanding of Human Impacts to Watersheds			F			✓
Stewardship	Better Understand the Stewardship Resource Base			F			✓
GIS	Improve Quality of Provincial GIS Layers/Tie in with Geomatic (Survey data)		2	F			✓
	Develop Property Sensitive Electronic Information (GIS Layer)(internal need)		1	F	✓		✓
Other	Evaluate IJC[8] Management Implications for Lake Nipissing Subwatersheds			S			✓

1. Highest Priorities based on staff voting are identified in Red
2. Numbers in each column reflects number of working committee (CA Staff) votes each information want/need received through prioritization voting (higher numbers = higher priority)
3. Signifies best scale to approach issue with S = Subwatershed and F = Full Watershed
4. Protection of People and Property
5. Conservation
6. Sustainability
7. Added after voting was completed
8. IDF means Intensity, Duration and Frequency
9. IJC means International Joint Commission

Table 18 – Subwatershed Priorities*

Subwatershed and Significant Tributaries	Key Subwatershed Management Need	Major Tributary Need	Downstream Driven Need
Duchesnay Creek	Baseline Inventory to Identify Management Needs ❷		
Canadore Trib		Stormwater Management Plan	
Chippewa Creek	Integrated Watershed Management Plan ❸		
Eastview Trib			
Johnson Trib			
Golf Club Trib			
North Airport Trib		Master Drainage Plan ❹	
Park Creek	Comprehensive WMP	Headwater Stormwater MP	
Jessups Creek	Status Quo		
La Vase River	Develop Implementation Framework	Stormwater Management Plans - Lower Tributaries facing Development ❷	
Cooks Creek Trib			
Lake Nipissing/North Bay	Status Quo		
Pinewood Parkway Trib		Reassess Hydrologic Strategy ❶	
Bond Street Trib			
Gauthier Trib			
Windsor/Boulter/Bear	Baseline Inventory to Identify Management Needs ❷		
Windsor		┌ May need	Support Info for Callander Bay
Boulder		| Individual	
Bear		└ Management Plans	
Burford Creek	Baseline Inventory to Identify Management Needs		Support Info for Callander Bay
Callander Bay/South Shore	Shoreline Management Plan		
Cranberry Trib		┌ Master Drainage	Support Info for Callander Bay
Trib #1		| Plan for Settlement	Support Info for Callander Bay
Trib #2		└ Area	Support Info for Callander Bay
Wistiwasing River	Integrate CWMP/SWP Recommendations & Develop Implementation Framework		Support Info for Callander Bay
Graham Cr Trib			
Wasi Lake Trib		Future Integrated WMP	
North River	Status Quo		Support Info for Lake Talon Sub
Balsam Trib			
Trout Lake	Status Quo		Support Info for Lake Talon Sub
Armstrong Trib			
Lees Trib		SWM Plan**	
Dorans Trib		SWM Plan**	
Four Mile Trib/Bay		Comprehensive WMP	
Long Lake Trib			
Turtle Lake	Status Quo		Support Info for Lake Talon Sub
Kaibuskong River	Consider IWMP		Support Info for Lake Talon Sub
West End of L Nosbonsing		Investigate Strategy for Municipal Servicing/Sewage Treatment	
Depot Trib			
Lake Talon	Future Comprehensive Watershed Management Plan		
Kaibuskong Bay			
Upper Mattawa Trib			
Sharpes Creek	Baseline Inventory to Identify Management Needs		Support Info for Lake Talon Sub
Blueseal Trib			
Amable du Fond River	Status Quo		
Kelly Creek			
Pautois Creek	Status Quo		
Headwater Lakes			
Boom Creek	Status Quo		
Lower Mattawa River	Status Quo		
Earls Lake Trib		Hydrology Study	

* Highlighted numbers reflect the votes each task received from the Working Committee (higher number = higher priority)

** Could be completed in conjunction with Master Drainage Plan for North Airport Tributary

From a "Conservation" core mandate perspective the NBMCA should continue to identify and protect significant watershed features. Further inventorying of wetland and habitats critical for species at risk are specifically identified. Activities in this function have less overall urgency than in other core functions. The NBMCA's conservation functions are delivered through various NBMCA programs including municipal plan input and review/planning advice to municipalities, watershed planning, conservation area management and stewardship. Priorities suggest that the NBMCA should specifically target stewardship as means of advancing this responsibility. The NBMCA should adopt strategies to ensure that information critical to the identification and protection of significant features are reviewed and updated at regular intervals.

From a "Sustainability" core mandate perspective the NBMCA advances this responsibility through most of its programs. Overall the priority to meet this core responsibility can be rated as moderately urgent based on priority scoring. Sustainability at a full watershed scale is accomplished through protection of hydrologic water balances, cool and cold water aquatic habitats, recreational and drinking water quality, lakes and streams from eutrophication and blue green algae threats, as well as advancing climate change adaptation and monitoring of resource sectors impacts on watersheds. Many of these protection interests overlap with the jurisdictions of partners and advancing sustainable concepts is the main impetus for developing an integrated management framework. Sustainability is also the main impetus for reporting watershed conditions through annual report cards.

From a specific needs perspective improved hydrologic monitoring of stream flows and lake levels are identified as priority monitoring needs. Enhanced meteorological monitoring and expanded snow condition monitoring are also implied. Enhanced monitoring to better assess storm intensity, duration and frequency is also identified. Storm Intensity-Duration-Frequency curves for the North Bay Airport should be assessed when new information is released by Environment Canada (expected in the next few years) to determine if changes to events probability are significant. Monitoring coordination is further discussed below.

Floodplain and/or refined Approximate Regulated Area mapping is absent in most subwatersheds flowing through the Municipality of Callander. Updated floodplain mapping is needed in the Chippewa Creek basin due to structural changes and evolution of municipal development policies. Updated flood and wave damage calculations are identified for the Lake Nipissing shoreline to increase support and awareness for the need to undertake further mitigation actions and data could be useful to influence lake level management policies. New or updated mapping would also be task considerations in other subwatersheds when comprehensive or integrated management plans are completed.

The information base that the NBMCA relies on for planning and watershed management purposes has identified gaps and/or deficiencies. The resolution and quality of information through the provincial GIS data base is often imperfect or unreliable at a lot level scale. Priorities recognize the need to improve information quality used to set policy or to guide management decisions. New information for critical habitats which support local species at risk

protection, refining Ecozone information into Ecoregions and Ecodistricts and improving the understanding of risks to and limitations of overburden aquifers near future rural unserviced growth nodes (hamlets) are identified as elevated needs based on prioritization voting.

Prioritization results also reflects the NBMCA desire to improve stewardship within its area of jurisdiction by becoming more knowledgeable of the "human" resource base and by finding ways to encourage this "resource" to contribute and assist the NBMCA in achieving its objectives. The NBMCA has also self-identified that it should lead regional climate change adaptation and monitor multi-resource sector impacts to drainage systems.

Research and program enhancement priorities as well as interest to lead climate change mitigation and resource sector monitoring will be integrated with subwatershed management priorities to develop 5-year implementation strategies below.

4.4 NBMCA MONITORING

The North Bay-Mattawa Conservation Authority relies on a network of monitoring sites to track hydrologic, snow course, meteorological, water quality and groundwater conditions within its jurisdiction. Data is generated to satisfy both short and long term interests. Monitoring is undertaken using electronic gauges which can poll data frequently and support real time monitoring needs. Data is also collected weekly or biweekly through field sampling usually undertaken on a seasonal basis. When extreme conditions are encountered the NBMCA relies on timely access to data so it can issue advisories and warnings. New monitoring and research is now mandated under the Drinking Water Source Protection Plan in the Callander Bay basin. Data is also archived to serve comprehensive watershed management interests.

Within the NBMCA's area of jurisdiction the level of monitoring has been declining for decades as the provincial government reduces service levels. As a result the Conservation Authority's ability to monitor indiscriminate events or track long term trends has correspondingly diminished. Reduced government monitoring has forced the NBMCA to take on new monitoring responsibilities. In an effort to bolster data availability, the NBMCA has recently begun to resurrect abandoned sites and add new monitoring stations. New responsibilities have generated the need to expand monitoring to include groundwater and low flow conditions. The NBMCA's monitoring capabilities will need to continue to expand to satisfy long term management interests generated through this IWMS. Partnerships with municipalities and universities and new stewardship opportunities can be explored as strategies to enhance monitoring in the future. Some of these ideas are pursued below.

4.4.1 Meeting IWMS Monitoring Needs

Current data is generated from monitoring sites that mainly serve single purposes. The NBMCA can enhance monitoring by diversifying its monitoring network. New sensors can be added to existing electronic monitoring stations to measure additional parameters. In a quest to establish new sites the NBMCA can also seek partnerships to pursue common data collection

interests. Municipalities, for example, use weather data to guide road and sidewalk maintenance activities and use archived data to verify that services delivered met maintenance standards when faced with accident claims. Municipal interests dovetail with the NBMCA's interests to better detect storm events or to better measure climate change impacts. In meeting IWMS monitoring needs, the NBMCA can also consider remote locations not supported by permanent power or telecommunications. Most IWMS monitoring does not serve a real time function. Information can be retrieved when convenient such as during maintenance inspections.

In implementing this IWMS, the NBMCA will need to develop new subwatershed baselines, track subwatershed trends, evaluate sustainable subwatershed practices and management needs, and collect information in support of contemplated plans and studies. To enhance regional coverage, the NBMCA can consider the use of portable monitoring equipment which can be moved from site to site over time. Portable equipment can be placed at field monitoring sites for 2 to 5 years depending on data collection interest(s). Monitoring equipment would be moved to new locations over time and could periodically be moved back to previously monitored sites to capture additional data cycles. Trends can be established by comparing available time intervals (similar to the comparison completed by this IWMS for stations that were discontinued and then reactivated). This methodology of gathering data in intervals is suitable for sustainability "quality control" or "checkup" monitoring and can produce "snapshots" of subwatersheds not regularly monitored. The use of portable equipment is recommended to allow the NBMCA to increase areal coverage while controlling costs. Temporary sites can supply real time data if deemed necessary.

4.4.2 Specific Long Term Data Collection Interests

IWMS monitoring will require enhancements that meet specific subwatershed evaluation and reporting interests. Subwatersheds are primarily impacted by climate change, land use alterations, resource extraction activities and regional development initiatives. Data is needed to assess water balance impacts and changes to aquatic habitat as well as to watch for bacteriological indicators of human sewage contamination and to follow eutrophication trends. Signs of watershed stress caused by increasing development intensity, overexploitation of resources or from regional development impacts should be specifically watched. More specifically:

- Subwatershed water balance monitoring and reporting can be accomplished by tracking the long term hydrologic conditions of key subwatersheds. More accuracy is needed in the measurement of contributing areas to gauging sites so that improved cross-calibration between hydrologic stations and interpolation into unmonitored subwatersheds is possible. Water balance impacts from land use and climate change can be assessed from annual and seasonal hydrologic trends. Signs include a shifting of spring freshets as melts occur in a series of mini freshets at the coldest times of the year or of stream flows becoming more extreme in response to increased risk of severe

thunderstorms and a deepening summer dry period at the warmest time of the year. Regional precipitation and temperature data will a prerequisite to evaluating water balance and climate change impacts.

- In addition to flow monitoring, subwatershed aquatic habitat monitoring and reporting can be achieved by tracking water temperatures, pH and dissolved oxygen in rivers and streams. Monitoring of cold and cool water habitat is of highest priority. Cool water (marginal cold water) habitats are at high risk from evolving land use and climate change impacts. Most cold water habitats are located in headwaters and marginal habitats exist in a transition zone downstream. Watch for signs of this transition zones shifting higher into the headwater of subwatersheds.

- Subwatershed recreational/drinking water quality monitoring and reporting can be achieved by tracking of E Coli bacteriological levels in drainage systems under significant development pressure. Data should target points of stream and stormwater discharge near public swimming areas, public drinking water sources or near development clusters that rely on private water and waste water treatment systems. Contamination should be traced to its source and eliminated (such as finding and fixing leaky pipes and septic systems). Specific stormwater BMPs can be employed to reduce contamination reaching natural systems. Stormwater targets identified in the City of North Bay Infrastructure Background Study (Stantec, 2008) can be applied more broadly until subwatersheds specific targets are established.

- Eutrophication monitoring and reporting on the Canadian Shield can be achieved by tracking Total Phosphorous levels in the environment. It has been observed that many subwatersheds display water quality characteristics that are at the lower limits of public acceptability mainly due to the impact of eutrophication. Eutrophication is the principle cause of blue-green algae proliferation in area lakes. Eutrophication should be understood relative to natural trophic levels and targets should be developed to satisfy recreational, drinking water and blue-green algae control objectives. Lakeshore Capacity Assessments should be completed for all major lakes encountering development pressure and natural trophic levels should be investigated for systems subject to development restrictions. Small lakes in the lower Mattawa River system are also vulnerable to development pressure in the future and should be evaluated. Nutrient controls are best achieved when approached on a watershed basis.

- Resource exploitation and regional development monitoring and reporting can best be achieved by watching for specific subwatershed impacts. The resource sector is increasingly moving to self-assessment/self-reporting of management success rates.

Annual Reports issued by senior governments or through self-reporting should be obtained and assessed to determine if resource exploitation is following and meeting sustainable practices. An example in the forest sector would be following reported sustainable indicators such as the forests average age or net changes in ecosystem carbon levels. Aggregate impacts can be evaluated through the reporting of net areas opened and closed each year. Agricultural Census data can be used to track changes in agricultural land use practices. Resource sector reporting should be encouraged to include annual assessments on the basis of watershed boundaries. This IWMS has not identified specific field monitoring (such as enhanced groundwater or low flow monitoring) that might support this function and further assessment is required.

New satellite imagery products and GIS tools are increasingly becoming available to support watershed management activities. Satellite images can be used to enhance information supplied through the Ontario Geospatial Data Exchange/Land Information Ontario data base, facilitate storm event analysis/interpretation using radar, detect changes to regional snow depths and water content or track land use changes or resource sector impacts over time. The accuracy of satellite imagery interpretation can be enhanced by using monitoring information for truthing. As new remote sensing tools become refined, monitoring needs may be influenced by emerging satellite products and applications.

4.4.3 Recommended Monitoring Enhancements

Current regional monitoring within the NBMCA area of jurisdiction is found in **Figure 25** and **Table 19** also indicates suggested monitoring enhancements that respond to IWMS priorities. Enhancements to existing monitoring sites and new monitoring locations are suggested. Six locations have been recommended as comprehensive regional data collection sites (listed in **Table 19**). The location and data collected at comprehensive monitoring sites are specifically designed to meet information requirements generated through IWMS priorities. Comprehensive sites are arranged in inner and outer concentric rings around the NBMCA's office in North Bay to improve regional coverage. South River, which is outside the study area and not included in recommendations, could be integrated into the monitoring network to contribute important information that enhances regional interpretation. While specific field sites have been identified in **Table 19**, further assessment is needed to confirm the suitability and practicality of the suggested locations.

Figure 25 – Existing and Proposed Monitoring Sites

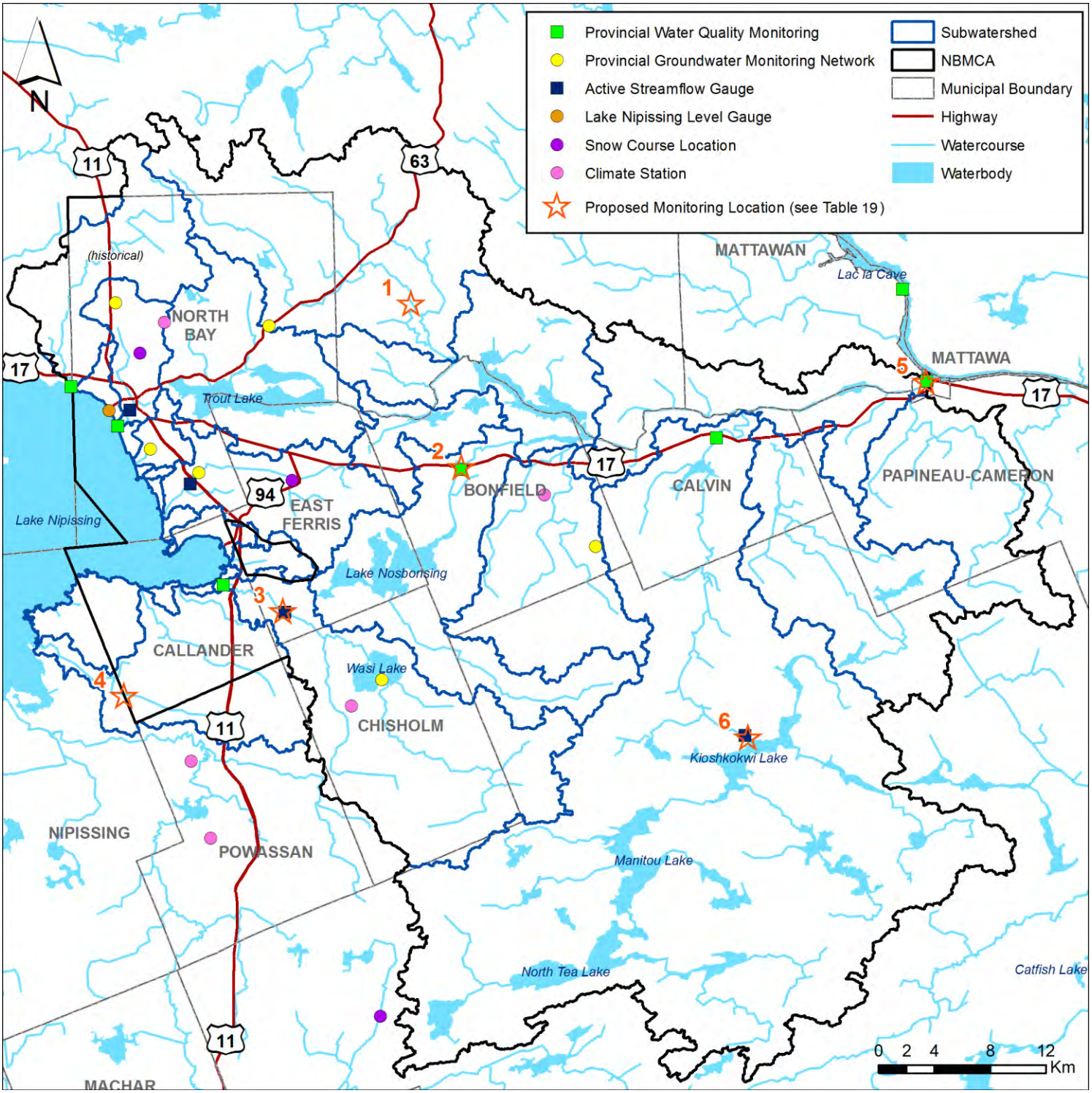


Table 19 – Summary of New Long Term Monitoring Enhancements in Support of IWM

	Site Description	Hydrologic	Precipitation	Snow Course	Water Quality	Groundwater
1	North River at Songis Road	✓	✓		✓	
2	Kaibuskong River at Highway 17	✓	✓			
3	Wasi River at NBMCA Hydrologic Gauge		✓		✓	
4	Bear Creek at Callander Boundary	✓	✓		✓	
5	Mattawa Island Conservation Area		✓	✓		
6	Amable du Fond NBMCA Hydrologic Gauge		✓		✓	

4.5 INTEGRATED 5-YEAR IMPLEMENTATION STRATEGIES

This document contains numerous suggestions and recommendation that provides guidance to the NBMCA for the future. Realistically however the NBMCA can only address a limited number of issues at a time and identifying which actions to start with requires the integration of priorities. Actions have been slotted into 5-year windows based on their overall perceived urgency. In developing action priorities a number of practicalities have also been considered including time needed to gather background information, develop a terms of reference, engage stakeholders, arrange partnerships and secure funding. The following action list is ordered based on priorities identified in **Table 17**, **Table 18** and recommendations emanating from IWMS monitoring recommendations. The ordering of actions however will be subject to continuous review and adjustments will be made as circumstance change. Review and reporting of implementation success rates are addressed in Section 5.

4.5.1 2015–2019 Recommended Actions

- Initiate collection of comprehensive background information for near term action priorities (identified in the first 10 years – listed in order of priority):
    - Chippewa Creek basin
    - Callander Settlement Area – Tributary 1
    - Callander Settlement Area – Tributary 2
    - Callander Settlement Area – Tributary 3
- Review hazard land information for all known damage centers to determine:
    - if hazard land policy interpretation is accurate based on current “Natural Hazards” policies under the Provincial Policy Statements
    - if damage center information is/will be significantly impacted by climate change predictions, recent changes to municipal land use policies or new modelling techniques

Preliminary results from IWMS finding suggests that these factors may impact

damage center interpretations in the following basins:
  - Chippewa Creek
  - Pinewood Parkway Creek
  - La Vase River
  - Lake Nipissing
  - Mattawa
- Review and refine the IWMS monitoring strategy identified in Section 4.4.3 and consolidate with other monitoring for Source Water Protection and/or interests of potential partners.
  - Start deploying new monitoring infrastructure based on identified priorities.
- Complete policy development to support DIA Regulations (As set out in Appendix A)
- Develop and implement a long term Stewardship Strategy

4.5.2 2020–2024 Recommended Actions

- Complete Callander Settlement Area Stormwater Management Plan (for 3 tributaries) and develop floodplain mapping or "Approximate Area" mapping for all unmapped Callander subwatersheds including:
  - Settlement Area tributaries (3)
  - Windsor Creek
  - Boulder Creek
  - Bear Creek
- Update current Comprehensive Plan or prepare new Integrated Watershed Management Plan for Chippewa Creek
- Calculate Lake Nipissing Flood/Wave Damages within NBMCA jurisdiction
- Review and Update Capacity Assessments for local water bodies (including Earls Lake, Taggart Lake, Smith Lake, Lake Chant Plein)
- Continue to implement the Stewardship Strategy developed in first 5-year period

4.5.3 2025–2029 Recommended Actions

- Assess Approximate Regulated Area mapping needs including updates to mapping that uses older fill regulation criteria
- Prepare a Callander Bay/South Shore Shoreline Management Study
- Develop and Implement Resource Sector Monitoring and Reporting Strategy
- Wasi Lake Tributary Comprehensive Watershed Management Study
- Continue to implement the long term Stewardship Strategy

4.5.4 2030–2034 Recommended Actions

- Lake Talon Subwatershed Management Study
- Assess Sanitary Servicing Options for West end of Lake Nosbonsing
- Prepare Lower La Vase River Stormwater Management Plan
- Complete Ecoregion Study to consolidate Ecodistricts/Ecoareas information from updated inventory information
- Continue to implement the long term Stewardship Strategy

A summary of action priorities and potential partnerships in undertaking above action strategies are identified in **Table 20.**

Table 20 – Recommended Action Strategy Potential Partnerships

Recommended 5-Year Action Strategies	Potential Partners				
	Fed	Prov	Municipal	NGO	Steward
2015-2019 Initiatives					
Initiate Collection of Comprehensive Background Information for pending IWMS action strategies		✓	✓	✓	✓
Review and Update Hazard Land Information for all known Damage Centers		✓	✓	✓	✓
Review and Implement IWMS Monitoring Plan	✓	✓	✓	✓	✓
Complete DIA Regulation Policy Development			✓	✓	
Develop Long Term Stewardship Strategy and Advance First Initiative			✓	✓	✓
	✓				
2020-2024 Initiatives					
Callander - Stormwater Man Plan for Settlement Area + Hazard Land Mapping for all unmapped areas		✓	✓	✓	✓
Update Chippewa Creek Watershed Management Plan or prepare new IWMP		✓	✓	✓	✓
Calculate Flood/Wave Damages for Lake Nipissing Shoreline in NBMCA	✓	✓	✓	✓	✓
Update Lakeshore Capacity Assessments for local water bodies		✓	✓	✓	✓
Advance Second Stewardship Initiative from Long Term Plan			✓	✓	✓
2025-2029 Initiatives					
Assess Approximate Regulated Area Mapping Needs			✓	✓	
Callander Bay/South Shore Shoreline Management Study		✓	✓	✓	✓
Develop Resource Sector Monitoring and Reporting Strategy		✓	✓	✓	✓
Wasi Lake Watershed Management Study		✓	✓	✓	✓
Advance Third Stewardship Initiative from Long Term Plan			✓	✓	✓
2030-2034 Initiatives					
Lake Talon Watershed Management Study		✓	✓	✓	✓
Servicing Needs of western shore of Lake Nosbonsing		✓	✓	✓	✓
Lower La Vase River Stormwater Management Plan			✓	✓	✓
Ecoregion Study - Consolidation of NBMCA information		✓	✓	✓	✓
Advance Fourth Stewardship Initiative from Long Term Plan			✓	✓	✓

5.0 IWMS PERFORMANCE EVALUATION AND REMEDIES TO BARRIERS

5.1 IWMS IMPLEMENTATION PERFORMANCE EVALUATION

This IWMS has outlined 5 strategies to be tackled in each 5-year cycle. A means to measure and report annual/5-year progress is required to keep track of implementation success rates. Traffic light colours are provided to help portray the status of implementation success as follows:

Red	Significant implementation problems are being encountered and identified annual and 5-year action strategies are not advancing as expected
Amber	Implementation of annual or 5-year action strategies are progressing but are behind schedule
Green	Progress to meet identified annual or 5-year action strategies are advancing as planned and are on schedule

At the end of each year implementation success can be measured based on a total count (i.e., at year 3 in a 5-year cycle are 3 strategies complete or in progress?). At the conclusion of each 5-year implementation period a more thorough review will be required. A quick review of the implementation strategy will be necessary to confirm that IWMS assumptions are still relevant. Scans should be completed to determine whether new information or data that affects IWMS interpretations has emerged or if new stress factors not considered in the IWMS evaluations are present. Implementation success can be impeded by barriers as identified below. It is even possible that priorities could be affected by the emergence of new management concepts. Any strategies not implemented will be carried forward and reintegrated into remaining actions. New reprioritized 5-year action strategies should be reviewed by affected stakeholders. The success in meeting annual and 5-year IWM action strategies should be communicated widely to partners and the public.

5.2 IWMS IMPLEMENTATION BARRIERS AND REMEDIES

Watershed planning in Ontario has been undertaken for some time and considerable experience has been gained that merits review and analysis. In a document entitled "Integrated Watershed Management – Navigating Ontario's Future" (Conservation Ontario 2010) common barriers faced by Conservation Authorities when undertaking watershed planning have been evaluated. The North Bay-Mattawa Conservation Authority has also engaged in considerable watershed planning and the successes and shortcomings of NBMCA experiences can also be reviewed. Watershed management faces challenges during both planning and implementation. The following sections review common barriers encountered, lessons learned, and explores remedies that may improve NBMCA watershed management implementation. Remedies are intended to provide guidance when developing implementation strategies.

5.2.1 Barriers to Watershed Management

Conservation Ontario's "Integrated Watershed Management – Navigating Ontario's Future" publication, while focused on Integrated Watershed Management Planning, provides observations with general applicability. The report observes that, while Conservation Authorities continue to be engaged in watershed planning in Ontario, recent use of watershed planning as a management tool has declined. The report solicits views from those in a position to undertake watershed plans as well as the views of outside agencies.

Barriers identified by agencies preparing or in a position to prepare Integrated Watershed Management Plans in Ontario include:

- Insufficient staff capacities (both physically and in terms of required expertise) of Conservation Authorities
- Continuously emerging legislation that changes the management landscape
- Lack of important data
- Lack of knowledge on how to identify and integrate social and economic factors

Barriers faced by the same group when implementing Integrated Watershed Management Strategies in Ontario include:

- Lack of funding
- Lack of staff capacity
- Lack of public and political support

A reason cited for a decline in use of watershed planning as a management tool is that the increasing magnitude of the exercise is making it more difficult and more expensive (watershed planning complexity has gradually evolved from hydrology based studies to comprehensive environmental plans to now undertaking watershed management plans that strive to integrate environmental, social and economic factors). Observations from outside agencies suggest that there are more fundamental reasons that may be leading to the decline (some comments are specific to Integrated Watershed Management Planning):

- No compelling reasons to protect water resources or to implement watershed plans
- Lack of linkage between watershed plans and land use planning decision-making
- Lack of funding
- Lack of a common understanding as to what Integrated Watershed Management is
- Lack of a champion (no recognized expert, politician or political party touting the need)
- Lack of communications and visual cues (such as delineation of subwatershed boundaries)

- Lack of Best Management Practices (BMPs) for Integrated Watershed Management Implementation

5.3 REMEDIES TO WATERSHED MANAGEMENT BARRIERS

5.3.1 Addressing Increased Watershed Management Scopes

It has been suggested, to combat the decline in the use of watershed planning as a management tool, that a simpler process be followed which is community driven and can be done quickly without costly monitoring and scientific assessment. Not all watershed problems require an integrated approach as the NBMCA has many tools available. It is possible to consider problems narrowly or to adopt an approach that only examines an issue in the context of a single tributary. For example, when examining a blue green algal problem in an area lake it may be more strategic to focus on this specific issue at a tributary level rather than assessing it in the context of many issues studied in a subwatershed context. However, the NBMCA should be cautious when tempted to ignore related issues. The need for complex watershed planning in Ontario has evolved over time from experience, recognizing that watershed functions and features support a complex ecosystem which is often integrated with human interests. Greater assessment is desirable to understand the full consequences of a management decision so that natural balances are recognized and protected. Provincial policies have evolved to push for greater complexity when evaluating and finding solutions to problems. Individual management issues usually cannot be examined effectively in isolation of the whole. The scoped approached to solve watershed problems should be reserved for when other options are not practical.

5.3.2 Addressing Capacity Barriers

The NBMCA is relatively small staff-wise when compared to large Conservation Authorities in Southern Ontario. When undertaking management assessment work the NBMCA is able to cover most fields of expertise required through internal resources. The NBMCA is not currently able to service specialty areas such as archaeology or hydrogeology internally. Future integrated management planning may also expand expertise needs to include an understanding of business and social sciences. The NBMCA's communications and outreach program is currently developing regional social marketing strategies and consequently social components of IWM Plans can likely be serviced internally.

The NBMCA does not usually undertake major exercises in-house and draws on the assistance of outside experts when completing large technical undertakings. The NBMCA at times may seek review assistance for specialty disciplines. In many instances specialists from within the region are engaged in major studies and plans; either from other government organizations or educational institutions. The NBMCA structures watershed planning exercises so that outside agencies and community experts help through participation on steering and/or technical review committees. The NBMCA will likely need to continue to utilize community experts when undertaking significant technical projects and may wish to expand its technical committees to

include people with business backgrounds for integrated planning purposes. Drawing on broader community resources emphasizes the benefits of having collaborative relationships with many groups and agencies within the region as outlined in Tables 9 and 10.

The role community experts provide when engaged by the NBMCA on a technical or steering committees may require further guidance. It may be beneficial for community experts that assist the NBMCA to have written guidelines that clarifies their expected contributions (such as a commitment to thoroughly review circulated materials and to provide timely feedback). The Conservation Authority may be required to engage senior officials of other organizations to ensure that loaned resources are free to participate and are able to offering full and unfettered advice. In the future the NBMCA may be required to establish more formal relationships with other agencies (including possibly neighbouring CAs) to assist in specialty areas. The NBMCA has already shifted to an informal collaborative model for some data collection and field management activities. The CA is well positioned to provide assistance with boots on the ground in exchange for advice on oversight and quality control, financial assistance, as well as analytical and interpretation services. The NBMCA should strengthen its relationship with the local College/University to encourage and incent academic research to study local resource management issues.

5.3.3 Addressing Data/Data Collection Barriers

Identifying and filling information gaps is a long term management challenge for the NBMCA. The assessment of subwatersheds has identified that many subwatersheds still require further base line information to properly identify resource features and understand management issues. Tracking subwatershed trends and impacts from management actions will also require monitoring. The NBMCA will only be able to collect a small portion of the data suggested by this strategy. Also, the NBMCA cannot be certain that information supplied by other agencies will continue to be available as information gathered by other agencies will likely continue to erode. The NBMCA will be faced with difficult choices when identifying data collection and monitoring priorities. Strategies to maximize data collection opportunities include:

- Data collection should be strategically focused on fulfilling information gaps for the highest priority subwatersheds that are targets for future watershed planning. Several years of baseline data should be collected in advance of a planning exercise and organized into a background inventory report prior to issuing a Request for Proposals. Data may be effectively gathered using student or internship programs with proper oversight and quality controls. Enhanced baseline data can permit stakeholders and researchers to be better informed at the initiation of a planning exercise and planning efforts can shift to targeted data collection, enhanced data interpretation, or more emphasis on strategy development and implementation planning.

- Long term lake level or stream flow monitoring equipment should be equipped with multiple sensors to also collect basic water quality and climatic data. The selection of new long term monitoring sites should be based on the evaluation of multiple needs.
- The NBMCA should consider using portable equipment to gather baseline stream flow or lake levels, water quality and climatic data for targeted subwatersheds, which can be deployed for a set period and then moved to the next targeted subwatershed in advance of each planning exercise.
- Stakeholders and the public may volunteer to help with monitoring (such as monitoring rainfall) or to help protect field monitoring equipment from vandalism. Consider establishing a volunteer network through stewardship initiatives.
- Weather data is needed by municipalities and the province for such activities as road maintenance and a collaborative meteorological network may be possible.
- Data collection points should be strategically located where data can provide indirect information for adjacent systems that are unlikely to be monitored in the future.
- Better engage with the academic community to encourage local data collection and research that focuses on local issues and priority areas. The NBMCA can stimulate interest and steer academic research by offering incentives to consider subject areas that are beneficial to the NBMCA.
- Increased use of remote sensing tools. The NBMCA is resourced with high quality orthoimagery for its area of jurisdiction and remote sensing tools are becoming increasing more powerful. Use of remote sensing tools should be maximized. Interpretation requires adequate ground-truthing to ensure that data quality and the level of error are suitable to support decision making.
- Raw data should be made available to stakeholders and the public (such as access through the internet - similar to HYDAT) so that information is serving the greatest common good. Interested parties can assist with data collection, evaluation and interpretation of management implications. Maximize the use of programs like the Lake Partners Program offered by MOE.

5.3.4 Addressing Project Benefit Recognition Barrier

There is no evidence that there are project benefit recognition issues within the NBMCA's area of jurisdiction (with the public) however it is suggested within Conservation Ontario guideline documents that this is an issue in some regions of Ontario particularly with other agencies. Should such a perception issue materialize, this would be an indication that serious communication gaps exist or that project or program planning lacked sufficient agency and community engagement. Agency awareness should be relatively high within the NBMCA's jurisdiction because it follows a collaborative approach to planning and management. When implementing programs or services or undertaking projects, the underlying reasons for the

activities should always be well explained as part of the communication strategy, including staff delivering programs and services who act as NBMCA frontline ambassadors.

Because significant natural hazards and events are rare, exposed populations are often unaware or soon lose sight of the magnitude of problems that can be associated with watersheds. Linkages between watershed health, economic health and the quality of the lives of people living and working within a watershed may also not be obvious. Such awareness needs to be continuously reinforced. The NBMCA is engaging in community based social marketing to improve the effectiveness of communication efforts and to foster stewardship. Desired behavioral changes in targeted communities can be encouraged through social marketing to move to more sustainable watershed management practices. A community based social marketing framework follows a pragmatic step-wise approach and provides "tools" that can foster sustainable behavioral changes. The tools are designed to overcome barriers that individuals and communities may have to behaving in a specific manner. Strategies also seek to enhance visual cues that stimulate awareness and thought (such as signing more watercourses and subwatershed boundaries, erecting signage at conspicuous locations such as at the outlet upon which the systems report card information can be displayed or displaying historic flood elevations). When construction or other management projects are undertaken, signage containing project justification information should always be prominently profiled.

5.3.5 Addressing Funding Barriers

One of the most successful planning exercises completed by the NBMCA was the preparation of the North Bay Waterfront Development and Shoreline Management Plan that led to the development of the North Bay Waterfront. The plan's steering committee included the local Member of Parliament, the Mayor of the City of North Bay and the Chair of the NBMCA. This committee met and provided input at key decision points in the process. This high level of political engagement lead to top level buy-in and resulted in prompt funding commitments once the plan was finalized.

Lack of funding is a wide spread problem that may restrict watershed planning or delay the implementation of recommendations. Historically funding for major initiatives required detailed technical evaluation of parameters such as risk to life and calculation of the dollar value of potential damages from flooding or erosion hazards. These risk factors were used to establish provincial funding priorities. Such information should be refocused to garner public support and to generate corporate interest. Also as planning exercises becomes more sophisticated new risks may be identified. Broader watershed services and benefits as highlighted in **Table 14** may be used to identify new risk factors as well as new partnership opportunities. Broadening service and benefit evaluations may generate support in tourism and recreation, food production and/or harvesting of resource products. Partnerships can be fostered with interest groups such as Trout Unlimited, Ducks Unlimited, Hunters and Anglers or with Service Clubs. With the traditional funding burden shifting to municipalities, project benefits that emphasize municipal priorities should be developed such as improvements to the quality of life of watershed residents, protection of property values or benefits that support

local growth and economic development. Obtaining and spending public funds on any initiative should be portrayed as a community investment and the broadest expected return on the investment should be clearly outlined. The province develops strategic funding opportunities and consideration of how management objectives might be structured to meet provincial goals (such as the Northern Ontario Growth Plan) should be considered.

The NBMCA should also examine other external public sector funding source including unique northern Ontario funding opportunities. Programs offered through the Northern Ontario Heritage Fund and FedNor should be investigated to ensure that the NBMCA is structuring its tasks in such a way that these funding opportunities can be accessed. If ineligible, the NBMCA may seek partners that can open eligibility to dedicated funding (such as municipalities or First Nation communities for mutually beneficial projects).

Obtaining funding to implement recommendations also may rely on economic calculation that may be generated as part of the planning exercise. The terms of reference of a planning exercise should identify whether an economic assessment of recommendations is required. An adaptive management approach to improve implementation successes may also consider which could update the economic analysis that may be needed to obtain funding support.

Appendix A NBMCA Policy Development for DIA Regulations and Timetable

NBMCA Proposed Policies and Guidelines Schedule for the Administration of the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation (Ontario Regulation 177/06)
Revised November 8, 2012

Policy/Guideline	Status	Examples of Items to be Covered	Resources	Projected Board Approval
Hearing Guidelines	Complete	Direction for hearings under CA Act	Conservation Ontario Guidelines	November 24, 2010
Wetlands and Other Areas Policy	Complete	Development and interference, PSW vs. non-PSW; adjacent lands	PPS; PRIC Guidelines	November 28, 2012
Environmental Impact Study (EIS) Guidelines	Complete	Planning and development proposal submission requirements	EIS from other CAs	November 28, 2012
Planning and Development Procedural Manual	In progress	Direction on planning and development applications, exemptions, cost, minor works, permit expiration, permit renewals, etc.	Conservation Ontario Guidelines, CALC document	May 2013
Hazardous Lands Policy	Pending	Unstable soil, unstable bedrock, steep slopes	PPS; Understanding Natural Hazards; Bedrock Geology of Ontario Expl. Notes; Geotechnical Principles for Stable Slopes Tech. Guide; Hazardous Sites Technical Guide; PRIC Guidelines	May 2014
Lake Nipissing Shoreline Policy	Pending	Erosion Hazard, Flooding Hazard, Dynamic Beach Hazard	PPS; Understanding Natural Hazards; Great Lakes-St. Lawrence River System and Large Inland Lakes Tech. Guide; Beach and Dune Management (St. Lawrence R) Tech. Guide; Tech. Guide for Large Inland Lakes; PRIC Guidelines; SNF Flood Damage Reduction Study (McLaren Plansearch); Lake Nipissing Shoreline Management Strategy (Baird)	May 2015
River or Stream Valleys – Riverine Flooding Hazards Policy	Pending	Flooding Hazard (one-zone, two-zone, special policy areas); Erosion Hazard	PPS; Understanding Natural Hazards; Adaptive Management of Stream Corridors in Ontario Tech. Guides; River and Stream Systems-Erosion Hazard Limit; River and Stream Systems-Flooding Hazard Limit; Geotechnical Principles for Stable Slopes Tech. Guide; PRIC Guidelines; individual watershed studies; floodplain studies/mapping	May 2016
River or Stream Valleys – Riverine Erosion Hazards Policy	Pending			
River or Stream Valleys – Other Valleylands Policy	Pending			
Watercourses Policy	Pending	Straightening, changing, diverting, or interfering with the existing channel of a river, creek, stream or watercourse	PPS; Understanding Natural Hazards; Adaptive Management of Stream Corridors in Ontario Tech. Guides; River and Stream Systems-Erosion Hazard Limit; River and Stream Systems-Flooding Hazard Limit; PRIC Guidelines; ; individual watershed studies; floodplain studies/mapping	May 2017