Marathon Palladium Project Environmental Impact Statement Addendum

VOLUME 2 OF 2

6.2.8 Species at Risk

Prepared for:

GENERATIONPGM

Prepared by:

Stantec

Ecometrix Environmental Intelligence

Northern Bioscience Ecological Consulting

Knight Piésold Consulting

Date: April 2021

Environmental Assessment by Review Panel under CEAA 2012

Reference Number 54755

Table of Contents

LIST OF TABLES

LIST OF FIGURES

Abbreviations

AIR	Additional information requests
AOC	Area of concern
ATV/UTV	all terrain vehicle / utility task vehicle
BN	Biigtigong Nishnaabeg
CCP	Caribou Conservation Plan
CFSA	*Crown Forest Sustainability Act*
CIAR	Canadian Impact Assessment Registry
dB	decibel
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
FMP	Forest Management Plan
FMU	Forest Management Unit
FRI	Forest Resource Inventory
GenPGM	Generation PGM Inc.
GHD	General Habitat Description
GIS	geographic information system
GS	Generating Station
ha	hectare
IR	Information Request
LIO	Land information Ontario

LSA	Local Study Area
LSCR	Lake Superior Coast Range
MAF	Mean Annual Flow
MECP	Ministry of the Environment, Conservation and Parks
MFN	Michipicoten First Nation
MMF	Mean Monthly Flow
MNR	Ministry of Natural Resources (now MNRF)
MNRF	Ministry of Natural Resources and Forestry (formerly MNR)
NFMC	Nawiinginokiima Forest Management Corporation
PNP	Pukaskwa National Park
PPV	Peak particle velocity
PSMF	Process Solids Management Facility
RSA	Regional Study Area
SAR	Species at Risk
SID	Supporting Information Document
SIR	Supplemental Information Request
SSA	Site Study Area
TLRU	Traditional Land and Resource Use
VEC	Valued Ecosystem Component
WMP	Water Management Pond
WMU	wildlife management unit
WNS	White-nose syndrome

6.2.8 Species at Risk

Species at Risk (SAR) were selected as a Valued Ecosystem Component (VEC) in the original EIS (2012). Wildlife that are SAR are assessed separately in Section 6.2.7 of this EIS Addendum (Vol 2). SAR are linked to other VECs, including:

- Atmospheric Environment (Section 6.2.1 of this EIS Addendum [Vol 2]) due to potential effects of air quality (including olfactory environment), fugitive dustfall, and increased ambient light levels
- Acoustic Environment (Section 6.2.2 of this EIS Addendum [Vol 2]) due to potential effects from noise and vibration
- Water Quality and Quantity (Section 6.2.3 of this EIS Addendum [Vol 2]) due to potential effects on vegetation (particularly wetlands) due to increased or lowered groundwater or surface water levels
- Vegetation (Section 6.2.5 of this EIS Addendum [Vol 2]) upon which most of the wildlife habitat models are based
- Wildlife (Section 6.2.7 of this EIS Addendum [Vol 2]) which interact with SAR (e.g., predators, prey)
- Indigenous traditional land and resource use (Section 6.2.12 of this EIS Addendum [Vol 2]) since changes in SAR have the potential to affect traditional land and resource use by Indigenous communities for food, medicine, or other cultural significance
- Human health (Section 6.2.10 of this EIS Addendum [Vol 2]) since vegetation affected by dust deposition could potentially affect organisms or humans that ingest this vegetation

6.2.8.1 Summary of Original Species at Risk Assessment

6.2.8.1.1 Assessment of Residual Effects in Original EIS

Section 6.2.8 of the original EIS (2012), as well as the original assessment of effects on woodland caribou (Northern Bioscience 2012c) (SID #26) (CIAR #234) and birds (Northern Bioscience 2012b) (SID# 25) (CIAR #234), as well as subsequent responses to information requests from the Panel provided an assessment of the following effects to species at risk as result of the Project:

- change to woodland caribou potential habitat and movement corridors
- change to potential habitat for little brown myotis and northern myotis
- change to potential habitat of SAR birds i.e., olive-sided flycatcher, bald eagle, peregrine falcon, common nighthawk, and eastern whip-poor-will

- change to confirmed habitat of Canada warbler and rusty blackbird

Additional information on the assessment of effects on species at risk was provided in responses to the following IRs:

- Responses to IRs 23.1, 23.3, 23.4, and 23.5 (CIAR #410 and #428)
- Responses to SIR #11 (CIAR #586)

Main predicted effects to species at risk included the following:

- loss of rock barren habitat with potential for winter use by caribou (although no confirmed use), as well as potential impairment of connectivity (caribou movement through site) during operations and after c
- loss of Canada warbler habitat due to forest clearing for Project infrastructure, roads, and transmission line
- loss of <2 ha of rusty blackbird habitat around a small pond due to forest clearing for mine infrastructure
- loss of potential habitat for other bird SAR i.e., olive-sided flycatcher, bald eagle, peregrine falcon common nighthawk, and eastern whip-poor-will
- sensory disturbance (noise) and effects of dust deposition of terrestrial SAR from Project activities during construction and operation
- potential for collisions of terrestrial SAR with Project infrastructure and vehicles during construction and operation
- clearing of vegetation for Project infrastructure, transmission line, and roads could disturb or destroy SAR bird nests and their young during the breeding season

Key mitigation measures originally proposed to avoid, reduce and/or offset potential effects of the Project on species at risk included:

- optimizing the mine footprint to reduce forest clearing and loss of non-forested habitats
- clearing vegetation outside the SAR bird breeding season, wherever feasible
- employing noise mitigation and dust suppression
- enforcing speed limits on Project roads
- designing the transmission line to reduce collisions with SAR birds, limiting the use of guy wires, and marking the line to increase visibility where practical

- rehabilitation of roads and Project site by selective re-vegetation at closure to restore caribou habitat to the extent feasible
- off-site rehabilitation of inactive forest access roads and degraded caribou habitat to improve connectivity and woodland caribou habitat in adjacent range

6.2.8.1.2 Determination of Significance in Original EIS

For species at risk, the original EIS (2012) concluded that there would be no significant adverse effect. Habitat loss is limited to the SSA.

The abundance of other cervid species and predators within the SSA and lack of historic observations make use of the site as a transportation corridor for woodland caribou unlikely; however, the possibility cannot be eliminated. There are ample ways for caribou to by-pass or traverse the site and loss of potential connectivity is reversible at decommissioning; proposed off-site mitigation will create an overall benefit to woodland caribou.

6.2.8.2 Approach to Update the Assessment

The following subsections provide an update to the assessment of residual environmental effects of the Project, including a determination of their significance based on the following:

- updated environmental conditions within the SSA, LSA and RSA, as appropriate
- recognition of updated standards, criteria, guidelines, or other thresholds that inform the determination of significance
- consideration and recognition of Project refinements, including changes to the Project components and activities, that may affect potential Project interactions, mitigation measures and residual effects

Changes to the results of the previous assessment have been highlighted and discussed below, as appropriate. Supplementary rationale and explanation for the conclusions of the assessment have been provided based on the previous responses to the information requests (IRs, SIRs, AIRs) and additional input from the various technical discipline leads based on the current assessment.

6.2.8.3 Scope of the Assessment

6.2.8.1.3 Regulatory and Policy Setting

There have been no changes to the regulatory and policy setting since the preparation of the original EIS (2012). As described in Section 5.2 of the terrestrial baseline update report (Northern Bioscience, 2020) (CIAR #722) there have been some changes to the ranking of some provincially or federally listed SAR.

With respect to the forest management regime, several Forest Management Units (FMU) in the Project area have been merged since the original EIS. The Project now falls entirely within what is now the Pic Forest FMU, which has a new Forest Management Plan (FMP) for the 2021-2031 period (McDonald 2021). The Pic Forest FMU is managed by the Nawiinginokiima Forest Management Corporation (NFMC), the first Local Forest Management Corporation in Ontario. Some high-level direction for managing caribou in the coastal and discontinuous range has been provided in Ontario's Caribou Conservation Plan (MNR 2009a), and a management approach has been under consideration for this caribou population for a considerable period of time (e.g., ECCC 2017; MNRF 2018). However, in the absence of specific management direction for woodland caribou in the coastal and discontinuous range (e.g., MNRF 2018), the FMP represents the most important provincially-approved habitat management direction for woodland caribou, as well as other SAR.

The environmental effects assessment for SAR has been prepared in accordance with the EIS Guidelines (Appendix B of this EIS Addendum [Vol 2]). Concordance tables, indicating how the EIS Guidelines have been addressed, are provided in (Appendix A of this EIS Addendum [Vol 2]).

6.2.8.1.4 Influence of Consultation and Engagement on the Assessment

Consultation for the Project has been ongoing since 2004 and will continue throughout the life of the Project. Chapter 4 of the original EIS (2012) and Chapter 5 of this EIS Addendum (Vol 2) provides more details on the consultation process and activities undertaken by GenPGM and formerly by Stillwater. Comments and feedback received throughout the consultation process pertaining to the SAR are summarized below:

- Information was requested on Project-specific data pertaining to SAR (specifically on lake sturgeon, bat species) and furbearers
- Concerns relating to changes in SAR and migratory birds information were raised

Feedback related to SAR has been addressed through updates to the EIS Addendum and supporting materials, and responses and meetings with communities and stakeholders, as appropriate. Traditional knowledge and traditional land and resource use (TLRU) information provided by Indigenous communities identified the importance of plants, fungi, and wildlife to these communities. Specific SAR species locations were not identified in the SSA by Indigenous communities; instead, information has been provided in general terms with regards to SAR and cumulative effects to SAR. Lake sturgeon in Pic River were mentioned as a species of interest to Biigtigong Nishnaabeg (BN) and other Indigenous communities. A list of species of interest to Indigenous communities has been provided in Table 12 and 13 of the Baseline Terrestrial Environment Report (Northern Bioscience 2020) (CIAR #722), and in Section 6.2.12 of this EIS Addendum (Vol 2) provides further details on how TLRU and traditional knowledge have been incorporated into the assessment, while Sections 6.2.6 and 6.2.7 of this EIS Addendum (Vol 2) provides details on vegetation and wildlife.

6.2.8.1.5 Potential Effects, Pathways and Measurable Parameters

Table 6.2.8-1 summarizes the potential environmental effects of the Project on SAR, the effect pathway, and the measurable parameters. These potential environmental effects and measurable parameters were selected based on professional judgment, recent EAs for mining projects in Ontario, and comments provided during consultation. The original EIS (2012) often had these various pathways assessed collectively; they are separated in this update to facilitate a more explicit examination of effects, pathways, and measurable parameters.

Table 6.2.8-1: Potential Effects, Effects Pathways and Measurable Parameters for Species at Risk

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change to woodland caribou or their habitat	• Loss of potential habitat through clearing of the SSA • Impairment of potential habitat in LSA from sensory disturbance • Injury or mortality due to collisions with Project infrastructure or vehicles • Potential impairment of movement in LSA due to sensory disturbance	• Area (ha) of potential habitat • Area (ha) of additional disturbance in LSA / RSA • # individuals potentially affected by disturbance for movement through LSA
Change to little brown myotis, northern myotis, or their habitat	• Loss of potential roosting habitat through clearing of the SSA • Impairment of potential roosting or foraging habitat in LSA from sensory disturbance	• Area (ha) of potential roosting habitat • # individuals potentially affected by disturbance
Change to Canada warbler or their habitat	• Loss of habitat through clearing of the SSA • Impairment of habitat in LSA from sensory disturbance • Injury or mortality due to collisions with Project infrastructure or vehicles	• Area (ha) of nesting season habitat • # individuals potentially affected by disturbance • # individuals potentially affected by collisions
Change to rusty blackbird or their habitat	• Loss of habitat through clearing of the SSA • Impairment of habitat in LSA from sensory disturbance • Injury or mortality due to collisions with Project infrastructure or vehicles	• Area (ha) of nesting season habitat • # individuals potentially affected by disturbance • # individuals potentially affected by collisions
Change to olive-sided flycatcher, evening grosbeak, eastern wood-pewee, or their habitat	• Loss of potential habitat through clearing of the SSA • Impairment of potential habitat in LSA from sensory disturbance	• Area (ha) of potential nesting season habitat • # individuals potentially affected by disturbance

Table 6.2.8-1: Potential Effects, Effects Pathways and Measurable Parameters for Species at Risk

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
	• Injury or mortality due to collisions with Project infrastructure or vehicles	• # individuals potentially affected by collisions
Change to bald eagle, peregrine falcon, or their habitat	• Loss of potential habitat through clearing of the SSA • Impairment of potential habitat in LSA from sensory disturbance • Injury or mortality due to collisions with Project infrastructure or vehicles	• Area (ha) of potential nesting season habitat • # individuals potentially affected by disturbance • # individuals potentially affected by collisions
Change to common nighthawk, eastern whip-poor-will, or their potential habitat	• Loss of potential habitat through clearing of the SSA • Impairment of potential habitat in LSA from sensory disturbance • Injury or mortality due to collisions with Project infrastructure or vehicles	• Area (ha) of potential nesting season habitat • # individuals potentially affected by disturbance • # individuals potentially affected by collisions
Change to yellow-banded bumblebee or their habitat	• Loss of potential habitat through clearing of the SSA • Injury or mortality due to collisions with Project infrastructure or vehicles	• # individuals potentially affected by disturbance • # individuals potentially affected by collisions
Change to monarch or their habitat	• Loss of potential habitat through clearing of the SSA • Injury or mortality due to collisions with Project infrastructure or vehicles	• # individuals potentially affected by disturbance • # individuals potentially affected by collisions
Change to lake sturgeon or their habitat	• Loss of lake sturgeon habitat in the Pic River, through direct (overprinting of habitat, physical alteration) or indirect (loss of flow, blasting) effects • Changes in water quality, (including constituent concentrations, mobilization of solids) in the Pic River	• Area of habitat (ha) or # individuals potentially affected • Changes in constituent concentrations, from baseline concentrations, directly related to Project activities in mg/L and/or exceedances of most appropriate water quality guideline or criteria for the protection of the aquatic life

6.2.8.1.6 Assessment Boundaries

In general, the spatial boundaries for the assessment of environmental effects are presented in Section 2.4 of the EIS Addendum (Vol 1) (CIAR #727) while the LSA and RSA are defined based on the extent of potential effects specific to each VEC.

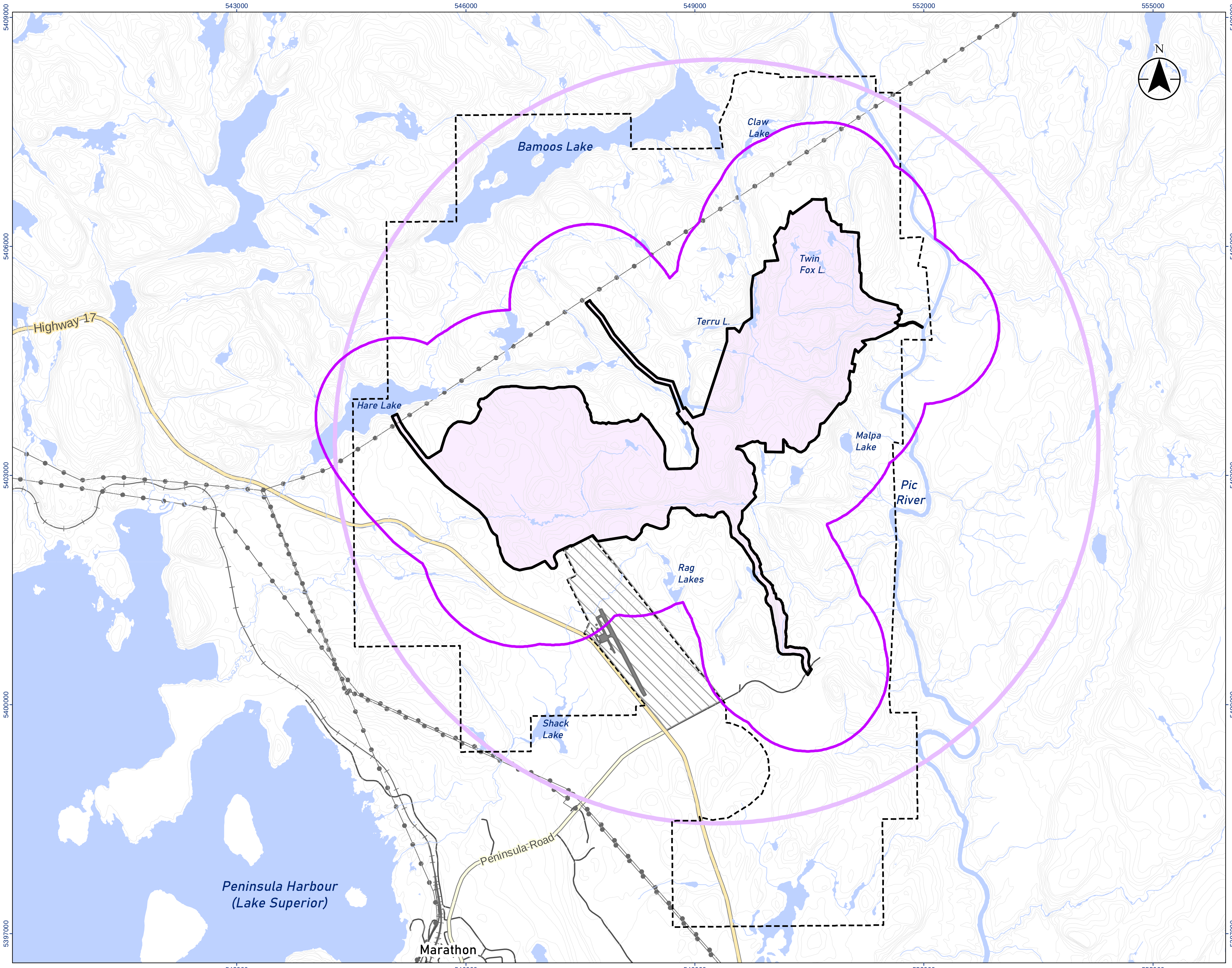
- **Site Study Area**: The SSA is the direct footprint of the Project and is consistent across all VECs. The SSA has been revised from the original EIS (2012) to reflect changes and refinements to the Project design. The SSA encompasses 1,116 ha.
- **Local Study Area**: The SAR LSA represents the area within which changes to SAR from Project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. In the original EIS (2012), the SAR LSA consisted of a 5 km buffer from the approximate centroid of the Project footprint or SSA. This LSA was overly conservative for assessing effects on SAR VECs, however, and the LSA has been refined to better reflect potential direct and indirect effects on SAR. The revised LSA for SAR, exclusive of woodland caribou and lake sturgeon, encompasses a 1 km buffer from the updated Project footprint or SSA. This is anticipated to reflect the potential geographic extent of sensory disturbance of SAR more accurately (i.e., auditory, visual, and olfactory) and indirect effects on habitat (e.g., edge effects, groundwater). This aspect of the SAR LSA is consistent with the revised LSA used for vegetation. The LSA for lake sturgeon is the same as that presented for the fish and fish habitat VEC, and includes areas associated with local subwatershed where Project-related environmental effects are reasonably expected to occur based on available information and professional judgment. Based on provincial and federal direction, a broader scale of analysis was used for woodland caribou than for other SAR, largely due to their mobility and sensitivity to anthropogenic disturbance. For this EIS Addendum, the SSA plus an additional 10 km buffer was used for the LSA since it is expected to capture potential disturbance effects (e.g., noise, light, noise, smell) from the Project. This is consistent with MNRF's (2013c) General Habitat Description for Forest-dwelling Caribou, which states that development that results in sensory disturbance should be avoided within 10 km of Category 1 caribou habitat (i.e., high use areas such as calving, nursery, and winter habitat that are most sensitive to disturbance). The original EIS (2012) used the Lake Superior Coast Range west of Pukaskwa National Park as the Local Study area, which is overly conservative – it is also carried through in this analysis as well to facilitate comparison. **Regional Study Area**: The SAR RSA is the area within which residual environmental effects from Project activities and components may interact cumulatively with the residual environmental effects of other past, present, and future (i.e., certain, or reasonably foreseeable) physical activities. The RSA is based on the potential for interactions between the Project and other existing or future potential projects with regard to SAR effects. The original EIS (2012) did not explicitly define the spatial extent of the RSA for most SAR. To facilitate a more quantitative assessment of effects on terrestrial SAR habitat, the SAR RSA has been defined as the Pic Forest FMU. Forests are the primary vegetation community and SAR habitat type in the LSA and surrounding landscape. Commercial forestry has by far the largest footprint of any reasonably foreseeable project in the landscape surrounding the Project, and forests are managed for sustainability at the FMU scale. This makes the Pic Forest FMU an appropriate scale of analysis. This RSA encompasses 1,153,240 ha and includes both the SSA and LSA.

For lake sturgeon, RSA includes the SSA and LSA, the northwest basin of Lake Superior and its associated drainages as well as the lower reaches of the Pic River extending from the LSA to its confluence with Lake Superior,

Based on federal direction, the RSA for woodland caribou is the Lake Superior Coast Range (LSCR) plus a 10 km buffer into the zone of discontinuous distribution (Lake Superior Uplands Linkage). Previously, cumulative effects considered both the LSCR and the entire area of discontinuous distribution – these will also be carried forward separately in the analysis to facilitate comparison.

The SAR LSA boundaries are depicted on Figure 6.2.8-1 and the RSA boundaries are depicted on Figure 6.2.8-2 for most SAR, and on Figure 6.2.8-3 for caribou.

The temporal boundaries for the Project that have been considered in the determination of environmental effects are described in Section 1.5 of the EIS Addendum (Vol 1) (CIAR #727). The temporal boundaries used to assess potential effects on the SAR VEC span all phases of Project life.



Legend

- Site Study Area
- Local Study Area
- Original Terrestrial Local Study
- Project Boundary (MLAS, MENDM Changed 2017)
- Airport Property
- Airport Infrastructure
- Waterbody (LIO)
- Watercourse (LIO)
- Contour
- Hydro Line
- Highway
- Major Road
- Minor Road
- Railway

0 1 2 3 km

1:51,254 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.

Project Location
Marathon

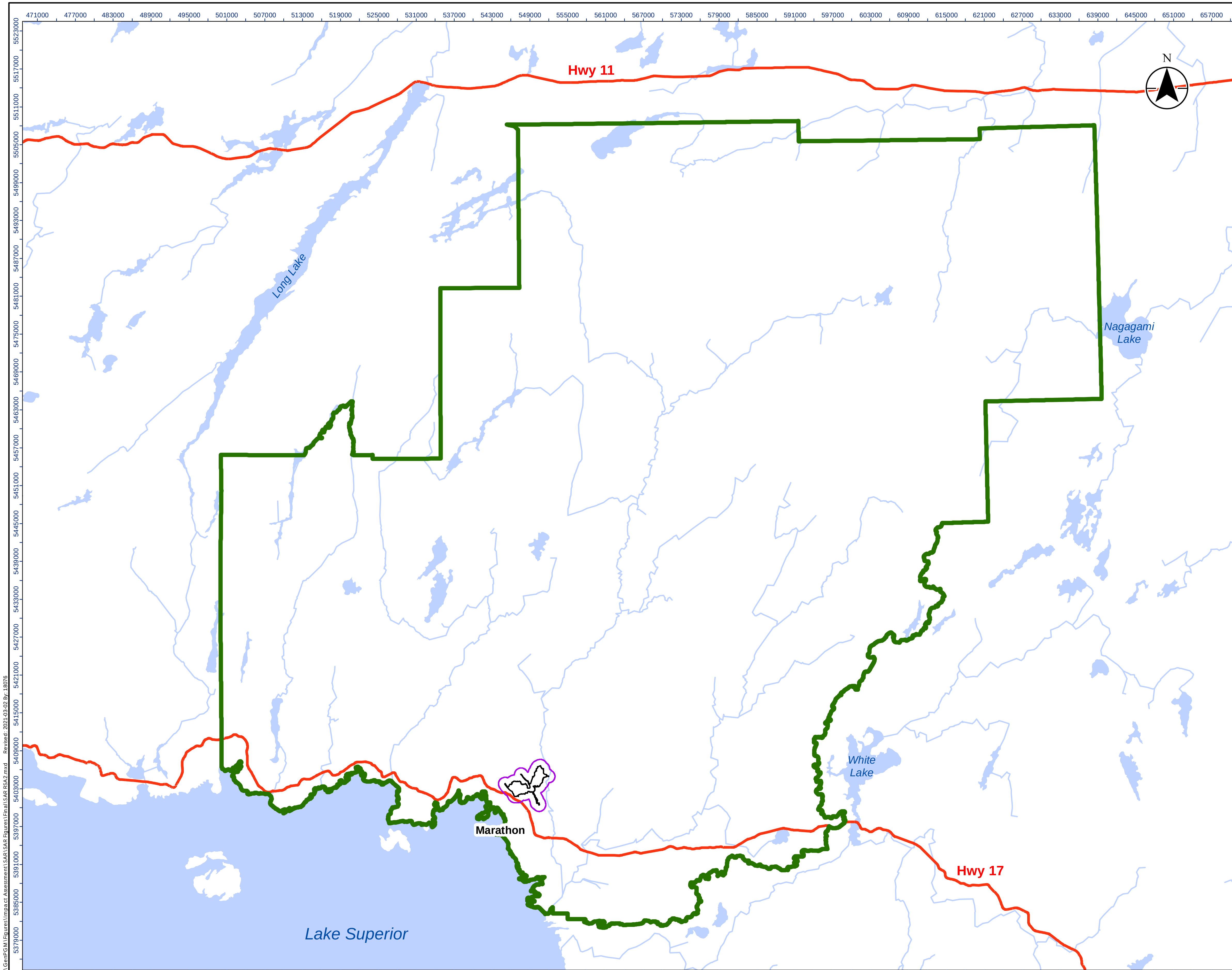
Prepared by D Harvey & R. Foster on 2021-03-02

Client/Project
GENERATION MINING LTD.
MARATHON PALLADIUM PROJECT

Figure No.
6.2.8-1

Title
Spatial Boundaries of the SSA and LSA for Species at Risk (with the exception of caribou)

C:\GIS\GenPGM\Figures\Impact Assessment\SAR\SAR Figures\Final\SAR LSA1.mxd Revised: 2021-03-02 By: 18076



Stantec

NORTHERN BIOSCIENCE

Legend

- Site Study Area
- Local Study Area
- Regional Study Area
- Expressway / Highway
- Waterbody (LIO 1:2M)
- Watercourse (LIO 1:5M)

0 6 12 18 24 30 36 km

1:618,592 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.

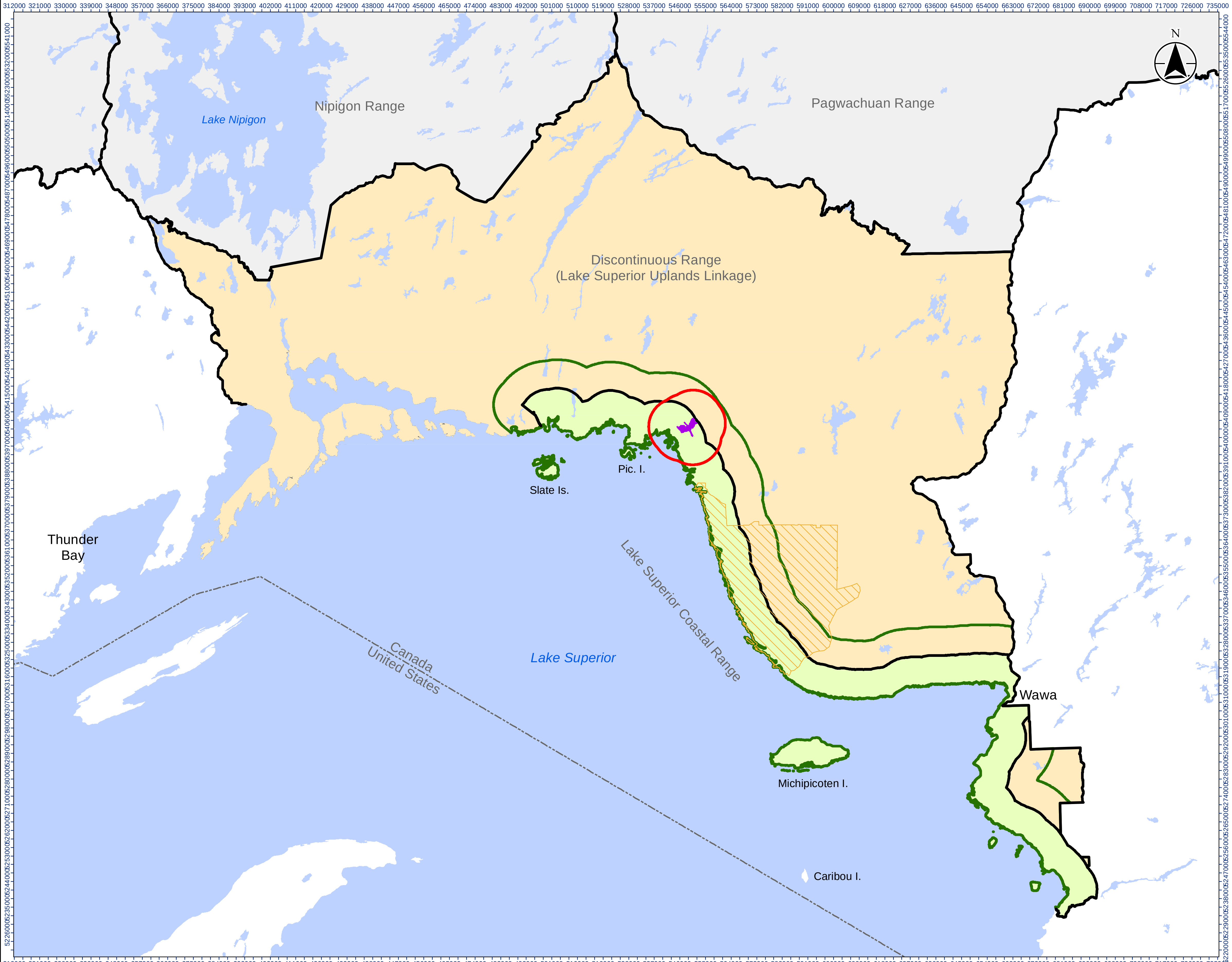
Project Location
Marathon

Prepared by R. Foster on 2021-03-02

Client/Project
GENERATION MINING LTD.
MARATHON PALLADIUM PROJECT

Figure No.
6.2.8-2

Title
Spatial Boundaries of the RSA and LSA for Species at Risk (with the exception of caribou)



Stantec

NORTHERN BIOSCIENCE

Legend

- 2020 Site Study Area (SSA)
- 2020 Caribou Local Study Area (LSA)
- 2020 Caribou Regional Study Area (RSA)

2013 Caribou RSA

- Lake Superior Coastal Range (LSCR)
- Discontinuous Range (LSUL)
- Other Caribou Ranges (Continuous Distribution)
- Pukaskwa National Park
- Waterbody (LIO 1:2M)
- International Boundary

0 10 20 30 40 50 60 km

1:1,366,418 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.

Project Location
Marathon

Prepared by R. Foster on 2021-03-02

Client/Project
GENERATION MINING LTD.
MARATHON PALLADIUM PROJECT

Figure No.
6.2.8-3

Title
Spatial Boundaries of the Caribou LSA and RSA

6.2.8.1.7 Residual Effects Characterization

Table 6.2.8-2 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 6.2.8-2: Characterization of Residual Effects on Species at Risk

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive** – Effect moves measurable parameters in a direction beneficial to SAR relative to baseline conditions. **Adverse** – Effect moves measurable parameters in a direction detrimental to SAR relative to baseline conditions.
Magnitude	The amount of change in measurable parameters of the VEC relative to existing conditions	**Change to SAR Habitat** **Negligible –** no measurable change in habitat for SAR **Low –** Project changes less than 5% of SAR habitat in the LSA **Medium –** Project changes 1 5-10% of SAR habitat in the LSA **High –** Project changes more than 10% of SAR habitat in the LSA
Geographic Extent	The geographic area in which a residual effect occurs	**Negligible (SSA) –** residual effects are limited to SSA **Low –** residual effects are restricted to the SSA or immediate surroundings **Medium (LSA) –** residual effects extend into the LSA **High (RSA) –** residual effects extend into the RSA
Timing	Considers when the residual effect is expected to occur, where relevant to the VEC	**No sensitivity** - Effect does not occur during critical life stage (e.g., breeding or spawning season or cultural activity times) or timing does not affect the VEC. **Medium sensitivity** - Effect may occur during a lower sensitive period of a critical life stage; for many species this is the start (e.g., several days prior to nesting for birds) or end (e.g., periods when birds have fledged but remain in proximity to their nest) of the critical period. **High sensitivity** - Effect occurs during a critical life stage (e.g., bird nesting periods, lake sturgeon spawning periods) or culturally important activities (e.g., harvesting or festival time)
Duration	The time required until the measurable parameter or the VEC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Negligible –** residual effect is limited to a single event **Low (short-term) –** the residual effect is limited to short term events (a few years or less) **Medium –** the residual effect is limited to the operational/decommissioning phases (years to decades) **High (Long-term) –** the residual effect extends beyond the life of the project (centuries)

Table 6.2.8-2: Characterization of Residual Effects on Species at Risk

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Frequency	Considers whether the residual effect is expected to occur once, at regular or irregular intervals or continuously	**Negligible –** the condition of phenomena causing the effect rarely occurs **Low (Multiple irregular event) –** occurs at no set schedule and are unlikely to occur **Medium (Multiple regular event) –** occurs at regular intervals (i.e. >1% of the time) **High (Continuous) –** occurs continuously
Reversibility	Considers whether the residual effect is reversible or irreversible.	**Negligible –** effect ceases immediately once source or stressor is removed **Low –** effect ceases once source or stressor is removed **Medium –** effect persists for some time after source or stressor is removed **High (Irreversible) –** the residual effect is unlikely to be reversed
Ecological/Societal Value	Considers the magnitude that the residual effect is expected to have on the ecological or societal community, as determined through consultation and engagement.	**Negligible –** the VEC has no value from a cultural or societal context **Low –** the VEC is common in the LSA and/or has little to no value from a cultural or societal context **Medium –** the VEC is abundant in the RSA, though may be less so in the LSA, and/or has moderate cultural or societal value **High –** the VEC is rare and/or of high cultural or societal value

Note: Timing was not included in the original EIS.

6.2.8.1.8 Significance Definition

A significant residual environmental effect on SAR or their habitat is defined as one that:

- results in long-term, irreversible loss of a species of interest to Indigenous communities
- results in a decrease in habitat that threatens the long-term viability of SAR in the RSA
- results in a change in health of one or more SAR compared to baseline conditions, where the change is likely to threaten the long-term sustainability in the RSA or impairment of use

6.2.8.4 Existing Conditions for Species at Risk

Existing conditions are described in Chapter 4 of the EIS Addendum (Vol 1) (CIAR #727). The updated terrestrial baseline report (Northern Bioscience, 2020) (CIAR #722) provides an overview of how baseline conditions for SAR have changed since the original EIS (2012) and/or how the understanding of the baseline conditions has evolved.

6.2.8.5 Determining Project Interactions with Species at Risk

Table 6.2.8-3 identifies, for each potential effect, the Project's physical activities that might interact with the SAR and result in the identified effect. This table is based on a similar table from the original EIS (2012) and has been updated to reflect changes to the Project. The original EIS (2012) often had these various pathways assessed collectively; they are separated in this update to facilitate a more explicit examination of effects, pathways, and measurable parameters.

Table 6.2.8-3: Project Interactions with Species at Risk

Physical Activities	Effects (Change to)									
	Woodland caribou or their habitat	Little brown myotis, northern myotis, or their habitat	Canada warbler or their habitat	Rusty blackbird or their habitat	Olive-sided flycatcher, evening grosbeak, eastern wood-pewee, or their habitat	Bald eagle, peregrine falcon, or their habitat	Common nighthawk, eastern whip-poor-will, or their habitat	Yellow-banded bumble bee or their habitat	Monarch or their habitat	Lake sturgeon or their habitat
Site Preparation/ Construction										
Clearing, grubbing and stripping of vegetation, topsoil and other organic material	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Grading with topsoil	✓	✓	✓	✓	✓	✓	✓	–	–	–
Drilling and blasting to develop the open pits and plant site area	✓	✓	✓	✓	✓	✓	✓	–	–	–
Excavation and pre-stripping to remove mine rock and overburden	✓	✓	✓	✓	✓	✓	✓	–	–	–
Preparation of construction surfaces and installation of temporary construction facilities	✓	✓	✓	✓	✓	✓	✓	–	–	–
Site preparation for waste management	✓	✓	✓	✓	✓	✓	✓	–	–	–
Construction of administration buildings, storage buildings, other ancillary structures and site services such as parking lots, area fencing, and security systems	✓	✓	✓	✓	✓	✓	✓	–	–	–
Construction of explosives facilities	✓	✓	✓	✓	✓	✓	✓	–	–	–

Table 6.2.8-3: Project Interactions with Species at Risk

	Effects (Change to)									
Physical Activities	**Woodland caribou or their habitat**	**Little brown myotis, northern myotis, or their habitat**	**Canada warbler or their habitat**	**Rusty blackbird or their habitat**	**Olive-sided flycatcher, evening grosbeak, eastern wood-pewee, or their habitat**	**Bald eagle, peregrine falcon, or their habitat**	**Common nighthawk, eastern whip-poor-will, or their habitat**	**Yellow-banded bumble bee or their habitat**	**Monarch or their habitat**	**Lake sturgeon or their habitat**
Construction of PSMF containment dams and MRSA	✓	✓	✓	✓	✓	✓	✓	–	–	–
Management of surface water and groundwater on the site, including seepage and run-off	–	–	–	–	–	–	–	–	–	✓
Maintenance and management of mine rock stockpiles, overburden, and PSMF	✓	✓	✓	✓	✓	✓	✓	–	–	✓
Construction of water management facilities and drainage works (including but not limited to pipelines, dewatering facilities, stormwater management, control ponds, and water management pond)	✓	✓	✓	✓	✓	✓	✓	–	–	✓
Dewatering of natural waterbodies in the project area	–	✓	–	✓	–	–	–	–	–	–
Construction of new mine site access and haul roads, including any water crossings and water body shoreline works or undertaking	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Upgrading of the existing mine access road(s) and entrance(s) to the project area including any water crossings and water body shoreline works or undertakings	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Construction of a 115kV electrical transmission line within a new right-of-way from the M2W Transmission corridor	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Aggregate sources and amounts	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Management of waste	✓	–	✓	–	–	✓	–	–	–	–
Any works or undertakings associated with upgrading a rail load-out facility for mine	✓	✓	✓	✓	✓	✓	✓	✓	✓	–

Table 6.2.8-3: Project Interactions with Species at Risk

Physical Activities	Effects (Change to)									
	Woodland caribou or their habitat	Little brown myotis, northern myotis, or their habitat	Canada warbler or their habitat	Rusty blackbird or their habitat	Olive-sided flycatcher, evening grosbeak, eastern wood-pewee, or their habitat	Bald eagle, peregrine falcon, or their habitat	Common nighthawk, eastern whip-poor-will, or their habitat	Yellow-banded bumble bee or their habitat	Monarch or their habitat	Lake sturgeon or their habitat
concentrate and off-site accommodations complex										
Operating vehicles	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Hiring and management of workforce	–	–	–	–	–	–	–	–	–	–
Taxes, contracts and purchases	–	–	–	–	–	–	–	–	–	–
Operation										
Drilling, blasting, loading and hauling of mine rock from the pits to ROM stockpile pad, crusher or the MRSA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Operation of explosives facilities	–	–	–	–	–	–	–	–	–	–
Handling, transportation, use and disposal of explosives	✓	✓	✓	✓	✓	✓	✓	–	–	–
Transportation of crushed material to coarse ore stockpile	✓	✓	✓	✓	✓	✓	✓	–	–	–
Transportation of mill feed (ore) to the Process Plant	✓	✓	✓	✓	✓	✓	✓	–	–	–
Process Plant operation	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Transportation of filtered concentrate	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Management and maintenance of the entire mine waste stream, including but not limited to process solids and mine rock	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Decommissioning of the temporary process water pond (proposed during mine operations), including removal or breaching of dams	✓	✓	✓	✓	✓	✓	✓	–	–	–
Dewatering activities (e.g. open pit)	–	–	–	–	–	–	–	–	–	–

Table 6.2.8-3: Project Interactions with Species at Risk

Physical Activities	Effects (Change to)									
	Woodland caribou or their habitat	Little brown myotis, northern myotis, or their habitat	Canada warbler or their habitat	Rusty blackbird or their habitat	Olive-sided flycatcher, evening grosbeak, eastern wood-pewee, or their habitat	Bald eagle, peregrine falcon, or their habitat	Common nighthawk, eastern whip-poor-will, or their habitat	Yellow-banded bumble bee or their habitat	Monarch or their habitat	Lake sturgeon or their habitat
Management of surface water and groundwater on the site; including seepage, run-off, contact water, process water and storm water	–	–	–	–	–	–	–	–	–	✓
Management of surface water on site during dam removal or breaching	–	–	–	–	–	–	–	–	–	–
Management of domestic waste from the mine site	✓	–	✓	–	–	✓	–	–	–	–
Management of hazardous waste	–	–	–	–	–	–	–	–	–	–
Environmental safety procedures	–	–	–	–	–	–	–	–	–	–
Operating vehicles	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Hiring and management of workforce	–	–	–	–	–	–	–	–	–	–
Taxes, contracts and purchases	–	–	–	–	–	–	–	–	–	–
Decommissioning and Closure/Post-Closure										
Installation of barriers around the pit perimeters	✓	✓	✓	✓	✓	✓	✓	–	–	–
Management of inputs from groundwater and surface water run-off into pits	–	–	–	–	–	–	–	–	–	–
Decommissioning, dismantling and/or disposal of equipment	✓	✓	✓	✓	✓	✓	✓	–	–	–
Demolition/removal of surface buildings and associated infrastructure and disposal of resulting rubble	✓	✓	✓	✓	✓	✓	✓	–	–	–
Decommissioning/removal of explosives facilities	✓	✓	✓	✓	✓	✓	✓	–	–	–
Removal of power lines and electrical equipment	✓	✓	✓	✓	✓	✓	✓	–	–	–

Table 6.2.8-3: Project Interactions with Species at Risk

Physical Activities	Effects (Change to)									
	Woodland caribou or their habitat	Little brown myotis, northern myotis, or their habitat	Canada warbler or their habitat	Rusty blackbird or their habitat	Olive-sided flycatcher, evening grosbeak, eastern wood-pewee, or their habitat	Bald eagle, peregrine falcon, or their habitat	Common nighthawk, eastern whip-poor-will, or their habitat	Yellow-banded bumble bee or their habitat	Monarch or their habitat	Lake sturgeon or their habitat
Decommissioning of the potable water and sewage treatment systems (e.g. water treatment plant and membrane bioreactor)	✓	✓	✓	✓	✓	✓	✓	–	–	–
Maintenance and management of mine rock stockpiles and PSMF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Following removal of infrastructure, soil, groundwater, and surface water testing for residual contamination, and disposal of contaminated soils and treatment of groundwater and surface water, as required	–	–	–	–	–	–	–	–	–	–
Reclamation and restoration of landscape (including water bodies) to productive capacity including management and monitoring	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Management of flooded pits to protect groundwater and surface water quality during flooding and pit overflow	–	–	–	–	–	–	–	–	–	–
Operating vehicles	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
Hiring and management of workforce	–	–	–	–	–	–	–	–	–	–
Taxes, contracts and purchases	–	–	–	–	–	–	–	–	–	–

Notes:

✓ = Potential interaction

– = No interaction

* minor wording changes to the physical activities list have been made to better align with the updated Project description covered in Chapter 1 (EIS Addendum [Vol 1])

6.2.8.6 Assessment of Residual Effects on Species at Risk

A conservative approach has been taken for assessment of residual effects to reduce the likelihood that an effect will be understated.

6.2.8.1.9 Woodland Caribou

Analytical Assessment Techniques

Woodland caribou and their habitat were initially discussed in the original baseline report (Northern Bioscience, 2012a) (SID #24)) (CIAR #227) followed by a more in-depth analysis (Northern Bioscience, 2012c) (SID #26) (CIAR #234) based on direction from MNR (2011a). Caribou habitat models were subsequently updated in 2013 based on newly available Forest Resource Inventory (FRI) in IR 23.1 (CIAR #428). These analyses were based on MNRF's caribou habitat models used in forest management planning and range assessment (MNRF 2014c; Appendix A), including the 2021-2031 Pic Forest FMP that overlaps the Project (McDonald 2021). Regardless of limitations these models may have, they remain the only approved caribou habitat model for Ontario and were therefore used for this EIS addendum. The Project layout and SSA have changed since the original EIS (2012), so potential effects on caribou habitat have been reassessed using the approved caribou models.

The original impact analyses also used MNRF's (2014b) disturbance model for woodland caribou, which was modified from Environment Canada's (2011) disturbance model to better reflect availability of Ontario data sets. No range assessment is yet available for the LSCR, despite the MNR's (2009a) commitment to conduct and report on preliminary range assessments within the first six months of implementation of the Caribou Conservation Plan (CCP), and preliminary population assessments for all ranges at the southern extent of continuous caribou distribution. MNRF's (2014c) Integrated Assessment Protocol for Woodland Caribou Ranges in Ontario states that habitat assessment as described in the protocol may vary somewhat within the Far North of Ontario or for the Lake Superior Coast Range due to data availability and past modelling efforts. MECP's current position is that the disturbance analysis methodology is not appropriate for the linear LSCR:

> "While it is well understood that both anthropogenic and natural disturbance are important considerations when assessing impact to caribou and their habitat, the Range Management Policy [MNRF 2014c] does not apply to the LSCR [Lake Superior Coast Range]. As such, the application of Principle 1 – Cumulative Disturbance (i.e., natural and anthropogenic disturbances + 500 metre buffer) also does not apply to this Range under Ontario's caribou policy framework (i.e., Caribou Conservation Plan)." (Green pers. comm. 2020)

The federal recovery strategy for the woodland caribou identifies 65% undisturbed habitat in a range as a disturbance management threshold; this threshold applies to all ranges in Ontario, including the LSCR. Environment Canada's (2020) position is:

> "The federal recovery strategy recognizes that there may be some ranges where alternative/unique approaches are required, however until such alternatives are determined (e.g., through a federally approved range plan), the national disturbance threshold will apply."

This direction is consistent with ECCC's (2016b*) Range Plan Guidance for Woodland Caribou, Boreal Population*. Therefore, the disturbance analysis has been updated to include the revised SSA as well as new disturbance since the original analysis. Disturbance layers used for this updated analysis are listed in Appendix D9.4 of this EIS Addendum (Vol 2).

The original habitat categorization for the Project by MNR (2013c) based on General Habitat Description (GHD) for Woodland Caribou (MNR 2013a) is presented in Appendix D9.2 of this EIS Addendum (Vol 2). MECP has recently updated caribou habitat categorization in the LSCR, including the Project area; the criteria and updated mapping are presented in Appendix D9.3 of this EIS Addendum (Vol 2).

Project Pathways

Project pathways are discussed in detail in Northern Bioscience (2012c) (SID #26) (CIAR #234) and IR 23.3 (CIAR #428), and summarized below:

- Loss of potential caribou winter and refuge habitat in the SSA
- Impairment of potential winter and refuge habitat use in the LSA due to sensory disturbance
- Impairment of caribou movement through the LSA due to sensory disturbance
- Potential injury or mortality of caribou from collision with Project vehicles
- Potential increased risk of predation due to possible changes in predator – prey dynamics due to Project effects on gray wolf, black bear, moose, white-tailed deer, and beaver, or their habitats

The potential for interaction with the Project has been greatly reduced since the original EIS (2012). At the time of the original EIS, there were estimated to be at least 500 caribou in the LSCR, with most on offshore islands and an unknown, but smaller, number on the mainland and nearshore islands. The overall caribou population in the LSCR has since dramatically declined due to wolves crossing over to both the Slate Islands and Michipicoten Island via ice bridges in 2014 (MNRF 2018). As a result, the caribou populations on the Slate Islands dropped from approximately 100 in 2009 (Carr et al. 2012) to just two bull caribou in 2017 (MNRF 2018). There were an estimated 680 caribou on Michipicoten Island in the fall of 2010 and 480 in the fall of 2014, but the population had declined to less than 116 animals by the fall of 2016 (MNRF 2018). This led MNRF and others to translocate six caribou (2 bulls, 4 cows) to Caribou Island and nine caribou (1 bull; 8 cows) to the Slates Islands during the early winter of 2018 (MNRF 2018). No caribou are believed to now persist on Michipicoten Island, although two wolves may remain. Apparently, some of the translocated caribou have given birth (G. Eason pers. comm.) and it is estimated that the number of caribou on the Slate Islands has grown to approximately 30 animals (McColm pers. comm. 2020). Nonetheless, there are still no more than 50 animals on offshore islands in the LSCR currently, compared to over 700 caribou a decade ago.

Caribou populations in the mainland portion of the LSCR have been most rigorously monitored in Pukaskwa National Park (PNP), where they declined from a high of 30 individuals in the late 1970s to only four in 2009 (Bergerud 2007; Patterson et al. 2014). With no observations at the core of their PNP distribution at Otter Island since 2011 (Bergerud et al. 2014), and only a lone vagrant observed near the north of the Park in 2015 (Drake et al. 2018), they are now considered locally extirpated (Bergerud et al. 2014). Caribou are no longer monitored explicitly by Parks Canada, apart from trail cameras set up on former calving islands (Patterson pers. comm. 2020). Five aerial surveys of the mainland LSCR and nearshore islands west of PNP have been conducted since 2013. Based on modelling of observed tracks during their 2016 aerial survey, MNRF (Shuter et al. 2018) estimated approximately 55 caribou (C.I. 13 - 227) in the mainland LSCR and nearshore islands. This estimate may have been partially inflated, however, by caribou individuals that are known to have emigrated from the Slate Islands at the time of the ice bridge (Drake et al. 2018; InfoSuperior 2017) and may also not account for the potential misidentification of white-tailed deer sign as caribou sign (e.g., Foster 2014; Gord Eason pers. comm. 2021). Only one caribou has been sighted (Foster 2014) during the five aerial surveys but tracks of small groups (3-4 animals) of caribou have been observed at several different locations during each survey. Based on observed caribou sign from the most recent surveys (e.g., Northern Bioscience 2020) (CIAR #722), the remaining mainland population may be closer to Shuter et al.'s (2018) lower confidence interval (i.e., 13 animals). The population is without doubt very small and, therefore, vulnerable to extirpation due to stochastic risk factors alone (Environment Canada 2008), assuming it is essentially independent of the populations on the Slate Islands and Caribou Island (Shuter et al. 2018); Caribou Island in particular is likely too distant to present any feasible opportunity for natural connectivity with mainland caribou. Despite several unconfirmed reports of caribou along the north shore during 2020 (SooToday 2021), there is a real risk that the mainland population will become locally extirpated before the Project becomes operational. Even in the best-case scenario that there is no further decline in the mainland population in the near future, the potential for caribou to interact with the Project is very low.

Mitigation and Enhancement Measures

Standard mitigation used for other wildlife are presented in Section 6.2.7 of this EIS Addendum (Vol 2) and are generally relevant to woodland caribou as well. In addition, MNRF's (2013a) *Best Management Practices for Mineral Exploration for Woodland Caribou* identified specific mitigation measures such as:

- Construction activities will be suspended if individual caribou are observed during construction until caribou have left the area and the observation reported to the MNRF
- Hunting by the Proponent's employees and subcontractors will be banned to avoid risk of inadvertent caribou mortality due to misidentification or poaching

- SAR awareness training will be conducted for all construction and operations employees, agents, and contractors so that they can recognize woodland caribou and are aware of the proper procedures to follow if caribou are observed
- If plowing, escape routes through snowbanks will be provided for caribou every 1 km; snowbanks will be trimmed where appropriate to reduce height
- Recreational snowmobile and ATV / UTV use by Project personnel will be prohibited at the Project site
- Educational signage will be posted and maintained at the start of the access road to increase awareness of the potential presence of caribou to reduce the potential for collisions, encourage reporting, and reduce accidental hunting mortality (e.g., Figure 6.2.8-4)
- Pits and trenches that are not geologically important will be backfilled or contoured to a stable angle of repose and, if greater than 3 m deep, will provide at least one sloped ramp as a point of egress for caribou
- If not backfilled (i.e., geologically important), trenches >3 m deep will be fenced unless a means of egress for caribou is provided by a sloped ramp
- Disturbed bedrock will be stockpiled on site in a safe and stable manner
- Non-merchantable timber and slash will be piled at appropriate locations along trails and roads to reduce predator sight lines and foraging efficiency. Trails will be otherwise left for natural regeneration
- Other disturbed areas will be stabilized and revegetated using native seed mixes or natural regeneration as appropriate to site conditions
- To reduce potential increase in forage for alternate prey which could subsequently attract predators, the use of non-native, invasive, and/or high productivity plant species for erosion control will be avoided. For example, use of clovers (*Trifolium* spp.) which are palatable to bears, will be avoided
- Where possible, habitat that was disturbed by mineral exploration activities (including roads and landings) will be rehabilitated and restored by:
    - site preparation and planting of jack pine (*Pinus banksiana*), black spruce (*Picea mariana*), and/or white spruce (*Picea glauca*) at minimum density of 1,000 stems per hectare, and/or
    - site preparation and aerial seeding of jack pine at 20,000 viable seeds per hectare, and/or

  - implementing alternate site renewal treatments to return the site to a forested condition that reflects the original stand, with a focus on conifer renewal.

- Where practicable, sites will be rehabilitated progressively, rather than waiting until the project is complete

Figure 6.2.8-4: Examples of signs for Caribou used by MNRF (left) and for the Whitesand Shoreline Stabilization Project (right)

Off-site Mitigation

To address potential cumulative effects on woodland caribou in the RSA, off-site mitigation opportunities elsewhere in the LSCR and adjacent zone of discontinuous distribution were identified for woodland caribou following MNR (2013) guidance. These options were developed in cooperation with MNR Nipigon District and were presented in Northern Bioscience (2014) (CIAR #671). These mitigation opportunities were compared to the 2021-2031 Pic Forest FMU FMP (McDonald 2021) to ensure that they remain consistent with current management direction, particularly with respect to road decommissioning objectives. Opportunities identified in Northern Bioscience (2014) remain valid and may be suitable to achieve overall benefit for woodland caribou in the LSCR.

Recent research supports this approach. Within the continuous range of woodland caribou in Ontario, increased wolf density in areas with substantial commercial forestry activity was associated with reduced adult survival rates of woodland caribou (Fryxell et al. 2020). Unlike fire-dominated systems, commercial logging often leaves branching road networks that are heavily used by wolves and can lead to increased predation risk for co-occurring caribou (Fortin et al. 2013; James and Stuart-Smith 2000; Kittle et al. 2017; Newton et al. 2017). As discussed in the original EIS (2012), linear corridors such as roads facilitate foraging by wolves and increase predation risk for caribou in the LSCR. Drake et al. (2018) suggested that the fate of the remaining animals in the mainland portion of the LSCR is “unequivocally grim” unless habitat connectivity with a source population to the north can be enhanced. Patterns of genetic erosion within the continuous range of woodland caribou in Ontario and Manitoba suggest ongoing range retraction (Thompson et al. 2019), underscoring the importance of improving connectivity with northern ranges if populations in the LSCR are to be maintained (Armstrong et al. 2012). Road decommissioning is identified as one of the potential mitigation options for caribou (e.g., Environment Canada 2012; ECCC 2019; Fryxell et al. 2020) and could help restore potential connectivity among ranges.

Caribou Transfers and Penning

Translocation of caribou and temporary penning of female caribou and calves have been identified as possible caribou management approaches in the LSCR and zone of discontinuous distribution (MNRF 2018).

The observed decline of caribou populations on offshore islands precipitated the translocation of the remaining woodland caribou from Michipicoten Island to Caribou Island and the Slate Islands in 2018 by MNRF, Michipicoten First Nation (MFN), and other partners (MNRF 2018). Additional transfers are pending as part of the Overall Benefit Permit for the East-West Tie Transmission Project. Penning of cow and calf caribou is being used as an emergency measure in Alberta, Yukon Territory, and several locations in British Columbia (e.g., Wildlife Infometrics 2019, 2020) to reduce calf mortality and increase recruitment (Serrouya et al. 2019), although its efficacy has been questioned (Harding et al. 2020). Penning may have some application to caribou recovery in localized situations, but is very intensive and costly, while typically providing only modest recovery benefits (Adams et al 2019). Given its location far from the Lake Superior shoreline, Caribou Island is essentially serving as a caribou pen since the 2018 translocation, with Lake Superior serving as the barrier rather than fences; however, no subsequent soft release of cows and calves into the adjacent landscape is possible because of the island’s isolation.

Although caribou transfers were once considered as a recovery option for the PNP caribou population, transfers to the mainland are not considered viable by Parks Canada, at least not to Pukaskwa National Park (Gonzales et al. 2015). Results of population modelling efforts for boreal caribou suggest that even when average adult and calf survival rates are relatively high, a population size of at least 300 caribou is needed if they are to have a high probability of persistence (Environment Canada 2008). Currently, the total caribou population in the LSCR is well below that threshold and geographically isolated (mainland, Slate Is., Caribou I.). Gonzalez et al. (2015) concluded that long-term recovery and persistence of woodland caribou in Pukaskwa may be unlikely with or without translocation. Due to the perceived risk of local extirpation, Ontario Nature (Alexander 2020) Michipicoten First Nation (CBC 2020;) and others (SooToday 2021; SuperiorCaribou 2021) have recently advocated for translocation of the remaining caribou from the LSCR mainland to offshore islands. This approach is not being currently contemplated as a form of mitigation for the Project but could potentially be supported if consistent with the approved management approach for the LSCR, once available.

Predator/Prey Control

There is broad consensus that predation is the most important demographic challenge facing woodland caribou population in boreal Canada, particularly in disturbed landscapes (e.g., Bergerud 2007; Serrouya et al., 2019). Recent research within continuous caribou range in Ontario (Fryxell et al. 2020) suggests reduced adult survival rates of woodland caribou were associated with increased wolf density in areas with substantial commercial forestry activity. According to Bergerud et al. (2014), the caribou–moose–wolf system must be managed, including protection of lakeshores and islands to permit successful calving and persistence of caribou in the LSCR. However, according to Fryxell et al. (2020), wolf levels would have to be reduced to 3-4 wolves/1,000 km^2 for substantive benefit to annual growth rates for caribou; although recent data are not available, Bergerud (2007) estimated wolf densities two to three times higher than that in the LSCR. Although MNRF's (2005a) Strategy for Wolf Conservation in Ontario does not provide an estimate of regional wolf densities, background information for the strategy indicated an assumed density of 7.5 wolves/1,000 km^2 for the broad proposed wolf ecological zone that included many Wildlife Management Units surrounding the Lake Superior shoreline (MNR 2005b).

Predator control was conducted in Alberta (Hervieux et al. 2014), British Columbia (Bridger 2019), and Quebec (GWCRT 2007; The Toronto Star 2019) in an effort to retain at-risk caribou herds, and has been advocated in Ontario (e.g., Bergerud 2007), but remains controversial for its ethics and likely long-term ineffectiveness (e.g., Brook et al. 2015). Despite a history of poisoning wolves during the mid-1900s (Harris and Armstrong in press), predator control has not been supported in the recent past by the Ontario government (MNR 2009a). Nonetheless, direct control of predators on the larger offshore islands (i.e., Michipicoten I., Slates Is.) through translocation, sterilization, or lethal removal has recently been identified as a potential management approach by MNRF (2018). Lethal control or translocation of wolves from offshore islands has support with some stakeholders (e.g., OFAH 2018), but not others (e.g., Ontario Nature 2018). A pack of eight wolves was recently captured and translocated from Michipicoten Island to Isle Royale, on the American side of Lake Superior (Miot 2019). Most predator control programs involve the help of local trappers with removal of predators in the study areas, and trappers would have to take more than 30% of the wolf population to reduce the wolf population growth rate and have a population effect on caribou (Russell 2010). Predator control is not being contemplated as mitigation for the Project.

Indirect control of predators, for instance by managing habitat and/or harvest of other prey species (e.g., moose, beaver, white-tailed deer) is also being considered (Armstrong 2012; MNRF 2018). Alternate prey management was identified in Environment Canada (2012, ECCC 2020) as a strategy to benefit declining caribou populations and this approach is being tried in some jurisdictions. For example, experimental moose reduction is being attempted in British Columbia to stop the decline of mountain caribou (Serrouya et al. 2017). Some stakeholders (e.g., OFAH 2018) oppose reducing moose and white-tailed deer populations in the LSCR as a means of indirect predator control and support the approach outlined in MNR's (2009b). Through consultation with local communities throughout the course of the Project, and in most recent consultations, it has been restated by BN, local Metis groups and many in the Town of Marathon they remain opposed to reducing moose and deer populations or altering their habitat to support caribou recovery. Cervid Ecological Framework. For Cervid Ecological Zone B, in which the LSCR falls, the broad objective is to maintain low to moderate density moose populations (i.e., 0.0-0.4

moose/100 km^2) where appropriate as per species-specific policy direction; in WMU 21A and 21B which overlap the LSCR, the specific moose population objectives are approximately 21-29 and 18-23 moose per 100 km^2 respectively (see Section 6.2.7.6.1 of this EIS Addendum [Vol 2]). Current moose densities are within or above those target ranges. It is debatable if those moose densities are compatible with long-term caribou persistence (e.g., Bergerud 2007; Bergerud et al. 2007, 2014). Alternate prey management is not being proposed as mitigation for the Project, however, although habitat manipulation will occur consistent with the Conceptual Closure Plan (See Section 1.5.2.3 of the EIS Addendum [Vol 1]) (CIAR #727) and agency guidance.

Project Residual Effect

Habitat Quantity and Quality

No effects on calving habitat are anticipated since there are no known calving areas in the SSA or LSA i.e., within 10 km of the Project as detailed in Northern Bioscience (2012c) (SID #26) (CIAR #234).

Updated analyses of modelled caribou habitat indicate there are approximately 106 ha of caribou winter habitat (41 ha preferred, 65 ha usable) within the revised SSA (Appendix D9.1 of this EIS Addendum [Vol 2]). This is similar to the amount in the SSA from the original EIS (2012), with differences due mainly to changes in age and, therefore, suitability of the forest and boundaries of the SSA. This represents approximately 0.9% of the available winter habitat (both preferred and usable) within the LSA and less than 0.2% of that available in the RSA west of PNP[1], and a much lower proportion if the relatively undisturbed RSA in PNP and farther east were included. Virtually all (97.3%) of the winter habitat in the SSA is in areas already considered disturbed using MNR's and Environment Canada's disturbance model; only 2.9 ha of winter habitat in the SSA is undisturbed i.e., more than 500 m from existing disturbance. There may be additional winter habitat for caribou in the SSA, LSA, and RSA that is not adequately captured by MNR's habitat model, such as lichen-bearing bedrock outcrops surrounded by balsam fir and spruce-dominated forests (Ecosite 21 or B052) in and near the SSA which could potentially provide winter habitat now or in the future (SID #26, pp. 52-53) (CIAR #234).

Updated analyses of modelled caribou habitat indicate there are approximately 732 ha of caribou refuge habitat (221 ha preferred, 511 ha used) within the revised SSA. This is similar to the amount in the SSA calculated based on the new eFRI in IR 23.1 (CIAR #438), with differences due mainly to changes in age and, therefore, suitability of the forest and boundaries of the SSA. This represents about 4.0% of the available refuge habitat within the LSA (only 1.6% of the preferred), and less than 0.8% of refuge habitat available in the RSA west of PNP[1] and a much lower proportion if the relatively undisturbed RSA in PNP and farther east were included. Like winter habitat, most of the refuge habitat in the SSA is considered disturbed using MNR's and Environment Canada's disturbance model i.e., more than 500 m from existing disturbance. The confirmed current use (Northern Bioscience 2020) (CIAR #722) of the SSA by gray

[1] Updated caribou habitat models were not available for Pukaskwa National Park or MNRF Northeast Region.

wolves and black bears, as well as alternate prey i.e., moose, white-tailed deer, and beaver, reduces the suitability of potential caribou habitat, refuge or otherwise, in the SSA.

Habitat Categorization

Based on MECP's updated habitat categorization (Appendix D9.3 of this EIS Addendum [Vol 2]), approximately 20,263 ha of the LSCR west of Marathon is classified as Category 1, the most sensitive habitat (MNR 2013c). Most (15,859 ha, 78.3%) of this is on the mainland south of Highway 17, with only 668 ha (3.3%) north of the highway near Little Santoy Lake, and the remaining 3,736 ha (18.4%) on the Slate Islands. The original habitat categorization (MNR 2013b) classified only Pic Island as Category 1, with most of the mainland as Category 2 except for disturbed areas (e.g., roads, railways, transmission lines, cutovers). MECP has not classified Category 2 and 3 habitats in the LSCR or area of discontinuous distribution, nor were these categories identified or used in the development of the 2021-2031 Pic FMP (McDonald 2021).

The failure to identify Category 2 and 3 by provincial agencies may reflect the lack of consistent government monitoring and survey effort in the mainland LSCR and nearshore islands. Although there has been some caribou monitoring on the Slate Islands (Kingston pers. comm. 2020), the only government survey effort since 2013 on the mainland appears to a single aerial survey of the mainland coast and nearshore islands in 2016 (Shuter et al. 2018), as well as some ad hoc trail camera monitoring for which there are no reports available (Tyhuis pers. comm. 2020). The lack of current documented use in the LSCR may preclude a meaningful categorization of caribou habitat, with the possible exception of Category 1.

Caribou Habitat Disturbance Model

Using updated disturbance mapping based on federal (Environment Canada 2012, ECCC 2020) and provincial (MNR 2014b) caribou habitat disturbance models, the vast majority (96%) of the SSA is already considered disturbed, with only an additional 45 ha (4%) of new disturbance to be created (Table 6.2.8-4). This 45 ha represents less than 0.2% of the existing disturbance in the LSA; development from the Project would increase the overall level of disturbance in the 2020 LSA from 42.6% to 42.7%. At the RSA level (i.e., Coastal Range + 10 km buffer), this additional 45 ha of disturbance would increase the percentage disturbance from 28.06% to 28.07%. In other words, the additional disturbance from the Project (45 ha) would have a negligible effect on overall range disturbance levels at the RSA level, or at the range level (LSCR without the 10 km buffer) according to provincial and federal caribou habitat disturbance models. Overall disturbance at either the RSA (28%) or range level (29%) is below the 35% maximum disturbance threshold, above which caribou populations are less likely to be self-sustaining over the long-term; however, the disturbance is concentrated primarily in the western portion of the range (see Appendix D9.4 of this EIS Addendum [Vol 2]). As discussed in the original EIS (2012), caribou populations have been declining in the LSCR despite relatively low levels of disturbance and are extirpated from Pukaskwa National Park despite the absence of significant anthropogenic disturbance. It may be that the federal and provincial disturbance models have poor predictive power for linear ranges such as the LSCR with extensive linear anthropogenic features.

Table 6.2.8-4: Summary of disturbance within the site, local, and regional study areas, 2020 based on federal and provincial caribou disturbance models

Location	Study Area	Total Area (ha)	Disturbed Area (ha)	Undisturbed Area (ha)	% Disturbed
Site Study Area	2020 SSA	1,116	1,071	45	96
SSA + 10 km buffer	2020 LSA	53,781	22,928	30,853	43
Mainland Coastal Range west of Pukaskwa N.P. (PNP)	2013 LSA	105,057	55,561	49,496	53
Entire Coastal Range	2013 RSA	375,856	107,292	268,564	29
Coastal Range + 10 km buffer into area of Discontinuous Distribution	2020 RSA	666,820	187,130	479,690	28
Coastal Range + 10 km buffer west of PNP only		242,465	104,275	138,190	43
Area of Discontinuous Distribution (Lake Superior Uplands Linkage)		2,995,670	1,691,180	1,304,490	56

Caribou Survival

With appropriate mitigation, no adverse effects on woodland caribou survival are anticipated from the Project given the lack of documented historical or current use of the SSA by woodland caribou and the very low numbers of woodland caribou estimated to remain in the mainland LSCR.

Caribou Movement

The SSA is approximately 6 km in width and has the potential to be at least a partial barrier to movement by caribou, particularly during the anticipated 2-year site development phase and 13-year mine operating life. This potential risk will be reduced at closure with partial site rehabilitation.

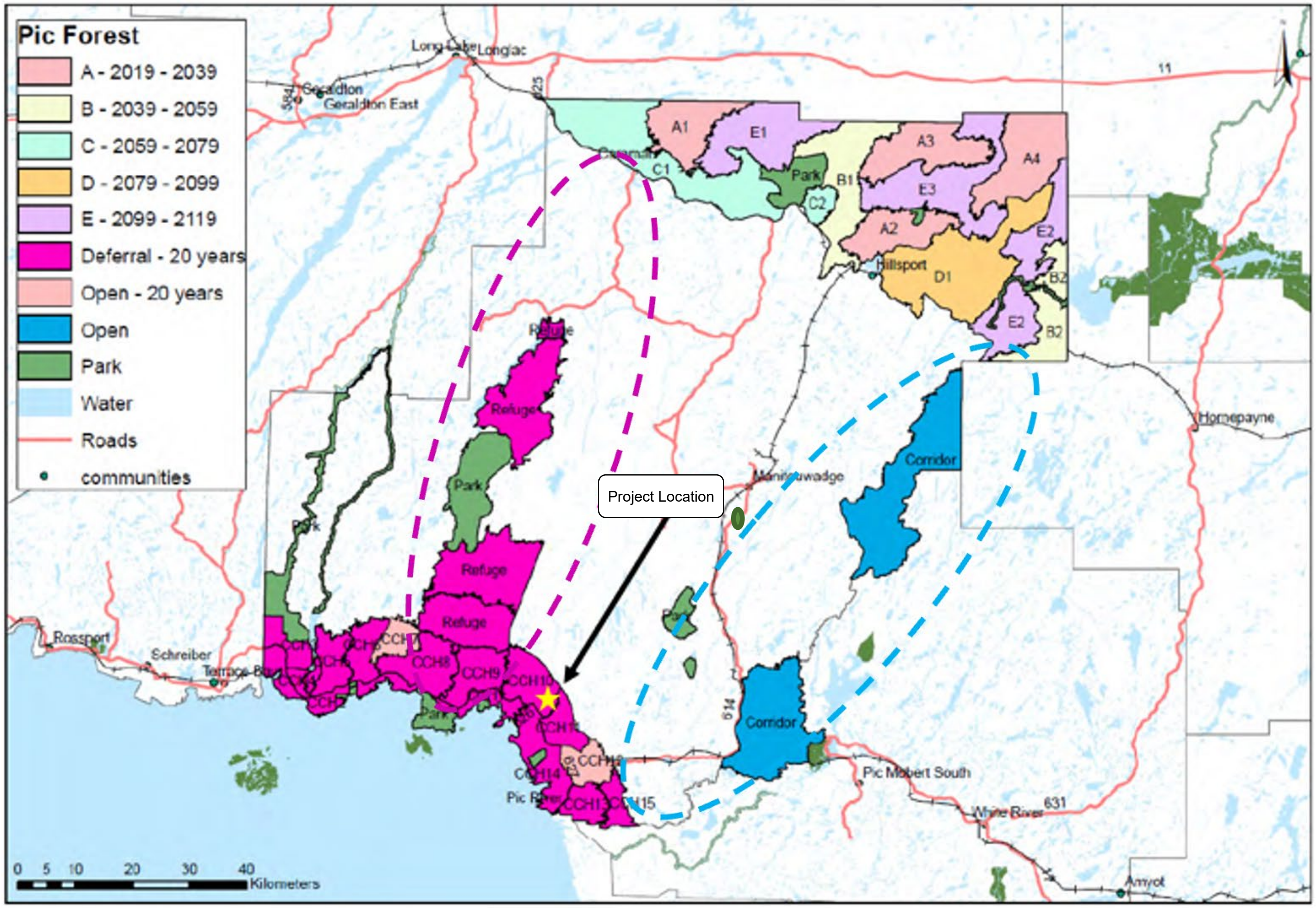
Genetic analyses (Drake et al. 2018) indicate that there has been little genetic interchange among caribou east and west of the Project area. Caribou from the Pic Island / Coldwell Peninsula area showed no genetic mixing with those from the central part of PNP or the Otter Island area farther south. This suggests that caribou in the Otter Island area have remained relatively sedentary and not bred with other animals for many generations (Drake et al. 20018), consistent with philopatry demonstrated by radio-collared animals from the Otter Island area (Neale 2000). Faecal DNA from a lone caribou observed near the northern boundary of the park in 2015 was most closely related to animals from Pic Island / Hearst group, suggesting it may have wandered into the park from those areas, perhaps on the extensive Lake Superior shorefast ice observed in 2014. Given the local extirpation of caribou in PNP and reduced numbers in the remainder of the LSCR farther west, it appears unlikely that the Project would be a substantial barrier to caribou dispersal. Despite the limited anthropogenic disturbance in PNP[2], woodland

[2] with the exception of the 60-km coastal hiking trail created after park establishment in 1978

caribou have disappeared there while they persist in a much more disturbed landscape west of Marathon, potentially due to the more rugged topography and abundant nearshore islands that potentially serve as refuge. Unless the conditions that drove caribou to extirpation in PNP change, it is unlikely that dispersal from the currently occupied range west of the Project east to PNP would result in a positive population outcome.

Genetic analyses (Drake et al. 2018) indicate there have been infrequent long-distance movements between the LSCR and other ranges to the north within the last few decades. Faecal DNA of a caribou from the Slate Islands was sampled in the Nipigon Range, 150 km northwest of the Slate Islands; the date of the faecal collection is unknown - it may have been one of the several animals that were translocated from the Slates throughout the 1980s to surrounding areas (i.e., St Ignace Island, Terrace Bay mainland in 1984/85; Bergerud and Mercer 1989) or an animal that crossed naturally to the mainland (Drake pers. comm. 2020). Maintaining and encouraging connectivity from the LSCR through the area of discontinuous distribution to ranges farther north within continuous caribou distribution is a stated objective of MNR's Caribou Conservation Plan (2009a). Initial direction from MNR (2013b) indicated that it was important to maintain connectivity through the "Neys-Killala Corridor" running north from the Coldwell Peninsula (Neys) through the Killala Conservation Reserve north to the continuous caribou distribution. Landscape pattern in the LSCR and area of discontinuous distribution is primarily achieved through implementation of forest management plans. Landscape pattern and connectivity were extensively analyzed and maintained consistent with the CCP and the Boreal Landscape Guide in the draft Pic FMP (McDonald 2021). As detailed in the Supplementary Documentation[3] for the Pic FMP, this "Neys-Killala" corridor is now located west of the Project, with an additional potential corridor located to the east near White Lake (Figure 6.2.8-5). No significant effects are anticipated from the Project on caribou north-south connectivity and movement, given the location of the Project immediately north of the Town of Marathon. In addition, as discussed in the original EIS (2012), caribou are the most wide-ranging terrestrial mammal (Schaefer et al. 2000). Even members of the less mobile woodland caribou ecotype are more than capable of diverting around the Project site, as demonstrated by genetic (e.g., Drake et al. 2018) and radio-telemetry (e.g., Northern Bioscience 2012c; IR 23.23) (CIAR #428) evidence of long-distance movement.

[3] Available at https://nrip.mnr.gov.on.ca/s/permit2/a0z3g0000004B6YAAU/subfm9662021fmp97?language=en_US



(Source: McDonald. 2021. Pic Forest Management Plan, Supplementary Documentation)

Figure 6.2.8-5: Pic Forest (2019-2029) Caribou Habitat Management Map, Including the Northern Continuous Range, the Central Discontinuous Zone, and the Southern Coastal Range

In Figure 6.2.8-5, the star denotes the approximate location of the Project. The dotted fuchsia ellipse denotes Neys-Killala corridor with deferred harvest blocks linking the Coastal Range portion of the Pic Forest FMU through the discontinuous distribution (white) to the future harvest blocks (A-E) in the northern continuous caribou range. The blue dotted ellipse denotes potential eastern travel corridor.

Determination of Significance

The residual effects of the Project arise from the loss of approximately 107 ha of potential caribou winter habitat in the SSA (albeit only 2.9 ha are undisturbed) and an additional 45 ha of modelled disturbance. With remediation at closure, at least some of this loss may be mitigated in the long-term. Sensory disturbance to caribou in the LSA is not expected to be significant as there are very few caribou with which the Project could interact, and no documented recent use of the LSA by caribou. Even with partial rehabilitation including the removal of the access road and transmission line, the 4-6 km wide SSA could potentially impair movement of caribou, although they are highly mobile. However, these effects are expected to be minor, and more than compensated for by the proposed off-site mitigation that will rehabilitate forest access roads, reduce predation risk, and improve connectivity for remaining caribou in the LSCR. Therefore, as with the original EIS (2012), the residual environmental effect on caribou is predicted to be **not significant.**

6.2.8.1.10 Little Brown Myotis and Northern Myotis

At the time of the original EIS (2012), the devastating effects of white-nose syndrome (WNS), caused by a non-native pathogenic fungus, on Canadians population of little brown myotis and northern myotis were becoming clearer. This led to the emergency assessment of these species as Endangered in 2013 by COSEWIC and the province of Ontario. WNS was first detected in bats near Wawa in 2010-2011 and along the north shore of Lake Superior in 2013-2014 (WNS RT 2021).

Analytical Assessment Techniques

Habitat requirements for little brown myotis and northern myotis vary seasonally and can be broadly categorized as:

1) overwintering habitat used for hibernation and overwinter survival i.e., hibernacula such as caves, abandoned mines, and well
2) summering habitat, which includes:
    a. maternity roosting habitat for reproductive females
    b. other roosts for males and non-reproductive females
    c. foraging habitat within commuting range of the roosts (Sasse and Perkins 1996, Norquay et al. 2013)
3) swarming habitat used in the late summer and early fall for mating and socializing. Swarming sites are also typically used as hibernacula (Fenton and Barclay 1980, Randall and Broders 2014)

Overwintering and Swarming Habitat

As described in IR 23.3 (CIAR #428), there are no hibernacula in the LSA or SSA and, therefore, no Project-related effects on overwintering or swarming habitat for SAR bats are expected.

Roosting Habitat

Analyzing potential effects on summering habitat for little brown myotis and northern myotis is hindered by limited understanding of roosting habitat used in natural environments by these species in northern Ontario. Most known maternity roosts for little brown myotis are in buildings, attics, bat boxes, and other anthropogenic structures (COSEWIC 2013), in part due to the difficulty of detecting them in natural habitats in the absence of radio-telemetry. In general, maternity roost trees tend to be taller, larger diameter, with more open canopies, closer to water, and found in forest stands with a substantially higher density of snags compared to random trees (Kalcounis-Rüppell et al. 1996). For example, in northern Alberta, little brown myotis maternity roosts were typically tall (20+ m), dying, or newly dead aspen (*Populus* sp.) with heart rot and low leaf cover (Crampton and Barclay 1998). In Ontario, maternity roosts have been found in trembling aspen (*P. tremuloides*), red oak (*Quercus rubra*), white birch (*Betula papyrifera*), and pine (*Pinus* sp.). They have also been found in Ontario and elsewhere in rock crevices and under exfoliating tree bark (Slough and Jung 2008).

Non-breeding little brown myotis roost during the day, in small spaces or crevices found in loose bark, hollow trees, rock faces, and human structures such as attics, walls, and bat boxes, either individually or in small groups (MNR 2011b). Day roosts of non-reproductive little brown myotis observed in a central Ontario study were primarily in dead, large-diameter (20+ cm) large-toothed aspen (*P. grandidentata*), but also red maple (*A. rubrum*), black ash (*Fraxinus nigra*), balsam fir (*Abies balsamea*), white birch, and trembling aspen. Day-roosting myotis (species unknown) have also been observed under boulders along bedrock shorelines in northwestern Ontario (Foster pers. obs.). Northern myotis maternity colonies are less commonly in anthropogenic structures and are less well known, at least in Ontario. In Ontario, one study did observe maternity roosts in the upper canopy of red oak and red maple.

In New Brunswick, maternity roosts of northern myotis were more common in large-diameter shade-tolerant hardwoods such as sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*) than in conifers and were associated with mid-decay classes rather than trees in early or late stages of decay (Broders and Forbes 2004; Broders et al. 2006).

All known myotis maternity roosts in boreal Ontario have been in anthropogenic structures such as buildings; no natural maternity roosts in trees have been documented. Many of the tree species used in studies in central and southern Ontario are not present at the Project site, i.e., pine, ash, oak, maple, large-toothed aspen.

According to MNR's (2012) significant wildlife habitat (SWH) criterion schedules for Ecoregion 3E (MNR 2011b) and Ecoregion 3W (draft, MNR 2017b), bat maternity colonies are found in the following 50 treed ecosites: B015-019, B023-028, B039-043, B054-059, B069-076, B087-092, B103-108, and B118-125. According to MNR (2011b, 2017b), mature (> 80 years old), larger diameter (>25 cm diameter) trembling aspen in decay class 1-4 (Watt and Caceres 1999) are important, particularly in deciduous or mixed forest stands with >10 snags/ha. These criteria follow direction provided in MNR's *Bats and Bat Habitats: Guidelines for Wind Power Projects* (MNR 2011b).

According to MNRF (2017b),

> "Snag density is a qualitative assessment of a treed ecosite, not a method of determining presence/absence of maternity roost habitat. There is no minimum threshold in terms of the number of snags/ha for an ELC ecosite to be considered suitable maternity roost habitat. However, an ELC with 10 or more snags/ha may be considered to be high quality potential maternity roost habitat. This information may be relevant when considering overall benefit in cases where a s.17(2)c permit under the ESA is required."

MNR's *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (MNR 2010) does not address bat maternity roosts. However, the 2021-2031 FMP for the Pic FMU (McDonald 2021) does have an area of concern (AOC) prescription for bat maternity roosts; no criteria for their identification are provided, nor have any been identified on the Pic Forest (i.e., RSA).

For the purposes of this Project, potential maternity roost habitat was modelled conservatively and all forested ecosites with a minimum of 80 years of age and at least 10% cover of trembling aspen were considered potentially suitable maternity roost habitat. Roosting habitat for non-reproductive bats was not modelled explicitly as it is more variable (including the use of non-treed habitats) and may include smaller-diameter trees, with individual bats often switching roosts (COSEWIC 2013; ECCC 2018).

Foraging Habitat

Modelling of foraging habitat is challenging for little brown myotis and northern myotis that depend upon insect prey that may be temporally and spatially scattered, but also locally abundant (ECCC 2018). Foraging habitat use may also depend upon age (juveniles vs. adults), sex, and reproductive status (i.e., pregnant, lactating, or non-reproductive), as well as landscape pattern (Broders et al. 2006; Henry et al. 2002; Owen et al. 2002; Randall et al. 2014). Little brown myotis are aerial insectivores that commonly feed on emerging aquatic insects, even gleaning from the water's surface (Clare et al. 2011; Moosman et al. 2012; Thomas et al. 2012; van Zyll de Jong 1985); as such, they frequently forage over ponds and streams and along the margins of larger waterbodies, but also in other open habitats such as forest edges and along roads (Fenton and Barclay 1980; Segers and Broders 2014). Juveniles tend to forage in less cluttered environments than adults (Crampton and Barclay 1998; Owen et al. 2002)) and adults have occasionally been observed gleaning prey within forests (Ratcliffe and Dawson 2003). Northern myotis typically glean terrestrial insects, but occasionally flying insects as well (Caceres and Barclay 2000; Broders et al. 2014; Dodd et al. 2012; Lacki et al. 2009; Ratcliffe and Dawson 2003; Thomas et al. 2012). They most often forage within forests along forest streams or trails, but also along forest edges (Henderson and Broders 2008; Owen et al. 2003). Any forest or waterbody in the SSA was considered potential foraging habitat for one or both species for the purpose of assessing effects from the Project.

Project Pathways

Foraging Habitat

Forest clearing and site development will result in loss of foraging habitat for little brown myotis, particularly along the margins of the streams and small waterbodies in the SSA. Nine small waterbodies (0.5-5.0 ha in size) will be lost within the SSA; little brown myotis were detected foraging near most of them in 2020, as well as along streams and the main access road. Although acoustic monitoring in 2020 suggests that northern myotis may not use the site regularly, clearing of the SSA could affect potentially suitable foraging habitat for this species.

Roosting Habitat

Forest clearing in the SSA could result in the loss of potential roosting habitat. Although maternity roosts have not been confirmed in the SSA, they could be present. Without appropriate mitigation (i.e., clearing outside the breeding season), this clearing could potentially cause mortality of pups of either species found in maternity roosts. Clearing of forest could also destroy day roosts of non-reproductive little brown myotis and northern myotis, as trees with crevices, hollows, or exfoliating bark may be present in the SSA. Potential roosts in <1 ha of talus, cliff, and rock barren habitat in the SSA could also be affected by Project activities. Not only could clearing potentially result in the loss of suitable trees for maternity colonies but if felling of trees occurs during the maternity season i.e., May 15 through August 31, it could potentially result in the death of non-volant pups in those roosts.

Although acoustic monitoring indicated there was foraging by myotis at the Project site, maternity roosts have not been confirmed at the Project site. In some landscapes, little brown myotis may commute from maternity roosts in urban areas to forage afield in more natural environments (Thomas and Jung 2019). In the boreal Yukon, little brown myotis were identified foraging at sites over 5 km from their maternity roosts, with males foraging up to 1.2 km from their summer day roosts (Randall et al. 2014). In the absence of radio-telemetry studies, it is unknown how far little brown myotis may travel between roosts and foraging habitat at the Project site. It is quite possible, however, that there are day roosts of non-reproductive myotis in the SSA.

Overwintering and Swarming Habitat

No hibernacula are known from near the Project, so no potential effects pathways are anticipated. Although there is evidence that northern myotis hibernated in large, deep cracks in limestone and shale in Nebraska (Lemen et al. 2016) where mines and caves are rare and localized, there are no reports of this behaviour in Ontario. Acoustic monitoring at the Project indicated only one potential northern myotis, suggesting little if any use of the LSA. Little brown myotis have been reported using talus as autumnal roosts and possibly hibernacula (Neubaum 2018), but this behaviour has not been documented in Ontario.

Other Pathways

Effects on little brown myotis and possibly northern myotis are possible through disturbance in the LSA from noise, light, or dust, potential collisions with Project infrastructure or vehicles, as well as habitat fragmentation and changes to the predator-prey community.

Bats are nocturnal creatures and are strongly influenced by the daily fluctuation of sunlight (Erkert 1982; Hauessler and Erkert 1978). Artificial lighting can therefore have an effect upon a range of bat behaviour such as foraging and commuting, emergence, roosting, breeding and hibernation (Alsheimer 2011; Stone et al. 2015). The Project access road and transmission line will not be lit, so effects would be primarily associated with the mine site, where adequate lighting is required for human safety concerns. *Myotis* species are generally considered light-averse, particularly forest-dwelling species such as northern myotis, but little brown myotis have been recorded foraging at LED (light-emitting diode) streetlights (Lewanzik and Voight 2017). Depending on the types of lights used at the Project site, they may either be repelled or may benefit from increased insect densities near artificial lighting. Slow-flying bats with echolocation adapted for cluttered environments such as northern myotis appear to avoid artificial lights due to light-dependent predation risk (Furlonger et al. 1987; Rydell, 1992; Stone et al. 2009, 2012). Lighting inside roosts has caused partial abandonment by little brown myotis (Laidlaw and Fenton 1971).

Noise may affect bat foraging, movement, or roosting depending on the timing, magnitude, and frequency of the noise generated by Project activities. Low frequency sounds (i.e., audible to humans) are unlikely to adversely affect myotis as most bats can only perceive sounds from 15-90 kHz, although they may have lower frequency social calls (Adams et al. 2000; Corcoran and Moss 2017; Lattenkamp et al. 2021). Roosting little brown myotis are generally unresponsive to frequencies within their range (i.e., >40kHz) when in torpor. Noise effects are likely to be most strongly felt during foraging, or late in the day when bats are coming out of daily torpor (Luo et al. 2014). Noise effects from roads may differently affect species depending on foraging strategies (Bonsen et al. 2015).

Roads, particularly large highways with high traffic volumes, can have adverse effects on bats from collisions with vehicles, road avoidance, and road barrier effects (Fensome and Mathews 2016). The low reproductive rate and low abundance of bats make them vulnerable to even small sources of mortality. The risk of collisions for bats and other wildlife depends upon traffic volume, vehicle speed, and animal crossing speed and behaviour, and well as landscape e.g., sight lines (Abbot et al. 2012; Fensome and Mathews 2016; Jaarsma et al. 2006; Litvaitis and Tash 2008). Secondary roads have been shown to have an effect on bats in a Mediterranean landscape in Europe (e.g., Medinas et al. 2019), but comparable studies in the boreal Canada where road density is substantially less are generally lacking. A Pennsylvania study did report mortality of little brown myotis along a busy highway, but found reduced mortality where canopy cover near the road diverted bats high enough above the traffic (Russell et al. 2008). Generalist species such as little brown myotis that are more tolerant of noise and artificial lighting may be more at risk since they are less likely to avoid roads. Low flying bats appear to be at greater risk than high-flying species (Medinas et al. 2019). Northern myotis may also be at risk due to its characteristic low and slow flight behaviour (Abbott et al. 2015), as has been observed with gleaning species in European studies (e.g., Berthinussen and Altringham 2012; Kitzes and Merenlender 2014; Zurcher et al. 2010).

Myotis echolocate and are highly maneuverable so collisions with stationary transmission lines are not expected (compared to fast-moving vehicles). Electrocution is not expected to be an issue due to the bats' small wingspan and the much larger spacing of the wires on the transmission line.

Edge habitat around the periphery of the cleared SSA may provide increased foraging opportunities for little brown myotis but may have an adverse effect on northern myotis because they generally glean insects in forested environments. The magnitude of this effect is unknown since there appears to be little use of the LSA by northern myotis, and they also known to use forest edges for foraging (e.g., Caceres and Barclay 2000).

Mitigation and Enhancement Measures

Habitat Loss

General mitigation to reduce the loss of potential habitat are as described in Section 6.2.7 of this EIS Addendum (Vol 2), such as project design to reduce the SSA.

Avoid clearing of trees in the SSA during the maternity period (i.e., May 15th through August 31) when female SAR bats are likely to be giving birth and raising their pups. This will avoid direct mortality of non-volant pups if there are undetected maternity roosts present in the SSA. If limited clearing must be done during this window, bat maternity surveys using the current MECP protocol would be used to confirm bat presence/absence in suitable tress (e.g., large diameter cavity trees) and appropriate protection measures applied.

A precautionary approach towards loss of potential maternity roost habitat is warranted since large snags suitable as roost sites may be limited in the boreal forest (Randall et al. 2014; Thomas and Jung 2019). A conservative approach has additional merit for little brown myotis and northern myotis given their dramatic recent declines due to WNS as well as other emerging threats such as a potential decline in prey insect biomass (ECCC 2018). Therefore, multiple bat boxes and bat rocket boxes will be used as mitigation to replace the loss of potentially suitable roost trees in the SSA. Bat boxes and rocket boxes of approved design will be deployed in the LSA and adjacent RSA prior to clearing of the SSA. They will preferentially be installed along south-facing shorelines of waterbodies to maximize passive heating, since recent research (e.g., Wilcox and Willis 2016) suggests that increased ambient temperatures of bat boxes may be beneficial in northern climates, particularly for bats recovering from WNS. Situating most boxes along shorelines will also reduce foraging costs for little brown myotis, the predominant SAR bat species at the Project.

Maternity colonies of little brown myotis often use the same-specific trees year-after-year (Frick et al. 2010; Slough and Jung 2020) and some studies have reported poor occupancy of replacement maternity roosts (e.g., bat houses) (Humphrey and Cope 1976; Neilson and Fenton 1994). However, other studies have found little brown bats occupied bat houses, particularly if conditions such as temperature, predation risk, and accessibility are suitable (White 2004) and if they were placed nearby to original maternity roosts (Brittingham and Williams 2000). For example, Slough and Jung (2020) found that large numbers of bats evicted from a cabin in the Yukon used a replacement bat house in the first year after eviction, with at least 124 of 268 (46.3%) adult females banded at the previous cabin roost recaptured at the replacement bat roost (bat box) within 7 years of the cabin being demolished, demonstrating foraging area fidelity and eventual group reestablishment.

Little brown myotis and northern myotis often use multiple maternity roosts, often during the course of a breeding season (Kuntz 1982; Lewis 1995). In a Yukon study, female little brown myotis frequently switch maternity roosts separated by 2-4 km and as far as 6 km (Slough and Jung 2020). Little brown myotis at least, appear to exhibit a fission-fusion pattern of behaviour which involves regular roost switching by adult females and pups (Olson and Barclay 2013). This behaviour offers multiple possible advantages such as site familiarity, the maintenance of social relationships (Kerth et al. 2006, 2011; Garroway and Broders 2007; Willis and Brigham 2004), reduced commuting costs for foraging, roost selection that ensures optimal microclimatic conditions for gestation and postnatal growth of pups, lower ectoparasite loads, and avoiding disturbance by humans or predators (Lewis 1995; Olson and Barclay 2013). Roost switching behaviour observed in little brown myotis may facilitate acceptance of replacement bat roosts installed as mitigation for loss of potential maternity roost trees in the Project SSA.

Eventual remediation within the SSA as per the Conceptual Closure Plan (see Section 1.5.2.3 of the EIS Addendum [Vol 1]) will at least partially mitigate the loss of foraging habitat, particularly for little brown myotis.

Disturbance

If potentially suitable maternity roost trees are observed in the LSA during operations, exit surveys following approved MECP / MNRF protocols will be used to verify use. If use by myotis is confirmed, mitigation will be applied following MNRF's AOC prescription for bat maternity roosts that has been developed for the Pic Forest (i.e., Project RSA) by the FMP planning team based on advice from the Regional Species at Risk Specialist. It is to be applied to trees (particularly mature trees with cavities) from which any bat species, (including little brown myotis and northern long-eared bat) have been observed flying. The AOC prescription includes a reserve of 100 m around the roost tree where harvesting, renewal, and tending operations are forbidden, and a modified activity zone from 100-200 m where high impact activities that result in the felling or knocking over of trees are not permitted from June 1 to July 31. The AOC prescription has not actually been applied on the Pic Forest since there are no known maternity roosts in the 643,990 ha FMU, which includes the SSA, LSA and RSA of the Project. However, no surveys are conducted pre-harvest for maternity roosts by MNRF or the forest company.

Other Effects

General mitigation measures for disturbance from sound, light, dust, and other edge effects as well as collisions with Project infrastructure and vehicles described in Section 6.2.7 of this EIS Addendum (Vol 2) are also relevant to SAR bats.

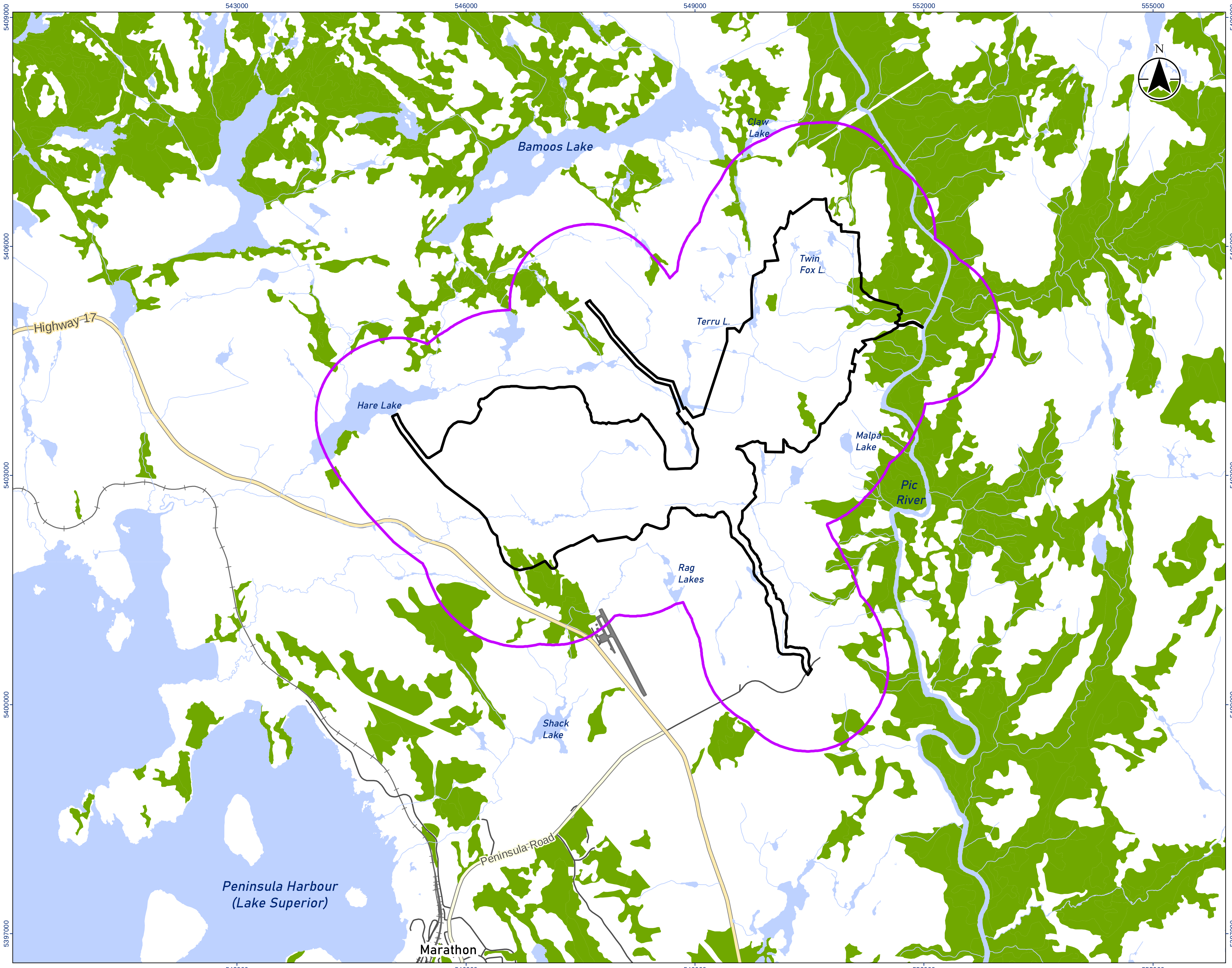
Project Residual Effect

Roosting Habitat

As discussed in IR 23.3 (CIAR #428), little brown myotis and northern myotis are widespread across the boreal forest in Canada and must be adapted to the dynamic disturbance regime, where large wildfires naturally destroy active maternity roost trees, with resulting snags found in the burned landscape smaller than preferred sizes (Jung 2020). Forest harvesting within the Pic FMU (i.e., the RSA) is designed to emulate natural disturbance (e.g., wildfire) and landscape pattern as per the *Forest Management Guide for Boreal Landscapes* (MNR 2014a). The intent is to maintain or enhance natural landscape structure, composition, and patterns that provide for the long-term health of forest ecosystems to sustain all species, including SAR, as required under the *Crown Forest Sustainability Act* (CFSA). Forest operations under an approved FMP (such as on the Pic Forest) are exempt from Ontario's *Endangered Species Act*[4] since the Province of Ontario considers that the CFSA forest policy framework sufficiently protects species at risk. By extension, the planned level of annual forest harvest in the Pic Forest is considered to not adversely affect the sustainability of SAR bat populations in the RSA. Over 17,000 ha of forest was scheduled to be harvested on the Pic Forest in 2020-2021 alone (McDonald 2021), much during the bat maternity period (May 15 through August 31) when female SAR bats are likely to be giving birth and raising their pups. Given that *actual* harvest on the Pic Forest typically achieves much less than the *planned* (sustainable) harvest, the additional clearing of approximately 1,000 ha of forest in the Project's SSA is well within levels considered sustainable by MNRF, although this area cleared is not planned for regeneration to future mature forest. Furthermore, only 39 ha of habitat within the SSA was modelled as higher potential maternity roost habitat (Figure 6.2.8-6), which is approximately 0.01% of the more than 378,000 ha of potential maternity roost habitat with those characteristics within the RSA (Pic Forest FMU).

Although this "coarse filter" approach prescribed by the boreal landscape guide may be sufficient to provide an adequate supply of habitat (particularly foraging) at a broad scale, an additional "fine filter" may also be required to further protect local wildlife values. For this reason, mitigation efforts will provide bat boxes and rocket boxes as partial replacement habitat for the loss of potential roost trees in the SSA.

[4] an exemption made permanent in December 2020 by Bill 229, *Protect, Support and Recover from COVID-19 Act* (Budget Measures), 2020.



Legend

- Potential Bat Roosting Habitat
- Site Study Area
- Local Study Area
- Airport Infrastructure
- Waterbody (LIO)
- Watercourse (LIO)
- Highway
- Major Road
- Minor Road
- Railway

0 1 2 3 km

1:51,254 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.

Project Location
Marathon

Prepared by D Harvey & R. Foster on 2021-03-02

Client/Project
GENERATION MINING LTD.
MARATHON PALLADIUM PROJECT

Figure No.
6.2.8-6

Title
Potential Bat Roosting Habitat

Determination of Significance

The main residual effects of the Project arise from the loss of approximately 1,000 ha of possible bat foraging and day roost habitat in the SSA during the development and operation of the mine, as well as the loss of an estimated 39 ha of potential bat maternity roost habitat. Bat boxes and rocket boxes will partially mitigate this loss of potential roosting habitat. Similar habitat is abundant and widespread in the RSA and the Project-associated loss is well within the range of annual disturbance considered sustainable in boreal ecosystems. With remediation at closure, at least some of this loss will be mitigated by forest regeneration. As with the original EIS (2012), the residual environmental effect on SAR bats and their habitat is predicted to be **not significant**.

6.2.8.1.11 Canada Warbler

Analytical Assessment Techniques

Canada Warbler Habitat Quantity

Canada warbler habitat in the SSA and LSA was modelled using the methods described in Appendix D9.5 of this EIS Addendum (Vol 2).

Canada Warbler Habitat Quality

Potential changes to Canada warbler habitat quality were assessed as for other non-SAR songbirds as discussed in Section 6.2.7.6.2 of this EIS Addendum (Vol 2).

A geographic information system (GIS) (ESRI ArcMap) was used to overlay the Project components, physical activities and predicted indirect effects on modelled Canada warbler habitat for the following:

- a 10 m buffer from the outer boundary of the SSA to encompass potential edge effects on Canada warbler habitat from increased sunlight, wind, and resultant evapotranspiration (see Section 6.2.6 of this EIS Addendum [Vol 2])
- a 30 m buffer around the edge of the SSA to reflect potential fugitive dust deposition on Canada warbler habitat (see Sections 6.2.1 and 6.2.6 of this EIS Addendum [Vol 2])
- areas of the LSA adjacent to the SSA where groundwater is predicted to decrease or increase 0.5 m or greater (see Sections 6.2.3 and 6.2.6 of this EIS Addendum [Vol 2])
- areas of the LSA adjacent to the SSA where background sound is expected to increase by at least 50 decibels (EC 2021) (see Sections 6.2.2 of this EIS Addendum [Vol 2]). 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.

A primarily qualitative approach informed by relevant literature, project-specific information (including multiple years of fieldwork), and professional opinion was used to assess potential effects on Canada warbler habitat and its use for the following:

- changes in ambient light levels and the olfactory environment i.e., smells (see Section 6.2.1 of this EIS Addendum [Vol 2])
- increased levels of ambient light (see Section 6.2.1 of this EIS Addendum [Vol 2])
- invasive plant species (see Section 6.2.6 of this EIS Addendum [Vol 2])

Change in Canada warbler habitat quality, or impairment of habitat, is conservatively assumed for the duration of the Project life from site preparation and construction, through operation, with levels of habitat impairment generally declining at closure and after rehabilitation.

Canada Warbler Survival

Change in Canada warbler survival was assessed qualitatively through a review of the literature, consideration of the factors that can contribute to the susceptibility of the species to the Project-specific effect mechanisms 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 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.

To assess the potential number of Canada warblers affected by the project, average density of Canada warblers in the SSA were calculated as for other songbird species described in Section 6.2.7.6.1 of this EIS Addendum (Vol 2). This approach uses point count data from the Project site and the following formula (Blancher et al. 2007, 2017):

$$\text{Density} = (n * P * T) / (\pi * DD^2)$$

Where n = number of Canada warblers tallied on point count

P = Pair adjustment - multiplies estimate by up to 2, depending on whether one or both members of a pair are likely to be detected (a species-specific constant provided in Blancher et al. 2017)

T = time of day adjustment - Average Time of Day Adjustment: adjusts average count across all 50 BBS stops to a smoothed peak count.

DD = approximate detection distance (m) at peak time of day during a 3-minute BBS count, accounting for movement of birds during the count (a species-specific constant provided in Blancher et al. 2017)

Average density for Canada warbler in the SSA were calculated from the individual point-count densities.

Canada Warbler Habitat Fragmentation and Movement

Potential fragmentation of Canada warbler habitat in the study area and changes to their movement were assessed as for other songbirds (see Section 6.2.7.6.4 of this EIS Addendum [Vol 2]).

Project Pathways

Project pathways are generally similar for Canada warbler as for other non-SAR songbirds, as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2). Habitat loss is the primary effects pathway, particularly of shrub-rich mixedwoods with abundant coarse woody debris. Habitat quality in the LSA may also be impaired from sensory disturbance. Collisions with Project infrastructure or vehicles is a risk.

Mitigation and Enhancement Measures

Mitigation and enhancement measures are similar for Canada warbler as for other non-SAR songbirds as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2).

Of particular relevance is the stockpiling of non-merchantable coarse woody debris during site clearing for use during future rehabilitation efforts in the SSA as per the Conceptual Closure Plan (see Section 1.5.2.3 of the EIS Addendum [Vol 1]). Canada warblers are ground-nesters, often using downed logs and other coarse woody debris as cover for their nests (COSEWIC 2008). Redistribution of these habitat features during rehabilitation, combined with shrub growth and tree planting will enhance eventual suitability of the site for Canada warbler.

Project Residual Effect

Canada warbler was a relatively common nesting species in birch-dominated mixedwood forest in the LSA in 2008, 2009, and 2020. Based on habitat modelling (Appendix D9.5 of this EIS Addendum ([Vol 2]), virtually all the SSA (1071 of 1116 ha, 96.0%) is potential Canada warbler habitat, of which 771 ha (72.0%) are preferred ecosites (B050, B052 and B055). Based on the same modelling, potentially suitable habitat is abundant in the RSA, with over 443,000 ha of preferred habitat and an additional 302,000 ha of used habitat. Preferred Canada warbler habitat in the SSA represents only about 0.17% of the available habitat in the RSA. As discussed in IR 23.4.5 (CIAR #428), breeding habitat for this species may not be limiting, as its decline may be linked to other factors such as the dramatic loss of overwintering habitat in northern South America (COSEWIC 2008) or decline in the abundance of spruce budworm (*Choristoneura fumiferana*) throughout its breeding range (Sleep et al. 2009), although conservation of important breeding habitat remains a high recovery priority (Environment Canada 2016).

Approximately 444 ha of the LSA (outside the SSA) could potentially be affected by noise during operations of greater than 50 dB (see Acoustic Environment Section 6.2.2 of this EIS Addendum [Vol 2]). This includes 326 ha of ecosites that are modelled as preferred Canada warbler habitat.

Using methods and the formula described in Blancher et al. (2007, 2017) and point count data from the Project site, the estimated density of Canada warblers in the SSA is 0.08221 individuals (both sexes) per ha. This suggests that there are an estimated total of 92 Canada warblers breeding in the SSA that would be potentially displaced by clearing of the SSA. Observed densities at the Project site are much higher than the estimated density of 0.0111 males/ha (range 0.0102 to 0.0129) for Bird Conservation Region 8 (BAMP 2021); densities for breeding pairs are about four times higher at the Project site than in Bird Conservation Region 8 as a whole. This is perhaps not surprising since Ontario represents the core of Canada warbler's national range, and the overmature birch mixedwoods along the north shore of Lake

Superior provide very suitable habitat for this species. Based on 110,427 point count survey visits from 32,287 unique survey stations in Alberta, Ball et al. (2016) found little evidence that local-scale fragmentation (i.e., edges created by linear features) influenced Canada warbler abundance.

Based on these observed densities, potentially another 36 Canada warblers in the LSA could be disturbed by noise greater than 50 dB. In general, the relationships between anthropogenic disturbance and habitat quality for Canada warbler are poorly understood (ECCC 2016c). Multi-year monitoring at an active gold mine on McFauld's Peninsula near Red Lake, Ontario suggests that Canada warblers are at least somewhat tolerant of noise pollution (Foster 2015b). During annual surveys from 2010-2015, small numbers of Canada warbler males were consistently observed singing on territory along a 50-100 m wide fringe of aspen mixedwood forest around the periphery of the mine, despite significant mine noise. Similarly, Canada warblers were observed on territory in close proximity to the Kakabeka Falls Generating Station (GS) near Thunder Bay, Ontario despite considerable anthropogenic noise from the GS (Harris and Foster 2010).

With appropriate mitigation, the risk of injury or mortality to Canada warblers from collisions with Project infrastructure of vehicles is expected to be low.

Determination of Significance

With mitigation, residual effects on Canada warbler will be **not significant.** The change in Canada warbler habitat quantity and quality is not expected to threaten the long-term viability of populations of this species in the RSA. Potential forest habitat for this species is abundant and widespread in RSA and the Project-associated loss is well within the range of annual disturbance considered sustainable in boreal ecosystems.

6.2.8.1.12 Rusty Blackbird

Analytical Assessment Techniques

A primarily qualitative approach informed by relevant literature, project-specific information (including multiple years of fieldwork), and professional opinion was used to assess potential effects on rusty blackbird. Rusty blackbirds were not detected on any point counts for the Project so density estimates could not be calculated using (Blancher et al. (2007, 2017).

The assessment of Project residual environmental effects on potential habitat for these species used GIS (ESRI ArcMap) to overlay the Project components and physical activities on existing FRI information and base layers (available from LIO).

Project Pathways

Project pathways are similar for rusty blackbirds as for other non-SAR songbirds as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2). Habitat loss is the primary effect pathway, particularly small waterbodies with adjacent conifer forest. Rusty blackbirds may also be sensitive to changes in hydrology in the LSA, based on their propensity for foraging in wet habitats (Greenberg et al. 2011).

Mitigation and Enhancement Measures

General mitigation and enhancement measures are similar for rusty blackbird as for other non-SAR birds as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2), particularly for marsh birds and waterfowl.

Project Residual Effect

No rusty blackbirds were detected in the Project LSA in 2020. However, a family group (adults with fledged young) was observed in 2009 along the shoreline of waterbody L16 in the SSA (Northern Bioscience 2012a). Rusty blackbirds were observed in 2017 at five locations along lakeshores and streams in the RSA to the north and west of the LSA (Foster 2019). Breeding habitat for this species is typically conifer-dominated forests adjacent to wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps, and beaver ponds (COSEWIC 2017; Environment Canada 2015; Francis 2007). There is suitable breeding habitat for rusty blackbird in the LSA, although it may not always be occupied. There are nine small waterbodies (between 0.5 ha and 5.0 ha in size) in the SSA and a total of 17.7 ha of aquatic habitat when smaller ponds are included as well. These will be lost during site development, although some waterbodies will eventually be reestablished (e.g., filling of the pit). However, they will likely not have the same productivity and characteristics as the waterbodies lost during site development and may not be as suitable for rusty blackbird habitat. However, as discussed in IR 23.4.2 (CIAR #428), breeding habitat for this species is likely not limiting for this species. Similar habitat is widespread in the RSA, with over 11,000 remaining waterbodies of similar size (i.e., <10 ha) that collectively cover 11,409 ha.

Approximately 401 ha of habitat in the LSA is predicted to have a groundwater drawdown of at least 0.5 m; however, less than 5 ha are currently wetland that might be suitable foraging habitat for rusty blackbird; this change may be balanced by the 442 ha in the LSA that is predicted to have a groundwater increase of at least 0.5 ha, including 6 ha of wetland. Potential changes in surface water hydrology in the LSA are expected to be within the range of natural flow variation on these systems and less pronounced than changes due to beaver activity and are not expected to adversely affect rusty blackbird.

Potential effects from collisions with Project infrastructure or vehicles, sensory disturbance, or indirect effects from the Project are expected to be minimal for rusty blackbird given their infrequent use of the LSA and habitat preference for riparian conifer forests.

Determination of Significance

With mitigation, residual effects on rusty blackbird will be **not significant**, as there is only limited use of the LSA by this species. Suitable forest habitat adjacent to small waterbodies is abundant and widespread in the RSA, and the limited loss of such habitat within the SSA is not expected to threaten the long-term viability of rusty blackbird populations in the RSA.

6.2.8.1.13 Olive-sided Flycatcher, Eastern Wood-Pewee, and Evening Grosbeak

Analytical Assessment Techniques

A primarily qualitative approach informed by relevant literature, project-specific information (including multiple years of fieldwork), and professional opinion was used to assess potential effects on these three species. A single eastern wood-pewee was heard on a point count and so density was calculated following Blancher et al. (2007, 2017). Although single evening grosbeaks were observed on a single point count in both 2008 and 2009, neither were singing males so calculating breeding densities may not be appropriate (they may have just been itinerant rather than on territory). Olive-sided flycatcher was not detected on any point counts for the Project site so density estimates could not be calculated.

The assessment of Project residual environmental effects on potential habitat for these species used GIS (ESRI ArcMap) to overlay the Project components and physical activities on existing FRI information and base layers (available from LIO).

Project Pathways

Project pathways are generally similar for olive-sided flycatcher, eastern wood-pewee, and evening grosbeak as for other non-SAR songbirds, as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2). Loss of forest habitat is the primary effect pathway.

Mitigation and Enhancement Measures

General mitigation and enhancement measures are similar for olive-sided flycatcher, eastern wood-pewee, and evening grosbeak as for other non-SAR songbirds, as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2).

Project Residual Effect

No olive-sided flycatchers were detected in the Project LSA in 2020. A single olive-sided flycatcher was seen in 2009 on the shore of a small lake southeast of Bamoos Lake outside the current SSA (Northern Bioscience 2012a) (SID #24) (CIAR #227). Olive-sided flycatchers were observed at several locations near open areas (wetlands, trails) in the RSA to the west and north of the Project in 2017 (Foster 2019). Conifer forests with snags or other suitable perches adjacent to open areas for hawking insects is the preferred habitat for this species in Ontario (Cadman et al. 2007; COSEWIC 2007; ECCC 2016d). There is likely suitable breeding habitat in the LSA, although it may not be occupied, at least not in all years.

Eastern wood-pewee was not listed as special concern until 2012 (federally) and 2014 (provincially). No eastern wood-pewees were detected in the LSA in 2020, but a lone male was heard on a point count in the LSA in 2010 (Northern Bioscience 2012b) (SID# 25) (CIAR #234). Based on this observation, the density of eastern wood-pewees in the LSA was calculated as 0.00105 birds/ha; this translates to a total of 1.2 birds in the SSA. Densities of eastern wood-pewee are low in Bird Conservation Region 8, which overlaps the Project, with an estimated 0.0013 males/ha (range 0.001 — 0.0017) (BAMP 2021b). This species prefers gaps and edges of deciduous and mixedwood forests (COSEWIC 2012; MacLaren 2007;

Watt et al. 2018), which are abundant in the LSA. Although this species is relatively uncommon along the north shore of Lake Superior (eBird 2020) and is near the northern limits of its distribution (BAMP 2021b; MacLaren 2007), there is potentially suitable breeding habitat in the LSA. It may not always be occupied, however, due to factors other than habitat suitability.

The evening grosbeak was not considered a SAR during the initial baseline study (Northern Bioscience 2012b) (SID# 25) (CIAR #234) and was only recently assessed as Special Concern by COSEWIC (2016), and thereafter by Ontario (2017). No evening grosbeaks were observed during 2020 fieldwork, but single individuals were observed in the LSA during point counts in both 2008 and 2009 (Northern Bioscience 2012b). Neither individual was a singing male, so it is not known if they were breeding birds or not. Evening grosbeaks are socially monogamous and not territorial during the breeding season (Cornell Lab of Ornithology 2019; COSEWIC 2016a).

In Ontario, this species breeds primarily in open, mature mixedwood forests with a high proportion of balsam fir and white spruce (Cadman et al. 2007). Their distribution and abundance vary across their range, as this species moves large distances in response to the availability of food sources, particularly outbreaks of spruce budworm, its main food source during the breeding season (COSEWIC 2016a). They are also nomadic during the winter in response to cone, berry, and seed crops. No recent spruce budworm outbreaks are known from the Project area; in 2019, areas suffering moderate to severe defoliation from spruce budworm were farther east from Chapleau District to Cochrane District (MNRF 2019). Although the LSA may provide potentially suitable breeding habitat for evening grosbeaks, it may be occupied only sporadically.

The loss of forest habitat in the SSA is not expected to have an adverse effect on population sustainability for these three species in the RSA, given the low level of observed use in the LSA and the widespread and abundant suitable mixedwood habitat in the surrounding landscape. With appropriate mitigation (e.g., clearing of trees outside of the breeding season) no habitat-related effects are anticipated. Standard mitigation for sensory disturbance, collisions, and other indirect effects should sufficiently reduce potential effects on survival for these species, particularly given the limited number of individuals potentially affected.

Determination of Significance

With mitigation, residual effects on olive-sided flycatcher, eastern wood-pewee, and evening grosbeak will be **not significant**. There is limited use of the LSA by these species and the change in wildlife habitat quantity and quality is not expected to threaten the long-term viability of their populations in the RSA. Potential forest habitat for these species is abundant and widespread in RSA and the Project-associated loss is well within the range of annual disturbance considered sustainable in boreal ecosystems.

6.2.8.1.14 Bald Eagle and Peregrine Falcon

Analytical Assessment Techniques

A primarily qualitative approach informed by relevant literature, project-specific information (including multiple years of fieldwork), and professional opinion was used to assess potential effects on bald eagle and peregrine falcon.

Project Pathways

Project pathways are generally similar for bald eagle and peregrine falcon as for other non-SAR birds, particularly raptors, as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2). Loss of forest habitat is the primary effect pathway. Mortality from collision with project infrastructure (e.g., transmission line) or vehicles, particularly if scavenging roadkill (bald eagle) is another potential risk.

There is no documented nesting of either species in the LSA, so effects pathways are limited to foraging or migrating individuals.

Mitigation and Enhancement Measures

General mitigation and enhancement measures are similar for bald eagle and peregrine falcon as for other non-SAR birds, particularly raptors, as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2).

No nests for either species are currently present in the LSA; therefore, mitigation measures are most relevant to foraging habitat.

Standard mitigation measures to reduce the risk of collision mortality with transmission lines and project vehicles is of particular relevance for bald eagle. Proper waste disposal at the Project site will also reduce risk to bald eagle health and survival from accidental poisoning or bird strike with Project infrastructure.

Project Residual Effect

As discussed in IR 23.4 (CIAR #428), bald eagles are not anticipated to be affected by the Project. No bald eagles were observed during 2009-2010 (Northern Bioscience 2012b) (SID# 25) (CIAR #234) or 2020 fieldwork (Northern Bioscience 2020) (CIAR #722). Bald eagles are not known to nest in the study area. A single adult was observed near the Marathon Airport in 2008 (Golder Associates Ltd 2009) and two bald eagles were observed north of the LSA during other 2017 fieldwork (Foster 2019). There are no concentrated sources of food (e.g., spawning suckers [*Catostomus* sp.]) in the LSA for nesting, migrating, or overwintering eagles, although remains of hunter-killed big game may be present in the fall.

Based on the limited data available, there are, however, modest but increasing numbers of Bald Eagles present at Marathon and on the lower Pic River in the fall and early winter, which reflect Ontario's growing Bald Eagle population generally (IR 23.4.4) (CIAR #428). The municipal landfill immediately south of the LSA may represent a potential attractant to bald eagles, so there is the potential risk of collision by Project vehicles. This can be adequately mitigated by SAR training, signage, and speed limits on the access road, and represents a much lower risk of collision compared to adjacent Highway 17 with higher traffic volumes and speeds.

Although there are some peregrine falcon nests along the nearby shores of Lake Superior, as discussed in the updated terrestrial baseline report (Northern Bioscience 2020) (CIAR #722), there is no documented use of the LSA by peregrine falcon and, therefore, no residual effects are anticipated.

Determination of Significance

Residual effects on bald eagle and peregrine falcon will be **not significant**. These species are not known to currently nest in the LSA. With appropriate mitigation, no adverse effects, such as potential collisions with Project vehicles or infrastructure, are anticipated during potential foraging or other use of the LSA by these two species.

6.2.8.1.15 Common Nighthawk and Eastern Whip-poor-will

Analytical Assessment Techniques

A primarily qualitative approach informed by relevant literature, project-specific information (including multiple years of fieldwork), and professional opinion was used to assess potential effects on common nighthawk and eastern-whip-poor-will.

The assessment of Project residual environmental effects on potential habitat for these species used GIS (ESRI ArcMap) to overlay the Project components and physical activities on existing FRI information and base layers (available from LIO). As discussed in IR 23.4.2 (CIAR #428), nesting habitat for these species includes rock barrens with scattered trees, as well as young burns and cutovers (COSEWIC 2009; Foster 2015; Mills 2007; Sandilands 2007, 2010). Potential habitat for common nighthawk and eastern-whip-poor-will in the LSA were identified as based on a mix of sparse forest and open habitat, primarily poorly vegetated bedrock (Figure 6.2.8-5).

Project Pathways

There has been no documented use of the LSA by either common nighthawk or eastern whip-poor-will as discussed in the updated baseline report (Northern Bioscience 2020) (CIAR #722). If either species uses the LSA in the future, project pathways would be generally like those for other non-SAR birds as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2). The Project could result in the loss of potential habitat, primarily sparsely-treed rock barren and other open communities.

Although none were detected in the LSA, common nighthawk and eastern whip-poor-will may be particularly susceptible to road mortality since they may sit on gravel roads to dusk-bath and/or while foraging (Sandilands 2010).

Mitigation and Enhancement Measures

General mitigation and enhancement measures are similar for common nighthawk and eastern whip-poor-will as for other non-SAR birds, as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2).

Project Residual Effect

Potential habitat in the SSA and LSA relative to the RSA are presented in Figure 6.2.8-5. Within the SSA, there are only about 6 ha of non-treed upland ecosite and 42 ha of treed conifer Ecosite B012 that is potentially suitable, where there is sufficient unmapped rock barren area intermixed with jack pine and black spruce forest. There has been no observed use of these habitats and they represent less than 0.1% of the potentially suitable habitat for these species within the RSA, not including cutovers, burns, and anthropogenic features such as transmission line rights-of-way.

Table 6.2.8-5: Summary of potential common nighthawk and eastern whip-poor-will habitat in the Project study areas based on potentially suitable boreal ecosites

Ecosite / Habitat Type	Area (ha) in SSA	Area (ha) in LSA	Area (ha) in RSA
B007 Active Mineral Barren	0.0	6.3	479.5
B012 Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer	41.8	121.6	47,115.7
B046 Dry to Fresh, Coarse: Sparse Shrub	0.0	0.4	41.8
B047 Dry to Fresh, Coarse: Shrub	3.0	17.3	954.2
B062 Moist, Coarse: Sparse Shrub	0.8	8.4	24.3
B063 Moist, Coarse: Sparse Shrub	2.4	17.6	881.0
B164 Sparsely Treed Rock Barren	0.0	0.9	1,766.7
B165 Open Rock Barren	0.0	0.4	68.3
B166/167 Talus or Raised Beach			36.8
B168 Open Talus	0.6	0.6	12.4
Total	48.6	173.5	51,380.7

Given the lack of documented use of the LSA, sensory disturbance is not considered at issue. Common nighthawk and eastern whip-poor-will may be particularly susceptible to road mortality since they may sit on gravel roads to dusk-bath and/or while foraging (Sandilands 2010). SAR training, signage, and speed limits will serve to mitigate this risk, however, should either common nighthawk or eastern whip-poor-will use the LSA.

Determination of Significance

Residual effects on common nighthawk and eastern whip-poor-will will be **not significant**. There is no current use of the LSA by these species and, with appropriate mitigation, no adverse effects (e.g., potential collisions with Project vehicles) are anticipated in the event of future use. With rehabilitation of the SSA at closure, open and semi-treed habitat suitable for nesting and foraging by these species will likely be more abundant than is currently available.

6.2.8.1.16 Monarch and Yellow-banded Bumble Bee

Analytical Assessment Techniques

A primarily qualitative approach informed by relevant literature, project-specific information (including multiple years of fieldwork), and professional opinion was used to assess potential effects on monarch and yellow-banded bumble bee.

Project Pathways

Project pathways for monarch and yellow-banded bumble bee are generally similar to those for other wildlife, as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2). Loss of potential nectaring (foraging) habitat on roadside wildflowers is the primary effects pathway for both species; loss of potential nest habitat is possible within the SSA for yellow-banded bumble bee as well. Sensory effects (e.g., light, noise) are presumed to be less of an issue for these insects, however. There is a risk of mortality from collision with Project vehicles. Invasive plant species could also potentially affect nectar sources, although some (e.g., purple loosestrife) have flowers that are attractive to bumble bees (*Bombus* sp.) (e.g., iNaturalist 2018) and monarch as well.

Mitigation and Enhancement Measures

General mitigation and enhancement measures are similar for monarchs and yellow-banded bumble bees as for other wildlife as discussed in Section 6.2.7.6 of this EIS Addendum (Vol 2).

Of particular relevance to these species are the use of native seed mixes during rehabilitation of the SSA at closure as per the Conceptual Closure Plan (see Section 1.5.2.3 of the EIS Addendum [Vol 1]). Inclusion of selected wildflower species in the seed mixes to provide additional nectar sources throughout the growing season will benefit both migrant monarchs and resident yellow-banded bumble bees. Although not currently found on site, inclusion of common milkweed (*Asclepias syriaca*) in the rehabilitation efforts would provide larval food sources for monarch caterpillars; this approach could be considered assuming agency approval.

Project Residual Effect

The LSA sees irregular use by adult monarchs, with none observed during 2007-2010 fieldwork but numerous adults (15+) observed on July 7-8, 2020 along the main access road through the Project site (Northern Bioscience 2020) (CIAR #722). Adults likely represent the 2nd or 3rd generation of migrating adults (COSEWIC 2016b), including females that are in search of suitable milkweed plants upon which to oviposit. However, the obligate host plants of larval monarchs i.e., milkweed (*Asclepias* spp.) are not present in the LSA. Risk of collision with project vehicles is a potential risk to migrating adults, particularly if nectaring along roadside wildflowers. In some areas, the monarch is vulnerable to mortality from vehicle collisions, particularly throughout its summer range (Damus 2007); this risk is higher where milkweed grows in abundance (ECCC 2016a). Given the infrequent use of the LSA by monarchs, the relatively low traffic speeds and volumes (especially compared to Highway 17 immediately to the south), and generally north-south alignment of the road, this risk is expected to be minimal and can be mitigated by training, signage, and speed limits.

Small numbers of yellow-banded bumble bees were observed in June-August 2020 foraging for nectar and/or pollen on goldenrods (*Solidago* spp.) and other roadside flowers along the main access road through the Project SSA and LSA. Yellow-banded bumble bee is a habitat generalist within open coniferous, deciduous, and mixed-wood forests, wet and dry meadows, prairie grasslands, roadsides, urban parks, gardens, and agricultural areas (COSEWIC 2015). It is a generalist pollen forager and has been collected from a wide variety of plant species (COSEWIC 2015). Yellow-banded bumble bees nest underground (Laverty and Harder 1988), with queens overwintering often in loose soil or rotting trees (Benton 2006).

Although 1,116 ha of potential habitat will be lost during site clearing and operations, at least some will be rehabilitated upon closure. Given the broad habitat requirements for this species and abundant potential habitat in the RSA, this habitat loss is not expected to affect regional populations. There is the potential mortality of a few individuals, if actually nesting in the SSA, during site clearing and development. There is also a minor risk of mortality from vehicle collisions, although this can largely be mitigated as for monarch. Cumulatively, the potential habitat loss and mortality from the Project is not considered to affect the sustainability of regional populations. Although listed as Special Concern due to apparent declines in abundance in parts of its range (COSEWIC 2015), recent targeted bumblebee surveys in northwestern Ontario (Harris et al. 2019) have indicated that the species is not uncommon along roadsides in much of northwestern Ontario.

Determination of Significance

With mitigation, residual effects on monarch and yellow-banded bumble bee will be **not significant**. Loss of habitat and collisions with Project vehicles will affect few individuals and will not substantively affect the sustainability of their populations in the LSA or RSA. With rehabilitation of the SSA at closure, suitable open habitat may be more abundant than is currently available.

6.2.8.1.17 Lake Sturgeon

Analytical Assessment Techniques

Generally, quantitative approaches have been used to assess potential effects on lake sturgeon and their habitat. As it concerns lake sturgeon and their habitat it is noted that the analysis of potential project-related effects is focused on the Pic River (LSA, RSA). The Pic River is one of twelve Lake Superior tributaries that support lake sturgeon spawning. A recent, multiyear telemetry project was conducted on lake sturgeon in the Pic River to determine seasonal use and fidelity and identify factors contributing to entry or exit timing (Eccelstone et al., 2020). The study concluded that the Pic River provides seasonal habitat for lake sturgeon. Spawning and non-spawning sturgeon enter the river concurrently in the spring, returning to overwinter in Lake Superior. As described by Eccelstone et al. (2020), three distinct migration patterns are evident each year: (1) a number of tracked lake sturgeon (non-spawners) entered the river and remained within the lower portion of the Pic River (km 5 to km10, from the mouth) for all or part of the spring-summer months; (2) a number (non-spawners) entered the river and traveled upriver to the lower rapids 25 km upriver from Lake Superior (approximately 2 km downstream of the project site); and, (3) other individuals (spawners) tended to enter and ascend the river very quickly, usually reaching more upstream areas (km 97 to km 103, from the mouth) upriver from Lake Superior within 10 days of entering, remaining for a period of 10 to 15 days and then rapidly descended the river, spending a variable amount of time within the lower reaches of the river before returning to Lake Superior for the fall and winter.

Based on the current design of the Project, only indirect Project related effects are like to accrue, since no direct habitat overprinting or alterations on the Pic River, are planned. The MRSA is in relatively close proximity to the Pic River, but the setback from the river provides sufficient buffer to protect shoreline and riparian feature.

Potential Project-related effects therefore to be considered are indirect in nature and could be associated with the following:

- Changes to water quantity (flow or water level) - The effects have been assessed consistent with that detailed in Section 6.2.3.6.1 of this of this EIS Addendum (Vol 2). The impacts to water quantity associated with changes in surface drainage can indirectly impact lake sturgeon in the Pic River, as they have the potential to reduce flow volumes, velocities and water depth, thereby changing the overall wetted margins of water bodies and potentially available fish habitat. Expected changes to watersheds during the phases of mine life were delineated and compared to the watershed delineations from baseline on the basis of several indictors (e.g., Mean Annual Flow (MAF), Mean Monthly Flow (MMF). Change in MAF from pre-disturbance (environmental flow) conditions of > 10% was used as a screening threshold to determine whether further assessment of changes in flow were required. If the change in MAF was >10%, the MMF was compared with baseline environmental flows and a residual effect was identified if the predicted change in MMF was greater than 10% of the baseline environmental flows. Changes of less than 10% are not anticipated to be negligible in scale and within the variability seen in existing conditions.
- Use of explosives (blasting) - The potential effects on lake sturgeon due to blasting are considered by way of estimation of blasting setback requirements. Estimates of blasting setback distance requirements were undertaken for the construction phase (process solids management facility (PSMF) and on-site road construction) and operation phase (open pit construction including north and south pits) using a charge weight of 12.2 kg/delay and 384.17 kg/delay, respectively and assuming a rock substrate (see Section 6.2.2.6 of this EIS Addendum [Vol 2]).

- Changes in water quality - The analytical assessment of potential changes to water quality is detailed in Section 6.2.3.6.2 of this EIS Addendum (Vol 2) and the updated water quality assessment report (Appendix D11 of this EIS Addendum [Vol 2]). The assessment was carried out in a manner similar to that described in the original EIS submission, yet incorporating updated information as applicable, and covers all mine life phases. The predictions of surface water quality were then assessed against the background water quality and/or the most appropriate assessment benchmarks for the protection of aquatic life that would also be protective of lake sturgeon to characterize potential project-related effects. The results of this analysis were then used to identify the potential effects to fish and fish habitat as protection of aquatic biota by definition is inclusive of fish (for all life stages), their food sources and habitat.

Project Pathways

Project pathways may be associated with each phase of the mine life cycle.

Indirect habitat loss through changes in surface water quantity (flow) low could result from Project-related water management practices.

The detonation of explosives near water has the potential to cause lethal or sub-lethal effects on fish, including lake sturgeon, as rapid changes to water pressure or particle velocities in the substrates can result in morphological and physiological damage to fish, larvae and eggs.

The water that fish inhabit is the medium responsible for their ability to carrying out the majority of their life processes. An adverse change to the water quality in the aquatic environment can impact fish and fish habitat, including lake sturgeon.

Mitigation and Enhancement Measures

The principal mitigation strategies that will be employed to avoid effects on lake sturgeon and their habitat include the following:

- As it concerns changes to water quantity
    - Maintain existing drainage patterns as is possible so as not to alter natural hydrological patterns, while ensuring water quality is not adversely affected.
- As it concerns use of explosives (blasting)
    - Avoiding the use explosives within setback areas as determined by the DFO Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998).
- As it concerns changes in water quality

- Implement the site waste management, water management and erosion and sediment control strategies and ensure the measures associated with these strategies are maintained as applicable throughout the duration of the Project.

Project Residual Effect

Changes in Water Quantity

During the site preparation/construction and operations phases, water that would otherwise report to the Pic River from subwatersheds 101, 102 and 103 will be diverted to manage water pond (WMP). The change in flow to the Pic River will be negligible. Similarly, during the closure phase an incremental change will be noted in subwatershed 101, with water from the WMP and stormwater management pond diverted to this area. Again, the change in flow to the Pic River will be negligible. The change in river MAF, for all phases of the Project, is reported to be as less than or equal to 0.15% which would be practically indistinguishable from existing conditions (see Section 6.2.3.6.1 of this EIS Addendum (Vol 2) for further detail).

Based on the above, no residual effect is identified.

Use of Explosives

Blasting will occur during the site preparation and construction phase and throughout the operations phase. The use of explosives has the potential to produce instantaneous pressure changes that can cause damage to fish swim bladders and internal organs. Vibrations (PPV) from the use of explosives may also kill or damage fish eggs or larvae. Guideline thresholds have been identified by DFO for instantaneous pressure change (recommended 100 kPa) and PPV (13 millimeters/sec) and are used in this assessment. Calculations for instantaneous pressure changes and PPV were based on formulas from Wright and Hopky (1998).

Estimates of blasting setback distance requirements were undertaken for the construction phase (PSMF and on-site road construction) and operation phase (open pit construction including north and south pits) using a charge weight of 12.2 kg/delay and 384.17 kg/delay, respectively and assuming a rock substrate (see Noise Updated Effects Assessment – Appendix D2 of the EIS Addendum [Vol 2]). Table 6.2.8-6 summarizes the prescribed setback distances for both general fish habitat and spawning habitat.

Table 6.2.8-6: Estimate of Required Setback Distances for Blasting Activities

Phase	Activity	Location of Blast	Fish Habitat Type	Required Setback Distance (m)
Construction	PSMF / On-site road construction	Edge of PSMF / Edge of road right-of-way	General	18
			Spawning	53
Operation	Open pit extraction	Edge of open pit footprint	General	98
			Spawning	296

Notes:
Required setback distances estimates based on recommended thresholds of 100 kPa (instantaneous pressure change) and 13 millimeters/sec (PPV)
Estimates are based on the use charge weights of 12.2 kg/delay (Construction) and 384.17 kg/delay (Operation).

In all cases, the estimated setbacks to meet thresholds will be attainable, as it concerns the Pic River. The distance to the Pic River from blasting locations is expected to be, at minimum, on the order of one kilometer. Effects to lake sturgeon as a result of these activities are therefore not expected.

Based on the above, no residual effect, in consideration of proposed mitigation measures, has been identified.

Changes in Water Quality

During the site preparation and construction phase and the operations phase no releases are planned to the Pic River. A water collection and diversion system will be constructed at the MRSA. During these Project phases, both water that may be affected by the mobilization of suspended material or by the soluble/leachable products of mine rock stored in the MRSA will be collected and diverted to the WMP for management. As indicated above, under normal operating conditions there will be no Project-related releases to the Pic River and therefore no residual effects for site preparation and construction and operations phases have been identified.

During the closure phase, for planning purposes is has been proposed that the water collection and diversion system will be maintained for five years and therefore no Project-related releases to the Pic River will occur. After five years, the natural drainage patterns that are associated with the MRSA will be restored and water from subwatersheds 102 and 103 will report the Pic River, assuming the water quality has been deemed acceptable for release. Predictions of water quality during this period indicate that constituent concentrations in the Pic River will be below water quality benchmarks that are protective of aquatic life, including all life stages of Lake Sturgeon. Over the longer term, once the open pit reaches the elevation where it will overtop, water will be directed in a controlled fashion into subwatershed 103 and subsequently to the Pic River. Predictions of water quality during this period indicate that constituent concentrations in the Pic River will be below water quality benchmarks that are protective of aquatic life, including all life stages of Lake Sturgeon. Based on the above, no residual effect has been identified.

Determination of Significance

No residual Project-related effects on lake sturgeon have been identified. The changes in the pathways that have been identified by which Lake Surgeon and their habitat may be affected are expected to be negligible in scale.

6.2.8.7 Prediction Confidence

Overall confidence in the residual environmental effect and significance predictions for SAR and their habitat is high. This prediction confidence is based on consideration of the following:

- The potential environmental effects and effect mechanisms for the Project are known based on similar mining operations and other large construction projects and are well understood
- The mitigation measures are well understood and align with provincial standards and standard management practices
- The understanding of existing conditions is supported by high quality background information, including detailed FRI mapping, literature review, traditional knowledge studies/information and baseline reports from multiple years of field studies
- The assessment uses conservative assumptions and methods to increase the level of confidence, specifically:
    - The SSA, while assumed to be entirely cleared and developed in the assessment, includes areas that will not be physically altered
    - Although progressive revegetation will occur during operation, the analysis assumes that revegetation activities will only commence during the closure phase. Since progressive rehabilitation of wildlife habitat will occur, this is a conservative case scenario.

The Project effects on SAR habitat are quantified using GIS.

6.2.8.8 Summary of Project Residual Effects

A summary of residual environmental effects that are likely to occur because of the Project is provided in Table 6.2.8-7.

Table 6.2.8-7: Project Residual Effects on Species at Risk

Residual Effect	Residual Effects Characterization									
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological/ Societal Value	Significance Determination
Change to woodland caribou habitat and their habitat	C, O, D	A/P	N	L	LS	M	M	L	M	NS
Change to little brown myotis, northern myotis, and their habitat	C, O, D	A/P	N	N	NS	M	N	M	L	NS
Change to Canada warbler and their habitat	C, O, D	A	N	L	NS	M	M	M	L	NS
Change to Rusty blackbird and their habitat	C, O, D	A	N	N	NS	M	M	M	N	NS
Change to olive-sided flycatcher, east wood-pewee, evening grosbeak and their habitat	C, O, D	A	N	N	NS	M	M	M	N	NS
Change to common nighthawk, eastern whip-poor-will, and their habitat	C, O, D	A/P	N	N	NS	M	M	H	N	NS
Change to bald eagle, peregrine falcon, and their habitat	C, O, D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NS
Change to monarch and their habitat	C, O, D	A/P	N	N	NS	N	N	N	N	NS
Change to yellow-banded bumble bee and their habitat	C, O, D	A/P	N	N	LS	N	N	N	N	NS
Change to lake sturgeon habitat	C, O, D	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NS

Table 6.2.8-7: Project Residual Effects on Species at Risk

Residual Effect	Residual Effects Characterization									
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological/ Societal Value	Significance Determination
KEY See Section 2.5 of the EIS Addendum (Vol 1) and Table 6.2.8-2 for detailed definitions **Project Phase:** C: Site Preparation / Construction O: Operation D: Decommissioning **Direction:** P: Positive A: Adverse **Magnitude:** N: Negligible L: Low M: Medium H: High N/A: Not applicable	**Geographic Extent:** N: Negligible L: Low M: Medium H: High **Timing:** NS: No sensitivity MS: Medium sensitivity HS: High sensitivity **Duration:** N: Negligible L: Low M: Medium H: High **Significance Determination** S: Significant NS: Not Significant	**Frequency:** N: Negligible L: Low M: Medium H: High **Reversibility:** N: Negligible L: Low M: Medium H: High **Ecological / Societal Value:** N: Negligible L: Low M: Medium H: High								
Note: Timing was not included in the original EIS.										

6.2.8.9 References

Abbott, I.M., A. Berthinussen, E. Stone, M. Boonman, M. Melber, and J. Altringham. 2015. Bats and Roads. Pp. 290-299 *in* van der Ree, R., D.J. Smith, and C. Grilo [eds.]. Handbook of Road Ecology. John Wiley & Sons Ltd., Chichester, UK.

Abbot, I.M., F. Butler, and S. Harrison. 2012. When flyways meet highways – The relative permeability of different motorway crossing sites to functionally diverse bat species. Landscape and Urban Planning 106: 293-302.

Adams, L.G., R. Farnell, M.P. Oakley, T.S. Jung, L.L. Larocque, G.M. Lortie, J. Mclelland, M.E. Reid, G.H. Roffler, and D.E. Russell, 2019. Evaluation of maternal penning to improve calf survival in the Chisana caribou herd. Wildlife Monographs 204(1): pp.5-46.

Adams, M. D., B. S. Law, and K.O. French. 2005. Effect of lights on activity levels of forest bats: increasing the efficiency of surveys and species identification. Wildlife Research, 32:173–182.

Alexander, M. 2020. Imminent Extirpation of the Lake Superior Caribou. Ontario Nature Blog. Website: https://ontarionature.org/imminent-extirpation-of-the-lake-superior-caribou/ [accessed January 2021].

Armstrong, T. (E.R.), M. Gluck, G. Hooper, I. Mettam, G.D. Racey, and M. Rondeau. 2012. Caribou conservation and recovery in Ontario: development and implementation of the Caribou Conservation Plan. *Rangifer* Special Issue No. 20:145-157.

Alsheimer, L.R. 2011. The effect of artificial night lighting on the little brown bat (*Myotis lucifugus*). MSc. Thesis, State University of New Yorkz at Fredonia, NY. 35 pp.

Ball, J.R. and E.M. Bayne. 2014. Status of Canada warbler (*Cardellina candensis*) in Alberta. Alberta Wildlife Status Report No. 70. Prepared for Alberta Environment and Sustainable Resource Development and Alberta Conservation Association.

Ball, J.R., P. Sólymos, E.M. Bayne, T. Habib, D. Stepnisky, L. Mahon, F. Schmiegelow, S. Song, and S. Cumming. 2013. Determination of habitat associations and development of best management practices for Canada Warblers in mixed-wood boreal forests in Alberta. Unpublished report submitted to Habitat Stewardship Program for Sepcies at Risk, Environment Canada. 29 pp.

Ball, J.R., Sólymos, P., Schmiegelow, F.K.A., Haché, S., Schieck, J., Bayne, E.M., 2016. Regional habitat needs of a nationally listed species, Canada Warbler (*Cardellina canadensis*), in Alberta, Canada. Avian Conserv Ecol 11(2):10.

Banton, E., J. Johnson, H. Lee, G. Racey, P. Uhlig, & M. Wester. 2009. Ecosites of Ontario (Operational Draft). Ecological Land Classification Working Group; Ministry of Natural Resources.

Benton, T. 2006. Bumble bees. Harper-Collins, UK.

Bergerud, A.T., 2007. The need for the management of wolves — an open letter. Rangifer Special Issue No. 17:39-50.

Bergerud, A.T., and W.E. Mercer. 1989. Caribou introductions in eastern North America. Wildlife Society Bulletin 17:111-120.

Bergerud, A.T., W.J. Dalton, H. Butler, L. Camps, and R. Ferguson. 2007. Woodland Caribou persistence and extirpation in relic populations on Lake Superior. Rangifer Special Issue No. 17: 57-78.

Bergerud, A.T., B.E. McLaren, L. Krysl, K. Wade, and W. Wyett. 2014. Losing the predator-prey space race leads to extirpation of woodland caribou from Pukaskwa National Park. EcoScience 21(3-4): 1-13.

Berthinussen, A., and J. Altringham. 2012. The effect of a major road on bat activity and diversity. J. Appl. Ecol. 49:82-895

Bonsen, G., B. Law, and D. Ramp. 201. Foraging strategies determine the effect of traffic on bats. Acta Chiropterologica 17(2):347-357.

Boreal Avian Modelling Project (BAMP), 2021a. Canada Warbler. Website: https://borealbirds.github.io/species/CAWA [accessed January 2021].

Boreal Avian Modelling Project (BAMP), 2021b. Eastern Wood-Pewee. Website: https://borealbirds.github.io/species/EAWP [accessed January 2021].

Bridger, M. 2019. South Peace Caribou Recovery following Five Years of Experimental Wolf Reduction. British Columbian Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 29 pp.

Broders, H.G. and G.J. Forbes. 2004. Interspecific and intersexual variation in roost-site selection of northern long-eared and little brown bats in the Greater Fundy National Park Ecosystem. Journal of Wildlife Management 68(3):602-610.

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 in the Greater Fundy ecosystem, New Brunswick. Journal of Wildlife Management 70:1174– 1184.

Brook, R.K., M. Cattet, C.T. Darimont, P.C. Paquet, and G. 2015. Proulx. Maintaining ethical standards during conservation crises. Canadian Wildlife Biology & Management 4(1):72-79.

Caceres, C., and R. Barclay. 2000. *Myotis septentrionalis*. Mammalian Species. 634:1-3. American Society of Mammalogists.

Canadian Broadcasting Corporation (CBC). 2020. Still no plan from province on future of remaining Lake Superior caribou. Website: https://www.cbc.ca/news/canada/sudbury/lake-superior-caribou-population-plan-1.5853064 [accessed January 2021].

Carr, N.L., A.R. Rodgers, S.R. Kingston, P.N. Hettinga, L.M. Thompson, J.L. Renton, and P. Wilson. 2012. Comparative woodland caribou population surveys in Slate Islands Provincial Park, Ontario. Rangifer Special Issue No. 20:205-217.

Clare, E.L., B.R. Barber, B.W. Sweeney, P.D.N. Hebert and M.B. Fenton. 2011. Eating local: influences of habitat on the diet of little brown bats (*Myotis lucifugus*). Molecular Ecology doi: 10.1111/j.1365 294X.2011.05040.x.

Coleman, L.S., W.M. Ford, C.A. Dobony, and E.R. Britzke. 2014. Comparison of radio-telemetric home-range analysis for little brown bat habitat evaluation. Northeastern Naturalist 21: 431-445.

Conway, C.J. 1999. Canada Warbler (*Wilsonia canadensis*). In A. Poole and F. Gill (eds.). The Birds of North America, No. 421. The Birds of North America, Inc., Philadelphia, PA. 24 pp.

Corcoran, A.J. and C.F. Moss. 2017. Sensing in a noisy world: lessons from auditory specialists, echolocating bats. Journal Experimental Biology 220:4554-4566.

Cornell Lab of Ornithology. 2019. All About Birds – Evening Grosbeak. Cornell Lab of Ornithology, Ithaca, New York. Website: https://www.allaboutbirds.org/guide/Evening_Grosbeak/lifehistory [accessed January 2021].

COSEWIC. 2007. COSEWIC assessment and status report on the Olive-sided Flycatcher *Contopus cooperi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 25 pp.

COSEWIC. 2008. COSEWIC assessment and status report on the Canada Warbler *Wilsonia canadensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 35 pp.

COSEWIC. 2009. COSEWIC assessment and status report on the Whip-Poor-Will *Caprimulgus vociferus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 28 pp.

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.

COSEWIC. 2013. COSEWIC assessment and status report on the Little Brown Myotis *Myotis lucifugus*, northern myotis *Myotis septentrionalis* and tri-colored bat *Perimyotis subflavus* in Canada. Committee on the Status of Endangered Wildlife in Canada.br Ottawa. xxiv + 93 pp.

COSEWIC. 2015. COSEWIC assessment and status report on the Yellow-Banded Bumble Bee *Bombus terricola* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 60 pp.

COSEWIC. 2016a. COSEWIC assessment and status report on the Evening Grosbeak *Coccothraustes vespertinus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 64 pp.

COSEWIC. 2016b. COSEWIC assessment and status report on the Monarch *Danaus plexippus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 59 pp.

COSEWIC. 2017. COSEWIC assessment and status report on the Rusty Blackbird *Euphagus carolinus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 64 pp

Cox, S. 2020. The complicated tale of why B.C. paid $2 million to shoot wolves in endangered caribou habitat this winter. The Narwhal. April 25. Available at: https://thenarwhal.ca/the-complicated-tale-of-why-b-c-paid-2-million-to-shoot-wolves-in-endangered-caribou-habitat-this-winter/

Crampton, L.H. and R.M.R. Barclay. 1998. Selection of roosting and foraging habitat by bats in different aged aspen mixedwood stands. Conservation Biology 12(6):1347-1351.

Damus, M. 2007. Wind Plant Consequences to Butterflies – How Much Do We Know? In Tall Structures and Birds/Bats Information Group Volume 4, Issue 1.

Dodd, L. E., M. J. Lacki, E. R. Britzke, D. A. Buehler, P. D. Keyser, J. L. Larkin, A. D. Rodewald, T. B. Wigley, P. B. Wood, and L. K. Rieske. 2012. Forest structure affects trophic linkages: how silvicultural disturbance impacts bats and their insect prey. Forest Ecology and Management 267: 262-270.

Drake, C., M. Manseau, C.F.C. Klutsch, P.Priadka, P.J. Wilson, S. Kingston and N. Carr. 2018. Does connectivity exist for remnant boreal caribou (*Rangifer tarandus caribou*) along the Lake Superior Coastal Range? Options for landscape restoration. Rangifer 38(1):13-26.

Erkert, H.G. 1982. Ecological aspects of bat activity rhythms. Pp. 201-242 *in*: Kunz, T.H. (Ed.). Ecology of Bats. Plenum Press, New York NY.

Elkie, P., M. Gluck, J. Boos, J. Bowman, C. Daniel, J. Elliott, D. Etheridge, D. Heaman, G. Hooper, R. Kushneriuk, G. Lucking, S. Mills, B. Naylor, F. Pinto, B. Pond, R. Rempel, K. Ride, A. Smiegielski, G. Watt, and M.Woods. 2009. Science and information in support of the forest management guide for landscapes: Package “A” simulations, rationale and inputs. Ministry of Natural Resources. Forest Policy Section, Sault Ste. Marie, ON.

Environment Canada. 2008. Scientific review for the identification of critical habitat for woodland caribou (Rangifer tarandus caribou), boreal population, in Canada. August 2008. Ottawa: Environment Canada. 72 pp. plus 180 pp. appendices.

Environment Canada 2011. Scientific assessment to inform the identification of critical habitat for woodland caribou (*Rangifer tarandus caribou*), boreal population, in Canada: 2011 update. Ottawa. 102 pp. + app.

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 and Climate Change Canada (ECCC). 2016. Range

Plan Guidance for Woodland Caribou, Boreal Population. Species at Risk Act: Policies and Guidelines Series. Environment and Climate Change Canada, Ottawa. 26 pp.

Environment and Climate Change Canada (ECCC). 2016a. Management Plan for the Monarch (*Danaus plexippus*) in Canada. *Species at Risk Act* Management Plan Series. Environment and Climate Change Canada, Ottawa. iv + 45 pp.

Environment and Climate Change Canada (ECCC). 2016b. Range Plan Guidance for Woodland Caribou, Boreal Population. Species at Risk Act: Policies and Guidelines Series. Environment and Climate Change Canada, Ottawa. 26 pp.

Environment and Climate Change Canada (ECCC). 2016c. Recovery Strategy for the Canada Warbler (*Cardellina canadensis*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 56 pp.

Environment and Climate Change Canada (ECCC). 2016d. Recovery Strategy for the Olive-sided Flycatcher (*Contopus cooperi*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vii + 52 pp.

Environment and Climate Change Canada (ECCC). 2017. Report on the Progress of Recovery Strategy Implementation for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population in Canada for the Period 2012-2017. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. ix + 94 pp.

Environment and Climate Change Canada (ECCC). 2018. Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), the Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (*Perimyotis subflavus*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. ix + 172 pp.

Environment and Climate Change Canada. 2020. Amended Recovery Strategy for the Woodland Caribou (Rangifer tarandus caribou), Boreal population, in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. xiii + 143pp.

Fensome AG, Mathews F. 2016. Roads and bats: a meta-analysis and review of the evidence on vehicle collisions and barrier effects. Mammal Review 46:311–323.

Fenton, M. B. and R. Barclay. 1980. *Myotis lucifugus*. Mammalian Species No. 42 pp. 1-8. American Society Mammalogists.

Fortin, D., P.-L. Buono, A. Fortin, N. Courbin, C. T. Gingras, P. R. Moorcroft, R. Courtois, and C. Dussault. 2013. Movement responses of caribou to human-induced edges lead to their aggregation near anthropogenic features. American Naturalist 181: 827– 836.

Foster, R.F. 2014. East-West Tie Transmission Project Woodland Caribou 2014 Aerial Survey Field Summary Report. Unpublished report prepared for Dillon Consulting Ltd. by Northern Bioscience, Thunder Bay, ON. 16 pp.

Foster, R.F. 2015a. Gull Bay Shoreline Stabilization Project 2015 Whip-poor-will Surveys. Unpublished report for Hatch Ltd. by Northern Bioscience, Thunder Bay, ON. 13 pp.

Foster, R.F. 2015b. Phoenix Gold Project: 2015 Species at Risk Survey. Unpublished report for Rubicon Minerals Corporation by Northern Bioscience, Thunder Bay, ON. 15 pp.

Foster, R.F. 2019. Superior Lake Project 2019 Species at Risk Surveys. Unpublished report for Superior Lake Resources & Ophiolite Consultants Pty Limited by Northern Bioscience, Thunder Bay, ON. 65 pp.

Foster, R.F. 2020. East-West Tie March 2020 Aerial Survey. Unpublished report prepared for NextEra Energy Transmission - Canada NextEra Energy Canada, LP. by Northern Bioscience, Thunder Bay, ON. 30 pp.

Foster, R.F., G. Racey, and A.G. Harris. 2017. Evaluation of ecological land classification systems and description of biophysical attributes for three at-risk landbirds. Unpublished report prepared for Environment Canada by Northern Bioscience, Thunder Bay, ON. 79 pp. + app.

Francis, C.M. 2007. Rusty Blackbird. pp. 596-597 in Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier [eds.]. 2007. Atlas of the Breeding Birds of Ontario, 2001–2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ministry of Natural Resources, and Ontario Nature, Toronto, Ontario, xxii + 706 pp.

Frick, W.F, D.S. Reynolds, and T.H. Kunz. 2010. Influence of climate and reproductive timing on demography of little brown *Myotis lucifugus*. Journal of Animal Ecology 79:128–136.

Fryxell, J.M., T. Avgar, B. Lui, J.A. Baker, A.R. Rodgers, J. Shuter, I.D. Thompson, D.E.B. Reid, A.M. Kittle, A. Mosser, S.G. Newmaster, T.D. Nudds, G.M. Street, G.S. Brown, and B. Patterson. 2020. Anthropogenic disturbance and population viability of woodland caribou in Ontario. Journal of Wildlife Management 84(4):636-650.

Furlonger, C.L., Dewar, H.J., Fenton, M.B., 1.987. Habitat use by foraging insectivorous bats. Canadian Journal of Zoology 65: 284–288

Garroway CJ, Broders HG. 2007. Nonrandom association patterns at northern long-eared bat maternity roosts. Canadian Journal of Zoology 85: 956– 964.

Gaspésie Woodland Caribou Recovery Team (GWCRT). 2007. Gaspésie Woodland Caribou Recovery Plan (2002-2012) (*Rangifer tarandus caribou*) Update. 90 pp. Available at: https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/rs_gasp%C3%A9sie_woodland_caribou_0207_e.pdf

Gonzales, E.K., P. Nantel, A.R. Rodgers, M.L. Allen, and C.C. Drake. 2015. Decision-support model to explore the feasibility of using translocation to restore a woodland caribou population in Pukaskwa National Park, Canada. Rangifer 35 Special Issue No. 23: 27-48.

Green, K. 2020. Personal Communication. Email correspondence to R. Foster. October 29, 2020.

Greenberg, R. and S. M. Matsuoka. 2010. Special section: Rangewide ecology of the declining Rusty Blackbird, Rusty Blackbird: Mysteries of a species in decline. Condor 112(4):770-777.

Harding, L.E., M. Bourbonnais, A.T. Cook, T. S. Pribille, V. Wagner and C. Darimont. 2020. No statistical support for wolf control and maternal penning as conservation measures for endangered mountain caribou. Biodiversity and Conservation 29(3): 3051-3060.

Harris. A.G. and T. (E.R.) Armstrong. In press. An overview of experimental Gray Wolf (*Canis lupus*) poisoning programs in northern Ontario, 1956 to 1964. Canadian Field Naturalist.

Harris, A.G., and R.F. Foster. 2010. Kakabeka Falls GS 2009 Rare Plant and Bird Survey. Prepared for Ontario Power Generation by Northern Bioscience, Thunder Bay, ON. 43 pp.

Harris, A.G., R.F. Foster, L. Spenceley, and B. Ratcliff. 2019. Northwestern Ontario Bumble Bee Survey 2018. Unpublished report for the Ministry of Natural Resources and Forestry Species at Risk Stewardship Program by Northern Bioscience, Thunder Bay, ON. 40 pp.

Haeussler, U., and H. Erkert. 1978. Different direct effects of light intensity on the entrained activity rhythm in neotropical bats (Chiroptera, Phyllostomidae). Behav. Process. 3, 223–239.

Henderson, L. E. and H. G. Broders. 2008. Movements and resource selection of the Northern Long-Eared Myotis (*Myotis septentrionalis*) in a forest-agriculture landscape. Journal of Mammalogy 89(4):952-963.

Henry, M., D.W. Thomas, R. Vaudry, and M. Carrier. 2002. Foraging distances and home range of pregnant and lactating little brown bats (*Myotis lucifugus*). Journal of Mammalogy 83:767– 774.

Hervieux, D., M. Hebblewhite, D. Stepnisky, M. Bacon, and S. Boutin. 2014. Managing wolves (*Canis lupus*) to recover threatened woodland caribou (*Rangifer tarandus caribou*) in Alberta. Canadian Journal of Zoology 92:1029-1037.

InfoSuperior. 2017. Caribou, Ice and Wolves – Death Spiral? Website: https://infosuperior.com/blog/2017/11/30/caribou-ice-and-wolves-create-deadly-mix/ [accessed January 2021].

InfoSuperior. 2019. Lake Superior’s Iconic Caribou Population: Back from the Brink? Website: https://infosuperior.com/blog/2019/03/04/lake-superiors-iconic-caribou-population-back-from-the-brink/ [accessed January 2021].

Jaarsma, C.F., F. van Langevelde, and H. Botma. 2006. Flattened fauna and mitigation: Traffic victims related to road, traffic, vehicle, and species characteristics. Transportation Research part D 11: 264-276.

James, A. R. C., and A. K. Stuart-Smith. 2000. Distribution of caribou and wolves in relation to linear corridors. Journal of Wildlife Management 64: 154– 159.

Jung, T.S. 2020. Bats in the changing boreal forest: response to a megafire by endangered little brown bats (*Myotis lucifugus*). Écoscience 1(2):1-12.

Kalcounis, M., K. Hobson, M. Brigham, and K. Hecker. 1999. Bat activity in the boreal forest: Importance of stand type and vertical strata. Journal of Mammalogy 80:673-682.

Kalcounis-Rüppell, J.M. Psyllakis and R.M. Brigham. 1996. Tree roost selection by bats: an empirical synthesis using meta-analysis. Wildlife Society Bulletin 33(3):1123-1132.

Kerth G, C. Ebert, and C. Schmidtke. 2006. Group decision making in fission-fusion societies: evidence from two-field experiments in Bechstein's bats. Proceedings of the Royal Society B 273:2785–2790.

Kerth G, N. Perony, and F. Schweitzer. 2011. Bats are able to maintain long-term social relationships despite the high fission–fusion dynamics of their groups. Proceedings of the Royal Society B 278: 2761– 2767.

Kittle, A. M., M. Anderson, T. Avgar, J. A. Baker, G. S. Brown, J. Hagens, E. Iwachewski, S. Moffatt, A. Mosser, B. R. Patterson, et al. 2017. Landscape-level wolf space use is correlated with prey abundance, ease of mobility and the distribution of prey habitat. Ecosphere 8:e01783.

Kitzes, J., and A. Merenlender, 2014. Large roads reduce bat activity across multiple species. PLoS One 9: e96341.

Lacki, M. J., D. R. Cox, L. E. Dodd, and M. B. Dickinson. 2009. Response of Northern Bats (*Myotis septentrionalis*) to prescribed fires in Eastern Kentucky forests. Journal of Mammalogy 90(5): 1165-1175.

Laidlaw, G.W.J., and M.B. Fenton. 1971. Control of nursery colony populations of bats by artificial light. J. Wildl. Manage. 35, 843–846.

Luo, J., B-M Clarin, I.M. Borissov, and B. Siemes. 2014. Are torpid bats immune to anthropogenic noise? J. Experimental Biology 217:1072-1078.

Lattenkamp, E.Z., M. Nagy, M. Drexl, S.C. Vernes, L. Wiebgrebe, and M. Knörnschild. 2021. Hearing sensitivity and amplitude coding in bats are differentially shaped by echolocation calls and social calls. Proceedings of the Royal Society B: Biological Sciences.

Laverty, T.M. and L. Harder. 1988. The Bumble Bees of Eastern Canada. Canadian Entomologist 120: 965-987.

Lemen, C.A., P.W. Freeman, and J.A. White. 2016. Acoustic evidence of bats using rock crevices in winter: A call for more research on winter roosts in North America. Transactions of the Nebraska Academy of Sciences and Affiliated Societies. 506.

Lewanzik, D. and C.C. Voigt. 2017. Transition from conventional to light-emitting diode street lighting changes activity of urban bats. J. Applied Ecology 54: 264-271.

Lewis, S.E. 1995. Roost fidelity of bats: a review. Journal of Mammalogy 76:481-496.

Litvaitis, J.A. and J.P. Tash. 2008. An approach toward understanding wildlife-vehicle collisions. Environmental Management 42(4):688-697.

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

McDonald, N. 2021. 2021-2031 Forest Management Plan for the Pic Forest MU966. Nawiinginokiima Forest Management Corporation. Website: https://nrip.mnr.gov.on.ca/s/permit2/a0z3g0000004B6YAAU/subfm9662021fmp97?language=en_US [accessed January 2021].

McColm, L. 2020. Species at Risk Recovery Biologist, Ontario Ministry of the Environment, Conservation and Parks. Personal Communication. Email correspondence to R. Foster. October-December, 2020.

MacLaren, M.A. 2007. Eastern Wood-Pewee. pp. 340-3441 in Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier [eds.]. 2007. Atlas of the Breeding Birds of Ontario, 2001–2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ministry of Natural Resources, and Ontario Nature, Toronto, Ontario, xxii + 706 pp.

Medinas D, V. Ribeiro, J.F. Marques, B. Silva, A.M. Barbosa, H. Rebelo, and A. Mira. 2019. Road effects on bat activity depend on surrounding habitat. Sci Total Environ. 660:340–347.

Mills, A. 2007. Whip-poor-will. pp. 312-313. *In* Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Coutourier. Atlas of Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ministry of Natural Resources, and Ontario Nature. Toronto.

Ministry of Natural Resources (MNR). 2005a. Strategy for Wolf Conservation in Ontario. Ontario Strategy for Wolf Conservation in Ontario. Queen’s Printer for Ontario, Toronto. 10 pp.

Ministry of Natural Resources (MNR). 2005b. Backgrounder on Wolf Conservation in Ontario. Ministry of Natural Resources, Peterborough. 52 pp.

Ministry of Natural Resources (MNR). 2009a. Ontario’s Woodland Caribou Conservation Plan. Ministry of Natural Resources. Queen’s Printer for Ontario, Toronto. 21 pp.

Ministry of Natural Resources (MNR). 2009b. Cervid Ecological Framework. Ministry of Natural Resources, Peterborough. 18 pp.

Ministry of Natural Resources (MNR). 2010. Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales. Toronto: Queen's Printer for Ontario. 211 pp.

Ministry of Natural Resources (MNR). 2011a. Appendix 1: Assessing the Effects of the Proposed Marathon Platinum Group Metals and Copper Mine Project on Woodland Caribou.

Ministry of Natural Resources (MNR). 2011b. Bats and Bat Habitats: Guidelines for Wind Power Projects. Second Edition. Queen's Printer for Ontario.

Ministry of Natural Resources (MNR). 2013a. Best Management Practices for Mineral Exploration and Development Activities and Woodland Caribou in Ontario. 18 pp.

Ministry of Natural Resources (MNR). 2013b. Guiding Principles and Objectives for Offsetting Impacts to Woodland Caribou Marathon Platinum Group Metals and Copper Mine Project.

Ministry of Natural Resources (MNR) 2013c. General Habitat Description for the Forest-dwelling Woodland Caribou (*Rangifer tarandus caribou*). June 30, 2013. Queen's Printer for Ontario. 15 pp.

Ministry of Natural Resources (MNR). March 2014a. Forest Management Guide for Boreal Landscapes. Toronto: Queen's Printer for Ontario. 104 pp.

Ministry of Natural Resources and Forestry (MNRF). 2014b. Integrated Assessment Protocol for Woodland Caribou Ranges in Ontario. Species at Risk Branch, Thunder Bay Ontario, vii + 95 pp.

Ministry of Natural Resources and Forestry (MNRF). 2014c. Range Management Policy in Support of Woodland Caribou Conservation and Recovery. Species at Risk Branch, Thunder Bay Ontario, vii + 13 pp.

Ministry of Natural Resources and Forestry (MNRF). 2017. Survey protocol for species at risk bats within treed habitats: Little Brown Myotis, Northern Myotis & Tri-colored Bat. Guelph District. Draft April 2017. 13 pp.

Ministry of Natural Resources and Forestry (MNRF). 2018. Seeking Advice on the Future of Caribou in the Lake Superior Coast Range. Species at Risk Branch, Peterborough Ontario. 28 pp.

Ministry of Natural Resources and Forestry (MNRF). 2019. Forest health conditions in Ontario 2019. Website: https://www.ontario.ca/page/forest-health-conditions [accessed February 2021]. 170 pp.

Miot, C. 2019. Imported wolves settle in as Lake Superior island teems with moose. Science. American Association for the Advancement of Science. April 30, 2019. Website: https://www.sciencemag.org/news/2019/04/imported-wolves-settle-lake-superior-island-teems-moose. [accessed February 2021].

Moosman, P. R., H. H. Thomas, and J. P. Veilleux. 2012. Diet of the widespread insectivorous bats *Eptesicus fuscus* and *Myotis lucifugus* relative to climate and richness of bat communities. Journal of Mammalogy 93(2):491-496.

Neale, G. 2000. Effects of snow depth on seasonal home ranges and spatial separation of wolves, moose and woodland caribou in the greater Pukaskwa ecosystem, Ontario, Canada. M.Sc. Thesis. University of Montana, Missoula, Montana. 89 pp.

Neubam, D.J. 2018. Unsuspected retreat: autumn transitional roosts and presumed winter hibernacula of little brown myotis in Colorado. J. Mammology 99(6):1294–1306.

Nelson, J.J., and E.H. Gillam. 2017. Selection of foraging habitat by female little brown bats (*Myotis lucifugus*). Journal of Mammalogy 98:222– 231.

Newton, E. J., B. R. Patterson, M. L. Anderson, A. R. Rodgers, L. M. Vander Vennen, and J. M. Fryxell. 2017. Compensatory selection for roads over natural linear features by wolves in northern Ontario: implications for caribou conservation. PLoS ONE 12:e0186525.

Norquay, K.J.O., F. Martinez-Nunez, J.E. Dubois, K. Monson, and C.K.R. Willis. CKR. 2013. Long-distance movements of little brown bats (*Myotis lucifugus*). Journal of Mammalogy 94: 506– 515.

Northern Bioscience. 2012a. Marathon PGM Terrestrial Baseline Assessment 2009. (SID #24) (CIAR #227). Marathon PGM-Cu Project. Prepared for Stillwater Canada Inc. by Northern Bioscience, Thunder Bay, ON. 79 pp.

Northern Bioscience. Foster. 2012b. Stillwater PGM-Cu Project Bird Studies. (SID# 25) (CIAR #234) Marathon PGM-Cu Project. Prepared for Stillwater Canada Inc. by Northern Bioscience, Thunder Bay, ON. 84 pp.

Northern Bioscience. 2012c. Marathon Platinum Group Metals and Copper Mine Project Woodland Caribou Impact Assessment. (SID #26) (CIAR #234). Unpublished report prepared for Stillwater Canada Inc. by Northern Bioscience, Thunder Bay, ON. 95 pp.

Northern Bioscience. 2014. Stillwater PGM-CU Project Proposed Caribou Habitat Off-site Mitigation. Supplementary Information Document (CIAR #671). Unpublished report prepared for Stillwater Canada Inc. by Northern Bioscience, Thunder Bay, ON. 74 pp.

Northern Bioscience. 2020. Marathon Palladium Project Terrestrial Environment Baseline Report Update. (CIAR #722). Report prepared for Generation PGM Inc. by Northern Bioscience, Thunder Bay, ON. 109 pp.

Norton, M.R., and S.J. Hannon. 1977. Songbird response to partial-cut logging in the boreal mixedwood forest of Albert. Canadian Journal of Forest Research 27:44-53.

Olson, C.R., and R.M. Barclay. 2013. Concurrent changes in group size and roost use by reproductive female little brown bats (*Myotis lucifugus*). Canadian Journal of Zoology 91:149–155.

Ontario Federation of Anglers and Hunters (OFAH). 2018. EBR Registry Number 013-2587: Seeking Advice on the Future of Caribou in the Lake Superior Coast Range. 3 pp. Available at: https://www.ofah.org/wp-content/uploads/2018/05/Stuart-EBR-013-2587-308C-794-may03-18.pdf

Owen, S.F., M.A. Menzel, W.M. Ford, J.W. Edwards, B.R. Chapman, K.V. Miller, and P.B. Wood. 2002. Roost Tree Selection by Maternal Colonies of Northern Long eared Myotis in an Intensively Managed Forest. Published by USDA Forest Service, Newtown Square PA, March 2002.

Parks Canada Agency. 2017. Multi-species Action Plan for Pukaskwa National Park of Canada. Species at Risk Act Action Plan Series. Parks Canada Agency, Ottawa. iv + 22 pp.

Patterson, L.D., 2020. Ecologist Team Leader, Pukaskwa National Park. Email communication to R. Foster. October 2020.

Patterson, L.D., C.C. Drake, M.L. Allen, and L. Parent, 2014. Detecting a population decline of Woodland Caribou (*Rangifer tarandus caribou*) from non-standardized monitoring data in Pukaskwa National Park, Ontario. Wildlife Society Bulletin 38(2): 348-357.

Randall. L.A., T.S. Jung, R.M.R. Barclay. 2014. Roost-site selection and movements of little brown myotis (*Myotis lucifugus*) in southwestern Yukon. Northwestern Naturalist 95:312– 317.

Ratcliffe, J. M. and J. W. Dawson. 2003. Behavioural flexibility: the little brown bat, *Myotis lucifugus*, and the northern long-eared bat, *M. septentrionalis*, both glean and hawk prey. Animal Behaviour 66(5):847-856.

Rowse E.G., D. Lewanzik, E.L. Stone, S. Harris, and G. Jones. 2016. Dark Matters: The Effects of Artificial Lighting on Bats. *In* Voigt C., Kingston T. (eds) Bats in the Anthropocene: Conservation of Bats in a Changing World. Springer, Cham.

Russell A.L., C.M. Butchkoski, L. Saidak, and G.F. McCracken. 2009. Road-killed bats, highway design, and the commuting ecology of bats. Endangered Species Res 8:49–60.

Russell, D. 2010. A review of wolf management programs in Alaska, Yukon, British Columbia, Alberta and Northwest Territories. Unpublished report prepared for Yukon Wolf Conservation and Management Plan Review Committee by Shadow Lake Environmental Consulting. 47 pp.

Rydell, J., 1992. Exploitation of insects around streetlamps by bats in Sweden. Funct. Ecol. 6: 744–750.

Sandilands, A. 2007. Common Nighthawk. pp. 308-309. *In* Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Coutourier. Atlas of Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ministry of Natural Resources, and Ontario Nature. Toronto.

Sandilands, A. 2010. Birds of Ontario: Habitat Requirements, limiting Factors, and Status. Nonpasserines: Shorebirds through woodpeckers. UBC Press., Vancouver, BC. 387 pp.

Schaefer, J.A. 2003. Long-term range recession and the persistence of caribou in the taiga. Conservation Biology 17(5):1435–1439.

Segers, J. and H. Broders. 2014. Interspecific effects of forest fragmentation on bats. Canadian Journal of Zoology 92(8):665-673.

Serrouya, R., B. N. McLellan, H. van Oort, G. Mowat, and S. Boutin. 2017. Experimental moose reduction lowers wolf density and stops decline of endangered caribou. PeerJ 5:e3736.

Serrouya, R., D. R. Seip, D. Hervieux, B. N. McLellan, R. S. McNay, R. Steenweg, D. C. Heard, M. Hebblewhite, M.P. Gillingham, and S. Boutin. 2019. Saving endangered species using adaptive management. Proceedings of the National Academy of Science 116:6181–6186.

Shuter, J., N.C. Assalin, and A. Rodgers. 2018. Results of the 2016 Lake Superior Coast Range (LSCR) caribou (*Rangifer tarandus caribou*) aerial survey. Unpublished report Ministry of Natural Resources and Forestry & Parks Canada. 35 pp.

Sleep, D.J.H., M.C. Drever, and K.J. Szuba. 2009. Potential role of spruce budworm in range-wide decline of Canada warbler. Journal of Wildlife Management. 73(4):546–555.

Slough, B.G. and T.S. Jung. 2008. Observations on the natural history of bats in the Yukon. Northern Review 29:127-150.

Slough, B.G. and T.S. Jung. 2020. Little brown bats utilize multiple maternity roosts within foraging areas – implications for identifying summer habitat. Journal of Fish and Wildlife Management 11(1): 311-320.

SooToday. 2021. Former MNRF biologist calling for mainland caribou rescue along Lake Superior. Website: https://www.sootoday.com/local-news/former-mnrf-biologist-calling-for-mainland-caribou-rescue-along-lake-superior-3289136 [accessed January 2021].

Stone, E.L., G. Jones, and S. Harris. 2009. Street lighting disturbs commuting bats. Curr. Biol. 19:1123–1127.

Stone, E.L., G. Jones, and S. Harris. 2012. Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. Glob. Change Biol. 18:2458–2465.

Stone, E.L., S. Harris, and G. Jones. 2015. Impacts of artificial lights on bats: a review of challenges and solutions. Mammalian Biology 80:213–219.

SuperiorCaribou. 2021. The Lake Superior Caribou Updated 21/01/19. Website: http://lakesuperiorcaribou.ca/documents/update210119.pdf [accessed January 2021].

The Toronto Star. 2019. Website: https://www.thestar.com/news/canada/2019/12/11/conservationists-criticize-quebec-plan-to-protect-caribou-by-killing-wolves.html [accessed January 2021].

Thomas J.P., and T.S. Jung. 2019. Life in a northern town: rural villages in the boreal forest are islands of habitat for an endangered bat. Ecosphere 10:e02563.

Thomas, H. H., P. R. Moosman, J. P. Veilleux, and J. Holt. 2012. Foods of bats (Family Vespertilionidae) at five locations in New Hampshire and Massachusetts. The Canadian Field-Naturalist 126(2): 117-124.

Thompson, L.M., C.F.C. Klutsch, M. Manseau, and P.J. Wilson. 2019. Spatial differences in genetic diversity and northward migration suggest genetic erosion along the boreal caribou southern range limit and continued range retraction. Ecology and Evolution 00:1-17.

van Zyll de Jong, C. G. 1985. Handbook of Canadian Mammals: Bats. National Museum of Natural Sciences. Ottawa, ON. 212 pp.

Watt, R. and M. Caceres. 1999. Managing snags in the boreal forests of northeastern Ontario. MNR, Northeast Science & Technology. TN-016. 20 pp.

Watt, D. J., J. P. McCarty, S. W. Kendrick, F. L. Newell, and P. Pyle. 2018. Eastern Wood-Pewee (*Contopus virens*), version 2.0. *in* The Birds of North America (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.eawpew.02

Westwood, A., L. Reitsma, and D. Lambert. 2017. Prioritizing Areas for Canada Warbler Conservation and Management in the Atlantic Northern Forest of Canada. High Branch Conservation Services. Hartland, VT.

White-Nose Syndrome Response Team (WNS RT). 2019. White-Nose Syndrome Occurrence by Count/District. Website: https://www.whitenosesyndrome.org/static-spread-map/july-5-2019 [accessed January 2021].

Wildlife Informetrics. 2019. Maternal Penning to Enhance Survival of Caribou within the Klinse-Za Herd. Website: http://www.bcogris.ca/sites/default/files/update-maternal-penning-klinse-za190418.pdf [accessed January 2021].

Wildlife Infometrics. 2020. The Klinse-Za caribou maternity pen. Website: https://wildlifeinfometrics.com/project/klinse-za-caribou-maternity-pen/ [accessed January 2021].

Wilcox, A. and C.K.R. Willis. 2016. Energetic benefits of enhanced summer roosting habitat for little brown bats (*Myotis lucifugus*) recovering from white-nose syndrome. Conserv. Physiol. 4: doi:10.1093/conphys/cov070.

Willis C.K.R. and R.M. Brigham. 2004. Roost switching, roost sharing and social cohesion: forest-dwelling big brown bats, conform to the fission-fusion model. Animal Behaviour 68: 495–505.

Zurcher, A.A., Sparks, D.W., Bennett, V.J., 2010. Why did the bat not cross the road? Acta Chiropterol. 12(2):337-340.