HARDROCK PROJECT
Final Environmental Impact Statement / Environmental Assessment

Chapter 13.0:
Assessment of Potential Environmental Effects on Wildlife and Wildlife Habitat

Prepared for:
Greenstone Gold Mines GP Inc.
365 Bay St, Suite 500
Toronto ON M5H 2V1

Prepared by:
Stantec Consulting Ltd.
1-70 Southgate Drive
Guelph ON N1G 4P5

Project Number: 160961111
June 2017

Table of Contents

LIST OF TABLES

LIST OF FIGURES

13.0 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON WILDLIFE AND WILDLIFE HABITAT

Wildlife includes birds, mammals, reptiles, amphibians, and insects, as well as Species at Risk (SAR) and Species of Conservation Concern (SOCC). Wildlife habitats are areas where wildlife live and can find food, water and shelter. Wildlife and wildlife habitat was selected as a Valued Component (VC) for assessment because of its ecological, aesthetic, recreational, economic, and cultural importance. The Project has the potential to affect wildlife and wildlife habitat including the direct and indirect loss of habitat, increased mortality risk and disruption of movement.

Wildlife and wildlife habitat is linked to the following VCs:

- atmospheric and acoustic environments (Chapters 7.0 and 8.0) – changes in noise, vibration and lighting have the potential to affect wildlife use of habitat
- vegetation communities (Chapter 12.0) – vegetation communities are closely linked to the identification of wildlife habitats and changes in vegetation communities directly informs the changes in wildlife habitat availability
- land and resource use (Chapter 16.0) – changes in wildlife and wildlife habitat have the potential to affect land and resource use associated with hunting, trapping and guide outfitting
- traditional land and resource use (Chapter 18.0) – changes in wildlife and wildlife habitat have the potential to affect traditional land and resource use by Aboriginal communities, through hunted and trapped species and hunting and trapping areas and activities
- human and ecological health (Chapter 19.0) – atmospheric emissions and water discharges (effluent and seepage) from Project activities can add concentrations of parameters of potential concern in ambient air, soil, surface water and sediment which in turn may affect the health of wildlife.

13.1 SCOPE OF ASSESSMENT

13.1.1 Regulatory and Policy Setting

13.1.1.1 Environmental Impact Statement Guidelines and Terms of Reference Requirements

The wildlife and wildlife habitat assessment has been prepared in accordance with the requirements of the federal Environmental Impact Statement Guidelines (EIS Guidelines; Appendix A1) and provincial Terms of Reference (ToR; Appendix A2). Concordance tables, indicating where EIS Guidelines and ToR requirements have been addressed, are provided in Appendix B.

13.1.1.2 Federal Species at Risk Act

The federal *Species at Risk Act* (SARA) became law in June 2003 and protects federally listed SAR and designated critical habitats. SARA applies to federal lands and is administered throughout Canada by Environment and Climate Change Canada (ECCC; formerly Environment Canada [EC]). The purposes of SARA are to "prevent wildlife species in Canada from disappearing, to provide for the recovery of wildlife species that are extirpated (no longer exist in the wild in Canada), endangered, or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened" (Government of Canada 2016).

SARA includes prohibitions against killing, harming, harassing, capturing or taking individuals of SAR, damaging or destroying residences or critical habitats, and can impose restrictions on development and construction projects which could affect SAR.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent body of experts, assesses wildlife according to a broad range of scientific data. The committee meets annually to review status reports on species suspected of being at risk and provides assessments to government and the public. The federal Cabinet then decides whether those species should get legal protection under SARA. These decisions are made after consultation with affected stakeholders and other groups.

SARA is implemented by the Government of Canada to protect SAR in Canada and it applies to wildlife listed in Schedule 1 of SARA and their critical habitat.

The Project is not located on federal lands. On lands under provincial jurisdiction, SARA goals are typically implemented through provincial legislation, policy, and guidelines. Therefore, SARA does not directly apply to the Project. The effective SAR policy for this Project is the provincial policy, the Ontario *Endangered Species Act, 2007* (ESA).

13.1.1.3 Federal Migratory Birds Convention Act

The *Migratory Birds Convention Act* pertains to migratory birds and their habitats, as defined in Article 1 of the Act[1]. It prohibits the harming, killing, disturbance or destruction of migratory birds, nests and eggs (Section 6) and also prohibits depositing oil, oily waters, or other substances harmful to migratory birds in areas that they may inhabit (Section 5[1]).

13.1.1.4 Federal Recovery Strategies

Federal Recovery Strategies are developed for species designated as extirpated, endangered, or threatened under Schedule 1 of SARA, and include the identification of critical habitat.

[1] Birds not addressed under the *Migratory Birds Convention Act* are grouse, quail, pheasants, ptarmigan, hawks, owls, eagles, falcons, cormorants, pelicans, crows, jays, kingfishers, and some species of blackbirds.

There are three final recovery strategies (boreal caribou, EC 2012; Canada warbler, EC 2016a; common nighthawk, EC 2016b) and one proposed recovery strategy (little brown myotis and northern myotis, EC 2015) relevant to the Project. The recovery strategies for boreal caribou, little brown myotis, and northern myotis identify critical habitat and are considered in this assessment.

13.1.1.5 Provincial Endangered Species Act

The ESA protects species that are listed as threatened or endangered on the Species at Risk in Ontario (SARO) List. The SARO list is developed by the Committee on the Status of Species at Risk in Ontario (COSSARO). COSSARO classifies species according to their degree of risk based on the best available scientific information, community knowledge and Aboriginal traditional knowledge.

The ESA protects individuals of the listed species from harm or harassment and their habitats from damage or destruction. Threatened and endangered species on the SARO list receive immediate general habitat protection; general habitat is defined as areas on which the species depends, directly or indirectly, to carry out its life processes. Regulated habitat is scheduled to be defined within two (endangered) or three (threatened) years of a species being added to the SARO list. Regulated habitat is species-specific and is more precisely defined than general habitat to include specific habitat features and geographic boundaries.

Under certain circumstances, different types of permits may be issued under the ESA to allow activities that would otherwise be prohibited by the Act. The permit type that would likely be most relevant to the Project would be issued under Section 17(2)(c) of the ESA. Commonly referred to as an overall benefit permit, requirements include: demonstration that reasonable alternatives were considered; documentation of steps taken to limit residual effects on the species; and, commitment to measures to be undertaken that will achieve an overall benefit to the species.

Ontario Regulation 242/08 provides specific exemptions from the provisions of the ESA under certain conditions. Exemptions and conditions vary by species, type of activity, the date the species was listed and the date the activity commenced.

Protection under the ESA extends to both public and private lands and is administered by the Ministry of Natural Resources and Forestry (MNRF; formerly the Ministry of Natural Resources). When COSSARO classifies a species as at risk, the classification applies throughout Ontario, unless COSSARO indicates that the classification applies only to a specified geographic area in Ontario.

13.1.1.6 Provincial Fish and Wildlife Conservation Act

The *Fish and Wildlife Conservation Act* is administered by the MNRF for planning, wildlife management and wildlife enforcement. This Act provides protection for wildlife and wildlife residences, such as dens and nests.

13.1.1.7 Ontario's Woodland Caribou Conservation Plan

The *Woodland Caribou Conservation Plan* (MNR 2009a) provides policy direction for the management and recovery of woodland caribou (forest-dwelling boreal population). This plan applies to areas of continuous and discontinuous caribou distribution. The Project occurs within the discontinuous distribution area and woodland caribou and their habitat are included in this assessment.

13.1.1.8 Provincial Policy Statement

The *Provincial Policy Statement* (PPS) (MMAH, 2014) informs land use planning decisions under the *Planning Act* in Ontario. While EAs are not subject to *Planning Act* approval, the policy guidance and practice developed to support the PPS provides a framework for assessing the functions and sensitivities of natural features. This framework was considered in evaluating potential environmental effects and the identification of mitigation measures that will reduce or eliminate the environmental effect.

Policy 2.1 of the PPS establishes a provincial interest in the protection of natural heritage features. The natural heritage features identified in the PPS that are considered in this chapter include habitat of endangered and threatened species and significant wildlife habitat (SWH). Guidance to help identify and evaluate natural heritage features is provided in the *Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement* (MNR 2010a), the *Significant Wildlife Habitat Technical Guide* (MNR 2000) and the Eco-Region Criteria Schedules (MNRF 2015a) for SWH.

While specifically developed for decisions under the *Planning Act,* the PPS and guidance documents can also be used as tools for identifying important wildlife habitats for consideration under the environmental assessment (EA).

It should be noted that "significance" under the PPS is not associated with the term "significant" as it relates to the assessment of residual adverse environmental effects. Threshold criteria for the determination of significance are discussed in Section 13.1.6.

13.1.2 Influence of Consultation on the Identification of Issues and the Assessment Process

Consultation has been ongoing prior to and throughout the EA process, and will continue with government agencies, local Aboriginal communities, and stakeholders through the life of the Project. Chapter 3.0 (community and stakeholder consultation) provides more detail on the consultation process covering open houses, site visits, targeted meetings, newsletters, questionnaires, presentations, and capacity funding for technical reviews and community-based studies among other areas. The Record of Consultation (Appendix C) includes detailed comments received during the development of the Final EIS/EA. As part of the information

sharing throughout the consultation process, Project-related information was provided by Aboriginal communities in the form of traditional knowledge (TK) and traditional land and resource use (TLRU) studies and other forms of information sharing. This information was considered in the environmental effects assessment as described in Section 13.1.3.

Consultation feedback related to wildlife and wildlife habitat has been addressed through direct responses (in writing and follow up meetings), updates to baseline information, and in the Final EIS/EA, as appropriate. An overview of the key comments that influenced the wildlife and wildlife habitat effects assessment between the Draft and Final EIS/EA is provided below.

Existing Conditions and Follow-Up Monitoring

Aroland First Nation (AFN), Long Lake #58 First Nation (LLFN), and the MNRF requested additional baseline surveys and monitoring be conducted. In response, additional field surveys for SAR, amphibians, breeding birds and vegetation were conducted in 2016. Methods and results are included in Sections 13.2.1 and 13.2.2.4. To document existing conditions for large mammals, the presence of all mammals recorded through the field survey program were reviewed and habitat assessments were completed. Population data available from MNRF, that are collected on a wildlife management unit scale (appropriate to the home ranges of large mammals), were included in the Final EIS/EA. A small mammal toxicity study was also undertaken in fall 2016. The toxicity study methods and results are detailed in the human health and ecological risk assessment (HHERA VC, Chapter 19.0).

Through consultation, GGM recognizes that Aboriginal communities are interested in participating in a moose health (i.e., tissue sampling) monitoring study in the region. Given the large ranges of these animals and mandate of the MNRF, GGM will participate in an MNRF-led study with local Aboriginal communities during Project operation. A "Hardrock Project Conceptual Biodiversity Management and Monitoring Plan" (Conceptual BMMP) (Appendix M13) has also been provided in the Final EIS/EA to outline the ongoing wildlife monitoring during construction and operation.

Incorporation of Additional Information in the Effects Assessment

AFN, Ginoogaming First Nation (GFN), Pic Mobert First Nation (PMFN), and the MNRF requested information on specific species be added to the Final EIS/EA (listed in Section 13.1.4). The MNRF and the Métis Nation of Ontario (MNO) requested that sensory disturbance be considered in the assessment as well.

In response, information on moose (Figure 13-3), raptor nests (Figure 13-5), reptiles and amphibians (Figure 13-11), and SAR (American white pelican, barn swallow, and SAR bats; Figure 13-6, Figure 13-7, and Figure 13-9, respectively) has been provided (see Section 13.2), and these wildlife habitats have been included in the assessment (see Table 13-10). Information from consultation input and TK studies was included (see Section 13.1.2 and 13.1.4).

In response to the request for incorporation of sensory disturbance, additional discussion and analysis of lighting, vibration and noise was included in the effects assessment (Section 13.4.2).

Waterfowl and Migratory Birds

AFN, Animbiigoo Zaagi'igan Anishinaabek (AZA), MNRF and the Canadian Environmental Assessment Agency (CEA Agency) requested additional information on waterfowl migratory birds, particularly regarding potential effects associated with waterfowl and migratory bird use of the tailings management facility (TMF).

Waterfowl and birds (which includes migratory birds) are included as species groups assessed (see Table 13-3) and consideration of potential effects of the Project on these groups is included in the Final EIS/EA.

The HHERA VC (Chapter 19.0) evaluated potential Project effects on avian species from changes in water quality resulting from Project activities. The evaluation includes water from the tailings pond and water from other Project components. The TMF reclaim pond was excluded as aquatic habitat because it would not provide the vegetation required to support breeding nor would it provide a food source for resident or migratory waterfowl. Waterfowl exposures are expected to be limited to direct contact with the tailings pond water. Adaptive management measures have been developed to deter waterfowl from coming in contact with tailings pond water in the Conceptual BMMP (Appendix M13). The Conceptual BMMP (Appendix M13) provides a description of mitigation and management strategies consistent with EA commitments and best management practices, monitoring plans, and adaptive management.

Mitigation Measures

The CEA Agency and AFN asked for additional details regarding mitigation measures for migratory birds, bat hibernation habitat, SAR, significant wildlife habitat and species of traditional importance. As applicable, mitigation measures are included in Sections 13.4.2.2, 13.4.3.2, and 13.4.4.2, and are also included in the Conceptual BMMP (Appendix M13). This Plan also includes further details on monitoring and wildlife management at the site during construction and operation.

Wildlife Movement

CLFN, LLFN and the MNO expressed concern around movement of wildlife and asked about a plan for managing wildlife onsite.

Potential effects to wildlife movement are assessed in Section 13.4.4 of the Final EIS/EA. It is expected that due to the removal of vegetation and the presence of activity, animals (particularly large mammals) will move around the site. A Conceptual BMMP (Appendix M13) has been developed and included in the Final EIS/EA and addresses protection measures for wildlife interactions with the Project.

13.1.3 Consideration of Aboriginal Information and Traditional Knowledge

GGM understands the importance of wildlife and wildlife habitat to Aboriginal communities through information sharing during the consultation process (Chapter 3.0). Project-specific TK and TLRU information (Appendix J) have been considered in Project planning including, baseline studies, alternatives assessment approach, mitigation and monitoring, where appropriate. However, only non-confidential TK and TLRU information is presented in the Final EIS/EA, where applicable to the Project, to respect the preferences of Aboriginal communities. An overview of the key Aboriginal information that influenced the wildlife and wildlife habitat effects assessment between the Draft and Final EIS/EA is summarized below.

Project-specific studies from AFN, LLFN, and MNO confirm that community members hunt and trap in the Project development area (PDA), local assessment area (LAA) and regional assessment area (RAA). Project-specific studies from GFN and Eabametoong First Nation (EFN) confirm that community members hunt within the RAA. Traditional land and resource use is discussed further in Chapter 18.0.

Wildlife species identified as having traditional value or interest to Aboriginal communities are listed below. This information has been compiled from Project-specific TK studies and consultation input. Information on species caught or consumed by AFN is considered confidential and therefore detailed information from AFN was not listed in the table below, however it has been assumed that the species listed will also be of traditional value or interest to other Aboriginal communities.

Wildlife Species of Interest to Aboriginal Communities*	Aboriginal Community	Recorded during baseline surveys
Bald Eagle	AFN	Yes
Beaver	CLFN, MNO, EFN	Yes
Black Bear	MNO, EFN	Yes
Caribou	MNO	No
Deer	MNO, GFN	No
Waterfowl/ Ducks	AZA, EFN, GFN, MNO	Yes
Geese	LLFN, MNO, GFN	Yes
Ruffed Grouse[A]	LLFN, GFN, MNO, EFN	Yes
Lynx	CLFN, MNO	Yes
Marten	CLFN, EFN, GFN, LLFN, MNO	Yes
Mink	CLFN, MNO, EFN	No
Moose	AFN, AZA, CLFN, EFN, GFN, LLFN, MNO, PMFN, PPFN	Yes

Wildlife Species of Interest to Aboriginal Communities*	Aboriginal Community	Recorded during baseline surveys
Muskrat	CLFN	No
Otter	EFN	No
Prairie Chicken	MNO	No
Rabbit (i.e. Snowshoe Hare)	CLFN, LLFN, MNO, GFN, EFN	Yes
Great Grey Owl	GFN	Yes
Cougar	GFN	No
Wolf	EFN	Yes
American White Pelican	GFN	Yes
Wolverine	GFN, AFN	No

NOTES:

* Aboriginal communities consulted on wildlife species of interest are provided in Chapter 3.0.

A Partridge was also noted by MNO. Partridge is a term that is sometimes used to refer to grouse species (i.e. ruffed grouse, spruce grouse).

For the purposes of this assessment, all species that were identified during consultation or in TK and TLRU information have been considered to have value to Aboriginal communities and informed the understanding of what wildlife and wildlife habitat are like today and aligned with the potential Project interactions considered in this chapter.

Moose, caribou and bald eagle have been included as species directly assessed in this chapter. Effects on duck species, pelicans and, geese are included as part of the assessment of waterfowl nesting habitat and waterbird stopover and staging habitat.

Deer, muskrat, otter and mink were not recorded during baseline studies; however, they are assumed to be present in the LAA (Section 13.2.2.1). Rabbit (i.e., snowshoe hare), ruffed grouse, great grey owl, beaver, marten, black bear, lynx, and wolf were recorded during baseline studies (Section 13.2.2.1). The effects to these species are addressed through habitat assessments of similar species because they occupy similar habitat.

The Greater Prairie chicken no longer occurs in the wild in Ontario and is listed as "Extirpated" on SARO. Wolverine is known to occur north of the LAA and the species may be returning to the general area. However, as the likelihood of wolverine occurring within the LAA is currently still considered very low, this species is not directly assessed in this chapter; however, the potential effects on wolverine can be inferred through the species included within the assessment because they occupy similar habitat (i.e., moose, caribou).

Cougar is endangered and occurrences are very rare in Ontario (though have increased in recent years). It is associated with large undisturbed forests in northern Ontario. Reported occurrences in the range of the PDA are all historic, the species is unlikely to occur in the PDA and is not considered further in this chapter.

13.1.4 Selection of Potential Environmental Effects and Measurable Parameters

Table 13-1 summarizes the potential environmental effects of the Project on wildlife and wildlife habitat, the measurable parameters, and the rationale for their selection.

These potential environmental effects and measurable parameters are selected based on professional judgment, recent EAs for mining projects in Ontario, and comments provided during consultation. The description of species occurrences, the life cycle function supported by the habitats and the rationale for inclusion in the assessment is provided in Section 13.2.2.1 and Table 13-6.

Table 13-1: Potential Environmental Effects and Measurable Parameters for Wildlife and Wildlife Habitat

Potential Environmental Effect	Measurable Parameters	Notes or Rationale for Selection of the Measurable Parameter
Change in habitat	Change in area (ha) of habitat for: • Migratory birds, represented by: – Forest and treed wetland bird breeding habitat, specifically: ▪ Canada warbler breeding habitat ▪ eastern wood-pewee breeding habitat. – Open habitat bird breeding habitat, specifically: ▪ common nighthawk breeding habitat ▪ barn swallow breeding habitat ▪ barn swallow foraging habitat. – Non-treed wetland (fen, bog, marsh) bird breeding habitat (e.g., Wilson's snipe, yellow warbler, common yellowthroat, swamp sparrow) – Waterfowl nesting habitat • Waterbird stopover and staging habitat, specifically: – American white pelican stopover and foraging habitat. • Raptor nesting habitat, specifically: – bald eagle nesting habitat. • Mammals represented by: – Moose foraging habitat (including seeps) – Moose late winter cover habitat – Woodland caribou habitat – Northern myotis and little brown myotis maternity roost habitat.	The assessment is focused on those wildlife groups and their habitats that are known to occur within the PDA and/or LAA as determined from baseline studies and consultation input. CEAA 2102 requires the assessment of effects on migratory birds as defined in subsection 2(1) of the *Migratory Birds Convention Act, 1994*, Migratory birds are as defined in Article 1 of the MBCA, 1994. Raptors (e.g., bald eagle) and American white pelican are not covered by the MBCA but have been included among the bird species assessed as a result of consultation with Aboriginal groups and MNRF. SAR[A]/SOCC[B] and SWH[C] present within the PDA and/or LAA are encompassed by the species assessed. Migratory birds are included in the assessment within the bird groupings identified (as applicable). Project activities will result in the direct and indirect loss or alteration of habitat through vegetation clearing (direct) and sensory disturbance (indirect). Habitat loss for each wildlife group or species identified is a measurable and quantifiable parameter.

Table 13-1: Potential Environmental Effects and Measurable Parameters for Wildlife and Wildlife Habitat

Potential Environmental Effect	Measurable Parameters	Notes or Rationale for Selection of the Measurable Parameter
	• Amphibians and reptiles, represented by: – Western painted turtle overwintering habitat – Amphibian breeding habitat. • Insects, represented by: – Taiga alpine butterfly breeding habitat.	
Change in mortality risk	Risk (qualitative) of mortality due to vegetation clearing during construction and operation activities. Risk (qualitative) of collisions with Project vehicles. Risk (qualitative) of adverse human-wildlife interactions.	The measurable parameters are focused on the most likely sources of wildlife mortality associated with the Project.
Change in movement	Risk (qualitative) of the Project creating a barrier that prevents wildlife movement.	Project activities may create impermeable or semi-permeable barriers to wildlife movement. An impermeable barrier is a human-made structure or disturbance that prevents wildlife movement. Whether or not a barrier is impermeable depends on the species and the type of barrier.

NOTES:
A SAR are defined as "species on Schedule 1 of SARA and/or listed as endangered, threatened or extirpated under the ESA"
B SOCC are defined as "species listed as special concern under the ESA and/or provincially rare species (e.g., listed as S1-S3 or SH by the MNRF)"
C SWHs are defined with consideration of the provincial guidance provided in the SWH Criteria Schedules (MNRF 2015a) and as detailed in Section 13.2.1.3.

13.1.5 Boundaries

13.1.5.1 Spatial Boundaries

The areas applied for the assessment of potential environmental effects on wildlife and wildlife habitat are described below and shown in Figure 13-1.

Project Development Area

The PDA encompasses the Project footprint and is the anticipated area of physical disturbance associated with the construction, operation, and closure of the Project. The PDA is approximately 2,200 ha in size.

Local Assessment Area

The LAA applied for wildlife and wildlife habitat comprises the area within which wildlife-specific Project effects are most likely to occur. The LAA is delineated by a 500 m zone around the PDA. The 500 m zone represents the indirect effect due to sensory disturbance on woodland caribou[2], one of the most sensitive species that might interact with the Project. The total area of the LAA is 4,094 ha (41 km^2) and includes the PDA.

Regional Assessment Area

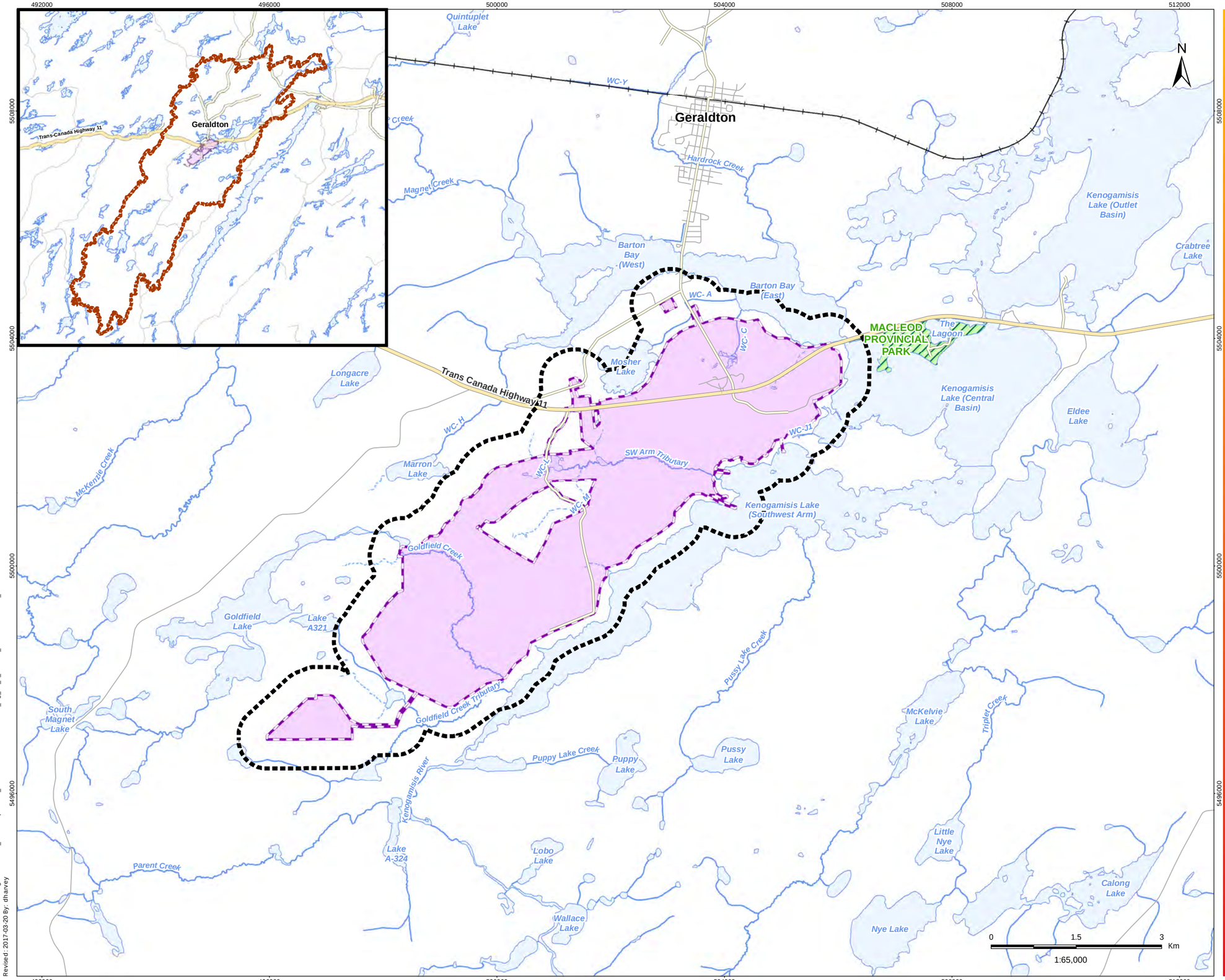
The RAA applied for wildlife and wildlife habitat is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present or reasonably foreseeable projects or activities are considered. The RAA also reflects the large home ranges of landscape-level species, such as caribou, moose, and black bear, which may potentially interact with the Project. The Wildlife and Wildlife Habitat RAA and the Vegetation Communities RAA are the same, emphasizing the direct linkage between these VCs. As described in Section 12.1.4.1, the RAA was selected using natural ecological boundaries, specifically the Burrows River, Kenogamisis River and Kenogamisis Lake watersheds. The range of habitat types found within the LAA is represented within the RAA. The total area of the RAA is approximately168,300 ha (1,683 km^2) and includes the LAA.

13.1.5.2 Temporal Boundaries

The temporal boundaries for the assessment of wildlife and wildlife habitat are:

- Construction: Years -3 to -1, with early ore stockpiling commencing after the first year of construction.
- Operation: Years 1 to 15, with the first year representing a partial year as the Project transitions from construction to operation.
- Closure:
  - Active Closure: Years 16 to 20, corresponding to the period when primary decommissioning and rehabilitation activities are carried out.
  - Post-Closure: Years 21 to 36, corresponding to a semi-passive period when the Project is monitored and the open pit is allowed to fill with water creating a pit lake.

[2] This is consistent with the Recovery Strategy for the Woodland Caribou, Boreal Population, in Canada (Environment Canada 2012), which applies a 500-m zone to linear and polygonal anthropogenic disturbances to identify disturbed caribou habitat.



Stantec

Legend

- Regional Assessment Area
- Local Assessment Area
- Project Development Area

Existing Features

- Highway
- Major Road
- Local Road
- Railway
- Watercourse- Permanent
- Watercourse- Intermittent
- Provincial Park
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.

March 2017
160961111

Client/Project

Greenstone Gold Mines GP Inc. (GGM)
Hardrock Project

Figure No.

13-1

Title

Spatial Boundaries for Wildlife and Wildlife Habitat

W:\active\60960865\drawing\MXD\Final_EA\Chapter\13_WildlifeHabitat\160961111_Fig_13_1_Wildlife_AssessmentArea_20170320.mxd
Revised: 2017-03-20 By: dharvey

13.1.6 Residual Environmental Effects Description Criteria

Table 13-2 summarizes how residual environmental effects are characterized in terms of direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and ecological and socio-economic context. Quantitative measures or definitions for qualitative categories are provided.

Table 13-2: Characterization of Residual Environmental Effects on Wildlife and Wildlife Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The relative change compared to baseline conditions.	**Positive** — an increase in area (ha) of wildlife habitat, a decrease in wildlife mortality risk, an increase in wildlife movement. **Adverse** — a decrease in area (ha) of wildlife habitat, an increase in wildlife mortality risk, a decrease in wildlife movement.
Magnitude	The amount of change in measurable parameters or the VC relative to baseline conditions.	**Low** — a measurable change in area (ha) of wildlife habitat or mortality risk that is within the range of normal variability of baseline conditions and will not affect the long term persistence or viability of wildlife within the RAA; or creation of a semi-permeable barrier that will not affect wildlife movement **Moderate** — a measurable change in area (ha) of wildlife habitat or mortality risk that is unlikely to affect the long term persistence or viability of wildlife within the RAA; or creation of a semi-permeable barrier that is unlikely to affect wildlife movement. **High** — a measurable change in area (ha) of wildlife habitat or mortality risk that might affect the long term persistence or viability of wildlife within the RAA; or creation of an impermeable barrier that will affect wildlife movement.
Geographic Extent	The geographic area in which a residual environmental effect occurs.	**PDA** — the residual environmental effect is restricted to the PDA. **LAA** — the residual environmental effect extends into the LAA. **RAA** — the residual environmental effect extends into the RAA.

Table 13-2: Characterization of Residual Environmental Effects on Wildlife and Wildlife Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations should be noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable (N/A)** — seasonal aspects are unlikely to affect wildlife habitat, mortality risk, or movement. **Applicable** — seasonal aspects may affect wildlife habitat, mortality risk, or movement.
Frequency	Identifies how often the residual environmental effect occurs within a given time.	**Single event** — the residual environmental effect occurs once. **Multiple irregular event (no set schedule)** — the residual environmental effect occurs sporadically, at an irregular interval, and is not predictable. **Multiple regular event** — the residual environmental effect occurs regularly, and may be at predictable intervals or specific times. **Continuous** — the residual environmental effect occurs continuously.
Duration	The length of time required until the residual environmental effect can no longer be measured or otherwise perceived.	**Short-term** — the residual environmental effect is limited to construction or active closure. **Medium-term** — the residual effect extends throughout construction, operation and active closure. **Long-term** — the residual environmental effect extends beyond active closure.
Reversibility	Pertains to whether a measurable parameter or the VC can return to its baseline condition after the Project activity ceases.	**Reversible** — the residual environmental effect is likely to be reversed after activity completion and rehabilitation. **Irreversible** — the residual environmental effect is permanent and is unlikely to return to its existing condition after activity completion and rehabilitation.
Ecological and Socio-economic Context	Considers uncommon characteristics of the area, a community and/or ecosystems that may be affected by the Project and/or whether the VC or measurable parameter is important to the functioning of an ecosystem or community of people.	**Typical** — the VC or measurable parameter is considered common and/or is considered not important to the functioning of the community. **Atypical** — the VC or measurable parameter is considered uncommon and/or is considered important to the functioning of the community.

13.1.7 Significance Thresholds for Residual Environmental Effects

The definition of significance for the residual environmental effects on wildlife and wildlife habitat is based on the regulatory and policy setting for the Project (Section 13.1.1) and in consideration of the criteria presented in Table 13-2.

A significant residual environmental effect on wildlife and wildlife habitat is one that threatens the long-term persistence or viability of a wildlife species within the RAA (including SAR, SOCC, SWH and species of interest to Aboriginal communities).

This significance threshold considers all of the characterizations described in Table 13-2 when making a determination of significance. Direction is considered because only adverse residual environmental effects threaten the long-term persistence or viability of a wildlife species. Magnitude is considered in terms of whether or not the residual environmental effect might threaten the long-term persistence or viability of a wildlife species (see Table 13-2). Geographic extent is considered in the significance threshold by predicting and measuring Project-related residual environmental effects beyond the PDA and into the RAA. Duration is considered in that, in general, only long-term residual environmental effects threaten the long-term persistence or viability of a wildlife species. Reversibility is considered in this significance threshold as, in general, only irreversible residual environmental effects may threaten the long-term persistence or viability of a wildlife species within the regional assessment area. Ecological and socio-economic context is addressed as the significance threshold considers local baseline conditions when determining whether the change in habitat may affect SAR, SOCC, SWH, species of interest to Aboriginal communities, and the long-term persistence or viability of a wildlife species. The remaining characterizations (i.e., timing, and frequency) inform the determination of significance in terms of understanding when and how often the residual effect is anticipated to occur. Specifically, frequency and timing are integral to the characterization of residual environmental effects and have been considered in the development of mitigation measures, where appropriate.

13.2 EXISTING CONDITIONS FOR WILDLIFE AND WILDLIFE HABITAT

This section provides a summary of existing conditions for wildlife and wildlife habitat and the methods used to characterize baseline conditions. Additional details are provided in "Environmental Baseline Data Reports – Hardrock Project: Terrestrial" (Baseline Report – Terrestrial; Appendix E8).

13.2.1 Methods

The description of the existing conditions is based on a review of background information, including communication with the MNRF regarding environmental features and protected species in the area; feedback from consultation; traditional knowledge studies; site-specific field investigations to inventory natural heritage features and collect data on species presence; and habitat identification. These information sources are described in the following sections.

13.2.1.1 Background Information Review

Background information and data were collected and reviewed to identify natural heritage features). Information sources included:

- SARA Registry online database
- MNRF's NHIC online database, Natural Areas and Species records search (NHIC 2014)
- MNRF's Land Information Ontario, digital mapping of natural heritage features (MNRF 2015b)
- Important Bird Areas database (BirdLife International n.d.)
- Atlas of the Mammals of Ontario (Dobbyn 1994)
- Ontario Herpetofaunal Summary (Oldham and Weller 2000)
- Ontario Breeding Bird Atlas (Cadman *et al.* 2007)
- Christmas Bird Count database (National Audubon Society 2010)
- Kenogami Forest Management Plan (Terrace Bay Pulp 2011).

Information on wildlife use of the area was also obtained from discussions with biologists from the MNRF, stakeholders, Aboriginal communities, and from traditional knowledge studies (Traditional Knowledge Assessments / Information; Appendix J). Further detail on the background review is provided in Baseline Report – Terrestrial (Appendix E8).

13.2.1.2 Field Surveys

Field surveys were conducted in 2013, 2014, 2015 and 2016 to complement information gathered during the background information review, and to collect current baseline data on wildlife occurrence, distribution, and habitat use. Baseline field investigations conducted in 2013 and 2014 were documented in a Terrestrial Baseline Report, with 2015 field investigations documented in a Supplemental Baseline Report. The reports are provided in Baseline Report – Terrestrial (Appendix E8). Field investigations conducted in 2016 are summarized in Table 13-3 and Section 13.2.2.1.

In addition to the targeted surveys, observations of wildlife were recorded throughout the field program, including both direct (visual, auditory) and indirect (scat, browse, tracks) observations to provide additional information on wildlife presence and use of the PDA.

Table 13-3: Summary of Wildlife Baseline Surveys, 2013 to 2016

Survey	Date	Protocol	Description/Survey Area
Amphibians	May, Jun 2013; May, Jul 2014; May, Jun, Jul 2015; Jun, Jul 2016	Marsh Monitoring Program (Bird Studies Canada 2003)	In 2013, 157 anuran (frog and toad) call stations were surveyed across the LAA; in 2014, 50 anuran call stations were surveyed; in 2015 32 anuran call stations and 60 transects for salamander breeding pools were surveyed; in 2016, 8 acoustic recorders targeting Goldfield Creek, the Southwest Arm Tributary and aggregate sources were deployed.
Turtle nesting and wintering habitat	Jun 2014 (nesting); Sep 2014 (wintering); Observations recorded during all field surveys (2014-2016)	Significant Wildlife Habitat Technical Guide (MNR 2000); Draft Significant Wildlife Habitat Ecoregion 3E Criterion Schedule (MNR 2012a)	In June 2014, searches for turtles and suitable turtle nesting habitat were conducted during nesting waterfowl surveys within the LAA. In September 2014, basking surveys were completed along waterbodies to identify suitable areas for turtle wintering. General wildlife habitat assessments to identify areas suitable for turtle nesting and overwintering were completed concurrently with other wildlife and vegetation surveys.
Snake hibernacula	Sep 2014 and May 2015 (emergence); Observations recorded during all field surveys (2014-2016)	Significant Wildlife Habitat Technical Guide (MNR 2000); Draft Significant Wildlife Habitat Ecoregion 3E Criterion Schedule (MNR 2012a) and Significant Wildlife Habitat Criteria Schedules for Ecoregion 3E (MNRF 2015a)	General wildlife habitat assessments to identify areas suitable for snake overwintering (hibernacula features) were completed concurrently with other wildlife and vegetation surveys. In September 2014 and May 2015, snake emergence surveys were conducted within the LAA during vegetation and wildlife surveys to identify potential hibernacula.
Breeding birds	May, Jun 2013; Jun, Jul 2014, 2015 and 2016	Ontario Forest Bird Monitoring Program (Cadman *et al.* 1998); Mining Project Baseline Assessment and Survey Requirements (EC 2014)	In 2013 and 2014, a total of 237 breeding bird point count stations and area searches were surveyed across the LAA. In 2015, 41point count stations and seven audio-recorders were deployed. Sixty-eight (68) point count stations and 8 audio-recorders were deployed in 2016. The 2016 survey locations focused on Goldfield Creek, the Goldfield Creek diversion, Southwest Arm Tributary, and aggregate sources.

Table 13-3: Summary of Wildlife Baseline Surveys, 2013 to 2016

Survey	Date	Protocol	Description/Survey Area
Nesting waterfowl	May and Jun 2013; 2014	Bird and Bird Habitats: Guidelines for Wind Power Projects (MNR 2011b)	In 2013, area searches were conducted at 87 locations within the LAA; in 2014, area searches were conducted along the shorelines of Kenogamisis Lake (including Barton Bay and the Southwest Arm) as well as other suitable lakes, including Goldfield and Mosher Lakes. All referenced occurrences of American white pelican were recorded during these surveys.
Migratory waterfowl	Sep, Oct 2014	Bird and Bird Habitats: Guidelines for Wind Power Projects (MNR 2011b)	Sixty-three (63) stations were surveyed within the LAA with a focus on Kenogamisis Lake, and associated bays. All references of waterfowl and waterbirds, including American white pelican, were recorded during these surveys.
Crepuscular and nocturnal birds	Jun 2013, May-Jul 2014, May-Jul 2015 and Jun-Jul 2016	Whip-poor-will Roadside Survey Participants Guide (Bird Studies Canada 2013)	Twenty (20) stations were surveyed within the LAA in 2013, 46 stations in 2014 and 22 stations in 2015. Stations were located along road-side areas that were safely accessible at night. Audio-recorders were deployed where night access was difficult. In 2016, eight audio-recorders were deployed along Goldfield Creek, Southwest Arm Tributary and aggregate sources.
Mammals	Jun 2013, Observations recorded during all field surveys (2013-2016)	Multiple Species Inventory and Monitoring Technical Guide (Manley *et al.* 2006); Provincial Wildlife Monitoring Program (MNR 2010b)	In 2013, six transects within the LAA (each approximately 1 km in length) were walked to systematically record observations and evidence of mammals. From 2013-2016, observations of mammals and evidence of mammals during field surveys were recorded. In October 2016 small mammal trapping was undertaken as part of a small mammal toxicity study. Traps were set at 11 sites (see the Human and Ecological Health VC [Chapter 19.0] for detailed methods and results).
Bat detection	May-Jun 2014, Jun-Jul 2015	Bat and Bat Habitats: Guidelines for Wind Power Projects (MNR 2011a)	In 2014, 12 audio-recorder and handheld recorders were deployed within the LAA to assess the presence of bat species; overnight acoustic monitors were set up in areas of mature tree stands to capture bat numbers and activity. Handheld recorders were used in conjunction with crepuscular bird and amphibian surveys to capture bat activity flying overhead. In 2015, one sound recorder was deployed at the TMF with hand-held acoustic monitors used to record bat activity during breeding amphibian and crepuscular/nocturnal bird surveys.

Table 13-3: Summary of Wildlife Baseline Surveys, 2013 to 2016

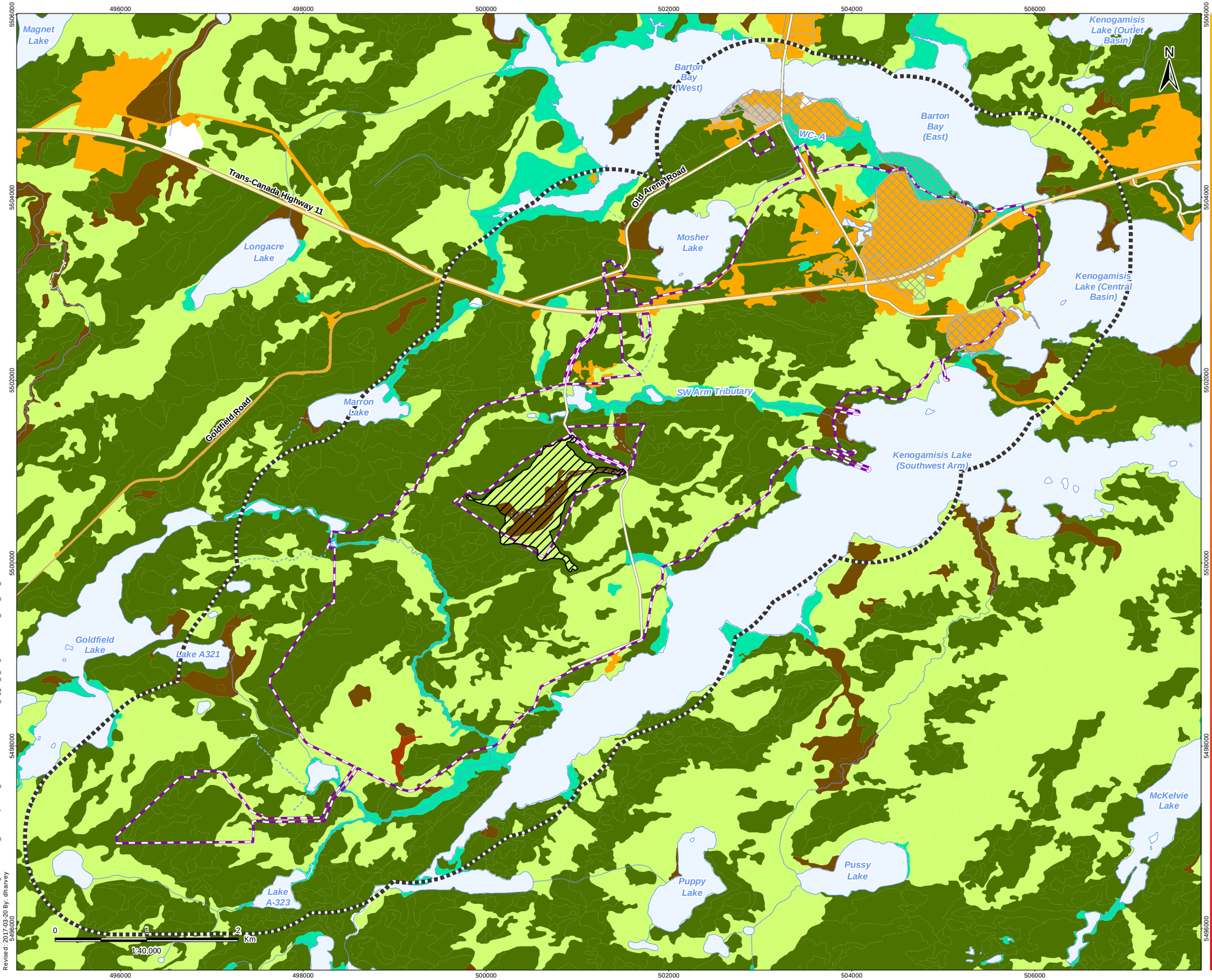
Survey	Date	Protocol	Description/Survey Area
Bat maternity roosts	Spring 2014 Jun 2016	Bat and Bat Habitats: Guidelines for Wind Power Projects (MNR 2011a) Maternity Roost Surveys (Anthropogenic Structures) Guidelines (provided to Stantec from MNRF, pers. comm. Bill Greaves, 2015)	In 2014, 57 plots were surveyed within the PDA in two general locations (see Baseline Report – Terrestrial; Appendix E8), targeting mixed and deciduous forest habitats for bat roosting trees. In June 2016, an assessment of the potential for buildings in the PDA to support anthropogenic maternity roosts was conducted, targeting the MacLeod Townsite, Hardrock Townsite, Manitoulin Shed, and MTO Patrol Yard. Buildings were visually assessed during the day to identify those with the potential to support maternity roosts (i.e., old houses, barns, buildings with holes or spaces where bats may exit). Handheld audio-recorders were then used in conjunction with visual exit surveys to evaluate bat maternity roosting activity at the buildings identified.
Bat hibernacula	Jun, Jul 2015 Jun and Sep 2016	Bat and Bat Habitats: Guidelines for Wind Power Projects (MNR 2011a)	Fourteen (14) potential bat hibernacula features were identified in, or within 1 km of, the PDA. In 2015, 13 of these features were visually surveyed to assess their potential to support bat hibernacula; one location could not be surveyed as access was not granted by the landowner. The remaining feature was visually assessed in June 2016 and swarming and overwintering surveys were conducted at this feature in September 2016.

13.2.1.3 Habitat Identification

Wildlife habitats within the LAA and PDA were identified by comparing field data collected on wildlife habitat features and species presence to mapped vegetation communities (ecosite types). Ecosite mapping was based on Forest Resource Inventory (FRI) data, and confirmed through ground-truthing and vegetation surveys. The development of the ecosite mapping is discussed in Section 12.2.1 of Chapter 12.0 (vegetation communities VC) and described in detail in "Supplemental Environmental Baseline Data Report – Hardrock Project: Terrestrial" (Supplemental Baseline Report – Terrestrial; Appendix E8.2). Vegetation communities are shown on Figure 13-2. Where available, information provided by the traditional knowledge studies was incorporated into the identification of wildlife habitat. In addition, MNRF data (i.e., Land Information Ontario database) was used to identify the location of known specialized wildlife habitat features such as bald eagle nesting sites, moose aquatic feeding areas and moose calving areas.

Where habitat types are identified and described in the *Significant Wildlife Habitat Technical Guide* (MNR 2000), and the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 3E* (MNRF 2015a) consideration of the vegetation community criteria identified within these documents was used to identify wildlife habitat availability within the PDA, LAA and RAA. Field data were reviewed in consideration of the guidance provided in the Ecoregion Criteria for evaluating significance to further determine which habitats would be considered as SWH for the purposes of this assessment. A conservative approach was taken in the identification and evaluation of wildlife habitats, as detailed in Table 13-4. This is considered appropriate for the purposes of an EA as it is inclusionary and means that more wildlife habitats and functions are considered.

The method for identifying habitat for each of the species assessed is detailed in Table 13-4.



W:\active\60960865\drawing\MXD\Final_EA\Chapter\13_WildlifeHabitat\160961111_Fig_13_2_VegCommunities_PDA_LAA_20170320.mxd
Revised: 2017-03-20 By: dharvey

Stantec

Legend

- Local Assessment Area
- Project Development Area

Existing Features

- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Sensitive Feature

Upland Vegetation Communities

- Forest
- Meadow

Wetland Vegetation Communities

- Bog
- Fen
- Marsh
- Swamp

Disturbed Vegetation Communities

- Disturbed
- Historical Tailings Area

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.
3. Vegetation Community Mapping was originally derived from the MNRF Forest Resource Inventory (2008) and has been refined based on field work conducted from 2013-2016.
4. Historical Tailings Areas have been mapped by Stantec based on; historic airphotos, fieldwork, and historic reports.

March 2017
160961111

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.

13-2

Title

Vegetation Communities within the PDA and LAA

Table 13-4: Method for Identification of Wildlife Habitats

Measurable Parameter	Habitat Identification Methods
Canada warbler breeding habitat	Confirmed habitat is defined on the basis of the Project-specific field surveys as the ecosite polygons where the species was recorded during the breeding season (see Table 13-6). In Ontario, Canada warbler generally prefers boreal mixed wood forests, but breeding habitat may also include forested swamps, shrub thicket swamps, riparian woodlands, moist forests, brushy ravines, and deciduous forests (EC 2016a). All forest and swamp ecosites are considered potential habitat for Canada warbler.
Eastern wood-pewee breeding habitat	Confirmed habitat is defined on the basis of the Project-specific field surveys as ecosite polygons where the species was observed during the breeding season (see Table 13-6). Eastern wood-pewee prefer deciduous and mixed woodlands (COSEWIC 2012). All deciduous and mixed forest ecosites are considered potential habitat for Eastern wood-pewee.
Common nighthawk breeding habitat	Common nighthawk nest in a wide range of open, sparsely vegetated habitats, including beaches, grasslands, wetlands, burns, cutblocks, gravel roads and mine features (EC 2016b). Common nighthawk ranges may include isolated foraging and roosting areas that are not directly adjacent to nesting locations (EC 2016b). For this reason, in the absence of confirmed breeding evidence (i.e., nest with eggs) the locations where the species was observed are not considered confirmed breeding habitat. Potential habitat is defined on the basis of the Project-specific field surveys as ecosite polygons where the species was observed during the breeding season (see Table 13-6) as well as cultural meadow (B110), and disturbed ecosites (B194, B197, B198).
Barn swallow breeding habitat Barn swallow foraging habitat	Field survey results were compared to the General Habitat Description (MNR 2013a) to identify barn swallow habitat. Nests are considered category 1 habitat for barn swallow. Category 2 habitat for barn swallow includes up to 5 m from the nest, and category 3 habitat is foraging habitat from 5m-200 m from the active nest (MNR 2013a) (see Table 13-6).
Non-treed wetland bird breeding habitat	All fen, bog and marsh ecosites are considered potential breeding habitat for non-treed wetland breeding birds.
Bald eagle nesting habitat	The known bald eagle nest location is considered confirmed habitat. Treed ecosite types (including deciduous, mixed, and coniferous forests as well as treed swamps) provide suitable nesting habitat for woodland raptors, including bald eagle (MNRF 2015a). While bald eagles nest in close proximity to water (Sandilands 2005), for the purposes of this assessment, all forest and treed swamp ecosites are considered potential nesting habitat. This is considered a conservative approach to the assessment of Project-related effects on bald eagle nesting habitat.
Waterfowl nesting habitat	SWH for waterfowl nesting is conservatively considered to be present in the absence of confirmed use of this habitat type. It is treated as significant based on the known presence of waterfowl during the breeding season and the presence of the vegetation communities to support this habitat type (MNRF 2015a). Ecosites B129-135, B140-152, B224 are identified as SWH for waterfowl nesting (MNR 2000, MNRF 2015c).

Table 13-4: Method for Identification of Wildlife Habitats

Measurable Parameter	Habitat Identification Methods
American white pelican stopover and foraging habitat	Confirmed habitat was defined on the basis of the Project-specific field surveys; all waterbodies used by American white pelican are considered confirmed stopover and foraging habitat (see Table 13-6).
Moose foraging habitat	Confirmed habitat is defined on the basis of the Project-specific field surveys; all ecosite polygons where moose browse was observed are confirmed moose foraging habitat (see Section 13.2.2.1). Moose use young forest communities and shrub communities for foraging. Potential foraging habitat is identified as: - shrub ecosite types B134 (Mineral Thicket Swamp) and B135 (Organic Thicket Swamp) - areas with early successional growth (i.e., areas forested from 1980 onwards (MNR 2008) - remaining ecosite polygons where moose browse was not observed but are the same ecosite community type as ecosites where use was confirmed. Seeps are also included as potential foraging features as these features may support feeding and drinking (MNRF 2015a).
Moose late winter cover habitat	SWH for moose late winter cover is conservatively considered to be present in the absence of confirmed use of this habitat type. It is treated as significant based on the known presence of moose and the presence of the ecosites to support this habitat type as identified in the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 3E* (MNRF 2015a). Ecosites that are identified in the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 3E* (MNRF 2015a) as candidate ecosites for moose later winter cover habitat and that are present are considered SWH for moose late winter cover. These are B037 (Dry, Sandy: Spruce – Fir Conifer), B050 (Dry to Fresh, Coarse Loamy: Jack Pine-Black Spruce Conifer), B051 (Dry to Fresh, Coarse: Hemlock – Cedar Conifer), B052 (Dry to Fresh, Coarse Loamy: Spruce-Fir Conifer), B065 (Moist, Coarse Loamy: Aspen – Birch Hardwood), B066 (Moist, Coarse: Hemlock – Cedar Conifer), B114 (Moist, Fine: Pine – Black Spruce Conifer), and B117 (Moist, Fine: Conifer).
Woodland caribou habitat	Habitat is identified in accordance with *the General Habitat Description for the Forest-dwelling Woodland Caribou* (MNR 2013b) and the Recovery Strategy for Woodland Caribou (*Rangifer tarandus caribou*) (EC 2012). The LAA is not in an area identified as critical habitat for woodland caribou (EC 2012). In Ontario, protected habitat for woodland caribou is categorized as: Category 1 – nursery areas, winter use areas, travel corridors; Category 2 – seasonal ranges; and, Category 3 – remaining areas within the range (MNR 2013b). The LAA is not in an area identified as critical habitat for woodland caribou (EC 2012).

Table 13-4: Method for Identification of Wildlife Habitats

Measurable Parameter	Habitat Identification Methods
Northern myotis and little brown myotis maternity roost habitat	Although the presence of bat maternity roost habitat was not confirmed through field surveys, potentially suitable habitat (natural and anthropogenic) has conservatively been identified based on habitat requirements described in the federal recovery strategy (EC 2015), Bats and Bat Habitats: Guidelines for Wind Power Projects (MNR 2011a) and with consideration for the ecosites identified in the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 3E* (MNRF 2015c). The LAA does not contain critical habitat for northern myotis or little brown myotis (EC 2015). Ecosites that are identified in the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 3E* (MNRF 2015c) as candidate ecosites for natural bat maternity roost habitat and that are present are considered potential wildlife habitat for bat maternity roosts. These are B040, B055, B059, B070, B076, B088, B104, B119 and B125. In addition, buildings (e.g., the townsites, MTO Patrol Yard) are considered potential anthropogenic maternity roost habitat.
Western painted turtle overwintering habitat	Confirmed habitat is defined on the basis of the Project-specific field surveys; turtle overwintering was only confirmed in Kenogamisis Lake (see Section 13.2.2.1). SWH for potential turtle overwintering is conservatively considered to occur in all open water ecosites that provide water deep enough not to freeze and provide soft mud substrates.
Amphibian breeding habitat	Confirmed habitat is defined on the basis of the Project-specific field surveys; all woodland and wetland ecosite polygons where presence of at least one species of amphibian was recorded through field surveys are conservatively considered confirmed SWH for amphibian breeding. All candidate ecosite communities identified in the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 3E* (MNRF 2015c) that occur are considered potential amphibian breeding habitat: conifer (B065, B066, B114, B117), deciduous (B070, B119), and mixed (B076, B125) forests, meadow (B110); conifer swamp (B128, B129, B223), thicket swamp (B134, B135), and open fen and marsh (B141, B142, B144, B146, B149).
Taiga alpine butterfly breeding habitat	Confirmed habitat is defined on the basis of the Project-specific field surveys; all ecosite polygons where taiga alpine butterfly was observed are confirmed habitat. Taiga alpine butterfly occurs most commonly in open black spruce-sphagnum bogs, but may also occur in black spruce swamps or other habitats (Layberry et al. 1998; Minnesota Department of Natural Resources 2016). Potential habitat for Taiga alpine butterfly is identified as remaining ecosite polygons where taiga alpine butterfly was not observed but are the same ecosite community type as ecosites where the species was confirmed.

13.2.2 Overview of Existing Conditions

The RAA is within the Boreal Forest Region, the largest forest region in Ontario and is a complex of upland forest and wetlands and human development. White and black spruce, tamarack, balsam fir, and jack pine are common throughout the RAA with frequent occurrences of deciduous species, including white birch, trembling aspen, and balsam poplar. Wetland types include swamp, marsh, bog, and fen and many of these wetlands have a shallow open water component. Existing disturbances include forest harvesting, mining, urban and rural development, recreation sites, and infrastructure (roads, railway, power lines). Common wildlife species include black bear, moose, marten, snowshoe hare, red fox, beaver, a variety of songbirds, and waterfowl. This description also applies to the LAA, with the addition that shoreline of Kenogamisis Lake is a prominent characteristic, and the predominant existing disturbances are the historical mine sites, a road network that includes Highway 11, and recreation.

The PDA is comprised predominantly of mid-aged treed communities. Treed communities include upland treed communities of conifer, deciduous and mixed conifer-deciduous stands, amongst conifer swamp vegetation communities. The PDA and LAA support small and large lakes, creeks and associated riparian habitat comprised of marsh and thicket communities. Bog and fen communities are also present within the PDA and LAA. These communities support a variety of wildlife species, and are discussed in Section 13.2.2.1.

13.2.2.1 Species Presence and Habitat Associations

A total of 196 wildlife species were recorded during the baseline surveys. The results of the baseline surveys are reported in detail in Baseline Report – Terrestrial (Appendix E8), and summarized by key wildlife groups in the following sections. For all SAR and SOCC observed during the field program, Table 13-6 further describes the species occurrences, the life cycle function supported by the habitats and the rational for inclusion or exclusion in the assessment.

The PDA and LAA supported a variety of wildlife and associated habitat. Wildlife encountered within the PDA and LAA included small and large mammals, breeding birds, migratory waterfowl, amphibians, reptiles, and insects. Supporting habitat for these species is predominantly treed upland and wetland communities, and open water habitats (Kenogamisis Lake). Specific habitat associations are described further below.

Wildlife species identified as having traditional value or interest to Aboriginal communities are listed in Table 13-5 below. This information has been compiled from Project-specific TK studies and consultation input. Information on species caught or consumed by AFN is considered confidential and therefore detailed information from AFN was not listed in the table below, however, it has been assumed that the species listed will also be of traditional value or interest to other Aboriginal communities.

Table 13-5: Wildlife Species of Interest to Aboriginal Communities

Wildlife Species of Interest to Aboriginal Communities*	Aboriginal Community	Recorded during Baseline Surveys
Bald Eagle	AFN	Yes
Beaver	CLFN, MNO, EFN	Yes
Black Bear	MNO, EFN	Yes
Caribou	MNO	No
Deer	GFN, MNO	No
Waterfowl/ Ducks	AZA, EFN, GFN, MNO	Yes
Geese	GFN, LLFN, MNO	Yes
Ruffed Grouse[A]	EFN, LLFN, GFN, MNO	Yes
Lynx	CLFN, MNO	Yes
Marten	CLFN, EFN, GFN, LLFN, MNO	Yes
Mink	CLFN, EFN, MNO	No
Moose	AFN, AZA, CLFN, EFN, GFN, LLFN, MNO, PMFN, PPFN	Yes
Muskrat	CLFN	No
Otter	EFN	No
Prairie Chicken	MNO	No
Rabbit (i.e., Snowshoe Hare)	CLFN, LLFN, MNO, GFN, EFN	Yes
Great Grey Owl	GFN	Yes
Wolf	EFN	Yes
American White Pelican	GFN	Yes
Wolverine	GFN, AFN	No

NOTES:

* Aboriginal communities consulted on wildlife species of interest are provided in Chapter 3.0.

A Partridge was also noted by MNO. Partridge is a term that is sometimes used to refer to grouse species (i.e. ruffed grouse, spruce grouse).

For the purposes of this assessment, all species that were identified during consultation or in TK and TLRU information have been considered to have value to Aboriginal communities. This information has been used to inform and verify baseline conditions and align with the potential Project interactions considered in this chapter.

Moose, caribou and bald eagle have been included as species directly included as part of the assessment. Effects on duck species, pelicans and geese are included as part of the assessment of waterfowl nesting habitat and waterbird stopover and staging habitat.

Deer, muskrat and mink were not recorded during baseline studies; however, they are assumed to be present in the LAA. Rabbit (i.e., snowshoe hare), ruffed grouse, great grey owl, beaver, marten, black bear, lynx, and wolf were recorded during baseline studies. While these species have not been directly included in the species assessed they are identified in Table 13-8. This table identifies additional species associated with the measurable parameters. The effects to these species can be inferred by the effects on the measurable parameters that are associated with the same general habitat associations.

The Greater Prairie chicken no longer occurs in the wild in Ontario and is listed as "Extirpated" on SARO. The Project is also within the historical range of wolverine (Ontario Wolverine Recovery Team, 2013), a species that is listed as Threatened provincially, and Special Concern federally. The Atlas of the Mammals of Ontario shows a historic record of wolverine from the 100 km^2 block containing the RAA (Dobbyn 1994), however the exact location of the record within this block is unknown. There were very few records of wolverine around the RAA from 1980 to 2012 (Ontario Wolverine Recovery Team 2013), and the Project is located just outside the southern limit of the proposed Western Recovery Zone for wolverine (Ontario Wolverine Recovery Team 2013). Through consultation and from information provided from traditional knowledge studies, Aboriginal communities have noted that wolverine are known to occur north of the LAA and the species may be returning to the general area. However, as the likelihood of wolverine occurring within the LAA is currently still considered very low, this species is not directly assessed in this chapter. However, the potential effects on wolverine can be inferred through the species included within the assessment because they occupy similar habitat (i.e., moose, caribou).

Mammals

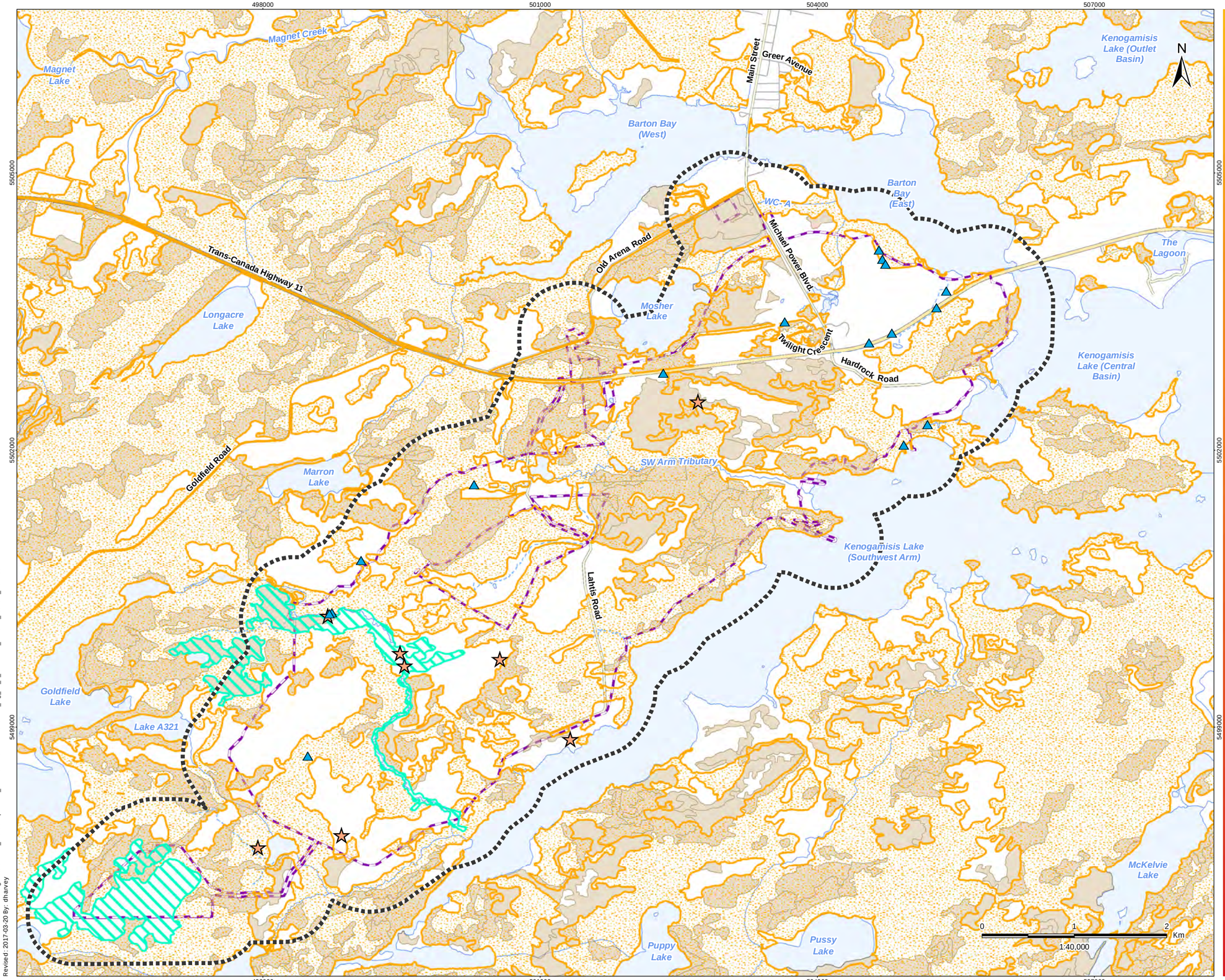
Seventeen mammal species were observed during baseline surveys: moose, black bear, grey wolf, red fox, lynx, pine marten, ermine, little brown myotis, northern myotis, silver-haired bat, hoary bat, striped skunk, snowshoe hare, woodchuck, red squirrel, least chipmunk, and beaver (Baseline Report – Terrestrial; Appendix E8). Two of these are SAR: little brown myotis and northern myotis and are further discussed in Table 13-6. In addition, the PDA is within the historical range for another SAR, woodland caribou. An additional six species of mammals were documented within the PDA through the 2016 small mammal trapping program: red-backed vole, masked shrew, meadow vole, deer mouse, short-tailed shrew, and smoky shrew. No mammal SOCC were identified through the field program.

Large mammals such as moose and bear have large home ranges. Because of these large ranges, moose populations are managed on a landscape scale. In Ontario, MNRF is responsible for the management of wildlife including moose and manages moose populations by Wildlife Management Unit (WMU). The density of large mammals, based on MNRF work includes moose density estimates for WMU 19 (16 moose/100 km^2) and 21A, (28 moose/100 km^2) and an estimate of 20 bears/100 km^2 in the Ecological Zone D, which encompasses the PDA (MNRF 2014a, 2014b, 2014c). The MNRF data provide historic and current information on species populations on a scale appropriate for the species. The occurrence of large mammals in a localized site within a WMU will vary from year to year.

During field studies, evidence of moose was recorded within the PDA and LAA including scat, tracks, browsing and trails (Figure 13-3). Moose browse occurred primarily in the southern portion of the LAA, with observations along Goldfield Creek. Moose foraging and browsing activity was predominantly observed in conifer and mixed forest and conifer swamp communities within the LAA. Moose foraging and browsing activity was observed in ecosites B035 (Dry, Sandy: Pine-Black Spruce Dominated), B050 (Dry to Fresh, Coarse Loamy: Jack Pine-Black Spruce Conifer), B065 (Moist, Coarse Loamy: Pine-Black Spruce Conifer), B076 (Moist, Coarse: Mixed Wood), B125 (Moist, Fine: Mixed Wood), B128 (Intermediate Conifer Swamp), B134 (Mineral Thicket Swamp) and B144 (Organic Meadow Swamp). Seeps are also considered to provide potential feeding and drinking areas and are shown on Figure 13-3. Traditional knowledge study information confirms the occurrence of moose in the area. No specialized microhabitat features such as moose calving areas or moose aquatic areas were identified within the PDA (MNRF 2015b). Habitat for moose within the LAA consisted of foraging/browse habitat as well as potential late winter cover habitat. Moose foraging and late winter cover habitat are considered further in this chapter.

The Project is within the historical range of the boreal population of woodland caribou (EC 2012), a population that is on Schedule 1 of SARA and listed as Threatened provincially and federally. Specifically, the Project is in a discontinuous distribution area between the Nipigon and Pagwachuan ranges and the isolated Coast Range (EC 2012; MNRF 2014d) (Figure 13-4). The discontinuous distribution area is the area within Ontario "where caribou exist in isolated populations, where individuals and local populations do not freely intermingle and mix and where there are geographic or human-caused barriers preventing the genetic interchange of information (MNR 2009a). Caribou use of the LAA is unlikely due to the brownfield conditions across much of the PDA, and the proximity to Highway 11 and other intensive human use (e.g., Geraldton) (MNRF e-mail message to Northern Bioscience, March 19, 2014)[3]. The LAA is not within the seasonal range of caribou and does not contain high use areas such as nursery areas, winter use areas or travel corridors for caribou. Thus, habitat within the LAA does not meet the criteria to be considered Category 1 (high use areas) or Category 2 (seasonal ranges) for caribou. The PDA is considered Category 3 habitat (i.e., remaining area within the range that supports caribou indirectly). The southern portion of the PDA is comprised of upland and wetland vegetation communities typical of the boreal forest, while the northern portion is primarily comprised of anthropogenic and previously disturbed areas. As the Project will affect Category 3 habitat and one of the goals of the provincial Caribou Conservation Plan is to develop a management strategy for the discontinuous distribution area, to enhance connectivity between the northern continuous ranges and the Coast Range (MNR 2009a) caribou are considered further in this chapter.

[3] Historical data provided by MNRF show caribou recorded west (up to 1995), north (1980s to 2011) and east (1970s to 1990s) of the LAA, but not within the LAA.



Stantec

Legend

- Local Assessment Area
- Project Development Area
- Highway
- Major Road
- Local Road
- Railway
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Seep
- Confirmed Moose Foraging Habitat
- Potential Moose Foraging Habitat
- Potential Moose Late Winter Cover Habitat
- Evidence of Moose Observed

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.

March 2017
160961111

Client/Project

Greenstone Gold Mines GP Inc. (GGM)
Hardrock Project

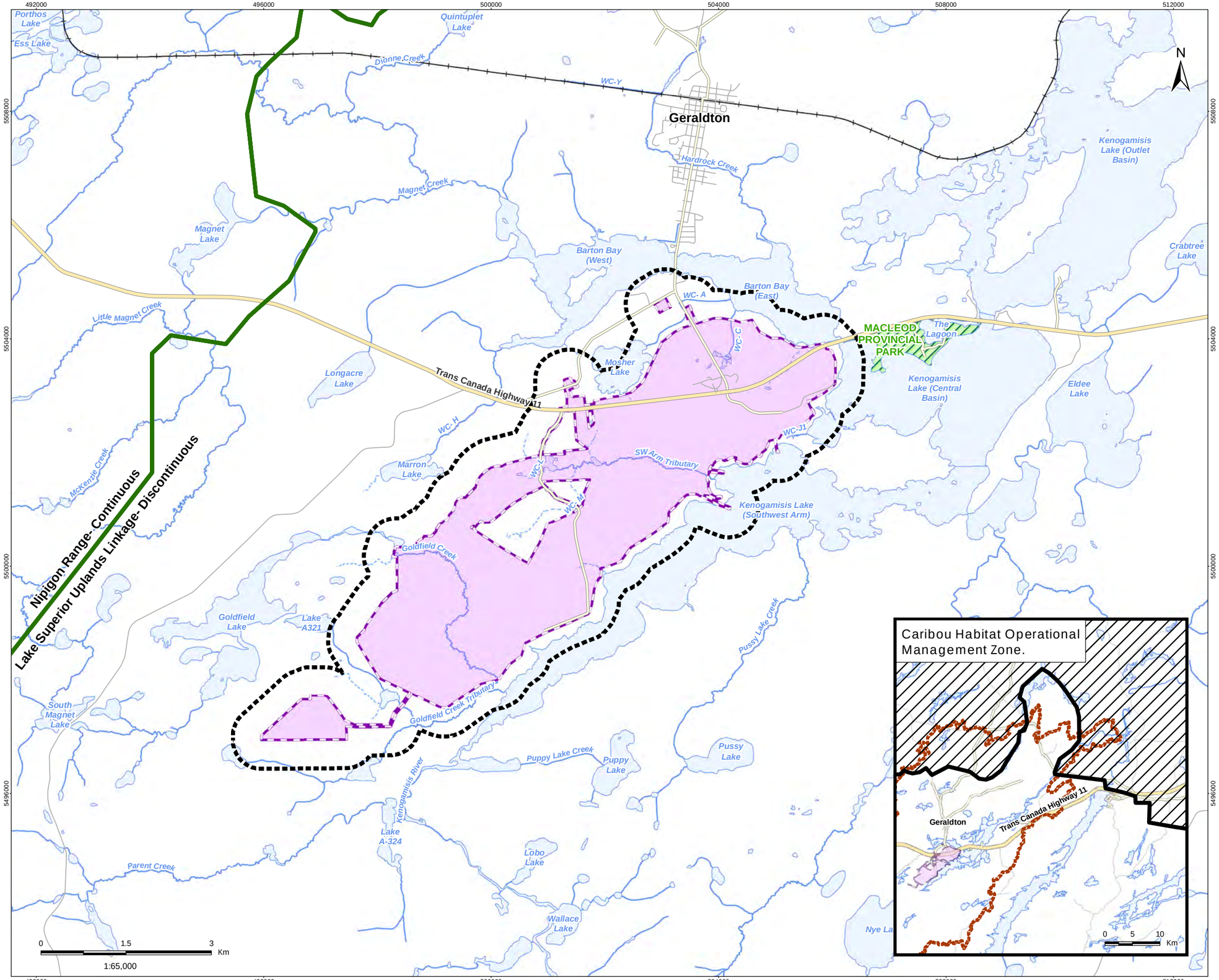
Figure No.

13-3

Title

Existing Conditions for Moose Habitat

W:\active\160960865\drawing\MXD\Final_EA\Chapter13_WildlifeHabitat\160961111_Fig_13_3_Mammal_Habitat_Moose_20170320.mxd
Revised: 2017-03-20 By: dharvey



Stantec

Legend

- Regional Assessment Area
- Local Assessment Area (Category 3 habitat) after LAA on legend
- Project Development Area
- Caribou Range Boundary
- Caribou Habitat Operational Management Zone (Kenogami Forest 2011-2021 Forest Management Plan, Terrance Bay Pulp, 2011)

Existing Features

- Highway
- Major Road
- Local Road
- Railway
- Watercourse- Permanent
- Watercourse- Intermittent
- Provincial Park
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.

March 2017
160961111

Client/Project

Greenstone Gold Mines GP Inc. (GGM)
Hardrock Project

Figure No.

13-4

Title

Existing Conditions for Woodland Caribou Habitat

W:\active\60960865\drawing\MXD\Final_EA\Chapter\13_WildlifeHabitat\160961111_Fig_13_4_CaribouHabitat_20170320.mxd
Revised: 2017-03-20 By: dharvey

Birds

One hundred and thirty-seven (137) bird species, of which 120 are assumed to be breeding locally, were recorded during baseline surveys (Baseline Report – Terrestrial; Appendix E8). All SAR or SOCC species observed during the field program are further addressed in Table 13-6 with the rationale for inclusion or exclusion for further assessment in this chapter.

Existing conditions for migratory birds as defined in subsection 2(1) of the *Migratory Birds Convention Act, 1994*, are described below under Forest and Treed Wetland Birds, Open Habitat Birds, Non-treed Wetland Birds and Waterbirds and are shown on Figures 13-6 to 13-8.

Bird species most commonly recorded during breeding bird surveys included: white-throated sparrow, ruby-crowned kinglet, Nashville warbler, hermit thrush, Swainson's thrush, Canada goose, red-eyed vireo, ovenbird, and American robin.

Forest and Treed Wetland Birds

Breeding bird species commonly recorded that are associated with treed habitats included: American crow, American robin, black and white warbler, black-capped chickadee, common raven, gray jay, hermit thrush, Nashville warbler, ovenbird, red-eyed vireo, pileated woodpecker, ruby-crowned kinglet and white-throated sparrow. Canada warbler (SAR), eastern wood-pewee (SOCC) and eastern whip-poor-will (SAR) were recorded during field surveys; these species are further discussed in Table 13-6.

Open Habitat Birds

Barn swallow, bank swallow and common nighthawk were recorded in association with open/anthropogenic habitats within the PDA. These SAR species are discussed in more detail in Table 13-6.

Non-treed Wetland Birds

Breeding bird species recorded that are associated with non-treed wetland included: alder flycatcher, common yellowthroat, yellow warbler, swamp sparrow, white-throated sparrow, yellow-bellied flycatcher, and Wilson's snipe as well as waterfowl species (see below). No SAR or SOCC breeding bird species associated with non-treed wetlands were recorded.

Waterbirds

Waterbird species recorded within the LAA during field surveys included: snow goose, Canada goose, American white pelican, wood duck, gadwall, American wigeon, American black duck, mallard, blue-winged teal, green-winged teal, ring-necked duck, greater scaup, lesser scaup, bufflehead, common goldeneye, hooded merganser, common merganser, red-breasted merganser, common loon, pied-billed grebe, red-necked grebe, cackling goose, white-winged scoter and short-billed dowitcher. Red-necked grebe and short-billed dowitcher are both SOCC, and American white pelican is a SAR. These species are further discussed in Table 13-6.

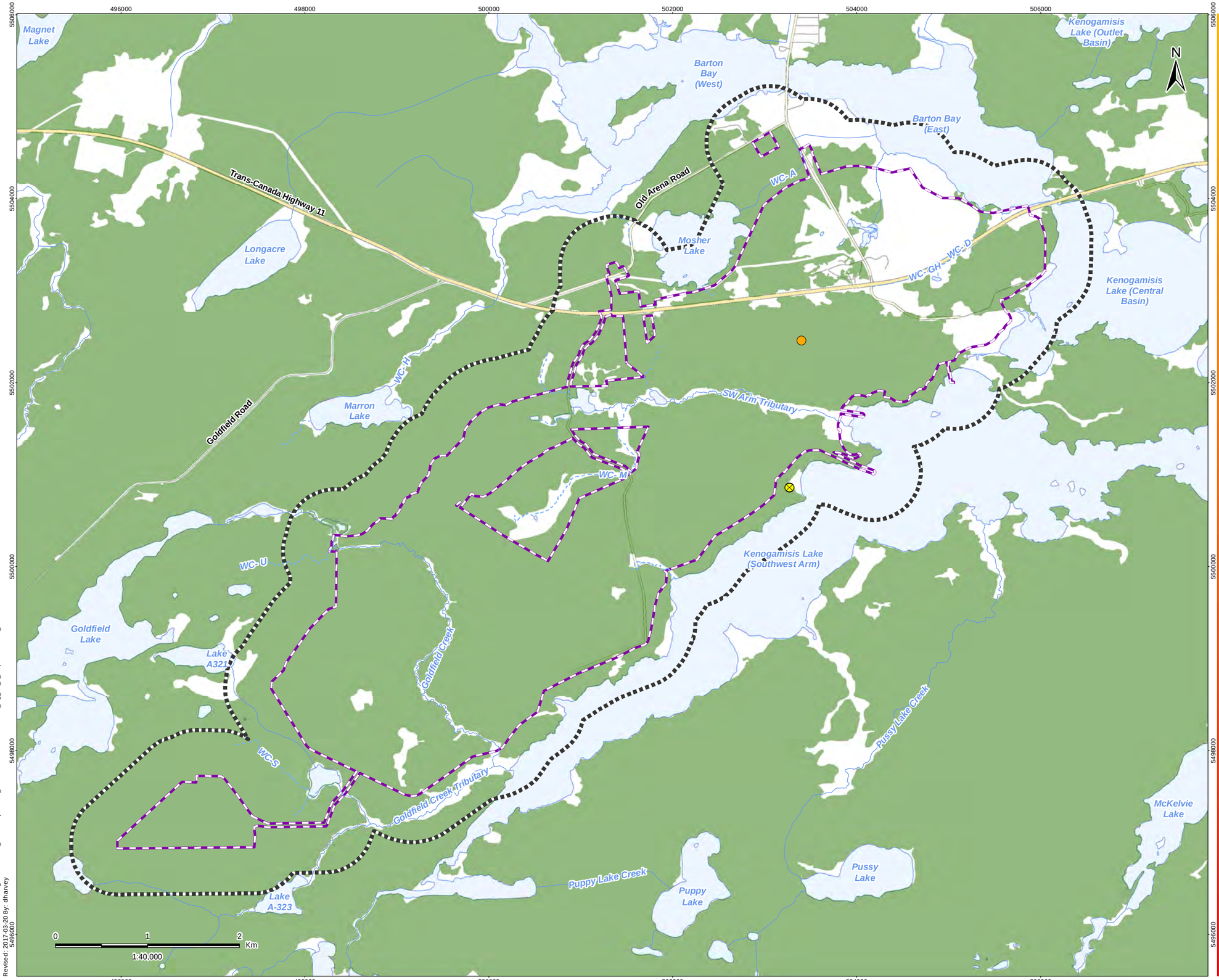
During migratory waterfowl surveys high numbers of waterfowl were recorded using Kenogamisis Lake (inclusive of the Southwest Arm, Central Basin and Barton Bay east and west) as stopover and staging areas.

No nesting pairs of waterfowl were observed during nesting waterfowl surveys; however, species recorded that are considered to be breeding in the area include: ring-necked duck, Canada goose, wood duck, American black duck, mallard, green-winged teal, bufflehead, common goldeneye, hooded merganser and common merganser.

Raptors

Fifteen raptor species (including owls) were recorded within the PDA and LAA during 2013-2016 field surveys, and are: turkey vulture, osprey, bald eagle, northern harrier, broad-winged hawk, red-tailed hawk, American kestrel, merlin, peregrine falcon, great gray owl, great-horned owl, barred owl, long-eared owl, northern saw-whet owl and boreal owl. Two of these species are listed as SOCC: bald eagle and peregrine falcon. These are addressed in more detail in Table 13-6. Bald eagle is a species of cultural importance and significance to Aboriginal communities. Bald eagle nests were identified by Aboriginal communities as commonly occurring in the RAA along the shorelines of lakes including Kenogamisis Lake.

Two raptor nesting locations were identified within the PDA and LAA, and are shown on Figure 13-5. One bald eagle nest was identified south of the Southwest Arm Tributary adjacent to the shoreline of Kenogamisis Lake through consultation with the MNRF (MNRF e-mail message to Stantec, November 15, 2016). One active woodland raptor nest (species unconfirmed) was identified during field surveys within the PDA in an upland deciduous forest community (see Figure 13-5).



Stantec

Legend

- Local Assessment Area
- Project Development Area
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Potential Raptor Nesting Habitat
- Bald Eagle Nest
- Woodland Raptor Nest

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

March 2017
160961111

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.

13-5

Title

Existing Conditions for Raptor Nesting Habitat

W:\active\60960865\drawing\MXD\Final_EA\Chapter\13_WildlifeHabitat\160961111_Fig_13_5_RaptorHabitat_20170320.mxd
Revised: 2017-03-20 By: dharvey

Amphibians and Reptiles

Six amphibian species were recorded during baseline surveys: boreal chorus frog, wood frog, spring peeper, gray tree frog, American toad, and Jefferson/blue-spotted salamander (Baseline Report – Terrestrial; Appendix E8). No amphibian SAR or SOCC were recorded.

Anuran breeding habitat was confirmed within the LAA in B034 (Dry, Dandy: Jack Pine-Black Spruce Dominated), B035 (Dry, Sandy: Pine – Black Spruce Dominated), B049 (Dry to Fresh, Coarse Loamy: Jack Pine – Black Spruce Dominated), B050 (Dry to Fresh, Coarse Loamy: Jack Pine-Black Spruce Conifer), B055 (Dry to Fresh, Coarse Loamy: Aspen-Birch Hardwood), B104 (Fresh, Silty to Fine Loamy: Aspen-Birch Hardwood), B110 (Moist, Fine: Cultural Meadow), B127 (Poor Conifer Swamp), B128 (Intermediate Conifer Swamp), B129 (Rich Conifer Swamp), B135 (Organic Thicket Swamp), B136 (Sparse Treed Fen), B144 (Organic Meadow Swamp), B223 (Peaty Phase: Mineral Intermediate Conifer Swamp).

Two reptile species were recorded during baseline surveys: western painted turtle and eastern garter snake (Baseline Report – Terrestrial; Appendix E8). Four western painted turtles were observed basking on a small island in Kenogamisis Lake. Kenogamisis Lake is suitable for turtle overwintering, and areas along the shoreline may be suitable for turtle nesting. A single eastern garter snake was observed basking on a warm day in September 2014, and additional observations were made in June and July 2015. Snake hibernacula are likely to be present within the PDA and LAA, although specific locations are unknown. Neither of these reptile species is SAR or SOCC.

Insects

Twenty-eight insect species were recorded during baseline field investigations, including eight odonata species (i.e., dragonflies and damselflies) and 20 butterfly species (Baseline Report – Terrestrial; Appendix E8). One species recorded is a SOCC: the taiga alpine butterfly. This species is addressed in more detail in Table 13-6.

Species at Risk and Species of Conservation Concern

As described in Table 13-6, of the SAR and SOCC observed during the field program, five SAR (barn swallow, Canada warbler, common nighthawk, little brown myotis, northern myotis) and three SOCC (bald eagle, eastern wood-pewee, and taiga alpine butterfly) are confirmed to be either resident or breeding within the PDA and LAA. In addition, the Project is located within the discontinuous range for woodland caribou (SAR) and the LAA supports foraging and staging habitat for American white pelican (SAR). These seven SAR and three SOCC species are considered further in this assessment.

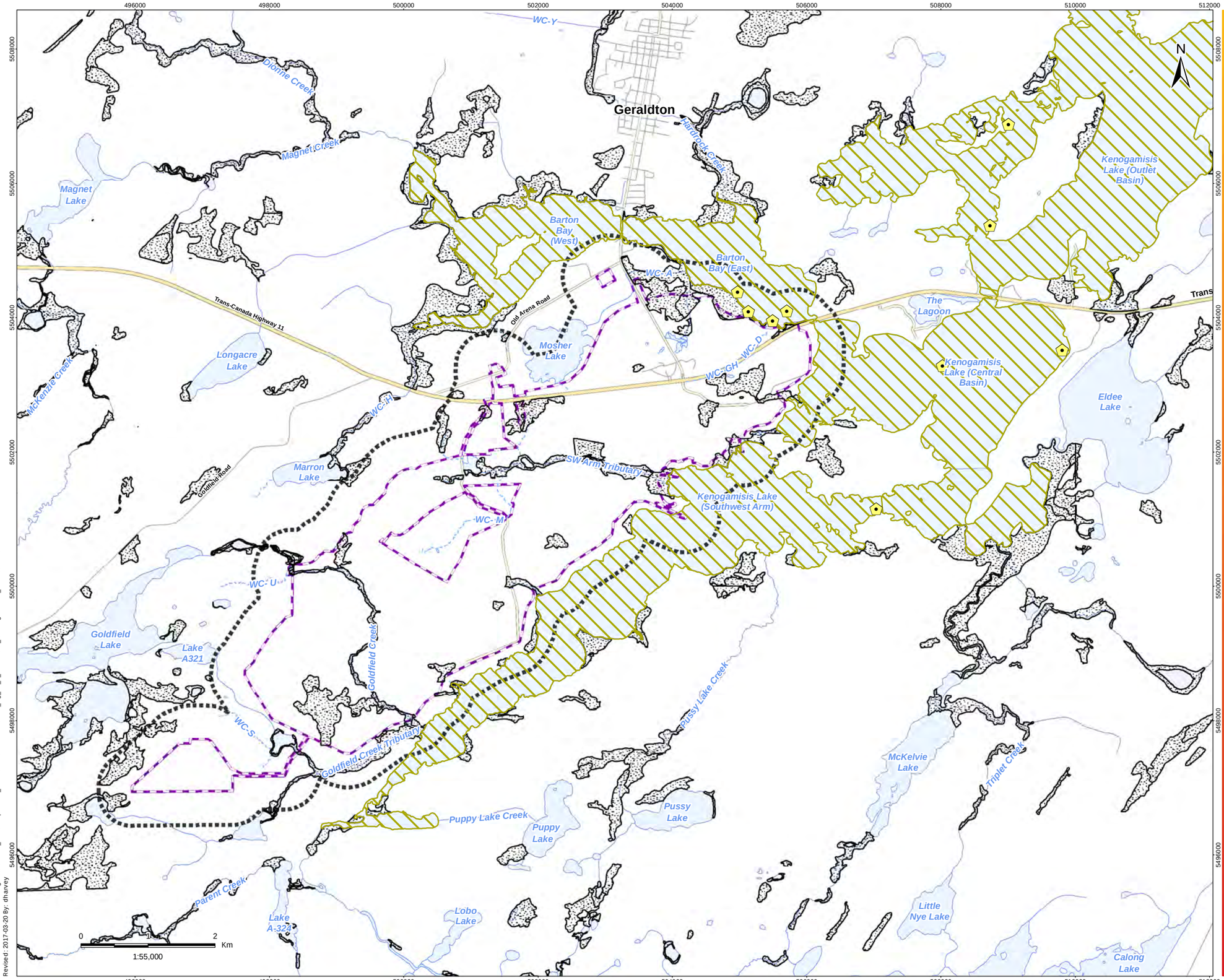
Table 13-6: Species at Risk and Species of Conservation Concern Recorded during Baseline Surveys, 2013-2016

Common Name	Status	S-Rank*	COSSARO	COSEWIC	SARA	Species Observations and Habitat Associations
BIRDS						
American white pelican	SAR	S2B	Threatened	Not at Risk	-	No evidence of breeding was recorded within the PDA or LAA. Between 2013-2015 a total of 169 observations of pelican were recorded; 47 in 2013, 4 in 2014 and 118 in 2015. Of these, 13 were flying overhead, with the remaining 156 observed feeding in Kenogamisis Lake. Locations of pelicans recorded within the LAA are shown on Figure 13-6. The majority of observations occurred outside of the LAA, in the Central Basin and the Outlet Basin (88%; 138 of 156). The remaining 12% (18 of 156) were recorded within the LAA, in Barton Bay East. All individuals were observed either flying over Kenogamisis Lake or using the lake for stopover/staging and foraging. Individuals stopping and foraging on Kenogamisis Lake are likely from the Lake Nipigon breeding colony. Kenogamisis Lake is considered stopover and foraging habitat for American white pelican and is included in this assessment.
Bald eagle	SOCC	S4B, S2N	Special Concern	-	-	During field surveys, bald eagle was observed foraging on Kenogamisis Lake. One bald eagle nest location within the LAA was identified through MNRF correspondence (MNRF e-mail message to Stantec, November 15, 2016)and is shown on Figure 13-5. Active bald eagle nests are also reported to occur outside of the LAA along the shorelines of Kenogamisis Lake (Traditional Knowledge Assessments / Information, Appendix J). Kenogamisis Lake is considered to provide foraging habitat for bald eagle. Confirmed bald eagle nesting habitat occurred within the LAA and is included in this assessment.
Bank swallow	SAR	S4B	Threatened	Threatened	-	No bank swallow nesting colonies were recorded within the LAA. Bank swallow was observed within the LAA flying over the Highway 11 corridor and foraging over Barton Bay. One gravel pit approximately 1.5 km east of the PDA and outside of the LAA supported an active colony of nesting bank swallows. Mosher Pit (located at the western boundary of the PDA along Highway 11) had exposed sandy banks, however, no bank swallow burrows were observed at this location. No other potentially suitable habitat for bank swallow nesting was identified within the PDA. The LAA is not considered to support bank swallow nesting so this species is not considered further in this assessment.
Barn swallow	SAR	S4B	Threatened	Threatened	-	Confirmed locations of nesting barn swallow are present within the PDA, in two buildings contained within the MTO Patrol Yard (15 nests active in 2016). Another nesting location within the LAA was confirmed in the Manitoulin Transport shed (one nest active in 2016). No nesting was observed under bridges or in the townsites within the PDA. Nests are considered category 1 habitat for barn swallow (MNR 2013a). Category 2 habitat for barn swallow includes up to 5 m from the nest, and category 3 habitat includes foraging habitat from 5m-200 m from the active nest (MNR 2013a). Foraging habitat is comprised of open areas that provide good sources of insects (MNR 2013a). It includes 200 m around the MTO Patrol Yard (MTO garage and dome building) and the Manitoulin shed. The 200 m Category 3 habitat is primarily comprised of the open anthropogenic habitat contained within the MTO Patrol Yard and surrounding the Manitoulin shed, but also includes Kenogamisis Lake (Barton Bay East); it is likely that barn swallows are foraging over the bay. Category 1, 2 and 3 habitat for barn swallow within the LAA are shown on Figure 13-7. Barn swallow confirmed nesting habitat occurred within the PDA and LAA and is included in this assessment.
Canada warbler	SAR	S4B	Special Concern	Threatened	Schedule 1	Breeding was confirmed within the PDA and LAA during 2013-2016 breeding bird surveys. From 2013-2016, four Canada warbler observations were recorded within the PDA and LAA. In 2014, two individuals were observed in two separate locations within the PDA; in 2015, two individuals were observed calling in the same location within the PDA. No observations of Canada warbler were made in 2016. Canada warbler was recorded breeding ecosites B104 (Fresh, Silty to Fine Loamy: Aspen-Birch Hardwood), B128 (Intermediate Conifer Swamp), and B55 (Dry to Fresh, Coarse Loamy: Aspen Birch Hardwood). These ecosite polygons are considered confirmed breeding habitat for Canada warbler (Figure 13-8). Breeding habitat for Canada warbler is considered to occur across the PDA and LAA, and is included in this assessment.
Common nighthawk	SAR	S4B	Special Concern	Threatened	Schedule 1	Recorded during crepuscular and nocturnal bird surveys and early morning breeding bird surveys and considered to be breeding within the LAA. There were six observations of common nighthawk within the PDA: one individual in 2014, two individuals in 2015, and three individuals in 2016. Common nighthawk was recorded in pine-black spruce upland forest communities (ecosites B034 and B035), conifer swamp (ecosite B128) organic meadow swamp (ecosite B144), and disturbed compact graveled surface in the Hardrock townsite (B198). These ecosite polygons are considered potential breeding habitat for common nighthawk (Figure 13-7). Breeding habitat for common nighthawk is considered to occur within the PDA and LAA, and is included in this assessment.

Table 13-6: Species at Risk and Species of Conservation Concern Recorded during Baseline Surveys, 2013-2016

Common Name	Status	S-Rank*	COSSARO	COSEWIC	SARA	Species Observations and Habitat Associations
Eastern whip-poor-will	SAR	S4B	Threatened	Threatened	Schedule 1	A single call was reported in 2013 within the LAA, outside of the PDA. Targeted follow-up surveys across the LAA in 2013, 2014, 2015 and 2016 did not detect this species. Habitat for this species includes dry deciduous or mixed forests with exposed openings on the forest floor in areas of patchy canopy cover. As the PDA is situated in portions of a disturbed envelope of early-mid successional forest that was previously forested and mined in the last century, potential areas of small open patches in the areas of regrowth may occur; however, open patches in these areas of regrowth are mostly located in wet or organic soils, which are not suitable for Whip-poor-will nesting. Field investigations determined suitable breeding habitat to be rare or absent within the PDA and LAA. Eastern whip-poor-will is not considered further in this assessment.
Eastern wood-pewee	SOCC	S4B	Special Concern	Special Concern	-	In 2013, one Eastern wood-pewee was recorded in ecosite B049 (Dry-Fresh, coarse Loamy: Jack Pine-Black Spruce Dominated). This ecosite polygon is considered confirmed breeding habitat for Eastern wood-pewee (Figure 13-8). No additional observations were recorded during 2014, 2015 or 2016 field surveys. Upland forest within the PDA and LAA is considered to provide habitat for Eastern wood-pewee. Breeding habitat for Eastern wood-pewee is considered to occur within the PDA and LAA, and is included in this assessment.
Olive-sided flycatcher	SAR	S4B	Special Concern	Threatened	Schedule 1	One individual was recorded in 2013 during breeding bird surveys; this observation was approximately 5 km west of the PDA, and was not located within the LAA. Olive-sided flycatcher was heard calling in ecosite type B114 (Moist, Fine Loamy: Pine-Black Spruce Conifer), which comprises <1% of the PDA. Olive-sided flycatcher was not observed during 2014-2016 field surveys and is not considered present within the PDA or LAA. This species is not considered further in this assessment.
Peregrine falcon	SOCC	S3B	Special Concern	Special Concern	Schedule 1	Observed in 2013. Peregrine falcon was not observed subsequently within the LAA and no evidence of breeding was observed. This species is not considered further in this assessment.
Red-necked grebe	SOCC	S3B, S4N	-	-	-	An observation of one individual was recorded in September 2014, north of the PDA, within the LAA, at the causeway over Barton Bay. This individual was considered passing through the area during migration (Baseline Report – Terrestrial; Appendix E8). There are no previous records for the LAA, which is outside the recognized breeding range for the species (Cadman *et al.* 2007). This species is not considered further in this assessment.
Short-billed dowitcher	SOCC	S3B,S4N	-	-	-	A pair was recorded in May, 2014, within the LAA. The birds were likely passing through during migration (Baseline Report – Terrestrial; Appendix E8). There are no previous records for the LAA, which is well outside the recognized breeding range for the species (Cadman *et al.* 2007). This species is not considered further in this assessment.
MAMMALS						
Little brown myotis	SAR	S4	Endangered	Endangered	Schedule 1	Little brown myotis and northern myotis were recorded within the PDA and LAA through acoustic monitoring surveys (Figure 13-9). Foraging habitat for SAR bats is present within the PDA in adjacent wetland, woodland and open water areas; the landscape surrounding the PDA provides extensive foraging habitat for SAR bats. Surveys conducted in 2014-2016 to identify hibernacula (overwintering) in historical mine shafts/structures indicated structures did not provide suitable habitat to support bat overwintering within the PDA or LAA (did not provide bat entry/access and lacked dry locations providing the right microclimate conditions). Overwintering habitat for bats is considered absent within the LAA. Surveys to identify maternity roosts in both natural (mature treed areas) and anthropogenic structures (buildings) did not confirm use of these habitats as maternity roosts. However, given bats are present in the area during the roosting season, a conservative approach has been applied and potential maternity roosting habitat is included in this assessment.
Northern myotis	SAR	S3	Endangered	Endangered	Schedule 1	
INSECTS						
Taiga alpine butterfly	SOCC	S3	-	-	-	Taiga alpine butterfly is considered a resident to the area, and was recorded within the PDA in each of 2014, 2015 and 2016. This species was recorded in conifer dominated ecosites: B034 (Dry, Sandy: Jack Pine-Black Spruce Dominated), B035 (Dry, Sandy: Pine-Black Spruce Dominated), B128 (Intermediate Conifer Swamp), B136 (Sparse Treed Fen) and B223 (Peaty Phase: Mineral Intermediate Conifer Swamp). These ecosite polygons are considered confirmed breeding habitat for taiga alpine butterfly (Figure 13-10). Breeding habitat for taiga alpine butterfly is considered to occur within the PDA and LAA, and is included in this assessment.

NOTES:
* Source: NHIC 2014; S2 – Imperiled, S3 – Vulnerable, S4 – Apparently Secure-Uncommon, not rare, S#B- Breeding status rank, S#N- Non Breeding status rank
\- not applicable



Stantec

Legend

- Local Assessment Area
- Project Development Area
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- American White Pelican Stopover and Foraging Habitat
- American White Pelican Staging/Foraging Location Observation
- Potential Waterfowl Nesting Habitat

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

March 2017
160961111

Client/Project

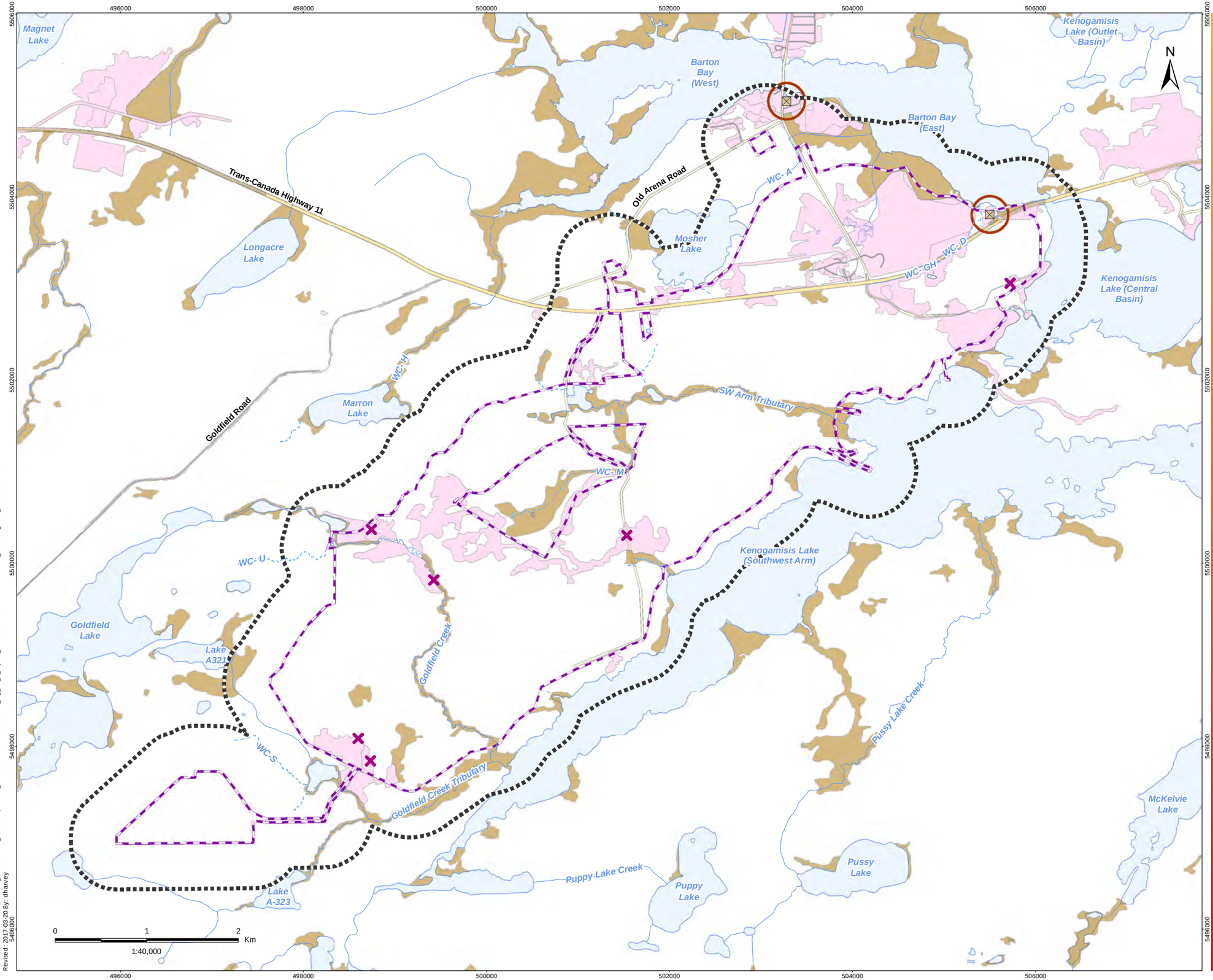
Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.
13-6

Title

Existing Conditions for Waterbird Habitat

W:\active\60960865\drawing\MXD\Final_EA\Chapter13_WildlifeHabitat\160961111_Fig_13_6_WaterbirdNestingHabitat_20170320.mxd
Revised: 2017-03-20 By: dharvey



Stantec

Legend

- Local Assessment Area
- Project Development Area
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Barn Swallow Confirmed Nesting Locations (Category 1 and 2 Habitat)
- Barn Swallow Category 3 Habitat
- Potential Common Nighthawk Habitat
- Common Nighthawk Observation
- Potential Non-treed Wetland Breeding Bird Habitat

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

March 2017
160961111

Client/Project

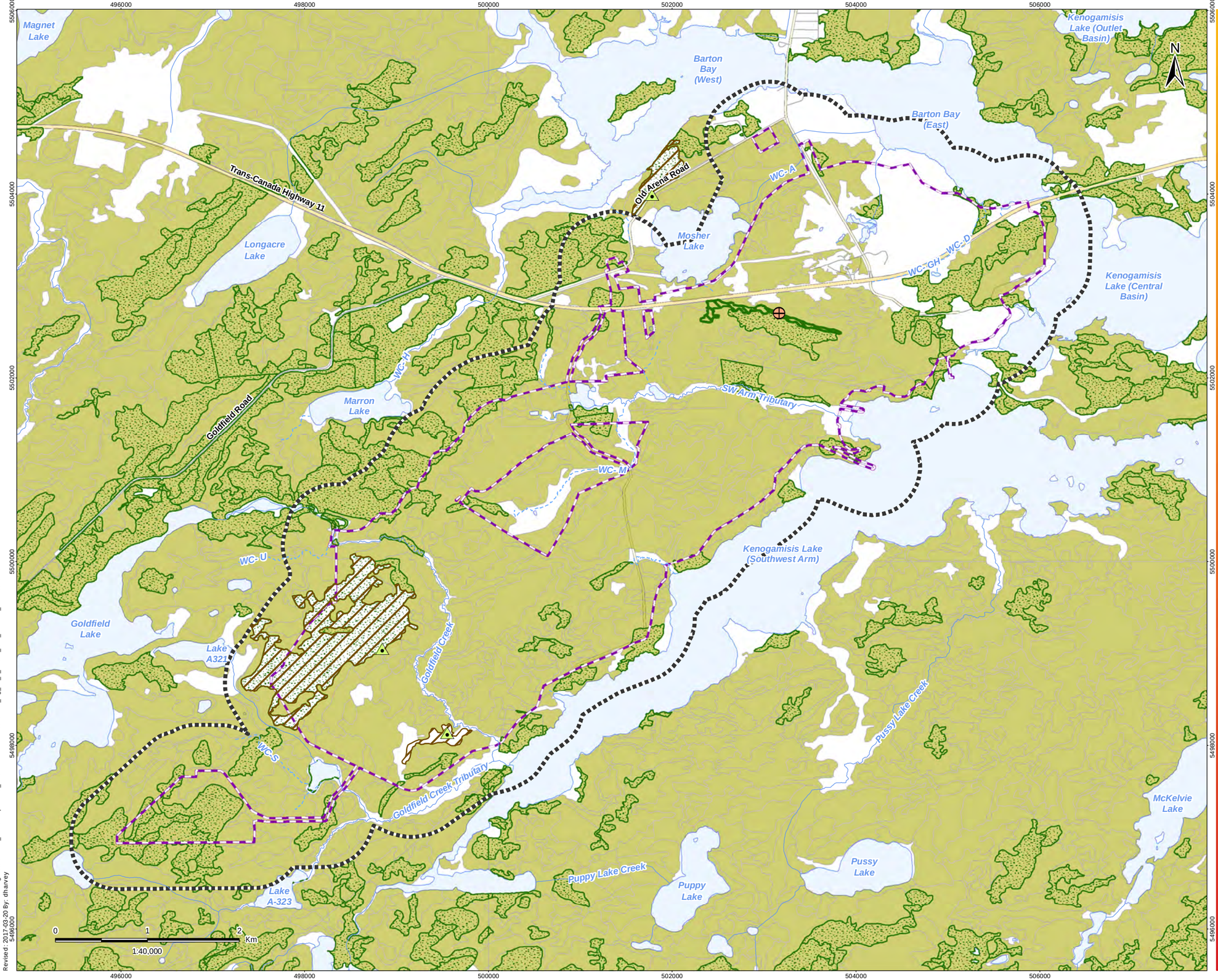
Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.
13-7

Title

Existing Conditions for Open Habitat and Non-treed Wetland Bird Habitat

W:\active\160960865\drawing\MXD\Final_EA\Chapter13_WildlifeHabitat\160961111_Fig_13_7_Open_andNonTreedWetlandHabitat_BreedingBirds_20170320.mxd
Revised: 2017-03-20 By: dharvey



Stantec

Legend

- Local Assessment Area
- Project Development Area
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Confirmed Canada Warbler Habitat
- Potential Canada Warbler Habitat
- Canada Warbler Observation
- Confirmed Eastern Wood-pewee Habitat
- Potential Eastern Wood-pewee Habitat
- Eastern Wood-pewee Observation

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

March 2017
160961111

Client/Project

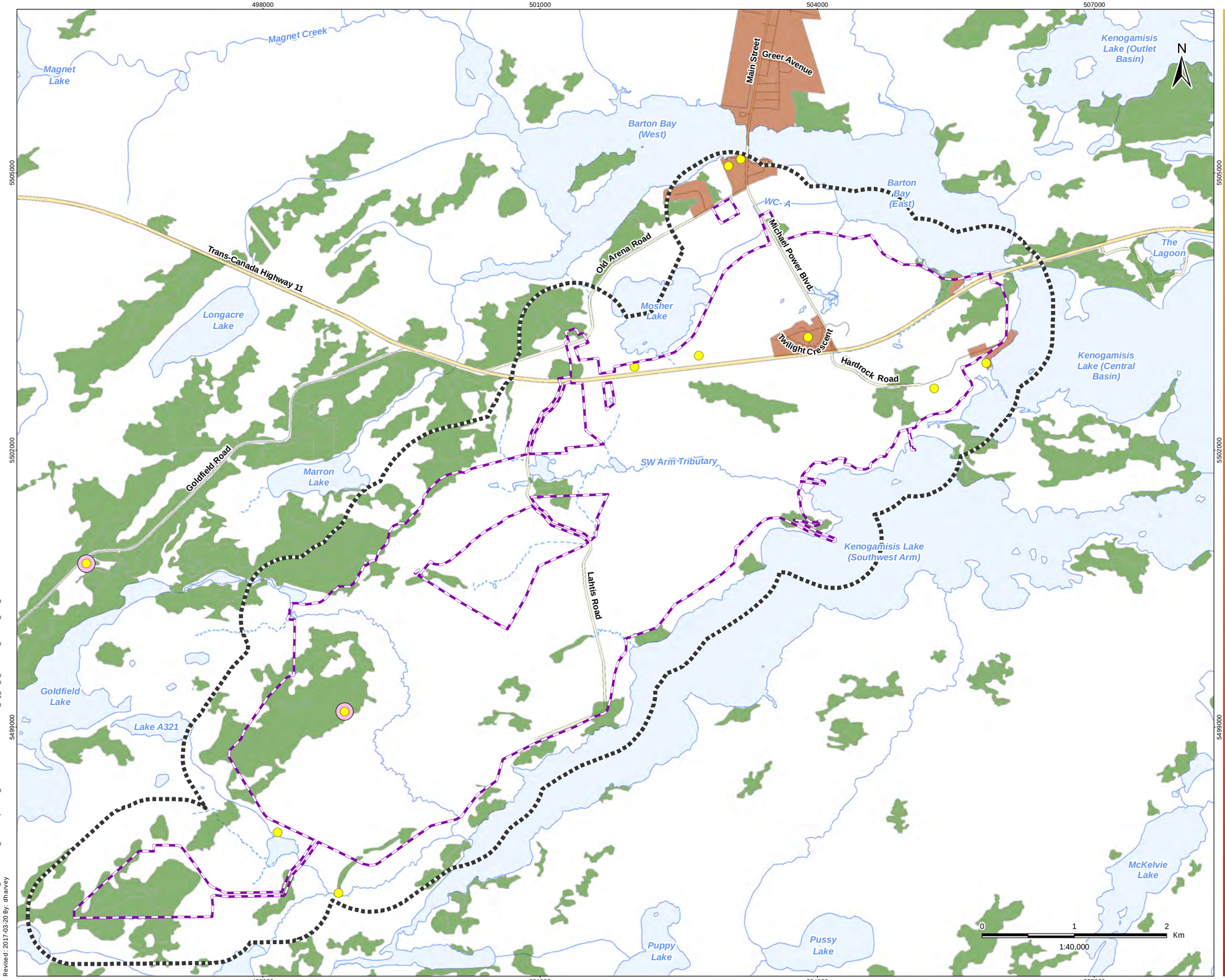
Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.
13-8

Title

Existing Conditions for Forest and Treed Wetland Bird Habitat

W:\active\60960865\drawing\MXD\Final_EA\Chapter\13_WildlifeHabitat\160961111_Fig_13_8_Forest_Bird_Habitat_20170320.mxd
Revised: 2017-03-20 By: dharvey



Stantec

Legend

- Local Assessment Area
- Project Development Area
- Highway
- Major Road
- Local Road
- Railway
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Potential Anthropogenic Maternity Roost Habitat
- Potential Natural Bat Maternity Roost Habitat
- Little Brown Myotis Observation
- Northern Myotis Observation

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.

March 2017
160961111

Client/Project

Greenstone Gold Mines GP Inc. (GGM)
Hardrock Project

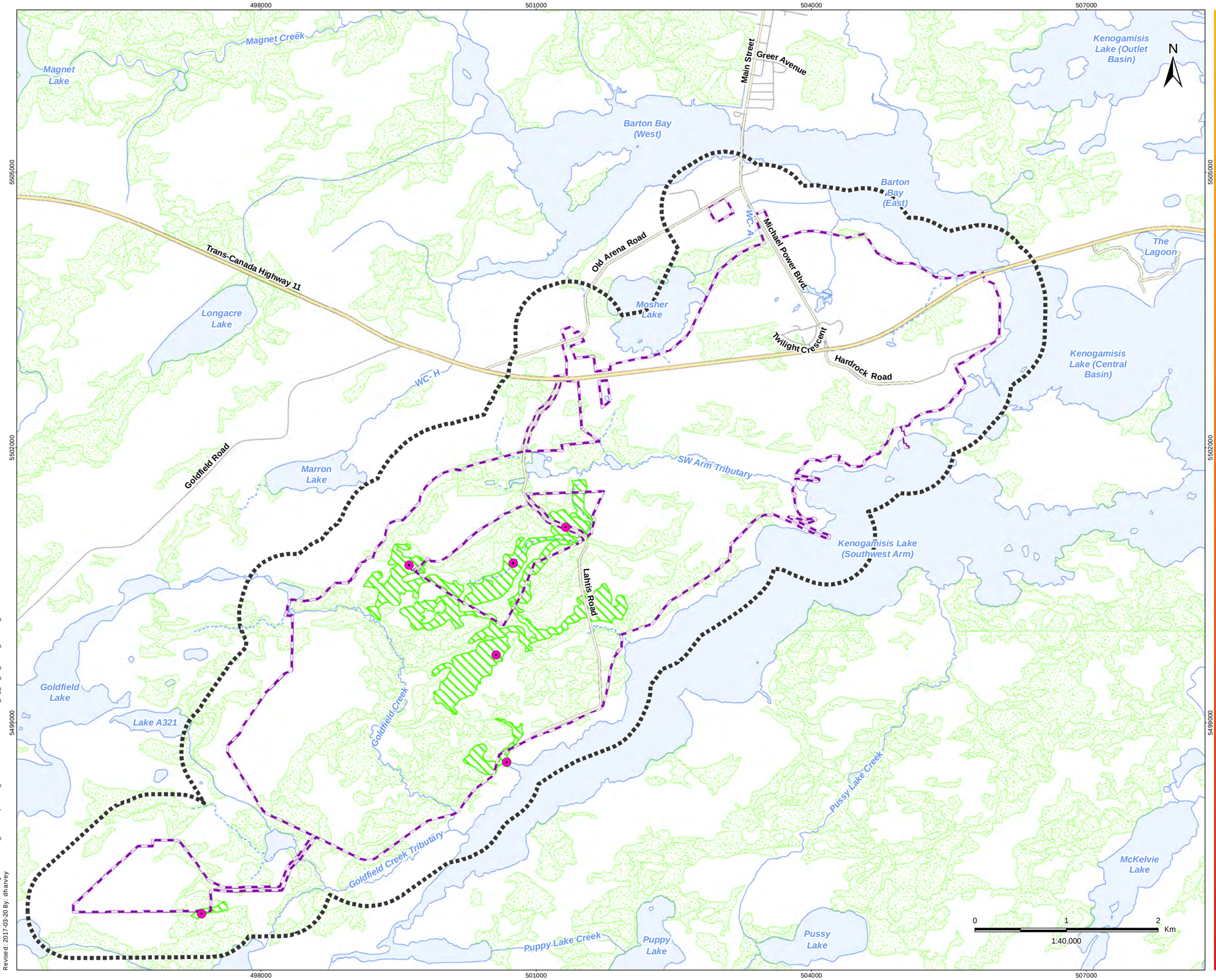
Figure No.

13-9

Title

Existing Conditions
for Bat Habitat

W:\active\60960865\drawing\MXD\Final_EA\Chapter\13_WildlifeHabitat\160961111_Fig_13_9_Mammal_Habitat_Bats_20170320.mxd
Revised: 2017-03-20 By: dharvey



Stantec

Legend

- Local Assessment Area
- Project Development Area
- Highway
- Major Road
- Local Road
- Railway
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Confirmed Taiga Alpine Butterfly Habitat
- Potential Taiga Alpine Butterfly Habitat
- Taiga Alpine Butterfly Observation

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.

March 2017
160961111

Client/Project

Greenstone Gold Mines GP Inc. (GGM)
Hardrock Project

Figure No.

13-10

Title

Existing Conditions for Insect Habitat

W:\active\60960865\drawing\MXD\Final_EA\Chapter\13_WildlifeHabitat\160961111_Fig_13_10_Insect_Habitat_20170320.mxd
Revised: 2017-03-20 By: dharvey

13.2.2.2 Habitat

Vegetation communities within the PDA and LAA included upland communities of conifer, deciduous and mixed forests, amongst early successional communities (i.e., shrubby communities, young forests). Wetland communities included primarily conifer swamps, with some fens, bogs, and marshes, interspersed with areas of riparian habitat adjacent to streams and rivers and open aquatic features. Areas of open water were generally located in areas along the Central Basin and Southwest Arm of Kenogamisis Lake. Descriptions of vegetation communities and their percent cover across the PDA and LAA are discussed in Section 12.2.2.1 of Chapter 12.0 (vegetation communities VC). Figure 13-2 shows vegetation communities within the LAA.

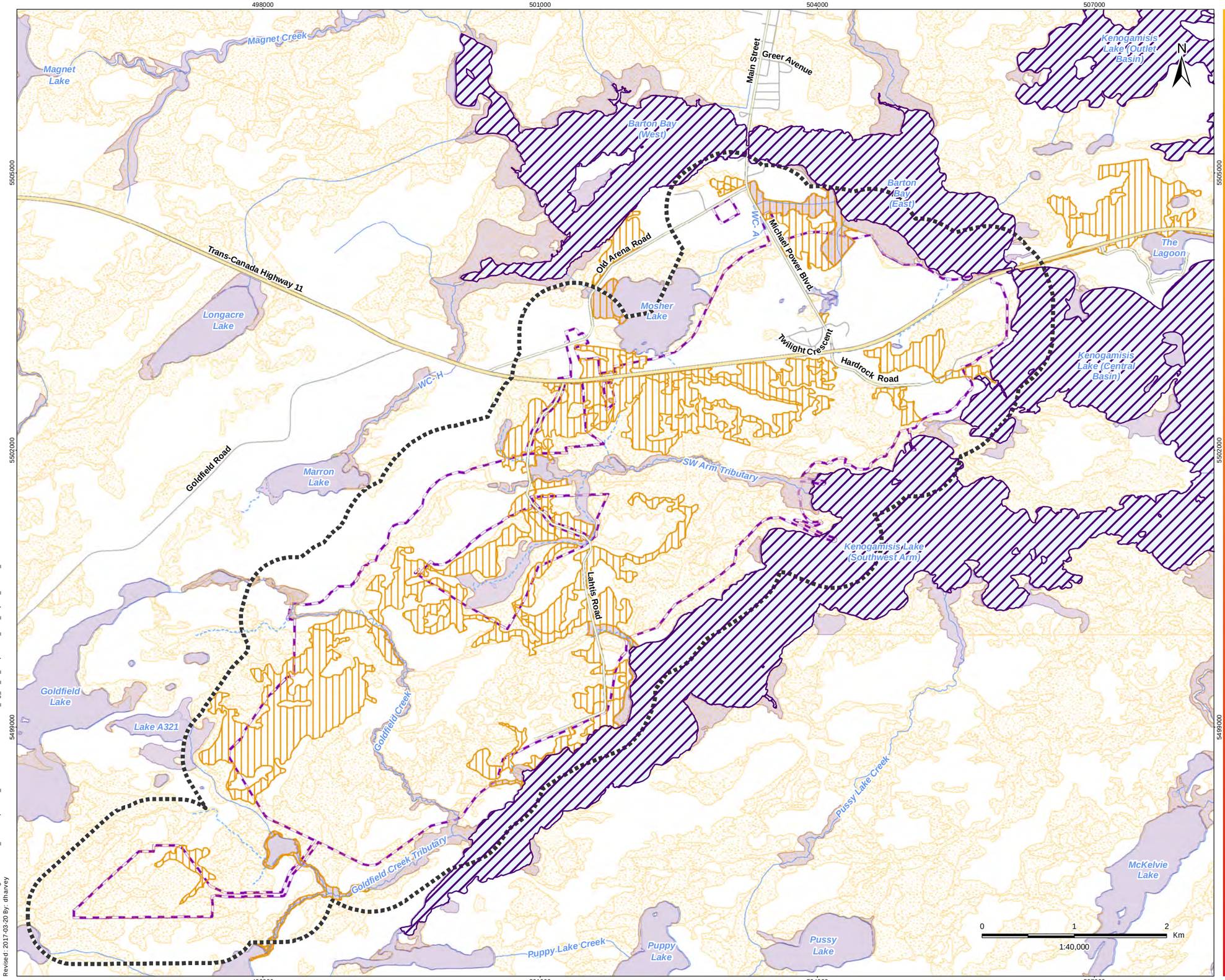
The method for identification of habitat for the species identified in Table 13-1 is described in Section 13.2.1.3 and Table 13-4. Field surveys confirmed the presence and use of habitats within the LAA for breeding birds (including Canada warbler, eastern wood-pewee, common nighthawk, and barn swallow), raptor nesting (including bald eagle), American white pelican stopover and foraging, moose foraging, western painted turtle overwintering, amphibian breeding and taiga alpine butterfly breeding. In addition, waterfowl nesting habitat, moose late winter cover and bat maternity roost habitat (natural and anthropogenic) are conservatively considered to be present. Determining the number of buildings that are present within the LAA and RAA and may provide anthropogenic bat roosting habitat is difficult and may fluctuate with construction and demolition activities, so a quantitative assessment for this measurable parameter was not undertaken.

Critical habitat for the species listed on Schedule 1 of SARA has been defined by the Government of Canada in federal recovery strategies for woodland caribou, little brown myotis and northern myotis and is considered absent from the LAA (see Section 13.2.2.1 and Table 13-6). Critical habitat for Canada warbler and common nighthawk has not been defined (EC 2016a, 2016b).

Existing conditions for wildlife and wildlife habitat within the LAA is described as follows:

- 3,015 ha of breeding habitat for Canada warbler (SAR) is identified within the LAA, including 2,876 ha of potential and 139 ha of confirmed breeding habitat (Figure 13-8).
- 665 ha of breeding habitat for eastern wood-pewee (SOCC) is identified within the LAA, including 657 ha of potential and 8 ha of confirmed breeding habitat (Figure 13-8).
- 411 ha of potential breeding habitat for common nighthawk (SAR) is identified within the LAA (Figure 13-7).
- 16 barn swallow (SAR) nests in three buildings were documented within the LAA (15 of which are in the PDA) (Category 1 habitat). 24 ha of Category 3 (foraging habitat) occurs within the LAA (Figure 13-7).
- 240 ha of potential habitat for non-treed wetland breeding birds occurs within the LAA (Figure 13-7).

- One known bald eagle nest (SOCC) and one woodland raptor nest occur within the LAA and there is 3015 ha of potential nesting habitat (Figure 13-5).
- 442 ha of American white pelican (SAR) staging and foraging habitat occurs within the LAA. It is restricted to Kenogamisis Lake (Figure 13-6).
- 375 ha of SWH for waterfowl nesting habitat occurs within the PDA and LAA (Figure 13-6).
- 2,138 ha of moose foraging habitat occurs within the LAA of which 1,964 ha is potential and 174 ha is confirmed. Confirmed habitat occurs primarily at the south end of the LAA (Figure 13-3).
- 959 ha of SWH for moose late winter cover occurs within the LAA, identified primarily in the north half of the PDA and LAA (Figure 13-3).
- Using the criteria outlined by MNRF, the entire LAA (4,094 ha) would be classified as Category 3 habitat (MNR 2013b) for woodland caribou (SAR) (Figure 13-4).
- The LAA provides 590 ha of potential natural bat maternity roost habitat (SAR) (Figure 13-9).
- No anthropogenic bat maternity roost habitat (SAR) was confirmed; however, several buildings are found within the LAA and these could provide potential anthropogenic bat maternity roost habitat (Figure 13-9).
- SWH for overwintering habitat for western painted turtle was confirmed in Kenogamisis Lake. There is 733 ha of SWH for turtle overwintering of which 441 ha is confirmed habitat and 292 ha is potential habitat (Figure 13-11).
- 2,355 ha of SWH for amphibian breeding occurs within the LAA of which 674 ha is confirmed and 1,525 ha is potential breeding habitat (Figure 13-11).
- 1,228 ha of SWH for Taiga alpine butterfly occurs within the LAA of which 162 ha is confirmed and 1,066 ha is potential (Figure 3-10).



Stantec

Legend

- Local Assessment Area
- Project Development Area
- Highway
- Major Road
- Local Road
- Railway
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Confirmed Amphibian Breeding Habitat
- Potential Amphibian Breeding Habitat
- Confirmed Turtle Overwintering Area
- Potential Turtle Overwintering Area

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.

March 2017
160961111

Client/Project

Greenstone Gold Mines GP Inc. (GGM)
Hardrock Project

Figure No.

13-11

Title

Existing Conditions for Amphibian and Reptile Habitat

W:\active\60960865\drawing\MXD\Final_EA\Chapter\13_WildlifeHabitat\160961111_Fig_13_11_Amphibian_and_Reptile_Habitat_20170320.mxd
Revised: 2017-03-20 By: dharvey

13.2.2.3 Mortality Risk

Sources of wildlife mortality are generally only quantified at broad scales (e.g., incidental take of birds[4]) or at focused scales for certain species groups (e.g., hunted species such as moose). Consequently, data are not available to fully characterize the existing conditions regarding wildlife mortality risk within the RAA and LAA, but clearly there are existing sources of mortality within these areas, including existing road networks, ongoing forest harvesting (e.g., incidental take), and hunting and trapping[5].

13.2.2.4 Movement

Human development within the RAA has resulted in habitat fragmentation and an associated disruption and alteration of wildlife movement patterns. An outcome of these changes is illustrated on a broader regional scale by the isolation of the Lake Superior Coast Range caribou herd from the contiguous herds north of the Project (MNRF 2014d). At a more local scale, the existing development within and around the LAA (i.e. Highway 11, Town of Geraldton) suggests that wildlife have established alternate movement patterns through, around and within the LAA over time. Within the northern portion of the PDA, historical mining activities occurred from the 1930s to the 1970s with rehabilitation occurring in the 1990s; some level of wildlife movement through that area of disturbance may have been re-established since that time. Terrestrial wildlife species (i.e. furbearers, large mammals, amphibians) may use riparian areas, shorelines, woodlands or anthropogenic features (i.e. hydro or pipeline corridors) for movement (MNR 2000). Riparian areas exist within the LAA associated with the Southwest Arm Tributary and Goldfield Creek and it is likely these areas currently facilitate the movement of wildlife locally within the PDA.

13.3 PROJECT INTERACTIONS WITH WILDLIFE AND WILDLIFE HABITAT

Table 13-7 identifies Project components and physical activities that may interact with wildlife and wildlife habitat. These interactions are indicated by a check mark (✓) and are discussed in Section 13.4 as they relate to project effect mechanisms, mitigation measures, and residual effect predictions. Justification for non-interactions (-) is provided following Table 13-7.

4 If a nest, egg or bird is inadvertently harmed, killed, disturbed or destroyed, Environment Canada refers to this as "incidental take" (Environment and Climate Change Canada 2016c).

5 See Chapter 16.0 (land and resource use VC) for a description of existing conditions for hunting and trapping in relation to this Project.

Table 13-7: Potential Project Environmental Effects on Wildlife and Wildlife Habitat, Prior to Mitigation

Project Components and Physical Activities	Potential Environmental Effects (prior to mitigation)		
	Change in Habitat	Change in Mortality Risk	Change in Movement
CONSTRUCTION			
Site Preparation (removal of existing buildings and associated infrastructure, timber harvesting, vegetation clearing, earthworks, overburden and topsoil stockpiling, temporary effluent treatment and discharge)	✓	✓	✓
Watercourse Crossings and Goldfield Creek Diversion	✓	✓	✓
Pre-Production Mining and Development of Mine Components (open pit, waste rock storage areas (WRSAs), ore stockpile, water management facilities, Phase 1 of TMF)	✓	✓	✓
Buildings and Supporting Infrastructure (process plant, temporary camp, STP, mine dry, administration building, truckshop, warehouse and offices, power plant)	✓	✓	✓
Linear and Ancillary Facilities (site roads and parking areas, onsite pipelines, power lines/transformer station, fuel supply, storage and distribution)	✓	✓	✓
Highway 11 Realignment and MTO Patrol Yard Relocation	✓	✓	✓
Aggregate Sources (excavation and dewatering related to aggregate source development and extraction)	✓	✓	✓
Employment and Expenditure	-	-	-
OPERATION			
Open Pit Mining (drilling, blasting, loading and hauling of ore and waste rock)	✓	✓	✓
Waste Rock Disposal	✓	-	✓
Ore Processing (ore crushing and conveyance, ore milling)	✓	-	✓
Water Management (contact water collection system, process water supply, effluent management and treatment, open pit dewatering)	-	-	-
Tailings Management (including excavation and removal of historical tailings)	-	✓	-
Site Buildings, Linear Facilities and Associated Infrastructure (site roads, power plant, explosives facility, fuel supply, storage and distribution)	✓	✓	✓
Employment and Expenditure	-	-	-
CLOSURE			
Active Closure (primary decommissioning and rehabilitation)	✓	✓	-
Post-Closure (pit filling and monitoring)	✓	-	✓
Employment and Expenditure	-	-	-

NOTES:
✓ Potential interactions that might cause an effect without mitigation.
– Interactions are not expected.

Justifications for the non-interactions identified depend on the potential environmental effect but generally conform to one of the following categories:

- Localized or more passive activities within the PDA (e.g., water management) for which the effects on wildlife are encompassed within the range of the much greater effects associated with open pit mining and ore processing.
- Activities for which no apparent pathway exists to a potential environmental effect (e.g., employment and expenditure and potential environmental effects on wildlife; tailings management and change in habitat).

13.4 ASSESSMENT OF ENVIRONMENTAL EFFECTS

13.4.1 Analytical Methods

13.4.1.1 Analytical Assessment Techniques

The general approach to assessing potential environmental effects on wildlife and wildlife habitat follows the sequence and methods outlined in Chapter 6.0 (EA methods). Analytical assessment techniques specific to each potential environmental effect are described separately in Sections 13.4.2 through 13.4.4.

Table 13-8: Measurable Parameters and Additional Wildlife Associations

Measurable Parameter	General Habitat Association	Additional wildlife associations
• American white pelican staging and foraging habitat • Western painted turtle overwintering habitat • barn swallow foraging habitat (Category 3)	open water	• shorebirds • aquatic furbearers (e.g., beaver, mink, otter) • bald eagle foraging
• Canada warbler breeding habitat • Eastern wood-pewee breeding habitat • Bald eagle nesting habitat • moose foraging habitat • moose late winter cover • caribou Category 3 habitat • Northern myotis and little brown myotis maternity roost habitat • amphibian breeding habitat • taiga alpine butterfly breeding habitat	woodland (coniferous, deciduous and mixed forests) and treed wetland	• mink, otter, marten fisher and black bear denning sites • snowshoe hare • lynx • red fox • Eastern wolf • small mammals • raptor (including owls) nesting • deer • ruffed grouse • woodland migratory breeding birds

Table 13-8: Measurable Parameters and Additional Wildlife Associations

Measurable Parameter	General Habitat Association	Additional wildlife associations
• non-treed wetland breeding bird habitat • moose foraging habitat • amphibian breeding habitat • waterfowl nesting	non-treed wetlands (marsh, bog and fens)	
• Common nighthawk breeding habitat • barn swallow nesting habitat • Northern myotis and little brown myotis anthropogenic maternity roost habitat	Open habitats (disturbed/anthropogenic, including buildings)	• ground-nesting birds (e.g., killdeer) • raptors (foraging)

13.4.1.2 Analytical Assessment Techniques for Change in Habitat

The assessment of Project effects on wildlife habitat uses a geographic information system (GIS) to:

1. overlay the PDA on spatial data for the measurable parameters (see Section 13.2.1.3) to determine how much each measurable parameter is predicted to be directly affected (e.g., removed) by the Project
2. overlay a sensory disturbance zone applied to the PDA on spatial data for the measurable parameters to determine how much of each measurable parameter is predicted to be indirectly affected by the Project. These effects are then considered in the context of habitat availability within the RAA.

The sensory disturbance zone defines the area over which the effects of a disturbance are assumed to reduce the effectiveness of the adjacent wildlife habitat due to avoidance or underutilization. For this assessment three sensory disturbance zones have been applied around the PDA:

- mammals (except caribou) and birds: 200 m, based on provincial guidance (e.g., MNR 2000)
- caribou: 500 m, according to the boreal caribou recovery strategy (EC 2012)
- other wildlife**:** 100 m, for wildlife groups presumed to be less sensitive to sensory disturbance.

Wildlife habitat within the PDA is conservatively considered to have no value to wildlife during construction, operation and active closure of the Project. The sensory disturbance zones are applied around the outer extent of the PDA and therefore these areas are beyond the Project footprint where vegetation will be removed. Wildlife habitat that occurs within these zones has been quantified and conservatively assumed to have no value to wildlife during construction and operation of the Project because of the potential for avoidance or reduced use of the

habitat as a result of sensory disturbance. However, it may retain some value for wildlife, depending on species and project phase. Project-specific information on noise, light and vibration (Chapters 7.0 and 8.0) combined with best available science and professional opinion were used to qualitatively assess potential sensory disturbance effects.

The ecosite mapping for the RAA was comprised of the ecosite mapping developed for the LAA (Baseline Report – Terrestrial; Appendix E8) plus ecosite mapping developed from MNRF's FRI for the Kenogami and Lake Nipigon forests. The FRI classification scheme was converted to the "Ecosites of Ontario" (MNR 2009b) to be consistent with the classification scheme used for the LAA. Ecosite code conversions were done using the provincial protocol (i.e., MNR 2012b). The total mapped area within the RAA is 156,179 ha (1,562 km^2)[6].

The assessment of Project effects on habitat during the operation phase assumes full build-out with no wildlife habitat value within the PDA. Indirect effects are conservatively assumed for the duration of the Project life though clearing, site preparation, and operation whereas development will progress over multiple years, and some areas within the PDA (such as the TMF and WRSAs) will be rehabilitated progressively during construction and operation.

13.4.1.3 Analytical Assessment Techniques for Change in Mortality Risk

Change in mortality risk is assessed qualitatively through a review of the literature, consideration of the factors that can contribute to the susceptibility of a species or species group to the Project-specific effect mechanisms (see Section 13.4.4.2) and professional judgment. The construction and operation phases are the focus of the assessment of mortality risk. During closure, adverse Project effects on mortality risk are expected to be less pronounced relative to the construction and operation phases and to be in decline over the duration of the phase, with a return to the baseline (existing) condition at the end of active closure. A conservative approach of characterizing closure effects the same as construction effects has been used.

13.4.1.4 Analytical Assessment Techniques for Change in Movement

Change in wildlife movement is assessed qualitatively using professional judgment, including an assessment of habitat connectivity, consideration of species' sensitivity to human disturbance and seasonal movements. The evaluation is focused on amphibians, moose, and furbearers. Given the direct link between project-related habitat loss and the creation of barriers to wildlife movement, the movement assessment assumes the presence of Project components/barriers to movement from the onset of construction through to closure.

6 The Lake Nipigon Forest FRI was still in production at the time the RAA ecosite mapping was prepared; therefore, a portion of the RAA (7.2%), along the southwestern boundary, is unmapped. The 92.8% of the RAA that is mapped provides an appropriate spatial extent for assessing effects on wildlife habitat.

13.4.1.5 Assumptions and the Conservative Approach

Assumptions that include a conservative approach reduce the likelihood that an effect will be understated, which then reduces the chance for a mistaken determination that an effect is not significant, when in fact it could be. Conservative assumptions used in the wildlife and wildlife habitat assessment are identified directly as part of the identification of wildlife habitats (see Section 13.2.1.3) and the description of analytical assessment techniques for the potential environmental effects (see Sections 13.4.2.1, 13.4.3.1 and 13.4.4.1). These assumptions plus other elements of the assessment that contribute to a conservative approach are then discussed collectively with respect to prediction confidence (Section 13.6).

13.4.2 Assessment of Change in Habitat

13.4.2.1 Project Mechanisms for Change in Habitat

Construction

Vegetation removal during site preparation is the primary effect mechanism for change in habitat. The effect occurs during construction phase but will be evident throughout the life of the Project and into post-closure. There is the potential for habitat features such as raptor and other bird nests, animal dens, beaver dams, and snake hibernacula to be directly affected through vegetation removal and construction activities.

Construction activities also have the potential to affect habitat indirectly as the result of sensory disturbance (through noise, light and vibration) and, to a lesser extent, other indirect effects such as edge effects, dust deposition, and changes to groundwater or surface water systems. Noise and light may cause wildlife to avoid or abandon habitat (e.g., nesting locations) and may cause stress or other physiological effects. Noise may also affect the ability of wildlife species to detect and find prey or mates. These effects are generally considered greatest if disturbance occurs during critical life stages such as courtship or nesting.

Operation

For the purposes of this assessment, it has been assumed that wildlife habitat will generally not be restored during operation due to ongoing activity within the PDA, including open pit mining, ore processing, waste and water management, and road use. However, there may be some localized areas within the PDA where some wildlife habitat value is retained because vegetation removal is not complete (e.g., along some rights-of-way). In addition, some active restoration of vegetation will occur during the operation of the Project in the TMF and WRSAs and through the "Hardrock Project, Fisheries Act, Paragraph 35(2)(b) Authorization and MMER Schedule 2 Draft Offset Plan" (Draft Fisheries Offset Plan; Appendix F10).

The indirect effects (e.g., sensory disturbance) during operation, in the absence of mitigation, are likely to be more pronounced than those during construction or closure given the larger scale and more prolonged time frame.

Vibration from the equipment and processes associated with the continuous Project operation (e.g., blasting and process equipment) may cause levels of vibration that extend beyond the PDA. The main noise-generating sources associated with Project operation include process plant equipment such as rock breakers, feeders, moving sources such as trucks, excavators, and bulldozers as well as blasting that is anticipated to occur once daily during weekdays. Lighting sources from the Project construction and operation phases will include stationary lighting sources associated with buildings/infrastructure and mobile sources from the equipment and traffic. Stray lighting can cause light pollution which can cause adverse effects for surrounding wildlife.

The extent of sensory disturbance experienced by wildlife as a result of Project operation will vary with the type of disturbance, the intensity of human use, season and spatial scale. Sensory disturbance may be most pronounced if experienced during key life cycle periods such as early in the nesting cycle.

There is also the potential for wildlife habitat to be affected through changes to vegetation communities as a result of changes to surface and groundwater regimes. This is further discussed in Section 12.4.4 of Chapter 12.0 (vegetation communities VC). Changes of wetlands to upland community may particularly affect amphibian breeding habitat and non-treed wetland (fen, bog and marsh) breeding bird habitat.

No changes are anticipated to the water levels or water quality of Kenogamisis Lake, so no potential indirect negative effects are expected to the barn swallow foraging habitat, American white pelican stopover and foraging habitat, or turtle overwintering habitats that are supported by the lake due to changes in water conditions.

Indirect effects may cause wildlife to avoid or underutilize habitats near the Project.

Closure

Post-closure activities, such as revegetating areas where disturbance or removal of vegetation has occurred, will restore some wildlife habitat to the PDA. Habitats post-closure will be comprised primarily of early successional, open aquatic and meadow habitats.

Wildlife use and wildlife habitat value of the rehabilitated areas will vary over time according to species-specific habitat requirements, rehabilitated plant community composition, and rates of succession. There will be some loss of wildlife habitat that will persist following Project post-closure, due to permanent Project components such as the open pit, WRSAs, TMF.

Restoration of forest or treed wetland habitat is considered limited. The primary areas that will contain forest or treed wetland vegetation communities after closure are along the Kenogamisis Lake shoreline, along the Goldfield Creek diversion and the Southwest Arm Tributary. These areas may continue to support bald eagle nesting habitat, forest and treed wetland bird breeding habitat, natural bat maternity roost habitat, moose foraging habitat and amphibian breeding habitat.

Indirect effects will abate when the Project closes, with reduced traffic levels and the cessation of Project activities.

13.4.2.2 Mitigation for Change in Habitat

Project planning and design and the application of proven mitigation measures will be used to reduce adverse effects on habitat. Mitigation considered for construction, operation and closure are presented in Table 13-9.

Table 13-9: Mitigation Measures for a Change in Habitat

Mitigation Measure for a Change in Habitat	Construction	Operation	Closure
Mitigation for potential effects from lighting in Chapter 7.0 (atmospheric environment VC).	✓	✓	✓
Mitigation for potential effects from noise and vibration described in Chapter 8.0 (acoustic environment VC).	✓	✓	✓
Mitigation measures related to vegetation described in Chapter 12.0 (vegetation communities VC).	✓	✓	✓
Implement measures detailed in the Conceptual Closure Plan (see Appendix I) including the revegetation plan.	-	-	✓
Obtain proper authorizations under the ESA, including Ontario Regulation 242/08 (as applicable) for damage or destruction of habitat protected under the ESA and implement measures required by the authorization.	✓	-	-
If an active bald eagle nest occurs within 800 m of Project construction or operation activities, develop protection measures.	✓	✓	-
Prior to construction flag environmentally sensitive areas adjacent to work areas (e.g., key habitat features such as dens, roosts, stick nests, beaver dams, hibernacula) prior to clearing and construction, and evaluate the features for additional mitigation measures (e.g., timing windows and/or setbacks).	✓	-	-
Retain actual or potential wildlife trees (e.g., cavity trees or snags) in areas where it is safe to do so.	✓	-	-

Table 13-9: Mitigation Measures for a Change in Habitat

Mitigation Measure for a Change in Habitat	Construction	Operation	Closure
Incorporate MNRF Best Management Practices for Mineral Exploration and Development Activities and Woodland Caribou in Ontario (MNR 2013c) in the development of the Biodiversity Management and Monitoring Plan (BMMP) and apply specific mitigation measures developed in consultation with MNRF (a Conceptual BMMP is provided as Appendix M13).	✓	-	-
Managing vegetation cover along the boundaries of high activity areas (e.g., access roads) where adjacent to wildlife habitat to reduce sensory (noise and visual) disturbance.	-	✓	-
Avoid use of herbicides where feasible or practical.	-	✓	-
Progressive rehabilitation of disturbed areas used during construction.	-	✓	-
Use of directional light fixtures to avoid the transmission of light outside of the PDA.	-	✓	-

NOTES:
✓ Mitigation measures are applicable.
– Mitigation measures are not applicable.

In addition to the mitigation measures to reduce potential environmental effects, GGM is committed to the implementation of a BMMP (a Conceptual BMMP is provided in Appendix M13).

13.4.2.3 Characterization of Residual Environmental Effects for Change in Habitat

The residual environmental effects for change in habitat are characterized for the species assessed in the following sections. The maximum direct loss of habitat as a result of vegetation removal has been conservatively predicted to occur during construction. The maximum indirect loss of habitat is expected to occur as a result of Project operation.

Construction

Approximately 84% of the vegetation directly affected by the Project is forest and treed wetland (1,860 ha). Additional details on the vegetation communities that will be lost is provided in Section 12.4.3.1 and Table 12.8 of Chapter 12.0 (vegetation communities VC).

With respect to indirect habitat loss as the result of sensory disturbance, construction noise and vibration, levels will vary for specified locations as activities change in position and intensity. During construction, the predicted sound level is anticipated to range from 40-45 dBA in areas immediately adjacent to the PDA boundary, and range from 35-45 dBA throughout most of the LAA (see Figure 3-1 in "Technical Data Report: Hardrock Project – Noise and Vibration

Assessment" (Noise and Vibration TDR; Appendix F2). Physiological responses to noise exposure in birds may begin to appear at exposure levels of 55 to 60 dBA (Barber et al. 2010). Because the noise levels that are expected to occur beyond the PDA during construction are not predicted to reach levels that may result in physiological responses, the amount of habitat assessed as lost through indirect effects (see Section 13.4.2.1) is considered conservative.

The direct and indirect residual environmental effects of the Project on the species assessed for change in habitat are characterized in the following sections. The effects of the Project on other wildlife species and species groups known or likely to be present within the LAA are also discussed.

Migratory Bird Habitat

The Project will result in the direct loss of 1,853 ha of Canada warbler breeding habitat, of which 111 ha is confirmed and 1,742 ha is potential breeding habitat (Table 13-10, Figure 13-8). An additional 620 ha is considered lost through indirect effects, though Project-specific predictions for noise suggest this estimate may be conservative. Habitat to support Canada warbler (forest and treed wetland) is common in a regional context and, through direct and indirect effects, the Project will result in an estimated loss of 1.9% of the potential Canada warbler breeding habitat within the RAA. The effect of the Project on other wildlife associated with forested habitat, such as marten, fisher and black bear and small mammals can be inferred from the estimated loss of Canada warbler breeding habitat (see Table 13-10).

Table 13-10: Predicted Change in Wildlife Habitat During Construction and Operation After Mitigation

Measurable Parameter	Habitat Type	Existing Conditions (ha) in LAA	Maximum Direct Loss (ha)	Maximum Indirect Loss (ha)*	Existing Conditions (ha) in RAA	% of habitat in RAA lost (Direct and Indirect Effects)
Migratory Bird Habitat						
Canada warbler breeding habitat	Confirmed	139	111	20	154	
	Potential	2,876	1,742	600	129,787	
	Total	**3015**	**1,853**	**620**	**129,941**	**1.9**
Eastern wood-pewee breeding habitat	Confirmed	8	8	0	8	
	Potential	657	320	169	29,127	
	Total	**665**	**328**	**169**	**29,135**	**1.7**
Barn swallow breeding habitat	Category 1 and 2	15 nests	0	0	-	-[A]
Barn swallow foraging habitat	Category 3	24	8	5	-	-[A]

Table 13-10: Predicted Change in Wildlife Habitat During Construction and Operation After Mitigation

Measurable Parameter	Habitat Type	Existing Conditions (ha) in LAA	Maximum Direct Loss (ha)	Maximum Indirect Loss (ha)*	Existing Conditions (ha) in RAA	% of habitat in RAA lost (Direct and Indirect Effects)
Common nighthawk breeding habitat	Potential	411	321	52	1,867	20
Non-treed wetland bird breeding habitat	Potential	240	87	77	7,571	2.2
Waterfowl nesting habitat	-	375	208	87	10,104	2.9
Additional Bird Habitat						
Bald eagle nesting habitat	Potential[B]	3,015	1,854	620	129,941	1.9
American white pelican stopover and foraging habitat	-	442	2	96	4,250	2.3
Mammal Habitat						
Moose foraging habitat	Confirmed	174	99	41	194	
	Potential	1,964	1,085	471	88,850	
	Total	**2,138**	**1,184**	**512**	**89,044**	**1.9**
Moose late winter cover habitat	-	959	576	226	57,670	1.4
Woodland caribou habitat	Discontinuous Range (Category 3)	4,094	2,200	1,894	-	-
Northern myotis and little brown myotis maternity roost habitat	Potential – natural	590	268	155	28,423	1.5
Amphibian and Reptile Habitat						
Western painted turtle overwintering habitat	Confirmed	441	2	25	4,282	
	Potential	292	77	36	17,998	
	Total	**733**	**79**	**61**	**22,280**	**0.6**
Amphibian	Confirmed	674	469	98	844	

Table 13-10: Predicted Change in Wildlife Habitat During Construction and Operation After Mitigation

Measurable Parameter	Habitat Type	Existing Conditions (ha) in LAA	Maximum Direct Loss (ha)	Maximum Indirect Loss (ha)*	Existing Conditions (ha) in RAA	% of habitat in RAA lost (Direct and Indirect Effects)
breeding habitat	Potential	1,525	910	176	45,816	
	Total	**2,199**	**1,379**	**274**	**46,660**	**3.5**
Insect Habitat						
Taiga alpine butterfly breeding habitat	Confirmed	162	114	25	162	
	Potential	1,066	689	105	34,954	
	Total	**1,228**	**803**	**655**	**209,886**	**2.7**

NOTES:

A The number of confirmed barn swallow nests in the RAA is not known.

B Although bald eagles typically nest in close proximity to shorelines, potential nesting habitat has been conservatively identified as described for woodland raptors in MNRF 2015c (see Table 13-6).

* based on a 500 m (caribou), 200 m (mammals and birds) or 100 m (other wildlife) sensory disturbance zone (see Section 13.4.2.1).

\- not applicable

The Project will result in the direct loss of 328 ha of eastern wood-pewee breeding habitat, of which 8 ha is confirmed and 320 ha is potential breeding habitat (Table 13-10, Figure 13-8). An additional 169 ha is considered lost through indirect effects, though Project-specific predictions for noise suggest this estimate may be conservative. Through direct and indirect effects, the Project will result in an estimated loss of 1.7% of the potential eastern wood-pewee breeding habitat within the RAA. Again, the effect of the Project on other wildlife associated with forested habitats can be inferred from the estimated loss of eastern wood-pewee breeding habitat (Table 13-10).

The Project will result in the direct loss of barn swallow nesting habitat; two buildings that support 15 active nests will be removed (Table 13-10, Figure 13-7). Buildings suitable to support barn swallow nesting occur in Geraldton and throughout the RAA, though the number of active nests within the RAA is unknown. The Project will also result in the direct loss of 8 ha and an indirect loss of 5 ha of Category 3 (foraging habitat) associated with the open lands surrounding the existing MTO Patrol Yard (Table 13-10, Figure 13-7). No additional Category 1, 2 or 3 habitat for barn swallow is expected to be lost through indirect effects as the third building where barn swallow nesting was confirmed is more than 200 m from the PDA (i.e., the distance applied to determine indirect effects, see Section 13.4.2.1). The implementation of mitigation measures such as the creation of replacement habitat for the damage or destruction of existing structures that provide nesting habitat will reduce adverse effects to barn swallow habitat and result in no measurable change to barn swallow nesting habitat availability in the LAA.

The Project will result in the direct loss of 321 ha of common nighthawk breeding habitat within the PDA during construction (Table 13-10, Figure 13-7). An additional 52 ha is considered lost through indirect effects, though Project-specific predictions for noise suggest this estimate may be conservative. Through indirect and direct effects, the Project will result in an estimated loss of 20% of the potential common nighthawk breeding habitat within the RAA. However, the abundance and distribution in the RAA of the open habitat that is required by common nighthawk will fluctuate over time with the creation and regeneration of forested areas as the result of human activities (e.g., logging) and natural events (e.g., fire).

The Project will result in the direct loss of 87 ha of potential breeding habitat for non-treed wetland birds (Table 13-10, Figure 13-7). An additional 77 ha is considered lost through indirect effects, though Project-specific predictions for noise suggest this estimate may be conservative. There are 7,571 ha of non-treed wetland within the RAA. Through direct and indirect effects, the Project will result in a loss of 2.2% of the potential breeding habitat for non-treed wetland birds within the RAA.

The Project will result in the direct loss of 208 ha of SWH for waterfowl nesting with an additional 87 ha considered lost through indirect effects. Through direct and indirect effects, the Project will result in a loss of 2.9% of the potential waterfowl nesting habitat within the RAA.

Although Project activities will result in the direct loss or alteration of migratory bird habitat through vegetation clearing, regionally these habitats are common and the percent loss of migratory bird habitat is low. Sensory disturbance to migratory birds is expected to be minimal and habitat conservatively considered lost as a result of sensory disturbance will be regained following the cessation of operations and the completion of active closure activities. Loss of habitat and sensory disturbance is not expected to affect the long-term persistence or viability of migratory bird populations.

<u>Additional Bird Habitat</u>

The extent of construction activities that overlap with American white pelican stopover and foraging habitat involves the installation of intake and treated effluent discharge pipelines into Kenogamisis Lake. This footprint equates to 2 ha of area that is conservatively considered directly lost. An additional 96 ha of stopover and foraging habitat is considered lost through indirect effects. Through direct and indirect effects, the Project will result in a loss of 2.3% of the potential stopover and foraging habitat provided by Kenogamisis Lake (4,250 ha [ToR, Hardrock Project Terms of Reference; Appendix A2]). The effect of the Project on other wildlife associated with the open aquatic habitat provided by Kenogamisis Lake, such as mink, otter, beaver and bald eagle foraging can be inferred from the estimated loss of American white pelican stopover and foraging habitat (see Table 13-10).

One known woodland raptor nesting location will be directly lost due to vegetation removal and construction of the Project (Figure 13-5). The Project will result in the direct loss of 1,854 ha of potential bald eagle nesting habitat. This estimate includes all treed ecosites within the LAA, however bald eagles prefer nesting sites in forest that is located along the shorelines of lakes (Sandilands 2005). Consequently, this estimate may be conservative for bald eagles but it does represent the direct loss of woodland raptor nesting habitat more broadly. Maintaining forest cover along the shoreline of Kenogamisis Lake will mitigate loss of bald eagle nesting habitat by leaving nest trees and perches intact. The known bald eagle nest is not expected to require removal for the Project and is located approximately 150 m from the PDA (Figure 13-5). During operation, treed cover will remain between the nest and the edge of the PDA, reducing the potential for direct human encounters with the known eagle nest. In addition to the habitat directly lost through the removal of vegetation, 620 ha of potential bald eagle nesting habitat is considered lost through indirect effects (avoidance or underutilization of the habitat as a result of sensory disturbance, including the known nesting location). Through direct and indirect effects, the Project will result in a loss of 1.9% of the potential bald eagle nesting habitat within the RAA.

Mammal Habitat

No uncommon or distinct habitat features that would concentrate large mammals were identified within the PDA. The Project will not result in the removal of known specialized microhabitat features (i.e., aquatic feeding or calving areas).

The Project will result in the direct loss of 1,184 ha of moose foraging habitat, of which 99 ha is confirmed and 1,085 ha is potential (Table 13-10, Figure 13-3). An additional 512 ha is considered lost through indirect effects. Young forest and shrub communities that would provide moose foraging habitat is common in a regional context; more than 89,000 ha of this land cover type occurs within the RAA. Through direct and indirect effects, the Project will result in a loss of 1.9% of the potential moose foraging habitat within the RAA.

The Project will result in the direct loss of 576 ha of SWH for moose late winter cover (Table 13-10, Figure 13-3). An additional 226 ha is considered lost through indirect effects. Upland sites characterized by dense conifer cover that would provide moose late winter cover are common in a regional context; more than 57,000 ha of this land cover type occurs within the RAA. Through direct and indirect effects, the Project will result in a loss of 1.4% of the potential moose late winter cover within the RAA.

The conclusions for moose foraging and late winter cover are supported by other regional data—the Kenogami Forest Management Unit, which includes the RAA, has over 400,000 ha of moose foraging habitat and 500,000 ha of moose winter habitat (Terrace Bay Pulp 2011).

The Project will result in the direct loss of 2,200 ha of Category 3 woodland caribou habitat (Table 13-10, Figure 13-4). An additional 1,894 ha is considered lost through indirect effects. Through direct and indirect effects, the Project will result in a loss of 4,094 ha of Category 3 habitat. Category 3 habitat, is identified as having a higher tolerance for alteration than seasonal (Category 2) and high use (Category 1) habitat (MNRF 2014d).

No critical habitat for SAR bats will be lost due to construction of the Project. However, the Project will result in the direct loss of 268 ha of potential natural maternity roost habitat (Table 13-10, Figure 13-9). An additional 155 ha of potential natural maternity roost habitat is considered lost through indirect effects. Potential habitat to support natural bat maternity roosting habitat is considered widespread in the boreal forest; 28,423 ha of potential natural maternity roost habitat occurs in the RAA. Through direct and indirect effects, the Project will result in a loss of 1.5% of the potential natural maternity roost within the RAA. The Project will also result in the direct loss of buildings (i.e., townsites, MTO Patrol Yard and other individual buildings in the PDA) that provide potential anthropogenic bat maternity roost habitat. Buildings are present within the RAA (i.e., primarily within the town of Geraldton but also occasional residences and businesses elsewhere within the RAA). Northern myotis favour natural roosts, while little brown myotis use both natural and anthropogenic roosts (EC 2015).

Amphibian and Reptile Habitat

The Project will result in the direct loss of 79 ha of turtle overwintering habitat; 2 ha of which is confirmed and 77 ha is potential turtle overwintering habitat (Table 13-10, Figure 13-11). An additional 61 ha is considered lost through indirect effects. Typical turtle overwintering habitat consists of permanent waterbodies that are deep enough not to freeze, with a mud substrate (MNRF 2015a). Lakes and waterbodies with these characteristics are scattered throughout the RAA, with approximately 22,280 ha found in the RAA. Through direct and indirect effects, the Project will result in a loss of 0.6% of the potential turtle overwintering habitat within the RAA. The effect of the Project on other wildlife associated with open aquatic habitats, such as aquatic furbearers, can be inferred from the estimated loss of turtle overwintering habitat (see Table 13-10).

The Project will result in the direct loss of 1,379 ha of SWH for amphibian breeding of which 469 ha is confirmed and 910 ha is potential amphibian breeding habitat (Table 13-10, Figure 13-11). An additional 274 ha is considered lost through indirect effects. Wetland and woodland habitat that would support amphibian breeding is common in the RAA; 46,660 ha of potential amphibian breeding habitat occurs in the RAA. Through direct and indirect effects, the Project will result in a loss of 3.5% of the potential amphibian breeding habitat in the RAA. The amount of habitat directly lost is a conservative estimate as it is likely amphibian breeding function will be maintained or reestablished along the Southwest Arm Tributary and the Goldfield Creek diversion.

Insect Habitat

The Project will result in the direct loss of 803 ha of taiga alpine butterfly habitat, of which 114 ha is confirmed habitat and 689 ha is potential habitat[7] (Table 13-10, Figure 13-10). An additional 130 ha is considered lost through indirect effects. Taiga alpine butterfly was found in a variety of coniferous dominated ecosites within the LAA; 35,116 ha of potential Taiga alpine butterfly habitat occurs in the RAA. Through direct and indirect effects, the Project will result in a loss of 2.7% of potential taiga alpine butterfly habitat in the RAA.

Operation

No new areas will experience ground disturbance as a result of operation activities, therefore no new direct loss of wildlife habitat is predicted for the operation phase.

The indirect effects (e.g., sensory disturbance), discussed above (under construction) and quantified in Table 13.9 are expected to continue and be more pronounced during operation as some species might exhibit habitat avoidance because of noise, artificial lights and vibrations (Habib et al., 2007, Narins 1990).

Vibration may occur during operation from normal process equipment operation and from blasting activities in the open pit. Vibration due to blasting extends beyond the PDA and may be perceived by some wildlife depending on the species (further discussed below). Details (including vibration zone mapping) are provided in Figure 3-5 and 3-7 in Noise and Vibration TDR (Appendix F2).

The main noise-generating sources associated with Project operation include process plant equipment such as rock breakers, feeders, and conveyors, mobile sources such as trucks, excavators, and dozers, as well as power generation. Blasting noise was considered separately from other Project sources. Blasts will occur on a regular basis (five times per week) depending on the detailed open pit plan and specific operational requirements throughout the LOM. The sound level at the extent of the LAA during blasting was predicted to be equal to or less than 115 dBA. (Figure 3-6 in Noise and Vibration TDR; Appendix F2). These sources are primarily located within the northern portion of the Project, within the previously disturbed area. Sound levels in the wildlife LAA beyond the PDA are predicted to be 50 dBA or less as a result of Project operation noise. Additional details, including predictive mapping, are provided in Figures 3-2 and 3-3 in Noise and Vibration TDR (Appendix F2).

7 The design of the TMF was revised to leave a Sparse Treed Fen (B136) community intact (Sections 12.2.2.2 and 12.4.3.1), this community was a relatively large and atypical feature where taiga alpine butterfly habitat was confirmed (Section 13.2.2.2).

Levels of noise that may be experienced by wildlife from operation of the Project will be influenced by multiple factors such as distance and direction (i.e., up or down wind) from noise emission sources, habitat time, weather (wind speed and direction) and temporal factors (time of year, time of day). The response to noise and vibration by wildlife will vary depending on the species. Amphibians have shown sensitivity to noise and vibrations (Nairns 1990). Noise may also affect bat foraging, movement and roosting, however effects will vary depending on the degree of overlap between the frequency and volume of the disturbance noise and the frequencies of the echolocation used by the bat species. There is evidence that torpid bats rapidly habituate to repeated and prolonged noise (Luo et al. 2014). The predicted sound levels as a result of day to day operation noise are expected to be lower than the exposure levels shown to result in physiological responses in birds (Barber et al., 2010).

Kenogamisis Lake supported American white pelican stopover and foraging. Small numbers of pelicans were regularly observed in Barton Bay (East) in relatively close proximity to the shoreline (and PDA). Predicted noise levels within this area are 40-45 dBA during the Project's operation. The predicted sound level from blasting along the shore line of Barton Bay (East) is equal to or less than 120 dBA. There may be localized avoidance of this area by foraging and staging pelicans during the short duration blast events. This effect may be reduced because blasting is to occur during daytime hours, while pelicans forage mainly at night and early morning (Sandilands 2010). The primary limiting factors for American white pelican are related to breeding habitat rather than foraging habitat (Sandilands 2010). Given the extent of foraging habitat available within the LAA and RAA, the Project operation is not anticipated to result in indirect effects to pelican stopover or foraging habitat that affect the population.

Project activities may cause disturbance to nesting bald eagles, depending on the nest location, type of activity, duration, frequency and time of day. Eagles typically respond to the closeness of a disturbance rather than the noise level (Ellis et al. 1991). In a study that tested nesting eagles' responses to various disturbances, 75% of alert and flight responses occurred when activity was 500 m and 200 m away, respectively (Grubb et al. 1992). The known bald eagle nest is located approximately 180 m from the closest point of the Project's operation activities (WRSA D). As the nest occurs within the 200 m sensory disturbance zone that has been applied to provide a quantitative analysis of indirect effects, it is considered lost through the influence of indirect effects.

Closure

During active closure, Project infrastructure, equipment, and ancillary facilities will be removed and areas directly affected by the Project will be rehabilitated. Some permanent infrastructure will remain (e.g., Hydro One transformer station, 44 kV and 12.5 kV distribution lines and 115 kV transmission lines, MTO Patrol Yard, Highway 11 corridor). Once decommissioning and active rehabilitation activities are completed, most areas will become accessible again and wildlife is expected to return to the LAA and PDA. The PDA is anticipated to include early successional and meadow vegetation communities (approximately 47% of the total area of rehabilitation)

and wetlands (approximately 12%). The remaining areas of broken exposed rock associated with WRSAs, and TMF dams, open water (e.g., pit lake, TMF sedimentation pond, contact water collection system), and permanent provincial infrastructure are considered to have limited value to wildlife upon closure. Some species (e.g., ground-nesting birds, moose) may return to the PDA soon after active closure, to use recently rehabilitated areas, while other species that require mature forest stands (e.g., marten, woodpeckers, bats) may not return to the PDA for decades following closure. The shrub stage of succession following active rehabilitation is likely to support the most varied suite of wildlife species (e.g., snowshoe hare, black bear, moose, songbirds).

The predicted reestablishment of the measurable parameters within the PDA following closure is presented in Table 13-14 and described below.

Table 13-11: Estimated Conditions for Wildlife Habitat in the RAA After Closure

Measurable Parameter[A]	Amount of habitat within LAA at maximum disturbance (ha)	Rehabilitated Vegetation upon Closure (ha)[B]	Recovery of indirectly affected habitat upon closure (ha)	Total amount of habitat within LAA upon closure (ha)	Irreversible loss upon closure (from existing conditions) (ha)	Loss of habitat within RAA upon closure (%)
Migratory Bird Habitat						
Canada warbler breeding habitat	1,162	239	620	2021	-994	0.8
Eastern wood-pewee breeding habitat	168	162	169	499	-167	0.6
Common nighthawk breeding habitat	38	1,466	52	1556	1,145	n/a
Non-treed wetland bird breeding habitat	76	45	77	198	-42	0.6
Waterfowl nesting habitat	80	45	87	212	-163	2
Additional Bird Habitat						
Bald eagle nesting habitat	541	239	620	1400	-1615	1.2
American white pelican stopover and foraging habitat	344	2	96	442	0	0

Table 13-11: Estimated Conditions for Wildlife Habitat in the RAA After Closure

Measurable Parameter[A]	Amount of habitat within LAA at maximum disturbance (ha)	Rehabilitated Vegetation upon Closure (ha)[B]	Recovery of indirectly affected habitat upon closure (ha)	Total amount of habitat within LAA upon closure (ha)	Irreversible loss upon closure (from existing conditions) (ha)	Loss of habitat within RAA upon closure (%)
Mammal Habitat						
Moose foraging habitat	442	404	512	1358	-780	0.9
Moose late winter cover habitat	157	239	216	612	-347	0.6
Woodland caribou habitat	0	239	1,904	2,143	-1,951	n/a
Northern myotis and little brown myotis maternity roost habitat- Natural	167	239	155	561	-29	0.1
Amphibian and Reptile Habitat						
Western painted turtle overwintering habitat	593	37	61	691	-42	0.2
Amphibian breeding habitat	546	114	274	934	-1,265	2.7
Insect Habitat						
Taiga alpine butterfly breeding habitat	295	85	130	510	-718	2

NOTES:

A Barn Swallow is not included as there is no measurable effect on barn swallow nesting habitat.

B Based on Table 12-8 and Figure 12-5 in Chapter 12.0 (vegetation communities VC). As ecosite information is not available, rehabilitated vegetation is estimated using vegetation communities that support the ecosite types used by the species as described in Table 13-6. These amounts are considered conservative as the Closure Plan is conceptual at this time and will continue to evolve.

Indirect effects related to sensory disturbance during the construction and operation phases would continue throughout active closure, however they are expected to be less pronounced than during operation. It is expected that indirect effects (i.e., avoidance of use) on habitat within the LAA and RAA will be reversed following the completion of active closure activities.

- Canada warbler may use younger seral stages but is more likely to use older stands (EC 2016a), so this species may not return to the PDA for several decades following closure. After consideration of rehabilitation and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 994 ha of potential Canada warbler breeding habitat is expected to occur upon closure (Table 13-10). This is a 0.8 % loss of Canada warbler habitat within the RAA.
- Eastern wood-pewee is more likely to use older stands (COSEWIC 2012), so may not return to the PDA for several decades following closure. After consideration of rehabilitation and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 167 ha of potential eastern wood-pewee breeding habitat is expected to occur upon closure (Table 13-10). This is a 0.6 % loss of eastern wood-pewee habitat within the RAA.
- Common nighthawk breeding habitat is predicted to be available throughout the PDA relatively soon after closure, in the form of recently rehabilitated Project features. It is likely to continue to be available in the rehabilitated meadow habitat in the TMF and the open rock and shrub-successional habitats in the WRSAs. Greater habitat availability over existing conditions for common nighthawk is expected to be present within the PDA upon closure; 411 ha of common nighthawk nesting habitat was identified through baseline studies and 1,556 ha of suitable habitat (WRSA rock/shrub successional, open meadow and existing disturbed areas) is expected to occur upon closure. This is an increase of 1,145 ha of potential common nighthawk habitat in the RAA.
- Non-treed wetland breeding bird habitat may be available during the operation phase through rehabilitated marsh areas along the edges of the Goldfield Creek diversion channel. After consideration of rehabilitation and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 42 ha of potential non-treed wetland breeding bird habitat is expected to occur upon closure (Table 13-10). This is a 0.6 % loss of non-treed wetland breeding bird habitat within the RAA.
- Bald eagle nesting habitat is expected to be maintained during the construction, operation and closure phases along the forested shoreline of Kenogamisis Lake, though use may be reduced as a result of sensory disturbance. Bald eagle (and woodland raptors more generally) use mature trees for nesting so these species may not return to the PDA for several decades following closure. After consideration of rehabilitation and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 1,615 ha of potential bald eagle nesting habitat is expected to occur upon closure (Table 13-10). This is a 1.2% loss of bald eagle nesting habitat within the RAA.

- Some waterfowl nesting habitat may be available during the operation phase through rehabilitated areas along the edges of the Goldfield Creek diversion channel. After consideration of rehabilitation and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 163 ha of waterfowl nesting habitat is expected to occur upon closure (Table 13-10). This is a 2% loss of waterfowl nesting habitat within the RAA.
- American white pelican staging and foraging habitat: it is expected that Kenogamisis Lake will continue to provide this function through the construction, operation and closure phases of the Project. After consideration of rehabilitation and the return to existing conditions of the area considered lost as a result of indirect effects no loss of American white pelican staging and foraging habitat is expected to occur upon closure.
- Category 3 caribou habitat is predicted to be limited within the PDA upon closure, and the likelihood that caribou will use habitat within the PDA or LAA in the future is not expected to improve over current conditions.
- Moose may use younger seral stages for foraging, including and early successional habitats that are restored as part of the closure plan but it will be many decades following closure before suitable winter cover is restored within the PDA. As revegetation occurs, moose populations are expected to increase in response to increases in early successional forest, browse and edge (Fisher and Wilkinson 2005). After consideration of rehabilitation and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 780 ha of potential moose foraging habitat and 347 ha of moose late winter cover is expected to occur upon closure (Table 13-10). This is a 0.9% loss of moose foraging habitat and a 0.6 % loss of winter cover habitat within the RAA.
- Natural bat maternity roost habitat is associated with mature forest stands and is unlikely to return to the PDA for several decades following closure. After consideration of rehabilitation of forest and swamp and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 29 ha of potential natural bat maternity roost habitat is expected to occur upon closure (Table 13-10). This is a 0.1 % loss of potential natural bat maternity roost habitat within the RAA. Few buildings will remain after closure and those that will (i.e., Hydro One transformer station) are not considered to provide potential anthropogenic habitat for bat maternity roosts. The abundance and distribution of potential anthropogenic bat maternity roost habitat in the RAA will fluctuate over time as the result of human activities (e.g., the construction and demolition of buildings). As long as there are buildings within the RAA there will be some potential for bats to roost in them and it is most likely that there will be more buildings over time rather than fewer.

- Turtle wintering area: the pit lake, TMF sedimentation pond and ponded area associated with S1 are unlikely to be suitable turtle wintering areas. The Goldfield Creek diversion and the Southwest Arm Tributary may have value as nesting turtle overwintering habitat. After consideration of rehabilitation of open aquatic areas and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 42 ha of potential turtle overwintering habitat is expected to occur upon closure (Table 13-10). This is a 0.2 % loss of turtle overwintering habitat within the RAA.
- Amphibian breeding habitat: it is expected that most wetlands within the PDA will not be restored to their original state during active closure. The Goldfield Creek diversion and the Southwest Arm Tributary may have value as amphibian breeding habitat. After consideration of rehabilitation and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 1,265 ha of potential amphibian breeding habitat is expected to occur upon closure (Table 13-10). This is a 2.7 % loss of amphibian breeding habitat within the RAA.
- Taiga alpine butterfly habitat: After consideration of rehabilitation and the return to existing conditions of the area considered lost as a result of indirect effects, an irreversible loss of 718 ha of potential taiga alpine butterfly habitat is expected to occur upon closure (Table 13-10). This is a 2 % loss of taiga alpine habitat within the RAA.

Characterization of Residual Environmental Effects on Wildlife Habitat Summary

Vegetation clearing and sensory disturbance is predicted to result in a decrease in the area of Canada warbler breeding habitat, eastern wood-pewee breeding habitat, non-treed wetland bird breeding habitat, bald eagle nesting habitat, waterfowl nesting habitat, moose foraging and late winter habitat, woodland caribou habitat, Northern myotis and little brown myotis maternity roost habitat, western painted turtle overwintering habitat, amphibian breeding habitat, common nighthawk habitat and American white pelican stopover and foraging habitat and taiga alpine butterfly breeding habitat. The loss of these habitats throughout the LOM will be partially reversed at closure through revegetation activities and the cessation of Project activities (when habitat considered lost through avoidance as a result of sensory disturbance may be used again). Exceptions are common nighthawk habitat and American white pelican stopover and foraging habitat. Upon closure common nighthawk habitat is expected to increase in availability and no net change in the amount of American white pelican stopover and foraging habitat is anticipated. Those wildlife habitats where a measurable, permanent loss is predicted are regionally common and the amount of irreversible loss is not expected to affect the long-term persistence or viability of wildlife species within the RAA.

With the implementation of habitat replacement requirements under the ESA prior to construction, no residual effect on barn swallow breeding habitat is anticipated.

13.4.3 Assessment of Change in Mortality Risk

Change in mortality risk is assessed for those Project activities identified with a checkmark, Table 13-7.

13.4.3.1 Project Mechanisms for Change in Mortality Risk

The effect mechanisms for change in mortality risk are distinct for the construction and operation phases.

Construction and Closure

For the construction phase, vegetation and overburden clearing (including timber harvesting) is the primary effect mechanism followed by traffic, and adverse human-wildlife encounters (e.g., food waste, garbage, problem wildlife, etc.). These effect mechanisms may result in the direct mortality of wildlife in the absence of mitigation. A similar level of onsite human activity can be conservatively assumed for the closure phase.

Operation

For the operation phase, in the absence of mitigation, traffic is the primary effect mechanism which may result in the direct mortality of wildlife as well as potential wildlife interactions with the TMF. Common nighthawk, amphibians, and mammals (e.g., moose) may be particularly susceptible to road mortality. Effect mechanisms that indirectly result in wildlife mortality through increased access for hunters and predators (e.g., linear feature development) were not considered in this assessment given the existing level of disturbance and human development with the LAA and that no new public roads will be created by the Project.

13.4.3.2 Mitigation for Change in Mortality Risk

Table 13-12 lists the measures to be implemented to mitigate the effects of the Project on wildlife mortality risk during all Project phases.

Table 13-12: Mitigation Measures for a Change in Mortality Risk

Mitigation Measure for a Change in Mortality Risk	Construction	Operation	Closure
Implementation of a BMMP (a Conceptual BMMP is provided in Appendix M13).	✓	✓	✓
Implement mitigation measures in the Conceptual Explosives and Blasting Management Plan, Conceptual Spill Prevention and Contingency Plan, and Conceptual Waste Management Plan.	✓	✓	✓
Report the discovery of active nests during all Project phases to the Project Environmental Department who will refer to the BMMP for direction on follow-up actions.	✓	✓	✓
Report the discovery of occupied habitat features (e.g., active dens, beaver dams) during all Project phases to the Project Environmental Department for direction on follow-up actions.	✓	✓	✓
Maintain the Project site in a manner that reduces the risk that wildlife will encounter potential	✓	✓	✓

Table 13-12: Mitigation Measures for a Change in Mortality Risk

Mitigation Measure for a Change in Mortality Risk	Construction	Operation	Closure
hazards, such as ropes, wires and holes.			
Avoid situations that can lead to the creation of problem wildlife. Although food wastes are the typical wildlife attractant implicated in the creation of problem wildlife, there are other attractants that may be a concern, specifically roadside wildlife carcasses and vegetation. Project personnel and contractors will be required to report roadside wildlife sightings or interactions to the Project Environmental Department for initiation of follow-up actions to address these concerns.	✓	✓	✓
Report wildlife-vehicle collisions, near misses or observations of a wildlife road mortality on Project roads to the Environmental Department. Implement adaptive management measures where high frequency locations of wildlife-vehicle interactions are identified.	✓	✓	✓
Require Project personnel and contractors to report wildlife incidents and encounters related to garbage or other attractants to the Environmental Department so that corrective action can be initiated.	✓	✓	✓
Require Project personnel and contractors working in active zones (e.g., mine site) to relay wildlife sightings to other workers as soon as possible (e.g., by radio).	✓	✓	✓
Implement road safety measures (e.g., speed limits and signage) and yield the right of way to wildlife on Project roads to reduce wildlife road mortality.	✓	✓	✓
Obtain a permit under the *Fish and Wildlife Conservation Act* for the removal of any raptor nests or beaver dams required for the Project. Removal to be conducted following timing restrictions and any other mitigation specified in the permit and as determined during consultation with MNRF.	✓	✓	✓
Address incidental take of migratory birds[A]. Greenstone Gold Mines GP Inc. (GGM) recognizes that scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds is the best way to reduce the risk of incidental take. If activities that could result in incidental take cannot be avoided, GGM will prepare a Bird Nest Mitigation Plan that outlines how risk of incidental take will be managed in accordance with Environment and Climate Change Canada guidance.	✓	-	-
To the extent feasible, recover and relocate turtles and amphibians encountered during fish salvage/rescues.	✓	-	-
Carry out the removal of structures supporting barn swallow nesting outside of the active nesting season (approximately May- August; O.Reg. 242/08, s.23.5).	✓	-	-
Carry out the removal of mature deciduous and mixed forest communities or buildings outside the core maternity roosting season for bats[B], to the extent practical. Additional mitigation may be required for occupied features. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., marten).	✓	-	-
Clear area of wildlife before blasting.	✓	✓	-

Table 13-12: Mitigation Measures for a Change in Mortality Risk

Mitigation Measure for a Change in Mortality Risk	Construction	Operation	Closure
Where Project site roads occur through forest or treed wetland communities, a regular vegetation cutting regime will occur along the edges of project site roads both to increase driver visibility and to reduce the attractiveness of the area for moose to browse (Tanner and Leroux, 2015).	-	✓	-
To reduce use of the ponds by waterfowl for foraging or breeding, no vegetation will be planted on the embankments of the TMF or the water management collection ponds. Vegetation that naturally regenerates around seepage and water collection ponds and the TMF will be removed as required.	-	✓	-
Monitor wildlife use (primarily targeting waterfowl but also species such as moose and bear) and water quality of the TMF, open aquatic areas and other key Project locations and implement adaptive management measures (e.g., deterrents and/or exclusionary measures) as required.	-	✓	-

NOTES:
A See Section 13.1.1 for a definition of incidental take.
B The primary roosting period for bats (May 1 to August 31 (Broders *et al.* 2006, Cagle and Cockrum 1943, Gerson 1984) covers the core maternity roosting period.
✓ Mitigation measures are applicable.
– Mitigation measures are not applicable.

In addition to the mitigation measures to reduce potential environmental effects, other commitments include:

- Report SAR occurrences at the Project site to the MNRF.
- Provide wildlife awareness and safety training to Project personnel and contractors.
- Upon discovery of injured wildlife at the Project site or on Project roads take measures to protect the individual from further harm and do not perform any work in the immediate location of the injured species that would subject it to further harm. Contact the Environmental Department to determine and implement required actions (e.g., if feasible, the capture and relocation of an injured species to a safe area and/or an appropriate care facility by the qualified person).
- Restrict project vehicles to designated areas and limit off road use by Project personnel.
- Consult with MNRF on the direction provided in Ontario's White-nose Syndrome Response Plan (MNRF 2015b) and its applicability to the Project.

- Incorporate MNRF Best Management Practices for Mineral Exploration and Development Activities and Woodland Caribou in Ontario (MNR 2013c) in the development of the BMMP and apply specific mitigation measures developed in consultation with MNRF (a Conceptual BMMP is provided as Appendix M13).
- Close mine shafts so that the potential for bat hibernacula is considered and the site is closed in compliance with the ESA, 2007.
- The potential for closure activities to contravene the ESA will be evaluated prior to closure and closure activities will either be conducted in ways to avoid adverse effects on a SAR or its habitat, or if that is not possible, GGM will work with MNRF to obtain required authorizations.

13.4.3.3 Characterization of Residual Environmental Effects for Change in Mortality Risk

The interactions that result in increased mortality risk within the PDA include site clearing (machinery/equipment), traffic, and increased human presence and are associated with specific, finite Project phases and activities and associated mitigation measures. Successful implementation of the mitigation measures described in Section 13.4.3.2 is essential to reducing the magnitude and duration of Project effects on mortality risk. On this basis, the number of direct mortalities resulting from the Project is expected to be small relative to existing sources of mortality within the RAA, including existing road networks, ongoing forest harvesting (e.g., incidental take), and hunting and trapping[8].

Construction and Closure

Increased mortality risk from site clearing (vegetation removal) during construction and from Project closure activities will be greatest for small species with limited avoidance capability (from machinery, for example), wildlife with strong site fidelity (e.g., nesting birds), and wildlife that require and occupy specialized habitat features such as a nest, den, cavity, maternity roost and burrow sites, particularly during denning, breeding, and hibernating periods. Risk can be reduced through the application of timing windows. This effect will be minimal for adult birds and medium-size to large mammals (e.g., moose, deer, black bear, marten) due to their ability to move out of the way in combination with the slow vehicle speeds on site roads.

No measurable residual effect resulting in direct loss and harm to migratory birds, their eggs and nests is expected following the implementation of a Bird Nest Mitigation Plan which includes appropriate preventive and mitigation measures to minimize the risk of incidental take and to help maintain sustainable populations of migratory birds.

[8] See Chapter 16.0 (land and resource use) for a description of existing conditions for hunting and trapping in relation to this Project

Operation

The operation of the Project may result in increased adverse wildlife-human encounters.

In general, vegetation clearing during site preparation will remove most wildlife habitat within the PDA; therefore, the incidence of wildlife-vehicle collisions (including migratory birds) during operation is expected to be low. However, progressive rehabilitation and natural revegetation in cleared areas and along roadsides may attract birds and other wildlife (e.g., moose), which could increase collision risk. While adherence to speed limits will likely reduce the risk of collisions for large mammals (Bertwistle 1999; Young and Vokurka 2007) it is uncertain whether this measure will also reduce the risk for birds, small mammals and amphibians, as they are difficult to see and avoid.

Adverse wildlife human-encounters may result from improper waste management (e.g., food, garbage, litter) and the subsequent attraction of wildlife (e.g., bears, ravens, red foxes) to areas within the PDA. Such situations can result in property damage, human injury, and lethal control of wildlife, however, with the implementation of a Waste Management Plan (WMP) that includes a reduction of attractants, the risk of these encounters is reduced. A "Hardrock Project Conceptual Waste Management and Monitoring Plan" is provided in Appendix M4.

A 115 kV transmission line, approximately 2.5 km long, will connect the Longlac Transformer Station to the provincial electricity grid. Monopoles will be located approximately every 150 to 200 m. The transmission line within the PDA is not considered a major contributor to mortality risk for birds (e.g., line strikes) based on the characteristics of the transmission line and the absence of concentrated bird activity (e.g., waterfowl staging areas) in the vicinity of the transmission line.

Summary of Residual Environmental Effects on Mortality

Throughout construction, operation and active closure, an increased risk of mortality to wildlife (including migratory birds) within the LAA as a result of Project activities is anticipated. With the implementation of the mitigation measures (Section 13.4.3.3), the residual adverse effect on wildlife mortality is predicted to be within the normal variability of baseline conditions and is not expected to affect the long-term persistence or viability of wildlife within the RAA.

13.4.4 Assessment of Change in Movement

Change in movement is assessed for those Project activities identified with a checkmark in Table 13-7.

13.4.4.1 Project Mechanisms for Change in Movement

The primary mechanism for change in movement is the presence of the open pit, WRSAs and associated components, which together act as a barrier to wildlife movement. Other Project features such as ditches, site roads and powerline corridors also have the potential to alter wildlife movement in the absence of mitigation. Wildlife may be reluctant to cross these features because of high levels of human activity, sensory disturbance, or because the features are too high or wide to physically move across.

13.4.4.2 Mitigation for Change in Movement

The mitigation measures provided in Table 13-13 will be implemented to reduce the effects of the Project on wildlife movement.

These mitigation measures have been included in the Conceptual BMMP (Appendix M13).

Table 13-13: Mitigation Measures for a Change in Movement

Mitigation Measure for a Change in Movement	Construction	Operation	Closure
Implementation of mitigation measures to reduce potential effects on wildlife habitat, specifically, those measures that reduce the size of movement barriers (by limiting the size of clearing areas) and that limit behavioral disruptions (by reducing the intensity of sensory disturbance).	✓	✓	✓
Implementation of the progressive rehabilitation of the Project as per the Closure Plan and Fish Habitat Offset Plan. A Conceptual Closure Plan and Draft Fish Habitat Offset Plan are provided in Appendix I and F10, respectively.	✓	✓	✓
When designing watercrossings include consideration of design features that promote wildlife (e.g. amphibian, turtle, furbearers) movement.	✓	✓	-
Provide low areas in the ploughed snow banks of access and haul roads if excessive snow buildup is encountered. These low areas will facilitate wildlife movements across and out of road corridors	✓	✓	✓

NOTES:
✓ Mitigation measures are applicable.
– Mitigation measures are not applicable.

In addition to the mitigation measures to reduce potential environmental effects, GGM is also committed to the development and implementation of a BMMP, including plans to manage large mammal and other occurrences (e.g., amphibians, turtle and furbearers) at the PDA. A Conceptual BMMP is provided in Appendix M13.

13.4.4.3 Characterization of Residual Environmental Effects for Change in Movement

In general, the larger components of the Project (open pit, WRSAs and TMF), will not be crossable by wildlife, other than those species that can fly. The Project will result in a loss of habitat availability and connectivity, which may result in changes to daily and seasonal movements. Access roads and associated vehicle traffic may also deter or affect movement for some wildlife species.

Regionally, the LAA is located immediately south of the town of Geraldton with large areas of open water along its north and east and southeastern boundaries, and Highway 11 transecting its north half. As such the LAA includes more natural and human-made barriers or impediments to wildlife movement between areas of contiguous habitat compared to other areas of the RAA (e.g., through the less-developed southern half of the RAA).

Although the LAA is in the discontinuous range for caribou, it is unlikely the LAA contributes to this zone's connectivity function, a conclusion that is supported by historical data which indicate low and declining caribou use of the area in and around the LAA (Section 13.2.2.1).

The movement of large mammals in the LAA could be disrupted due to vegetation removal and the presence of Project components. However, large mammals such as moose and bear have large home ranges which may allow them to adapt to changes in their environment such as the Project. Given that large mammal habitat appears to be extensive and contiguous throughout the RAA and that large mammals tend to move through and around anthropogenic areas readily within their home range, it is assumed that these species will mostly avoid the PDA and will shift their use to other areas of their ranges.

Locally, the Project may affect access to the peninsula that separates the Central Basin and Southwest Arm of Kenogamisis Lake, particularly during operation, as the remaining access routes (e.g., along the lakeshore and the Southwest Arm Tributary, see Figure 13-1) will be within the sensory disturbance zone of Project activities. While it is anticipated that large mammals will generally avoid the PDA there will be no physical barriers that prevent them from crossing the PDA (e.g., perimeter fencing).

At a site-specific level, amphibians and turtles may be affected by changes in habitat connectivity as they have limited dispersal abilities. While Project components are considered to act as barriers to movement for these species from the onset of construction through to closure, the Goldfield Creek diversion riparian corridor will provide habitat connectivity and may facilitate movement for some species of wildlife (e.g., amphibians, turtle and furbearers).

Summary of Residual Environmental Effects on Movement

There will be an adverse effect on wildlife (e.g. amphibians, turtles, furbearers and large mammal) movement throughout construction, operation and active closure as the Project is expected to disrupt wildlife movement patterns. However, wildlife (particularly large mammals) are expected to shift their movement patterns during the LOM to areas of available habitat elsewhere within the RAA. Following active closure, new movement patterns may be established as sensory disturbance abates and revegetation of the PDA progresses, although for some species (e.g., species requiring more developed security cover [trees]) this may take decades. The predicted change in movement is not expected to affect the long-term persistence or viability of wildlife in the RAA.

13.4.5 Summary of Residual Environmental Effects on Wildlife and Wildlife Habitat

A summary of residual environmental effects that are likely to occur as a result of the Project is provided in Table 13-14.

Residual adverse effects are considered further in terms of their significance in Section 13.5 and carried forward to the cumulative effects assessment (Chapter 20.0). A conceptual framework and scope for environmental management and monitoring plans, including follow up and monitoring programs is provided in Chapter 23.0. Conceptual environmental management and monitoring plans (EMMPs) are also provided in Appendix M.

Table 13-14: Summary of Residual Environmental Effects on Wildlife and Wildlife Habitat

Residual Effect	Activity			Residual Environmental Effects Characterization							
	Construction	Operation	Closure	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context
CHANGE IN HABITAT											
The direct loss of SAR habitats, SOCC habitats, SWHs, migratory bird habitat and habitats of importance to Aboriginal communities as a result of site clearing during construction. Change in wildlife habitat (including migratory bird habitat) as a result of indirect loss or alteration due to sensory disturbance (habitat avoidance or under-utilization of habitat due to human activity).	✓	✓	✓	**Adverse**	**Moderate**	**LAA**	**Applicable**	**Continuous**	**Long-term**	**Irreversible**	**Typical**
				Direction: Adverse. It is predicted that vegetation clearing and sensory disturbance will result in habitat loss or alteration or a reduction in habitat patch size for the wildlife habitats assessed. For barn swallow breeding habitat and American white pelican stopover and foraging habitat there will be no net loss of habitat and common nighthawk breeding habitat is expected to increase upon closure. **Magnitude**: Moderate (low for barn swallow and American white pelican). The loss of habitat is unlikely to affect the long-term persistence or viability of wildlife in the RAA. **Geographic Extent**: LAA. Residual adverse effects on wildlife habitats will extend into the LAA (i.e. the extent of indirect effects). **Timing**: Applicable. Seasonal aspects may affect change in habitat as a result of direct habitat loss or alteration), or reduction of habitat patch size. **Frequency**: Continuous. Change in wildlife habitats will occur continuously. **Duration:** Long-term (short-term for barn swallow and medium term for American white pelican and common nighthawk). The residual environmental effect will continue beyond closure. **Reversibility**: Irreversible (reversible for common nighthawk, barn swallow and American white pelican). It is expected that effects on all wildlife habitats will be partially reversed following the cessation of operation when wildlife habitat considered lost as a result of avoidance due to sensory disturbance will be regained. Some wildlife habitat will also be restored through the implementation of the Closure Plan (a Conceptual Closure Plan is provided in Appendix I), however other wildlife habitats, particularly those that are associated with wetlands and forest habitats will have some irreversible loss of habitat. Regionally, these habitats are common and the amount of habitat lost within the region of each habitat type as a result of the Project ranges from 0.1-2.7%. No critical habitat (EC 2012 and 2015) will be lost.							

Table 13-14: Summary of Residual Environmental Effects on Wildlife and Wildlife Habitat

Residual Effect	Activity			Residual Environmental Effects Characterization							
	Construction	Operation	Closure	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context
				Ecological and Socio-Economic Context: Typical. The wildlife habitats identified are generally common and widespread in the RAA, and are important for the functioning of the ecosystem as they support SAR, SOCC, are SWH or are valued wildlife components for Aboriginal communities.							
CHANGE IN MORTALITY RISK											
Increase in mortality risk	✓	✓	✓	**Adverse**	**Low**	**LAA**	**Applicable**	**Continuous**	**Medium-term**	**Reversible**	**Typical**
				Direction: Adverse. There will be an increase in wildlife mortality risk as a result of the Project. **Magnitude**: Low. The residual adverse effect on mortality risk during construction, operation and closure is predicted to be within the normal variability of baseline conditions and is therefore low in magnitude. **Geographic Extent**: LAA. Residual effects are predicted to extend into the LAA. **Timing**: Applicable. Seasonal aspects will directly affect mortality risk. If activities that may affect mortality occur during the times of year when wildlife are expected to be using the habitats identified, mortality risk will increase. **Frequency**: Continuous. Change in mortality risk will occur continuously throughout the construction, operation and closure phases. **Duration:** Medium-term. Effects will occur throughout construction, operation and active closure phases. **Reversibility**: Reversible. The interactions that result in increased mortality risk within the PDA (e.g. site clearing and human activity) will be reversed after closure, when activities cease. **Ecological and Socio-Economic Context:** Typical. The wildlife habitats identified are generally common and widespread in the RAA, and are important for the functioning of the ecosystem.							

Table 13-14: Summary of Residual Environmental Effects on Wildlife and Wildlife Habitat

Residual Effect	Activity			Residual Environmental Effects Characterization							
	Construction	Operation	Closure	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context
CHANGE IN MOVEMENT											
Disruption of existing wildlife movement patterns within and across the LAA	✓	✓	✓	**Adverse**	**Low**	**RAA**	**Applicable**	**Continuous**	**Long-term**	**Reversible**	**Typical**
				Direction: Adverse. The larger components of the PDA (open pit, WRSAs and TMF), will not be crossable by wildlife, (other than those species that can fly). The PDA is predicted to disrupt existing wildlife movement patterns within and across the LAA during the Project. **Magnitude**: Low. Large mammals are expected to change movement patterns to shift to the rest of their range. Changes in movement are not expected to affect the long-term persistence or viability of wildlife in the RAA. **Geographic Extent**: RAA. Residual adverse effects on wildlife movement will be located primarily within the LAA. Because of their large home ranges, moose movement patterns may shift to the rest of their range and as a result residual effects on wildlife movement are considered to extend into the RAA for moose. **Timing**: Applicable. Seasonal aspects may affect change in movement. **Frequency**: Continuous. Change in wildlife movements will occur continuously throughout the construction and operation phases. **Duration:** Long-term. The residual environmental effect is expected to extend beyond closure. **Reversibility**: Reversible. Following closure, it is anticipated that new movement patterns will be established as sensory disturbance abates and revegetation of the PDA progresses, although for some species (e.g., species requiring more developed security cover [trees]) this may take decades. **Ecological and Socio-Economic Context:** Typical. The wildlife habitats identified are generally common and widespread in the RAA, and are important for the functioning of the ecosystem.							

NOTES:
See Table 13-1 for detailed definitions.
✓ Residual effect anticipated.
– No residual effect anticipated.

13.5 DETERMINATION OF SIGNIFICANCE

The residual environmental effects from the Project on wildlife and wildlife habitat are determined to be **not significant** because they do not threaten the long-term persistence or viability of a wildlife species (including SAR, SOCC, and species of interest to Aboriginal communities) within the RAA. Evidence to support this determination is:

- No critical habitat as defined by SARA is present within the LAA therefore the Project does not result in loss of critical habitat for a SARA listed species.
- Canada warbler (SAR) and common nighthawk (SAR) are ranked S4B (apparently secure – uncommon, not rare) in Ontario (Table 13-6) and suitable breeding habitat is common within the RAA. Birds displaced by the Project are likely to find breeding habitat elsewhere within the LAA or RAA. Potential habitat for common nighthawk is expected to increase upon closure.
- With the implementation of mitigation measures, there is no measurable effect of the Project on barn swallow (SAR) breeding habitat.
- The LAA is considered an area where woodland caribou (SAR) are unlikely to occur (Section 13.2.2.1) and the LAA, in turn, is within a much larger area of discontinuous caribou distribution (Lake Superior Uplands Linkage zone). At such low density currently, the Project is not expected to alter caribou presence within the RAA.
- The area of caribou habitat affected during construction (conservatively estimated as the entire area of the PDA) represents only 0.1% of the Lake Superior Uplands Linkage zone.
- No SAR bat maternity roosting habitat was confirmed in the LAA. Although some loss of potential SAR bat maternity roosting habitat will result from the Project, the availability of this habitat within the RAA is common. When roosting trees have been removed, bats have shifted their use where other suitable habitat is available (EC 2015).
- There is no net loss of American white pelican (SAR) stopover and foraging habitat within the RAA.
- Eastern wood-pewee (SOCC) and bald eagle (SOCC) are ranked S4B (apparently secure – uncommon, not rare) in Ontario (Table 13-6) and suitable breeding habitat is common within the RAA. Birds displaced by the development are likely to find breeding habitat elsewhere within the LAA or RAA. The percentage of potential habitat lost in the RAA upon closure is 0.6% and 1.2 % respectively.

- Taiga alpine butterfly is ranked S3 (vulnerable) in Ontario (Table 13-6) and suitable habitat is common within the RAA (Section 13.4.2.3). The total area affected by the Project is only 2% of the potential habitat available within the RAA. The TMF was redesigned to avoid a large fen within the LAA where the taiga alpine butterfly was recorded during baseline surveys (Section 13.4.2.3).
- The irreversible loss of bird SWH and other wildlife habitat as a result of the Project is estimated as 42 ha (non-treed wetland bird breeding habitat) and 163 ha (waterfowl nesting habitat) and is 0.6% and 2%, respectively, of the potential habitat available within the RAA.
- The irreversible loss of mammal SWH and other wildlife habitat as a result of the Project is estimated as 780 ha (moose foraging) and 347 ha (moose late winter cover) and is 0.9% and 0.6% of the potential habitat available within the RAA respectively.
- The irreversible loss of reptile and amphibian SWH habitat as a result of the Project is estimated as 42 ha (turtle overwintering) and 1,265 ha (amphibian breeding) and is 0.2% and 2.7% of the potential respective habitat in the RAA.
- The wildlife habitat types within the LAA are common within a regional context (RAA) with the loss of habitat within the RAA ranging from 0.1-2.7%. This is supported by the findings of the vegetation communities assessment regarding the ecosite types identified within the LAA (Chapter 12.0; vegetation communities VC).
- Rehabilitation (which will be progressive throughout operation) will restore some wildlife habitat value for SAR, SOCC, SWH and species of interest to Aboriginal communities to the PDA over time.
- Increased mortality risk as the result of the Project is primarily confined to the construction phase, and this risk is highest for nesting birds. Mortality risk will return to baseline levels upon closure. The actual incidence of direct mortality as the result of the Project is expected to be reduced through implementation of a suite of mitigation measures (Section 13.4.3.2), in particular the implementation of timing windows for vegetation clearing and the development of a Bird Nest Mitigation Plan.
- The Project effect on wildlife movement at a regional scale is minimal as the existing conditions within the LAA have already resulted in long-term alteration of those movements and the Project is naturally bound to the north, east and south east by Kenogamisis Lake. Effects are predicted to be reversed at the end of active closure.

13.6 PREDICTION CONFIDENCE

Overall confidence in the residual environmental effect and significance predictions for wildlife and wildlife habitat is high. This prediction confidence assignment is based on professional judgment and the consideration of multiple factors, and includes consideration of the relative contribution of each factor to the overall confidence.

The factors contributing to higher confidence are:

- The potential environmental effects and effect mechanisms for this Project are common to mining operations and other large construction projects and are generally well understood.
- The mitigation measures are well understood and align with provincial standards and standard management practices.
- The understanding of existing conditions, including wildlife use of the LAA, is supported by literature review, traditional knowledge studies (Appendix J) and baseline field data (Baseline Report – Terrestrial; Appendix E8).
- The assessment used conservative assumptions and methods to increase the level of confidence, specifically:
  - a conservative approach is used to identify the presence of SWH within the LAA (Section 13.2.1.3)
  - a conservative-case scenario is used for the predictions of direct and indirect habitat loss (Section 13.4.2.1)
  - the PDA, while assumed to be entirely cleared and developed in the assessment, includes some areas that will not be physically altered
  - indirect effects are determined as if they were static over time and not influenced by factors such as time of year, vegetation cover, age and sex class, and topography
  - a conservative-case scenario is used for the prediction of amount and type of vegetation to be rehabilitated upon closure
  - although no bat maternity roost habitat was confirmed habitat loss predictions for potential bat maternity roost habitat were characterized
  - habitat loss predictions for Canada warbler, and eastern wood-pewee were characterized for confirmed and potential breeding habitat combined (Section 13.4.2.3)
  - habitat loss prediction for woodland caribou assumed the entire PDA was suitable as caribou habitat, with no consideration of actual habitat value (Section 13.4.2.3).
- The Project effects on habitat were quantified using GIS.

13.7 REFERENCES

13.7.1 Literature and Internet Sites

Barber, J.R., K. Crooks, and K. Fristrup. 2010. The costs of chronic noise exposure for terrestrial organisms. Trends in Ecology and Evolution. 25(3):180-189.

Bertwistle, J. 1999. The effects of reduced speed zones on reducing bighorn sheep and elk collisions with vehicles on the Yellowhead Highway in Jasper National Park. In: Evink, G.L., P. Garrett & D. Zeigler (eds.). Proceedings of the third international conference on wildlife ecology and transportation: 89-97. Missoula, Montana. FL-ER-73-99. Florida Department of Transportation, Tallahassee, Florida.

Bird Studies Canada. 2003. The Marsh Monitoring Program – Training Kit and Instructions for Surveying Marsh Birds, Amphibians and their Habitats. 2003 Edition. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. March 2003. 40 pages.

Bird Studies Canada. 2013. Whip-poor-will Roadside Survey Participant's Guide. Available from http://www.birdscanada.org/birdmon/wpwi.

BirdLife International. Important Bird Areas Database. (http://www.ibacanada.ca/explore.jsp?lang=EN).

Broders, H.G., G.J. Forbes, S. Woodley, and I.D. Thompson. 2006. Range extent and stand selection for roosting and foraging in forest-dwelling Northern Long-Eared bats and Little Brown bats in the Greater Fundy Ecosystem, New Brunswick. *Journal of Wildlife Management* 70(5):1174-1184.

Cadman, M. D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier. 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. (eds.) Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706pp.

Cadman, M. D., H. J. Dewar, and D. A. Welsh. 1998. The Ontario Forest Bird Monitoring Program (1987-1997): Goals, methods and species trends observed. Canadian Wildlife Service Technical Report.

Cagle, F.R., and L. Cockrum. 1943. Notes on a summer colony of *Myotis lucifugus lucifugus*. *Journal of Mammalogy* 24(4):474-492.

COSEWIC. 2012. COSEWIC assessment and status report on the Eastern Wood-pewee *Contopus virens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 39 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Dobbyn, J. 1994. Atlas of the Mammals of Ontario. Federation of Ontario Naturalists.

Ellis, D.H., C.H. Ellis, and D.P. Mindell. 1991. *Raptor Responses to Low-Level Jet Aircraft and Sonic Booms.* Environmental Pollution, Vol. 74, pp. 53-83.

Environment Canada. 2012. Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. xi + 138 pp.

Environment Canada 2014. Mining Project Baseline Assessment and Survey Requirements. June 18, 2014 draft. Provided to Stantec by Environment Canada (Dan MacDonell) on August 11, 2014.

Environment Canada. 2015. Recovery Strategy for Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*) and Tri-colored Bat (*Perimyotis subflavus*) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. ix + 110 pp.

Environment Canada. 2016a. Recovery Strategy for Canada warbler (*Cardellina canadensis*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 56 pp.

Environment Canada. 2016b. Recovery Strategy for the Common Nighthawk (*Chordeiles minor*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 49 pp.

Environment and Climate Change Canada. 2016c. Avoidance of Detrimental Effects to Migratory Birds (Incidental Take). (http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=C51C415F-1).

Fisher, J.T., and L. Wilkinson. 2005. The response of mammals to forest fire and timber harvesting in the North American boreal forest. Mammal Review 35(1): 51-81.

Gerson. H. 1984. Habitat Management Guidelines for Bats of Ontario. Ontario Ministry of Natural Resources. (August 1984).

Grubb T.G.; Bowerman, W.; Giesy J.P.; Dawson G.A.. 1992. Responses of breeding Bald Eagles to human activities in northcentral Michigan. Can. Field-Nat 106:443-453.

Government of Canada. 2016. Species at Risk Act (overview). (https://www.ec.gc.ca/alef-ewe/default.asp?lang=en&n=ED2FFC37-1,).

Habib, L., Bayne, E. M. and Boutin, S. (2007), Chronic industrial noise affects pairing success and age structure of ovenbirds *Seiurus aurocapilla*. Journal of Applied Ecology, 44: 176–184. doi:10.1111/j.1365-2664.2006.01234.x.

Layberry, R A., P.W. Hall, and J.D. Lafontaine. 1998. *The Butterflies of Canada*. University of Toronto Press.

Luo, J., Clarin, B.-M., Borissov, I. M., and Siemers, B. M. 2014. Are torpid bats immune to anthropogenic noise? The Journal of Experimental Biology 217(7):1072–8.

Manley, P.N.; Van Horne, B.; Roth, J.K.; Zielinski, W.J.; McKenzie, M.M.; Weller, T.J.; Weckerly, F.W.; Vojta, C. 2006. Multiple species inventory and monitoring technical guide. Gen. Tech. Rep. WO-73. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office 204p.

Minnesota Department of Natural Resources, 2016. Rare Species Guide: Taiga alpine. (http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=IILEPN8140).

National Audubon Society. 2010. Christmas Bird Count Database. Website: http://netapp.audubon.org/cbcobservation/.

Natural Heritage Information Centre (NHIC) database. 2014. Natural Areas and Species records search.

Narins, P.M. 1990 Seismic communication in anuran amphibians. Bioscience 40 (4):268-274.

Oldham, M.J. and W.F. Weller. 2000. Ontario Herpetofaunal Atlas internet database. Natural Heritage Information Center. Ministry of Natural Resources, Peterborough, ON.

Ontario Ministry of Municipal Affairs and Housing (MMAH). 2014. *Provincial Policy Statement*. Provincial Planning Policy Branch. Toronto, Ontario. Available at: http://www.mah.gov.on.ca/Page10679.aspx.

Ontario Ministry of Natural Resources and Forestry. 1987. Bald Eagle Habitat Management Guidelines. June 1987. 15pp.

Ontario Ministry of Natural Resources (MNR). 2000. *Significant Wildlife Habitat Technical Guide*. 344 pp.

Ontario Ministry of Natural Resources (MNR). 2008. Forest Resource Inventory – Kenogami Forest.

Ontario Ministry of Natural Resources (MNR). 2009a. *Ontario's Woodland Caribou Conservation Plan*. 24 pp.

Ontario Ministry of Natural Resources (MNR). 2009b. *Ecological Land Classification field manual – operational draft, April 20, 2009*. Ecological Land Classification Working Group, Ontario. Unpublished manual.

Ontario Ministry of Natural Resources (MNR). 2010a. *Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005*. Second Edition. Toronto: Queens Printer for Ontario. 233 pp.

Ontario Ministry of Natural Resources (MNR). 2010b. Provincial Wildlife Population monitoring Program Plan. Version 2.0, June 2010. Ministry of Natural Resources. Science and Research Branch. 53 pp.

Ontario Ministry of Natural Resources (MNR). 2011a. *Bats and Bat Habitats. Guidelines for Wind Power Projects*. July, 2011. 24 pp.

Ontario Ministry of Natural Resources (MNR). 2011b. *Bird and Bird Habitats: Guidelines for Wind Power Projects*. December 2011. 31p.

Ontario Ministry of Natural Resources (MNR). 2012a. *Draft Significant Wildlife Habitat EcoRegion 3E Criterion schedule*.

Ontario Ministry of Natural Resources (MNR). 2012b. *A guide to translate northwestern Ontario ecosites into "Ecosites of Ontario"*. Science and Information Services Division, Science and Information Branch. NWSI Tech. Note TN-48.

Ontario Ministry of Natural Resources (MNR). 2013a. *General Habitat Description for the Barn Swallow (Hirundo rustica)*. July, 2013.

Ontario Ministry of Natural Resources (MNR). 2013b. *General Habitat Description for the Forest-dwelling Woodland Caribou (Rangifer tarandus caribou)*. July, 2013. (http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_ghd_car_en.pdf)

Ontario Ministry of Natural Resources (MNR). 2013c. Best Management Practices for Mineral Exploration and Development Activities and Woodland Caribou in Ontario.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2014a. Moose Resource Report Wildlife Management Unit 21A. 2014.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2014b. Moose Resource Report Wildlife Management Unit 19. 2014.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2014c. Black Bear Ecological Zones. February 2014.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2014d. *Range Management Policy in Support of Caribou Conservation and Recovery*.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2015a. Significant Wildlife Habitat Criteria Schedules for EcoRegion 3E. January, 2015.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2015b. Land Information Ontario. Website: http://www.ontario.ca/page/land-information-ontario.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2015c. Ontario's White-nose Syndrome Response Plan. Wildlife Section, Species Conservation Policy Branch Ministry of Natural Resources and Forestry March, 2015 p 22.Ontario.

Sandilands. A. 2005. Birds of Ontario. Habitat Requirements, Limiting Factors and Status. Nonpasserines: waterfowl through cranes. UBC Press.

Sandilands, A. P. 2010. Birds of Ontario: habitat requirements, limiting factors and status. Vol. II, Nonpasserines: Shorebirds through Woodpeckers. UBC Press.

Tanner AL, Leroux SJ (2015) Effect of Roadside Vegetation Cutting on Moose Browsing. PLoS ONE 10(8): e0133155. doi:10.1371/journal.pone.0133155.

Terrace Bay Pulp. 2011. Kenogami Forest 2011 – 2021 Forest Management Plan. (http://www.efmp.lrc.gov.on.ca/eFMP/viewFmuPlan.do?fmu=350&fid=58916&type=CURRENT&pid=58916&sid=11118&pn=FP&ppyf=2011&ppyt=2021&ptyf=2011&ptyt=2016&phase=P1).

Wolverine Recovery Team. 2013. Recovery Strategy for the Wolverine (*Gulo gulo*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 66 pp.

Young, R., and Vokurka, C. 2007. Relating Wildlife Crashes to Road Reconstruction. Department of Civil and Architectural Engineering University of Wyoming.

13.7.2 Personal Communications

Evan Armstrong (MNRF) e-mail message to Al Harris (Northern Bioscience), March 19, 2014.

Philip Wilson (MNRF) e-mail message to Nicole Kopysh (Stantec), November 15, 2016.