NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Memo

Project No. 1050

To: **Uwe Roeper – Xeneca Power Development**
Nava Pokharel – Xeneca Power Development

From: **Andrew Schiedel**

Date: **June 14, 2013**

Re: **Walleye and Lake Sturgeon Spawning Parameters for the Development of the Operations Plan for the Wabageshik Rapids Hydroelectric Generating Station**

I am writing regarding the operations required to address the spawning habitat for walleye (*Sander vitreus*) and lake sturgeon (*Acipenser fulvescens*) at the proposed Wabageshik Rapids Hydroelectric Generating Station. The following is a summary of background information on the water temperatures and timing of spawning and early life stages for each species. This information can be used in the development of the operating plan.

Walleye

Spawning is expected to occur when water temperatures are in the range of 4 to 12°C. Spawning activity of walleye begins shortly after ice break-up with optimal water temperatures ranging from 6.7 – 8.9°C (Scott and Crossman 1973). Others have observed walleye spawning in higher temperatures, in the range of 10 to 16°C, including 10°C at the Mattagami Generating Station complex (Sheehan 1989), 12.9°C on the Ivanhoe River and 16°C on the Frederickhouse River (NRSI field studies for Xeneca), and 15°C in the Chapleau River (Booth et al. 1988). However, it has been NRSI's observation, over many years of spawning surveys, that peak spawning generally ends at or below 12°C and this is certainly supported in the literature (Corbett and Powles 1986, Raabe 2006, and Scott and Crossman 1973). The water temperature range of 4 to 12°C will therefore encompass the vast majority of walleye spawning activity each year.

Egg incubation until hatch is expected to occur within 18 days of the end of peak spawning at 12°C. In general, egg incubation occurs in 12 to 18 days, and the yolk sacs are absorbed rapidly (Scott and Crossman 1973, Kerr et al. 2004). Egg incubation until hatch is therefore expected to be completed 18 days of the end of peak spawning at 12°C.

Yolk sac absorption and continued larval development until the free-swimming stage is expected to require an additional 15 days. In general, larvae continue to develop for an additional 10 to 15 days after hatch until the young disperse into the upper levels of the water (Scott and Crossman 1973). Therefore, the additional 15 days should ensure that the larvae have dispersed and are sufficiently developed to withstand variation in flow.

Lake Sturgeon

Spawning is expected to occur when water temperatures are in the range of 8 to 16°C. Optimal spawning temperatures for lake sturgeon are reported to be in the range of 14 to 16°C (Auer 1982, Kempinger 1988, Auer 1996), although spawning activity may occur anywhere in the range of 8.5 to 18°C (Scott and Crossman 1973, Harkness 1923). On the Vermillion River, fish movement to spawning areas has been observed by Ministry of Natural Resources (MNR) biologists and other consultants to occur when water temperatures are below 16°C. In addition, NRSI was unable to capture adults in the Vermillion River when water temperatures were above 16°C. Therefore, spawning is expected to be completed when water temperature reaches 16°C.

Egg incubation to hatch is expected to endure no more than 8 days after a water temperature of 16°C is reached. Smith and King (2005) studied the lake sturgeon larval drift in the Black River, Michigan, and found that egg incubation endured 5 to 11 days. However, the duration of egg incubation was also noted to be temperature dependent. The highest durations resulted from the earliest spawn in the study year when water temperatures remained low (between 10 and 15°C) for a prolonged period after spawning. The other 6 spawning events they studied resulted in egg incubation periods of no more than 7 days. In establishing an incubation period for water temperatures above 16°C, the 11-day incubation period would not apply.

Kempinger (1988) studied lake sturgeon in the Lake Winnebago system in Wisconsin, and observed the egg incubation period to extend from 8 to 14 days. However, in the year when incubation required 14 days, the water temperature was never above 16°C during incubation. This reflects the temperature-dependence of incubation times, where cooler water temperatures result in longer incubation times, and vice versa. In the other 2 years of study, hourly capture of larvae was largely complete in 8 to 9 days after a water temperature of 16°C was reached. This suggests that lake sturgeon larvae will most likely hatch within an incubation period of 8 days when water temperature is above 16°C.

LaHaye et al. (1992) studied lake sturgeon in the Des Prairies River and L'Assomption River near Montreal, Quebec. Larval hatch was observed in L'Assomption River 8 days after peak spawn. In the Des Prairies River, hatch occurred 14 days after the first spawn, and 8 days after the second spawn. The 14-day incubation period occurred at temperatures well below 16°C because spawning occurred in the Des Prairies River in water temperatures between 11.6 and 15.4°C. The 8-day incubation periods observed in each river would be more representative of a lake sturgeon egg incubation time in water temperatures above 16°C.

These studies provide evidence that lake sturgeon larvae will hatch within an incubation period of 8 days after a water temperature reaches 16°C.

Yolk sac absorption and continued larval development until drift is expected to endure up to 17 days after the conclusion of the egg incubation period. Smith and King (2005) observed peak larval drift occurring up to 14 days after hatch. On average, the period from hatch to peak larval drift was 10 days, and drift was generally occurring when water temperatures were greater than 16°C, with lower temperatures interrupting the drift.

In their synthesis of current knowledge of lake sturgeon, Peterson et al. (2007), citing Kempinger (1988) and LaHaye et al. (1992), indicates that lake sturgeon larvae begin drifting 13 to 19 days after hatching.

The above information suggests that a period of 17 days will ensure the larvae are sufficiently developed to withstand some variation of flows within parameters established for larval drift.

Larval drift is expected to endure no more than 21 days after egg incubation for the Wabageshik Rapids site. Benson et al. (2006) conducted a study on the Peshtego River in Wisconsin, and observed larval drift periods of 15 to 17 days.

Smith and King (2005) observed multiple peaks in larval drift during each of 3 years of study, with drift interrupted by reductions in water temperature between the peaks in some years. In the first year of study, drift began on 11 May and lasted 8 days followed by 8 days of reduced water temperatures (mean of 13.6°C). The second drift lasted for 11 days, thus the total time from beginning to end was 27 days. In the second year of study, there were 3 peaks in drift with an interruption by cool water temperatures between the second and third peaks. The total time from beginning to end was 34 days. In the third year of study, low water temperatures (below 15°C) prolonged incubation time, and drift was delayed relative to the first 2 years of study. There was no subsequent interruption of drift that year, and the total duration of drift was 20 days. This suggests that when water temperatures remain above 16°C, drift may have a shorter duration.

A larval-drift period of 21 days following egg incubation and larval development should be sufficient for the Vermillion River System. While Smith and King (2005) observed total drift to endure longer than 21 days in some instances, the beginning of drift would have resulted from the earliest spawning event. In this case the drift period is being specified to follow the last spawning event and an associated time period for incubation and larval development. Therefore, some larvae may begin drifting while others are incubating and developing, and 21 days should provide ample time for drift of the latest-developing larvae.

In addition, specific river flows are less important after 21 days. The primary concern is to ensure that larvae can emigrate from the spawning habitat and find suitable nursery habitat downstream. A period of 21 days with constrained dam operations should be ample to achieve this. In addition, the section of the Vermillion between Wabageshik Rapids and the Domtar headpond is approximately 5km, which is a relatively short distance for lake sturgeon larval drift (Auer and Baker 2002, Benson et al. 2006). Once lake sturgeon larvae are in the Domtar headpond, upstream Vermilion River flows will have less influence on the movement of larvae. Overall, 21 days should be an ample time period to apply flow-variation parameters that accommodate larval drift.

Sincerely,
Natural Resource Solutions Inc.

Andrew Schiedel, B.A.
Aquatic Biologist

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Wabageshik Rapids
Hydroelectric Generating Station Project
Preliminary Fish Habitat Compensation Plan

Prepared for:
Xeneca Power Development Inc.
5255 Yonge Street, Suite 1200
Toronto, Ontario
M2N 6P4

Project No. 1050

Date: July 2013

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Wabageshik Rapids Hydroelectric Generating Station Project
Preliminary Fish Habitat Compensation Plan

Project Team:

Staff	Role
Andrew Schiedel	Aquatic Biologist, Project Manager
Steve Burgin	Aquatic Biologist
Ashley Favaro	Aquatic Biologist

Report submitted on July 24, 2013

A Schiedel

Andrew Schiedel, B.A.
Aquatic Biologist, Project Manager

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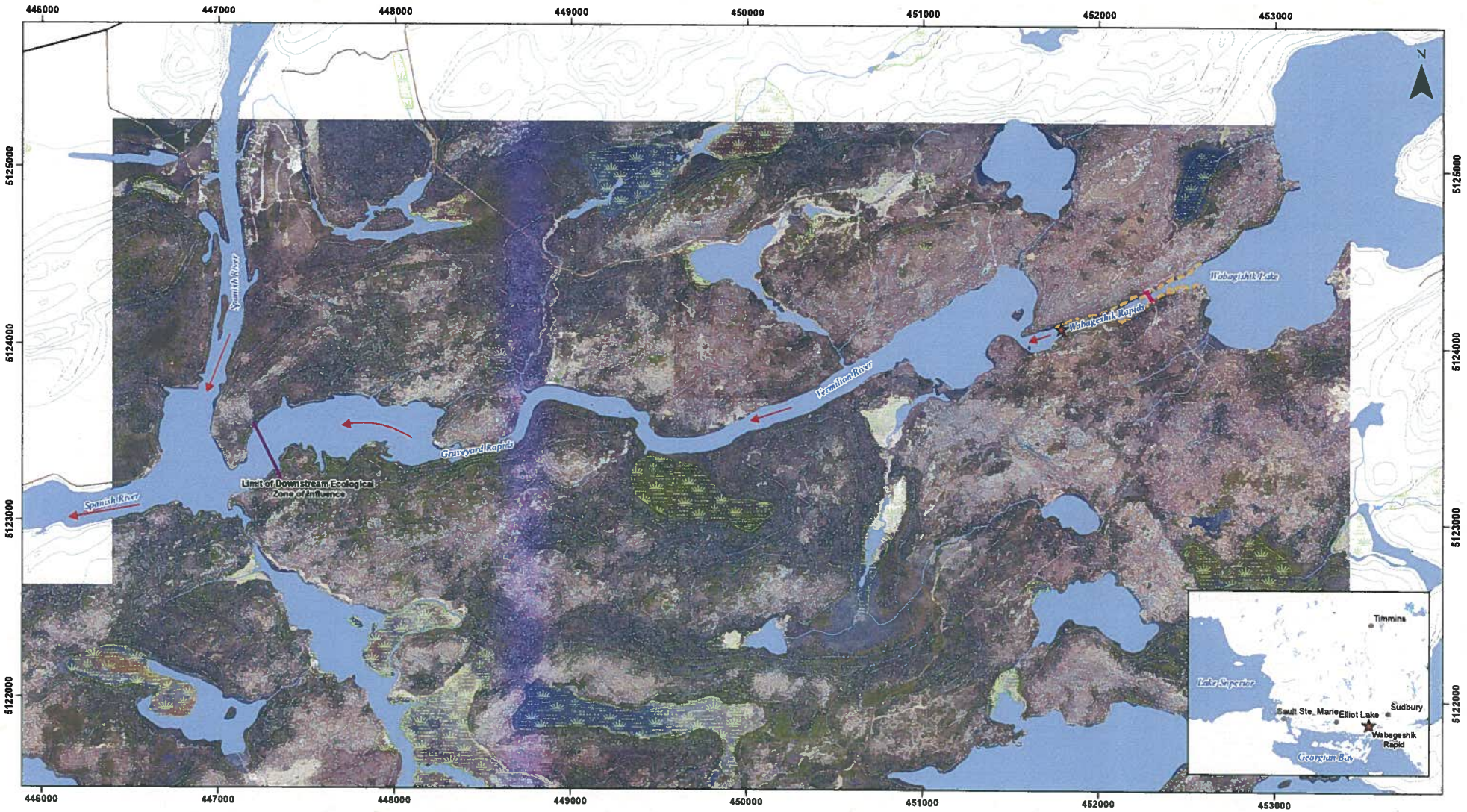
1.0 Introduction

This preliminary fish habitat compensation plan is intended to accompany the Wabageshik Rapids Hydroelectric Generating Station Project provincial Class Environmental Assessment (EA). The EA is being carried out according to the Class Environmental Assessment for Waterpower Projects (OWA 2008). This report outlines the objectives, design parameters and locations of the proposed compensation habitat. Additional design parameters will be provided in conjunction with detail design and permit applications for the project.

This habitat compensation is required in order to obtain permits from Fisheries and Oceans Canada (DFO) under the federal *Fisheries Act*, and from the Ontario Ministry of Natural Resources (OMNR) under the provincial *Lakes and Rivers Improvement Act*. Because the habitat involves lake sturgeon (*Acipenser fulvescens*) that is listed as Threatened on the Species at Risk in Ontario list, the compensation habitat must also achieve compliance with the provincial *Endangered Species Act*. As the regulating authorities, DFO and OMNR will have influence over the details of the final compensation plan. This preliminary plan has been produced in the context of discussion with DFO and OMNR, and is intended to be consistent with their general mandates and project-specific objectives.

1.1 Project Location

The Wabageshik Rapids Hydroelectric Generating Station Project (Wabageshik Rapids GS) site is located on the Vermillion River, 5km upstream of its confluence with the Spanish River (Figure 1). The proposed dam will be located near the downstream end of the 1,100m length of rapids. From a fisheries management perspective, the proposed dam is located in a habitat system contained by the Lorne Falls dam on the Vermillion River upstream of the proposed Wabageshik Rapids GS dam, and by two dams on the Spanish River downstream of the proposed Wabageshik Rapids GS dam. The two dams on the Spanish River are the Nairn Falls dam upstream of the Vermillion-Spanish confluence, and the Domtar dam downstream of the confluence.



Wabageshik Rapids Hydroelectric Generating Station Project

Figure 1 - Study Area

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0 100 200 300 400 500 Meters

March 8, 2013 Project No. NRSI-1050
UTM Zone 17, NAD 83 Scale: 1:20,000 (at 11x17")

Legend

- Wabageshik Rapid Proposed Hydroelectric Generating Station
- Limit of Downstream Ecological Zone of Influence
- Zone of Inundation
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Snowmobile Bridge
- Watercourse
- Waterbody
- Wetland Area
- Elevation Contour (10m Interval)

Path: X:\1016_XenecaPower\Vermilion\NRSI_1050_Wabageshik_StudyArea_20k_2013_03_08_GCS.mxd

Wabagishik Lake is located upstream of Wabageshik Rapids, and the Lorne Falls dam is located at the upstream end of the lake. The Lorne Falls dam represents an upstream barrier for fish movement from the lower Vermillion River. Some spawning habitat for walleye (*Sander vitreus*) exists in several locations in Wabageshik Lake, including at the base of the Lorne Falls spillway.

The Nairn Falls dam is located on the Spanish River 15km upstream of the confluence with the Vermillion River. Walleye are known to migrate to the base of the dam during the spawning season but there is a negligible amount of spawning habitat currently available at that location.

The Domtar dam is located 7km downstream of the Vermillion-Spanish confluence, and its headpond affects water levels in both rivers upstream of the confluence.

2.0 Compensation Habitat Objectives

2.1 Existing Habitat Requiring Compensation

Existing fish habitat in Wabageshik Rapids will be impacted by inundation between the proposed dam site and Wabageshik Lake, and by operations downstream of the proposed dam site. Wabageshik Lake itself will not be impacted by inundation as the project will be designed and operated to follow natural lake levels, as specified in the proposed operating plan (Ortech 2013). In addition, the footprint impact of the dam will affect a relatively small area of habitat. Operation of the facility will have a variety of effects on the habitat downstream. One particular area will be dewatered more frequently than under existing conditions, and it is being addressed through fish habitat compensation. The remainder of the downstream area is being addressed through operational planning (Ortech 2013).

Of the total wetted area of the channel within Wabageshik Rapids, there are areas that represent suitable spawning habitat for walleye, lake sturgeon and fish species in the sucker family (Catostomidae). Some of the spawning habitat within Wabageshik Rapids will be altered by the changes in water depth and velocity due to inundation. Another

area will be impacted by the facility footprint. Downstream of the facility, the area requiring compensation will not be impacted by operations during the spawning periods for walleye or lake sturgeon, but its general aquatic habitat function will be impacted at other times of the year.

2.1.1 Inundation Area

In the habitats that will be inundated, the riverine habitat will change to lacustrine habitat, which still functions as aquatic habitat albeit with different characteristics that suit different species of fish, benthic invertebrates and plankton. The most meaningful change in habitat function will be the alteration of the spawning habitat for walleye and lake sturgeon. The fish spawning habitat has specific water depth and velocity parameters that will cause its function to be reduced within the inundation area. The spawning habitat function is important because it is a required habitat component to maintain the life cycle of walleye, lake sturgeon and sucker species. Therefore, maintaining this spawning habitat will be the focus of the compensation for the fish habitat in the inundation area. For reference, the habitats within the inundation area of Wabageshik Rapids that are not suitable spawning habitat for walleye, lake sturgeon or sucker fish species are characterized in more detail in the natural environment report (NRSI 2013) included in Annex III of the main Environmental Report for this project.

Benthic invertebrates will also benefit from the compensation habitat works. Overall, there will be some impact on the fast-water benthic invertebrate community downstream of the proposed Wabageshik Rapids GS. Refer to the natural environment report (NRSI 2013) included in Annex III of the main Environmental Report for this project for a detailed discussion of the potential impacts on benthic invertebrates that can result from downstream operational effects. While some impact is expected, the construction of the compensation fish habitat will provide some benefit to offset the impacts to some extent. Although focus of the design will be on improving the habitat for fish spawning, several aspects of the spawning habitat will be beneficial to benthic invertebrates. Any new areas of gravel and/or cobble substrate will provide habitat for benthic invertebrates that live on hard substrates in fast water. In addition, more varied and complex habitat will be created as a result of measures to modify of water depths and velocities, such as the

placement of boulders to create resting areas for the fish. The habitat modifications will also address the increased frequency of dewatering the horseshoe-shaped area of habitat downstream. Therefore, the fish habitat compensation, while not focused on benthic invertebrates, is expected to provide some benefit that will offset some of the impacts from operations.

The area of walleye, lake sturgeon and sucker spawning habitat in the inundation area was calculated based on habitat mapping and measurements of channel units in the field in conjunction with aerial photography. Habitats characterized as riffles and runs were considered to be suitable spawning habitat for these fish species. At this time, the entire riffle and run areas are conservatively assumed to provide spawning habitat for both walleye and lake sturgeon. A detailed survey of the habitat parameters within these riffles will be performed during the detail design and permitting phase of the project. The areas of these habitats were estimated for moderate spring flow conditions, and are discussed as follows.

A riffle area at the upstream end of the rapids adjacent to Wabagishik Lake has an area of 2,380m^2 that is available to fish during the spring spawning season. The wetted width varies substantially with flow conditions, from 8m wide in summer low flow conditions to 55m wide during very high flows. The area of 2,380m^2 includes a large portion of the channel, but does not represent the maximum area, which occurs at very high flows. The substrates are a mixture of boulder, bedrock and cobble.

A larger riffle area occurs between the existing snowmobile bridge and proposed dam, with an area of 4,460m^2. This section of the channel has a deeper part of the channel along the south bank, such that summer low flows expose a large portion of the riffle. The area given for the riffle includes the entire area, as spring flows typically make the habitat in the entire riffle available to fish. Substrates are mostly cobble as well as some boulder.

Following inundation, some of the function of this spawning habitat is expected to persist. The remaining water velocity following inundation relative to existing conditions is demonstrated in the results of the Steady-State HEC-RAS model report prepared by

CPL (2012). A table showing the water velocities under existing and proposed conditions is provided in Appendix I. While the monthly Q_{10} flow value is a higher water velocity than would occur in a typical year, the monthly Q_{90} values, which are available in the HEC-RAS report, are more than half of the Q_{10} values shown in Appendix I. The result is that the existing average cross section velocities are in the high range of suitable spawning velocities for walleye and lake sturgeon (see section 3.0). Reducing the water velocities will therefore have little to no impact on the spawning habitat function.

Inundation will also increase water depth over the habitats, which will primarily affect suitability for walleye. This effect is more substantial in the riffle downstream of the snowmobile bridge but is limited in the upstream riffle. Overall, it is apparent that some spawning habitat function will remain. This remaining function will be available to walleye and sucker species residing Wabagishik Lake, although it is not known if these fish will utilize it as they typically move upstream to spawn.

Because the proposed Wabageshik Rapids GS will not have provisions for upstream fish passage, adult fish residing downstream will no longer have access to the inundated habitat for spawning. For adult fish residing downstream, the spawning habitat is effectively eliminated. Therefore, the complete function of the spawning habitat must be compensated downstream of the proposed GS.

2.1.2 Dam Site

The dam comprises several different components: the spillway, powerhouse, headrace and tailrace. The construction of these components will result in permanent changes to aquatic habitat. The powerhouse will have an area of 400m^2, the spillway will have an area of 200m^2, and the headrace and tailrace will have a combined area of 600m^2. Of these areas, the entire area of the powerhouse and spillway, and the area of the tailrace will affect aquatic habitat, resulting in an area of impact of approximately 400m^2 for the powerhouse, 200m^2 for the spillway, and 400m^2 for the tailrace. The headrace is not expected to impact aquatic habitat directly, although the area will be inundated.

The Wabageshik Rapids GS powerhouse and spillway footprint area (600m^2) is located at the transition from a run to a pool. The run has mostly bedrock substrate and does not provide fish spawning habitat or other important habitat function. The pool has more varied substrates and is therefore more productive habitat. The pool is expected to provide holding or refuge areas for walleye, lake sturgeon and redhorse suckers that spawn in adjacent habitats. These species may also spawn within the pool in locations with suitable velocities. The pool also provides foraging habitat for a variety of fish species, and northern pike are known to forage in this pool for small fish and drift (OMNR 2012b). Within the 600m^2 footprint of the powerhouse and spillway structures, these habitats will be eliminated. Some of the area will cover the run, but approximately 500m^2 will cover the pool, resulting in permanent impact that will be addressed through fish habitat compensation.

Where the tailrace area must be excavated, the existing cobble substrate on the channel bottom will be replaced following excavation (CPL 2013). This will ensure that the existing substrate characteristics will be maintained. While changes in water depth and velocity must also be considered, the information is not available at this time and a specific area of impact is not being assigned in this report. Instead, the suitability of the tailrace for spawning will be evaluated using 2-dimensional modelling as a design tool. Opportunities will then be sought to improve habitat characteristics in the tailrace and/or nearby habitat.

2.1.3 Downstream within Wabageshik Rapids

A specific area has been cited by the DFO biologist as being of concern for the operations of the proposed Wabageshik Rapids GS. It is a horseshoe-shaped area of riffle habitat located at the north side of the channel approximately 100 meters downstream of the spillway. As a result of the proposed intermittent operations, this horseshoe-shaped area will become dewatered more frequently than under existing conditions.

Intermittent operation typically occurs in February, July, August and September. While the proposed facility is in intermittent operation, flow rates will vary between the minimum flow (Q_{EA}) at night (5-8m^3/s plus Q_{Comp} of 0.5m^3/s) and limited turbine flow

(Q_{TL}) during the day (25m^3/s as per operating plan restriction (Ortech 2013). The daily variation in flow that occurs at these times will result in wetting and drying of channel substrate in this area of habitat. The area affected by drying has been calculated by comparing the area wetted under existing conditions during the average August flow rate of 15.5 m^3/s and the proposed minimum flow in August of 5 m3/s. The affected area is 1,000 m^2 in size (Xeneca 2012b).

A loss of benthic invertebrate production and a change in the benthic community will result from the intermittent operations. The use of 2-dimensional modeling to design the compensation fish habitat will facilitate the discernment of the best way to address the loss of this habitat function.

2.1.4 Summary of Habitats

The sum total of these areas of habitat requiring fish habitat compensation is 8,340m^2. These areas are summarized in Table 1 below.

Table 1. Summary of Habitat Areas Requiring Compensation

Location	Habitat	Area (m^2)
Inundation Area	Riffle	2,380
	Riffle	4,460
Dam Site	Pool	500
Downstream	Horseshoe-shaped riffle	1,000
	Total	**8,340**

It should be noted that there will be temporary disturbances of habitat during construction resulting from the installation of coffer dams and dewatering within the construction areas. This document does not address these temporary disturbances because the construction sequencing for the construction of the fish habitat compensation is not yet established. Potential impacts from the temporary disturbances include the interruption of the availability of spawning habitat, resulting in the loss of a cohort of a species of fish. This matter will be addressed through permits and approvals during the detail design phase of the project.

The design will also have consideration for potential effects on navigation. This will also be reviewed and addressed through permits and approvals during the detail design phase.

2.2 Fisheries Management Objectives

The OMNR provided fisheries management objectives and potential fish passage concerns for the Wabageshik Rapids GS project (OMNR 2011). The management objectives are provided for Wabagishik Lake and the Vermillion River downstream. For both locations, the objectives are to:

- "Conserve existing aquatic species diversity.
- Maintain or increase walleye and northern pike productive capacity & abundance.
- Maintain diverse and sustainable angling opportunities for all species currently angled including walleye, northern pike, and smallmouth bass (OMNR 2011)."

Specifically for the Vermillion River, there is also the objective to:

- "Increase lake sturgeon productive capacity & abundance to facilitate recovery of the species within the Lower Vermillion River (below Wabagishik Lake) & Spanish River (between Nairn Center and Espanola).
    - Maintain or improve lake sturgeon spawning areas / potential and provide for optimal incubation success.
    - Maintain or improve other lake sturgeon habitat parameters including foraging habitats and nursery areas.
    - Maintain connectivity to all suitable habitats and / or compensate for habitats functionally lost to the population of concern (OMNR 2011)."

The OMNR's fish passage concerns were related to uncertainty as to whether or not walleye and lake sturgeon are able to pass upstream through Wabageshik Rapids and into Wabageshik Lake under existing conditions (OMNR 2011). An analysis was performed in the natural environment report by NRSI (2013) found Annex III of the main Environmental Report. It was determined that under certain flow conditions during the spring spawning period, both walleye and lake sturgeon are theoretically able to pass upstream through Wabageshik Rapids. There are behavioural considerations regarding whether or not these fish species do in fact pass upstream through the rapids; however,

it must be assumed that this can occur. Although walleye are known to inhabit Wabagishik Lake, there is no available evidence to conclude that lake sturgeon inhabit Wabagishik Lake.

The plan to replace the fish spawning habitat is consistent with the OMNR's fisheries management objectives and fish passage concerns. It serves to maintain or increase walleye productive capacity and abundance, and maintain sustainable angling opportunities for walleye. It also maintains and potentially improves lake sturgeon spawning areas, and can improve incubation success by constructing the compensation habitat to remain wetted as the spring flows recede.

While no fish passage is being provided, the compensation habitat can be located in the Vermillion River downstream of Wabageshik Rapids, thus maintaining the spawning habitats in a location available to the lake sturgeon population of concern. For walleye, the OMNR has previously indicated that spawning habitats are available within Wabagishik Lake, and its resident population will be sustained without fish passage (Xeneca 2012a). Existing recruitment from the spawning habitat in Wabageshik Rapids serves the Vermillion and Spanish River system downstream, thus it is appropriate to locate the compensation habitat downstream in the Vermillion River.

As discussed in section 2.1, some of the spawning habitat function will remain in the 2 riffle areas within upper part of Wabageshik Rapids. However, this will not serve to reduce the need for compensation due to the uncertainty of this continued function. However, monitoring may be able to demonstrate this function after the proposed Wabageshik Rapids GS is operational.

Fish species in the sucker family also use the spawning habitat. However, the OMNR's fisheries management objectives are not focused on these species. While there is no specific consideration for these species, it can be reasonably assumed that the management for walleye will serve to maintain spawning habitat for sucker species as well.

2.3 Overall Benefit for Lake Sturgeon

The Wabageshik Rapids GS project will need to comply with the provincial *Endangered Species Act*, which requires that projects adversely affecting a Threatened or Endangered species achieve overall benefit for that species. Therefore, the compensation for the lost lake sturgeon spawning habitat will be an important component of achieving overall benefit for lake sturgeon.

3.0 Design Parameters

The compensation fish habitat will be designed to function as suitable spawning habitat for walleye and lake sturgeon. To this end, the design parameters are based primarily on information on spawning habitat preferences for these species, determined by studies documented in the literature. Because the habitat must remain stable during high flow events, the design will also be based on the requirements to achieve stability. The stability component of the design will be determined during the detail design phase of the project.

To achieve a rigorous design that provides a high level of confidence in the constructed and modified habitat, 2-dimensional modeling will be used for the Wabageshik Rapids tail water area. This includes the section of Wabageshik Rapids from the proposed dam to the outlet of the rapids into a large bay, which is a distance of approximately 300m. Refer to section 4.0 for more context on this location. The 2-dimensional modeling will facilitate species-specific analysis of the suitability of the proposed habitat for the walleye and lake sturgeon.

Design criteria based on the spawning habitat preferences of walleye and lake sturgeon are provided in Table 2, which includes water velocity, water depth and channel substrate. The design criteria for both species are expressed as ranges, and are used to determine a combined design criteria.

Table 2. Spawning Habitat Preferences for Walleye and Lake Sturgeon

Design Criteria	Water Velocity (m/s)	Water Depth (m)	Substrate Size (mm)
Walleye	0.3 to 1.1	0.2 to 1.5	50 to 380
Lake Sturgeon	0.2 to 1.8	0.3 to 2.0	50 to 400
Combined	0.3 to 1.1	0.3 to 1.5	50 to 380

Some of the sources of information on the preferred water velocities, depths and substrates are discussed briefly below. Some of the habitat parameters discussed are broader than those given in Table 2, which emphasizes the most typical or optimal ranges to ensure a successful design. Table 2 also omits sand and gravel substrates in favour of materials more suitable for construction.

3.1 Walleye

Kerr et al. (1997) reviewed information on walleye spawning habitat from a variety of sources and water bodies. Rock substrate with clean interstitial spaces was identified as an important substrate characteristic, citing lower survival on fine substrates. They also noted that walleye tend to avoid the highest velocities in spawning areas by seeking slower-moving channel margins or shelter behind large objects, with velocities of 2.0m/s being avoided. For constructing spawning beds for walleye, they recommend using substrates in the range of 5 to 38cm in diameter, keeping water depths in the range of 20 to 65cm, including boulders or other structures to create resting areas, and having pools of deep water in proximity to spawning sites to facilitate rest during the day when spawning is not occurring.

Lyttle (undated) adapted a Habitat Suitability Index to evaluate spawning habitat in the Missisquoi River above and below the Swanton Dam. Lyttle considered suitable water velocity for walleye to be in the range of 0.6 to 1.1m/s, and suitable water depths to be in the range of 0.3 to 1.5m. Suitable substrates for walleye included sand, gravel and cobble, with particle size categories ranging from 0.06 to 256mm.

McMahon (1984) developed a habitat suitability index model for walleye. As a spawning habitat parameter for the reproduction component of the model, they determined that

water depths within the range of 0.3 to 1.5m are suitable, and noted that the criteria could be modified based on information for local walleye populations.

Biologists from the MNR Sudbury District Office cited 0.3m/s as a minimum water velocity for walleye spawning, based on experience in the Sudbury District. The biologist from DFO agreed with this minimum velocity for walleye spawning habitat (Xeneca 2013).

3.2 Lake Sturgeon

Chiotti et al. (2008) documented spawning events in the Big Manistee River, Michigan, and determined that average water velocity at spawning sites was 0.34 to 1.32m/s and water depth was 1.5 to 3.0m. They found that spawning sites had a high proportion of cobble (34 to 44%) along with some sand (0.04 to 8%), and determined that spawning locations had higher heterogeneity of substrate materials compared to non-spawning locations.

LaHaye et al. (1992) compared the physical characteristics of lake sturgeon spawning grounds in the Des Prairie River and the L'Assomption River. Eggs were collected in the Des Prairie River at water depths in the range of 10 to 158cm (deeper water could not be sampled), and at water velocities from 0.02 to 1.09m/s. Sampling stations were less likely to have deposited eggs as water depth and velocity increased. In both spawning grounds, eggs were found where substrates ranged from fine and coarse gravel to boulder. Spawning lake sturgeon were observed to be attracted to locations with current breaks and moderately heterogeneous substrates. Because of the variety of suitable substrates, constructing spawning habitats is a suitable management tool for lake sturgeon and substrates can be sized according to hydraulic needs.

Lyttle (undated) developed a Habitat Suitability Index to evaluate spawning habitat in the Missisquoi River above and below the Swanton Dam. Lyttle considered suitable water velocity for lake sturgeon to be in the range of 0.6 to 1.1m/s, and suitable water depths to be in the range of 0.3 to 4.5m. Suitable substrates for lake sturgeon were deemed to be slightly larger than for walleye, and included gravel, cobble and boulder, with particle size categories ranging from 2 to 4096mm.

Verdon and Gendron (1991) describe the materials used to construct the new spawning ground at the Des Prairie River spillway. Approximately 6000m^3 of material comprising coarse gravel, pebbles and boulders was deposited over an area of the river measuring approximately 0.5ha (5,000m^2).

Manny and Kennedy (1998) studied lake sturgeon spawning habitat in the Detroit and St. Clair Rivers. Due to the large channel size, the spawning depths of 9 to 12m were much greater than typical depths cited in other literature. They determined that lake sturgeon spawning substrates included rounded cobble 10 to 40cm in diameter, and coarse gravel 2 to 8cm in diameter. Water velocities ranged from 0.35 to 0.98m/s, which they found to be typical of velocities observed by others.

Threader et al. (1998) developed a habitat suitability index for lake sturgeon. They considered water velocities of 15 to 70cm/s to be optimal for spawning, with velocities up to 177cm/s being suitable. Optimal water depths were assumed to be in the range of 0.3 to 2.0m, with depths greater than 2.0m deemed to be sub-optimal. Cobble and boulder were considered to be the optimal spawning substrates, with sand, gravel and bedrock deemed to be sub-optimal but still suitable.

4.0 Locations

In accordance with the fisheries management objectives discussed in section 2.2, the compensation habitat will be located in the Vermillion River downstream of the proposed Wabageshik Rapids GS. Keeping the compensation habitat within the Vermillion River is also consistent with DFO's hierarchy of preferences for locating fish habitat. The habitat will be located in as many as three locations, prioritized as follows:

1. Wabageshik Rapids tail water area, beginning at the proposed dam and extending 300m downstream to the large bay,
2. The bay downstream of Wabageshik Rapids, where the relatively fast water velocities extend into the bay, and
3. at Graveyard Rapids 3km downstream of the proposed Wabageshik Rapids GS.

A letter from Xeneca, Nava Pokharel, P.Eng. (refer to Appendix II), provides an overview of 5 potential locations that were considered for constructing spawning habitat. Two of the areas are included in the prioritized locations. The first-priority tail water area was added after discussions with biologists from MNR and DFO. It is facilitated by the plan to use 2-dimensional modeling to design improvements to the habitat parameters for spawning in this area.

The selection of the final locations will occur as part of detail design and permitting, and will follow the above priority list of locations.

5.0 Proposed Monitoring

5.1 Monitoring Rationale and Objectives

The OMNR and DFO typically require monitoring a part of their approval of the creation of fish habitat as compensation in order to determine whether or not the habitat is functioning as intended by the design. The specific objectives of the monitoring are to determine

1. whether or not the water depth and velocity parameters are met by the new spawning habitat,
2. whether or not adult walleye, lake sturgeon and sucker species are present within the new spawning habitat,
3. whether or not spawning is occurring, determined by the presence of eggs within the new spawning habitat, and
4. if eggs and/or spent adults are found at the spawning site, whether or not spawning was successful, determined by the presence of larvae within or downstream of the new spawning habitat.

5.2 Methodologies

Monitoring of the compensation fish habitat will be carried out annually for the first 5 years of operation of the Wabageshik Rapids GS. The following methods will be carried out in the spring season, specifically during the spawning periods for walleye and lake

sturgeon. All capture methods will be carried out under permits as required under the provincial *Fish and Wildlife Conservation Act* and *Endangered Species Act*.

The methods found in "Lake Sturgeon and Waterpower: Data Collection and Sampling Protocols for Mitigation Effectiveness Monitoring" will be followed for lake sturgeon spawning surveys (OWA 2012). Walleye spawning surveys will follow a similar protocol outlined in the Natural Environment Characterization and Impact Assessment Report (NRSI 2013).

5.2.1 Habitat Measurements

Water depths and water velocities will be measured when water temperatures are suitable for walleye and lake sturgeon spawning. This will require that measurements are taken on at least 2 occasions during the spawning season in order to describe the depths and velocities available for each species.

If it is found that the fish are not using the compensation habitat, the habitat measurements will be used to verify the predicted conditions from the 2-dimensional model used to design the spawning habitat. The 2-dimensional modeling may then be used to analyze the habitat parameters at a variety of flow conditions. However, this will only be done if there is clearly a need to analyze the habitats beyond the observation of use by walleye and lake sturgeon.

5.2.2 Visual Surveys

Spotlight surveys will be carried out as a means of determining the presence of walleye within the new spawning habitat. Spotlights will be used after dark during the early part of the night to try to visually locate any fish.

Since lake sturgeon actively spawn during the day, visual surveys for lake sturgeon will be carried out within the new habitat during day light hours to determine the presence of spawners. Locations of observation, species observed, and notes on behavior will be recorded. Observations will also be made in the surrounding areas, including existing spawning habitat, to provide context for the observations within the new habitat.

5.2.3 Egg mats

Egg mats will be installed within the new spawning habitats to determine whether or not eggs are being deposited.

5.2.4 Drift Netting for Lake Sturgeon Larvae

If it is determined that lake sturgeon eggs were most likely deposited on the spawning bed, through capture of spent adults and/or capture of eggs, larval drift netting will be conducted to determine spawning success.

5.2.5 Capture of adults

Sampling techniques such as angling, trap netting and gill netting will be used as appropriate to determine presence of adults during the spawning season. The fish will be observed to determine the sex and spawning condition (green, ripe, free running or spent), and measured for length and weight. For walleye, the fish will be marked by a suitable means such as a fin clip, to be determined in consultation with the OMNR. For lake sturgeon, PIT tags will be installed in any captured adults or juveniles as per the requirements of the sampling permit from the OMNR.

5.3 Possible Mitigation Strategies

If the compensation fish habitat is not functioning as intended, Xeneca will discuss appropriate mitigation strategies with DFO and the Sudbury District OMNR. There would be a variety of options to modify the habitat. For example, additional large boulders could be placed in order to provide more resting areas for spawning fish and/or to provide greater variety of water velocities. Similarly, additional large or small substrate material could be placed in order to change the substrate composition, initially in a portion of the spawning bed in order to test success.

5.4 Schedule and Reporting

These methods will be carried out in years 1,2, 3, 4 and 5 of facility operation. Reporting will occur in conjunction with other monitoring activities that take place in any of those years.

6.0 Conclusion

The information in this report provides the rationale and intended direction for the fish habitat compensation to be carried out as part of the Wabageshik Rapids GS project. The biological background and criteria for the habitat design is included herein, and the feasibility of the plan is reviewed in the appended letter from Xeneca's engineer. Additional engineering and construction design details will be developed during the detail design phase of the project.

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APPENDIX I

HYDRAULIC PARAMETERS IN WABAGESHIK RAPIDS

Table 1: Wabagishik Rapids - Hydraulic Parameters comparison Pre and Post project in Riffle Areas during spring high flows

					Existing (Pre)						Proposed (Post)					
Habitat Area	HEC-RAS Section	Sta	Ref	Flow (Q)	Velocity	Wet. Ptr.	Bot.	Surf.	Max. Depth	Avg. Depth	Velocity	Wet. Ptr.	Bot.	Surf.	Depth	Avg. Depth
			Flow	m3/s	m/s	m	m	m	m	m	m/s	m	m	m	m	m
Riffle Area downstream of Snowmobile Bridge	0+495	495	May ($Q_{10\%}$)	215	3.8	41	200.68	202.54	1.9	1.41	1.4	49	200.68	205.01	4.3	3.52
	0+495	495	April ($Q_{10\%}$)	268	4.0	42	200.68	202.77	2.1	1.62	1.7	49	200.68	205.02	4.3	3.53
	0+637	637	May ($Q_{10\%}$)	215	1.7	76	201.61	204.02	2.4	1.68	1.0	92	201.61	205.14	3.5	2.39
	0+637	637	April ($Q_{10\%}$)	268	1.8	78	201.61	204.30	2.7	1.92	1.2	94	201.61	205.22	3.6	2.42
Riffle Area upstream of Snowmobile Bridge	0+900	900	May ($Q_{10\%}$)	215	2.1	57	202.91	205.19	2.3	1.80	1.8	58	202.91	205.48	2.6	2.06
	0+900	900	April ($Q_{10\%}$)	268	2.1	58	202.91	205.63	2.7	2.20	2.0	59	202.91	205.73	2.8	2.29
		9														
	0+955	955	May ($Q_{10\%}$)	215	1.8	71	202.93	205.47	2.5	1.73	1.6	72	202.93	205.66	2.7	1.90
	0+955	955	April ($Q_{10\%}$)	268	1.8	73	202.93	205.86	2.9	2.08	1.8	73	202.93	205.94	3.0	2.15
	0+988	988	May ($Q_{10\%}$)	215	2.0	73	202.51	205.72	3.2	1.67	1.9	75	202.51	205.82	3.3	1.74
	0+988	988	April ($Q_{10\%}$)	268	2.1	78	202.51	206.04	3.5	1.91	2.0	78	202.51	206.09	3.6	1.95

Source: HEC-RAS location map for Wabagishik Project (Project # 1052-001): Headpond Inundation Mapping 1+183 to 0+798 (Drawing # 06-125)

5255 Yonge St., Suite 1200, North York, ON M2N 6P4
tel 416-590-9362 fax 416-590-9955 www.xeneca.com

January 9, 2013

NRSI
225 Labrador Drive, Unit 1
Waterloo, Ontario
N2K 4M8, Canada

Attn: Andrew Schiedel

Dear Andrew:

Re: Proposed Wabageshik G.S. – Possible Habitat Compensation

Further to the discussion with NRSI and agencies, we understand that you are drafting a plan with habitat compensation options for the above project. Thereto, we would like to provide the following engineering input.

As we understand it the range of site conditions suitable for spawning of Walleye, Sturgeon and other species are:

- Average velocities of 0.5 m/s to 1.0 m/s during the spawning season.
- Coarse substrate.
- Not subject to silt deposition.

We have examined the hydraulic conditions in the river system triangle bound by Domtar dam, Nairn dam and Wabagishik Rapids. It appears that there are several sites that meet the above requirements. These locations include (see maps attached):

1. Vermillion River - Graveyard Rapids: This site is roughly 10,000 m2 in area. It has the right range of flow velocities in during spawning. The flow velocities are fairly consistent over a wide range of flow rates, making this are suitable under various freshet conditions. It is largely rock bottom and could be made suitable by placing coarse substrate by barge. The area is not subject to siltation.

2. Vermillion River – Embayment: This site is roughly 5,000 m2 in area and consists of a small gravel delta where the Vermillion River enters a small embayment area immediately downstream of the proposed project site. Part of this area was already mapped by NRSI as suitable for spawning. This area could be enlarged by adding 5,000 m2 of additional substrate on the left and right flanks of the existing spawning habitat. The site has a broad range of flow velocities during spawning, depending on the exact location. Coarse substrate could be used to widen and

(cont.)

lengthen the area. Although the embayment is rich in silt, the risk of siltation in the proposed locations is low. Almost no silt comes down from upstream at this location.

3. Vermillion River – Wabageshik GS Tailrace area: This area is roughly 3,000 m2. However, this site may need to be reserved for restoration of the potential spawning area that may be disturbed during tailrace construction.

4. Spanish River – Nairn Spillway: This site is at least 15,000 m2 in area, located at the base of the Nairn Spillway. The area has a wide range of velocities during spring freshet when water is spilled, which largely coincides with spring spawning. The optimal velocity zone can be chosen by moving the site closer or further from the base of the spillway, as may be required. It is largely rock bottom and could be made suitable by placing coarse substrate by barge. The area is not subject to siltation.

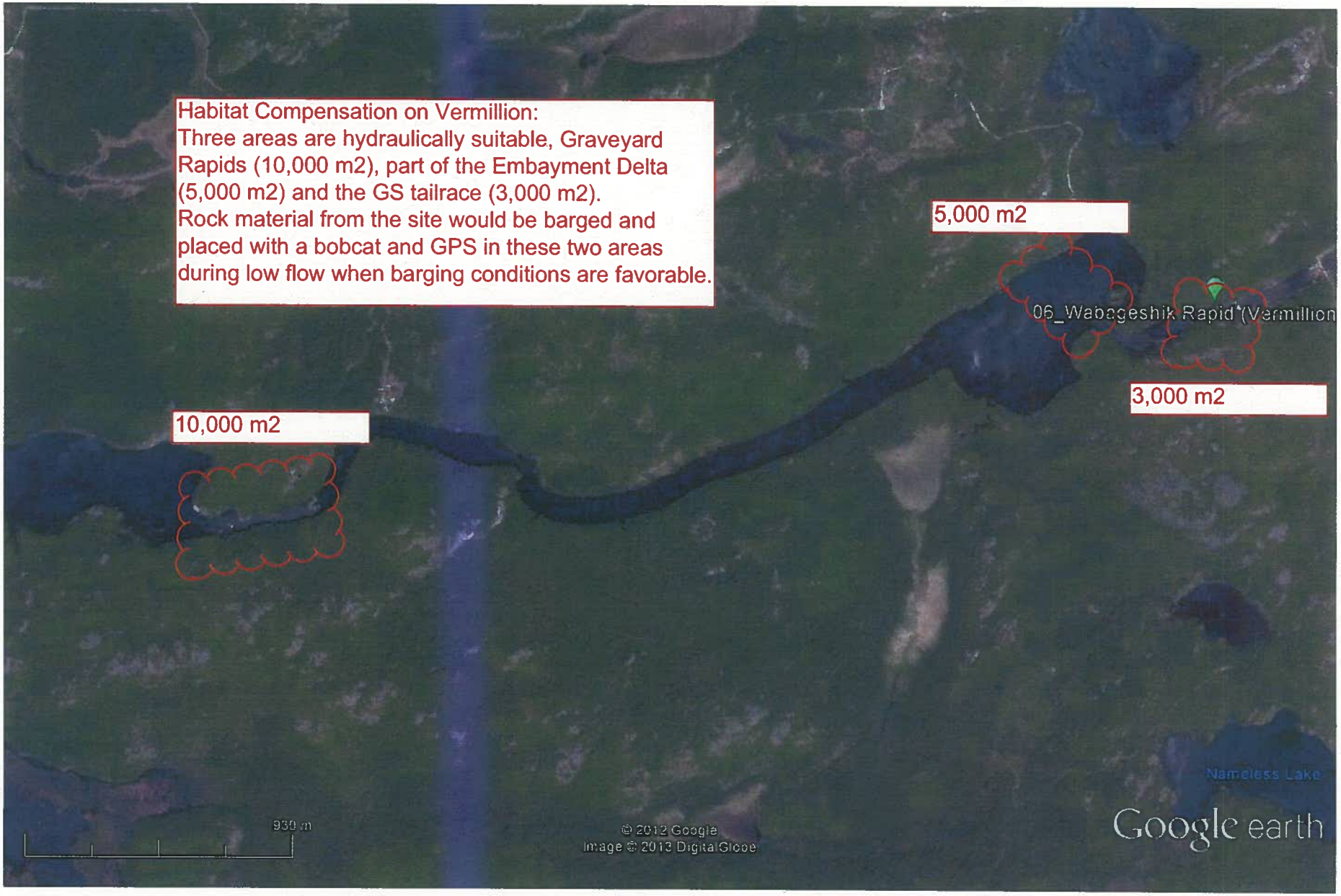
5. Spanish River – Nairn Tailrace: This site is at least 15,000 m2 in area, located immediately downstream of the Nairn Tailrace. The site has suitable velocities whenever the facility is operating (nearly all the time during spring spawning). The optimal velocities occur in close proximity to the base of the facility. It is largely rock bottom and could be made suitable by placing coarse substrate by barge. The area is not subject to siltation.

The final determination should be made in collaboration with NRSI and the agencies.
Xeneca has already committed to provide habitat compensation as part of the environmental assessment process. Based on our analysis, several very good options for habitat compensation appear to exist. The final determination as to which option should be implemented should be made in collaboration with the agencies.

I trust this information will be useful for the preparation of the habitat compensation plan.

Yours truly,

Nava Pokharel, P. Eng.
Senior Project Manager
Xeneca Power Development Inc.



Google earth

miles 1
km 2

Google earth

feet 2000

meters 700

Wabageshik Rapids
Hydroelectric Generating Station Project
Preliminary Biological Monitoring Plan

Prepared for:
Xeneca Power Development Inc.
5255 Yonge Street, Suite 1200
Toronto, Ontario
M2N 6P4

Project No. 1050

Date: July 2013

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Wabageshik Rapids Hydroelectric Generating Station Project
Preliminary Biological Monitoring Plan

Project Team:

Staff	Role
Andrew Schiedel	Aquatic Biologist, Project Manager
Jessica Walker	Terrestrial and Wetland Biologist
Ashley Favaro	Aquatic Biologist

Report submitted on July 24, 2013

A Schiedel

Andrew Schiedel, B.A.
Aquatic Biologist, Project Manager

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1.0 Introduction

This preliminary biological monitoring plan is intended to accompany the Wabageshik Rapids Hydroelectric Generating Station Project provincial Class Environmental Assessment (EA). The EA is being carried out according to the Class Environmental Assessment for Waterpower Projects (OWA 2008). This document outlines the biological monitoring that is related to the facility operations and the compensation fish habitat. It does not address any aspect of the roads and transmission lines that are part of the project, nor does it address monitoring that may be required for construction of the dam, powerhouse and related facilities. For information on construction monitoring, please refer to the Construction Management Plan (CPL 2011), which is also included with the main Environmental Report for the Wabageshik Rapids Hydroelectric Generating Station Project provincial Class EA.

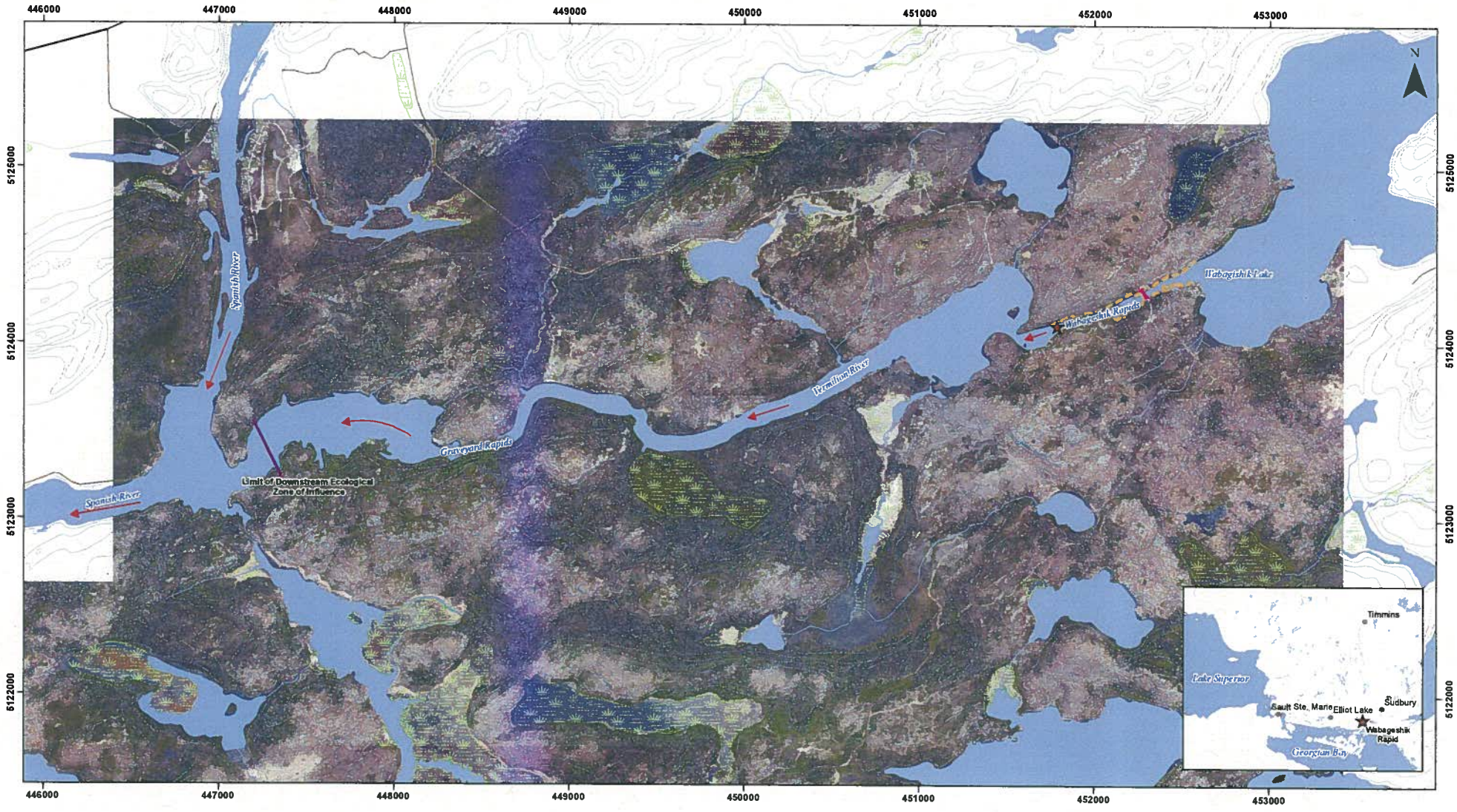
Non-biological monitoring components are not included in this biological monitoring plan. Monitoring of hydrology, erosion and other non-biological processes are provided elsewhere in the Class EA documentation. Xeneca is committed to hydrologic monitoring both upstream and downstream of the proposed generating station.

This biological monitoring plan is considered preliminary because it was developed prior to detail design and permit applications. Additional design details, permit conditions and further correspondence with agencies will result in refinement of the monitoring methods. Care will be taken to ensure that the final monitoring plan continues to achieve the rationale and objectives for each monitoring component. This monitoring plan is well informed by preliminary design information, typical monitoring requirements, and accepted standard sampling methods and can be regarded as a clear indication of the monitoring that will occur.

1.1 Project Location

The Wabageshik Rapids Hydroelectric Generating Station Project (Wabageshik Rapids GS) site is located on the Vermillion River, 5km upstream of its confluence with the Spanish River (Figure 1). The proposed dam will be located near the downstream end of the 1,100m length of rapids. From a fisheries management perspective, the proposed

dam is located in a habitat system contained by the Lorne Falls dam on the Vermillion River upstream of the proposed Wabageshik Rapids GS dam, and by two dams on the Spanish River downstream of the proposed Wabageshik Rapids GS dam. The two dams on the Spanish River are the Nairn Falls dam upstream of the Vermillion-Spanish confluence, and the Domtar dam downstream of the confluence.



Wabageshik Rapids Hydroelectric Generating Station Project

Figure 1 - Study Area

Natural Resource Solutions Inc.
Aquatic, Terrestrial and Wetland Biologists

0 100 200 300 400 500 Meters

March 6, 2013 Project No. NRSI-1050
UTM Zone 17, NAD 83 Scale: 1:20,000 [at 11x17]

Legend

- Wabageshik Rapid Proposed Hydroelectric Generating Station
- Limit of Downstream Ecological Zone of Influence
- Zone of Inundation
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Snowmobile Bridge
- Watercourse
- Waterbody
- Wetland Area
- Elevation Contour (10m Interval)

Path: X:\1016_XenecaPowerVermilion\NRSI_1050_Wabageshik_StudyArea_20K_2013_03_06_GCS.mxd

1.2 Monitoring Schedule

Monitoring will be scheduled such that several components of the monitoring plan will occur in a given year, and all components for that year will be documented in a single comprehensive biological monitoring report. The monitoring plan will span 9 years, with reports being prepared following years 1, 3, 6 and 9. Data will be based on the calendar year, and reports will be prepared by the end of April following monitoring years 1, 3, 6 and 9. Xeneca is committed to monitoring at the Wabageshik Rapids GS for a period of 9 years and is willing to work with other facility operators on the system to develop a collaborative long-term monitoring plan for lake sturgeon. A schedule of monitoring activities is provided in Table 1.

Table 1. Schedule of Biological Monitoring Pre-construction and Operational Data Collection

		Year						
Activity	**Pre-Construction**	**1**	**2**	**3**	**4**	**5**	**6**	**9**
Benthic Invertebrates	Complete	x		x			x	x
Fish Community	Complete			x			x	x
Compensation Fish Habitat*	Not Applicable	x	x	x	x	x		
Fish Stranding	Not Applicable	x	x	x				
Vegetation and SWH	x	x		x			x	
Turtle Overwintering Habitat	x	x		x			x	
Deer Crossing	x	x	x	x				

x = Data will be collected and reported.

2.0 Benthic Invertebrates

2.1 Monitoring Rationale and Objective

Benthic invertebrates are a food source for fish, and can serve as an indicator of the general health and characteristics of the aquatic ecosystem. Operation of the Wabageshik Rapids GS will result in daily fluctuations in flow that are expected to result in change to the aquatic ecosystem. Monitoring benthic invertebrates will provide a

means of understanding the extent and nature of change to the aquatic ecosystem. In addition, there are management objectives for fisheries (Section 3.1 below) and the river provides habitat for lake sturgeon (*Acipenser fulvescens*), which is listed as Threatened on the Species at Risk in Ontario List. The information from benthic invertebrate monitoring will be useful for the management of lake sturgeon and fisheries resources as the aquatic ecosystem changes as a result of the Wabageshik Rapids GS project.

2.2 Methodology

Benthic invertebrate sampling will utilize artificial substrate sampling, which is to occur in years 1, 3, 6 and 9 of the monitoring program. No further pre-construction data collection will occur as baseline data was collected as part of studies for the Environmental Assessment.

Sampling for benthic invertebrates will occur once during the monitoring year using Hester-Dendy artificial substrate samplers (H-D sampler). The H-D sampler will be installed in the river in August and retrieved after approximately 6 weeks. A total of 10 H-D samplers must be installed in Wabageshik Rapids downstream of the Wabageshik Rapids GS, and 5 H-D samplers must be installed within Graveyard Rapids, approximately 4km downstream of the Wabageshik Rapids GS. The timing, numbers and locations correspond to the baseline data collected as part of the Environmental Assessment. In addition to the sampling of benthic invertebrates, basic habitat information such as wetted width, depth and hydraulic head will be collected at the location of the H-D samplers. Sampling will also be coordinated with hydrologic monitoring to facilitate association of benthic results with the hydrology at the location of the H-D samplers.

Each individual H-D sampler must be constructed in accordance with Environmental Protection Agency (EPA) specifications, using 3mm (1/8") thick tempered masonite, with nylon spacers and stainless steel hardware. Fourteen round plates are attached together at variable spacing with a bolt through the centre. Of the 13 spaces on the H-D sampler, 8 spaces are 3.5mm thick, 1 space is 6.5mm thick, 2 spaces are 10mm thick and 2 spaces are 13mm thick. Altogether the H-D samplers provide a total surface area

of 0.16m^2. These plates are intended to act as an artificial substrate on which benthic invertebrates can colonize.

Refer to the methods in the Wabageshik Rapids Hydroelectric Generating Station Project Natural Environment Characterization and Impact Assessment Report (NRSI 2013a) for detailed methods for installing, retrieving and preserving the H-D samplers. The benthic invertebrates will be identified to the lowest practical taxonomic level by a professional taxonomist.

2.3 Possible Mitigation Strategies

Should the benthic invertebrate monitoring results reveal changes in the benthic community that are of concern for the general ecology or specific management objectives for the river, Xeneca will discuss appropriate mitigation strategies with the Sudbury District Office of the Ontario Ministry of Natural Resources (OMNR). Possible mitigation strategies include reducing the ratio of maximum flow to minimum flow during specific months of the year, which can be achieved by increasing the minimum flow or decreasing the maximum flow. A different approach would be to alter the riffle habitat to maintain a greater wetted area during minimum flow conditions.

2.4 Reporting Requirements

The results of the benthic invertebrate monitoring will be presented as part of a comprehensive monitoring report after each year of benthic invertebrate data collection, which includes years 1, 3, 6 and 9 of operation. The data will be analyzed by calculating a variety of benthic community metrics, similar to those found in the Natural Environment Characterization and Impact Assessment Report (NRSI 2013a). As the H-D samplers provide quantitative results, density will be calculated. The density and one or more metrics describing the diversity and characteristics of the community will be statistically compared among years using Analysis of Variance (ANOVA).

Detailed engineering surveys will be carried out post construction to confirm model predictions and to monitor the changes in wetted width downstream of the Wabageshik Rapids GS. This information will be used in conjunction with the benthic invertebrate

community monitoring data to determine, what impact, if any, the downstream water level fluctuations are having on benthic invertebrate production and community composition.

3.0 Fish Community

3.1 Monitoring Rationale and Objective

Recreational fisheries are a primary management focus for the Vermillion River, as detailed in the OMNR's fisheries management objectives (OMNR 2011). The management objectives are provided for Wabagishik Lake and the Vermillion River downstream. For both locations, the objectives are to:

- "Conserve existing aquatic species diversity.
- Maintain or increase walleye and northern pike productive capacity & abundance.
- Maintain diverse and sustainable angling opportunities for all species currently angled including walleye, northern pike, and smallmouth bass (OMNR 2011)."

Specifically for the Vermillion River, there is also the objective to:

- "Increase lake sturgeon productive capacity & abundance to facilitate recovery of the species within the Lower Vermillion River (below Wabagishik Lake) & Spanish River (between Nairn Center and Espanola).
    - Maintain or improve lake sturgeon spawning areas / potential and provide for optimal incubation success.
    - Maintain or improve other lake sturgeon habitat parameters including foraging habitats and nursery areas.
    - Maintain connectivity to all suitable habitats and / or compensate for habitats functionally lost to the population of concern (OMNR 2011)."

Operation of the Wabageshik Rapids GS will result in daily fluctuations in flow that are expected to result in change to the aquatic ecosystem. The aquatic ecosystem is already being influenced by a number of other facility operations on the system including the Lorne Falls dam on the Vermillion River and the two dams on the Spanish River: the Nairn Falls dam upstream of the Vermillion-Spanish confluence, and the Domtar dam downstream of the confluence. The information obtained from fish community

monitoring at the Wabageshik Rapids GS will be useful for the management of fisheries resources as the aquatic ecosystem changes as a result of the Wabageshik Rapids GS project. This information will be useful for discerning whether the management objectives are being met. Information collected by other users on the system will provide further means of determining the state of the fisheries resources and comparing to the objectives.

The approval of the Wabageshik Rapids GS under the provincial *Endangered Species Act* will also require that overall benefit be achieved for lake sturgeon. This preliminary biological monitoring plan cannot reflect all of the ESA permit conditions and other details for lake sturgeon. Additional specific monitoring objectives and methodologies for lake sturgeon will be added to the final biological monitoring plan, if it is deemed the appropriate means of documentation. Nevertheless, the fish community sampling described herein will generate some useful information on lake sturgeon.

In addition to obtaining vital fish community information, the fish captured during fish sampling can be used for the fish tissue mercury monitoring program.

3.2 Methodology

Fish community sampling will follow the Riverine Index Netting (RIN) protocol (Jones and Yunker 2010), and will occur in years 3, 6 and 9 of the monitoring program. Baseline data was previously collected as part of studies for the Environmental Assessment and no further pre-construction data collection will occur.

Fish sampling will occur on one occasion during the monitoring year using large RIN nets. Sampling will be conducted in August following the RIN protocol. A total of 15 nets will be set in the Vermillion River between Wabageshik Rapids and the confluence with the Spanish River, similar to the protocol followed during pre-construction baseline surveys. Refer to the methods in the Wabageshik Rapids Hydroelectric Generating Station Project Natural Environment Characterization and Impact Assessment Report (NRSI 2013a) for past net set locations from 2011 baseline sampling.

3.3 Possible Mitigation Strategies

Should the fish community monitoring results reveal changes in the fish community that are of concern for the fisheries management objectives for the Vermillion River, Xeneca will discuss appropriate mitigation strategies with the Sudbury District OMNR. It is important to understand that changes in the fish community can occur as a result of a variety of influences, including angling pressure and the influences of the operations of other facilities on the Vermillion and Spanish Rivers.

Possible mitigation strategies include reducing the ratio of maximum flow to minimum flow during specific months of the year, which can be achieved by increasing the minimum flow or decreasing the maximum flow. Another consideration would be whether changes to the fish community are caused by impacts on recruitment. In this case, modification to the compensation fish habitat may be an option. Fish stocking could also be a viable management option for a valued species such as walleye. All of these options would also be informed by the compensation fish habitat monitoring described in Section 4.0 below.

3.4 Reporting Requirements

The results of the fish community monitoring will be presented as part of a comprehensive monitoring report after each year of fish sampling, which includes years 3, 6 and 9 of operation. The results will be analyzed primarily based on species presence, and to a lesser extent on the abundance of fish captured. Information from the OMNR Sudbury District Office will also be incorporated as appropriate to bring attention to other potential influences.

4.0 Compensation Fish Habitat

4.1 Monitoring Rationale and Objectives

As part of the Wabageshik Rapids GS Project, fish habitat compensation is planned to offset habitat within Wabageshik Rapids that is being inundated upstream of the GS, impacted by footprint areas of the GS, and more frequently dewatered downstream of

the GS. Fish habitat will be constructed in the Vermillion River in the 300m tail water area between the proposed dam and a bay immediately downstream of Wabageshik Rapids, within a fast-water area that extends into this bay, and within Graveyard Rapids located 4km downstream. Details of this compensation habitat are available in the preliminary fish habitat compensation plan (NRSI 2013b) which is also included with the main Environmental Report for the Wabageshik Rapids Hydroelectric GS Project provincial Class EA.

The OMNR and Fisheries and Oceans Canada (DFO) typically require monitoring as part of their approval for the creation of fish habitat as compensation. Monitoring is necessary to determine if the habitat is functioning as intended by the design. The specific objectives of the monitoring are to determine:

1. whether or not the water depth and velocity parameters are met by the new spawning habitat,
2. whether or not adult walleye (*Sander vitreus*), lake sturgeon and sucker species (*Catostomidae spp.)* are present within the new spawning habitat,
3. whether or not spawning is occurring, determined by the presence of eggs within the new spawning habitat, and
4. if eggs and/or spent adults are found at the spawning site, whether or not spawning was successful, determined by the presence of larvae within or downstream of the new spawning habitat.

4.2 Methodologies

Monitoring of the compensation fish habitat will be carried out annually for the first 5 years of operation of the Wabageshik Rapids GS. The following methods will be carried out in the spring season, specifically during the spawning periods for walleye and lake sturgeon. All capture methods will be carried out under permits as required under the provincial *Fish and Wildlife Conservation Act* (1997) and *Endangered Species Act* (2007).

The methods found in "Lake Sturgeon and Waterpower: Data Collection and Sampling Protocols for Mitigation Effectiveness Monitoring" will be followed for lake sturgeon spawning surveys (OWA 2012). Walleye spawning surveys will follow a similar protocol

outlined in the Natural Environment Characterization and Impact Assessment Report (NRSI 2013a).

Habitat Measurements

Water depths and water velocities will be measured when water temperatures are suitable for walleye and lake sturgeon spawning. This will require that measurements are taken on at least 2 occasions during the spawning season in order to describe the depths and velocities available for each species.

If it is found that the fish are not using the compensation habitat, the habitat measurements will be used to verify the predicted conditions from the 2-dimensional model used to design the spawning habitat. The 2-dimensional modeling may then be used to analyze the habitat parameters at a variety of flow conditions. However, this will only be done if there is clearly a need to analyze the habitats beyond the observation of use by walleye and lake sturgeon.

Visual Surveys

Spotlight surveys will be carried out as a means of determining the presence of walleye within the new spawning habitat. Spotlights will be used after dark during the early part of the night to try to visually locate any fish.

Since lake sturgeon actively spawn during the day, visual surveys for lake sturgeon will be carried out within the new habitat during day light hours to determine the presence of spawners. Locations of observation, species observed, and notes on behavior will be recorded. Observations will also be made in the surrounding areas, including existing spawning habitat, to provide context for the observations within the new habitat.

Egg mats

Egg mats will be installed within the new spawning habitats and immediately downstream to determine whether or not eggs are being deposited.

Drift Netting for Lake Sturgeon Larvae

If it is determined that lake sturgeon eggs were most likely deposited on the spawning bed, through capture of spent adults and/or capture of eggs, larval drift netting will be conducted to determine spawning success.

Capture of adults

Sampling techniques such as angling, trap netting and gill netting will be used as appropriate to determine presence of adults during the spawning season. The fish will be observed to determine the sex and spawning condition (green, ripe, free running or spent), and measured for length and weight. For walleye, the fish will be marked by a suitable means such as a fin clip, to be determined in consultation with the OMNR. For lake sturgeon, PIT tags will be installed in any captured adults or juveniles as per the requirements of the sampling permit from the OMNR.

4.3 Possible Mitigation Strategies

If the compensation fish habitat is not functioning as intended, Xeneca will discuss appropriate mitigation strategies with DFO and the Sudbury District OMNR. There would be a variety of options to modify the habitat. For example, additional large boulders could be placed in order to provide more resting areas for spawning fish and/or to provide greater variety of water velocities. Similarly, additional large or small substrate material could be placed in order to change the substrate composition, initially in a portion of the spawning bed in order to test success.

4.4 Schedule and Reporting

These methods will be carried out in years 1, 2, 3, 4 and 5 of facility operation. Reporting will occur in conjunction with other monitoring activities that take place in any of those years.

5.0 Fish Stranding

5.1 Monitoring Rational and Objective

Fish stranding may potentially occur in the fast-water habitat immediately downstream of the Wabageshik Rapids GS. The presence of a large, shallow riffle area adjacent to a deep section of the channel suggests that fish could become stranded as the water recedes. According to the surveyed cross sections at Wabageshik Rapids, there are areas of habitat that will be wetted and exposed by the modified peaking operations. In addition, habitat at the edge of the channel will experience wetting and drying at all of the cross section locations. Based on this information, it is only possible to indicate that there is potential for fish stranding to occur. Operational monitoring is recommended to determine whether or not fish stranding occurs.

5.2 Methodology

Fish stranding will be monitored within the 300m section of Wabageshik Rapids downstream of the proposed GS where the potential for stranding exists. Xeneca will install a camera directed downstream of the proposed GS to observe any stranding of fish during incidental or emergency shutdown of flows. The areas downstream will be visually assessed for stranding of all fish species. Onsite staff will be trained in the identification of stranding and will be required to notify a biologist of any occurrences for further observation and reporting.

Monitoring for fish stranding is initially planned for the first 3 years of operation. The need for continued monitoring after 3 years will be determined based on the information gathered in the first 3 years. The MNR and DFO will also be consulted regarding the need for continued monitoring. If continued monitoring is required, the methods may also be refined to address specific fish stranding issues.

5.3 Possible Mitigation Strategies

Should fish stranding be identified as an issue, possible mitigation measures include minor habitat adjustments at problem areas to provide a pathway for stranded fish to reach the flowing water. Another option would be to adjust the operations such that flow

is reduced at a slower rate to provide more time for fish to escape areas being dewatered.

5.4 Reporting Requirements

All occurrences of fish stranding will be reported in years 1, 2 and 3 in conjunction with other monitoring activities. Any additional fish stranding reporting procedures required by the MNR and/or DFO will be developed during the permit application phase of the project.

6.0 Vegetation and Significant Wildlife Habitat

6.1 Monitoring Rational and Objective

Four Mineral Shallow Marsh wetland communities occur at the outlets of tributary streams within the downstream extent of the proposed Wabageshik Rapids GS. These wetlands provide habitat for a variety of native fauna that occur within the project area and have been identified as Candidate Significant Wildlife Habitat (SWH) including Amphibian Breeding Habitat (Woodland), Waterfowl Nesting Areas, Marsh Bird Breeding Areas, Turtle Overwintering Areas and habitat for common snapping turtle. The ecological integrity of these wetlands is imperative if use by indicator species is to continue. Modified peaking operations during the growing season (June, July and August) are predicted to impact vegetation communities within these wetlands. Daily water level fluctuations greater than 25cm will likely result in the loss of shoreline vegetation within the wetland communities and likely lead to changes in plant species composition and percent cover. A year-round operational constraint of +/- 15cm daily water level fluctuation within the bay below Wabageshik Rapids will help to mitigate impacts to shoreline vegetation. This constraint within the bay applies directly to the wetlands within the bay, and translates into a smaller range of water level fluctuation at the wetlands further downstream. While the water-level constraint will certainly provide mitigation, the magnitude of residual impacts is not well understood. It is therefore recommended that post-construction monitoring be conducted to better understand the magnitude of impacts to the shoreline vegetation within wetland communities by

monitoring vegetation parameters. Additionally, during vegetation monitoring it is recommended that fauna surveys be conducted within these communities to determine if indicator species are still present.

6.2 Methodology

Monitoring of vegetation and wildlife within Candidate SWH will include vegetation monitoring, and surveys of amphibians, waterfowl and marsh birds during the breeding season. Vegetation and SWH surveys will first be conducted one year prior to construction to establish a benchmark dataset to which operational monitoring results will be compared. Subsequent monitoring will occur during years 1, 3 and 6 of operations.

Monitoring of vegetation communities within the wetlands should coincide with the growing season which generally occurs within wetlands during the late spring and summer months. It is recommended that one survey be conducted during the spring (June). This timing coincides with SWH activity such as amphibian breeding activity, waterfowl nesting and marsh bird breeding which can also be surveyed during this time. Vegetation surveys will also be conducted during turtle overwintering habitat assessments in April and during aquatic surveys conducted in August.
Surveys for vegetation communities should consist of quadrat plot sampling using $1m^2$ subplots located in reference to stations established using stakes. These plots will be maintained at the same locations each survey year to assess changes in species composition, percent cover and in some instances, height. The number of plots will vary depending on the size of the wetland and accessibility within the inundated portions of the wetland.

Wildlife surveys to occur in conjunction with the vegetation surveys will include area searches for amphibians, nesting waterfowl, marsh breeding birds and potential turtle nesting activity. These surveys will be helpful in assessing if any indicator species continue to use Candidate SWH after the construction of the Wabageshik Rapids GS.

Methods for amphibian and breeding bird surveys will follow similar methods to that outlined within the Natural Characterization and Impact Assessment Report, as well as

the methods outlined within the SWH Ecoregion Criterion Schedule (OMNR 2012) and the Marsh Monitoring Program (Bird Studies Canada 2009). Breeding bird surveys will be conducted in June when birds are known to be active. They will occur within the wetland communities and will focus on identifying nesting activity of marsh and waterfowl species. Indicator species listed within the Ecoregion criterion will be identified and activity recorded to assess whether the community is being used for nesting and therefore provide SWH. Survey methodology for breeding amphibians will consist of visits to determine the number of indicator species as outlined within the ecoregion criteria.

6.3 Possible Mitigation Strategies

Should surveys identify that wetland communities are being adversely impacted, Xeneca will discuss the matter with the Sudbury District OMNR and develop appropriate mitigation strategies. Possible strategies include reducing the maximum daytime flow for some or all of the months of June through October, and further constraining the daily water level fluctuations during the growing season. Monitoring should continue after mitigations are put into place to ensure that the strategies employed have the desired effect.

6.4 Reporting Requirements

An analysis will be conducted to compare pre-construction and post-construction wetland communities. The results will be presented as part of a comprehensive monitoring report for each year of post-construction data collection (years 1, 3 and 6). The reports will focus on wetland vegetation composition within the downstream extent of the proposed Wabageshik Rapids GS. Additionally, the reports will determine if the Wabageshik Rapids GS operations are having any impacts to SWH and indicator species that utilize these habitats.

7.0 Turtle Overwintering Habitat

7.1 Monitoring Rational and Objective

Blanding's turtles (*Emydoidea blandingii*) were identified as a Species at Risk (SAR) that are known from the vicinity of the Wabageshik Rapids GS project area. This species is listed as Threatened by COSSARO and is therefore protected within Ontario by the ESA (OMNR 2012). Blanding's turtles were not observed during field investigations however, turtle-specific surveys were not conducted. As such, a precautionary principle was taken to assess potential impacts to this species. It is recognized that additional surveys are required to meet the requirements of permits and approvals for the Wabageshik Rapids GS. If Blanding's turtles are present and it is shown that the operating regime will have a negative impact on the species then an agreement may be required under section 16(3) of the ESA, and approval may be required under section section 17(2)(c) of the ESA. This monitoring protocol has been developed in the case that Blanding's turtle overwintering habitat is confirmed within the project area.

Additionally, common snapping turtle (*Chelydra serpentine*) is listed as Special Concern provincially and is considered a Species of Conservation Concern. Habitat for this species is therefore considered Significant Wildlife Habitat. Common snapping turtle was observed within the project area during field investigations July 2011.

Four Non-Woody Mineral Shallow Marsh wetland communities are associated with the four tributaries within the downstream extent of the proposed Wabageshik Rapids GS. These wetlands, along with the embayment area located just downstream of the rapids, provide candidate overwintering habitat for a several turtle species including Blanding's turtle and common snapping turtle. The ecological integrity of these wetlands is imperative if continued use by turtle species is expected to continue. Modified peaking operations during the overwintering season (November to March) will alter water levels within these wetlands. A year-round operational constraint of +/- 15cm daily water level fluctuation will limit the degree of water level fluctuation, which will mitigate the potential for impacts on overwintering turtles. However, the there is uncertainty about how much constraint on water level fluctuation is required to sufficiently mitigate the potential for impacts. It is therefore recommended that post-construction monitoring be conducted in conjunction with the +/-15cm constraint to better understand the effects of operations on

the turtle overwintering habitat function of the wetland communities and embayment area.

7.2 Methodology

Monitoring of turtle overwintering habitat within the wetlands will include habitat assessment during the overwintering season and study of turtles emerging in the spring. It is recommended that monitoring be conducted on a total of 4 occasions. The first year will establish pre-construction conditions and subsequent monitoring will occur in years 1, 3 and 6 of facility operation.

The overwintering season generally occurs from late fall (October to early spring (March). The time period during the late overwintering periods (January, February and March) coincides with inactivity of overwintering turtles when they are most likely susceptible to the water level fluctuations resulting from the Wabageshik Rapids GS operations. The assessment of turtle overwintering habitat should occur on 2 occasions: once in January and once in February, with consideration for the flow conditions and operating regime at the time of the assessment. The assessment will consist of measuring variables associated with suitable habitat in locations were turtles have been previously observed overwintering. The variables to be measured include water temperatures, dissolved oxygen levels, water depth and depth of ice. The number of sampling locations will be specified according to the size of the habitats being used by overwintering turtles and may vary depending on accessibility during winter conditions, particularly ice cover.

Additionally, a survey in late April to record observations of emerging turtles will provide evidence of continued site fidelity within the project area. This survey should generally occur in late April and early May when turtles such as Blanding's turtles are known to begin emerging from overwintering locations (Newton and Herman 2009). Surveys for determining the presence of Blanding's turtles will include baited hoop nets, as well as basking surveys following MNR's Blanding's turtle survey protocol. Netting surveys should incorporate the installation of 2-3 baited hoop nets within each wetland community. Each net should be checked daily for approximately 6 days. These traps should be set by trained professionals to reduce the risk of trap mortality. Area

searches/basking surveys conducted during ideal weather conditions will provide additional information to determine the presence of any significant turtle species within the wetland communities. It is understood that these surveys will require permitting including a Wildlife Scientific Collector's Authorization, an Animal Care Protocol approval as well as a Request for a Permit Under clause 17(2)(b) of the Endangered Species Act, 2007 (ESA). These permits will be obtained prior to survey commencement.

An analysis to compare post-construction years with pre-construction years will be reported after each year of post-construction data collection.

7.3 Possible Mitigation Strategies

Should surveys identify that turtle overwintering habitats are being adversely impacted, Xeneca will discuss appropriate mitigation strategies with the Sudbury District OMNR. Possible strategies include increasing one or more of the minimum flow requirements for the months of January, February and March, and further constraining the daily water level fluctuations during the overwintering season. Monitoring should continue after any mitigations are put into place to ensure that the strategies employed have the desired effect.

7.4 Reporting Requirements

The results will be presented as part of a comprehensive monitoring report for each year of post-construction data collection for turtle overwintering monitoring (years 1, 3 and 6). The analysis will summarize the turtle overwintering habitat characteristics and determine if the Wabageshik Rapids GS operations are having any impacts on the turtle overwintering habitats. In addition, the report will include any evidence of harm or mortality for Blanding's turtle and common snapping turtle.

8.0 Deer Crossing

8.1 Monitoring Rational and Objective

Deer monitoring surveys conducted in 2011 identified a deer crossing at the downstream end of the Wabageshik Rapids. This section of river has been shown to be used by deer populations during the early winter and early spring months, and therefore may function as an important corridor to and from deer yards that are located to the northwest and the southwest. The proposed Wabageshik Rapids GS may potentially impact deer crossing at the downstream location because operations will augment flows during the day when deer crossing activity occurs. Crossings were documented at flows of 50 to 60m^3/s, which is approximately the maximum turbine capacity of 64m^3/s. One crossing was also documented when flow was approximately 100m^3/s. It was therefore predicted that operations will not impact the downstream deer crossing function, and Xeneca has committed to undertaking post-construction monitoring to ensure that is the case.

8.2 Methodology

Deer monitoring will be conducted annually for 1 year prior to operations and for 3 years following the start of operations.

Monitoring of deer crossings should coincide with previous observations of deer crossings. This includes the early winter and early spring periods when deer have been observed crossing in higher abundances. These time periods are associated with seasonal movements into and out of deer yards that likely exist within the surrounding landscape. Monitoring should include deer camera surveys located at both the downstream and upstream crossing locations during these time periods to discern whether or not deer are crossing during operations in late-March to mid-April, and early-December to Mid-January. It is recommended that nine cameras be installed within the study area to provide consistency with pre-construction survey effort. The locations of these cameras will include both the known crossing location downstream of Wabageshik Rapids but should also include upstream locations to see if deer are behaviourally adapting to the new inundation and operations posed by the Wabageshik Rapids GS. This will allow for a behavioural assessment of deer crossings as they could use upstream crossings in the event that downstream crossing locations should become

unsuitable, or based on the change to the upstream locations associated with the inundation area.

The footage from the deer cameras will be compiled and analyzed to determine deer crossing behaviour within the downstream and upstream portions of Wabageshik Rapids, including comparison to the flow record of the dam.

8.3 Possible Mitigation Strategies

Should surveys identify that deer crossing is being adversely impacted, Xeneca will discuss appropriate mitigation strategies with the Sudbury District OMNR. Possible strategies include reduction of the maximum daytime flow during seasonal peaks in crossings, and adjustment of the daily timing of increased daytime flows. Monitoring should continue after mitigations are put into place to ensure that the strategies employed have the desired effect.

8.4 Reporting Requirements

An analysis will be conducted to compare pre-construction and post-construction deer crossing behaviour. These analyses will be summarized in reports that will be completed once after the first year of post-construction data collection and again after the third year of post-construction data collection. The reports will focus on deer behaviour/crossings during the monitoring period to assess if their behaviour has been negatively impacted by the proposed Wabageshik Rapids GS. The results of the monitoring surveys will be shared with the Sudbury District OMNR for their review.

9.0 References

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Wabageshik

Baseline Environmental Conditions for Road Options

June 2013

Report prepared for:

Xeneca Power Development Inc.
5255 Yonge Street,
Suite 1200, Toronto, ON,
M2N 6P4

Report prepared by:

Allan Harris, Stephan Hart, and Robert Foster
Northern Bioscience
363 Van Horne Street
Thunder Bay, Ontario
Canada P7A 3G3

NORTHERN BIOSCIENCE
ECOLOGICAL CONSULTING

EXECUTIVE SUMMARY

This report is a baseline environmental report for a proposed access road to the proposed Wabageshik hydroelectric project on the Vermillion River, about 11 km east of the town of Espanola. Two road options were proposed connecting the existing Panache Lake Road to the proposed dam site of the Vermillion River. The "New Road Option" extends northeast from the Panache Lake Road, passes between Elizabeth Lake and Aurora Lake, then swings north to the Vermillion River. The "Snowmobile Trail Road Option" largely follows an existing snowmobile trail from a bridge over the creek connecting Elizabeth Lake and Brazil Lake, north to where it joins the New Road Option. Both are about 5.1 km long and will require removal of about 6 ha of forest. The study area includes a 500 m wide buffer on both road options. A total of 20 person-days of fieldwork was conducted in May and June 2013 by Northern Bioscience. A total of 21 bird monitoring point counts were completed, sound recorders were deployed at three locations, encounter surveys for species at risk were completed, and vegetation was classified and described. Targeted surveys for Blanding's Turtle and Whip-poor-will were completed and a potential deer yard was assessed.

The study area is dominated by hardwood and mixed wood stands on silty soil (ecosites G101, 104, and 107) and very shallow soil ecosites (G101, G104). Red Maple, Trembling Aspen and Balsam Fir are the most common forest canopy species. Most of the forest on both road options is 80 to 99 years old. There is an extensive area of younger forest (less than 40 years old) south of the Vermillion River. No forest is aged at greater than 100 years old, although individual trees and small clumps of trees with in the stand may exceed this age, probably as a result of trees being left uncut during historical high-grade logging. Most non-treed wetlands are associated with beaver activity and include alder thickets (ecosites G134 and G135) and meadow marshes (ecosite G142). Intolerant hardwood swamps (ecosite G130) are found intermittently where groundwater movement is close to the surface. Black Ash, Balsam Poplar, White Elm, Red Maple, and occasionally Yellow Birch, comprise the overstory. Lakes and ponds are common in the area surrounding the proposed road corridor.

A total of 69 species of birds were observed in the study area, the most common of which were Ovenbird, Red-eyed Vireo, Veery, American Redstart, and American Robin. Two forest nesting bird species at risk were discovered in the study area (Canada Warbler and Eastern Wood-Pewee) and several others have been documented nearby.

A cedar swamp on the east road option was identified by MNR as a potential deer yard. Pellet count data suggest that it is a relatively high quality deer wintering yard.

Although little is known of bat use of the study area, *Myotis* spp. (potentially including three species at risk: Little Brown Myotis, Northern Myotis, and / or Eastern Small-footed Bat) were detected on recordings through May 2013. Bats apparently use the Snowmobile Road option area for foraging, but probably range over most of the study area. Use of maternal trees was not documented, but suitable snag trees are common throughout the study area.

Whip-poor-will (a Threatened species in Ontario) was detected on three sound recorders in May 2013. Follow up surveys were completed in June 2013 and are reported in an attached appendix.

Twowetlandswithin 500 m of the proposed road (one on each of the road options) are predicted to be provincially significant based on MNR's rapid assessment technique.

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1.0 INTRODUCTION

The Wabageshik Project is located approximately 11.3 km east of the town of Espanola on the Vermillion River and has a proposed generating capacity of 3.4 MW (KBM Resources Group. 2013). The proponent is Xeneca Power Development Inc.

Northern Bioscience was engaged in 2013to assess proposed road locations to support the environmental assessment for this project.

Two road options were proposed connecting the existing Panache Lake Road to the proposed dam site of the Vermillion River (Figure 1). The "New Road Option" extends northeast from the Panache Lake Road, passes between Elizabeth Lake and Aurora Lake, then swings north to the Vermillion River. The "Snowmobile Trail Road Option" largely follows an existing snowmobile trail from a bridge over the creek connecting Elizabeth Lake and Brazil Lake, north to where it joins the New Road Option. The total length of the New Road Option and Snowmobile Trail Road Option are 5.10 km and 5.08 km respectively. The study area is defined as a 250 m buffer on either side of the proposed roads. A short section of temporary construction road on the north side of the Vermillion River was also assessed (Figure 1).

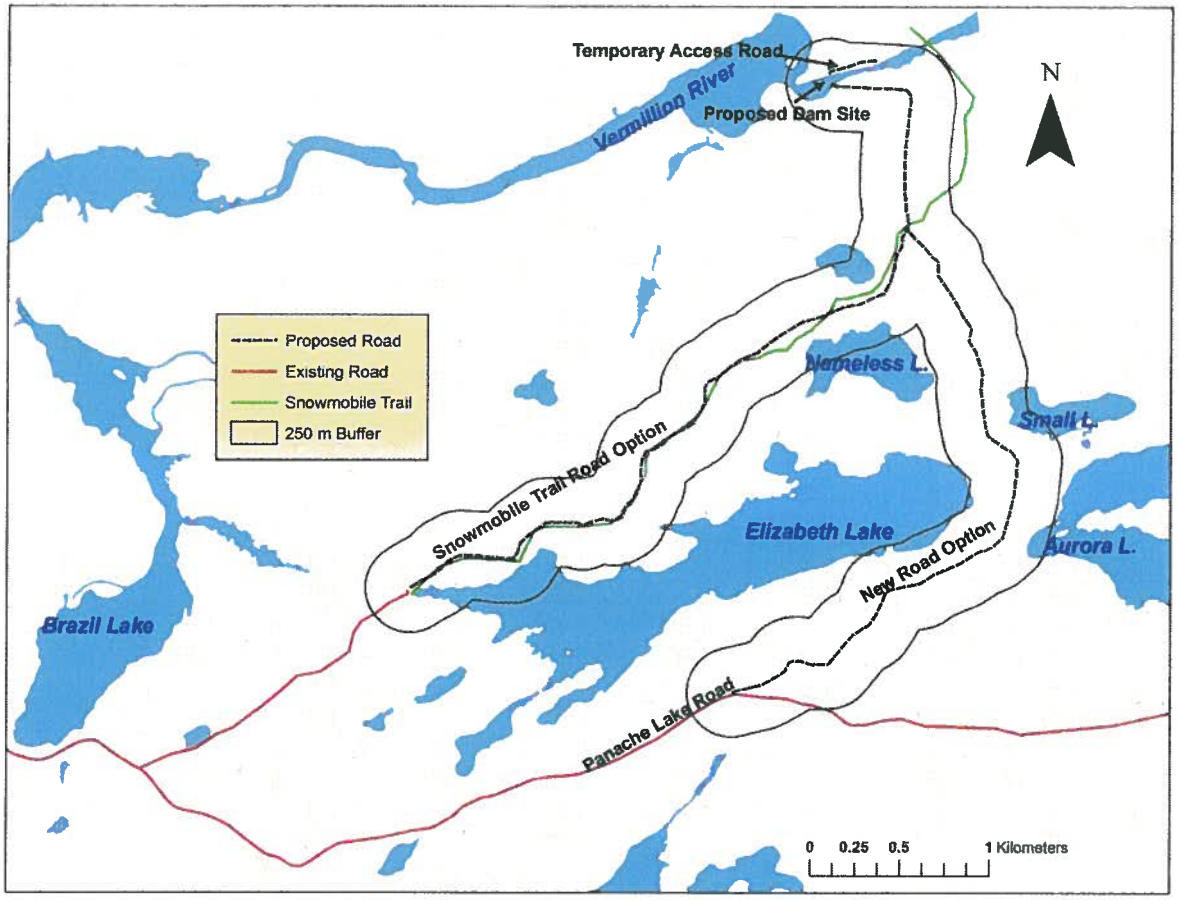

Figure 1.Overview map of the Wabageshik study area.

2.0 METHODS

2.1 Background Review

Background information on natural heritage features in the study area was compiled by KBM Resources Group (2013) and provided to MNR district staff for review and input. Additional sources were consulted in the present study. Major information sources included the following:

- OMNR Natural Heritage Information Centre (NHIC), Peterborough
- Bird Studies Canada (Ontario Bird Atlas)
- The Ontario Herpetofaunal Atlas (Oldham and Weller 2000)
- Northshore Forest Management Plan (Northshore Forest Inc. 2009)

2.2 Field Procedures Summary

A total of 20 person-days of fieldwork was conducted in May and June 2013 by Allan Harris (AGH), Rob Foster (RFF), Stephan Hart (SH) and Mike Jones (MJ) of Northern Bioscience. Additional fieldwork effort completed in June by ORMG is reported in Appendix 8. Fieldwork was timed to account for seasonal variation in vegetation phenology (e.g., seasonal life cycle changes, such as budding, flowering, etc.), wildlife populations, and habitat use. Access was by vehicle and foot. Vegetation and wildlife monitoring techniques followed standardized protocols so data can be used as a baseline for future monitoring. All field survey locations were geo-referenced (tracks and/or waypoints) using handheld Garmin GPS units.

Table 1.Summary of 2013 field work at the Wabageshik study area.

Dates	Personnel	Person-days*
AGH, RFF, MJ	May 14 to 15	6
RFF, SH	June 8 - 12	9
AGH, RFF, SH	June 13	3
AGH, SH	June 14	2

*Defined as a minimum of 8 hours in the field

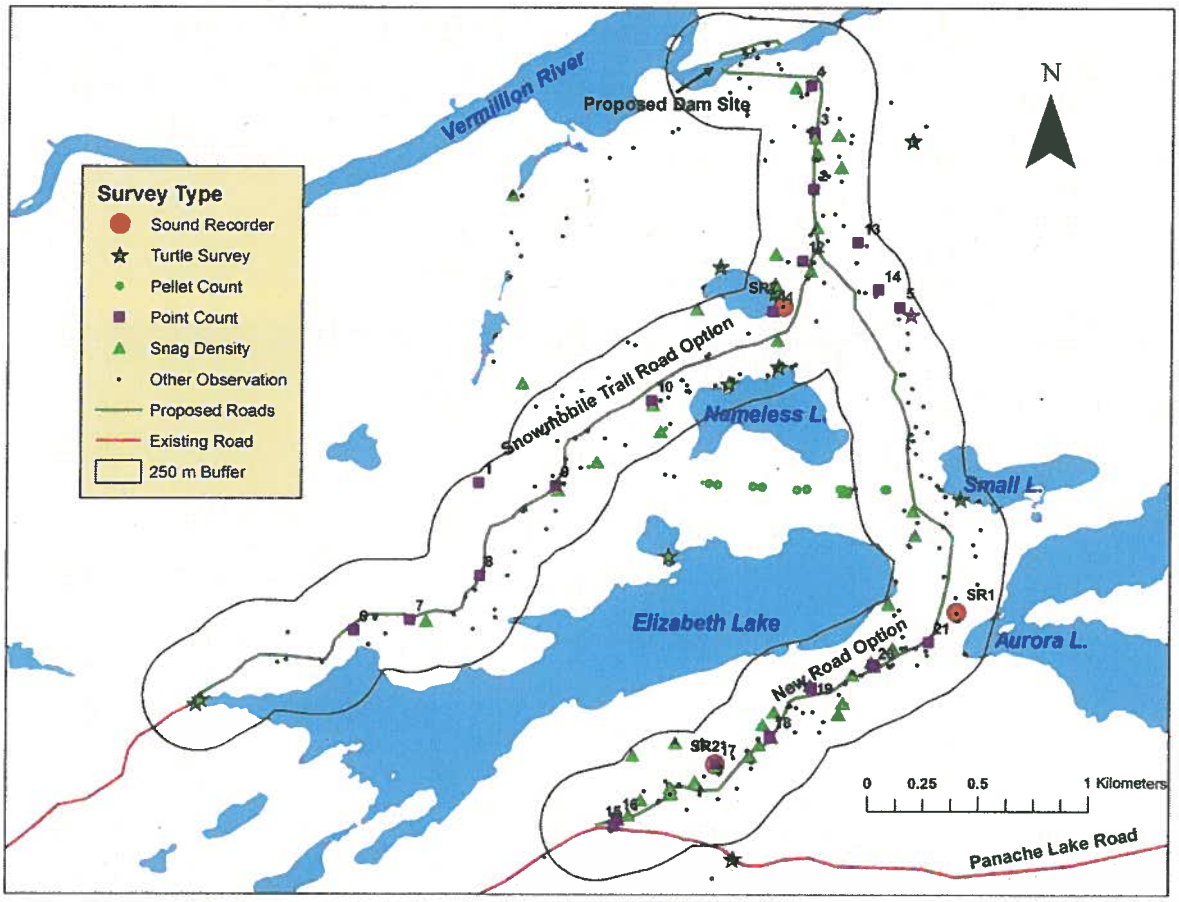

Figure 2. Locations of survey effort, Wabageshik study area, 2013. Refer to Appendix 8 for additional fieldwork locations.

2.3 Fieldwork

2.3.1 General

The study area was surveyed for species at risk, wetlands and other important ecosystems, significant wildlife habitat, and other valued ecosystem components. Species lists for vascular plants, mammals, birds, reptiles and amphibians were compiled. Targeted surveys for species at risk known to inhabit the study area were conducted (see Sections 2.3.5 to 2.3.9). All observations were georeferenced. Species lists are presented in Appendix 3 to Appendix 6. Coordinates of all fieldwork locations are in Appendix 7.

2.3.2 Land Classification

Forest and wetland ecosites were classified and mapped by KBM Resources Group. (2013) from high resolution aerial imagery using the *Ecosites of Ontario* classification (Ecological Land Classification Working Group 2009). Field verification was completed in May and June 2013. Appendix 7 includes field ecosite classifications.

2.3.3 Significant Habitat Model

KBM Resources Group. (2013) completed a coarse and fine filter assessment of potential habitat for species at risk identified during consultation with OMNR. These areas were mapped and used to guide field survey efforts.

2.3.4 Songbirds

Bird point counts were conducted on June 12-14 2013 at 21 stations (Figure 2). Methods were consistent with the Forest Bird Monitoring Program (FBMP), except that only a single survey session was conducted. Species observed or heard within and beyond 100 m radius were recorded for the first 5 and 10 minute duration. Species at risk surveys and incidental breeding and migrating bird observations were also recorded according to methods established by Ontario Breeding Bird Atlas.

2.3.5 Whip-poor-will

A preliminary survey to identify potential habitat was conducted using aerial photography, Ecological Land Classification mapping (KBM Resources Group. 2013) and a field reconnaissance on May 14 to 152013. Sound recorders (Wildlife Acoustics SM2 with stereo microphones) were deployed at three locations judged to be potential habitat from May 14 to 31 2013(see SR1, SR2, and SR7 on Figure 2). Recorders were programmed to record for 60 minutes at 21:30. A visual scan of the sonograms from these recordings was searched for Whip-poor-will calls. Incidental observations of other species of interest such as Common Nighthawks, owls and frogs were also noted.

OMNR's draft *Eastern Whip-poor-will Survey Protocol* (Nikki Boucher pers. comm. May 2013) was generally followed to confirm the presence and locations of Whip-poor-wills. This technique consists of three nocturnal surveys during the May 18 to June 30 period. Surveys were conducted along both road options in June 2013. Refer to Appendix 8 for details.

2.3.6 Deer Yard Assessment

Deer winter habitat was identified by the Ontario Ministry of Natural Resources by aerial survey of the proposed road and transmission lines on February 14th, 2013 (Selinger 2013, pers. Comm. 12 April).

A pellet group count was conducted on May 15 2013, before leaf-out, between 13:20 and 15:00 in clear, sunny condition, to estimate the winter deer yard population. Owing to topographic restrictions, the pellet group count was modified from that described in *Wildlife Monitoring Programs and Inventory Techniques for Ontario* (OMNR 1998). Instead of the recommended triangle, a single transect 1 km long was run from east to west through the area of interest.

A search for deer carcasses was conducted along the transect survey. Two observers walked the transect at 20 m apart and scanned for deer carcasses over an area extending out 10 m in either direction. Five 40 x 2 m pellet subplots were searched on each side of the transect at random intervals for a total area sampled of 800 m^2. Deer population size was estimated using a defecation rate of 12.7 pellet groups/day/deer (Chapman and Feldhamer 1982) and assuming a leaf-fall date of October 15, 2012 (212 days).

2.3.7 Blanding's Turtle

Blanding's Turtle surveys were conducted following OMNR's draft *Occurrence Survey Protocol for Blanding's Turtle*(OMNR 2013a). These guidelines became available in May 2013. It was a colder than average spring, with ice and snow cover persisting until mid to late April. Therefore it seemed reasonable to extend the survey window past the suggested cutoff date of June 15 until June 30 2013 (Kristi Beatty, pers. comm.).

Potentially suitable habitat was identified from aerial photographs, Ecological Land Classification maps produced by KBM Resources Group (2013), and a site visit on May 14-15 2013. Visual encounter surveys were conducted on 15 ponds, lakes, and wetlands in May and June 2013 (Figure 18). The shorelines were scanned for basking turtles using binoculars. On June 14 2013, Site 1 (Darkie Creek) was surveyed by canoe. Snapping Turtles and other turtle species were surveyed at this time as well. Details of the surveys are summarized in Appendix 1. Additional surveys were conducted by ORMG in June 2013. Refer to Appendix 8 for details.

2.3.8 Massassauga

Encounter surveys were conducted generally following the field surveys methods outlined in Eastern Massasauga Rattlesnake Recovery Team (2005).

2.3.9 Bats

As described above, a Wildlife Acoustics SM2Batsound recorder was deployed on the Snowmobile Trail Option in May 2013 (see SR7 in Figure 2). Nocturnal recordings greater than 20,000 Hz were scanned for bat species using the scan function in Song Scope software. Details of bat recorders are presented in Appendix 2.

Potential bat maternal habitat was assessed by measuring snag and cavity tree densities in forest stands along the proposed road corridors (OMNR 2011). The density of snags/ cavity trees ≥25 cm diameter breast height (dbh) was determined at points where ecosites were assessed (Appendix 7). Snag trees greater than 25 cm DBH were counted in 12.6 m radius

plots (equates to 0.05 hectares). This number was multiplied by 20 to convert to the number of snags / ha.

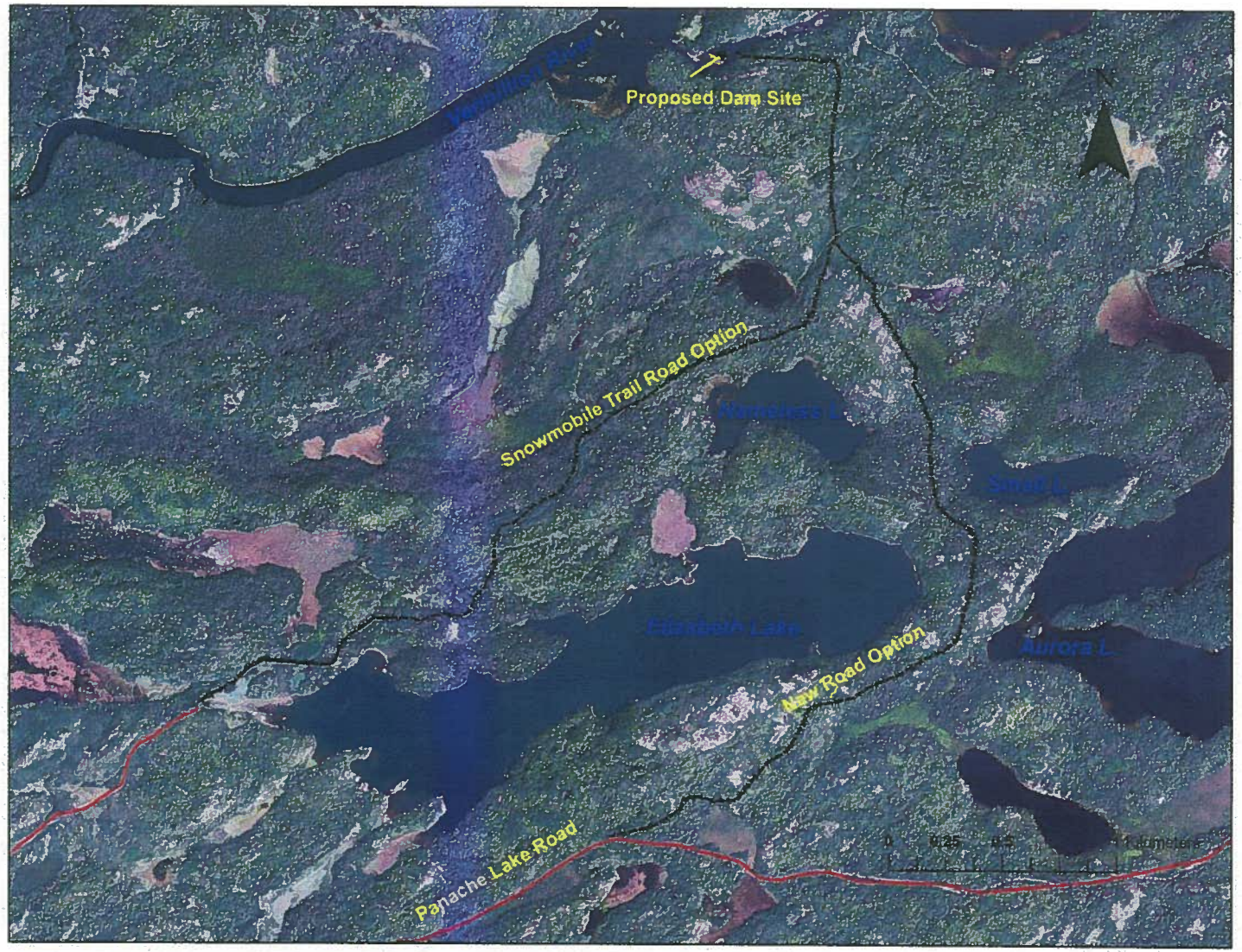

Figure 3. Wabageshik study area showing aerial photography.

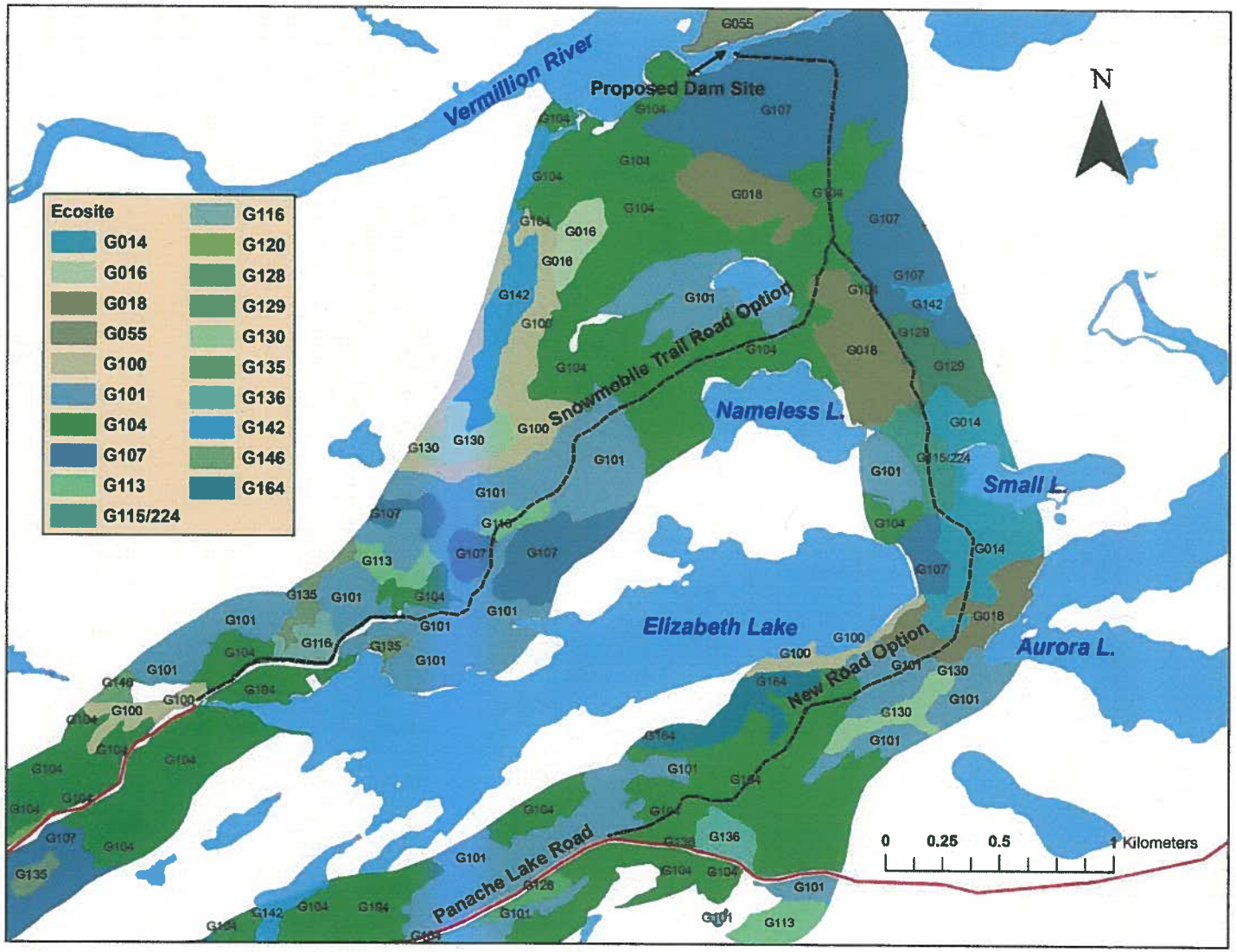

Figure 4.Wabageshik study area showing ecosites. Based on air photo interpretation completed by KBM.

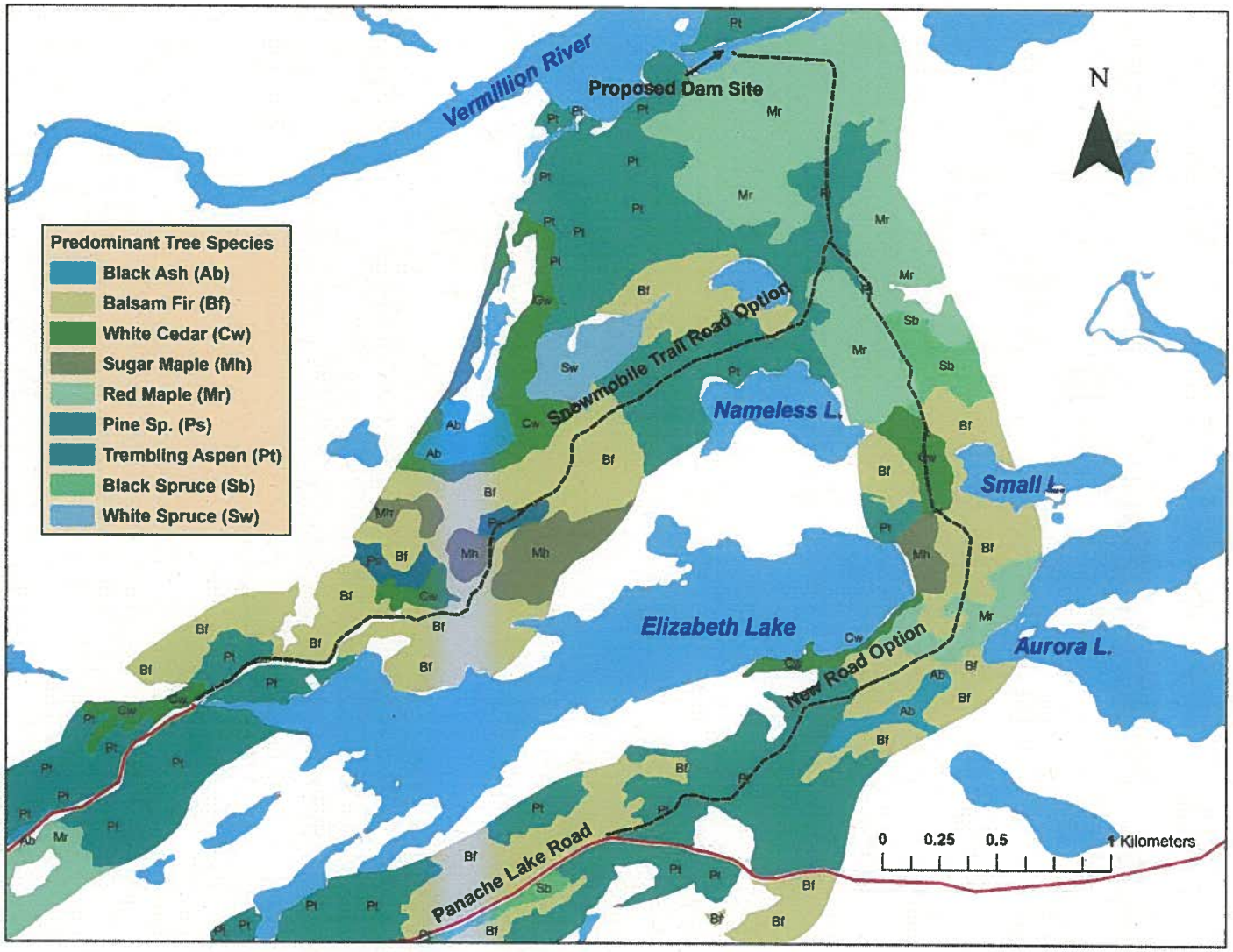

Figure 5. Wabageshik study area showing predominant tree species. Based on air photo interpretation completed by KBM.

3.0 VEGETATION

The proposed Wabageshik development area is located within the northern Great Lakes St. Lawrence forest ecoregion. The area has some overlap with the boreal ecoregion to the north, supporting vegetation communities representative of each ecoregion. The area has a high degree of topographic variation, resulting in varying soil depths and moisture regimes (Figure 3, Figure 4, Figure 5, Figure 6). Historical logging of the area, as well as extensive beaver activity, also plays a critical role in shaping many of the vegetation communities. As a result, the area is a diverse landscape of vegetation communities often in close proximity to each other.

Some adjustments were made to the ecosite mapping completed by KBM Resources Group (2013). Fine textured soils (silts and clays) were more common than indicated in the mapping, and some ecosites were changed from e.g. G040 to the fine soil equivalent, G104.

Figure 6.Wabageshik landscape showing rolling bedrock hills, rock barrens, and rich hardwood forest.

Upland mesic forests are the predominant habitat type in the study area. Red Maple and Trembling Aspen are the most common dominant forest cover species (Figure 5). Fine textured soils predominate, allowing even shallow soil sites to support relatively rich upland communities. Varying topography and drainage promote a variety of upland vegetation communities. Red Maple is by far the most common overstory species, and is found in virtually all upland ecosites in the study area. Sugar Maple, Red Oak, and Trembling Aspen are also common on most upland sites. White Pine is found scattered across the study area as large remnant super canopy trees and young trees on more shallow sites. Red Pine is restricted to lake shores and the edges of rock outcrops. Balsam Fir and spruces are generally restricted to north facing upland slopes. Paper Birch is found intermixed in most stands as a minor component, while

Ironwood makes up the subcanopy of tolerant hardwood stands. Common ecosites are moist, fine sugar maple hardwood (ecosite 122), fresh, silty to fine loamy maple hardwood (ecosite 107), moist fine mixedwoods (ecosite 125), moist-fine aspen-birch mixedwoods (ecosite 119) are prevalent in recently logged areas, with shallow, humid mixedwoods (ecosite 28) common on thin soiled sites with perched water tables. In most cases these upland communities support fairly rich understory communities of Sarsaparilla, Mountain Maple, Beaked Hazel, Canada Mayflower, and Northern Starflower. Hemlock reaches its northern limit within the study area and occurs very infrequently on rich, moist, upland sites in association with sugar maple, red oak, and ironwood.

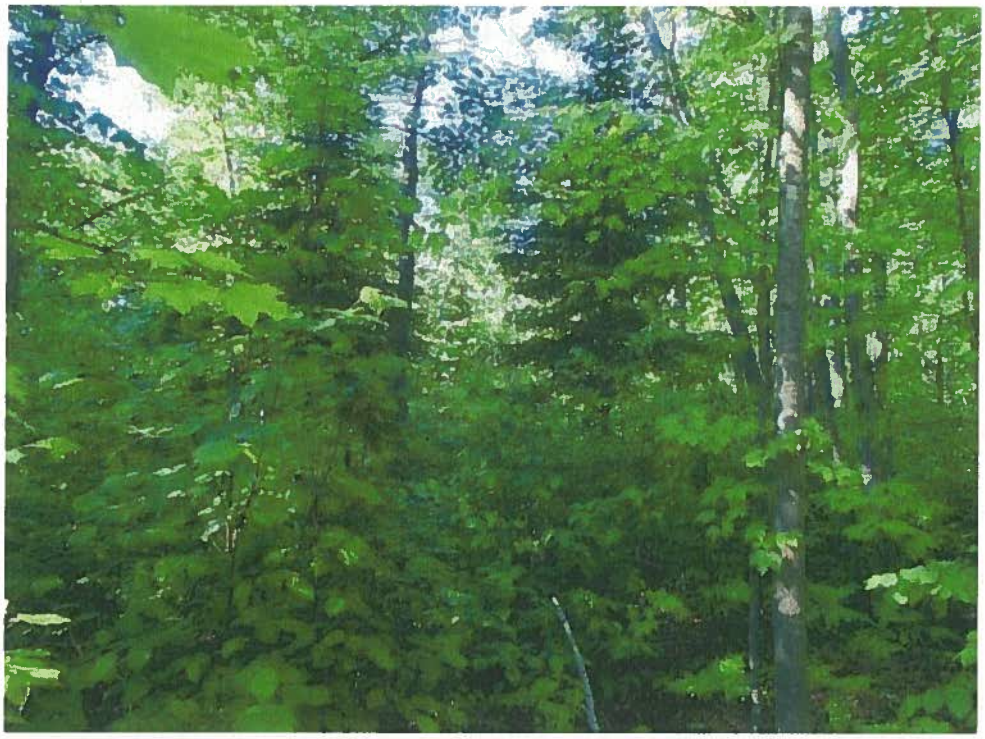

Figure 7.Typical upland hardwood stand (Ecosite G122) dominated by Sugar Maple, Red Maple and Trembling Aspen with a Paper Birch and Balsam Fir subcanopy. Note the moderately rich herbaceous ground layer.

Most non-treed wetlands are associated with beaver activity. Alder thickets (ecosites 134 and 135) are often found on the edge of active beaver ponds, whereas meadow marshes (ecosite 142) are found in old, non-flooded, beaver ponds, and are dominated by the sedge *Carex stricta*, White Meadowsweet, and Meadow Willow.

Intolerant hardwood swamps (ecosite 130) are found intermittently where groundwater movement is close to the surface. Black Ash, Balsam Poplar, White Elm, Red Maple, and occasionally Yellow Birch, comprise the overstory, understory communities are very rich. Alder is common in the shrub layer while ground cover is dominated by high herbaceous species cover. Mineral rich cedar swamps (ecosite 224) occur on similar site conditions but are a late successional stand development. Canopies are almost completely white cedar, with very little understory cover of any kind. The dense canopies of these stands combined with the open understories makes these stands ideal for deer winter habitat.

Figure 8. Mineral meadow marsh (ecosite 142).Formerly a beaver pond.

Figure 9. Mineral rich cedar swamp (ecosite 224). Note open understory.

Upland rock barrens (ecosite 165) are found on south facing slopes and exposed ridge tops throughout the area (Figure 10, Figure 11). Frequently less than 1ha in size and surrounded by forest, rock barrens support unique vegetation communities, providing important habitat for species requiring non-forested upland habitats. Typical rock barren communities are made up of drought adapted, shade intolerant, communities of common juniper, Bristly Sarsaparilla, blueberries, reindeer and *Stereocaulon* lichens, and the grass *Deschampsia flexuosa.* Rock barrens on ridge tops often support stunted, windswept Red Oak, Jack Pine, and Red Maple. Many rock barrens in the area appear to be influenced by past logging activity. Old cut tree stumps are found on many rock barrens, suggesting that at one time they were somewhat smaller with greater tree cover. Excessive soil disturbance on other south facing, thin soiled, sloped sites may also result in the creation of long term non-forested upland sites.

Figure 10. Open rock barren (ecosite 165). Note charred, cut stump.

Figure 11. Rock barren.

Rock barrens are often bounded by very shallow ecosites. Shrub dominated dry upland communities (ecosite 10) of Staghorn Sumac, Pin Cherry, serviceberry, and stunted Red Maple, support understories of reindeer lichens, blueberries, Bracken Fern, and Bush Honeysuckle. Richer thin-soiled sites support shallow mixedwoods (ecosite 19) of Red Oak, Paper Birch, Red Maple, and Balsam Fir, with moderate understory cover of Sarsaparilla, Bracken Fern, blueberries, Beaked Hazel and Canada Fly Honeysuckle.

Most of the forest on both road options is 80 to 99 years old (Figure 12). There is an extensive area of younger forest (less than 40 years old) south of the Vermillion River. No forest is aged at greater than 100 years old, although individual trees and small clumps of trees with in the stand may exceed this age, probably as a result of trees being left uncut during historical high-grade logging.

Thepotential area of forest lost due to clearing the road corridor is shown inTable 2. Both options will require clearing of about 6 ha consisting of 15 m wide right-of-way. However, the Snowmobile Trail Option partially follows an existing trail (about 5 m wide), so the area of forest removal will be less than indicated in Table 2. The exact location of the road within the corridor may be altered, and the proportions of ecosites may change slightly. A proposed temporary access road north of the river (Figure 1) follows the base of a steep bank of well-drained sandy soil. The forest is dominated by Large-tooth Aspen and White Pine (Ecosite G054 and G055) (Figure 13).

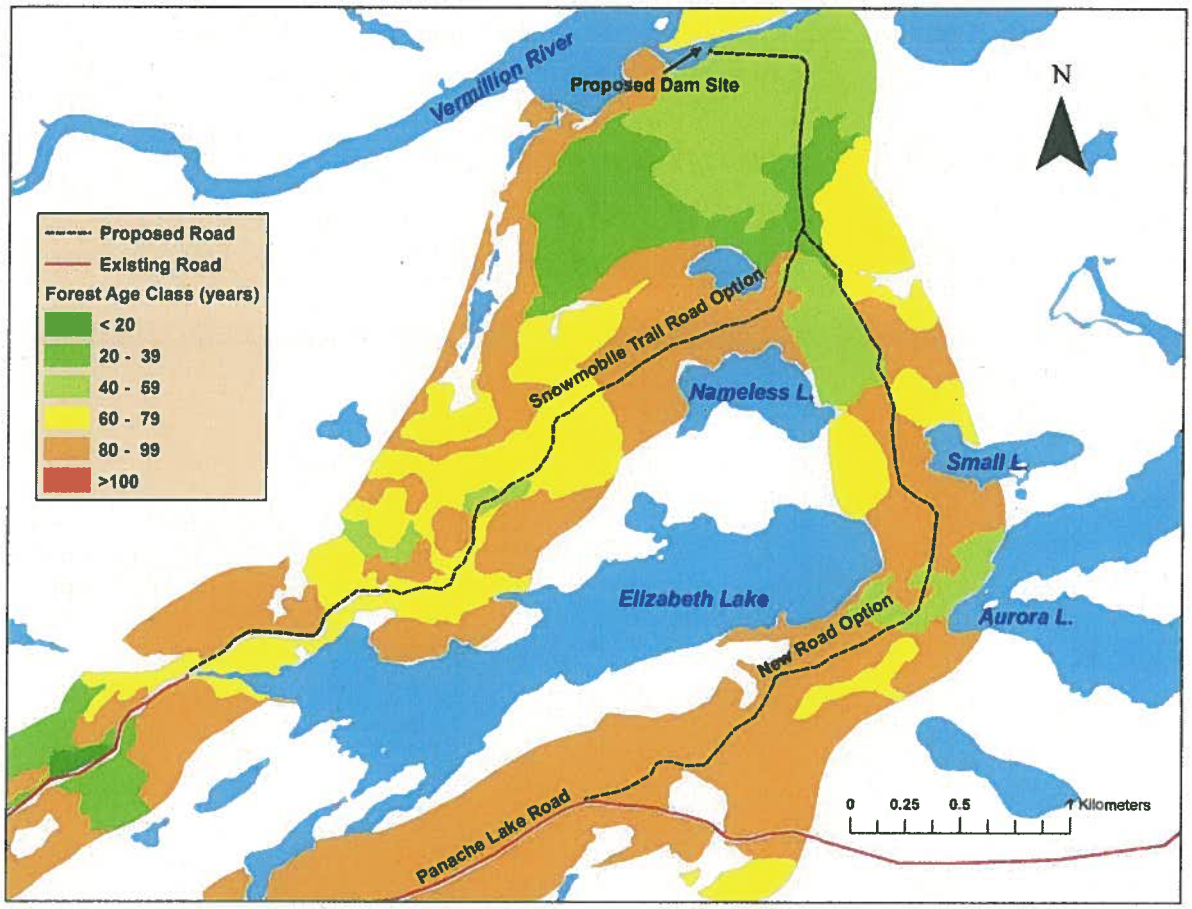

Figure 12. Forest age classes of the Wabageshik Road study area. Based on Forest Resource Inventory data.

Figure 13. Hillside north of Vermillion River at site of proposed temporary road.

Table 2. Approximate areas of forest removal by road construction assuming a 15 m wide road corridor, Wabageshik study area.

Ecosite	Ecosite Description	New Road Option (ha)	Snowmobile Trail Option (ha)*
G014	Very Shallow, Dry to Fresh: Conifer	0.75	0.00
G018	Very Shallow, Dry to Fresh: Maple Hardwood	0.43	0.58
G101	Fresh, Silty to Fine Loamy: Spruce - Fir Conifer	0.54	2.23
G104	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood	2.14	0.98
G107	Fresh, Silty to Fine Loamy: Maple Hardwood	1.31	1.49
G113	Moist, Fine: White Pine Conifer	0.00	0.37
G115/224	Moist, Fine: Hemlock - Cedar Conifer or Mineral Rich Conifer Swamp	0.62	0.00
G116	Moist, Fine: Spruce - Fir Conifer	0.00	0.51
Water	Water	0.03	0.03
Total Length		**5.10 km**	**5.08 km**
Total Area		**5.80 ha**	**6.17 ha**

*This option partially follows an existing trail, so area of forest removal will be less than indicated

4.0 WILDLIFE

4.1 Mammals

The Wabageshik area is expected to provide habitat for typical mammals of the Great Lakes – St. Lawrence Forest region. This area of Ontario is within the approximate range of 40 to 50 species of mammals (Thompson 2000; Banfield 1974; Dobbyn 1994). Not all those species may be present in the study area due to its relatively small area and lack of some habitat types, such as open fields, urban areas, and extensive conifer forest.

A total of 15 mammal species were observed during 2013 fieldwork (Appendix 4).Additional mammal species (particularly mice, voles and shrews) potentially occur in the study area but were not observed in 2013. At least three bat species were detected (see Section 5.1). No small mammal trapping was completed. Beaver lodges are common on many of the lakes and stream. Other furbearers such as Marten, Red Fox, Lynx, Mink and River Otter, are common in the Northshore Forest (Northshore Forest Inc. 2009) and no doubt inhabit the study area.

White-tailed Deer are the most abundant ungulate species in the study area and apparently use the area year round (see Section 4.5). Moose sign was seen throughout the study area although scarcity of winter habitat (dense conifer stands) may limit their use of the area at least in years with heavy snow cover.

Wolves and Coyotes are both present in the study area and probably feed largely on White-tailed Deer and Beaver. Black Bears and their sign were commonly observed in the study area. These large predators probably regularly use the study area, but wander widely throughout the year.

4.2 Birds

A total of 69 bird species were observed during 2013point counts and incidental observations (Table 3, Appendix 3).An additional 65species were observed during the 2000-2005 Ontario Breeding Bird Atlas (BBA) in Squares17MM52, 17MM51, 17MM41 and 17MM22 surrounding the study area. Habitat for some of these species may not be present in the Wabageshik study area.

The most commonly observed species on point counts in the study area were Ovenbird (present in 100% of point counts), Red-eyed Vireo (90%), Veery (52%), American Redstart (67%) and American Robin (48%) (Table 3). All of these species are associated with hardwood and mixed forest and common across central Ontario. Several boreal species including Cape May Warbler and Tennessee Warbler were observed in the study area but probably represent late migrants rather than nesting individuals. Common Loons, Pied-billed Grebes, and six duck species were observed on the lakes and streams. Species associated with extensive conifer forest, open country, and urban habitats are lacking.

Table 3. Bird monitoring point count data for the Wabageshik study area, June 2013.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
American Crow			1			1													1			3
American Redstart	1						1	1	1	2	1	3	2	1	1	2		1	1	2		20
American Robin	3	1			4	2	2	1	1		3			1						1		19
Black-and-White Warbler								1		1					1		1	1				5
Blackburnian Warbler							1		1				1			1			1			5
Black-throated Blue Warbler																1						1
Black-throated Green Warbler		1	1	2		1		1			1	2								1		10
Blue Jay														2			3		1	2	1	9
Broad-winged Hawk							1													1		2
Canada Goose		20															1	1				22
Canada Warbler				1				1							1					1		4
Cedar Waxwing														1							1	2
Chestnut-sided Warbler						1	1				1		1	2			1					7
Common Grackle					1						3											4
Common Raven		1																				1
Eastern Kingbird					1						1											2
Eastern Wood-peewee															1							1
Great Crested Flycatcher					1																1	2
Hairy Woodpecker																1						1
Hermit Thrush											1					2			1			4
Hooded Merganser											1											1
Least Flycatcher				1																		1
Magnolia Warbler	1					1			1									1				4
Mourning Warbler	1					1		1		1												4
Nashville Warbler	2	0		1		1				1								1	1		2	9
Northern Flicker					1				1													2
Northern Parula							1															1
Ovenbird	1	3	3	2	2	3	2	2	3	3	1	1	3	1	2	1	3	3	1	2	1	43
Philadelphia Vireo																			2			2
Pied-billed Grebe	0																					0
Purple Finch					1																	1
Red-breasted Nuthatch	1					1	1		1													4

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
Red-eyed Vireo	2	2	2	2	2		2	1	1	2	1	3	1	1	1	2	3	2		3	1	34
Ring-billed Gull																					1	1
Rose-breasted Grosbeak									1										1			2
Ruby-throated Hummingbird													1									1
Swainson's Thrush										1												1
Swamp Sparrow											1			1								2
Veery		2				1	1	3		1		2			3	1	3	2		2		21
White-throated Sparrow					1			2	1		1											5
Winter Wren	1			1																		2
Wood Duck														1								1
Yellow-bellied Sapsucker								1	1					1	1	1		1		1		7
Yellow-rumped Warbler					1																	1
Total	13	30	7	10	15	13	13	15	13	12	16	11	9	12	11	12	15	13	10	16	8	274

4.3 Reptiles and Amphibians

Four species of reptiles and three species of amphibians were observed in the Wabageshik study area during 2013 fieldwork (Appendix 5). Five frog species were commonly heard calling during the May fieldwork (Eastern American Toad, Tetraploid Gray Treefrog, Northern Spring Peeper, Wood Frog, and Northern Leopard Frog). Two additional species (American Bullfrog, Green Frog) were heard in June field work.Painted Turtles were seen in most lakes and ponds and Snapping Turtle (a Special Concern species) was observed at several locations (see Section5.2) (Figure 13). Targeted surveys for Blanding's Turtles did not discover any individuals of this species (see Section 5.2). Two snake species (Eastern Gartersnake and Northern Watersnake) were seen in small numbers.

Figure 14. Snapping Turtlebasking on Beaver lodge May 2013.

Figure 15. Northern Watersnake.

4.4 Significant Wildlife Habitat

Significant wildlife habitat as defined in OMNR's (2000) *Significant Wildlife Habitat Technical Guide* (SWHTG) can be characterized in four main categories:

- seasonal concentration areas of animals,
- rare vegetation communities and specialized habitat for wildlife,
- habitat for species of conservation concern (excluding Endangered and Threatened species), and
- animal movement corridors.

Descriptions of these types of significant wildlife habitat provided below are large extracted from the SWHTG and associated criterion schedules. OMNR's (2013b) significant wildlife habitat criterion schedule for Ecoregion 5E provides the recommended criteria for identifying Significant Wildlife Habitat (SWH) within Ecoregion 5E. It also provides descriptions for exceptions criteria for ecoregional SWH which are identified at an ecodistrict scale. Exceptions occur when criteria for a specific habitat are different within an ecodistrict compared to the remainder of an ecoregion or if a habitat only occurs within a restricted area of the ecoregion.

The schedules, including description of wildlife habitat, wildlife species, and the criteria provided for determining SWH, are based on science and expert knowledge. The Ecological Land Classification(ELC) Ecosite codes are based on the Operation Draft - Ecosites of Ontario, in addition ecosites are also outlined using the Field Guide to Forest Ecosystems (FEC) of Central Ontario.

4.4.1 Seasonal Concentration Areas of Animals

Potentially the most significant seasonal concentration of animals in the Wabageshik study area is a possible White-tailed Deer wintering yard between Elizabeth and Nameless lakes. No winter mortality was observed on the transect although a deer femur was observed in the general area prior to survey. Abundant deer pellets in cedar forest between Augusta and Elizabeth lakes suggest there may be some yarding behaviour in this area, at least in some years. See Section 4.5 for details.

Bat maternity colonies have recently received more attention due to the 2012 listing of some bat species. See Section 5.1 for details.

Small numbers (<10) of Painted and Snapping Turtles were observed on four waterbodies in the Wabageshik study area and presumably overwinter in at least some of them, although some may move seasonally to larger waterbodies. The wintering areas are unknown but they are typically in the same general area as their core habitat. For Midland Painted and Snapping Turtles, water must be sufficiently deep to prevent freezing, must have adequate dissolved oxygen and soft mud substrates. Wintering sites with more than 5 Painted Turtles or one snapping turtle are considered significant; this would likely include the small, unnamed waterbody west of the SnowmobileTrail Option where several Painted and Snapping Turtles were observed. Single Snapping Turtles were also observed in Nameless Lake and an unnamed pond south of Elizabeth Lake so these may also be significant overwintering habitat (Figure 19).

Table 4. Assessment of seasonal concentrations of wildlife for the Wabageshik study area.

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
Waterfowl Stopover and Staging Areas (Terrestrial)	Absent	No flooded field habitat is present in the study area due to lack of agricultural activity.
Waterfowl Stopover and Staging Areas (Aquatic)	Possible	Small lakes and ponds are present in study area, but marshes are limited, wild rice is absent, and no stopover areas have been documented in the FMP, CWS, or other sources. Numbers and species are likely too low to be considered significant.
Shorebird Migratory Stopover Area	Absent	Limited open shoreline habitat and no extensive mudflats or marshes. None documented by FMP, CWS or other sources. Several Spotted Sandpipers were the only shorebirds observed in study area. Numbers and species are too low to be considered significant.
Raptor Wintering Area	Absent	None documented, and only one small field on private land on Elizabeth Lake; but may see limited use by owls in winter.
Bat Hibernacula	Absent	No caves or mine shafts/adits documented in the study area
Bat Maternity Colonies	Possible	None documented or observed in fields. See Section 5.1
Bat Migratory Stopover Area	Absent	None documented. No landscape features thought to funnel bat migration present.
Turtle Wintering Areas	Probable	More than 5 Painted Turtles were found on 2 waterbodies and likely overwinter there: these are considered significant. Smaller numbers of Painted and/or Snapping Turtles were observed several other waterbodies in study area, which could be significant if they overwinter there

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
Snake Hibernaculum	Possible	Eastern Gartersnakes and Northern Watersnakes were observed multiple times and could potentially hibernate in study area. Suitable habitat may occur in rock crevices or rock piles, however, no hibernacula documented or observed in field.
Colonially -Nesting Bird Breeding Habitat (Bank and Cliff)	Absent	No suitable bank or cliff habitat present in study area.
Colonially -Nesting Bird Breeding Habitat Breeding Habitat (Tree/Shrubs)	Absent	None documented by FMP, CWS or other sources, nor observed in field.
Colonially -Nesting Bird Breeding Habitat (Ground)	Absent	None documented by FMP, CWS or other sources, nor observed in field. No suitable islands on waterbodies in study area.
Deer Yarding Areas	Probable	A white-tailed deer wintering yard was identified by OMNR between Nameless and Elizabeth lakes. Higher use also observed between Elizabeth and Augusta lakes in the field. See Section 4.5

4.4.2 Rare Vegetation Communities and Specialized Habitat for Wildlife

Rare vegetation communities often contain rare species, particularly plants and small invertebrates, which depend on such habitats for their survival and cannot readily move to or find alternative habitats. The criteria for significant wildlife habitat (SWH) defines rare vegetation communities as those that are ranked S1-S3 by NHIC or are areas that contain a vegetation community that is rare within the planning area (i.e., Ecoregion 5E). No rare community types are identified in the Northshore FMP.

The community type Precambrian Rock Barren is uncommon to rare in Ecoregion 5E but locally common in the study area. Most barrens were too small to be mapped in the FRI, although there was some Ecosite G164 mapped south of Elizabeth Lake. Rock barrens less than 1 ha are not considered significant under the Ecoregion 5E criterion. Most of the rock barrens observed in the field had characteristic rock barren flora for 5E such as *Cladina* lichens, *Polytrichum* moss, sparse grasses (e.g., *Danthonia spicata* and *Deschampsia flexuosa*), low shrubs (e.g., Common Juniper, blueberries, Sweetfern) and stunted open grown Red Oak and White Pine. Other typical species included Bracken Fern, Bristly Sarsaparilla, Gaywings, Pale Corydalis, Toadflax and Pin Cherry.

In Ecoregion 5E, stands containing at least 10% White Oak are considered significant since white oak is a preferred wildlife mast producing tree (compared to more common Red Oak) and such stands are uncommon in the Great Lakes St. Lawrence forest. A 13.1 ha mixedwood ($Bf_3Pt_2Sw_2Cw_1Ow_1Or_1$) stand with 10% White Oak is located between the snowmachine trail and the southwestern shore of Elizabeth Lake. Scattered White Oak are found in other stands in the study area, but at less than 10% cover.

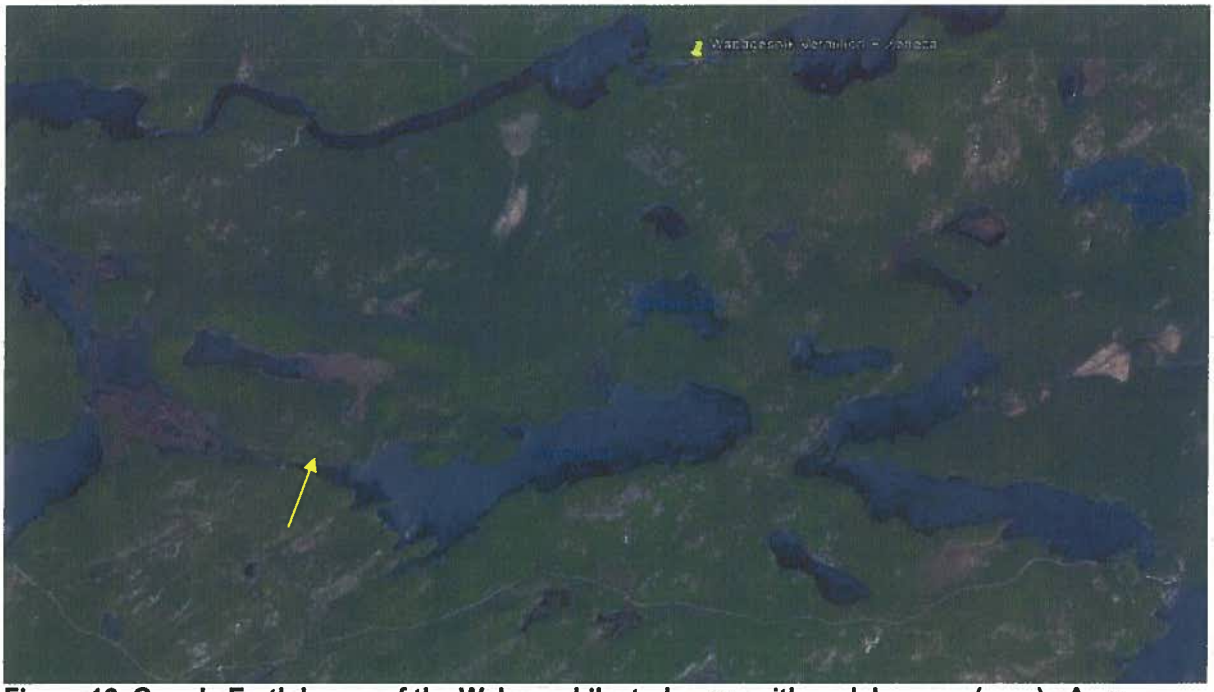

Figure 16. Google Earth Image of the Wabageshik study area with rock barrens (grey). Arrow denotes location of stand containing 10% White Oak.

Table 5. Assessment of rare vegetation communities in the Wabageshik study area.

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
Beach/ Beach Ridge/ Bar/ Sand Dunes	Absent	None identified in GIS data sets (e.g., FRI), topographic maps, and satellite imagery, nor observed in the field
Shallow Atlantic Coastal Marsh	Absent	Outside documented range; none observed in field
Cliffs and Talus Slopes	Absent	None apparent in GIS data sets (e.g., FRI) and topographic maps, and satellite imagery, nor observed in the field
Rock Barren	Confirmed	Small (<1-10 ha) rock barren communities are present rounded granitic outcrops throughout much of the study area.
Sand Barren	Absent	None identified in GIS data sets (e.g., FRI) and topographic maps, and satellite imagery, nor observed in the field
Alvar	Absent	Outside documented range; none observed in field
Old Growth Forest	Absent	None documented in the FMP (Northshore Forest Inc. 2009) nor other sources, nor observed in field likely due to the long history of logging in the area and close proximity to mill at Espanola (and major river for river-driving). Individual trees, particularly cedar may meet age criteria, but no FRI-typed stands met criteria.
Bog	Absent	None identified in GIS data sets (e.g., FRI), topographic maps, and satellite imagery, nor observed in the field
Tallgrass Prairie	Absent	None identified in GIS data sets (e.g., FRI) and topographic maps, and satellite imagery, nor observed in the field
Savannah	Absent	None identified in GIS data sets (e.g., FRI) and topographic maps, and satellite imagery, nor observed in the field
Rare Forest Type - Red Spruce	Absent	None documented in the FMP (Northshore Forest Inc. 2009), nor other sources, nor observed in field

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
Rare Forest Type – White Oak	Confirmed	One stand on the southwest shore of Elizabeth Lake near private land has White Oak at 10% cover.

Some wildlife species require large areas of suitable habitat for successful breeding and their long-term survival. Their populations decline when habitat becomes fragmented and reduced in size. Specialized habitat for wildlife is a community or diversity-based category, therefore, the more wildlife species a habitat contains, the more significant the habitat becomes to the planning area. The largest and least fragmented habitats within a planning area will support the most significant populations of wildlife. The specialized habitats for wildlife that are considered as SWH are outlined in Table 6 and their presence and/or significance in the Wabageshik study area assessed. Numerous specialized wildlife habitats are likely present in the study area due to the presence of forest and waterbodies although some could not be confirmed during fieldwork.

Table 6. Assessment of specialized habitat for wildlife in the Wabageshik study area.

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
Waterfowl Nesting Area	Probable	A number of waterfowl species were observed on waterbodies in the study are during the breeding season, often in pairs indicating that they nest along the shoreline or adjacent forests.
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	Possible	No Bald Eagles, Osprey or their nests were observed in the field, and no nests are documented for the area in the FMP (Northshore Forest Inc. 2009). They may forage and perch in the study area, particularly along the Vermillion River.
Woodland Raptor Nesting Habitat	Probable	No woodland raptor nests were observed in the field, and no nests are documented for the area in the FMP (Northshore Forest Inc. 2009). Broad-winged Hawks were observed during fieldwork, suitable trees are present, it is likely that they (and potentially other raptor species) nest in the study area.
Turtle and Lizard Nesting Areas	Probable	Small numbers of Painted and Snapping Turtles were observed on multiple waterbodies in study area and likely nest along the shoreline. The study area is outside the range of any lizard species however.
Seeps and Springs	Confirmed	Several small isolated seeps were observed in the field and the presence of small permanent or intermittent streams in the study area suggest others may be present. No site with multiple seeps or springs was observed so not considered significant.
Aquatic Feeding Habitat	Possible	No moose were observed in the field nor are any moose (or deer) aquatic feeding areas documented in the FMP (Northshore Forest Inc. 2009). The small beaver pond on the access road in to Elizabeth Lake has very abundant yellow water lily, a preferred moose food, and is a potential moose aquatic feeding area. No well-developed submergent or floating-leaved marshes were observed on

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
		the other lakes in the study area.
Mineral Lick	Absent	None were observed in the field nor documented in the FMP (Northshore Forest Inc. 2009).
Denning Sites for Mink, Otter, Marten Fisher and Eastern Wolf	Possible	A pair of River Otters was observed on the small unnamed lake north of Augusta Lake, and denning sites for this species as well as Mink is likely present along shorelines Relatively contiguous mixed forests with abundant large trees could provide habitat for Fisher and Marten, and potentially Eastern Wolf.
Amphibian Breeding Habitat (Woodland)	Confirmed	Tadpoles were observed in ditches and vernal pools along the snowmobile trail. Wood frogs adults were also abundant.
Amphibian Breeding Habitat (Wetlands)	Confirmed	Leopard Frogs were very abundant along the snowmobile trail,Green Frogs were heard calling from several waterbodies. Bullfrogs were heard calling from Nameless Lake and tadpoles were observed in the marsh at the west end of Elizabeth Lake.
Mast Producing Areas	Absent	Red Oaks were common on upland shallow soil sites, and produce mast, at least in some years; some White Oak also present. However, no forested or open site with >50% cover mast-producing tree species (>40 cm DBH) or >50% mast (berry) producing shrubs was observed. No mast-producing areas are documented in the FMP for the study area.

4.4.3 Habitat for Species of Conservation Concern (Not including Endangered or Threatened Species)

Habitats of Species of Conservation Concern include wildlife species that are listed as Special Concern or rare, that are declining, or are featured species. Habitats of Species of Conservation Concern do not include habitats of Endangered or Threatened Species as identified by the Endangered Species Act 2007. Table 7 summarizes SWH for Species of Conservation Concern. Three species that are designated as Special Concern federally and/or provincially were observed in the Wabageshik study area including Snapping Turtle, Canada Warbler, and Eastern Wood-Pewee. See Section 5.0 for a discussion of these species.

Table 7. Assessment of habitats of Species of Conservation Concern in the Wabageshik study area.

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
Marsh Bird Breeding Habitat	Probable	Marshes are present on some of the waterbodies in the study area and likely provide breeding habitat for marsh bird species.
Open Country Bird Breeding Habitat	Absent	No open country is present, with the exception of a small field/lawn on private property at the southwest shore of Elizabeth Lake.
Shrub/Early Successional Bird Breeding Habitat	Absent	Shrub and early successional species are relatively limited in the study area, with some shrubby areas along shorelines and former beaver ponds. However, the areas are small (<30 ha)

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
		and none of the target species were observed.
Special Concern and Rare Wildlife Species	Confirmed	Snapping Turtles, Canada Warblers, and Eastern Wood-Pewee were observed in the study area. See Section 5.0Species at Risk for discussion of these Special Concern species.

4.4.4 Animal Movement Corridors

Animal movement corridors are elongated areas used by wildlife to move from one habitat to another. They are important to ensure genetic diversity in populations, to allow seasonal migration of animals (e.g. deer moving from summer to winter range) and to allow animals to move throughout their home range from feeding areas to cover areas. Animal movement corridors function at different scales often related to the size and home range of the animal.

Identifying the most important corridors that provide connectivity across the landscape is challenging because of a lack of specific information on animal movements. There is also some uncertainty about the optimum width and mortality risks of corridors. Furthermore, a corridor may be beneficial for some species but detrimental to others. For example, narrow linear corridors may allow increased access for Raccoons, cats, and other predators. Also, narrow corridors dominated by edge habitat may encourage invasion by weedy generalist plants and opportunistic species of birds and mammals. Corridors often consist of naturally vegetated areas that run through more open or developed landscapes. However, sparsely vegetated areas can also function as corridors. Despite the difficulty of identifying exact movement corridors for all species, these landscape features are important to the long-term viability of certain wildlife populations.

Animal Movement Corridors should only be identified as SWH where confirmed or candidate SWH has been identified by MNR or the planning authority based on documented evidence of a habitat identified within these Criterion Schedules or the Significant Wildlife Habitat Technical Guide. The identified wildlife habitats will have distinct passageways or rely on well-defined natural features for movements between habitats required by the species to complete its life cycle. The Wabageshik study area lacks documented animal movement corridors and the continuous forest cover and rugged terrain suggests that it is not a significant movement corridor. Within the study area, watercourses likely serve as corridors for amphibians, turtles, snakes, and riparian mammals such Beaver, American Mink, Muskrat, and River Otter. The snowmachine trail may also serve as a movement corridor for many mammals judging by the abundance of Moose, Wolf, Black Bear, and White-tailed Deer tracks along it.

Table 8. Assessment of animal movement corridors in the Wabageshik study area.

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
Amphibian Movement Corridors	Possible	Along watercourses
Cervid Movement Corridors	Possible	None documented, although the snowmachine trail may serve as one

Significant Wildlife Habitat	Present/Absent in Study Area	Notes
Furbearer Movement Corridor	Possible	Along watercourses

4.5 White-tailed Deer Yard

The proposed Wabageshik development project is at the northern limit of Cervid Ecological Zone D2 (OMNR 2009). Within this zone cervid management focuses on maintaining high to moderate moose populations and only moderate White-tailed Deer populations. Zone C2, approximately 5 kmto the north strives to achieve a low deer population density. Within Zone D2, White-tailed Deer management emphasizes the provision of localized summer and winter habitat. As a result, there is some risk that forest clearing for road and transmission lines for the Wabageshik power development may remove important deer habitat, potentially negatively impacting local populations.

The study area is approaching the northern limit of contiguous White-tailed Deer populations in the province. The nearest environment Canada weather station in Sudbury records 141 days of snow cover a year with 82 days exceeding depths of 20 cm (Environment Canada 2013). As a result, winter habitat is critical for deer to cope with the relatively snowy conditions typical of the area. White cedar stands are ideal winter habitat for White-tailed Deer in northern Ontario. Cedar stands with dense canopies and relatively clear understories intercept snowfall, allowing deer ease of movement below, minimizing direct heat loss to snow and reducing energy expended on movement (Schmitz 2006). When foraging during the day however, deer require more open areas where browse and sun exposure are readily available (Armstrong *et al.* 1983). As a result, large contiguous lowlands of cedar dominated forest adjacent to young hardwood dominated stands are likely to be the highest quality winter deer habitat.

Deer winter habitat was identified by the Ontario Ministry of Natural Resources by aerial survey of the proposed road and transmission lines on February 14th, 2013 (Selinger 2013, pers. Comm. 12 April) (Figure 16). In addition, it was noted that deer in the area also occupy windblown, south-facing slopes with sparse tree cover, where snow depths are minimal; allowing access to good foraging and minimizing exposure to snow depths. Based on the aerial survey a 58.7 ha area of high deer use was identified along the proposed transmission line (Figure 16) for ground survey. The area identified encompasses a large, contiguous conifer dominated area of cedar swamp (Ecosite G224) (Figure 9), moist spruce-fir forest (Ecosite G116), and shallow conifer forest (G014), adjacent to a range of upland hardwood dominated stands, as well as open rock barrens, providing ideal browse in close proximity as well as south exposed slopes to maximize sun exposure.

No deer carcasses were found during the transect survey, although a deer femur was observed outside of the area sampled. Five 40 x 2 m pellet subplots were searched on each side of the transect at random intervals for a total area sampled of 800 m^2. A total of 39 pellet groups were identified. Using a defecation rate of 12.7 pellet groups/day/deer (Chapman and Feldhamer 1982) and assuming a leaf-fall date of October 15th, 2012 (212 days), a winter deer population of 10.6 ± 3.9SE was determined; equivalent to 18.1 ± 6.7SE deer/km^2. These densities are consistent with relatively high deer densities reported in other northern regions (Lesage *et al.* 2000), including the Northshore Forest (Northshore Forest Inc. 2009) suggesting that the area

identified is a relatively high quality deer wintering yard. Later visits to the area in June found high anecdotal use of the area by deer, with numerous pellet groups evident and a fawn sighted near the southwest corner of Nameless Lake (Figure 16). Deer were also observed through the entire proposed development area, suggesting that summer habitat is relatively widespread and common.

Potential Impacts and Mitigation

The proposed New Road Option corridor passes directly through the conifer dominated areas in the winter deer year, especially the cedar swamp (Figure 17). Nevertheless, it is unlikely an access road corridor would have a significant impact on overall winter habitat availability. Of an identified core winter area of 58.7 ha an access road corridor 15 m wide and 500m long, running north-south, would only disturb 0.75 ha of habitat, or about 1% of the identified area, while road use is likely to be restricted and infrequent following project completion. Furthermore, in many winter deer yards, high deer densities result in forage limitation (Lesage 2000). The creation of an open corridor could increase browse along the corridor edge, as well as access to sun exposed areas during day foraging, potentially improving some aspects of deer winter habitat in the area. As well, the observation of deer using locally available south-facing exposed rock barrens and ridges, suggests some alternative habitat availability and flexibility in deer habitat use. As a result, the impact of an access road corridor on deer winter habitat in the area is likely to be of minimal impact on winter deer populations. On the other hand, the roads may provide greater access for wolves and other predators.

The New Road Option could be rerouted to avoid the White Cedar stand shown inFigure 17, but this would force the road to within 150 of a lake, with potential impacts of turtles and other values. Alternatively if the road did cross this cedar stand, a narrower road corridor could be used to maintain conifer crown closure. Given the target of Cervid Ecological Zone D2 is to maintainonly moderate White-tailed Deer populations, and given the relatively small area of deer yard involved, negative impacts on this winter habitat will probably not impair zone targets.

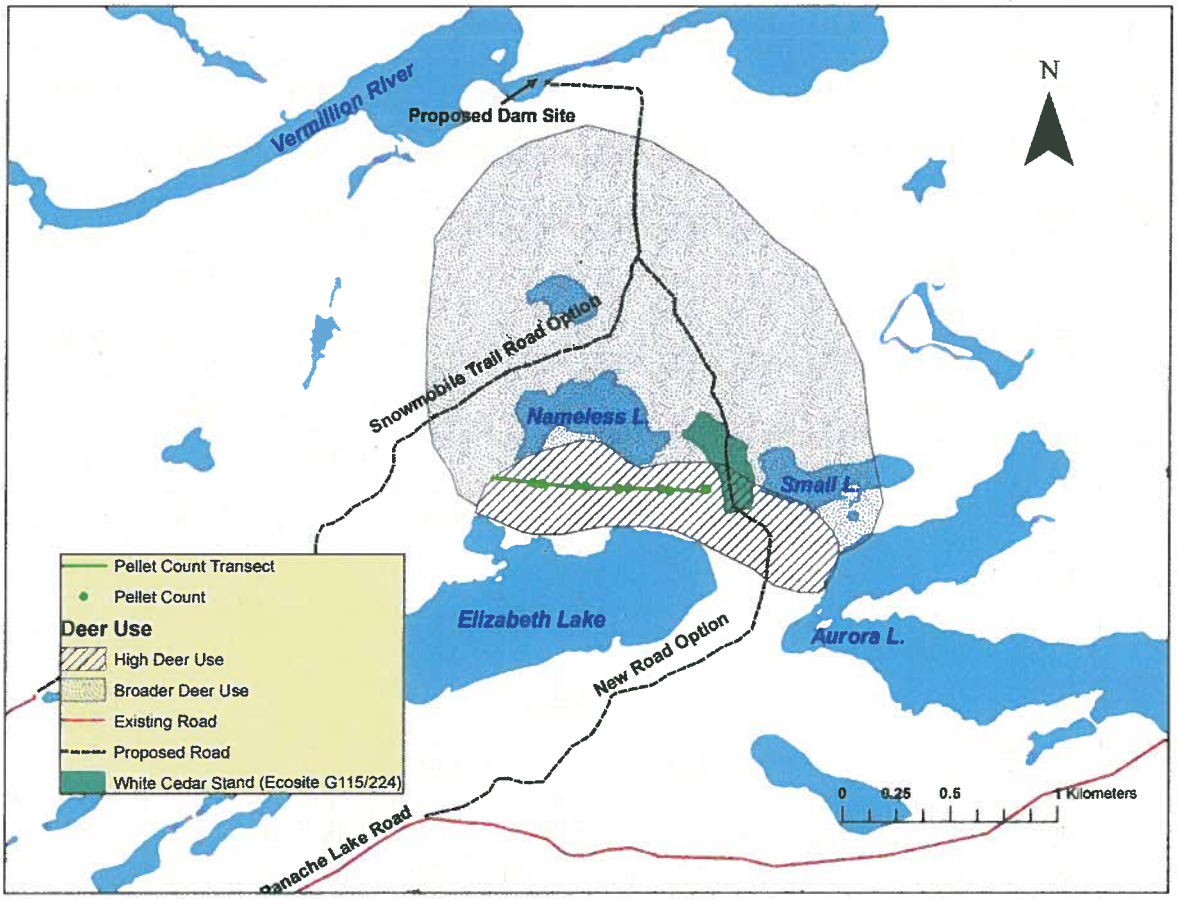

Figure 17. White-tailed Deer yard identified by OMNR showing locations of pellet count transect.

5.0 SPECIES AT RISK

Five Species at Risk (SAR) were observed during 2013 fieldwork: Whip-poor-will, Eastern Wood-Pewee, Canada Warbler, *Myotis* sp., and Snapping Turtle (Figure 19). Additional species at risk occurring in the surrounding area were compiled from the Northshore Forest ManagementPlan (Northshore Forest Inc. 2009), the Ontario Breeding Bird Atlas (OBBA 2013), eBird (2013), and the NHIC Biodiversity Explorer (NHIC 2013). These species are discussed in Table 9 and Sections 5.1 to 5.5.

Table 9.Summary of known or potential species at risk in the Wabageshik study area.

Species	Status* COSEWIC / ON	Impacts and Mitigation	Notes
Bald Eagle *Haliaeetus leucocephalus*	NAR/SC	-	Not observed during 2013 fieldwork and not documented within about 10 km in the Breeding Bird Atlas databaseor NHIC (2013).
Barn Swallow *Hirundo rustica*	THR/THR	-	Present in surrounding area (atlas squares 17MM41 and 17MM42) but not observed in fieldwork or documented in the study area. No typical breeding habitat (buildings) and no documented use in study area.
Black Tern *Childonia nigra*	NAR/SC	See Section 5.5	Not observed during 2013 fieldwork and not documented within > 10 km in the Breeding Bird Atlas database, eBird (2013), or NHIC (2013). Potential breeding habitat (large open wetlands) present nearby.
Bobolink *Dolichonyx oryzivorus*	THR /THR	-	Present in surrounding area (atlas squares 17MM42 and 17MM52) but not observed in fieldwork or documented in the study area. No habitat (hayfields, pastures) present in the study area.
Canada Warbler *Wilsonia canadensis*	THR/SC	See Section 5.4	Confirmed present. Singing males discovered at eight locations in the study area (Figure 19) and suitablehabitat common.
Chimney Swift *Chaetura pelagica*	THR /THR	-	Present in surrounding area (atlas squares 17MM41 and 17MM42) but not observed in fieldwork or documented in the study area. No typical breeding habitat (chimneys) and no documented use in study area.
Common Nighthawk *Chordeilies minor*	THR/SC	See Section 5.4	Present in surrounding area (atlas square 17MM42) but not observed in fieldwork or documented in the study area. Potential breeding habitat present.
Eastern Meadowlark *Sturnella magna*	THR/THR	-	Not observed during 2013 fieldwork and not documented within > 10 km in the Breeding Bird Atlas database or eBird (2013). No habitat (hayfields, pastures) present in the study area.
Eastern Wood-Pewee *Contopusvirens*	SC/-	See Section 5.4	Confirmed present. Singing males discovered at two locations in the study area (Figure 19) and suitable habitat common.
Golden-winged Warbler *Vermivora chrysoptera*	THR/SC	See Section 5.4	Present in surrounding area (atlas square 17MM52) but not observed in fieldwork or documented in the study area. Potential breeding habitat present.
Olive-sided Flycatcher *Contopus cooperi*	THR/SC	See Section 5.4	Present in surrounding area (atlas squares 17MM42 and 17MM51) but not observed in fieldwork or documented in the study area. Potential breeding habitat present.
Least Bittern *Ixobrychus exilis*	THR/THR	See Section 5.5	Not observed during 2013 fieldwork and not documented within about 40 km in the Breeding Bird Atlas database, eBird (2013), or NHIC

Species	Status* COSEWIC / ON	Impacts and Mitigation	Notes
			(2013).Potential breeding habitat (large open wetlands) present nearby.
Peregrine Falcon *Falco peregrinus anatum*	SC/SC	-	Not observed during 2013 fieldwork and not documented within about 10 km in the Breeding Bird Atlas database. No suitable breeding habitat (defined as cliffs with suitable ledges and a vertical drop of at least 15 m and a linear cliff length of at least 100 m (Ratcliff and Foster 2005). "Good" habitat has a vertical cliff face of at least 30 m and a minimum cliff length of 250 m. "Marginal" habitat has a vertical cliff face of 15 to 30 m and a minimum cliff length of 100 m.
Rusty Blackbird *Euphagus carolinus*	SC/NAR	See Section 5.4	Not observed during 2013 fieldwork and not documented within about 10 km in the Breeding Bird Atlas database, but within breeding range. Potential breeding habitat (shorelines, wetlands) present nearby.
Short–eared Owl *Asio flammeus*	SC/SC	See Section 5.5	Not observed during 2013 fieldwork and not documented within > 10 km in the Breeding Bird Atlas database, eBird (2013) or NHIC (2013). Potential breeding habitat (large open wetlands) present nearby.
Whip-poor-will *Caprimulgus vociferous*	THR/THR	See Section 5.3	Confirmed present. Suitable breeding habitat bedrock ridges and foraging habitat over lakes. See Section 5.3
Wood Thrush *Hylocichlamustelina*	THR/-	See Section 5.4	Present in surrounding area (atlas squares 17MM42 and 17MM51) but not observed in fieldwork or documented in the study area. Potential breeding habitat present.
Yellow Rail *Coturnicops noveboracensis*	SC/SC	See Section 5.5	Not observed during 2013 fieldwork and not documented within about 10 km in the Breeding Bird Atlas database or NHIC (2013). Potential breeding habitat (large open wetlands) present nearby.
Little Brown Myotis, Northern Myotis, *Myotis lucifugus, M. septentrionalis*	END/END END/END	See Section 5.1	*Myotis* sp. confirmed present with sound recorders. See Section 5.1
Monarch *Danaus plexippus*	SC/SC	-	Not observed during 2013 fieldwork but Wabageshik is within the species' range. Maintaining wetlands and roadsides will protect the food plant (milkweeds; *Asclepias* spp.) (Northshore Forest Inc. 2009).
Blanding's Turtle *Emydoideablandingii*	THR/THR	See Section 5.2	Targeted surveys were conducted following OMNR guidelines. No Blanding's Turtles were observed. See Section 5.2 for details. Known to occur in the Northshore Forest (Northshore Forest Inc. 2009, Oldham and Weller 2000).
Wood Turtle *Glyptemysinsculpta*	THR/END	See Section 5.2	Known to occur in the Northshore Forest (Northshore Forest Inc. 2009), but not in close proximity to the study area .
Snapping Turtle	SC/SC	See Section 5.2	Confirmed present. Adults were observed in several lakes and pond in and

Species	Status* COSEWIC / ON	Impacts and Mitigation	Notes
Chelydraserpentina			near the study area (Figure 19).
Milksnake *Lampropeltistriangulum*	SC/SC	See Section 5.2	None observed during 2013 fieldwork but known to occur in the Northshore Forest (Northshore Forest Inc. 2009, Oldham and Weller 2000, Rowell 2012).
Massassauga *Sistruruscatenatus*	THR/THR	See Section 5.2	None observed during 2013 fieldwork but known to occur in the Northshore Forest (Oldham and Weller 2000, Rowell 2012),. The study are is outside of critical habitat (Parks Canada Agency 2013)
Eastern Wolf *Canislycaon*	SC/SC	-	The Wabageshik area is within the expected range of this species, but its distribution and taxonomy are unclear (Northshore Forest Inc. 2009). Forest management that provides a diversity of forest conditions and provides White-tailed Deer for prey is expected to provide suitable habitat (Northshore Forest Inc. 2009).
Cougar *Pumaconcolorcouguar*	DD/END	-	The status of Cougar in the Wabageshik area is unclear (Northshore Forest Inc. 2009). Forest management that provides White-tailed Deer for prey is expected to provide suitable habitat (Northshore Forest Inc. 2009).

*NAR = Not At Risk; THR = Threatened; SC = Special Concern; END = Endangered; DD = Data Deficient

5.1 Little Brown Myotis, Northern Myotis, Eastern Small-footed Bat

Little Brown Myotis (*Myotis lucifugus*) and Northern Myotis (*M. septentrionalis*) have been designated as Endangeredin Ontario and by COSEWIC (2012).Catastrophic population declines caused by White Nose Syndrome have occurred across eastern North America (COSEWIC 2012).A third *Myotis* species, Eastern Small-footed Bat (*M. leibii*) has undergone similar declines and is a candidate for listing on the Ontario Endangered Species Act (see: http://www.mnr.gov.on.ca/en/Business/Species/ 2ColumnSubPage /STDPROD_068707.html). The Wabageshik study area is within the mapped range of all three of these species (Dobbyn 1994, Naughton 2012). Northern Myotis and Eastern Small-footed Bat have been recorded on the Northshore Forest (Northshore Forest Inc. 2009).

A bat recorder was placed near the centre of the study area (SR7 in Figure 2) from May 15 to 26 2013. It was positioned on a large rock outcrop (Ecosite G018) near a pond and beside the snowmobile trail.Bats were detected on most nights. At least three species of bats were present.*Myotis* sp. (including Little Brown Myotis, Northern Myotis, and Eastern Small-footed Bat) are difficult to identify to the species level and no attempt was made to distinguish these species. *Myotis* sp. were detected on most nights(Appendix 2).Big Brown Bat and/or Silver-haired Bat were also detected, but their calls usually cannot be discriminated from each other (MNR 2010). Hoary Bat was recorded on May 25 and 26 2013. Although recordings do not allow counts of number of individual bats nor the significance of the habitat, these data suggest the site has value as foraging habitat.

Little Brown Myotis, Northern Myotis, and Eastern Small-footed Bat typically hibernate in abandoned mine shafts or caves (Naughton 2012). Little Brown Myotis migrate up to 1000 km between summer ranges and winter hibernacula (Naughton 2012), so their presence during the summer does not indicate the presence of hibernacula in the ROW. Movement of approximately 50 km from summer range and hibernacula have also been documented for Northern Myotis (Naughton 2012).No caves were observed or previously documented in the area but the Ontario Ministry of Northern Development and Mines Abandoned Mines Information System (OMNDM 2012) identified the Elizabeth Lake mine (Abandoned Mine Identifier 085087) at about 150 m south of the middle of Elizabeth Lake (UTM Zone 17 Easting 451252 Northing 5121012). A second mine, the Texas Mine (Abandoned Mine Identifier 05085) is located about 100 m south of the Panache Lake Road south of the west end of Elizabeth Lake (UTM Zone 17 Easting 450025 Northing 5120062).Neither mine was visited in the field andtheir use by bats was not confirmed. Both these mines were identified as "trench" mines, so bat hibernation may not be possible.

During the summer, nursing females aggregate in colonies of dozens to thousands of individuals (depending on the species) in warm locations usually in or around buildings, but also tree cavities, exfoliating bark, cracks and crevices in cliffs. Northern Myotis, which typically have smaller colonies, switch maternity roosts every several days, carrying their flightless young with them (Naughton 2012). Maternity roosts typically include snags and cavity trees in mixedwood or deciduous forests. Larger snags allow for larger cavities and large bat communities therefore more thermal benefits.

Roost site availability is a predictor of *Myotis* activity with increases in snag densities resulting in increased likelihood of *Myotis* presence (Broders and Forbes 2004). Preferred roostsare >11m above the ground in large diameter snags >22m tall. Stands often have a canopy higher than that of the snags.

Aspen is the species most likely to provide ideal bat roosting in central Ontario, with white pine also able to fill this role. Old aspen stands (~120 years old) have bigger snags with more uniform characteristics. Stands of this age class ideal also provide a relatively open understory, with many canopy gaps, allowing better edge habitat within the forest for foraging for insects(Brassard and Chen 2008, Crampton and Barclay 1998, Menzel et al. 2002).

OMNR (2011) suggests that bat maternal habitat consists of forest stands with a minimum snag or cavity tree density of ≥10 snags per hectare of trees ≥25 cm diameter breast height (DBH).Clusters of snag trees of suitable diameter and density were found throughout the study area (Figure 17).Snag tree density ranged from 0 to 80 snags/ha (i.e. 0 to 4 snags/plot) for an overall average of 17 snags/ha. Snags were least common in very shallow soil communities (Ecosites G014, G016, G018) but suitable roost trees were scattered through a range of other ecosites and stand ages. Although Forest Resource Inventory mapping shows no forest stands greater than 100 years old in the study area, field observations suggest that individual trees within younger stands probably exceed 100 years.

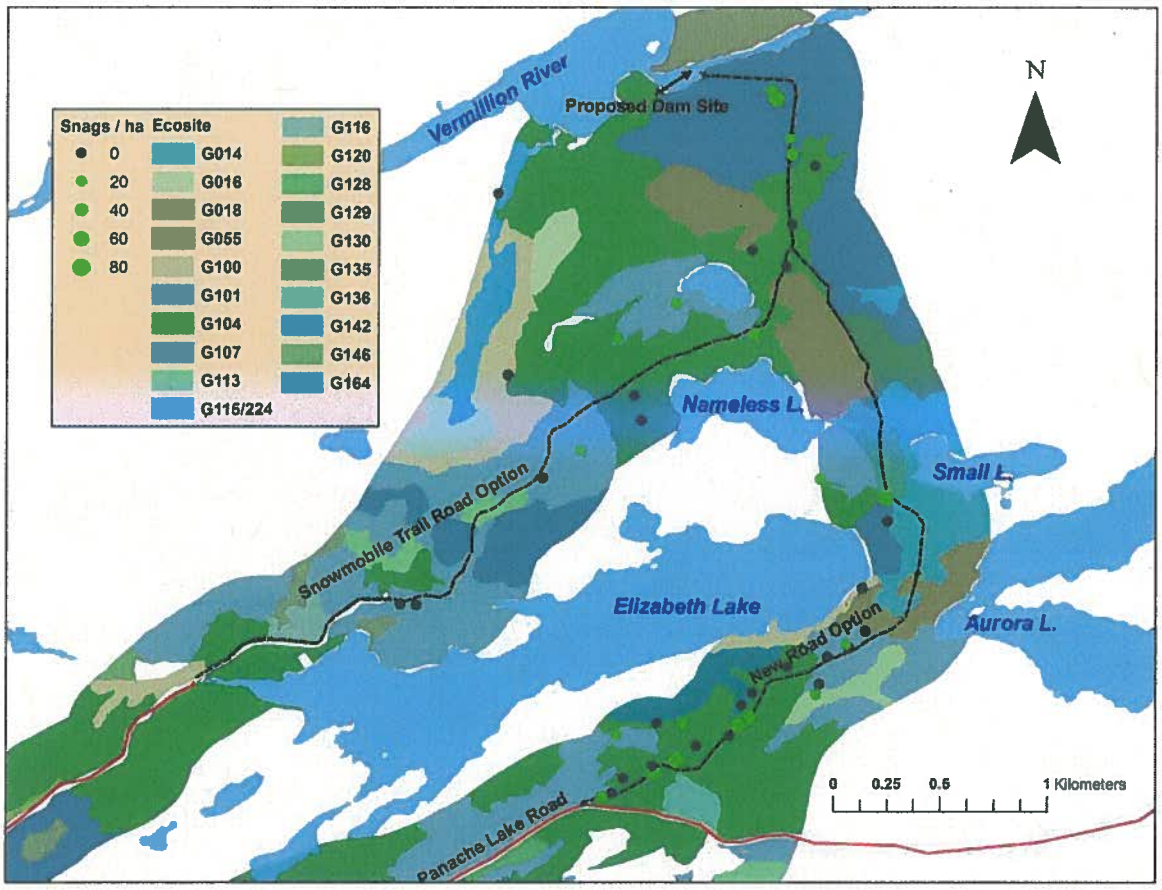

Figure 18. Snag tree density measurements, Wabageshik study area 2013.

In summary, although little is known of bat use of the study area, *Myotis* spp.were detected regularly through May 2013. Bats use the area adjacent to the pond north of Nameless Lake (SR7 in Figure 2) apparently for foraging. No bat recorders were placed elsewhere in the study area. Use of maternal trees was not documented, but suitable snag trees are common throughout the study area. No hibernacula were discovered. MNDM data shows two "trench" type mines nearby and many other abandoned mine in the Espanola – Sudbury area.

Potential Impacts and Mitigation

With a total area of about 6 ha, the proposed road corridor is unlikely to remove a significant number of maternal roost trees. At an average density of 17 trees/ha, about 102 trees would be removed. This could be reduced by avoiding portions of those stands with clumps of snag trees or reducing the right-of-way width when snags are encountered. The impact of removing about 100 snag trees is unlikely to be significant on *Myotis* populations. Bat populations in the boreal forest of northern Ontario are presumably adapted to a fire-driven ecosystem and periodically forced to shift locations of maternal colonies due to natural factors. Furthermore, since *Myotis* spp. are declining due to White-nose Syndrome, it seems unlikely that cavity tree availability is limiting. If maternity colonies or other bat roosts are observed during development, operations, or decommissioning of the project, they will be protected from disturbance until a management plan can be developed in cooperation with the OMNR. Clearing the proposed road corridor during the non-breeding season would avoid killing or disturbing bats at maternal colonies.

Traffic noise and forest canopy gaps created by roads sometimes cause foraging bats to alter travel routes, and thus increased road density presumably alters foraging area (Bennett and Zurcher 2012). The severity of this effect is not known particularly in areas with relatively low road density such as the Wabageshik study area. In contrast, the Bennett and Zurcher 2012 study was completed in an agricultural landscape with only small remnant woodland patches. Little Brown Myotis and Northern Myotis commonly forage along roads and trails (Naughton 2012). No significant negative impacts are anticipated on foraging habitat for bats. Given the expected low traffic noise (particularly at night) and relatively high proportion of forest cover, the impacts of the road on bat populations will probably be insignificant.

A summary of potential impacts and mitigation is presented in Table 10.

Table 10.Potential impacts and mitigation for bat species.

Potential Impact	Mitigation
Loss of roost trees	• Maintain clumps of snag trees where encountered. • Avoid placing road through older hardwood and mixedwood stands where possible • Minimize road right-of-way width
Disturbing or killing roosting bats in maternal colonies	• Clear right of way during the non-breeding season
Traffic noise	• Restrict traffic use
Habitat fragmentation by roads	• Where possible, minimize road right-of-way width – at least through older stands

Potential Impact	Mitigation
	• Where possible, maintain interlinking forest canopy over roads

5.2 Turtles and Snakes

Blanding's Turtle habitat consists of marshes, ponds, slough forest habitats, slow-moving streams and lakes, usually with abundant vegetation and soft organic substrate (OMNR 2013).Blanding's Turtles overwinter in bogs, fens, marshes, ponds, channels or other habitats with free (unfrozen) shallow water and commonly bask in spring. Hibernation takes place from late October to ice–off. Nesting occurs in late May to early July. Adults disperse from hibernation sites to summer habitat in April and return in September (OMNR 2013).

No Blanding's Turtles were observed during 2013 surveys (Figure 18; Appendix 1, Appendix 8), although potential habitat is present and the site is within the species' range. A turtle that could not be identified with certainty was observed at site 1 (bridge at Darkie Creek) in June 2013 with Painted Turtles and Snapping Turtles. Repeated subsequent surveys at this location observed only Snapping and Painted turtles. Nonetheless, this will be treated as potential Blanding's Turtle habitat. This site is > 5 km west of the proposed new road options.

Snapping Turtles were observed at a number of sites and appear to be relatively common in the study area (Figure 19).Snapping Turtle habitat consists ofstill or slow-moving water with a soft mud bottom and dense aquatic vegetation (COSEWIC 2008). Both these turtle species move to well-drained soils to lay eggs in late May or June.

Milksnake is known to occur in the general area (Oldham and Weller. 2000 but was not observed in 2013. This species lives in a wide range of habitats, usually including non-forested areas especially old fields and farm buildings where rodents are common (OMNR 2010, Rowell 2012). Milksnakes lay eggs in warm locations in large logs and stumps, decaying leaf piles, sandy areas, rocks, and rock crevices (OMNR 2010, Rowell 2012). Hibernation sites include animal burrows, rock crevices, caverns, or subterranean spaces in wetlands (OMNR 2010).

Massassauga is known to occur north of Georgian Baybut the study area is > 20 km from any critical habitat as determined in the national recovery strategy (Parks Canada Agency 2013). Massassauga is a habitat generalist using a variety of habitat types, although generally avoiding dense forest (Parks Canada Agency 2013). Hibernation sites include rodent and crayfish burrows, root systems, rock crevices, and sphagnum hummocks which provide insulated and moist microclimates where individuals can avoid freezing and dehydration (Parks Canada Agency 2013).Massassaugas bear live young and gravid females seek warm refuges such as large rock, beaver lodge, stump, brush or debris pile.

The suggested mitigation measures in Table 11 are consistent with OMNR's *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (OMNR 2010). Mitigation measures are similar for the two turtle species and two snakes and mainly related to threats from direct road mortality. Should Blanding's Turtle or Massassauga be discovered in the study area, OMNR will be immediately consulted.

Table 11.Potential impacts and mitigation for snake and turtle species.

Potential Impact	Mitigation
Traffic mortality (all species)	During the active season (May 1 to Sep 30): • Modify driver behaviour (warning signs, awareness training) • Reduce traffic through access control • Restrict speed (training, signs, speed control devices • Avoid conducting road maintenance work
Traffic mortality (turtle species)	• Build roads at least 150 m from suitable summer habitat for Blanding's Turtle or Snapping Turtle.
Disturbance to nests (turtle species)	• Do not disturb road bed during nesting and incubation period (June 1 – September 30) within 150 m of suitable summer habitat or road areas known/suspected nesting sites
Aquatic habitat disturbance	• No water drawdowns for dust control in suitable aquatic habitat • Dust control using only water within 150m of suitable habitat
Threats to hibernacula (Milksnake and Massassauga)	If hibernacula are discovered: • No new roads within 50m of hibernacula • No road maintenance within 50m of hibernacula during September 1 – October 15 or April 15 – June 1 • Avoid new roads51-100m of hibernacula • No road construction within 30 m of hibernacula • Avoid new roads during entrance or emergence period
Gestation/oviposition (Milksnake and Massassauga)	If gestation or oviposition sites are discovered: • No new roads, landings, pits within 50 m • No road maintenance within 50 m from June 1 – October 15

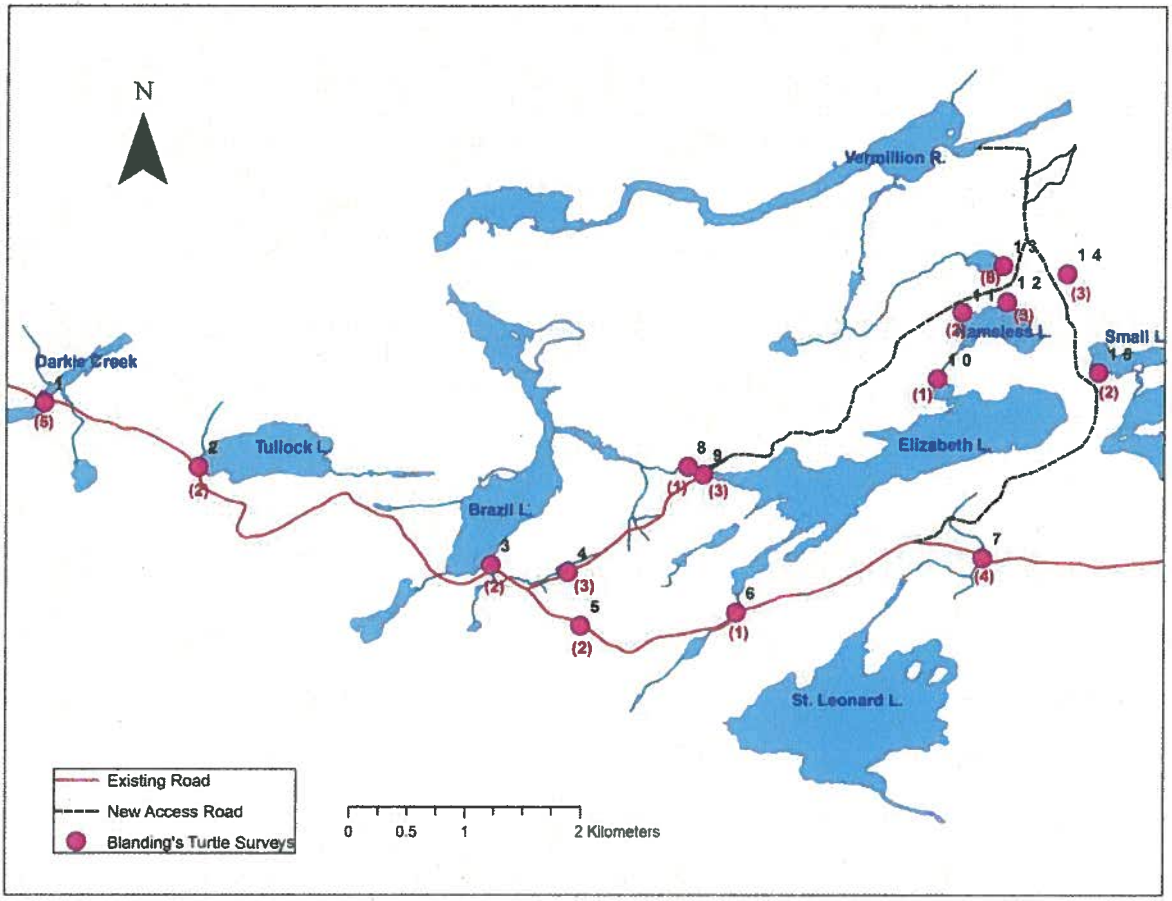

Figure 19. Blanding's Turtle survey effort, Wabageshik 2013. The number of surveys is indicted in red parentheses. See Appendix 1 for details and Appendix 8 for additional survey effort.

5.3 Whip-poor-will

Whip-poor-wills were detected at all three sound recorders in May 2013 (Figure 2) and subsequent follow up surveys in June 2013 (see Appendix 8). The distance and direction of the calling birds cannot be determined from the recordings but all three recorders were positioned on open rock knobs with little surrounding forest cover and the birds could have been calling from > 500 m away.

This ground-nesting species prefers rock or sand barrens with scattered trees, savannahs, old burns, and open conifer plantations (COSEWIC 2009, Mills 2007). Whip-poor-wills appear to avoid extensive areas of pure conifers, preferring young aspen-birch stands, successional areas, and hardwood and mixedwood stands. They prefer even-aged, young stands (up to pole age) and typically do not nest in mature stands (Sandilands 2010). Most nesting occurs in dry habitats, and rock outcrops adjacent to or in extensive forests may provide good nesting habitat (Sandilands 2010 and references therein). There is potentially suitable habitat throughout much

of the Wabageshik study area, including open bedrock knobs, and wetlands interspersed with forest cover.

Table 12 includes potential impacts and mitigation. Xeneca will work with MNR to designate appropriate buffers around Whip-poor-will habitat.

Table 12. Potential impacts and mitigation for Whip-poor-wills

Potential Impact	Mitigation
Habitat loss	• Minimize road corridor width (15 m or less) • Revegetate temporary roads and construction areas after construction
Destruction of nests	• Road construction should be completed during non-breeding season (mid-August to early-May)
Disruption of breeding	• Complete road construction and maintenance during non-breeding season (mid-August to early-May to minimize noise disturbance • Modify driver behaviour (warning signs, awareness training) • Reduce traffic through access control • Restrict speed (training, signs, speed control devices • restrict night use of roads during the nesting season

5.4 Forest Nesting Birds

Two forest nesting bird species at risk were discovered in the study area in 2013 (Canada Warbler, Eastern Wood-Pewee). Several other species occur in the area and are potentially present since suitable habitat occurs (Golden-winged Warbler, Common Nighthawk, Olive-sided Flycatcher, Rusty Blackbird, Wood Thrush).

The proposed project will result in the loss of about 6 ha of forest habitat, primarily hardwood and mixedwood stands on silty soil (ecosites G101, 104, and 107) and very shallow soil ecosites (G101, G104) (Table 2). The area will be distributed over a corridor about 5 km long.

The impacts of the road on the bird species will be variable, but probably not significant at the population level given the small amount of habitat involved. Canada Warbler and Eastern Wood-Pewee are apparently not highly sensitive to forest fragmentation and will inhabit small woodlots and forest edges, at least in landscapes that are primarily forested (COSEWIC 2008b, McLaren 2007). Similarly, Common Nighthawk nests in open rock barrens, clearings and cutovers where roads are present (Sandilands 2007). Golden-winged Warbler nests on clearing, edges, wet thickets, and early successional forest (COSEWIC 2006a). Olive-sided Flycatcher and Rusty Blackbird nest in forested wetland and edges (COSEWIC 2007, COSEWIC 2006b). The proposed road is not expected to have significant effects on these species. Wood Thrush may be more sensitive to forest fragmentation, but given the small area involved and the relatively low road density in the vicinity impacts are not expected to be significant.

Table 13 shows proposed mitigation techniques to minimize impacts on these and other forest nesting bird species. Disturbance impacts and risks of destroying nests can be minimized if road construction is completed in the non-breeding season (approximately mid-August to early-May).

Table 13.Potential impacts and mitigation for forest nesting birds.

Potential Impact	Mitigation
Habitat loss	• Minimize road corridor width (15 m or less) • Revegetate temporary roads and construction areas after construction
Destruction of nests	• Road construction should be completed during non-breeding season (mid-August to early-May
Disruption of breeding	• Complete road construction and maintenance during non-breeding season (mid-August to early-May to minimize noise disturbance • Modify driver behaviour (warning signs, awareness training) • Reduce traffic through access control • Restrict speed (training, signs, speed control devices

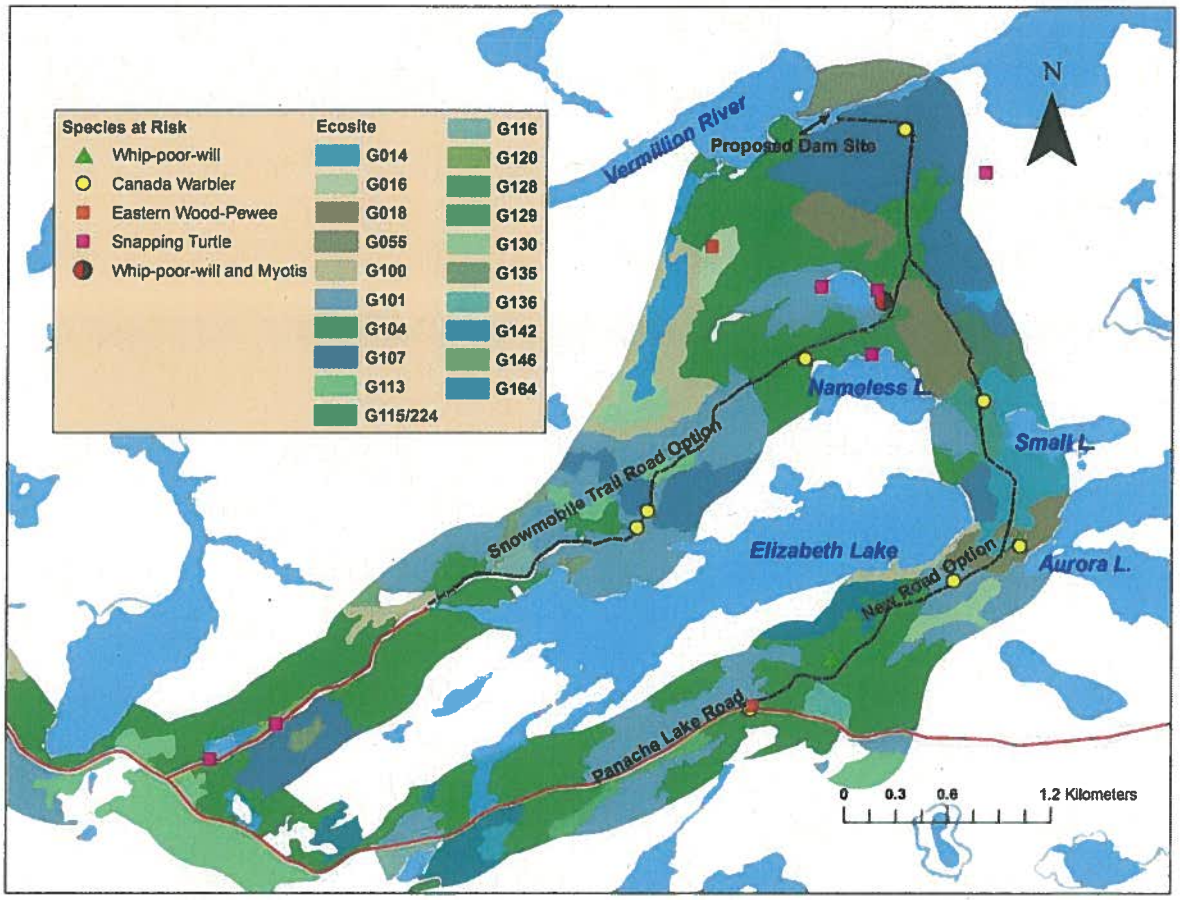

Figure 20. Location of species at risk observed during 2013 fieldwork.

5.5 Marsh Nesting Birds

Several marsh nesting bird species at risk, including Black Tern, Least Bittern, Yellow Rail, and Short-eared Owl were not observed in 2013, but occur in the surrounding area (Northshore Forest Inc. 2009, OBBA 2013) and suitable habitat is present in the study area.

These species have specific nesting habitat requirements, but all need relatively large marshes or graminoid fens. Mitigation measures are described in Table 14.

Table 14.Potential impacts and mitigation for marsh birds.

Potential Impact	Mitigation
Loss of habitat	• No wetland construction in marsh habitat
Disturbance	• Roads at least 20 m from potential habitat • Timing restrictions on road building...
Disruption of breeding	• Complete road construction and maintenance during non-breeding season (mid-August to early-May to minimize noise disturbance • Modify driver behaviour (warning signs, awareness training) • Reduce traffic through access control • Restrict speed (training, signs, speed control devices
Wetland habitat disturbance	• No water drawdowns for dust control in suitable wetland habitat • Dust control using only water within 150m of suitable habitat

5.6 Provincially Significant Wetlands

A "rapid assessment" of wetlands within 500 m of proposed roads lines at the Wabageshik Hydroelectric project was completed in 2013 (Harris 2013). A predictive model developed by the Ontario Ministry of Natural Resources (Chisholm et al. 1995, Davies et al. 1996) was used to identify those wetlands likely to be provincially significant according to the Northern Ontario Wetland Evaluation System (OMNR 1993). Two wetlands (Wetland 3and Wetland 6 in Harris 2013) are predicted to be provincially significant (Wetland 3extends from the west end of Elizabeth Lake to Brazil Lake and is transected by the Snowmobile Trial Road option (Figure 20). Wetland 6 is crossed by the Panache Lake Road near the south end of the New Road option (Figure 21).

Potential impacts on wetland functions and proposed mitigation are outlined in **Table 15**.

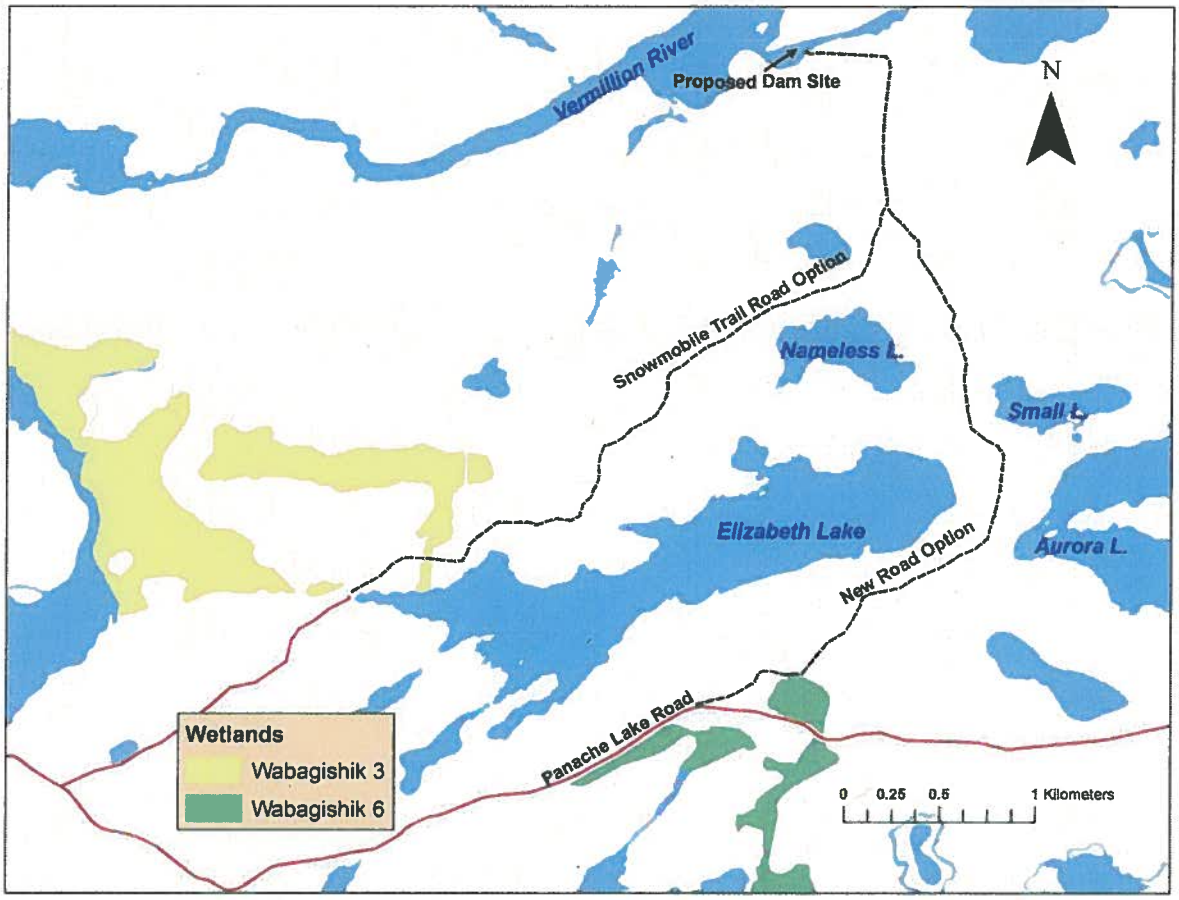

Figure 21. Potentially provincially significant wetlandsat Wabageshik study area.

Table 15.Potential impacts on wetland functions.

Potential Impact	Mitigation
General	• Transmission lines following existing roads should utilize the existing right of way. • Where possible, place the transmission line on the side of the road opposite the wetland
Diversion of water into or out of the wetland.	• Maintain the existing ditch channels to maintain the present water movement. Avoid making the ditches any deeper or wider
Loss of wetland vegetation along new road and transmission line.	• Restore and maintain low vegetation (low shrubs, graminoids) on the transmission line right of way. • Use passive revegetation through the existing seed bank where possible. • Replant trees where feasible, particularly Black Spruce and Tamarack
Compaction and rutting of peat during construction potentially leading to (i) alteration of surface water movement (ii) increased invasive plants.	• Use equipment and techniques to minimize compaction and rutting. • Winter construction on frozen ground will also reduce soil damage
Increases in invasive plant species.	• Rehabilitation should avoid the use of invasive plant species. Reed Canary Grass (*Phalaris arundinacea*) in particular should be avoided since it is highly invasive in northern Ontario wetlands. • Minimize soil rutting as described above

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Appendix 1. Blanding's Turtle survey effort, Wabageshik study area 2013. Refer to Figure 18 for locations. See Appendix 8 for additional survey details.

Site	Obs.	Date	Weather	Start Time	End Time	Duration (min)	Pers-Min's	Notes
1	SH	June 11	overcast, 23 C	14:50	15:00	10	10	no turtles, parking lot at Darkie Creek
1	SH/RFF	June 11	overcast, 23 C	15:04	15:12	8	16	7 PATU, south side of road
1	SH/RFF	June 11	ptly cloudy, 25 C	15:13	15:21	8	16	no turtles, north side of road.
1	SH/RFF	June 11	partly cloudy, 25 C	15:22	15:28	6	12	1 PATU, by fishing dock, Black Creek Picnic Area
2	SH/RFF	June 11	partly cloudy, 25 C	15:30	15:40	10	20	no turtles
3	SH/RFF	June 11	partly cloudy, 25 C	15:50	15:55	5	10	no turtles
5	SH/RFF	June 11	partly cloudy, 25 C	15:56	16:02	6	12	3 PATU
7	SH/RFF	June 11	overcast, 23 C	16:05	16:15	10	20	no turtles
11	SH	June 12	partly cloudy, 16C	8:00	8:15	15	15	walked along shoreline; no turtles seen
11	SH/RFF	June 12	partly cloudy, 22C	15:18	15:23	5	10	1 large SNTU 8 m offshore; scanned from overlook
11	SH/RFF	June 12	partly cloudy, 22C	15:18	15:23	5	10	1 large SNTU 8 m offshore; scanned from overlook
16	SH/RFF	June 12	clear, 19C	13:20	14:00		15	periodic checks along creek system; no turtles seen
9	SH/RFF	June 12	Sunny 22, C	16:00	16:15	15	30	no turtles
4	SH	June 12	Sunny 22, C	16:20	16:30	10	10	no turtles
	SH	June 12	Sunny 22, C	16:35	16:40	5	5	1 PATU
7	SH	June 12	Sunny 23, C	16:45	16:48	3	3	no turtles, checked shoulders for nests (40-50m each side)
1	SH	June 12	Partly cloudy 22, C	17:05	17:17	12	12	10 PATU, An unknown turtle species in shallow water; couldn't rule out Blanding's Turtle
13	SH	June 12	sunny, 18C	8:45	9:35	50	50	1 PATU
14	SH/RFF	June 12	partly cloudy, 17C, Beauf 2	10:10	10:45	35	55	no turtles, northern watersnake basking, lots of GRFR calling
13	SH/RFF	June 12	Partly cloudy,	14:50	15:08	18	20	4 PATU

Site	Obs.	Date	Weather	Start Time	End Time	Duration (min)	Pers-Min's	Notes
			24 C					
15	SH/RFF	June 13	sunn,y 22C	10:40	11:00	20	40	1 PATU swam by; rocky, deep lake with little wetland
1	AGH	June 13	partly cloudy, 20 C	11:00	11:30	30	30	8 PATU, 2 roadkilled SNTU
7	AGH	June 13	partly cloudy, 20 C	11:45	12:15	30	30	no turtles
4	AGH	June 13	partly cloudy, 20 C	12:25	12:50	25	25	1 SNTU
9	AGH	June 13	partly cloudy, 21 C	13:00	13:35	35	35	no turtles
incidental	AGH	June 13	partly cloudy, 21 C					SNTU on raod
1	AGH, SH	June 13	partly cloudy, 21 C	14:30	15:15	45	90	8 PATU, 1 SNTU, 2 roadkilled SNTU
Incidental	SH/RFF	June 13	partly cloudy, 21 C	11:05				1 SNTU, on trail, ~12cm long
13	SH/RFF	June 13	partly cloudy, 21 C	12:30	12:55	25	50	4 PATU, full lap of pond including 3 downstream ponds
14	SH/RFF	June 13	sunny, 22C, Beauf 2	11:55	12:15	20	40	no turtles, lots of GRFR calling
11	SH/RFF	June 13	partly cloudy, 22C	13:05	13:10	5	10	no turtles; BUFR calling
Incidental	SH/RFF	June 13	sunny, 22C, Beauf 2	13:18				1 SNTU (~15 cm TL); on trail in puddle, ~15cm long
Incidental	SH/RFF	June 13	sunny, 22C, Beauf 2	13:28				1 SNTU (~10 cm TL); in 2x15 m roadside ditches along trail
14	AGH	June 14	clear, 18 C	10:15	10:45	30	30	no turtles
12	AGH	June 14	clear, 18 C	11:10	11:20	10	10	1 SNTU
6	AGH	June 14	clear, 19 C	12:30	12:45	15	15	no turtles
5	AGH	June 14	clear, 19 C	12:50	13:05	15	15	2 PATU
2	AGH	June 14	clear, 19 C	13:20	13:40	20	20	no turtles
1	AGH, SH	June 14	clear, 20 C	13:50	14:08	18	36	6 PATU
11	SH	June 14	clear	9:05	9:13	8	8	no turtles, slightly windy and wavy
12	SH	June 14	clear	8:53	8:58	5	5	no turtles

Site	Obs.	Date	Weather	Start Time	End Time	Duration (min)	Pers-Min's	Notes
10	SH	June 14	clear, 18 C	9:57	10:15	18	18	no turtles
8	SH	June 14	clear, 18 C	11:08	11:13	5	5	1 PATU
9	SH	June 14	clear, 19 C	11:22	11:37	15	15	no turtles
4	SH	June 14	clear, 19 C	12:07	12:20	13	13	no turtles, breezy
7	SH	June 14	clear, 19 C	12:35	1:05	30	30	no turtles, breezy
3	SH	June 14	clear, 19C	13:20	13:45	25	25	1 PATU
13	SH	June 14	clear	8:05	8:43	28	28	No turtles, air T still very cool, walked 1/2 of pond
15	AGH	May 14	overcast, 9 C	13:25	13:40	15	15	no turtles
12	AGH	May 14	overcast, 9 C	16:40	16:55	15	15	no turtles
14	AGH	May 15	overcast, 9 C	8:30	9:10	40	40	no turtles
13	AGH	May 15	clear, 14 C	13:20	14:05	45	45	3 SNTU, 1 dead SNTU, 10 PATU
11	RFF	May 14	overcast 9 C	10:05	10:15	10	10	no turtles; scanned from overlook
13	RFF	May 14	overcast 11 C	10:20	10:30	10	10	no turtles; scanned from trail
13	RFF	May 14	overcast 11 C	10:20	10:30	10	10	no turtles; scanned from trail
15	RFF	May 14	overcast 11 C	15:00	15:25	25	25	walked along shoreline; no turtles seen

Appendix 2. Bat monitoring data, Wabageshik May 2013. Refer to Figure 2for locations.

Date	Start Time	Timer	Species	Note	Duration (ms)	Interpulse Interval (ms)	Min Freq (kHz)	Max Freq (kHz)	Distance
May 15 2013	21:30	13:39	Big Brown / Silver-haired		3.9	125	28	52?	close
May 15 2013	21:30	17:58	Bat sp.				27		distant
May 15 2013	21:30	18:02	Big Brown / Silver-haired				26		distant
May 15 2013	21:30	22:34	Bat sp.				26		distant
May 15 2013	21:30	23:26	Big Brown / Silver-haired		2.8	187	26	40	close
May 15 2013	21:30	24:35	Big Brown / Silver-haired		1.8	156	26	36	close
May 15 2013	21:30	24:35	Big Brown / Silver-haired		0.9	102	37	62	close
May 15 2013	21:30	24:52	Bat sp.				26		distant
May 15 2013	21:30	28:12	Bat sp.						distant
May 15 2013	21:30	31:01	Bat sp.						distant
May 15 2013	21:30	39:16	Myotis sp.		1	113	37	59	medium
May 15 2013	21:30	50:00	Bat sp.						distant
May 15 2013	21:30	50:25	Myotis sp.						medium
May 15 2013	21:30	52:13	Big Brown / Silver-haired						medium
May 16 2013	21:30	03:16	Myotis sp.						close
May 16 2013	21:30	13:42	Myotis sp.		3.8	98	32	72	close
May 16 2013	21:30	19:56	Myotis sp.		3	107	36	64	close
May 16 2013	21:30	47:18	Bat sp.						distant
May 16 2013	21:30	34:36	Bat sp.						distant
May 17 2013	21:30	06:53	Myotis sp.		4.5	104	38	70	close
May 17 2013	21:30	42:26	Bat sp.						distant
May 17 2013	21:30	46:24	Bat sp.						close
May 17 2013	21:30	17:08	Big Brown / Silver-haired				25	40	medium
May 17 2013	21:30	23:12	Myotis sp.		5.4	107	40	80	close
May 17 2013	21:30	27:13	Myotis sp.		4.6	104	38	74	close
May 18 2013	21:30	26:20	Myotis sp.		0.9	64	35	62	medium

Date	Start Time	Timer	Species	Note	Duration (ms)	Interpulse Interval (ms)	Min Freq (kHz)	Max Freq (kHz)	Distance
May 18 2013	21:30	17:46	Myotis sp.		0.9	64	35	62	medium
May 18 2013	21:30	26:38	Myotis sp.		3.6	85	36	63	close
May 18 2013	21:30	26:40	Myotis sp.		1.6	40	37	70	medium
May 19 2013	21:30	57:49	Myotis sp.						distant
May 20 2013	21:30			Rain					
May 21 2013	21:30	00:08	Big Brown / Silver-haired		6.5	122	27	56	close
May 21 2013	21:30	10:08	Myotis sp.		4.3	97	40	76	close
May 22 2013	21:30	57:15	Myotis sp.		3.2	81	38	74	medium
May 23 2013	21:30			Rain and wind					
May 24 2013	21:30	11:55	Bat sp.			177	37	65	medium
May 25 2013	21:30	40:22	Myotis sp.		5.3	102	34	70	close
May 25 2013	21:30	15:16	Big Brown / Silver-haired		6.1	114	27	62	close
May 25 2013	21:30	29:48	Myotis sp.		3.8	101	38	84	close
May 25 2013	21:30	35:42	Hoary Bat				20	28	distant
May 26 2013	21:30	44:49	Bat sp.						distant
May 26 2013	21:30	34:59	Hoary Bat		7.5	104	20	28	close
May 27 2013	21:30	35:50	Myotis sp.		2.9	101	37	64	close
May 27 2013	21:30	15:10	Bat sp.						distant
May 28 2013	21:30	05:13	Myotis sp.	Rain	2.7	98	37	62	medium
May 28 2013	21:30	13:48	Big Brown / Silver-haired		5.5	217	25	42	close
May 28 2013	21:30	21:03	Big Brown / Silver-haired		4.3	126	27	50	medium

Appendix 3. Bird species of the Wabageshik area.

Species listed under "Field Observations" were observed in 2013. Other columns are Ontario Breeding Bird Atlas bird species data for the atlas squares encompassing the Wabageshik area (OBBA 2013).Square 17MM52 is centred on the study area.

Species	17MM41	17MM42	17MM51	17MM52	Field Observation
Alder Flycatcher	S	S		T	S
American Bittern	S	T		H	S
American Black Duck	P			P	
American Crow	AE	FY	P	T	H
American Goldfinch	P	T	T	T	
American Kestrel	H	H		T	
American Redstart	S	P	T	CF	S
American Robin	S	CF	NU	FY	S
American Woodcock	S	NE		S	
Baltimore Oriole		S	P		
Barn Swallow	H	FY			
Barred Owl		S	T		
Bay-breasted Warbler		S			
Belted Kingfisher	CF	FY	NU	CF	H
Black-and-white Warbler	S	S	A	H	S
Black-billed Cuckoo	S	S	H	S	
Blackburnian Warbler	S		A	A	
Black-capped Chickadee	D	P	P	H	P
Black-throated Blue Warbler	S	P	A	T	S
Black-throated Green Warbler	S	T	S	T	S
Blue Jay	H	CF	CF	H	H
Blue-headed Vireo	S	T	S		S
Blue-winged Teal				P	
Bobolink		S		A	
Broad-winged Hawk	D	P	T	AE	H
Brown Creeper	H	H	P		
Brown Thrasher		T			
Brown-headed Cowbird	H	D			
Canada Goose	H	FY	P	FY	H
Canada Warbler		S	S	H	S
Cape May Warbler					H
Caspian Tern					X
Cedar Waxwing	P	P	P	H	H
Chestnut-sided Warbler	S	CF	CF	CF	S
Chimney Swift		FY	T		

Species	17MM41	17MM42	17MM51	17MM52	Field Observation
Chipping Sparrow	S	CF	T	FY	
Cliff Swallow		AE		AE	
Common Goldeneye	H	H			
Common Grackle	H	CF	H	H	H
Common Loon	FY	NE	FY	FY	H
Common Merganser	AE	FY		H	H
Common Nighthawk		T			
Common Raven	AE	AE	FY	T	
Common Snipe	S	S			
Common Yellowthroat	S	A	CF	P	S
Cooper's Hawk			H		
Double-crested Cormorant		H			
Downy Woodpecker	H	FY	NU	H	H
Eastern Bluebird		AE			
Eastern Kingbird	P	T	P	AE	P
Eastern Phoebe	AE	AE	CF	H	S
Eastern Wood-Pewee	D		S		S
European Starling	FY	FY	FY	H	
Evening Grosbeak	P	T	P		
Golden-crowned Kinglet			H	H	
Golden-winged Warbler				S	
Gray Catbird	S	T		H	
Gray Jay				H	
Great Blue Heron	H	H			H
Great Crested Flycatcher	S	P	S	AE	S
Great Horned Owl		NY	H		H
Green-winged Teal				P	
Hairy Woodpecker	H	NY	P	H	H
Hermit Thrush	S	T	T	S	S
Herring Gull	H	H			X
Hooded Merganser	H	D	H	FY	P
House Sparrow		H			
House Wren		S			
Indigo Bunting	S	T	S	S	
Killdeer	H	A		A	
Least Flycatcher	S	D	CF	S	S
Lesser Scaup		H			
Magnolia Warbler	S	D	A	H	S
Mallard	H	AE	FY	H	P
Marsh Wren		S			

Species	17MM41	17MM42	17MM51	17MM52	Field Observation
Merlin	H	CF	H	H	
Mourning Dove		FY		P	
Mourning Warbler	S	S	T	CF	S
Nashville Warbler	S	S	T	CF	S
Northern Cardinal		S			
Northern Flicker	H	D	CF	AE	H
Northern Harrier		T		CF	
Northern Parula					S
Northern Waterthrush	S		P		S
Olive-sided Flycatcher		T	S		
Osprey	AE	CF	NY	H	
Ovenbird	S	T	T	T	S
Philadelphia Vireo	S		S	T	S
Pied-billed Grebe		H		P	S
Pileated Woodpecker	T	T	H	S	H
Pine Siskin		T			
Pine Warbler	S		A	CF	
Purple Finch	P	CF	D	S	S
Red-breasted Nuthatch	S	T	A	H	H
Red-eyed Vireo	D	T	FY	CF	
Red-shouldered Hawk	S				
Red-tailed Hawk	H	S	H	T	H
Red-winged Blackbird	CF	D	S	CF	S
Ring-billed Gull		H			X
Ring-necked Duck	P	P	FY		P
Rock Pigeon		FY			
Rose-breasted Grosbeak	S	S	CF	P	S
Ruby-crowned Kinglet	S	H		S	
Ruby-throated Hummingbird	D	FY	T	H	H
Ruffed Grouse	S	FY	T	H	
Sandhill Crane	P	FY	H		X
Savannah Sparrow		S		S	
Scarlet Tanager	S		T	H	
Sedge Wren		S			
Sharp-shinned Hawk				CF	
Solitary Sandpiper					X
Song Sparrow	S	T	CF	T	S
Sora	S			T	
Spotted Sandpiper		P	A		H
Swainson's Thrush		S	T		S

Species	17MM41	17MM42	17MM51	17MM52	Field Observation
Swamp Sparrow	S	T	CF	T	S
Tennessee Warbler					H
Tree Swallow	FY	AE	AE	AE	
Turkey Vulture		T	H		H
Veery	S	T	T	T	S
Vesper Sparrow		S		S	
Virginia Rail				T	
Warbling Vireo			S		
Whip-poor-will	H	T			S
White-breasted Nuthatch	S	T			
White-throated Sparrow	S	T	CF	P	S
Willow Flycatcher	S				
Winter Wren	S	T	T	S	S
Wood Duck	H	FY	H	FY	P
Wood Thrush		T	T		
Yellow Warbler	S	CF	S	P	
Yellow-bellied Sapsucker	NY	T	NY	AE	H
Yellow-billed Cuckoo				S	
Yellow-rumped Warbler	S	T	S	P	S

A Agitated behaviour or anxiety calls of an adult
AE Adult leaving or entering nest sites in circumstances indicating occupied nest
CF Adult carrying food for young
D Courtship or display
FY Recently fledged or downy young, including incapable of sustained flight
H Species observed in its breeding season in suitable nesting habitat
NE Nest containing eggs
NU Used nest
NY Nest containing young
P Pair observed in suitable nesting habitat in nesting season
S Singing male(s) present, or breeding calls heard, in suitable nesting habitat in breeding season
T Territorial behaviour

Appendix 4. Mammals observed in theWabageshik area in 2013.

Smooth-faced Bats	**FAMILY VESPERTILIONIDAE**
Hoary Bat	*Lasiurus cinereus*
Silver-haired Bat or Big Brown Bat	*Lasionycteris noctivagans or Eptesicus fuscus*
Myotis sp.	*Myotis* sp.
Rabbits and Hares	**FAMILY LEPORIDAE**
Snowshoe Hare	*Lepus americanus*
Squirrels	**FAMILY SCIURIDAE**
Eastern Chipmunk	*Tamias striatus*
Red Squirrel	*Tamiasciurus hudsonicus*
Beavers	**FAMILY CASTORIDAE**
Beaver	*Castor canadensis*
New World Porcupines	**FAMILY ERITHIZONTIDAE**
Porcupine	*Erethizon dorsatum*
Dogs	**FAMILY CANIDAE**
Coyote	*Canis latrans*
Red Fox	*Vulpes vulpes*
Bears	**FAMILY URSIDAE**
Black Bear	*Ursus americanus*
Weasels and Their Allies	**FAMILY MUSTELIDAE**
River Otter	*Lutra candensis*
Deer	**FAMILY CERVIDAE**
Moose	*Alces alces*
White-tailed Deer	*Odocoileus virginianus*
Raccoons	**FAMILY PROCYONIDAE**
Northern Raccoon	*Procyon lotor*

Appendix 5. Amphibians and reptiles observed in theWabageshik area in 2013.

AMPHIBIANS	
Lungless Salamanders	**FAMILY PLETHODONTIDAE**
Northern Redback Salamander	*Plethodon cinereus*
Toads	**FAMILY BUFONIDAE**
Eastern American Toad	*Bufo americanus americanus*
Treefrogs	**FAMILY HYLIDAE**
Tetraploid Gray Treefrog	*Hyla versicolor*
Northern Spring Peeper	*Pseudacris crucifer crucifer*
True Frogs	**FAMILY RANIDAE**
Wood Frog	*Rana sylvatica*
True Frogs	**FAMILY RANIDAE**
American Bullfrog	*Lithobates catesbeianus*
Green Frog	*Lithobates clamitans*
Northern Leopard Frog	*Lithobates pipiens*
REPTILES	
Colubrids	**FAMILY COLUBRIDAE**
Northern Water Snake	*Nerodia sipedon sipedon*
Eastern Garter Snake	*Thamnophis sirtalis*
Box and Water Turtles	**FAMILY EMYDIDAE**
Painted Turtle	*Chrysemys picta*
Snapping Turtles	**FAMILY CHELYDRIDAE**
Snapping Turtle	*Chelydra serpentina*

Appendix 6. Preliminary list of vascular plant species observed in theWabageshik area in 2013.

FAMILY EQUISETACEAE	**Horsetail Family**
Equisetum fluviatile L.	Water Horsetail
Equisetum scirpoides Michx.	Dwarf Scouring Rush
Equisetum sylvaticum L.	Woodland Horsetail
FAMILY DENNSTAEDTIACEAE	**Bracken Fern Family**
Pteridium aquilinum (L.) Kuhn	Bracken Fern
FAMILY DRYOPTERIDACEAE	**True Fern Family**
Dryopteris carthusiana (Vill.) H.P. Fuchs	Spinulose Shield-fern
Dryopteris marginalis (L.) A. Gray	Marginal Woodfern
Gymnocarpium dryopteris (L.) Newman	Oak Fern
Matteuccia struthiopteris (L.) Tod.	Ostrich Fern
Onoclea sensibilis L.	Sensitive Fern
Woodsia ilvensis (L.) R. Br.	Rusty Woodsia
FAMILY OPHIOGLOSSACEAE	**Succulent Fern Family**
Botrychium virginianum (L.) Swartz	Rattlesnake Fern
FAMILY OSMUNDACEAE	**Flowering Fern Family**
Osmunda claytoniana L.	Interrupted Fern
Osmunda regalis L.	Royal Fern
FAMILY LYCOPODIACEAE	**Clubmoss Family**
Diphasiastrum digitatum (Dill. ex A. Braun) Holub	Fan Club-moss
Lycopodium annotinum L.	Stiff Clubmoss
Lycopodium clavatum L.	Running Pine
Lycopodium dendroideum Michx.	Treelike Clubmoss
FAMILY CUPRESSACEAE	**Juniper Family**
Juniperus communis L.	Ground Juniper
Thuja occidentalis L.	Eastern White Cedar
FAMILY PINACEAE	**Pine Family**
Abies balsamea (L.) Miller	Balsam Fir
Larix laricina (Du Roi) K. Koch	American Larch
Picea glauca (Moench) Voss	White Spruce
Picea mariana (Miller) B.S.P.	Black Spruce
Pinus banksiana Lamb.	Jack Pine
Pinus resinosa Sol. ex Aiton	Red Pine
Pinus strobus L.	Eastern White Pine
Tsuga canadensis (L.) Carrière	Eastern Hemlock
FAMILY CYPERACEAE	**Sedge Family**
Carex crinita Lam.	Fringed Sedge

Carex intumescens Rudge	Bladder Sedge
Carex lacustris Willd.	Lake-bank Sedge
Carex stipata Muhlenb. ex Willd.	Stalk-grain Sedge
Carex vulpinoidea Michx.	Fox Sedge
FAMILY JUNCACEAE	**Rush Family**
Juncus effusus L.	Soft Rush
FAMILY LEMNACEAE	**Duckweed Family**
Lemna minor L.	Lesser Duckweed
FAMILY LILIACEAE	**Lily Family**
Clintonia borealis (Aiton) Raf.	Blue Bead-lily
Erythronium americanum Ker Gawl.	Yellow Trout-lily
Maianthemum canadense Desf.	Wild-lily-of-the-valley
Maianthemum racemosum (L.) Link	Feathery False Lily of the Valley
Streptopus lanceolatus (Aiton) Reveal	Rose Twisted-stalk
Trillium cernuum L.	Nodding Trillium
FAMILY POACEAE	**Grass Family**
Calamagrostis canadensis (Michx.) P. Beauv.	Blue-joint Reedgrass
Danthonia spicata (L.) P. Beauv. ex Roem. &	Poverty Oatgrass
Glyceria canadensis (Michx.) Trin.	Canada Mannagrass
Milium effusum L.	Tall Millet-grass
Oryzopsis asperifolia Michx.	White-grained Mountain-ricegrass
FAMILY POTAMOGETONACEAE	**Pondweed Family**
Potamogeton robbinsii Oakes	Flatleaf Pondweed
Stuckenia pectinata (L.) Borner	Sago Pondweed
FAMILY TYPHACEAE	**Cat-tail Family**
Typha angustifolia L.	Narrow-leaved Cattail
Typha latifolia L.	Broad-leaf Cattail
FAMILY ACERACEAE	**Maple Family**
Acer pensylvanicum L.	Striped Maple
Acer rubrum L.	Red Maple
Acer saccharinum L.	Silver Maple
Acer saccharum ssp. saccharum Marshall	Sugar Maple
Acer spicatum Lam.	Mountain Maple
FAMILY ANACARDIACEAE	**Sumac Family**
Rhus radicans L.	Poison Ivy
Rhus typhina L.	Staghorn Sumac
FAMILY APIACEAE	**Parsley Family**
Sium suave Walter	Hemlock Water-parsnip
FAMILY APOCYNACEAE	**Dogbane Family**
Apocynum androsaemifolium L.	Spreading Dogbane

FAMILY ARALIACEAE	**Ginseng Family**
Aralia hispida Vent.	Bristly Sarsaparilla
Aralia nudicaulis L.	Wild Sarsaparilla
FAMILY ASTERACEAE	**Sunflower Family**
Achillea millefolium L.	Yarrow
Arctium minus (Hill) Bernh.	Lesser Burrdock
Chrysanthemum leucanthemum L.	Oxeye Daisy
Cirsium arvense (L.) Scop.	Crepping Thistle
Cirsium vulgare (Savi) Ten.	Bull Thistle
Doellingeria umbellata (Mill.) Nees	Parasol Whitetop
Eupatorium maculatum L.	Spotted Joepyeweed
Eurybia macrophylla (L.) Cass.	Large-leaf Wood-aster
Symphyotrichum puniceum (L.) A.& D. Löve	Swamp Aster
Taraxacum officinale G. Weber	Brown-seed Dandelion
FAMILY BALSAMINACEAE	**Touch-me-not Family**
Impatiens capensis Meerb.	Spotted Jewel-weed
FAMILY BETULACEAE	**Birch Family**
Alnus incana (L.) Moench	Speckled Alder
Betula alleghaniensis Britton	Yellow Birch
Betula papyrifera Marshall	Paper Birch
Corylus cornuta Marshall	Beaked Hazelnut
Ostrya virginiana (Miller) K. Koch	Eastern Hop-hornbeam
FAMILY BRASSICACEAE	**Mustard Family**
Cardamine parviflora L.	Small-flower Bitter-cress
FAMILY CABOMBACEAE	**Water Shield Family**
Brasenia schreberi J. Gmel.	Watershield
FAMILY CAMPANULACEAE	**Harebell Family**
Campanula aparinoides Pursh	Marsh Bellflower
FAMILY CAPRIFOLIACEAE	**Honeysuckle Family**
Diervilla lonicera Miller	Northern Bush-honeysuckle
Linnaea borealis L.	Twinflower
Lonicera canadensis Bartram	American Fly-honeysuckle
Lonicera dioica L.	Mountain Honeysuckle
Sambucus canadensis L.	Common Elderberry
Viburnum rafinesquianum Schult.	Downy Arrowwood
Viburnum trilobum Marshall	Highbush Cranberry
FAMILY CORNACEAE	**Dogwood Family**
Cornus alternifolia L. f.	Alternate-leaf Dogwood
Cornus canadensis L.	Bunchberry
Cornus stolonifera Michx.	Red-osier Dogwood

FAMILY ERICACEAE	**Heath Family**
Chamaedaphne calyculata (L.) Moench	Leatherleaf
Epigaea repens L.	Trailing Arbutus
Gaultheria hispidula (L.) Muhlenb. ex Bigelow	Creeping Snowberry
Gaultheria procumbens L.	Teaberry
Kalmia angustifolia L.	Sheep-laurel
Vaccinium angustifolium Aiton	Late Lowbush Blueberry
Vaccinium myrtilloides Michx.	Velvetleaf Blueberry
FAMILY FAGACEAE	**Beech Family**
Quercus rubra L.	Northern Red Oak
FAMILY FUMARIACEAE	**Fumitory Family**
Corydalis sempervirens (L.) Pers.	Pale Corydalis
FAMILY GROSSULARIACEAE	**Currant Family**
Ribes lacustre (Pers.) Poir.	Bristly Black Currant
Ribes triste Pall.	Swamp Red Currant
FAMILY LAMIACEAE	**Mint Family**
Lycopus americanus Muhlenb. ex Bartram	American Bugleweed
FAMILY LENTIBULARIACEAE	**Bladderwort Family**
Utricularia vulgaris L.	Greater Bladderwort
FAMILY LYTHRACEAE	**Loosestrife Family**
Lythrum salicaria L.	Purple Loosestrife
FAMILY MYRICACEAE	**Bayberry Family**
Comptonia peregrina (L.) J.M. Coult.	Sweet Fern
Myrica gale L.	Sweet Bayberry
FAMILY NYMPHAEACEAE	**Water Lily Family**
Nuphar variegata Durand in Clinton	Yellow Cowlily
Nymphaea odorata ssp. odorata Aiton	White Water-lily
FAMILY ONAGRACEAE	**Evening-primrose**
Oenothera biennis L.	Common Evening-primrose
FAMILY PLANTAGINACEAE	**Plantain Family**
Plantago major L.	Nipple-seed Plantain
FAMILY POLYGALACEAE	**Milkwort Family**
Polygala paucifolia Willd.	Gay-wing Milkwort
FAMILY POLYGONACEAE	**Buckwheat Family**
Polygonum cilinode Michx.	Fringed Black Bindweed
Polygonum virginianum L.	Virginia Knotweed
Rumex acetosella L.	Common Sheep Sorrel
Rumex orbiculatus A. Gray	Water Dock

FAMILY PRIMULACEAE	**Primrose Family**
Trientalis borealis Raf.	Northern Starflower
FAMILY RANUNCULACEAE	**Buttercup Family**
Anemone acutiloba (DC.) G. Lawson	Liverleaf
Anemone canadensis L.	Canada Anemone
Aquilegia canadensis L.	Wild Columbine
Caltha palustris L.	Marsh Marigold
Coptis trifolia (L.) Salisb.	Goldthread
Thalictrum dioicum L.	Early Meadowrue
FAMILY ROSACEAE	**Rose Family**
Fragaria vesca L.	Woodland Strawberry
Fragaria virginiana Miller	Virginia Strawberry
Geum rivale L.	Purple Avens
Prunus pumila L.	Sand Cherry
Prunus virginiana L.	Choke Cherry
Rubus idaeus L.	Common Red Raspberry
Rubus pubescens Raf.	Dwarf Raspberry
Sorbus americana Marshall	American Mountain-ash
Spiraea alba Du Roi	Narrow-leaved Meadow-sweet
Waldsteinia fragarioides (Michx.) Tratt.	Barren Strawberry
FAMILY RUBIACEAE	**Bedstraw Family**
Galium mollugo L.	Great Hedge Bedstraw
FAMILY SALICACEAE	**Willow Family**
Populus balsamifera L.	Balsam Poplar
Populus grandidentata Michx.	Large-tooth Aspen
Populus tremuloides Michx.	Trembling Aspen
Salix bebbiana Sarg.	Bebb's Willow
Salix petiolaris Sm.	Meadow Willow
FAMILY SANTALACEAE	**Sandalwood Family**
Comandra umbellata (L.) Nutt.	Umbellate Bastard Toad-flax
FAMILY SAXIFRAGACEAE	**Saxifrage Family**
Mitella nuda L.	Naked Bishop's-cap
Saxifraga virginiensis Michx.	Virginia Saxifrage
FAMILY SCROPHULARIACEAE	**Figwort Family**
Verbascum thapsus L.	Great Mullein
FAMILY VITACEAE	**Grape Family**
Parthenocissus quinquefolia (L.) Planchon ex DC.	Virginia Creeper

Appendix 7. Fieldwork locations, Wabageshik study area, 2013. UTM Zone 17.

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
AGH-13-0088	14/05/2013			451277	5120627	254		
AGH-13-0089	14/05/2013			451298	5120638	254		
AGH-13-0090	14/05/2013			451496	5120751	263		G164
AGH-13-0091	14/05/2013			451540	5120824	259		
AGH-13-0092	14/05/2013			451627	5120714	249		G136
AGH-13-0093	14/05/2013			451686	5120808	261		
AGH-13-0094	14/05/2013			451769	5120872	267		G164
AGH-13-0095	14/05/2013			451773	5120881	266		
AGH-13-0096	14/05/2013	Sound Recorder		451750	5120916	277		G164
AGH-13-0097	14/05/2013			451832	5120949	261		
AGH-13-0098	14/05/2013			451895	5120979	256		G073
AGH-13-0099	14/05/2013			452111	5121064	250		
AGH-13-0252	14/05/2013			452219	5121063	226		
AGH-13-0252	14/05/2013			452219	5121063	226		G130
AGH-13-0253	14/05/2013			452220	5121063	226		
AGH-13-0253	14/05/2013			452220	5121063	226		
AGH-13-0254	14/05/2013			452220	5121063	226		
AGH-13-0254	14/05/2013			452220	5121063	226		
AGH-13-0255	14/05/2013			452340	5121190	242		
AGH-13-0255	14/05/2013			452340	5121190	242		
AGH-13-0256	14/05/2013			452340	5121193	242		
AGH-13-0256	14/05/2013			452340	5121193	242		
AGH-13-0257	14/05/2013			452548	5121369	244		
AGH-13-0257	14/05/2013			452548	5121369	244		G164
AGH-13-0258	14/05/2013			452658	5121369	226		
AGH-13-0258	14/05/2013			452658	5121369	226		G130
AGH-13-0259	14/05/2013			452702	5121413	240		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
AGH-13-0259	14/05/2013			452702	5121413	240		
AGH-13-0260	14/05/2013			452879	5121418	231		
AGH-13-0260	14/05/2013			452879	5121418	231		
AGH-13-0261	14/05/2013			452834	5121604	262		
AGH-13-0261	14/05/2013			452834	5121604	262		
AGH-13-0262	14/05/2013	Sound Recorder		452834	5121606	264		
AGH-13-0262	14/05/2013			452834	5121606	264		G018
AGH-13-0263	14/05/2013			452832	5121676	259		
AGH-13-0263	14/05/2013			452832	5121676	259		
AGH-13-0264	14/05/2013			452776	5121771	257		
AGH-13-0264	14/05/2013			452776	5121771	257		G014
AGH-13-0265	14/05/2013			452756	5121902	269		
AGH-13-0265	14/05/2013			452756	5121902	269		
AGH-13-0266	14/05/2013			452773	5121995	263		
AGH-13-0266	14/05/2013			452773	5121995	263		
AGH-13-0267	14/05/2013	Turtle Survey		452850	5122123	241		
AGH-13-0267	14/05/2013			452850	5122123	241		
AGH-13-0268	14/05/2013			452781	5122134	251		
AGH-13-0268	14/05/2013			452781	5122134	251		
AGH-13-0269	14/05/2013			452758	5122165	240		
AGH-13-0269	14/05/2013			452758	5122165	240		
AGH-13-0270	14/05/2013			452749	5122180	243		
AGH-13-0270	14/05/2013			452749	5122180	243		
AGH-13-0271	14/05/2013			452745	5122184	243		
AGH-13-0271	14/05/2013			452745	5122184	243		
AGH-13-0272	14/05/2013			452712	5122219	248		
AGH-13-0272	14/05/2013			452712	5122219	248		G066
AGH-13-0273	14/05/2013			452613	5122354	269		
AGH-13-0273	14/05/2013			452613	5122354	269		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
AGH-13-0274	14/05/2013			452612	5122389	253		
AGH-13-0274	14/05/2013			452612	5122389	253		G130
AGH-13-0275	14/05/2013			452699	5122425	266		
AGH-13-0275	14/05/2013			452699	5122425	266		G017
AGH-13-0276	14/05/2013			452680	5122543	273		
AGH-13-0276	14/05/2013			452680	5122543	273		G017
AGH-13-0277	14/05/2013			452628	5122623	267		
AGH-13-0277	14/05/2013			452628	5122623	267		G129
AGH-13-0278	14/05/2013			452593	5122688	259		
AGH-13-0278	14/05/2013			452593	5122688	259		G129
AGH-13-0279	14/05/2013			452606	5122805	259		
AGH-13-0279	14/05/2013			452606	5122805	259		G129
AGH-13-0280	14/05/2013			452607	5122874	255		
AGH-13-0280	14/05/2013			452607	5122874	255		
AGH-13-0281	14/05/2013	Turtle Survey		452623	5122957	260		
AGH-13-0281	14/05/2013			452623	5122957	260		
AGH-13-0282	14/05/2013			452414	5123062	257		
AGH-13-0282	14/05/2013			452414	5123062	257		
AGH-13-0283	14/05/2013			452229	5123102	270		
AGH-13-0283	14/05/2013			452229	5123102	270		G164
AGH-13-0284	14/05/2013			452193	5122929	265		
AGH-13-0284	14/05/2013			452193	5122929	265		
AGH-13-0285	14/05/2013			452086	5122721	227		
AGH-13-0285	14/05/2013			452086	5122721	227		
AGH-13-0286	14/05/2013	Turtle Survey		452026	5122720	223		
AGH-13-0286	14/05/2013			452026	5122720	223		
AGH-13-0287	14/05/2013			452011	5122710	225		
AGH-13-0287	14/05/2013			452011	5122710	225		
AGH-13-0288	14/05/2013			451702	5122766	235		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
AGH-13-0288	14/05/2013			451702	5122766	235		
AGH-13-0289	14/05/2013			451010	5122179	233		
AGH-13-0289	14/05/2013			451010	5122179	233		
AGH-13-0290	15/05/2013	Turtle Survey		451831	5120486	255		
AGH-13-0290	15/05/2013			451831	5120486	255		
AGH-13-0291	15/05/2013			450875	5122063	249		
AGH-13-0291	15/05/2013			450875	5122063	249		
AGH-13-0292	15/05/2013			450884	5122073	250		
AGH-13-0292	15/05/2013			450884	5122073	250		
AGH-13-0293	15/05/2013			452000	5122966	236		
AGH-13-0293	15/05/2013			452000	5122966	236		
AGH-13-0294	15/05/2013			452295	5124287	215		
AGH-13-0294	15/05/2013			452295	5124287	215		G055
AGH-13-0295	15/05/2013			451965	5124179	212		
AGH-13-0295	15/05/2013			451965	5124179	212		
AGH-13-0296	15/05/2013			451905	5124154	214		
AGH-13-0296	15/05/2013			451905	5124154	214		
AGH-13-0297	15/05/2013			451872	5124134	225		
AGH-13-0297	15/05/2013			451872	5124134	225		
AGH-13-0298	15/05/2013			451874	5124134	231		
AGH-13-0298	15/05/2013			451874	5124134	231		
AGH-13-0299	15/05/2013			451861	5124150	219		
AGH-13-0299	15/05/2013			451861	5124150	219		
AGH-13-0300	15/05/2013			451890	5124300	248		
AGH-13-0300	15/05/2013			451890	5124300	248		
AGH-13-0301	15/05/2013	Turtle Survey	Snapping Turtle	452008	5123057	229		
AGH-13-0301	15/05/2013		Snapping Turtle	452008	5123057	229		
AGH-13-0302	15/05/2013	Turtle Survey		451761	5123173	231		
AGH-13-0302	15/05/2013			451761	5123173	231		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
AGH-13-0303	15/05/2013		Snapping Turtle	451684	5123078	240		
AGH-13-0303	15/05/2013			451684	5123078	240		
AGH-13-0304	15/05/2013	Sound Recorder		452046	5122992	249		
AGH-13-0304	15/05/2013			452046	5122992	249		
AGH-13-0305	15/05/2013			451010	5122223	243		
AGH-13-0305	15/05/2013			451010	5122223	243		G101
AGH-13-0306	15/05/2013			450929	5122177	247		
AGH-13-0306	15/05/2013			450929	5122177	247		G104
AGH-13-0307	15/05/2013			450214	5121584	246		
AGH-13-0307	15/05/2013			450214	5121584	246		
AGH-13-0413	13/06/2013		Snapping Turtle	443719	5121830	196		
AGH-13-0414	13/06/2013			451837	5120492	249		
AGH-13-0415	13/06/2013			451742	5120400	248		
AGH-13-0416	13/06/2013		Snapping Turtle	448152	5120324	228		
AGH-13-0417	13/06/2013	Turtle Survey		449425	5121206	232		
AGH-13-0418	13/06/2013		Snapping Turtle	448535	5120528	254		
AGH-13-0419	14/06/2013	Point Count 1		450673	5122193	234		G119
AGH-13-0420	14/06/2013			452245	5123293	255		
AGH-13-0421	14/06/2013	Point Count 2		452178	5123523	251		G091
AGH-13-0422	14/06/2013	Point Count 3		452181	5123778	246		G090
AGH-13-0423	14/06/2013			452170	5123801	241		
AGH-13-0424	14/06/2013	Point Count 4	Canada Warbler	452163	5123992	231		G088
AGH-13-0425	14/06/2013			452524	5123919	216		
AGH-13-0426	14/06/2013			452387	5123064	276		
AGH-13-0427	14/06/2013			452463	5123040	271		
AGH-13-0428	14/06/2013	Point Count 5		452571	5122991	270		G088
AGH-13-0429	14/06/2013			452610	5122957	260		
AGH-13-0430	14/06/2013			452102	5122731	234		
AGH-13-0431	14/06/2013		Snapping Turtle	451978	5122684	233		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
AGH-13-0432	14/06/2013		Canada Warbler	450619	5121674	224		
AGH-13-0433	14/06/2013			449737	5120008	228		
AGH-13-0434	14/06/2013			448323	5119980	237		
AGH-13-0435	14/06/2013			445054	5121246	238		
AGH-13-099	14/05/2013			452111	5121064	250		
MJ-13-005	14/05/2013			451285	5120620	236		
MJ-13-006	14/05/2013			452248	5123585	239		
MJ-13-007	14/05/2013			452292	5123676	240		
MJ-13-008	14/05/2013	Snag Density		452288	5123769	235		
MJ-13-009	14/05/2013			452118	5123944	231	80	
MJ-13-010	14/05/2013			451843	5124026	232		
MJ-13-011	14/05/2013			451878	5123881	250		
MJ-13-012	14/05/2013			451879	5123859	250		
MJ-13-013	14/05/2013			451990	5123742	245		
MJ-13-014	14/05/2013			451961	5123658	254		
MJ-13-015	14/05/2013	Snag Density		452010	5123232	254	0	G017
MJ-13-016	14/05/2013			452064	5123194	265		
MJ-13-017	14/05/2013	Snag Density		452008	5123097	241		
MJ-13-018	14/05/2013	Snag Density		451655	5122982	243	20	G070
MJ-13-019	14/05/2013			451379	5122818	247	20	G052
MJ-13-020	14/05/2013			451345	5122830	246		G038
MJ-13-021	14/05/2013			451256	5122667	251		
MJ-13-022	14/05/2013			451137	5122609	240		
MJ-13-023	14/05/2013			451052	5122589	226		
MJ-13-024	14/05/2013			451030	5122537	225		
MJ-13-025	14/05/2013			451034	5122510	225		
MJ-13-026	14/05/2013			450983	5122418	223		
MJ-13-027	14/05/2013			451017	5122171	249		
MJ-13-028	14/05/2013			449773	5121378	241		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
MJ-13-029	15/05/2013			451295	5120660	260		
MJ-13-030	15/05/2013	Snag Density		451374	5120958	271	20	
MJ-13-031	15/05/2013	Snag Density		451567	5121014	282	0	G158
MJ-13-032	15/05/2013			451572	5121017	285		
MJ-13-033	15/05/2013	Snag Density		451690	5121013	276	40	
MJ-13-034	15/05/2013			451789	5121016	283		
MJ-13-035	15/05/2013	Snag Density		452012	5121156	262	0	G0158
MJ-13-036	15/05/2013	Snag Density		452324	5121196	244	0	G055
MJ-13-037	15/05/2013	Snag Density		452363	5121324	245	0	
MJ-13-038	15/05/2013	Snag Density		452545	5121445	260	0	G018
MJ-13-039	15/05/2013			452608	5121448	262		
MJ-13-040	15/05/2013			452553	5121595	265		
MJ-13-041	15/05/2013	Snag Density		452526	5121646	247	0	G051
MJ-13-042	15/05/2013			452622	5121906	268		G058
MJ-13-043	15/05/2013			452375	5122171	289		
RFF-13-0005	14/05/2013			449398	5121193	229		
RFF-13-0006	14/05/2013			449811	5121389	229		
RFF-13-0007	14/05/2013			449975	5121377	239		
RFF-13-0008	14/05/2013			450213	5121575	236		
RFF-13-0009	14/05/2013			450565	5121596	222		
RFF-13-0010	14/05/2013			451166	5122428	230		
RFF-13-0011	14/05/2013			451530	5122580	238		
RFF-13-0012	14/05/2013			451612	5122609	241		
RFF-13-0013	14/05/2013			451614	5122636	234		
RFF-13-0014	14/05/2013			451996	5122963	235		
RFF-13-0015	14/05/2013			452422	5123266	266		G058
RFF-13-0016	14/05/2013			452315	5123361	262		
RFF-13-0017	14/05/2013			452276	5123412	260		
RFF-13-0018	14/05/2013			452304	5123563	241		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
RFF-13-0019	14/05/2013	Snag Density		452301	5123627	233	0	G058
RFF-13-0020	14/05/2013			452348	5123735	232		
RFF-13-0021	14/05/2013			452350	5123768	235		
RFF-13-0022	14/05/2013			452294	5123847	221		
RFF-13-0023	14/05/2013			452238	5123890	236		
RFF-13-0024	14/05/2013			452145	5123955	233		
RFF-13-0025	14/05/2013	Snag Density		452095	5123984	230	20	G104
RFF-13-0026	14/05/2013			452030	5124067	212		
RFF-13-0027	14/05/2013			452018	5124091	212		
RFF-13-0028	14/05/2013			451921	5124119	223		
RFF-13-0029	14/05/2013			451844	5124087	221		
RFF-13-0030	14/05/2013			451891	5123983	245		
RFF-13-0031	14/05/2013			452090	5123811	233		
RFF-13-0032	14/05/2013			452152	5123789	230		
RFF-13-0033	14/05/2013	Snag Density		452183	5123756	237	20	G106
RFF-13-0034	14/05/2013	Snag Density		452194	5123684	243	40	
RFF-13-0035	14/05/2013			452191	5123663	237		
RFF-13-0036	14/05/2013			452196	5123658	248		
RFF-13-0037	14/05/2013			452221	5123599	238		
RFF-13-0038	14/05/2013			452207	5123577	238		
RFF-13-0039	14/05/2013			452184	5123508	245		
RFF-13-0040	14/05/2013			452224	5123409	255		
RFF-13-0041	14/05/2013	Snag Density		452194	5123352	270	0	
RFF-13-0042	14/05/2013			452187	5123346	268		
RFF-13-0043	14/05/2013			452165	5123317	257		G052
RFF-13-0044	14/05/2013			452180	5123194	237		
RFF-13-0045	14/05/2013	Snag Density		452167	5123155	252	0	G101
RFF-13-0046	14/05/2013			452155	5123123	258		
RFF-13-0047	14/05/2013			452058	5123031	248		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
RFF-13-0048	14/05/2013			452014	5123030	234		
RFF-13-0049	14/05/2013	Snag Density		452020	5122841	250	40	G107
RFF-13-0050	14/05/2013			452041	5122735	232		
RFF-13-0051	14/05/2013			451851	5122687	230		
RFF-13-0052	14/05/2013			451819	5122665	236		
RFF-13-0053	14/05/2013			451788	5122632	239		
RFF-13-0054	14/05/2013			451740	5122636	232		
RFF-13-0055	14/05/2013			451538	5122462	254		G052
RFF-13-0056	14/05/2013			451519	5122443	255		
RFF-13-0057	14/05/2013			451516	5122440	252		
RFF-13-0058	14/05/2013	Snag Density		451493	5122430	252	0	G107
RFF-13-0059	14/05/2013			451335	5122364	247		
RFF-13-0060	14/05/2013	Snag Density		451206	5122292	246	20	
RFF-13-0061	14/05/2013			451172	5122270	239		
RFF-13-0062	14/05/2013			451135	5122262	247		
RFF-13-0063	14/05/2013			451057	5122189	249		
RFF-13-0064	14/05/2013			451022	5122066	239		
RFF-13-0065	14/05/2013			450981	5121983	239		
RFF-13-0066	14/05/2013			450838	5121879	239		G107
RFF-13-0067	14/05/2013			450807	5121772	234		
RFF-13-0068	14/05/2013			450750	5121617	243		G101
RFF-13-0069	14/05/2013			450752	5121583	242		
RFF-13-0070	14/05/2013			450653	5121530	233		
RFF-13-0071	14/05/2013	Snag Density		450441	5121567	231	0	G052
RFF-13-0072	14/05/2013			450260	5121508	231		G135
RFF-13-0073	14/05/2013			450182	5121459	226		
RFF-13-0074	15/05/2013			451281	5120627	255		
RFF-13-0075	15/05/2013	Snag Density		451357	5120686	263	0	
RFF-13-0076	15/05/2013			451394	5120715	263		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
RFF-13-0077	15/05/2013	Snag Density		451411	5120756	264	0	G104
RFF-13-0078	15/05/2013			451432	5120796	263		
RFF-13-0079	15/05/2013			451526	5120840	251		
RFF-13-0080	15/05/2013	Snag Density		451547	5120811	267	0	
RFF-13-0081	15/05/2013			451589	5120826	254		
RFF-13-0082	15/05/2013	Snag Density		451657	5120841	262	80	
RFF-13-0083	15/05/2013			451683	5120779	241		G136
RFF-13-0084	15/05/2013			451767	5120760	245		
RFF-13-0085	15/05/2013			451851	5120810	250		
RFF-13-0086	15/05/2013			451915	5120899	255		
RFF-13-0087	15/05/2013			451915	5120925	256		
RFF-13-0088	15/05/2013			451916	5120935	261		
RFF-13-0089	15/05/2013	Snag Density		451906	5120954	250	0	
RFF-13-0090	15/05/2013	Snag Density		451947	5121005	255	60	G107
RFF-13-0091	15/05/2013			451945	5121032	257		
RFF-13-0092	15/05/2013	Snag Density		451962	5121098	264	0	G018
RFF-13-0093	15/05/2013			452115	5121175	242		
RFF-13-0094	15/05/2013			452146	5121153	245		
RFF-13-0095	15/05/2013			452189	5121154	231		
RFF-13-0096	15/05/2013			452239	5121111	230		G130
RFF-13-0097	15/05/2013	Snag Density		452306	5121148	234	20	G101
RFF-13-0098	15/05/2013			452308	5121235	240		
RFF-13-0099	15/05/2013			452372	5121333	230		
RFF-13-0100	15/05/2013	Snag Density		452449	5121381	236	20	
RFF-13-0101	15/05/2013			452482	5121375	244		
RFF-13-0102	15/05/2013			452536	5121359	248		
RFF-13-0103	15/05/2013			452588	5121444	251		
RFF-13-0104	15/05/2013			452592	5121499	269		G018
RFF-13-0105	15/05/2013			452592	5121497	269		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
RFF-13-0106	15/05/2013			452574	5121618	254		
RFF-13-0107	15/05/2013			452563	5121749	228		
RFF-13-0108	15/05/2013			452615	5121913	261		G101
RFF-13-0109	15/05/2013	Snag Density		452644	5121959	267	0	
RFF-13-0110	15/05/2013			452656	5122015	258		
RFF-13-0111	15/05/2013	Snag Density		452634	5122069	252	60	
RFF-13-0112	15/05/2013			452595	5122072	263		
RFF-13-0113	15/05/2013	Pellet Count		452515	5122165	267		G036
RFF-13-0114	15/05/2013	Pellet Count		452505	5122165	269		
RFF-13-0115	15/05/2013	Pellet Count		452344	5122158	301		
RFF-13-0116	15/05/2013	Snag Density		452326	5122157	289	20	
RFF-13-0117	15/05/2013	Pellet Count		452304	5122166	290		
RFF-13-0118	15/05/2013	Pellet Count		452153	5122171	276		
RFF-13-0119	15/05/2013	Pellet Count		452109	5122167	262		
RFF-13-0120	15/05/2013	Pellet Count		451953	5122180	272		
RFF-13-0121	15/05/2013	Pellet Count		451911	5122183	268		
RFF-13-0122	15/05/2013	Pellet Count		451752	5122191	265		
RFF-13-0123	15/05/2013	Pellet Count		451711	5122196	255		
RFF-13-0124	15/05/2013			451688	5122200	237		
RFF-13-0125	15/05/2013			451558	5122223	224		
RFF-13-0126	15/05/2013			451517	5122233	229		
RFF-13-0127	15/05/2013			451245	5122395	233		
RFF-13-0128	15/05/2013			451066	5122298	234		
RFF-13-0129	15/05/2013			451016	5122184	246		
RFF-13-0130	15/05/2013			450660	5121707	241		
RFF-13-0131	15/05/2013			450215	5121582	236		
RFF-13-0235	08/06/2013			409409	5338532	352		
RFF-13-0236	09/06/2013			413667	5346591	335		
RFF-13-0237	09/06/2013			413622	5346506	326		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
RFF-13-0238	09/06/2013			413622	5346505	327		
RFF-13-0239	09/06/2013			413609	5346908	352		
RFF-13-0240	09/06/2013			413580	5347008	351		
RFF-13-0241	09/06/2013			413557	5347125	355		
RFF-13-0242	09/06/2013			413497	5347287	376		
RFF-13-0243	09/06/2013			413369	5347566	345		
RFF-13-0244	09/06/2013			413306	5347971	356		
RFF-13-0245	09/06/2013			413187	5348458	357		
RFF-13-0246	09/06/2013			412988	5348992	316		
RFF-13-0247	10/06/2013			405533	5355341	341		
RFF-13-0248	10/06/2013			405662	5355317	358		
RFF-13-0249	10/06/2013			405766	5355306	364		
RFF-13-0250	10/06/2013			405826	5355244	354		
RFF-13-0251	10/06/2013			405853	5355185	352		
RFF-13-0252	10/06/2013			405899	5355107	352		
RFF-13-0253	10/06/2013			405951	5354946	355		
RFF-13-0254	10/06/2013			406199	5354660	360		
RFF-13-0255	10/06/2013			406129	5354603	352		
RFF-13-0256	10/06/2013			406329	5354547	350		
RFF-13-0257	10/06/2013			406307	5354494	350		
RFF-13-0258	11/06/2013			443876	5121869	193		
RFF-13-0259	11/06/2013			443746	5121994	198		
RFF-13-0260	11/06/2013			445060	5121229	230		
RFF-13-0261	11/06/2013			447625	5120346	221		
RFF-13-0262	11/06/2013			448381	5119898	238		
RFF-13-0263	11/06/2013			451844	5120482	243		
RFF-13-0264	12/06/2013	Point Count 6		450116	5121522	227		G088
RFF-13-0265	12/06/2013	Point Count 7		450368	5121570	245		G122
RFF-13-0266	12/06/2013	Point Count 8	Canada Warbler	450680	5121771	248		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
RFF-13-0267	12/06/2013	Point Count 9		451019	5122179	251		G028
RFF-13-0268	12/06/2013	Point Count 10		451453	5122565	235		
RFF-13-0269	12/06/2013			451620	5122612	239		
RFF-13-0270	12/06/2013		Canada Warbler	451590	5122660	235		
RFF-13-0271	12/06/2013	Point Count 11		451998	5122971	235		
RFF-13-0272	12/06/2013	Point Count 12		452130	5123199	229		
RFF-13-0273	12/06/2013	Point Count 13		452381	5123281	255		
RFF-13-0274	12/06/2013			452374	5123194	266		
RFF-13-0275	12/06/2013	Point Count 14		452474	5123069	275		
RFF-13-0276	12/06/2013		Snapping Turtle	452631	5123742	222		
RFF-13-0277	12/06/2013			452682	5123812	247		
RFF-13-0278	12/06/2013			452218	5124052	205		
RFF-13-0279	12/06/2013			452156	5124011	236		
RFF-13-0280	12/06/2013			451802	5123962	243		
RFF-13-0281	12/06/2013			451569	5123798	228		
RFF-13-0282	12/06/2013			451544	5123783	226		
RFF-13-0283	12/06/2013			451369	5123710	221		
RFF-13-0284	12/06/2013			451261	5123664	212		
RFF-13-0285	12/06/2013			451151	5123561	208		
RFF-13-0286	12/06/2013			451061	5123393	222		
RFF-13-0287	12/06/2013		E. Wood-Pewee	451046	5123309	227		
RFF-13-0288	12/06/2013			450859	5123493	202		
RFF-13-0289	12/06/2013			450817	5123502	203		
RFF-13-0290	12/06/2013			450814	5123327	214		
RFF-13-0291	12/06/2013			450841	5123272	203		
RFF-13-0292	12/06/2013			450857	5123218	207		
RFF-13-0293	12/06/2013			450810	5123126	206		
RFF-13-0294	12/06/2013			450745	5122860	208		
RFF-13-0295	12/06/2013			450739	5122741	208		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
RFF-13-0296	12/06/2013			450864	5122646	210		
RFF-13-0297	12/06/2013			450934	5122540	213		
RFF-13-0298	12/06/2013			450996	5122485	199		
RFF-13-0299	12/06/2013			451029	5122381	219		
RFF-13-0300	12/06/2013			451712	5122777	260		
RFF-13-0301	12/06/2013			451888	5122871	243		
RFF-13-0302	12/06/2013			451626	5122605	232		
RFF-13-0303	12/06/2013			449432	5121217	227		
RFF-13-0304	12/06/2013			448217	5120335	236		
RFF-13-0305	13/06/2013			450981	5120498	243		
RFF-13-0306	13/06/2013		Canada Warbler	451281	5120615	251		
RFF-13-0307	13/06/2013	Point Count 15	Canada Warbler, E. Wood-Pewee	451292	5120638	251		G107
RFF-13-0308	13/06/2013	Point Count 16		451305	5120671	254		G119
RFF-13-0309	13/06/2013			451553	5120783	261		
RFF-13-0310	13/06/2013			451704	5120864	261		
RFF-13-0311	13/06/2013	Point Count 17		451750	5120919	270		G165
RFF-13-0312	13/06/2013			451773	5120911	268		
RFF-13-0313	13/06/2013	Point Count 18		451994	5121041	249		
RFF-13-0314	13/06/2013			452088	5121182	247		
RFF-13-0315	13/06/2013	Point Count 19		452181	5121263	252		G019
RFF-13-0316	13/06/2013			452336	5121283	239		
RFF-13-0317	13/06/2013			452409	5121321	231		
RFF-13-0318	13/06/2013	Point Count 20	Canada Warbler	452457	5121366	240		G107
RFF-13-0319	13/06/2013			452530	5121363	239		
RFF-13-0320	13/06/2013			452652	5121445	250		
RFF-13-0321	13/06/2013	Point Count 21		452707	5121471	254		
RFF-13-0322	13/06/2013			452697	5121433	245		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
RFF-13-0323	13/06/2013			452873	5121420	242		
RFF-13-0324	13/06/2013		Canada Warbler	452842	5121570	262		
RFF-13-0325	13/06/2013			452834	5121608	269		
RFF-13-0326	13/06/2013			452929	5121736	267		
RFF-13-0327	13/06/2013			452920	5121863	262		
RFF-13-0328	13/06/2013			452909	5121915	256		
RFF-13-0329	13/06/2013			452942	5121982	267		
RFF-13-0330	13/06/2013			452934	5122115	250		
RFF-13-0331	13/06/2013			452786	5122058	268		
RFF-13-0332	13/06/2013			452674	5122229	239		
RFF-13-0333	13/06/2013			452648	5122328	242		
RFF-13-0334	13/06/2013			452634	5122386	243		
RFF-13-0335	13/06/2013		Canada Warbler	452626	5122414	258		
RFF-13-0336	13/06/2013			452646	5122450	259		
RFF-13-0337	13/06/2013			452611	5122561	255		
RFF-13-0338	13/06/2013			452577	5122686	260		
RFF-13-0339	13/06/2013			452565	5122939	269		
RFF-13-0340	13/06/2013			452562	5122973	278		
RFF-13-0341	13/06/2013			452124	5123184	237		
RFF-13-0342	13/06/2013			451494	5122567	240		
RFF-13-0343	13/06/2013			451020	5122188	227		
SH-13-032	13/06/2013	Turtle Survey		443883	5121883	202.6753		
SH-13-033	13/06/2013	Turtle Survey		445068	5121238	227.8403		
SH-13-034	13/06/2013	Turtle Survey		447618	5120344	219.4107		
SH-13-035	13/06/2013	Turtle Survey		448379	5119907	235.7282		
SH-13-036	13/06/2013			451837	5120471	242.6935		
SH-13-037	13/06/2013	Snag Density		451030	5122163	220.3325	0	G028
SH-13-038	13/06/2013	Snag Density		451460	5122548	261.2794	0	G010
SH-13-039	13/06/2013			451993	5122966	244.2143		

Waypoint	Date	Survey Type	Species at Risk	Easting	Northing	Altitude	Snags/ha	Ecosite
SH-13-040	13/06/2013			452474	5123068	277.7244		
SH-13-041	13/06/2013	Turtle Survey		452625	5123745	243.7294		
SH-13-042	13/06/2013			451366	5123713	226.8655		
SH-13-043	13/06/2013	Snag Density		450818	5123497	209.2097	0	G142
SH-13-044	13/06/2013	Snag Density		450867	5122645	211.8531	0	G130
SH-13-045	13/06/2013			451993	5122970	241.6393		
SH-13-046	13/06/2013	Turtle Survey		449403	5121189	228.7143		
SH-13-047	13/06/2013	Turtle Survey		448296	5120376	233.5955		
SH-13-048	13/06/2013			448366	5119912	241.8088		
SH-13-049	13/06/2013	Snag Density		451309	5120667	265.1068	40	G107
SH-13-050	13/06/2013	Snag Density		451551	5120781	260.2621	60	G119
SH-13-051	13/06/2013	Snag Density		451752	5120908	284.6222	0	G165
SH-13-052	13/06/2013	Snag Density		452001	5121041	256.1142	60	G122
SH-13-053	13/06/2013	Snag Density		452175	5121277	260.3355	0	G019
SH-13-054	13/06/2013	Snag Density		452463	5121364	245.4377	0	G107
SH-13-055	13/06/2013			450669	5122196	220.7866		
SH-13-056	13/06/2013	Turtle Survey		451802	5122643	238.5395		
SH-13-057	13/06/2013			451615	5122609	238.5665		
SH-13-058	13/06/2013			451110	5122395	233.9071		
SH-13-059	13/06/2013	Turtle Survey		451534	5121861	231.7938		
SH-13-060	13/06/2013			449820	5121513	229.5345		
SH-13-061	13/06/2013			447591	5120500	212.7604		

Appendix 8. ORMG Fieldwork Report.

DISTRIBUTION LINE AND ACCESS ROAD TARGETED SURVEY RESULTS EASTERN WHIP-POOR-WILL (*CAPRIMULGUS VOCIFERUS*) AND BLANDING'S TURTLE (*EMYDOIDEA BLANDINGII*) WABAGISHIK HYDROELECTRIC PROJECT (VERMILION RIVER)

5 July 2013
Revised 18 July 2013

ONTARIO RESOURCE MANAGEMENT GROUP INC.

P. O. BOX 1234
PEMBROKE, ONTARIO
K8A 6Y6
Tel. (613) 638-0283
Fax. (613) 638-0283

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Nikki Boucher, MNR Sudbury District
Brendan O'Farrell, MNR Sudbury District
Ed Laratta, Xeneca Power Development
Mike Vance, Xeneca Power Development
Al Harris, Northern BioScience
Dave Thomson, Thomson Environmental
Arnold Rudy, KBM Resources Group
Karen Saunders, KBM Resources Group

Project Contracted by: Xeneca Power Development Inc.
5255 Yonge Street, Suite 1200
Toronto, Ontario
M2N 6P4

Contractor: Ontario Resource Management Group Inc.
P.O. Box 1234
Pembroke, Ontario Canada
K8A 6Y6
Tel: 1-613-638-0283
E-mail: ormg@ormg.org

Project Contact: Bruce Wheaton, CEO
Report Authors: Kristi Beatty, Biologist
Ontario Resource Management Group Inc.

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INTRODUCTION

Ontario Resource Management Group Inc. (ORMG) was contracted by Xeneca Power Development Inc. (Xeneca) to perform targeted surveys for Eastern Whip-Poor-Will (*Caprimulgus vociferus*) and Blanding's Turtle (*Emydoidea blandingii*) along the proposed road access and transmission line routes at the site of the Wabagishik hydroelectric generating project (Figure 1).

Survey results for the targeted assessments are detailed throughout this report. Specific habitat types and locations found within the study area are referenced for each survey site. This report is intended to be considered in conjunction with a baseline report prepared by Northern Bioscience, and available under separate cover. The current summary does not detail the project background, previous survey results, habitat delineation or other survey methodologies. It is a summary only of surveys carried out by ORMG as part of the roads and transmission line assessment for particular species.

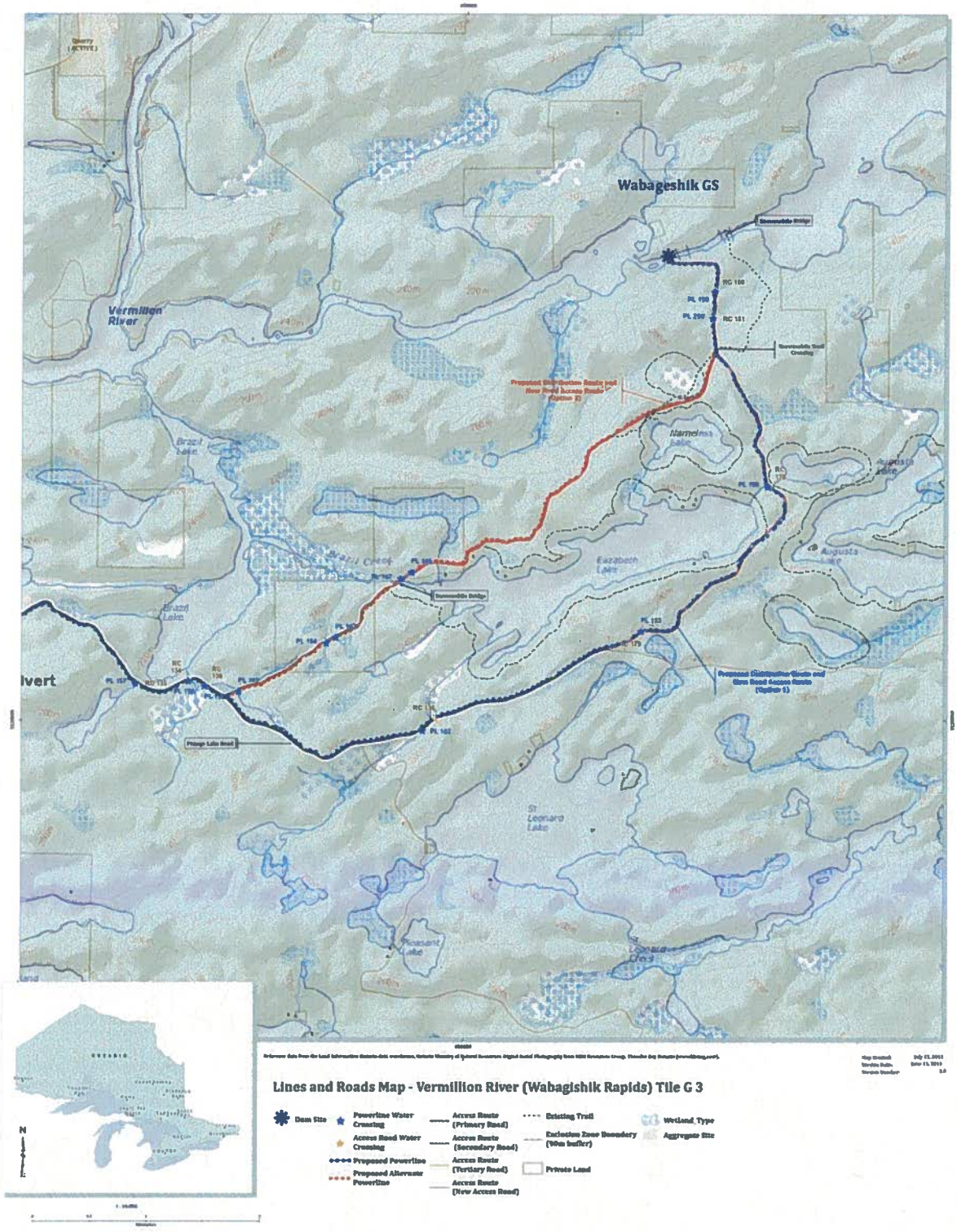


Figure 1 - Proposed Roads and Transmission Line Routing for Wabagishik Rapids GS Project

SPECIES ASSESSMENT

Additional assessment of potentially affected areas was performed by Northern Bioscience prior to ORMG assessments, to provide baseline information related to the current surveys. Surveys addressed in the current report were carried out as road routing options were finalized. Within the survey area, ORMG utilized accepted survey protocols for both Eastern Whip-Poor-Will and Blanding's Turtle, as provided by the Ministry of Natural Resources. All habitat types located within 250 of centerline of the proposed road access and transmission line route for the Wabagishik project were assessed on foot during suitable conditions (per protocol), over the course of three days (24-26 June 2013).

Routing of roads within a proposed project is not exact at the design stage. Preferred options are selected based on a combination of factors – economic, social, environmental, and other. Final routing decisions are made once all information has been assessed in conjunction with other available data, to select the roadway and transmission line which will have the least impact on any particular faction. To that end, the following report is intended to inform routing options from an ecological perspective as it relates to two species listed under the provincial Endangered Species Act (ESA). Two (2) options will be considered for road access (Figure 1), with resulting potential impacts due to clearing, grubbing, filling, grading, and other construction activities being assessed vs the flora and fauna confirmed within the impacted area(s).

Survey Results

Blanding's Turtle (*Emydoidea blandingii*)

Utilizing previously allocated survey sites 1 through 15 (Figure 2), ORMG assessed Sites 1-7, 9-11 and Site 13 a minimum of one time each. Sites with suitable habitat were assessed two (2) or three (3) times, depending on access. Sites 8, 12, 14 and 15 were not assessed by ORMG due to these sites having a) been surveyed several times previously (#12, 14), or b) unsuitable habitat (#8, 15).

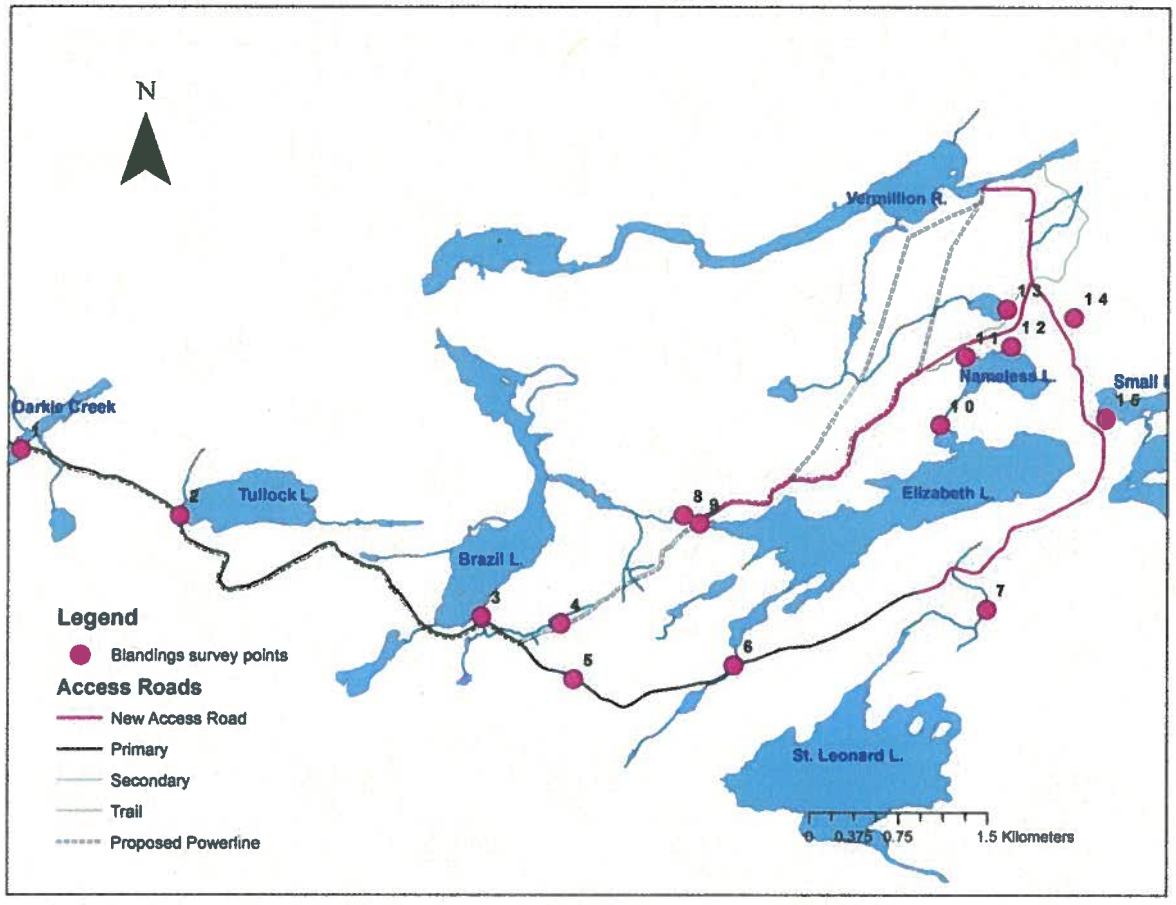


Figure 2 – Blanding's Turtle Survey Sites along Proposed Option 1 and Option 2 Roads Access Routes

Site #1 – Darkie Creek

Assessed: 24 June 2013, 1608-1630h
25 June 2013, 0914-0928h
26 June 2013, 0925-0942h

No Blanding's Turtles were confirmed at this site. Suitable habitat exists for turtle species at this site, including Blanding's Turtle. While the central portion of the creek is too deep and possesses little vegetation, excellent shoreline habitat is present (Figure 3).

Figure 3 - Representative Habitat at Darkie Creek

Fauna confirmed during passive monitoring of this site included:

- Painted Turtle (*Chrysemys picta*) (n=6)
- Northern Water Snake (*Nerodia sipidon*) (n=12)
- Eastern Garter Snake (*Thamnophis sirtalis* ssp. *sirtalis*) (n=3)
- American Bullfrog (*Rana catesbeiana*)
- Northern Leopard Frog (*Lithobates pipiens*)
- Chestnut-Sided Warbler
- Common Grackle

- Common Yellowthroat
- Great Blue Heron
- Red-Winged Blackbird
- Yellow Warbler
- Canada Darner (*Aeshna canadensis*)
- Four-Spotted Skimmer (*Libellula quadrimaculata*)
- Bluets (*Enallagma* spp)

Site #2 – Tulloch Lake

Assessed: 24 June 2013, 1635-1648h
25 June 2013, 0932-0935h

No Blanding's Turtles were confirmed at this site.

Lacustrine site, with moderately suitable habitat for Blanding's Turtle. Some shoreline areas are suitable for basking, and a large exposed boulder is present in the center of the lake (Figure 4).

Figure 4 - Representative shoreline habitat at Tulloch Lake

No turtles of any species were visible on any visit. Shoreline vegetation includes:

- Blue Flag Iris (*Iris versicolor*)
- *Carex* spp.
- Cattail (*Typha latifolia*)
- Pickerelweed (*Pontederia cordata*)
- Sedges (*Carex* spp.)
- Sensitive Fern (*Onoclea sensibilis*)
- Speckled Alder (*Alnus incana* ssp. *rugosa*)
- Water Shield (*Brasenia schreberi*)
- White Water Lily (*Nymphaea odorata*)
- Yellow Pond Lily (*Nuphar variegatum*)
- Grasses

Conversations with local fishermen confirmed Snapping Turtle (*Chelydra serpentina*) are present in this lake, along with Smallmouth Bass (*Micropterus dolomieu*) and Largemouth Bass (*Micropterus salmoides*). In addition, several Odonates were confirmed – Chalk-Fronted Corporal (*Libellula julia*), Canada Darner (*Aeshna canadensis*), and *Enallagma* species.

Site #3A – Brazil Lake – South End

Assessed: 24 June 2013, 1655-1709h

No Blanding's Turtles were confirmed at this site. Habitat along the majority of this lake is unsuitable for this species – rocky shores, little vegetation, steep shoreline angles (Figure 5).

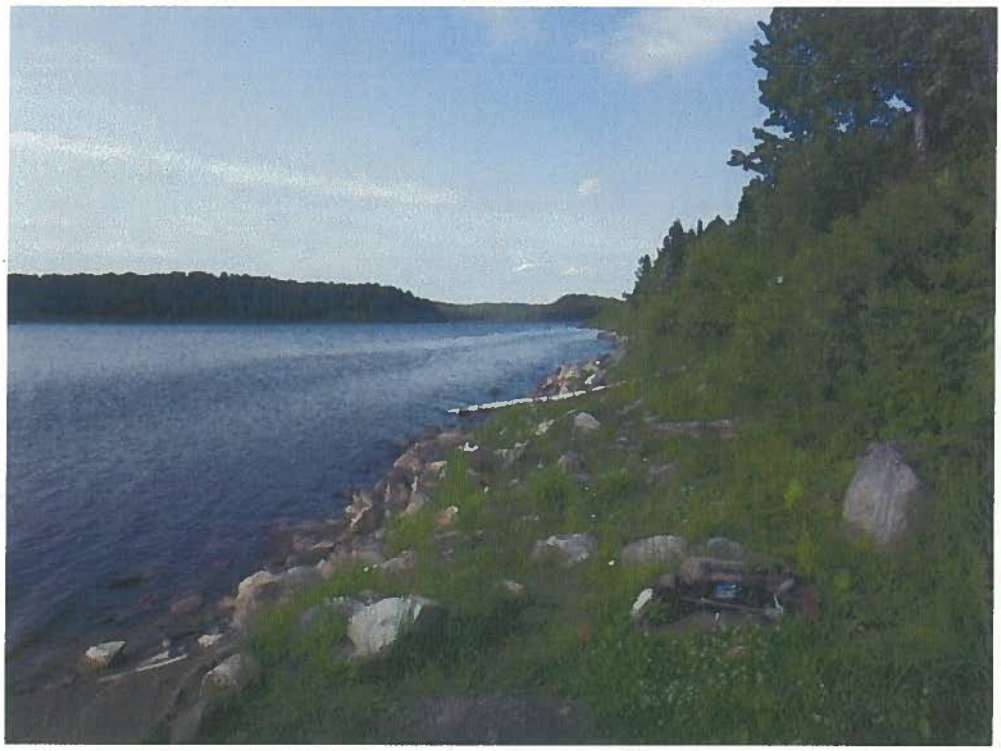


Figure 5 - Representative shoreline habitat in Brazil Lake

Site #4 – Beaver Marsh

Assessed: 24 June 2013, 1820-1838h
25 June 2013, 0951-1028h
26 June 2013, 1111-1120h

No Blanding's Turtles were confirmed at this site.

Suitable habitat exists for turtle species at this site, including Blanding's Turtle. As a whole, the marsh is relatively shallow, with an active beaver lodge, fully repaired and functioning dam, and consistent depth apparent throughout (based on emergent and floating vegetation prevalence across the entire water body). Numerous basking sites are available, with excellent vegetative cover along all margins. Limiting factor may be lack of availability of deep water for overwintering (specific measured depths would be required to determine) (Figure 6).

Figure 6 - Excellent Turtle habitat within Site 4 Beaver Pond

Confirmed vegetative species within this wetland include:

- Blue Flag Iris (*Iris versicolor*)
- *Carex* spp.
- Cattail (*Typha latifolia*)
- *Equisetum* spp.
- Hardstem Bulrush *(Scirpus acutus)*
- Marsh Cinquefoil (*Potentilla palustris*)
- Narrow-Leaved Meadowsweet (*Spirea alba*)
- Sensitive Fern (*Onoclea sensibilis*)
- Sheep Laurel (*Kalmia angustifolia*)
- Slender Willow (*Salix petiolaris*)
- Speckled Alder (*Alnus incana* ssp. *rugosa*)
- Spotted Touch-Me-Not (*Impatiens capensis*)
- Sweet Gale (*Myrica gale*)
- Water Shield (*Brasenia schreberi*)
- Yellow Pond Lily (*Nuphar variegatum*)

Tracks of a Snapping Turtle were confirmed on the roadway as it passed within 2m of the wetland (Figure 7). A Painted Turtle was also confirmed on the site on 25 June.

Figure 7 - Snapping Turtle (*Chelydra serpentina*) tracks on road adjacent to Site 4

Other species noted include:

- Red-Winged Blackbird (*Agelaius pheonicius*)
- Red-Eyed Vireo (*Vireo olivaceus*)
- White-Throated Sparrow (*Zonotrichus albicollis*)
- Black-Throated Green Warbler (*Setophaga virens*)
- Common Yellowthroat (*Geothlypis trichas*)
- Chestnut-Sided Warbler (*Setophaga pensylvanica*)
- Veery (*Catharus fuscescens*)
- Wood Duck (*Aix sponsa*)
- Turkey Vulture (*Cathartes aura*)
- Common Grackle (*Quiscalus quiscula*)
- Common Merganser (*Mergus merganser*)
- American Bullfrog (*Rana catesbeiana*)

- Northern Leopard Frog (*Lithobates pipiens*)
- Canada Darner (*Aeshna canadensis*)
- Four-Spotted Skimmer (*Libellula quadrimaculata*)
- Dot-Tailed Whiteface (*Leucorrhinia intacta*)
- Lilypad Clubtail (*Arigomphus furcifer*)
- Other Clubtails (*Gomphus* spp.)
- Bluets (*Enallagma* spp)
- Chalk-Fronted Corporal (*Libellula julia)*
- Common Whitetail (*Libellula lydia*)
- Mourning Cloak (*Nymphalis antiopa*)
- Beaver (*Castor canadensis*)

Site #5 – Roadside Beaver Pond

Assessed: 24 June 2013, 1712-1718h
25 June 2013, 1045-1059h
26 June 2013, 1019-1030h

No Blanding's Turtles were confirmed at this site. A Painted Turtle was noted basking on the far shore on a hummock of vegetation.

Suitable habitat exists for turtle species at this site, including Blanding's Turtle. Within the west end of the marsh exists an inactive beaver lodge in a state of disrepair, with open water surrounding the lodge. Emergent and floating vegetation occur within the open water area in varying densities. Numerous basking sites are available, with excellent vegetative cover along all margins (Figure 8). The east end of this marsh transitions from open water around the beaver lodge to dense emergent vegetation, shallow water and areas of swamp containing dead standing timber, Slender Willow (*Salix petiolaris*), Narrow-Leaved Meadowsweet (*Spirea alba*), Sheep Laurel (*Kalmia angustifolia*) and Cattail (*Typha latifolia*) (Figure 9).
Additional confirmed vegetative species within this wetland include:

- Blue Flag Iris (*Iris versicolor*)

- *Carex* spp.
- Cattail (*Typha latifolia*)
- *Equisetum* spp.
- *Carex* spp.
- Sensitive Fern (*Onoclea sensibilis*)
- Sheep Laurel (*Kalmia angustifolia*)
- Speckled Alder (*Alnus incana* ssp. *rugosa*)
- Water Shield (*Brasenia schreberi*)
- Yellow Pond Lily (*Nuphar variegatum*)

Figure 8 - Open water section at west end of Site 5 beaver pond

Figure 9 - East end of Site 5 swamp with no open water and dense vegetative cover

Fauna confirmed at this location included:

- American Woodcock (*Scolopax minor*)
- Chestnut-Sided Warbler (*Setophaga pensylvanica*)
- Common Grackle (*Quiscalus quiscula*)
- Common Merganser (*Mergus merganser*)
- Common Yellowthroat (*Geothlypis trichas*)
- Magnolia Warbler (*Setophaga magnolia*)
- Ovenbird (*Seirus aurocapilla*)
- Red-Winged Blackbird (*Agelaius pheonicius*)
- Swamp Sparrow (*Melospiza georgiana*)
- Moose (*Alces alces*)
- White-Tailed Deer (*Odocoileus virginianus*)
- American Bullfrog (*Rana catesbeiana*)
- Northern Leopard Frog (*Lithobates pipiens*)
- Canada Darner (*Aeshna canadensis*)

- Four-Spotted Skimmer (*Libellula quadrimaculata*)
- Other Clubtails (*Gomphus* spp.)
- Bluets (*Enallagma* spp)
- Chalk-Fronted Corporal (*Libellula julia)*
- Common Whitetail (*Libellula lydia*)

Site #6 – Roadside Swamp

Assessed: 24 June 2013, 1720-1735h
25 June 2013, 1107-1121h

No Blanding's Turtles were confirmed at this site. Not ideal habitat for Blanding's Turtle. Swamp habitat is dominated by dense dead standing timber (Ash spp.), with small pools interspersed with dense emergent vegetation. Pools house floating and emergent flora (Figure 10).

Figure 10 - Representative flooded standing timber in swamp at Site 6

Aquatic vegetation confirmed at this site includes:

- Awl-Fruited Sedge (*Carex stipata*)

- Black Ash (*Fraxinus nigra*) – dead or dying
- Blue Flag Iris (*Iris versicolor*)
- Canada Bluejoint (*Calamagrostis canadensis*)
- *Carex* spp.
- Cattail (*Typha latifolia*)
- Fowl Meadow Grass (*Poa palustris*)
- Fringed Sedge (*Carex crinita*)
- Marsh Cinquefoil (*Potentilla palustris*)
- Narrow-Leaved Meadowsweet (*Spirea alba*)
- *Phragmites* spp.
- *Poacea* spp
- Reed Canary Grass (*Phalaris arundinacea*)
- Sensitive Fern (*Onoclea sensibilis*)
- Spotted Touch-Me-Not (*Impatiens capensis*)
- Water Shield (*Brasenia schreberi*)

Additional vegetation typical of disturbed areas was present along the roadway.

Fauna confirmed within this swamp was minimal on both visits:

- Chestnut-Sided Warbler (*Setophaga pensylvanica*)
- Common Grackle (*Quiscalus quiscula*)
- Common Yellowthroat (*Geothlypis trichas*)
- Northern Cardinal (*Cardinalis cardinalis*)
- Veery (*Catharus fuscescens*)
- White-Throated Sparrow (*Zonotrichus albicollis*)
- Bluets (*Enallagma* spp)
- Chalk-Fronted Corporal (*Libellula julia)*
- Common Whitetail (*Libellula lydia*)
- Leopard Frog (*Rana pipiens*)
- Wood Frog (*Rana sylvatica*)

Site #7 – Meadow Marsh at Culvert

Assessed: 24 June 2013, 1744-1752h
25 June 2013, 1130-1156h
26 June 2013, 1042-1047h

No Blanding's Turtles were confirmed at this site. The area is largely suitable for Blanding's and other turtle species, however dense vegetation made searches difficult. North of the culvert on the main road, there is a small area of open water leading into a dense Cattail marsh (Figure 11). South of the culvert is a large Cattail and Sedge meadow marsh with a larger open water areas at its southern extent (Figure 12). Within this southern open water area, evidence of active beaver activity was present in the form of stripped twigs, downed Poplar and Alder branches, active runways and scat.

Figure 11 - Representative marsh area north of road and culvert at Site 7

Figure 12 - Large meadow marsh south of culvert at Site 7 (open water beaver pond at southern extent)

Large equipment was active immediately adjacent to the key southern habitat on site on 25 June, precluding any fauna confirmations on that date. Vegetation within the wetland largely consists of Cattail and Sedge species, with floating species such as Water Shield and Yellow Pond Lily present in deeper water areas both north and south of the culvert. Speckled Alder and Black Spruce form the perimeter of the marsh.

Fauna present included:

- Beaver (Castor canadensis)
- Black-Throated Blue Warbler (*Setophaga caerulescens*)
- Broad-Winged Hawk (*Buteo platypterus*)
- Chestnut-Sided Warbler (*Setophaga pensylvanica*)
- Common Grackle (*Quiscalus quiscula*)
- Common Yellowthroat (*Geothlypis trichas*)
- Swamp Sparrow (*Melospiza georgiana*)
- Veery (*Catharus fuscescens*)
- White-Throated Sparrow (*Zonotrichus albicollis*)

- Bluets (*Enallagma* spp)
- Chalk-Fronted Corporal (*Libellula julia)*
- Common Whitetail (*Libellula lydia*)
- Other Skimmers (*Libellula* spp.)
- Leopard Frog (*Rana pipiens*)
- Wood Frog (*Rana sylvatica*)

Site #9 – Outflow of Elizabeth Lake

Assessed: 25 June 2013, 1206-1221h
26 June 2013, 1042-1047h

No Blanding's Turtles were confirmed at this site. Suitable habitat exists within this lake for turtle species, including Blanding's. The outflow area is largely dominated by Equisetum spp., White Water Lily and grasses, including *Phragmites* (Figure 13). There were no obvious basking sites within the outflow bay, however vegetated banks were available. Dense vegetation along the shoreline in this area made searches difficult.

Figure 13 - Representative section of marsh habitat at Site 9 outflow of Elizabeth Lake

Incidental fauna were typical of all other sites in the area:

- Bullfrog (*Rana catesbeiana*)
- Leopard Frog (*Rana pipiens*)
- Chestnut-Sided Warbler (*Setophaga pensylvanica*)
- Common Grackle (*Quiscalus quiscula*)
- Common Yellowthroat (*Geothlypis trichas*)
- Ovenbird (*Seirus aurocapilla*)
- Red-Winged Blackbird (*Agelaius pheonicius*)
- Veery (*Catharus fuscescens*)
- White-Throated Sparrow (*Zonotrichus albicollis*)
- Bluets (*Enallagma* spp)
- Calico Pennant (*Celithemis elisa*) (female)
- Chalk-Fronted Corporal (*Libellula julia)*
- Common Whitetail (*Libellula lydia*)

Site #10 – North Bay in Elizabeth Lake

Assessed: 25 June 2013, 1310-1320h

No Blanding's Turtles were confirmed at this site. Unsuitable habitat. Dominated by Cattail, Sheep Laurel, Slender Willow, *Spirea* spp., Grass hummocks and dead standing timber, however no open water is present (Figure 14). Some flooding was evident beneath hummocks/emergent veg, but not deep or consistent.

Figure 14 - Unsuitable habitat surveyed at Site 10, north end of Elizabeth Lake

Site #11 – Nameless Lake

Assessed: 25 June 2013, 1436-1445h
25 June 2013, 1555-1600h
25 June 2013, 2043-2052h

No Blanding's Turtles were confirmed at this site. The majority of the shoreline of Nameless Lake consisted of exposed mud flats and very shallow water (<30cm) during the survey period. Decomposing vegetation was apparent along the shoreline, and an abandoned beaver lodge exists on the NW shore (Figure 15). A steep rocky shoreline along the western shore limits shoreline vegetation growth in many areas, making it less suitable for Blanding's Turtles, but highly suitable for Painted and Snapping Turtles.

Several large Snapping Turtles were observed at this site during late evening hours (2000h+) while surveyors were assessing Eastern Whip-Poor-Will (*Caprimulgus vociferus*) in the area. American Bullfrogs, Leopard Frogs, Wood Frogs and Spring Peepers (*Pseudacris crucifer*) were

abundant. A pair of Common Loons (*Gavia immer*) was noted on each visit (no young), and several Ring-Billed Gulls (*Larus delawarensis*) were evident in the area.

Figure 15 - Abandoned beaver lodge on western shore of Nameless Lake

Site #13 – Beaver Pond

Assessed: 25 June 2013, 1500-1522h
25 June 2013, 2052-2115h

No Blanding's Turtles were confirmed at this site. Habitat is suitable for Snapping, Painted and Blanding's Turtles. One of the most suitable turtle sites surveyed, Site #13 is an active beaver pond, with evidence of current beaver activity. The shoreline consists of Black Spruce, Speckled Alder and Poplar spp., interspersed with emergent wetland herbs, grasses and sedges (Figure 16). Vegetation is abundant and varied, with numerous species confirmed:

- Blue Flag Iris (*Iris versicolor*)
- Canada Bluejoint (*Calamagrostis canadensis*)
- *Carex* spp.
- Cattail (*Typha latifolia*)
- *Equisetum* spp.
- Fowl Meadow Grass (*Poa palustris*)

- Fringed Sedge (*Carex crinita*)
- Hardstem Bulrush *(Scirpus acutus)*
- Marsh Cinquefoil (*Potentilla palustris*)
- Narrow-Leaved Meadowsweet (*Spirea alba*)
- *Phragmites* spp.
- *Poacea* spp
- Reed Canary Grass (*Phalaris arundinacea*)
- Sensitive Fern (*Onoclea sensibilis*)
- Sheep Laurel (*Kalmia angustifolia*)
- Slender Willow (*Salix petiolaris*)
- Speckled Alder (*Alnus incana* ssp. *rugosa*)
- Spotted Touch-Me-Not (*Impatiens capensis*)
- Sweet Gale (*Myrica gale*)
- Water Shield (*Brasenia schreberi*)
- White Water Lily (*Nymphaea odorata*)

Figure 16 - Representative section of suitable marsh habitat in beaver pond at Site 13

A Painted Turtle was observed basking on the southern shore. Beaver (*Castor canadensis*) activity was confirmed with visual sightings of feeding and storing activity occurring. Additional

tracks confirmed White-Tailed Deer (*Odocoileus virginianus*) (doe and fawn), Raccoon (*Procyon lotor*), Grey Wolf (*Canis lupus*), and Black Bear (*Ursus americanus*). Additional fauna noted included:

- Red-Backed Salamander (*Plethodon cinereus*)
- Northern Water Snake Bullfrog (*Rana catesbeiana*)
- Leopard Frog (*Rana pipiens*)
- Spring Peeper (*Pseudacris crucifer*)
- Wood Frog (*Rana sylvatica*)
- Chestnut-Sided Warbler (*Setophaga pensylvanica*)
- Common Grackle (*Quiscalus quiscula*)
- Common Yellowthroat (*Geothlypis trichas*)
- Eastern Kingbird (*Tyrannus tyrannus*) (nesting, active)
- Ovenbird (*Seirus aurocapilla*)
- Red-Winged Blackbird (*Agelaius pheonicius*)
- Veery (*Catharus fuscescens*)
- White-Throated Sparrow (*Zonotrichus albicollis*)
- Bluets (*Enallagma* spp)
- Chalk-Fronted Corporal (*Libellula julia)*
- Common Whitetail (*Libellula lydia*)
- Dot-Tailed Whiteface (*Leucorrhinia intacta*)

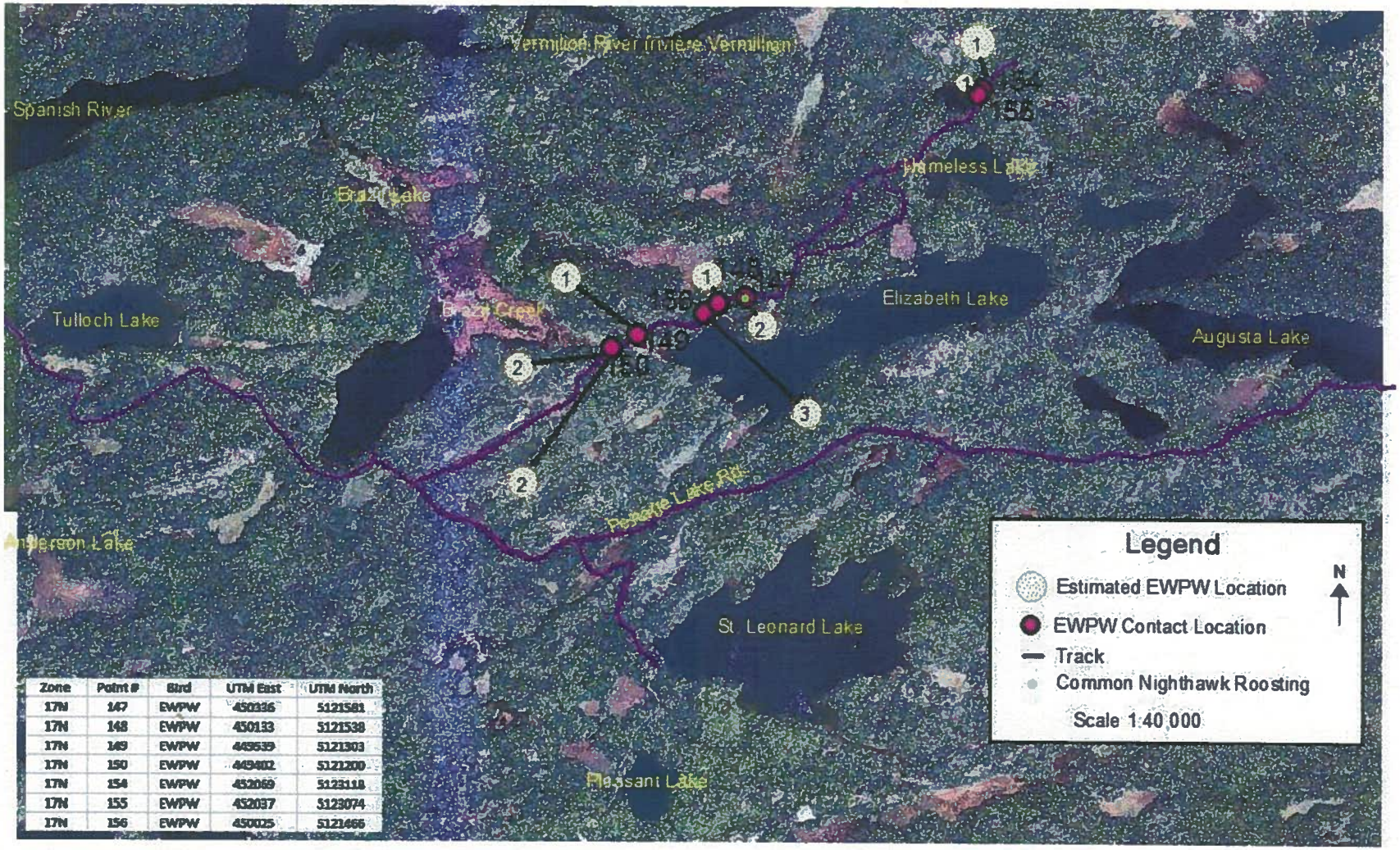
Eastern Whip-Poor-Will (*Caprimulgus vociferus*)

Eastern Whip-Poor-Will (EWPW) surveys were completed on 24 and 25 June 2013. Per the MNR Draft protocol for this species, these dates fall within the June full moon phase (23 June 2013). The Option 1 route (east/couth of Elizabeth Lake) was easily assessed from the shore of Elizabeth Lake, as well as from key points along either end of the proposed road route. Foot searches were carried out along the proposed Option 2 route along the north/west side of Elizabeth Lake (Figure 17).

24 June 2013 – EWPW Survey

Due to nocturnal safety considerations as a result of dense brush, steep rock ledges and evidence of Black Bear activity, the Option 1 route to the east of Elizabeth Lake was not entirely assessed at night. Due to clear conditions, however, EWPW calls were easily confirmed from the Option 2 route by surveyors on the opposite (west) shore of Elizabeth Lake. Option 2 routing was assessed on 24 June by two ORMG personnel travelling the route on foot. Survey conditions were clear, with scattered cloud and moderate wind. Surveys were conducted between the hours of 2000-2400.

Surveyors assessed the 4100m (8200m round trip) Option 2 route to within 500m of the proposed Wabagishik project site between the hours of 2028h and 2336h on 24 June 2013. Travel speeds were slow due to nocturnal conditions and unstable footing, allowing surveyors to fully assess the entire travelled route. Where an Eastern Whip-Poor-Will was heard, surveyors delayed a minimum of 6 minutes to confirm direction, distance and number of calling birds. GPS coordinates were taken for each confirmed call, with notes regarding direction and approximate distance from source. Calls recorded "ahead" of the surveyors and subsequently heard again as surveyors moved closer to the source were counted as a single bird. Distances between confirmed call sites were utilized to estimate the distance at which a bird could be heard calling (>500m under the existing survey conditions) (Figure 17). This distance measurement allowed approximation of the location of several calls heard by surveyors where the call sites could not be accessed (e.g. across Elizabeth Lake).



Zone	Point #	Bird	UTM East	UTM North
17N	147	EWPW	450336	5121581
17N	148	EWPW	450133	5121538
17N	149	EWPW	449539	5121303
17N	150	EWPW	449402	5121200
17N	154	EWPW	452069	5123118
17N	155	EWPW	452037	5123074
17N	156	EWPW	450025	5121466

Figure 17 - Locations of surveyors for confirmed EWPW calls 24-25 June 2013

24 June Results

At least five (5) Eastern Whip-Poor-Will were confirmed on 24 June. More than five birds were heard calling during the course of assessment, but it could not be confirmed that some calls were not duplicates, from the same bird at different times.

A **Common Nighthawk (*Chordeiles minor*)** was confirmed perched in a small tree alongside the trail at 2208h on 24 June. Holding position in the light from surveyor's headlamps, the bird was observed eating flying insects from its perch as they flew by.

25 June 2013 – EWPW Survey

Option 2 routing was again assessed on 25 June by two ORMG personnel travelling the route on foot. Survey conditions were clear, with no cloud cover and very light wind. Surveys were conducted between the hours of 2028-2336h. Due to clear conditions, EWPW calls were easily confirmed along both the Option 1 and Option 2 routes by surveyors on the west shore of Elizabeth Lake.

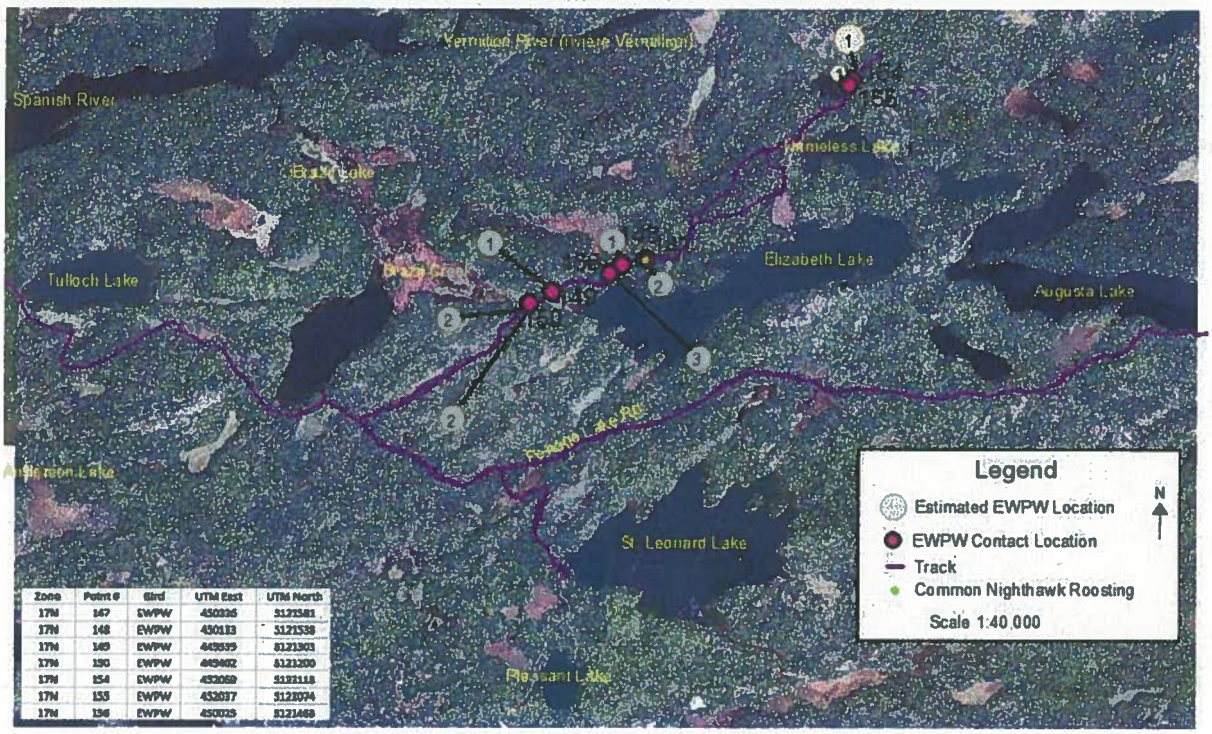
Surveyors assessed a 4700m (9400m round trip) route between the hours of 2028h and 2336h on 24 June 2013. GPS coordinates were obtained whenever surveyors confirmed a call, with approximate direction and distance notes taken. Several EWPW were noted at very close range (<50m) before ceasing to call due to assessor proximity.

25 June Results

At least ten (10) EWPW were noted by surveyors on 25 June. More than ten birds were heard, but some were considered duplicates due to distance and overlap of survey areas. At one point, at least four (4) individual birds were heard calling simultaneously from various directions/distances around the surveyors.

FINAL RESULTS

Combining results from 24 and 25 June, it is estimated that a **minimum of ten (10) and as many as thirteen (13) EWPW** are present within 500m of the Option 1 and Option 2 road routes for the Wabageshik project. Allowing for duplication in confirmed calls between 24 and 25 June, and as a result of distance and location on each survey night, it is still apparent that numerous EWPW are present in the area surrounding the potential road routes (Figure 18).



Zone	Point #	Bird	UTM East	UTM North
17N	147	EWPW	450336	5121581
17N	148	EWPW	450133	5121538
17N	149	EWPW	449939	5121303
17N	150	EWPW	449402	5121200
17N	154	EWPW	452069	5121118
17N	155	EWPW	452037	5120974
17N	156	EWPW	450325	5121468

Figure 18 - Approximate locations and numbers of individual EWPW confirmed during 24-25 June nocturnal surveys

Habitat along the route ranges from lowland marsh and swamp to mixed hardwood/softwood stands. One EWPW was confirmed within 20m of the north side of the Site 13 wetland, but most were located within mature Mixedwood stands. All were within 150-200m of a wetland or lacustrine feature.

Recommendations and Mitigation

Option 1

In the absence of an agreement for use of the existing snowmobile trail in Option 2, the proposed Option 1 routing will be pursued. Locating the road on the east side of Elizabeth Lake will require clearing of "pristine" Mixedwood forest, and avoidance of several rock ledges and swamp areas.

Mature hardwood and mixedwood forest habitat, as well as wetland habitats and large areas of exposed granite with steep cliffs, occur along a large portion of the proposed Option 1 route. Installation of a roadway that can accommodate vehicular traffic and transmission line poles will require deforestation, removal of ground vegetation, and potentially grubbing and infilling of some wetland. Loss of this habitat will be irreversible.

Utilization of construction BMPs as outlined in the Construction Management Plan (CMP) (CPL 2013) will be required to minimize extensive impacts to wetland and forest habitat during road construction, deforestation, clearing of ground vegetation, infilling and installation of transmission line poles. Sedimentation prevention measures, erosion protection, spill management policies and other practices will be required for all in water work, as specified in the CMP, or as required by agencies.

It is recommended that all clearing and filling be undertaken outside of the active herpetile and breeding bird seasons, with works occurring between 15 Sept and 15 April. A qualified biologist or wildlife technician should be present during felling of trees to ensure that no key cavity or raptor nest trees are disturbed, and that clearing avoids such sites by providing a buffer of undisturbed vegetation around each tree per MNR guidelines.

Option 2

From an ecological standpoint, the Option 2 Route would be preferred over Option 1. There would be minimal mitigation required to accommodate for loss of habitat along the proposed road. Location of the road and transmission line along the existing trail will eliminate much of

the clearing required for access. Some addition of large substrate will be required to repair existing ATV damage and to prevent erosion due to surrounding springs and streams, but clearing of vegetation and impacts to wetlands will be minimal.

Provided construction best management practices (BMPs) are undertaken as laid out in the Construction Management Plan (CMP) (CPL 2013), there should be minimal impacts to the surrounding ecosystems as a result of roadway creation on this route.

BMPs to contain sediment and minimize erosion (e.g. sediment screen, geotextile, straw bales, etc.), as well as installation of properly positioned and maintained culverts, will be required along several sections of the existing snowmbile trail to rectify existing ATV damage, re-route streams onto their natural courses (and away from the snowmobile track), and to buffer adjacent wetlands during and post-construction.

As the trail does not run directly to the proposed project site at the north end, any clearing for additional access should be completed outside of the active season for both breeding EWPW and for turtle species (e.g. clearing between 15 Sept and 15 April). This section of the proposed road is common to both Option 1 and Option 2, and impacts due to its construction would apply to both Options.

Should a net loss of habitat be required during construction of the roadway or transmission line on either route, the effect is likely to be irreversible (e.g. loss of wetland habitat due to filling for pole installation), but small in scale.

Assessment must be made of the existing bridge located at the outflow of Elizabeth Lake. At present, it is not suitable for the movement of heavy machinery.

Conclusions

Consideration of the potential ecological impacts associated with routing of roads and transmission lines around the proposed Wabagishik project is intended to inform decision making during the design and pre-construction phases, and to offer options for mitigation during construction of such structures.

Assessing the potential impacts to habitat (flora and fauna) that would result from each of the options listed above, it is evident that Option #2 (on the existing snowmobile trail) is by far the most ecologically feasible of the two routes. Traversing a previously disturbed and easily accessible route greatly minimizes potential adverse impacts to the surrounding environment during road development. Installation of the transmission line adjacent to the trail also reduces habitat disturbance by running the line along an existing habitat edge, dominated by species typical of disturbed areas. Minimal "pristine" habitat alteration or clearing would be required to facilitate this routing option. Areas which would need to be cleared will already be impacted by the penstock construction and associated works. Improvement of the trail would also offer an opportunity to reverse the considerable damage to habitat, wetlands and cold- and cool-water streams that has resulted due to excessive recreational ATV use of the existing trail system.

In order to utilize the Option #1 route, a larger portion of previously undisturbed habitat would be altered or cleared. Sections exiting wetlands would be filled, and existing mature Mixedwood forest would be cleared to allow for the width of the roadway along the proposed route, plus the accompanying transmission line.

Utilization of the Option #1 route would have the benefit of avoiding the snowmobile trail and resultant potential impacts to users of the trail during construction. However, addition of a second route to the project site may in fact increase vehicular and recreational traffic along the new route, opening access to the west side of Elizabeth Lake where none currently exists, and further affecting the surrounding (currently undisturbed) habitat.

Regardless of the final routing option selected, construction Best Management Practices must be implemented during all stages of vegetation removal, ground disturbance and construction.

Qualified subject matter experts should be employed on site during clearing to ensure that no key habitat features (raptor nests, cavity nests, hibernacula, etc.) are disturbed during the clearing process. Disturbance to vegetation and ground cover should be restricted to non-active seasons for breeding birds, amphibians and reptiles.

Kristi Beatty
Biologist / Project Manager
Ontario Resource Management Group Inc.
www.ormg.org
ormgkb@ormg.org
p (613) 638-0283