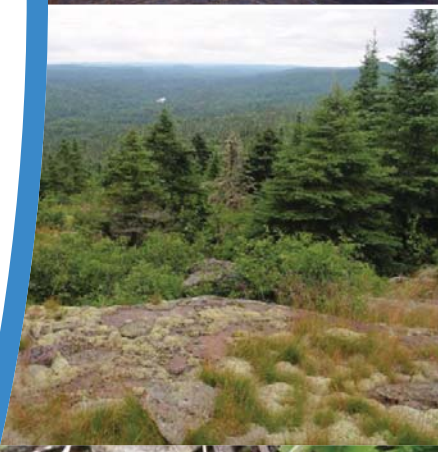
ENVIRONMENTAL ASSESSMENT FOR THE MARATHON PGM-Cu PROJECT AT MARATHON, ONTARIO



STILLWATER CANADA INC. MARATHON PGM-Cu PROJECT

SUPPORTING INFORMATION DOCUMENT No. 26 - MARATHON PGM-Cu PROJECT - ASSESSMENT OF IMPACTS ON WOODLAND CARIBOU

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MARATHON PLATINUM GROUP METALS AND COPPER MINE PROJECT

Woodland Caribou Impact Assessment

July 19, 2012

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EXECUTIVE SUMMARY

Forest-dwelling woodland caribou (*Rangifer tarandus caribou*) are listed as Threatened under both federal and provincial species at risk legislation. They are the focus of a provincial conservation plan. Woodland caribou range and abundance in Ontario have declined, mainly due to anthropogenic disturbance and associated changes in alternate prey and predator abundance. Across the north shore of Lake Superior, they are now almost entirely restricted to isolated populations in protected areas. The largest populations, approximately 100 and 400 individuals respectively, are found within Slate Islands and Michipicoten Island provincial parks, both of which lack large predators. Pukaskwa National Parks' population has declined from approximately 30 caribou in the 1970s to an estimated four currently, largely due to predation by wolves and possibly black bears. An estimated 8 to 15 caribou still use Pic Island in Neys Provincial Park and adjacent mainland at least part of the year, down from approximately 80 in the 1970s.

The OMNR has designated a 10-km wide strip along the north shore of Lake Superior as the "Lake Superior Coastal Range". The Stillwater Marathon PGM-Cu project site is in this range. North of this 10-km wide coastal strip is an area designated by the MNR as the "Upper Lake Superior Uplands Linkage", where the main conservation intent is to maintain and enhance connectivity between the coastal range and caribou ranges to the north.

The Marathon PGM-Cu Project site has no documented historic or current use by woodland caribou as indicated by OMNR records, surveys conducted during the present study, and traditional ecological knowledge provided to Stillwater for this EIS. The Project is expected to have limited impact on caribou habitat. There is no known calving or nursery habitat near the Project; the two islands on Bamoos Lake to the north of the Project are unsuitable primarily due to their small size and proximity to the mainland. There is no preferred winter habitat on the project site due to the low abundance of mature, conifer-dominated forests as well as other landscape attributes. Although atypical, it is possible that caribou could use small, lichen-rich openings on some of the bedrock hills near the Project, but there is no evidence of past or current use. Approximately 360 ha of potential caribou refuge habitat is within 500 m of the Project, of which 88 ha overlaps the proposed pits, rock stockpile, or process solids management facility (tailings). However, all but 12 ha of potential refuge habitat is in what is considered by OMNR and Environment Canada models as disturbed habitat (i.e., within the existing 500 m of existing disturbance). The potential refuge habitat found in scattered patches on the site, mainly near the highway and Pic River, and the abundance of predators and alternate prey on the site further reduces its suitability for use by woodland caribou. Refuge

habitat is abundant elsewhere in the adjacent “coastal” and “discontinuous” ranges. The vast majority of the Project site is already considered disturbed by OMNR’s range assessment protocol; the proposed project would add approximately 258 ha of new disturbance. All but 12 ha of potential refuge habitat is already considered disturbed by OMNR. This represents 0.07% of additional disturbance on a range-wide basis.

OMNR has expressed some concern that the Project may impede connectivity for caribou now or in the future within the coastal range and between the coastal range and caribou ranges farther north. There is no evidence that caribou moved through the Marathon PGM-Cu Project site in the past, nor any evidence of recent passage through the site. We have concluded that the project is unlikely to impede movement of caribou in any meaningful way, given their very low and declining numbers and high mobility, the relatively undisturbed landscape immediately north of the Project site, and the various options that will remain for caribou to traverse or bypass the site. Nonetheless, the possibility is acknowledged.

In our professional judgment, significant residual effects on caribou are unlikely. Effects, if any, are anticipated to be of low magnitude, small spatial extent, and largely reversible, with duration that would not extend for long past closure.

We believe there are opportunities for Stillwater to ensure overall benefit for woodland caribou in the coastal range by contributing to monitoring of caribou movement, and from measures such as enhanced silviculture and road decommissioning elsewhere in the range that caribou are known to use. This report makes recommendations in that regard.

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1 INTRODUCTION

Stillwater Canada Inc. (SCI) proposes to develop a platinum group metals (PGMs), copper (Cu) and possibly iron (Fe) open-pit mine and milling operation near Marathon, Ontario. A Notice of Commencement (NoC) of an environmental assessment (EA) in relation to the proposed Marathon PGM-Cu Project (the "Project") was filed by the Canadian Environmental Assessment Agency (CEA Agency) under Section 5 of the Canadian Environmental Assessment Act on April 29, 2010 (updated July 19, 2010).

The EA was referred to an independent Review Panel by the Federal Minister of the Environment on October 7, 2010. On March 23, 2011 SCI entered into a Voluntary Agreement (VA) with the Province of Ontario to have the Project subject to the Ontario Environmental Assessment Act (OEA Act). This agreement was the instrument that permitted the provincial government to issue a Harmonization Order (HO) under Section 18(2) of the Canada-Ontario Agreement on Environmental Assessment Cooperation to establish a Joint Review Panel for the Project between the Minister of the Environment, Canada and the Minister of the Environment, Ontario.

The HO was issued on March 25, 2011. The Terms of Reference (ToR) for the Project Environmental Impact Statement (EIS) and the agreement establishing the Joint Review Panel (JRP) were issued on August 8, 2011.

The following provides an overview of the proposed development including its location, surrounding land uses, the exploration history of the site and the primary conceptual features of the mining and milling facilities. The information provided below, in the Environmental Impact Statement Report and supporting technical studies is based on the conceptual mine design for the Project. The conceptual design provides planning level information for the environmental assessment process. Final detailed design will commence following EA approval in concordance with the concepts presented herein.

1.1 Project Location

The Project is located approximately 10 km north of the Town of Marathon, Ontario (Figure 1). The town, with a population of 3,353 (2011 Census), is situated adjacent to the Trans-Canada Highway 17 (Hwy 17) on the northeast shore of Lake Superior, about 300 km east and 400 km northwest (by highway) of Thunder Bay and Sault Ste. Marie, respectively.

The centre of the Project footprint sits at approximately 48° 47' N latitude and 86° 19' W longitude. The Project site is in an area characterized by relatively dense vegetation, comprised

largely of a birch and, to a lesser extent, spruce-dominated mixed wood forest. The terrain is moderate to steep, with frequent bedrock outcrops and prominent east to west oriented valleys. The climate of this area is typical of northern areas within the Canadian Shield, with long winters and short, warm summers.

Figure 1. Location of the Proposed Marathon PGM-Cu Project Site near Marathon, Ontario.

1.2 Surrounding Land Uses

The Project site lies partially within the municipal boundaries of the Town of Marathon, as well as partially within the unorganized townships of Pic, O'Neil and McCoy. The primary zoning designation within the Project Site is 'rural'.

In the immediate vicinity of the Project there are several authorized aggregate sites, including SCI's licensed aggregate site located to the northeast of Hwy 17 along the existing site access road (Camp 19 Road).

The Marathon Municipal Airport (CYSP), which operates as a Registered Airport (Aerodrome class) under the Canadian Aviation Regulations (CARs; Subsection 302), is adjacent to, and south of the Project site. The airport occupies a land area of approximately 219 hectares and is accessed from Hwy 17.

Several First Nations and Métis peoples claim the Project site as falling within their traditional land use boundaries. Based on Aboriginal accounts, prior to the construction of the forestry road, the land and water uses associated with (or close to) the site would have typically been limited to the Pic River corridor, the Bamoos Lake-Hare Lake-Lake Superior corridor and the Lake Superior shoreline and near-shore area, rather than the interior of the Project site. Traditional land and water uses (or rights conferred by Treaty) that can be ascribed to the site could include:

- Hunting;
- Trapping;
- Fishing; and,
- Plant harvesting for food, cultural and medicinal uses.

Primary industries supporting the Town of Marathon, as well as the region, have historically been forestry, pulp and paper, mining and tourism. The Project site is located within the Big Pic Forest Management Area. The Big Pic Forest includes Crown land east and north of Lake Superior and is generally north, south and west of the community of Manitouwadge and includes the communities of Marathon, Caramat and Hillsport.

Until July 2010 the forest was managed under the authority of a Sustainable Forest License (SFL), which was held by Marathon Pulp Inc. This SFL was revoked, with the forest reverting to the Crown as a Crown Forest. Until recently, Marathon Pulp Inc. (MPI) operated a kraft pulp mill in Marathon on the shore of Peninsula Harbour. The mill announced its indefinite shut down (effective at the end of February 2009) on February 11, 2009, and as a result there has

been a significant downturn in the local economy. A second mill operated in Terrace Bay was temporarily closed in December 2011.

The Hemlo Mining Camp is located 30 km to the southeast. There are currently two mines in production at the Camp (David Bell Mine, Williams Mine), which are estimated to be in operations until 2025.

1.3 Exploration History of the Site

Exploration for copper and nickel deposits on the Project site started in the 1920s and continued until the 1940s with the discovery of titaniferous magnetite and disseminated chalcopyrite occurrences. During the past four decades, the site has undergone several phases of exploration and economic evaluation, including geophysical surveys, prospecting, trenching, diamond drill programs, geological studies, resource estimates, metallurgical studies, mining studies, and economic analyses. These studies have successively enhanced the knowledge base of the deposit.

In 1963, Anaconda acquired the Marathon property and carried out systematic exploration work including diamond drilling of 36,531 m in 173 drill holes. This culminated in the discovery of a large copper-PGM deposit. Anaconda discontinued further work on the project in the early 1980s due to low metal prices at the time.

In 1985, Fleck purchased a 100% interest in the Marathon PGM-Cu Project with the objective of improving the project economics by focusing on the platinum group element (PGE) values of the deposit. The Fleck drilling totaled 3,615 m in 37 diamond drill holes. In 1986, H.A. Symons carried out a feasibility study for Fleck based on a 9,000 tonnes per day conventional flotation plant with marketing of copper concentrate and Kilborn Limited carried out a prefeasibility review for Fleck that included preliminary results from the Lakefield pilot plant tests (Kilborn Limited, 1987). The feasibility study indicated a low internal rate of return which was confirmed by Teck Corporation who concluded the project was uneconomic due to low metal prices at the time. On June 10, 1998, Fleck changed its name to PolyMet Mining Corp.

In 2000, Geomaque acquired certain rights to the Marathon PGM-Cu Project through an option agreement with Polymet. Geomaque and its consultants carried out a study of the economic potential of the Marathon PGM-Cu Project. The study included a review of the geology and drill hole database, interpretation of the mineralized zones, statistics and geostatistics, computerized block model, resource estimation, open pit design and optimization, metallurgy, process design, environmental aspects, capital and operating cost.

Marathon PGM Corp. acquired the Marathon PGM-Cu deposit from Polymet in December 2003. Marathon PGM Corp. funded programs of advanced exploration and diamond drilling on a continuous basis between June 2004 and 2009. Approximately 320 holes and 65,000 m were drilled from 2007 to 2009 to define and expand the resource and for condemnation holes outside of the pit area. A feasibility study was published in 2008 and updated in January 2010.

Stillwater Mining Company (SWC) and Marathon PGM entered into an agreement on September 7, 2010 pursuant to which SWC would acquire all of the outstanding shares of Marathon PGM. The acquisition agreement received ministerial approval under the Investment Canada Act on November 24, 2010 and the agreement closed on November 30, 2010. On December 31, 2010 Stillwater Mining Company formed a Canadian corporation, Stillwater Canada Inc. In March 2012, MC MINING LTD (MC) purchased 25% interest in Stillwater Canada Inc. who is the proponent of the Marathon PGM-Cu Project.

1.4 Project Overview

The Project is based on the development of an open pit mining and milling operation. The conceptual general layout of the components of the mine site, the transmission line corridor and access road is provided in Figure 3 below. One primary pit and a satellite pit complex to the south (currently envisaged to be comprised of four satellite pits) are proposed to be mined. Ore will be processed (crushed, ground, concentrated) at an on-site processing facility. Final concentrates containing copper and platinum group metals will be transported off-site via road and/or rail to a smelter and refinery for subsequent metal extraction and separation. The total mineral reserve (proven and probable) is estimated to be approximately 91.5 million tonnes. It is possible that an iron concentrate may also be produced, depending upon the results of further metallurgical testing and market conditions at that time.

During the operations phase of the Project, ore will be fed to the mill at an average rate of approximately 22,000 tonnes per day. The operating life of the mine is estimated to be approximately 11.5 years. The construction workforce will average approximately 400 people and will be required for between 18 and 24 months. During operations the work force will comprise an estimated 365 workers. The mine workforce will reside in local and surrounding communities, as well as in an Accommodations Complex that will be constructed in the Town of Marathon.

Approximately 288 million tonnes of mine rock[1] will be excavated. It is estimated that between eighty five to ninety percent of this material is non-acid generating (NAG) and will be

[1] Mine rock is rock that has been excavated from active mining areas but does not have sufficient ore grades to process for mineral extraction.

permanently stored in a purposefully built Mine Rock Storage Area (MRSA) located east of the primary pit. The NAG or so-called Type 1 mine rock will also be used in the construction of access roads, dams and other site infrastructure as needed. Drainage from the MRSA will be collected, stored, treated and discharged as necessary to the Pic River. During mine operations, about 20 million tonnes of mine rock could have the potential to generate acid if left exposed for extended periods of time. This mine rock is referred to as Type 2 mine rock or potentially acid generating (PAG). The Type 2 mine rock will be managed on surface during mine operations in temporary stock piles with drainage directed into the open pits. This material will be relocated to the bottom of the primary and satellite pits and covered with water to prevent potential acid generation and covered with Type 1 materials.

Process solids[2] will be managed in the Process Solids Management Facility (PSMF), as well as in the satellite pit complex. The PSMF will be designed to hold approximately 61 million m^3 of material, and its creation will require the construction of dams. Two streams of process solids will be generated. An estimated 85 to 90% of the total amount of process solids produced will be non-acid generating, or so-called Type 1 process solids. The remaining ten to fifteen percent of the process solids could be potentially acid generating and referred to as Type 2 process solids. The Type 2 process solids will be stored below the water table in the PSMF or below water in the pits to mitigate potential acid generation and covered with Type 1materials. Water collected within the PSMF, as well as water collected around the mine site other than from the MRSA will be managed in the PSMF for eventual reclamation in the milling process. Excess water not needed in the mill will be discharged, following treatment as is necessary, to Hare Lake.

Access to the Project site is currently provided by the Camp 19 Road, opposite Peninsula Road at Hwy 17. The existing road runs east towards the Pic River before turning north along the river to the Project site (approximately 8 km). The existing road will be upgraded and utilized from its junction with Hwy 17 for approximately 2.0 km. At this point a new road running north will be constructed to the future plant site. The primary rationale for developing the new road is to move traffic away from the Pic River. The new section of road will link two sections of forest access roads located on the site.

Power to the Project site will be provided via a new 115 kV transmission line that will be constructed from a junction point on the Terrace Bay-Manitouwadge transmission line (M2W Line) located to the northwest of the primary pit. The new transmission line will run

[2] Process solids are solids generated during the ore milling process following extraction of the ore (minerals) from the host material.

approximately 4.1 km to a substation at the mill site. The width of the transmission corridor will be approximately 30 m.

Disturbed areas of the Project footprint will be reclaimed in a progressive manner during all Project phases. Natural drainage patterns will be restored as much as possible. The ultimate goal of mine decommissioning will be to reclaim land within the Project footprint to permit future use by resident biota and as determined through consultation with the public, Aboriginal peoples and government. A certified Closure Plan for the Project will be prepared as required by Ontario Regulation (O.Reg.) 240/00 as amended by O.Reg.194/06 "Mine Development and Closure under Part VII of the Mining Act" and "Mine Rehabilitation Code of Ontario".
Maps showing the existing features and topography of the site, as well as the proposed conceptual development of the site are provided in Figure 2 and 3 below.

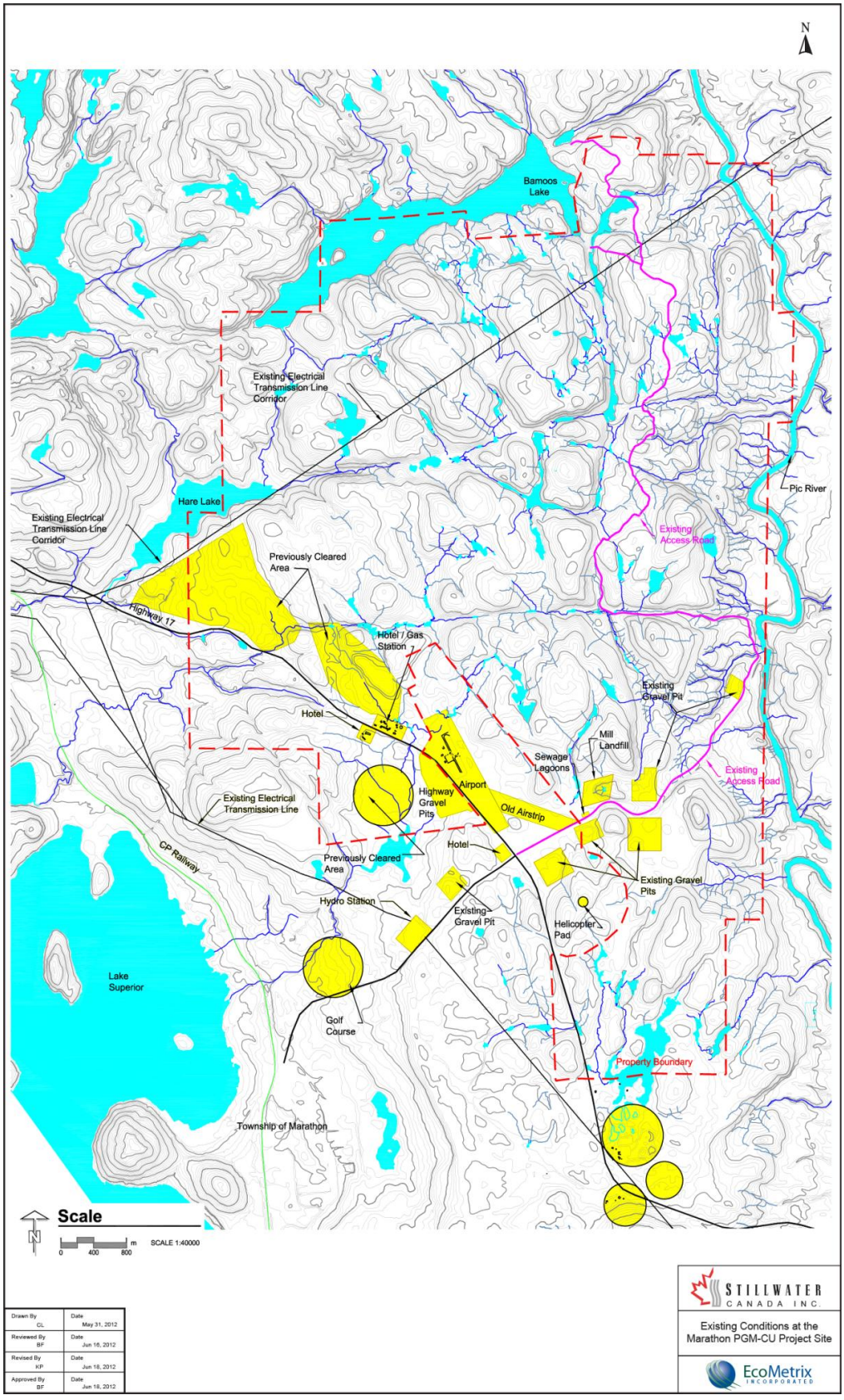

Figure 2. Existing Conditions at the Marathon PGM-Cu Project Site

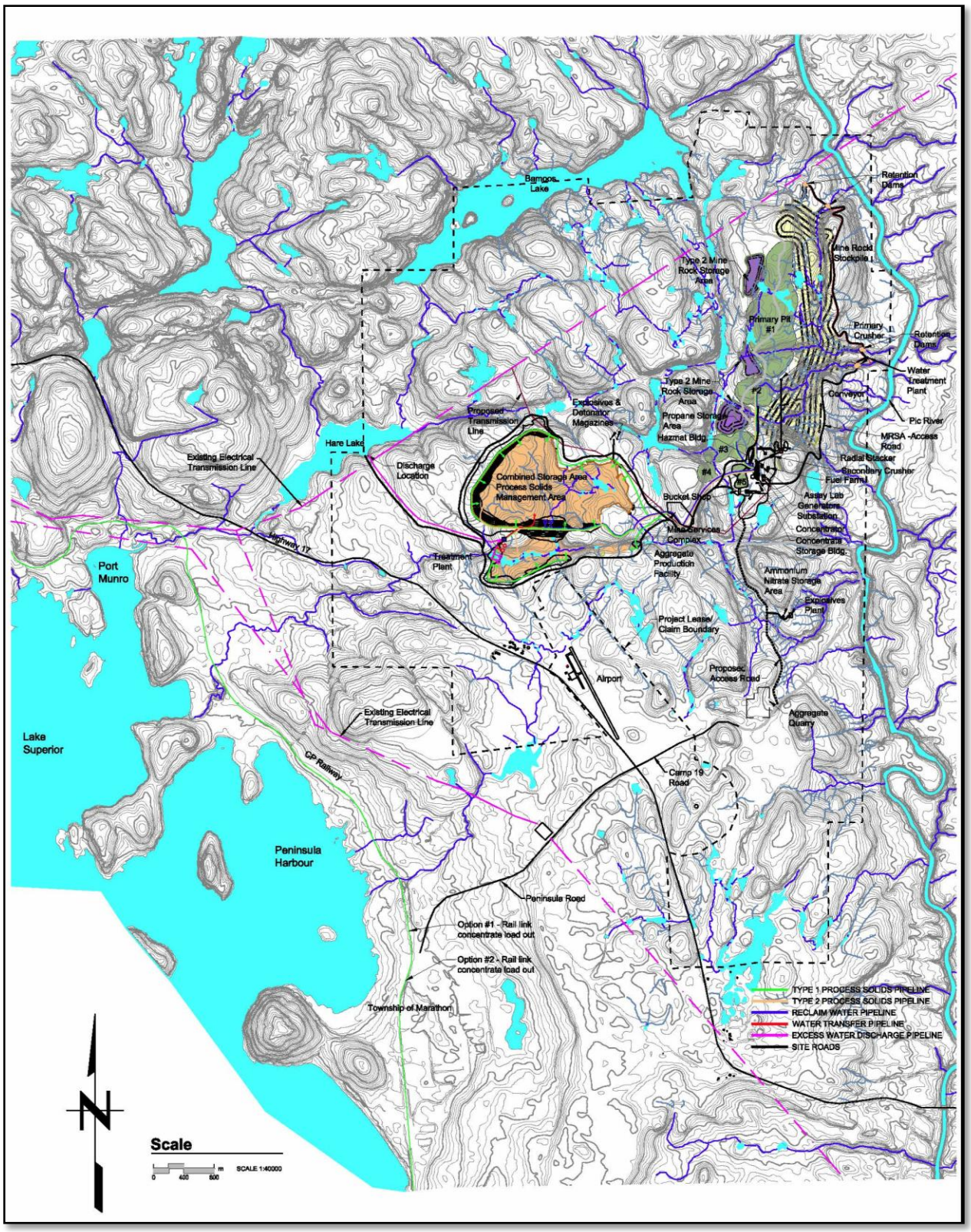

Figure 3. Marathon PGM-Cu Project Conceptual General Site Layout

1.5 Scope of Work

Terrestrial field surveys were initially conducted by Golder Associates Ltd. (2009). Additional field surveys and desktop analyses were conducted for terrestrial life science values by Northern Bioscience in 2009 and 2010 to address agency comments (Harris and Foster 2009). Fieldwork focussed on forest bird monitoring, rare plant surveys, and surveys for Species at Risk including woodland caribou (*Rangifer tarandus caribou*). In response to agency concerns (OMNR 2001), the geographic and temporal scope of the assessment for woodland caribou was expanded relative to the initial assessment, which largely focussed on shorter-terms impacts at the project site and adjacent landscape. No additional fieldwork was required for this expanded scope.

1.6 Report Format

Following this introductory section, the remainder of the current report is organized as follows:

- Section 2.0 provides a description of the policy and management context with respect to woodland caribou near the project site and Ontario in general.
- Section 3.0 describes historic and current woodland caribou populations and movements in the area of interest, as well as those of alternate prey and predators in the area of interest.
- Section 5.0 assesses habitat, connectivity, and disturbance levels in the area of interest.
- Section 6.0 predicts future trends in woodland caribou populations and habitat and potential effects of the project. Cumulative effects, possible mitigation, residual effects and compensation are discussed.

2 LEGISLATIVE AND POLICY CONTEXT

2.1 Endangered Species Act, 2007 (ESA)

Woodland caribou (forest-dwelling boreal population) are designated as Threatened in Ontario under the *Endangered Species Act, 2007*. The more northern forest-tundra woodland caribou that travel in larger herds and have long distance migratory movements are considered not at risk. Further reference in this report to “caribou” or “woodland caribou” will refer specifically to the forest-dwelling boreal population.

Under the ESA, threatened and endangered species receive both species and habitat protection. Section 9 of the ESA, which protects species at risk from being killed, harmed, harassed, captured or taken, is in effect for caribou. Section 10 of the ESA refers to habitat protection, and is not currently in effect for woodland caribou, as it is a “transition species” that was listed prior to implementation of the act. General habitat protection is anticipated to

come into effect on July 1 2013 unless a specific caribou habitat regulation is put into effect prior to that date. The Ontario Ministry of Natural Resources has begun public consultation to develop a caribou habitat regulation (Government of Ontario 2011), however the regulation has not yet been developed. Thus, while caribou habitat is considered through many resource management planning processes of the Ministry of Natural Resources', formal habitat protection under the ESA is not currently in place.

2.2 Caribou Conservation Plan (CCP)

The goal of Ontario's Woodland Caribou Conservation Plan (OMNR 2009a) is to "maintain self-sustaining, genetically-connected local populations of woodland caribou (forest-dwelling boreal population) where they currently exist, improve security and connections among isolated mainland populations, and facilitate the return of caribou to strategic areas near their current extent of occurrence". The CCP provides policy direction for the management and recovery of woodland caribou within the areas of continuous and discontinuous distribution (Figure 5). The CCP outlines the actions the Government of Ontario intends to undertake in response to recommendations in the Ontario Woodland Caribou Recovery Strategy as per section 11(8) of the ESA.

The CCP identifies caribou "ranges" as the geographical basis for caribou management. The study area is within the "Lake Superior Coast" range, consisting of an approximately 10 km wide strip along the shoreline from Lake Superior Provincial Park to just west of Terrace Bay (Figure 5). Immediately north of the study area is the "Lake Superior Uplands Linkage" consisting of discontinuous caribou range, and further north are the Nipigon and Pagwachuan ranges. Although the Lake Superior coastal range is described in the CCP as being part of caribou's continuous distribution in Ontario, it is not contiguous with other continuous ranges in Ontario that lay north of the discontinuous distribution. Proposed recovery zones in OMNR's Caribou Recovery Strategy (OWCRT 2008) differ substantially from current ranges identified in the CCP, demonstrating how the approach to conserving caribou in Ontario has evolved over time. Range boundaries have been refined since the release of the CCP in 2009, and are identified in the CCP as being based upon caribou movements, distribution and shared geography, habitat functions and behavioural responses, and predominant risk factors (OMNR 2009a). Boundaries of the discontinuous zone are not solely delineated on the basis of caribou ecology e.g., the eastern and western boundaries follow major roads. The 10 km width of the Lake Superior Coast range recognises caribou use near Lake Superior but is somewhat arbitrary since this is largely based on the observed distribution of caribou in Pukaskwa National Park, where the farthest inland caribou were found during 17 years of systematic searches was 8.7 km (Bergerud 1989). However Pukaskwa N.P. lacks the anthropogenic disturbance found elsewhere in much of the coastal range.

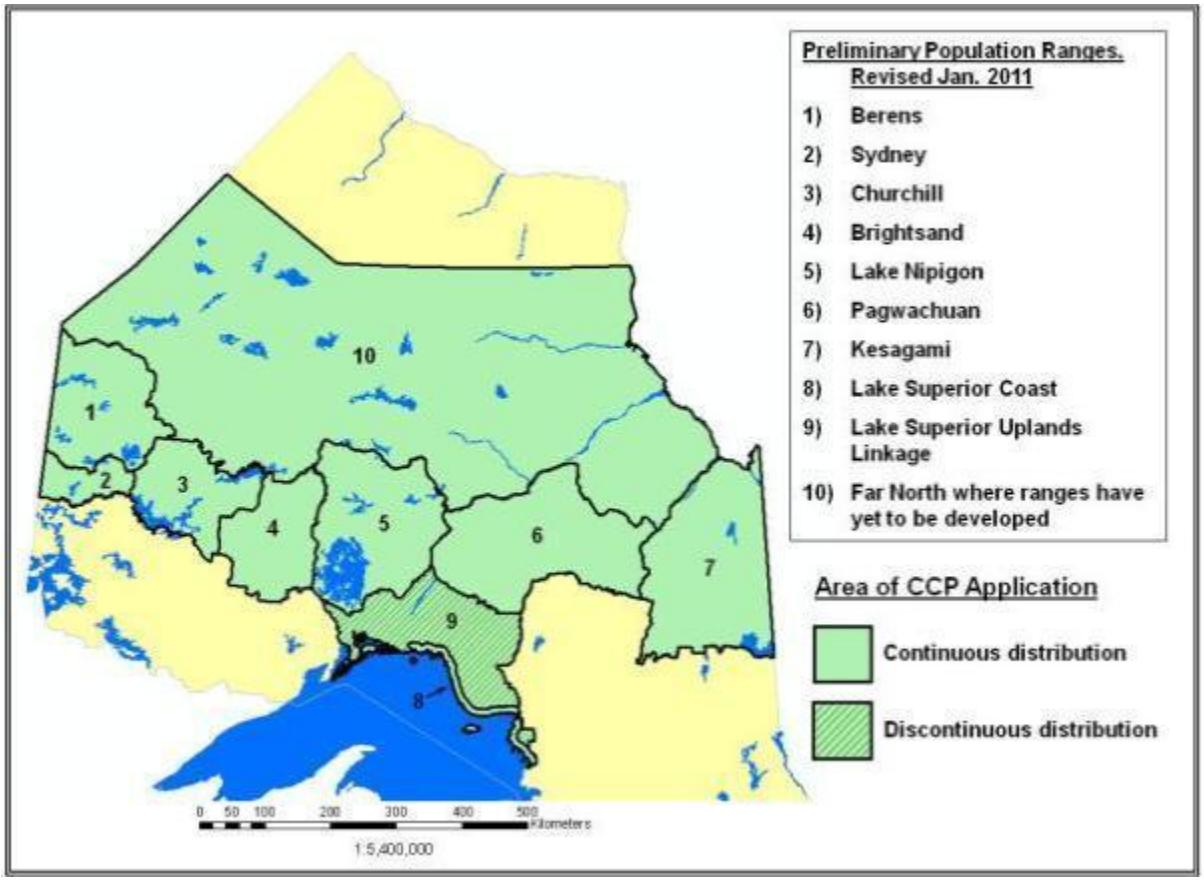

Figure 4. Revised preliminary local population ranges (Note that some of these boundaries have been refined since publication of the CCP in 2009).

The CCP also states that the 'Lake Superior coastal population will be managed for population security and persistence. The focus will be to protect and manage habitat and encourage connectivity to caribou populations to the north'. Discontinuous range will not be managed broadly for caribou habitat to support self-sustaining populations but will instead be managed with a focus on specific landscapes that may support temporary caribou occupancy or movement between the continuous range and Lake Superior (OMNR 2009a). The CCP indicates that opportunities to improve connectivity between local populations and isolated populations will be sought through forest management planning and other planning processes. Although not specifically stated in the CCP, this is presumed to refer primarily to the improvement of connectivity between the isolated Lake Superior Coast Range and other ranges within the area of continuous distribution to the north. The CCP also commits to the development of a management strategy for the area of discontinuous distribution, in order to improve connectivity between the northern continuous range and the Lake Superior coastal population, and improve the prospects for the persistence of the coastal population (OMNR 2009a). This strategy is still under development.

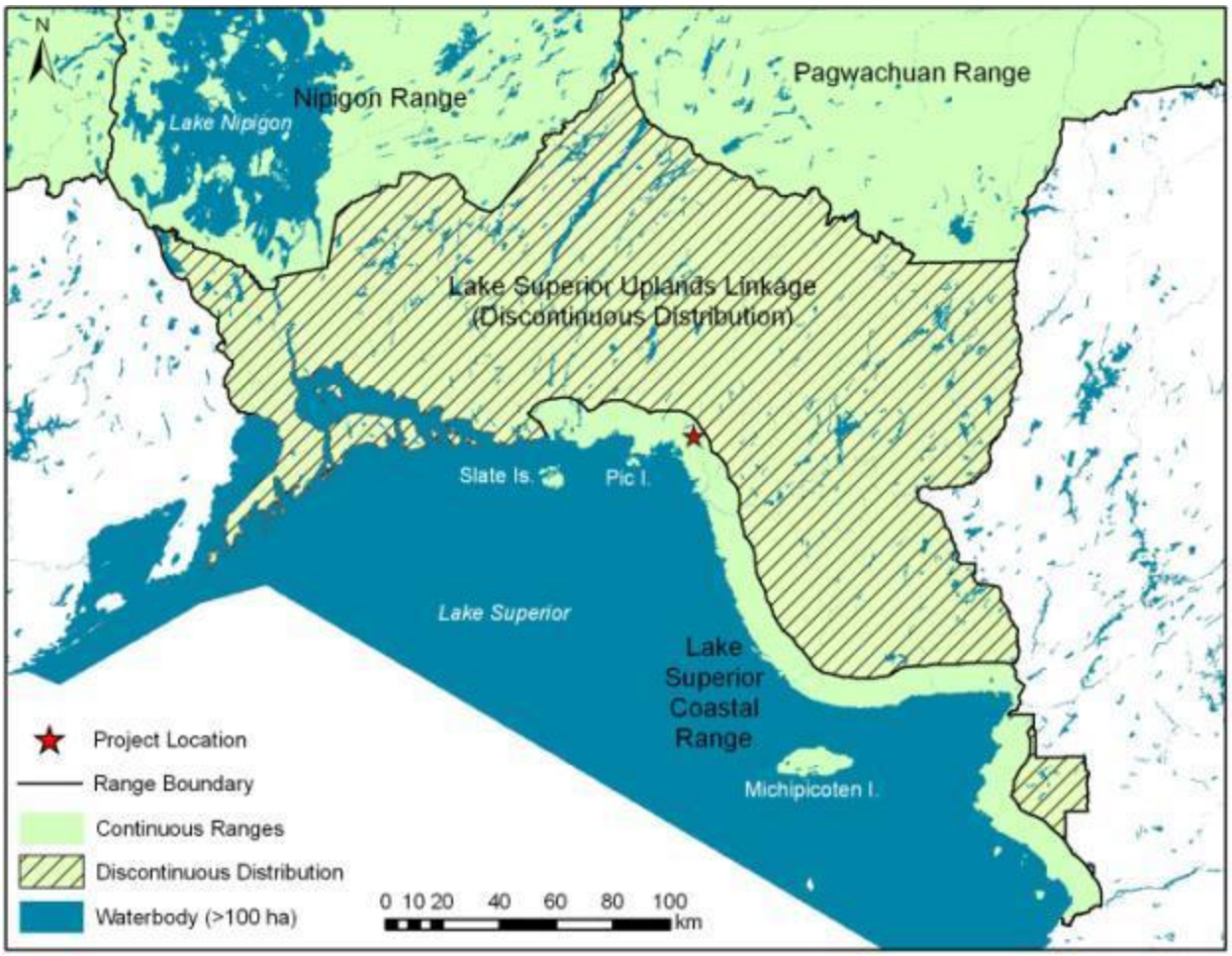

Figure 5. Location of Project in relation to woodland caribou ranges.

2.3 Cervid Ecological Framework / Wildlife Management Units

OMNR's Cervid Ecological Framework (CEF) provides the overarching policy direction for the management of cervids i.e., woodland caribou, moose (*Alces alces*), white-tailed deer (*Odocoileus virgianus*), and elk (*Cervus elaphus*), at the broad landscape level in Ontario (OMNR 2009b). The CEF has direct bearing on woodland caribou populations due to the interrelationship among caribou, wolves, and alternate prey, particularly moose and white-tailed deer. Predation is thought to be the key factor limiting woodland caribou (Bergerud 2006; Seip 1992). Habitat disturbance from logging or wildfire creates younger-aged forest with abundant browse that allow moose and deer to numbers to increase. Higher moose and deer densities support increased gray wolf (*Canis lupus*) abundance, which in turn leads to increased mortality of caribou and declines in caribou populations. In turn, wolf abundance increases in response to higher prey availability. With higher wolf abundance, predation increases and causes caribou populations to decline (OWCRT 2008).

The CEF establishes cervid ecological zones (CEZs) that establish broad population and habitat management guidance to assist in the setting of local population and habitat objectives at the Wildlife Management Unit (WMU) level. All of the Lake Superior Coastal Range, the Lake Superior Uplands Linkage and the southern portion of the Nipigon and Pagwachuan ranges are within Cervid Ecological Zone B (Figure 6). The project also falls within CEZ B, where the broad population management guidance is to:

- minimize impacts and maintain/restore caribou populations as directed by the CCP.
- maintain low to moderate density (~0.0-0.4/moose km^2) moose population where appropriate as per species-specific policy direction.
- manage for low density (~0-2 deer/km^2) white-tailed deer population through provincial deer management program.

The density values are broad ranges that apply at the CEZ scale and are not intended as specific WMU density targets, but may be used to assist population objective-setting exercises. The broad guidance for habitat management in CEZ B is to emphasize caribou habitat as a primary management consideration, emphasize moose habitat where appropriate as per species-specific policy direction and not to emphasize deer habitat management. While intended as broad management units based upon ecological considerations, WMUs are not strictly ecological units; many WMUs follow anthropogenic boundaries (e.g., roads, railways) that are easy for hunters to recognize in the field or MNR regions e.g., WMU 21A/21B.

The proposed project is along the border between WMUs 21A and 21B, which encompass much of the north shore of Lake Superior. WMUs adjacent to these include WMU 19 to the north, WMU 14 encompassing the Black Bay archipelago to the west, and WMU 33 encompassing Pukaskwa National Park and areas to the south along the Lake Superior shoreline. Moose densities in the WMUs that overlap the coastal range have moose densities that range from 0.286 to 0.332/km^2 (OMNR unpublished data)(Figure 6). Target moose numbers for WMU 21A and 21B are 3243 (R. Tyhuis pers. comm.) and 3400 moose or 0.25 and 0.22 moose/km^2 respectively. Current moose densities in WMU 21A (0.332) and WMU 21B (0.286) exceed these targets but are within the 0-0.4 moose/km^2 range identified for Zone B. Whether such high moose densities are compatible with maintaining caribou on the landscape has been questioned by Bergerud et al. (2007). Moose densities specifically for the Lake Superior Coast Range are not available. Recently approved provincial moose population objectives setting guidelines recognize that in areas where caribou are the primary management focus, moose should be managed to a low density of ~0.10 moose/km^2 (OMNR 2009c), providing consistent direction with that from the CCP and the CEF.

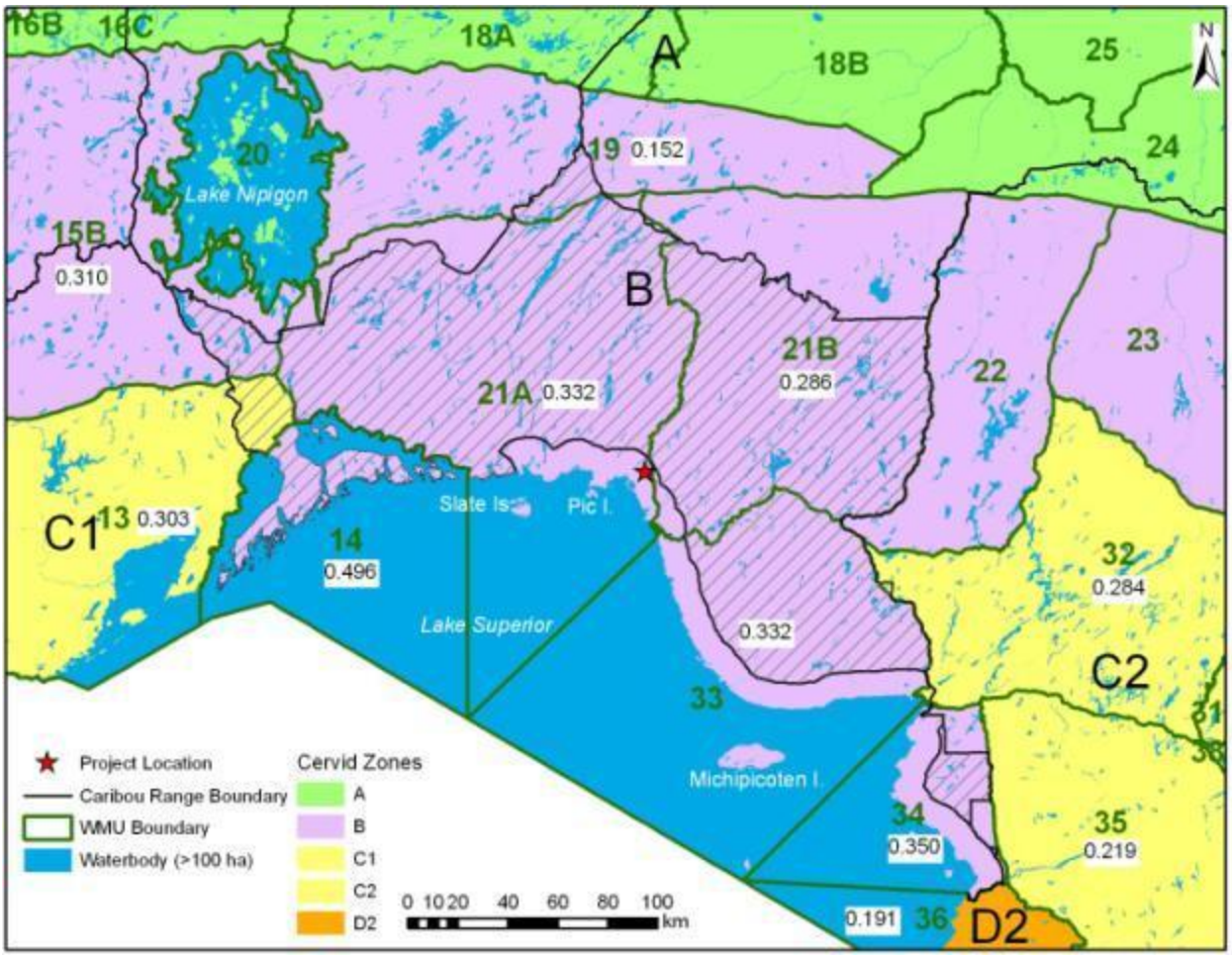

Figure 6. Project site with respect to cervid ecological zones, wildlife management units (WMUs), and caribou ranges. Values in white text boxes indicate the most recent estimate for moose density (moose/km^2) for labelled WMUs (OMNR unpublished data).

2.4 Forest Management Planning

2.4.1 Forest Management Units

Forests in Ontario are managed geographically on the basis of Forest Management Units (FMUs). The Marathon PGM-Cu Project site is entirely within the Big Pic Forest (Figure 7), which is adjacent to the Pic River Ojibway and Black River FMUs. The Kenogami and White River FMUs also have small portions within the Coastal Range. Other adjacent FMUs within the discontinuous zone include the Algoma Forest to the south, the Black River, Nagagami, and White River forests to the east, and the Kenogami, Lake Nipigon, and Lakehead forests to the north and west (Figure 7). The Black River FMU will be incorporated into the Pic River / Ojibway FMU in 2013. All these FMUs have, or are currently incorporating various strategies into their respective forest management plans to further the objective of long-term connectivity across caribou range (OMNR 2011). This primarily consists of strategically deferring large blocks of even-aged conifer-dominated stands where possible, to provide for refuge habitat and connectivity through space and time (G. Hooper, pers. comm.)

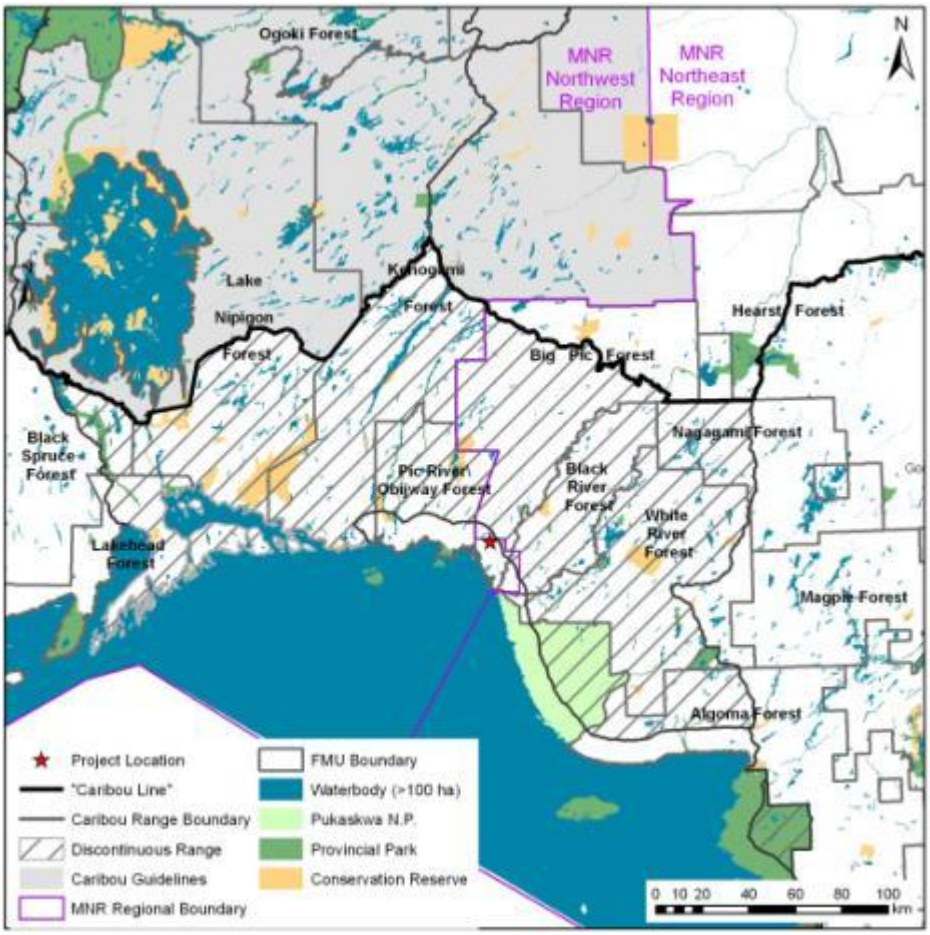

Figure 7. Location of Marathon PGM-Cu Project with respect to forest management units (FMUs) and application of OMNR caribou ranges and management guidelines.

2.4.2 Caribou Habitat Management Guidelines

Caribou habitat needs have been considered in many forest management plans in Ontario since the early 1990s (OMNR 2009a), when "mosaic"-based planning began in OMNR's Northwest Region. Since 1999 forest management direction for caribou has been provided by *Forest management guidelines for the conservation of woodland caribou: a landscape approach* (Racey et al. 1999). This direction has been applied in OMNR's Northwest Region north of what was known as the "caribou line", the southernmost limit of continuous caribou distribution (Figure 7). These guidelines have not been used in OMNR's Northeast Region, immediately east of the project, nor in the Lake Superior Uplands Linkage or coastal range.

The forest management guidelines for woodland caribou are not in effect in the landscape adjacent to the proposed project because the Pic River\Ojibway Forest is entirely south of the caribou line and the Big Pic Forest is in OMNR's Northeast Region. However the CCP directed that caribou habitat will be provided for during forest management planning for all forest management plans within the area of continuous caribou distribution. Revised direction for forest management planning with respect to caribou will be incorporated in the Boreal Landscape Guide, which will be applied across the boreal forest in both the Northwest and Northeast regions. Release and implementation of this guide has been long delayed, with anticipated completion in 2012 (OMNR 2012).

2.4.3 Dynamic Caribou Habitat Schedules

The CCP states that dynamic caribou habitat schedules (DCHS) will be developed for and integrated across all forest management plans within continuous caribou distribution. These dynamic habitat schedules are similar to caribou mosaics in that large (generally 10,000 – 20,000 ha) blocks of contiguous forest are scheduled for harvest and similar-sized blocks deferred in a patchwork across the FMU so that there is sufficient amount and arrangement of suitable caribou habitat in space and time. This is an attempt to emulate the large natural disturbance patterns typical of wildfire in the boreal forest of Ontario. How these dynamic caribou habitat schedules will be applied in the coastal range is as yet unclear given the linear shape and high disturbance of the coastal range. The Long Term Management Direction (LTMD) for the 2011-2021 Pic River Forest FMP states that "due to the geographic constraints of the coastal zone a dynamic caribou habitat schedule that would identify long term habitat maintenance could not be resolved" for any of the portions of the FMUs in the coastal range west of Pukaskwa N.P. Part of the difficulty is that the approximately 105,000 ha portion of the coastal range west of Pukaskwa N.P. catches the southern portions of five FMUs which complicates planning across this narrow, 80-km long strip of coastal range.

2.4.4 Deferrals

Although dynamic caribou habitat schedules were not developed, the FMP planning teams did identify areas in the coastal range that would be deferred from harvest for a 20 year term

(Figure 8) with the expectation that subsequent planning efforts would use the same tools to assess caribou habitat that will ensure population security and persistence consistent with the CCP. These areas were on average 6000 ha but as small as 1068 ha. The LTMD of the Big Pic Forest 2007-2017 plan was prepared and approved prior to the preparation of the CCP. The DCHS (caribou mosaic) for the northern continuous zone which overlaps the Nagagami Range was updated to promote the consolidation of disturbance areas and limit new fragmentation of the forest.

Development and incorporation of a DCHS in coastal continuous zone for the 2007-2017 Big Pic FMP was not considered feasible due to its limited size and linear geography. The caribou habitat management strategy for this zone was to define habitat/ecological tracts as best as possible and develop operational harvest blocks and deferral periods in consideration with adjacent FMUs and natural boundaries where possible. Within the coastal range, remaining 2007-2011 and planned 2012-2021 allocations on the Big Pic will be allowed within the discontinuous zone and Block 4 of the coastal range, including several harvest blocks on the Property (Figure 8). These include a 358 ha block scheduled for harvest prior to March 2012 that overlaps the Project in the area of the proposed solids management facility and a 208 ha block approximately 1. 5km south of the main project area. Harvesting operations will be deferred in Blocks 1-3 in the coastal range until at least the end of this plan (2017). Planned harvest within the newly defined deferral areas will not be allowed and road corridors may also be realigned. In addition, Phase II (2012-2017) planning for the FMP will include a review of Silvicultural Ground Rules to ensure sufficient conifer renewal, development of Conditions on Regular Operations), and development/review of road use management strategies (i.e. road planning, construction, decommissioning/rehabilitation, and renewal).

West of the Project, no specific caribou deferral has been developed in the Kenogami FMP. The small parcel of this FMU in the Coastal Zone is comprised mostly of a marten core deferral and private land. The remaining available Crown land within this area was simply not allocated due to being in the coastal continuous range. Two large blocks in the discontinuous range were deferred to enhance potential connectivity between the Lake Superior coastal range and continuous ranges to the north (Figure 8). Southeast of the Project, the coastal portion of the White River Forest currently has no deferral areas specifically for caribou. There is a considerable amount of allocated harvest along the northern boundary of Pukaskwa National Park (Figure 8), which might impact caribou movement from or to Pukaskwa National Park. Implementation of the CCP will be addressed in planning for the 2nd 10-year term of the FMP which is currently underway (V. Thompson pers. comm.).

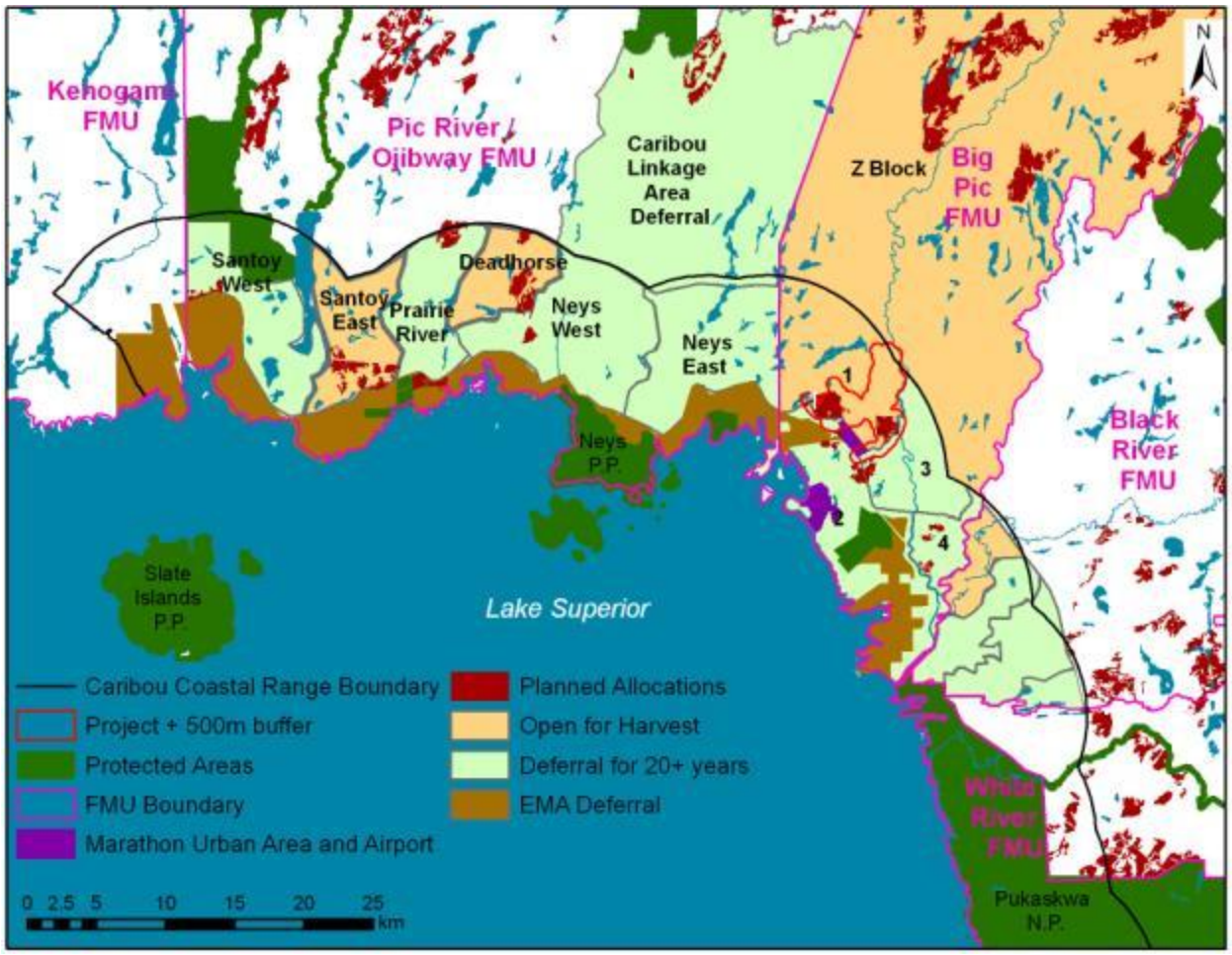

Figure 8. Planned harvest areas and deferrals in coastal zone of FMUs near the Marathon PGM-Cu Project + 500 m buffer.

2.4.5 Forest Operations in Coastal Zone

The following operational strategies will be implemented on the Big Pic and Pic River Ojibway forests to ensure effective regeneration of forest cover and create future caribou habitat within the continuous zone:

- Every effort will be made to find the Allowable Harvest Area (AHA) within the open harvest tracts.
- Residual targets for the Natural Disturbance Pattern Emulation Guidelines (NDPEG) will be reduced within the continuous zone blocks to achieve the desired future even-aged forest to the extent possible.
- Hardwood bypass will be minimized to ensure sufficient site disturbance for effective conifer regeneration and to avoid increases in the hardwood and mixedwood components.
- Primary road construction within the harvest tracts will be permitted. Where roads are necessary they will be strategically located and built to the lowest possible standard in

order to minimize long-term linear features (but not such that user safety is compromised). New road corridors will not be permitted to link to existing access roads. All primary road planning will include decommissioning strategies (i.e. water crossing removal and or access removal) to be implemented when harvesting within a block is completed. No roads will be constructed outside of the open harvest tracts. All operational roads and landings will be regenerated to forest cover. Branch road segments will be regenerated where feasible.

2.4.6 Marten Guidelines

The Forest Management Guidelines for the Provision of Marten Habitat (Watt et al. 1996) that have been applied across boreal Ontario may also benefit caribou. For each FMU, these guidelines require that 10-20% of the landscape be left in large (3000-5000 ha) patches of mature, conifer-dominated stands. These guidelines help meet habitat requirements of other, area-sensitive species dependent on mature to overmature conifer forests. Within the Lake Superior Uplands Linkage and the Lake Superior Coastal Range, the deferral of these "marten cores" may also benefit woodland caribou by potentially enhancing connectivity or providing refuge or winter habitat depending on their location on the landscape (Figure 41). In the 2007-2017 Big Pic FMP, marten cores were increased in size in the Caramat Zone in the northwest corner of the FMU as a caribou habitat management strategy.

2.4.7 Moose Habitat Emphasis Areas

The recently approved Stand & Site Guide (OMNR 2010) provides for fine-filter direction to emphasize moose habitat management to be applied in some specific areas depending on moose management objectives. Potential areas where moose management may be emphasized are selected based upon information in a strategic landscape map. Although the Boreal Landscape Guide for forest management plans is still in development, FMP teams were provided direction that moose habitat emphasis areas need to be considered during forest management planning. These moose habitat emphasis areas are intended to provide for late winter habitat, aquatic feeding areas and summer thermal shelter in cut block residual within large (preferably >10,000 ha) landscape patches identified on suitable areas with high current moose density, nutrient rich soil conditions, and adequate wetlands. The establishment of moose habitat emphasis in the coastal caribou range areas were considered inconsistent with the CCP, so none were identified. However, during operational planning, residual area placement will consider maintenance of moose habitat (late winter, aquatic feeding areas, summer thermal) where possible. Although consistent with the provincial CEF strategy objectives for this Zone B (i.e., to maintain low to moderate moose density), this direction for operation planning may not be consistent with maintaining caribou on the landscape, if applied within the coastal zone.

2.5 Protected Areas

Parks and protected areas have played a significant role in the persistence of caribou within the Lake Superior Coastal Range. Slate Island and Michipicoten Island provincial parks have the largest remaining coastal populations due to their insular nature (Bergerud et al. 2007). Neys Provincial Park and Pukaskwa National Park are still used by caribou as well, and the occupation of these areas may be partly attributable to the relatively undisturbed state and size of the protected areas. Pukaskwa National Park encompasses 1878 km^2 and approximately 80 km of Lake Superior Shoreline, with the northernmost tip of the park along the Pic River mouth only about 15 km south of the proposed mine site. Neys Provincial Park, located approximately 10 km west of the proposed mine site, encompasses 5475 ha, most of which is zoned as nature reserve.

Park management may have contributed to continued use of these mainland parks by caribou, particularly the lack of commercial forestry, limited road networks, and generally low levels of development and human disturbance relative to other areas in the coastal range. However, the protected area status has not prevented these caribou populations from declining over the last 30 years from approximately 30 to 5 caribou in Pukaskwa and from over 70 to less than 15 caribou currently in Neys. Similarly, protected area status of Lake Superior Provincial Park alone did not prevent the eventual extirpation of woodland caribou introduced to the mainland and to Montreal Island, immediately offshore. Sleeping Giant Provincial Park (24,400 ha) on the Sibley Peninsula west of the coastal range lost its resident caribou population in the middle of the 20th century despite being a park since 1944. While protected area status may be advantageous, most protected areas are much smaller in size than the broad scale at which caribou use the landscape annually. Management actions and decisions at this much broader landscape scale appear to be a key determinant in long-term caribou persistence.

The CCP identified that “protected areas will be managed as important components of a broad landscape approach to caribou conservation” (OMNR 2009a). Protected areas could potentially serves as “stepping stones” in potential woodland caribou movement corridors between the coastal zone and discontinuous range, particularly the Killala Lake (13,190 ha) and Gravel River (46,630 ha) conservation reserves (Figure 9). Several other smaller undeveloped protected areas are found along the Lake Superior shoreline including Prairie River Mouth (380 ha), Red Sucker Point (366 ha), and Craig’s Pit (528 ha) provincial parks. The Lake Superior Shoreline Enhanced Management Area (E2233g) encompasses 25,544 ha along the north shore of Lake Superior from Kama Bay to Pukaskwa N.P., and is part of the Great Lakes Heritage Coast Signature Site (OMNR 1999)(Figure 9). Although not a protected area *per se*, the management direction in the coastal area is for ecosystem protection and the promotion of recreation and tourism.

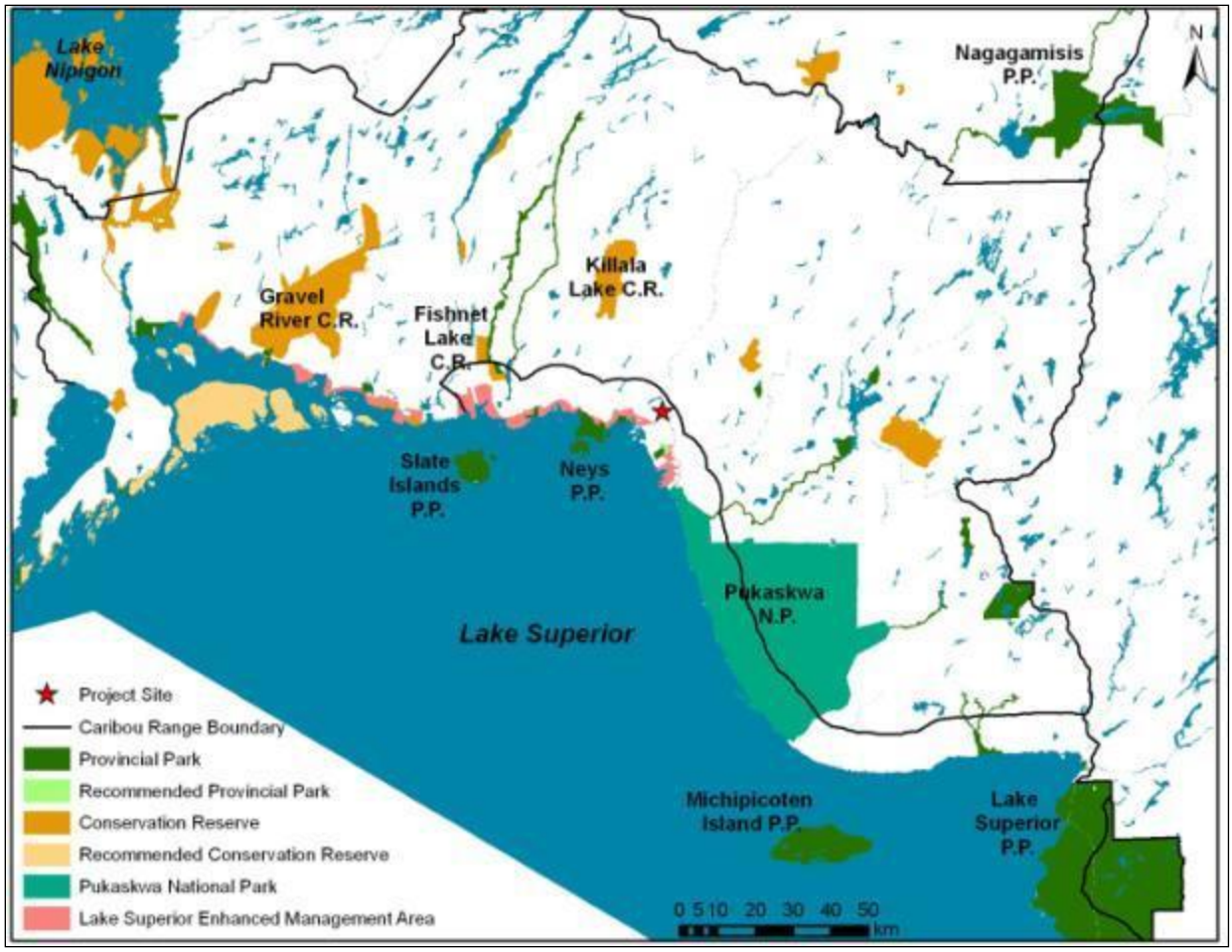

Figure 9. Recommended and regulated parks and conservation reserves in relation to the Marathon PGM-Cu Project.

3 POPULATION ASSESSMENT

3.1 Historic Caribou Population

Woodland caribou once occupied most of Ontario's boreal forest, but have declined significantly since European settlement (de Vos and Peterson 1951). Over the past 100 years, woodland caribou range in Ontario has receded northward (Figure 10, Figure 11). The decline of caribou in Ontario has been attributed to many factors (or their interactions) that are directly or indirectly related to human activity or development, including human settlement, logging, land clearing, road construction, fire, disease and parasites associated with white-tailed deer range expansion, predation, hunting and human disturbance (Bergerud 1974; Cumming 1998; Racey and Armstrong 2000; Schaefer 2003; Vors et al. 2007). Predation risk is likely the most important factor in seasonal movements of caribou, and logged landscapes appear to be associated with increased predation risk for caribou due to increased predator foraging efficiency and higher alternate prey (e.g. moose/deer) levels.

Circa 1900, woodland caribou were the predominant cervid along the north shore of Lake Superior, although even then, caribou densities were low. Bergerud (1989) estimated that pre-1900 caribou densities in the Pukaskwa area were approximately 0.06-0.14 caribou/km^2, the equivalent of 200 animals for the area now within Pukaskwa National Park. Caribou were observed on the Black Bay Peninsula and the islands of Nipigon Bay in the early 1900s (particularly St. Ignace and Cobinosh islands), but seemed to decline rapidly, apparently coincident with an increase in moose numbers (Gollat 1976). Approximately 20 caribou were sighted on the Black Bay Peninsula as late as 1975 (Gollat 1976). In 1990, a minimum of 75 caribou were estimated to exist in Terrace Bay district, outside of parks (Cumming and Beange 1993). Caribou abundance and distribution within the coastal zone has declined significantly since that time (Figure 12). Caribou range in Pukaskwa has seen a similar decline and caribou are now generally found within 5 km of the Lake Superior shoreline (Vance et al. 2008; Wade 1998).

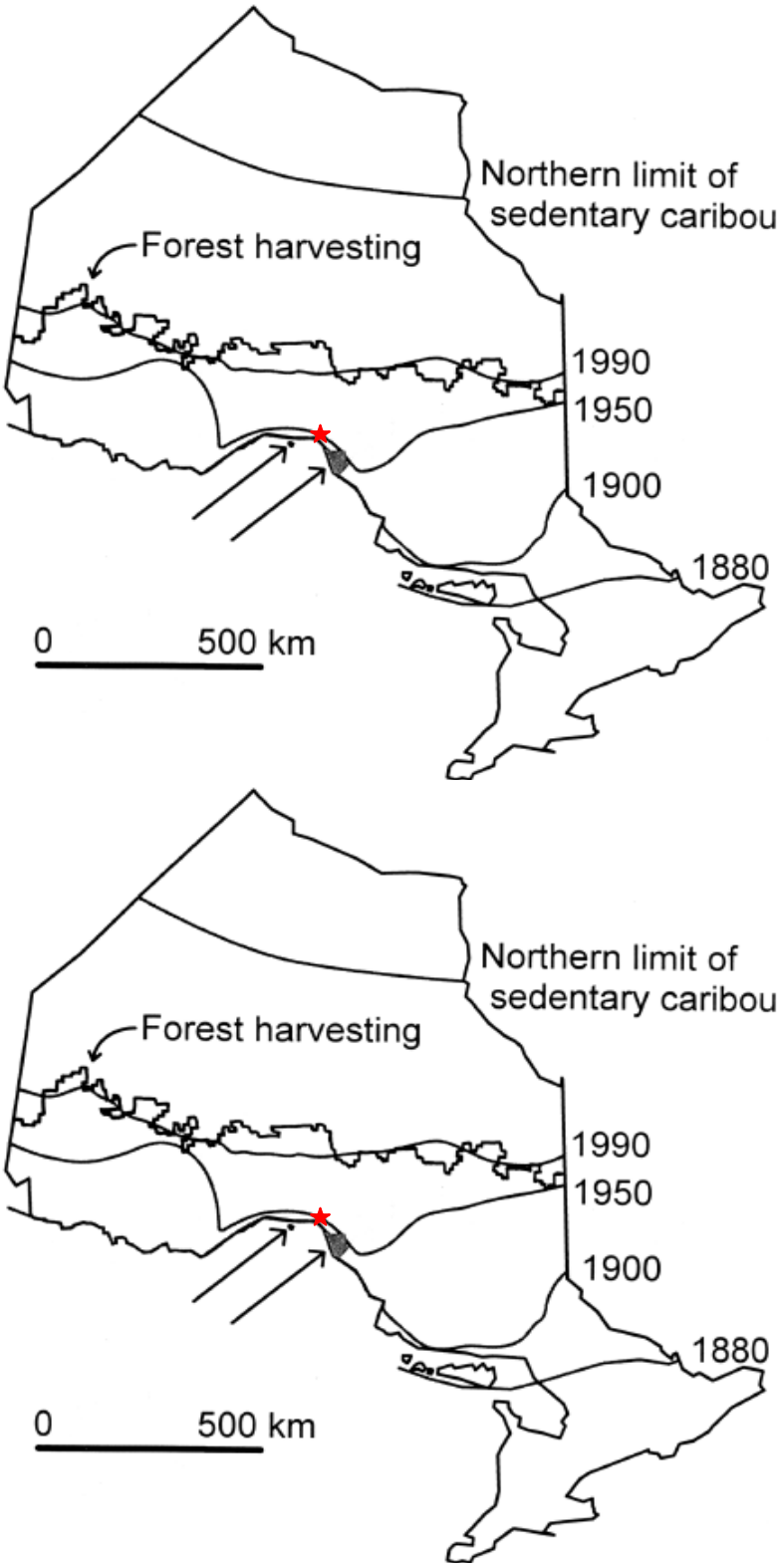

Figure 10. Range recession of sedentary woodland caribou and recent northern limit of forest harvesting in Ontario, Canada (Schaefer 2003, modified from Darby et al. 1989). Star denotes the Project site. Arrows denote Slate Island and Pukaskwa National Park populations.

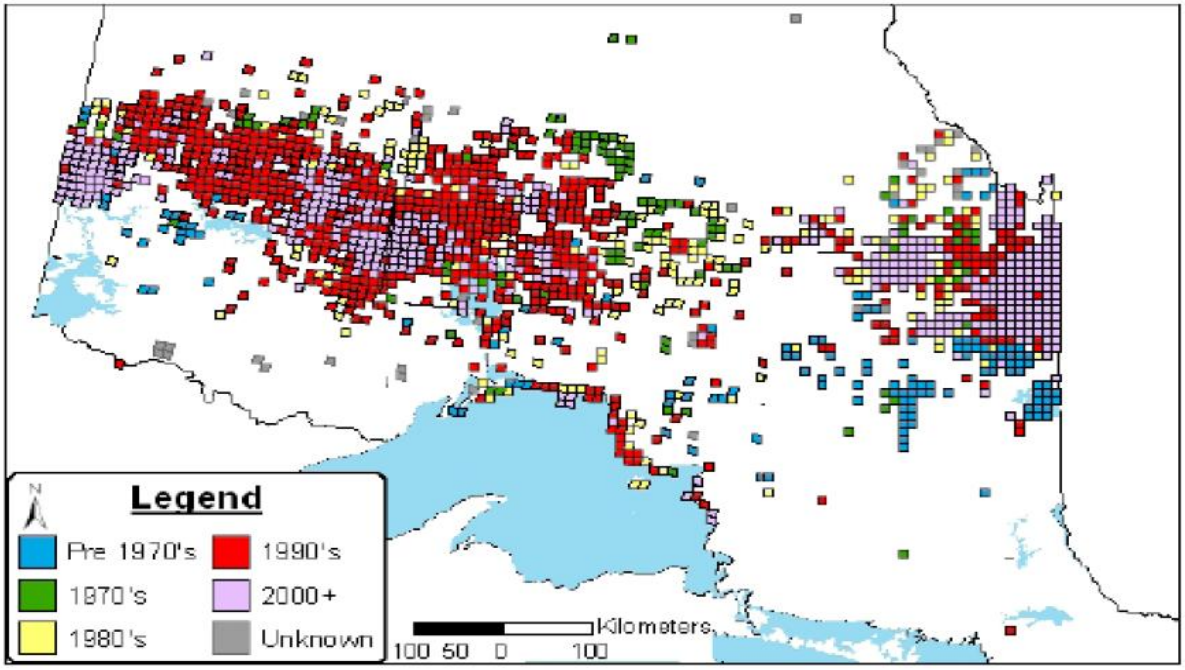

Figure 11. Documented forest-dwelling woodland caribou range occupancy in Ontario (by 10 km x 10 km Universal Transverse Mercator grid-cell) prior to 1970 and subsequent decades (note that only limited data are available for the northern part of caribou range) (each 10 km x 10 km grid-cell identifies only the most recent time period with caribou observations) (OWCRT 2008).

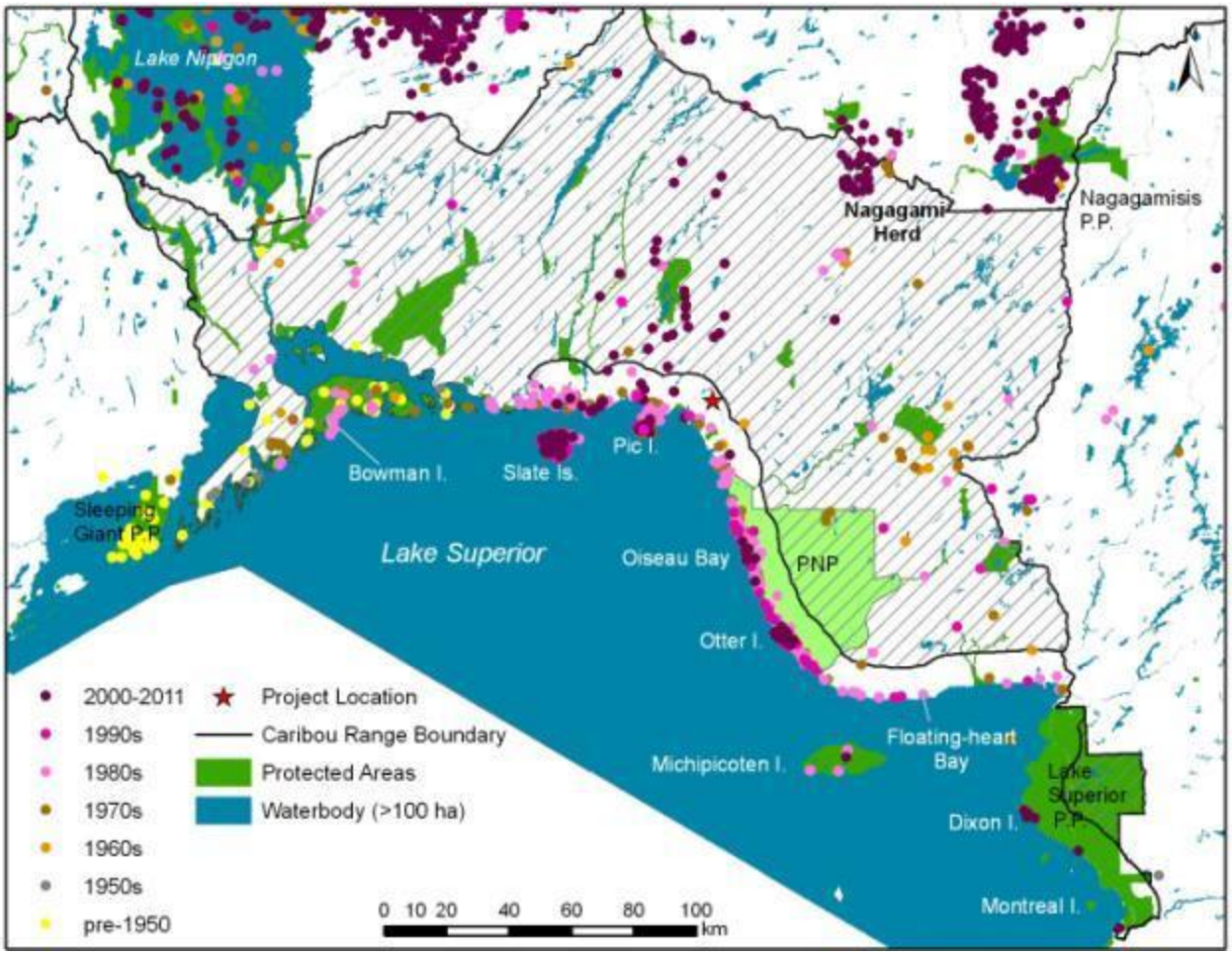

Figure 12. Caribou observations by decade within the Lake Superior Coastal Range Lake Superior Uplands Linkage and adjacent ranges (data from OMNR caribou database).

3.2 Current Caribou Population

3.2.1 Study area

There are no historic or current records for the Project site in OMNR's caribou database. No evidence of woodland caribou was observed in EIS field studies, nor have there been any anecdotal reports from staff or other users on the project site. Survey effort included an aerial survey in March 2009, searching shorelines, trails and roads for tracks, and searching bedrock barrens for pellets or evidence of winter feeding (cratering) June-Aug 2009. OMNR records included no caribou records in or immediately adjacent to the study area. Traditional ecological knowledge supports that there are no caribou on the Project site, currently or within the recent past.

3.2.2 Lake Superior Coastal Range

Woodland caribou within the Lake Superior Coastal Range appear to have persisted due to refuge from predation offered by islands along the Lake Superior coast, while the continuous range of caribou on the surrounding mainland landscape has retreated (Figure 13). Four

somewhat discrete populations are known to still exist in the coastal zone, all of them centred on protected areas with islands: Slate Islands, Neys, and Michipicoten provincial parks and Pukaskwa National Park (Figure 14). These main foci of known caribou presence in the coastal range are discussed below.

Records in the provincial caribou database can be considered incomplete for several reasons: 1) caribou occur in very low numbers in this area, 2) not all records are reported to and included within the database, and 3) caribou are secretive animals that are difficult to observe, and 4) survey effort across the range has never been uniform or consistent. For example, there are only 3 records for Michipicoten Island currently in the caribou database, even though it has by far the largest population in the coastal range. A total of 2508 records from the Lake Superior Coastal Range are currently in OMNR's caribou database, with approximately 77% from the Slate Islands, 12% from Pukaskwa National Park, and 4% from Neys Provincial Park. Of these 2508 records from the coastal range, there are only 15 post-1990 observations of live caribou outside of Slate Island PP and Pukaskwa NP, including three from Neys Provincial Park and one from the mouth of the Steel River

The national scientific assessment to inform the identification of critical habitat for caribou in Canada identified that the coastal range is "likely to maintain a self-sustaining population over time", based upon low levels of disturbance and a relatively robust population size (Environment Canada 2011); however, this analysis grouped data for the island populations (several of which are predator-free) and the mainland, apparently masking the implications of the low number of caribou remnant on the mainland.

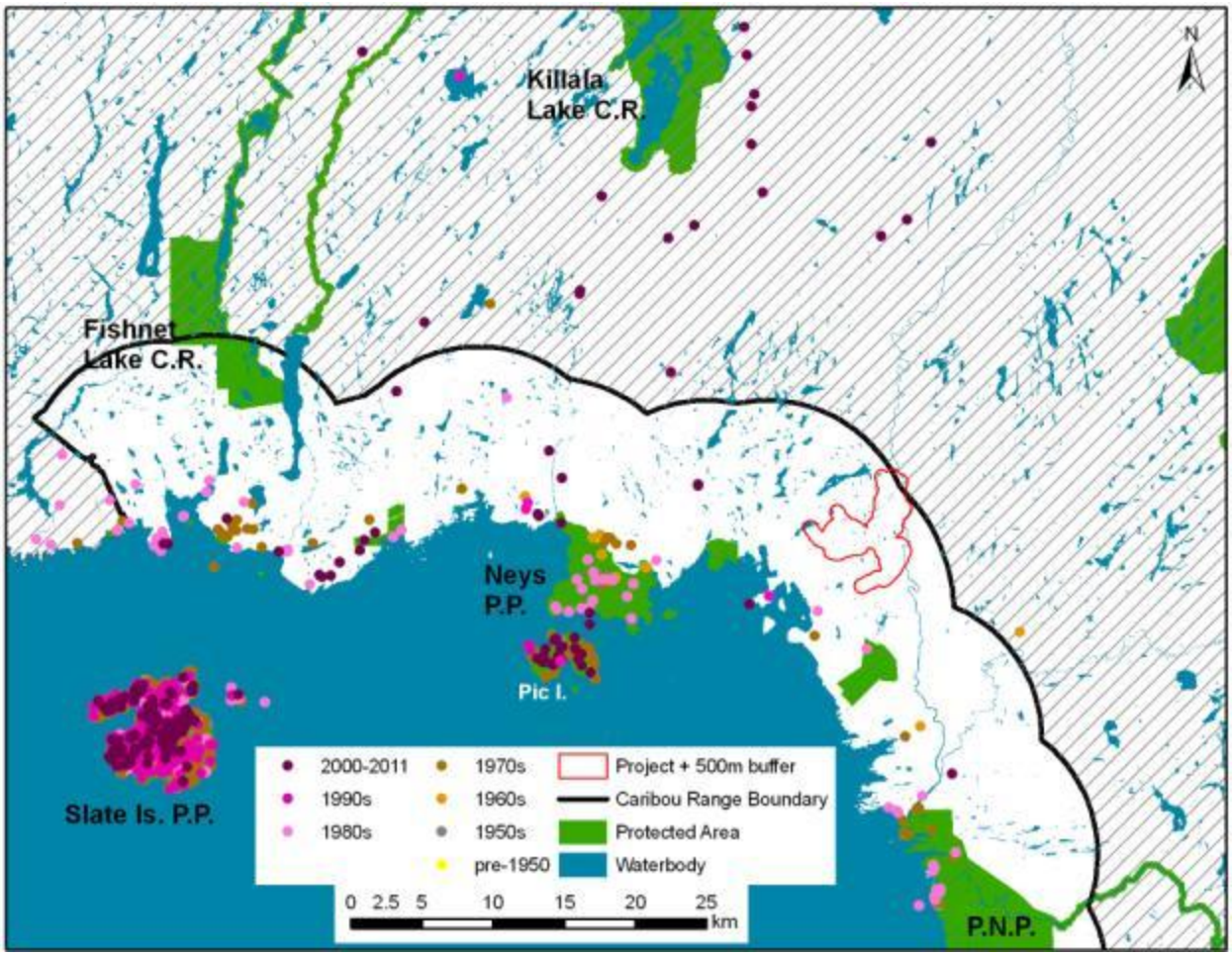

Figure 13. Caribou observations by decade within the coastal and discontinuous ranges near the Marathon PGM-Cu Project + 500 m buffer (OMNR and PNP unpublished data).

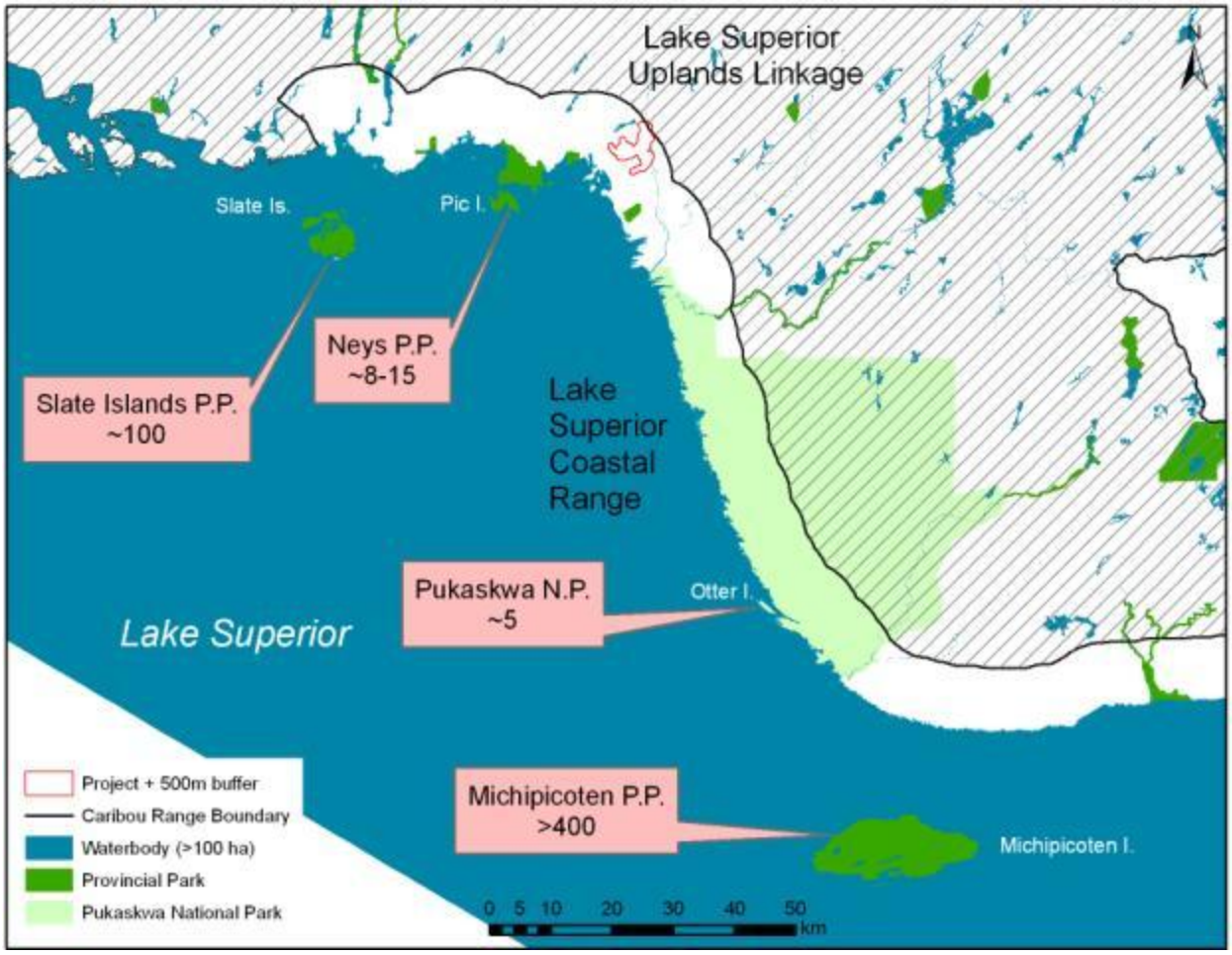

Figure 14. Presumed populations within the Lake Superior Coastal Range and estimated number of caribou in each population in 2011 (OMNR unpublished data).

3.2.2.1 Neys Provincial Park and Adjacent Mainland

Pic Island (1138 ha) is located approximately 18 km from the proposed mine site and 750 m from the adjacent Coldwell Peninsula in Neys Provincial Park. Ferguson et al. (1988) reported a herd of 24-77 caribou residing on Pic Island from 1976 to 1984. In the early 1900s, Pic Island was primarily used in winter when animals migrated there from further inland possibly because of the low snowfall along the coast of Lake Superior and lichen supplies on exposed rock outcrops (Ferguson 1988). A herd of approximately 100 caribou crossed over the ice in small groups on Thompson Channel in the winter of 1964-65, and caribou continued to use the beach in Neys during the 1960s (Ferguson 1983). As populations declined on the mainland, caribou began to reside year-round on the island, which offered some refuge from predators because of the partial water barrier and the presence of rugged topography for escape flights (Ferguson et al. 1988). By the late 1970s and early 1980s, Ferguson et al. (1988) found that caribou only occupied the Coldwell Peninsula when wolves were generally absent, despite food being much more plentiful on the mainland than on Pic Island. The combination of refuge from wolves and

arboreal lichens for winter forage still likely make this area attractive for caribou (R. Tyhuis pers. comm.).

Neale (2000) confirmed use of Pic Island by at least 10 caribou during the 1996 and 1997 winters. He also found observed five caribou (1 stag; 2 cow/calf pairs) in mainland Neys P.P. during the spring of 1997. Based on several recent years of winter aerial surveys, approximately 8-15 caribou are now estimated to spend at least part of the winter on Pic Island (S. Kingston pers. comm.). The number of caribou using the island in recent years appears to be variable, and some winter aerial surveys have found no use on the island (R. Hartley pers. comm.). This may be a function in part of forage limitations on the island as identified by Ferguson et al. (1988), at least at certain times of the year.

Caribou appear to move on and off Pic Island but where they go on the mainland is unknown. Surveys in January/February 2011 indicated only a couple of animals on Pic Island but a survey in March showed evidence of more caribou. They may represent transients or animals resident in the coastal range, possibly between Terrace Bay and Marathon, or even the discontinuous range. The degree of summer use is unknown, but thought to be lower (S. Kingston pers. comm.). Due to the low numbers and the difficulty in detecting caribou in the rugged topography along the coast, there is no estimate of the number of caribou on the mainland adjacent to Pic Island.

Flights conducted in the winters of 2008 and 2009 have confirmed caribou activity (cratering) on the forest in the area northwest of Neys Provincial Park and on Bottle Point Peninsula (south of Little Santoy Lake and east of the Steel River). According the draft Pic River Forest FMP LTMD Analysis Package there is no known present caribou occupancy in the coastal range within the Black River or Pic River forest FMUs, but the area could play a role in providing sufficient habitat in support of the continued coastal occupancy of caribou (security and persistence) and movement between remnant populations.

3.2.2.2 Slate Islands

The best-studied and one of the largest caribou populations within the coastal range is found at the Slate Islands, approximately 50 km west of the proposed mine. The Slate Islands are a predator-free archipelago of seven large islands and numerous smaller islets encompassing 36 km^2, and are 9 km from the nearest mainland. Caribou numbers on the Slate Islands have fluctuated from approximately 100 to 600 animals during the 1974-2003 time period (Bergerud et al. 2007), depending on the survey and analytical methods used. The Slate Islands averaged 7-8 caribou/km^2 from 1974 to 2004, orders of magnitude more abundant than the density of 0.06 caribou/km^2 for Pukaskwa NP during the same time period (Bergerud et al. 2007).

Approximately 100 caribou are estimated to be on the Slate Islands currently based on recent surveys (S. Kingston pers. comm.).

Connecting ice bridges from the mainland to the Slate Islands are rare and typically last, at the most, from mid-January to early March, and are not well suited to the normal seasonal dispersal urges of wolves (Bergerud et al. 2007). As a result, the Slate Islands have apparently been wolf-free for most of the last 80 years, with the exception of 1994-1996 and 2003-2004 (Bergerud et al. 2007). Two wolves crossed the ice in the winter of 1993-94 but apparently were poisoned, and in 2003-2004 a lone wolf was present on the island based on caribou carcasses with crushed bones (Bergerud et al. 2007). There does not appear to be a resident wolf population on the islands.

3.2.2.3 Pukaskwa National Park

Since monitoring began in Pukaskwa National Park, woodland caribou have declined in both number of animals and area occupied. From a high of 31 animals in 1977, the population has declined to as few as four animals by 2009 (Figure 15). The aerial survey conducted in 2009 (following previously used protocols) found only four caribou , but a survey using Forward Looking Infrared (FLIP) video conducted concurrently suggested that as a many as 16 animals were present (Euler 2010). Whichever population estimate is more correct, the declining population trend is real.

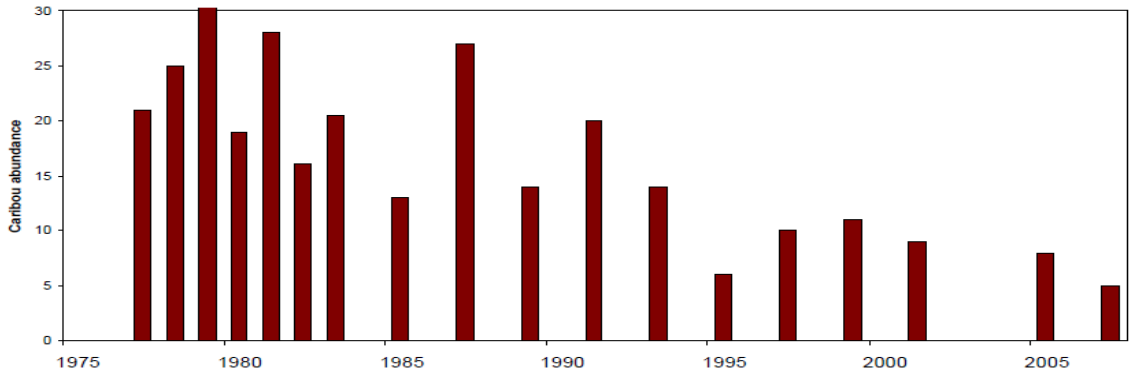

Figure 15. Estimated caribou abundance at Pukaskwa National from 1977 to 2007 (Vance et al. 2008).

In the late 1970s and 1980s woodland caribou were found from the Willow River south, with a concentration using the islands near Oiseau Bay and continuing along the coast to Floating Heart Bay, 26 km east of Pukaskwa NP towards Wawa (Bergerud and Dalton 1990; Bergerud et al. 2007). Although formerly found farther north as recently as the 1980s, for the last 15 or so years, very few caribou have been observed in the northern portion of the park and most caribou observations in Pukaskwa NP have been in the Otter Island area, a known calving and rutting site (Bergerud et al. 2007; PNP unpublished data), approximately 70 km south of the project. This 1.9 km^2 island is 600 m from the nearest mainland, and offers a lower predation

risk for rutting and calving (Bergerud 1985; Bergerud et al. 2007). Approximately 97% of caribou tracks observed during population surveys from 1974-1988 in Pukaskwa National Park were within 2 km of the Lake Superior shoreline, with the majority within 500 m (Bergerud et al. 2007), likely as a result of caribou seeking refuge from wolves on islands and peninsulas along the coast. Caribou may be restricted to the coastal zone because higher moose densities at inland locations can sustain higher predation from wolves independent of caribou densities (Bergerud 1989).

3.2.2.4 Other Coastal Areas

Historically, there was apparently a small, possibly disjunct, herd of caribou along the Lake Superior Shoreline between Pukaskwa National Park and Wawa (Wade 1998). The winter range had historically been centred on Mountain Ash Hill, approximately 17 km to the east of Point Isacor and 13 km west of Michipicoten Harbour (Wade 1998). However, there have been no sightings of caribou along the Lake Superior coast from Pukaskwa to Wawa since 1997 when the tracks of 4 or 5 animals were seen near Floating Heart Bay (OMNR unpublished data). There may be the occasional movement of individuals from Pukaskwa in and out of this area, but there don't appear to be any areas east of Pukaskwa that are continuously occupied (G. Eason, pers. comm.).

In the fall of 1989, 39 caribou were translocated from the Slate Islands to Lake Superior Provincial Park. By the following summer all but 1 of the 17 radio collared animals were either killed or died and were scavenged by wolves. Despite the high density of moose and wolves in Lake Superior P.P., the herd had persisted in the coastal zone near Cape Gargantua and Dixon Island for approximately 20 years. Three caribou were last observed in 2007 (Bergerud et al. 2007), but there have been no caribou in the park for the last couple of years, and it appears this herd is extirpated (G. Eason, pers. comm.).

Caribou are also found on Michipicoten Island P.P. (188 km^2) located south of Pukaskwa N.P. and approximately 15 km offshore at the southern limit of their range in North America (Figure 13). Seven caribou were translocated from the Slate Islands in 1982 to join a lone resident male, with an additional male transplanted in 1989 (Bergerud et al. 2007). In the absence of wolves, they increased to 160 animals by 2001 (Bergerud et al. 2007) and 2011 surveys indicate that there are at least 425 caribou (>2/km^2) on Michipicoten Island currently (G. Eason pers. comm.).

Eight caribou were also translocated in 1984 to Montreal Island (7 km^2) located 5 km off the mainland coast near Lake Superior P.P. (Bergerud and Mercer 1989). The caribou abandoned the island in 1994 when the lake froze and wolves crossed over and killed some of the herd

(Bergerud et al. 2007). Another 1984 translocation of six caribou to Bowman Island in 1984 was more notably unsuccessful due to predation by wolves, with at least 4 of 5 collared caribou perishing within 6 months (Bergerud and Mercer 1989).

3.2.3 Lake Superior Upland Linkage and North.

There are only 222 records in OMNR caribou database from the Lake Superior Upland Linkage, of which only 59 are since 1990. Of these, 27 are from the Nagagami Lake along the southern boundary of the Pagwachuan Range. Most of the remaining observations (n=26) are caribou tracks (no animals were sighted) from a March 2011 survey north of Terrace Bay. Neale (2000) also reported caribou sightings from near Ruffle Lake, approximately 40 km north of Neys P.P.

3.3 Woodland Caribou Movement Patterns / Connectivity

3.3.1 Coastal Range

Long-distance movement by caribou in the coastal range have been documented in the past but they have always stayed near the Lake Superior shore (Bergerud 1985). The radio-tracking of animals collared on Otter Island in Pukaskwa N.P. in the mid 1990s showed that animals moved along the Lake Superior coast, and did not always remain in PNP (Bergerud and Dalton 1990). Long distance seasonal movements by caribou along the Lake Superior coast are documented as occurring over several days during the spring and fall (Neale 2000). Two male caribou travelled from winter/spring range near Otter Island approximately 50 km east along the shore to Floating Heart Bay and another two caribou moved 30-40 km north of Otter Island towards the Oiseau Bay area (Parks Canada unpublished data). Three caribou that were tagged and translocated from the Slate Islands in October, 1985 provide some indication of their dispersal ability (Appendix 1). For example, a male caribou, captured the Slate Islands, tagged, and released on the opposite mainland (Cape Victoria), wintered near the Pic Island herd in 1984-85, then joined the Manitouwadge herd in the autumn of 1985; he was at the White River in August 1986 and died at the Swallow River about April 1987, a total straight line distance of approximately 200 km (Bergerud 1989)(Figure 16). These movement patterns may not represent typical behaviour however due to the stress of translocation to the mainland.

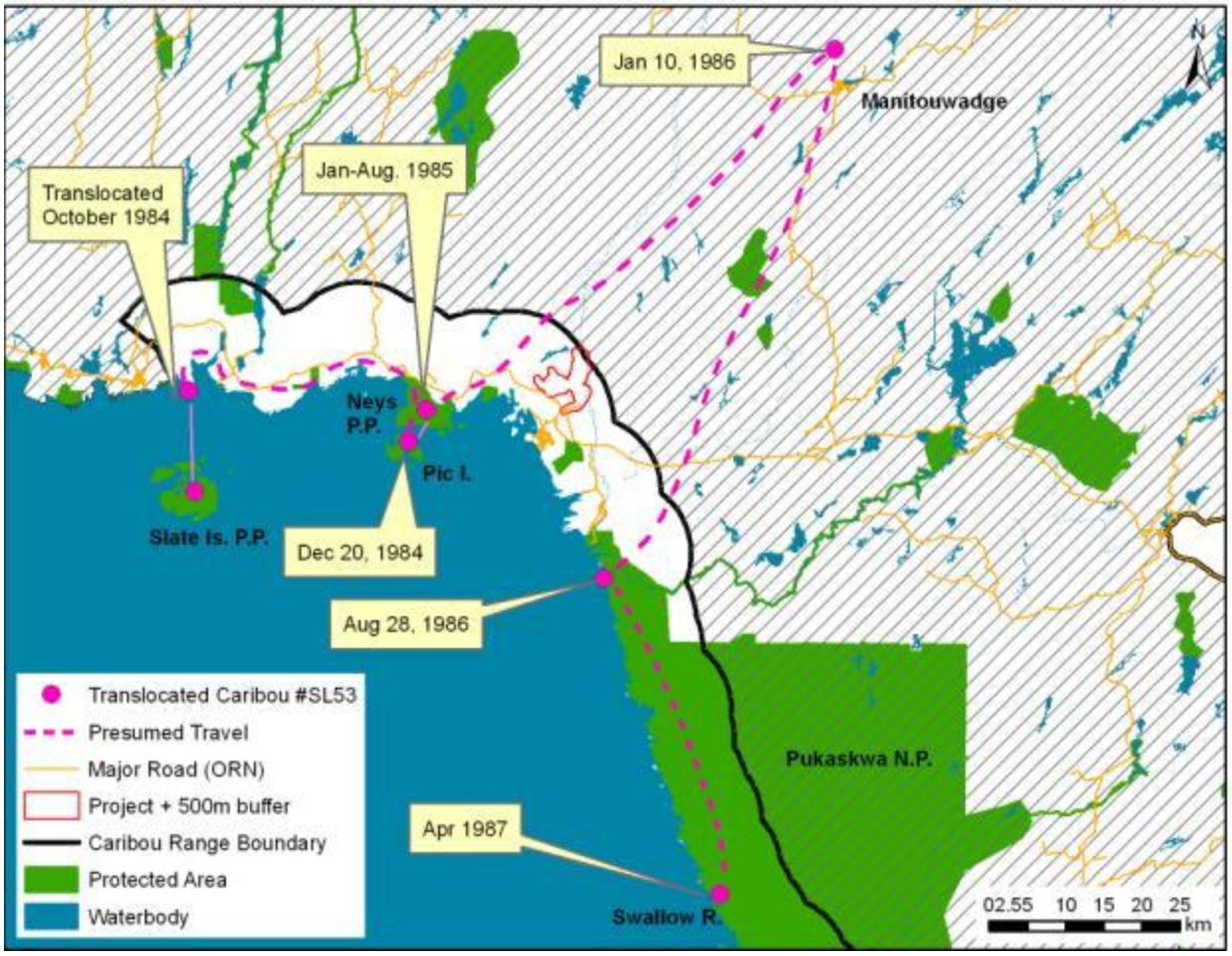

Figure 16. Observations and presumed general movement of tagged bull caribou SL54 translocated from the Slate Island in October 1984 (unpublished data OMNR, Parks Canada).

In addition to seasonal movements, reports of lone caribou in the discontinuous range suggest that at least some animals continue to make occasional long-distance movements. A member of the public reported a lone caribou swimming out the mouth of the Steel River into Lake Superior and headed east on July 10, 2005, with a wolf following shortly thereafter (OMNR unpublished data). It is possible it was a dispersing animal from the Slate Islands or the Nipigon Range, or was part of the population that uses Pic Island. Bergerud (1989) felt that genetic exchange occurs among these disjunct populations at only a low rate. Although likely infrequent, these long-distance movements may be important for demographic or genetic exchange however.

3.3.2 Movement Among Ranges

The likelihood of dispersal from the coastal range to the Nipigon, Pagwachuan, or other continuous ranges farther north is very low given the very low numbers of caribou currently in the coastal range. Surveys for moose and wolves and radio-tracking of caribou in Pukaskwa N.P. described a very low incidence of caribou forays away from the Lake Superior shore, with

5.8 km as the farther distance from shore recorded during 1974-1988 caribou surveys (Bergerud et al. 2007).

Based on available historic and current OMNR telemetry data from OMNR, there are no instances of dispersal from the continuous range to the coastal range, nor any notable movement of individuals south into the discontinuous range (Shuter and Rogers in press; J. Shuter pers. comm. 2011). However, almost all of OMNR's collaring efforts have been restricted to adult females, the demographic group that is least likely to disperse to other areas due to fidelity to traditional calving areas (Schaefer et al. 2000). Incidental observations of caribou outside their continuous range suggest that dispersal may occasionally occur. A transient bull caribou was sighted in October 2007 south of Thunder Bay, then two weeks later near Pass Lake and Hurkett (OMNR unpublished data), well outside its range. Although this record is more than 100 km west of Marathon, it demonstrates the dispersal ability of woodland caribou. In 1980-1981, there were a few observations of caribou in a small area of northern Minnesota (Mech and Nelson 1981). All but one of the 9 observations were of single animals, suggesting dispersal from the nearest known population on Lake Nipigon, approximately 240 km to the northeast.

There have been some recent observations of caribou tracks in the discontinuous zone north of Lake Superior (Figure 12). It is not known if these tracks are from animals that spend some of their time in the coastal range, animals drifting south from the Nagagami area in the Pagwachuan Range, or both (or neither). Only parts of the eastern portion of WMU 21A were flown in the last couple of years by fixed-wing aircraft, so it is not known if there is any recent caribou use or movement in the western portion of the WMU. Caribou have been observed on Leopard Lake southeast of Lake Nipigon.

Preliminary DNA analyses of caribou populations from Ontario suggest substantial genetic differentiation between island groups (Slate Is., Pic I., and Michipicoten I.) and woodland caribou from the continuous range. This suggests that there is limited gene flow as a result of limited genetic exchange There is less differentiation between the Slate Islands and Michipicoten I. than with Pic I. which is not surprising given that at least eight of the nine source animals on Michipicoten I. originated from the Slate Islands in 1982 (Bergerud and Mercer 1989). Exchange between the Slate islands and the mainland does periodically occur. A small herd of approximately a dozen caribou were observed walking across the ice to the Slate Islands circa 1912, although there may previously have been caribou there before as well (Euler et al. 1976).

OMNR (2011) has identified a candidate corridor with potential to enhance connectivity between coastal caribou and the area of continuous distribution to the north. This candidate corridor might link the Coldwell formation, a rugged geological feature which encompasses Neys P.P. and adjacent Lake Superior coast, with the Killala Lake C.R. within the discontinuous range to the north (OMNR 2011). It is hypothesized by OMNR that caribou could potentially move between the coastal and northern continuous ranges through this north-south Neys-Killala corridor (Figure 15). The north shore of Lake Superior has rugged relief, particularly near the coast (Figure 17) and is bedrock-dominated (Figure 18). This ruggedness may contribute to existing caribou viability for occupancy and facilitate long-term connectivity and movement objectives (OMNR 2011). In addition, caribou have been observed running uphill for escape behaviour (Ferguson 1983), so the rugged topography may benefit caribou in wolf encounters (Ferguson 1983).

However, based on existing mapping, the potential Ney-Killala corridor is no more rugged (Figure 17) and has a greater proportion of less-preferred glaciolacustrine landforms than areas farther west along the north shore (Figure 18). This potential corridor does appear to have a lower amount of existing anthropogenic disturbance than some other areas in the discontinuous range (see Figure 33There are no radio-telemetry data available to determine if caribou actually use this hypothetical corridor.

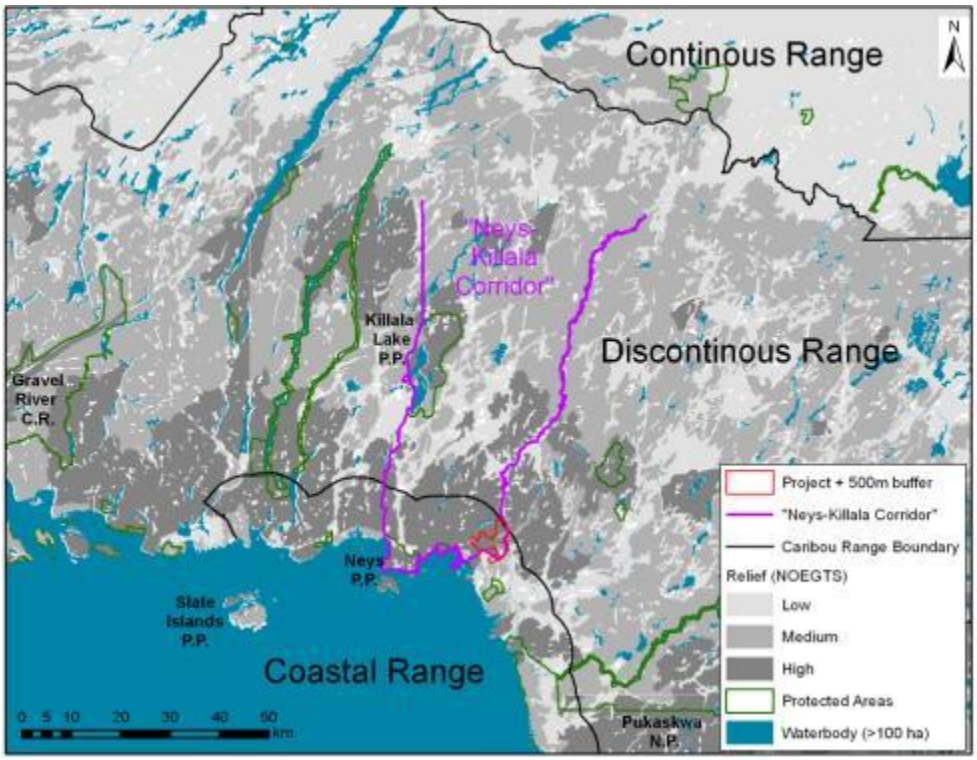

Figure 17. Relief based on Northern Ontario Engineering Geology Terrain Series (NOEGTS) mapping near the hypothetical "Neys-Killala Corridor" and the Marathon PGM-Cu Project + 500 m buffer.

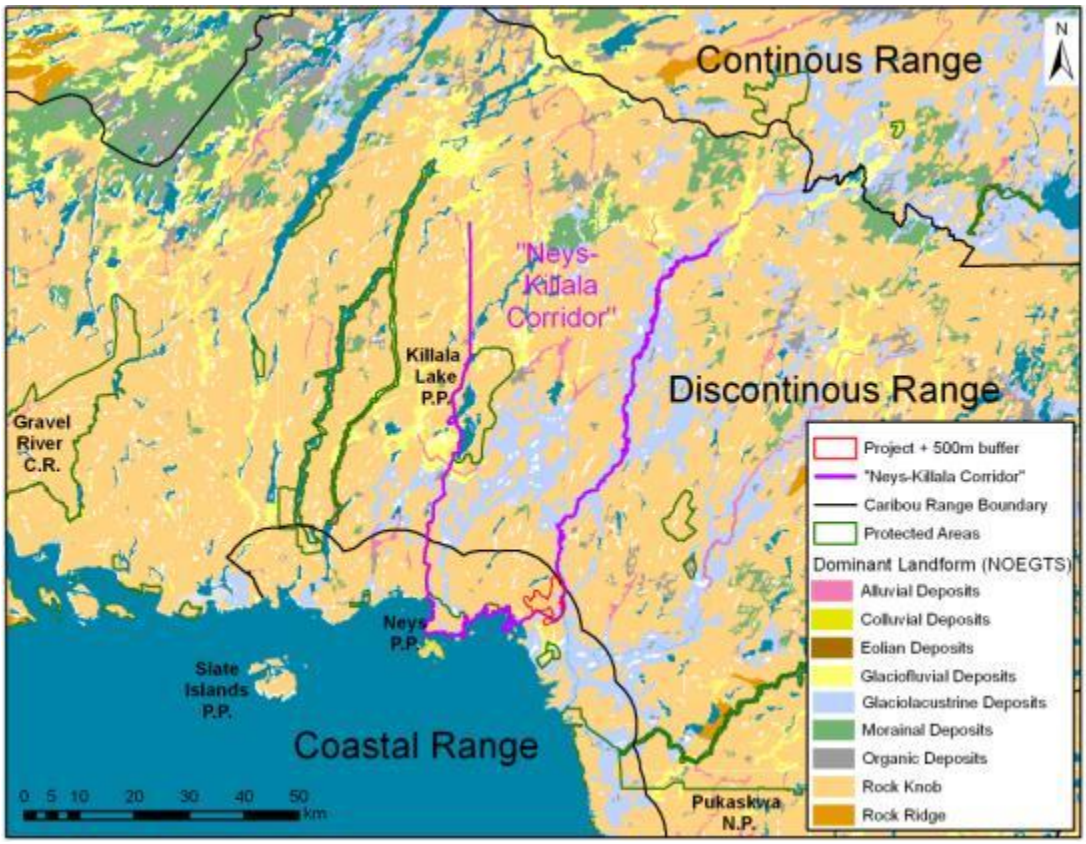

Figure 18. Surficial geology near the hypothetical "Neys-Killala Corridor" and the Marathon PGM-Cu Project + 500 m buffer.

3.4 Populations of Alternate Prey and Predators

Woodland caribou are considered less resilient than moose or white-tailed deer in their ability to withstand and recover from human disturbance and other stressors, since they are very vulnerable to predators, first breed at a later age, have only one young per year, and have larger home ranges (OMNR 2009a). In addition, elevated numbers of white-tailed deer increases the likelihood of transmission of the parasitic brainworm, *Parelaphostrongylus tenuis*, which is fatal to caribou (Bergerud and Mercer 1989; Trainer 1973). Moose and beaver (*Castor canadensis*) are the primary prey of gray wolves (*Canis lupus*) in much of boreal Ontario including the discontinuous and coastal ranges, and deer serves as primary prey for eastern wolves (*Canis lycaon*) farther south (OMNR 2005a).

In contrast to caribou, moose appear to be a relatively recent arrival along the north shore of Lake Superior as part of postglacial dispersal (deVos 1964; Karns 1997), although there is some uncertainty. Peterson (1955) noted that "the St Ignace area supported both a high population of wolves and moose and has apparently done so for some time". An analysis of wolf scat from St. Ignace Island in 1947-48, found deer and moose hair to be equally abundant (Peterson 1955). The breeding range of white-tailed deer in Ontario has expanded in recent years, after

an expansion in the early part of the 20th century followed by a range retraction during a period of harsher winters from the late 1950s through the late 1970s (Racey 2005; Thompson 2000)(Figure 19). Deer sign first appeared on the Coldwell Peninsula at Neys in 1965, although moose sign had been there since the 1940s (Ferguson 1983). During the 1970s, deer were reportedly abundant on Wilson and Copper islands for decades (approximately 20 km west of Terrace Bay), with isolated pockets on the adjacent mainland (Gollat 1976). Although no density estimates are available, deer are currently found within the coastal zone west of Pukaskwa, and Neale (2000) found deer hair in predator scat from the Otter Cove area, well within the park.

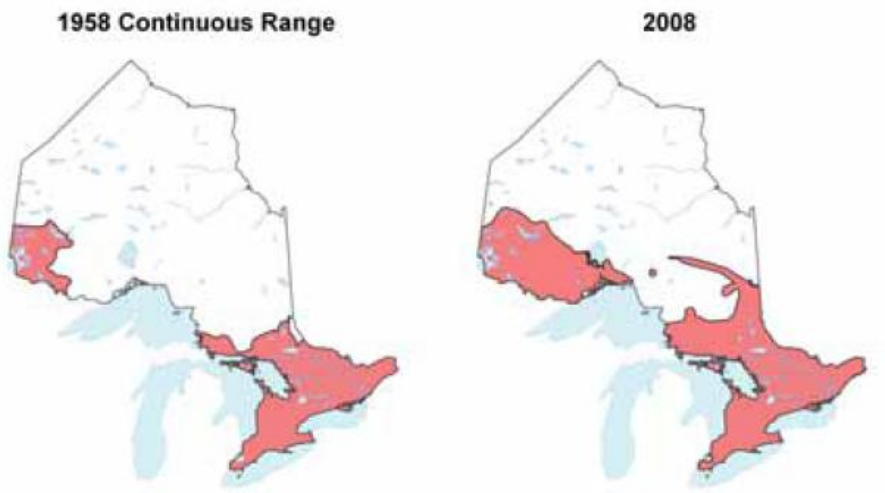

Figure 19. Expansion of continuous range of white-tailed deer range (OMNR 2008).

Beaver can be an important prey item of wolves, particularly in summer (OMNR 2005a; Voigt et al. 1976; Theberge et al. 1978 and references therein). OMNR fur harvest data (available for 2007-2010 show no returns for trapline TR022 which overlaps the Project site; trapline TR023 which encompasses the Pic River and east recorded 54 beaver and no wolves trapped for the same time period. Fur harvest returns, although compiled by spatially discrete traplines, are strongly dependent on trapper effort, access, and the price of fur. Although fall beaver surveys were once carried out, OMNR no longer routinely collects density data for beaver, nor are they included in their standard wildlife inventory manual (Ranta 1998). The importance of beaver as a prey item may depend on availability, proximity to wolf den and rendezvous sites, ungulate density and other factors (OMNR 2005a). Neale (2000) found beaver hair in 41% of wolf scats examined along the coastal zone of Pukaskwa National Park, and beaver comprised 35% of the diet of inland wolves (Krizan 1997). Beaver are likely even more abundant in the coastal zone outside Pukaskwa due to the greater proportion of young forests with more hardwood component (Forscner 2000). They are generally abundant on the lakes and watercourses of the coastal zone (R. Tyhuis, pers. comm.), including the project site. The importance of beaver likely changes seasonally however, because they are less vulnerable in winter.

Although data are limited for the north shore, the increase in moose and deer (and possibly beaver) as alternate prey may have increased wolf populations within the coastal range during the 20th century. Wolves were reportedly less common in central Ontario prior to the invasion of moose (Cringan 1957; Simkin 1965), and Kolenosky (1983) showed that historically wolves were more common in central and southern Ontario, where moose and deer provided much of the food base, than in northern Ontario where the less abundant caribou are the main food source. Hatter (1950) documented that wolves increased in British Columbia after moose expanded their range in the 1940's, and a similar dynamic may have occurred in the coastal range in Ontario.

Average moose densities in the WMUs that overlap the coastal range vary from 0.286 to 0.332 (OMNR unpublished data)(Figure 6). Average moose densities (per km^2) along the north shore of Superior have increased over the last several decades from 0.18 in 1974-85, to 0.24 in 2001 (Bergerud 2007) as well as within most WMUs overlapping the coastal and discontinuous ranges (Table 1). Moose density can vary considerably within large WMUs depending on habitat conditions, hunting pressure, and other factors (e.g., Figure 20). In the 13,625 ha WMU 21A, moose density (/km^2) is almost twice as high in the western half (0.42) of the WMU compared to the eastern half (0.22)(Tyhuis 2011a). Moose densities along the north shore of Lake Superior within WMU 21A appear to have increased between the 1975-1979 and 1990-1995 time periods (McKenney et al. 1998). The average density of moose/km^2 in the Greater Pukaskwa Ecosystem from 1993-1999 was 0.192 (Forshner 2000).

Table 1. Moose densities and wildlife sightings in wildlife management units (WMUs) in the coastal and discontinuous ranges (See Figure 6 for WMU locations).

WMU	Moose Density (/km^2)		# Seen/ Resident Hunter Day (2010 Moose PCS)			Predicted Wolf Density*** (/1000 km^2)
	1990-1995*	2005-2011**	Moose	Deer Seen/	Wolves	
13	0.14	0.30	0.223	0.439	0.089	12.5
14	0.28	0.40	0.570	0.048	0.225	17.7
15B	0.26	0.31	0.156	0.077	0.078	12.7
19	0.14	0.15	0.215	0.007	0.087	8.4
21A	0.18	0.33	0.125	0.021	0.067	13.3
21B	0.21	0.29	0.225	0.007	0.081	12.0
32	0.31	0.28	0.251	0.007	0.079	12.0
33	0.22	0.33	0.293	0.002	0.114	13.3
34	0.35	0.35	0.424	0.003	0.094	13.8
35	0.26	0.22	0.334	0.024	0.085	10.2
36	0.22	0.19	0.238	0.161	0.116	9.4

*McKenney et al. 1998; **(OMNR unpublished data; date depends on WMU)

*** estimated using equation Y=4.239+27.217*x*, wolf densities regressed on moose densities from Bergerud (2007)

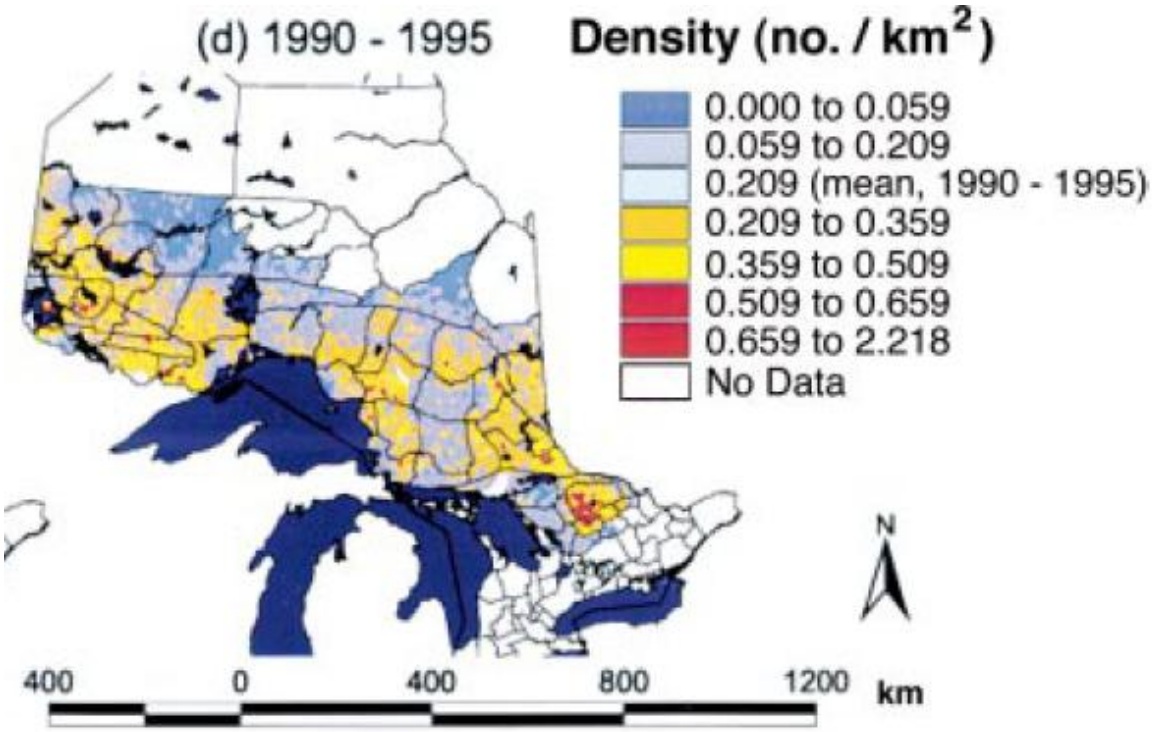

Figure 20. Moose densities in Ontario for the period 1990-1995 showing variation within individual WMUs (McKenney et al. 1998).

Moose densities within most of the continuous range of woodland caribou in Ontario are generally less than 0.10/km^2; Bergerud et al. (2007) predicted caribou to decline in WMUs which have moose densities exceeding this threshold. Moose densities that support greater than 6 wolves/1000 km^2 were predicted to result in caribou extirpation from wolf predation (Bergerud et al. 2007). Under the Strategy for Wolf Conservation in Ontario (OMNR 2005b), OMNR has committed to monitoring the status and trends of wolf populations by Wolf Ecological Zones. Wolf densities and trends in the discontinuous and coastal ranges are not yet known since aerial survey results are not complete. However, results from hunter surveys indicate a steadily increasing trend in wolf numbers in Wolf Ecological Zone 2, a very broad zone that includes the north shore of Lake Superior, throughout the 2000s (Patterson and de Almeida 2011). Using Bergerud et al.'s (2007) relationship between moose density and wolf density, the predicted density for wolves in all WMUs in the coastal and discontinuous ranges range from 8.4 to 17.7 wolf/1000 km^2. The highest predicted wolf densities are WMU 14 which encompasses Black Bay Peninsula. This corresponds with the highest wolf and moose numbers observed on WMU 14 based on 2010 post card survey (PCS) data (Table 1). OMNR (2005a) considers that wolf numbers in Ontario are stable or increasing in most areas of the province based on stable fur harvest data and increasing moose/deer numbers. Density of wolves (/1000 km^2) in the winters of 1995-1996 were 7.9 to 9.6 in Forshner's study area in Pukaskwa National Park and the area to the north (Appendix 2).

Even if Bergerud et al.'s (2007) equation is a poor predictor, it appears that wolf densities along the north shore of Lake Superior are higher than may be compatible with caribou persistence on a landscape scale. Woodland caribou in the coastal range likely have been able to persist (albeit in declining numbers) by taking advantage of escape habitat such as islands and peninsulas along the Lake Superior coast (Bergerud 1985). Caribou are close to extirpation in Pukaskwa N.P., apparently due to wolf predation in the central and southern portion of the park where wolf densities averaged 8.5/1000 km^2, with even higher densities of wolves on the north boundary of the PNP and adjacent logged landscapes to the north (Burrows 2001; Forshner 2000). Factors potentially ameliorating the impact of wolf predation on caribou persistence in this area are that several of the packs in this area do not appear to be food limiting, reproductive success is among the lowest in North America, and starvation of wolves has been documented despite moderate moose densities (Theberge 2002). Wolf predation on Pic Island during the late winter of 1976-1977 was partly responsible for the decline which reduced the island population by almost half (Ferguson 1983). Four of eight wolf scats collected from Pic Island and the adjacent Coldwell Peninsula from August 1977 to April 1978 contained caribou remains.

In addition to wolves, black bears (*Ursus canadensis*) and Canada lynx (*Lynx canadensis*) have been known to prey upon caribou (Ballard 1994; Bergerud 1971). In Pukaskwa, caribou hair has been found in the scat of wolf, bear, and lynx, although it is unknown to what degree this represents scavenging rather than predation events (Bergerud 1989). Neale (2000) found hair from both adult and young caribou in 2 of 8 lynx scats examined in the coastal zone. Although density estimates are unavailable for Pukaskwa N.P. or the surrounding coastal range, Neale (2000) believed that black bear are of sufficient abundance to be a significant predator on caribou calves in the park. However, black bears appear common in much of the coastal range west of Pukaskwa (Foster, pers. obs.) where disturbed habitats and dumps provide abundant food supplies. With one possible exception, Ferguson (1983) found no evidence of caribou predation in black bear 237 scats examined from Pic Island and the adjacent Coldwell Peninsula during 1977-1981. Coyotes are uncommon, but have now been seen in Pukaskwa National Park (Bergerud 1989) and along the north shore of Lake Superior (Foster pers. obs.), and could be another potential predator of caribou calves.

4 WOODLAND CARIBOU HABITAT

Woodland caribou use habitat at multiple scales from the broad landscape level to fine scale habitat selection determined by forage availability (e.g., lichens). Under natural conditions, caribou habitat in the boreal forest is not static, since disturbance from wildfire, blowdown, and insects can quickly change the amount and distribution of the habitat (OMNR 2008). As a result,

within caribou's continuous distribution in Ontario, caribou habitat is typically a shifting configuration of large patches of mature forest, which varies regionally due in large part to fire cycles and other natural disturbances. Logging and other anthropogenic disturbances have added another layer of variability to woodland caribou habitat use.

The 2007-2017 forest management plan for the Big Pic Forest, which overlaps the project site, states (p. 105) that "The Southern zone, encompassing the rest of the forest, was not considered current or potential caribou habitat, and therefore was not subject to any special considerations". The South Zone encompasses all the Coastal Range and Discontinuous Range (as defined in the CCP) within the Big Pic Forest (Figure 21). The FMP and the accompanying Analysis Package state that "there are no known woodland caribou populations currently located on the Forest" although it does mention of potential use at the northern edge of the FMU by the Nagagami herd.

Figure 21. Big Pic Forest 2007-2017 FMP Caribou Zones in relation to the Project + 500m buffer (red outline).

4.1 Calving/Nursery habitat

In Ontario, typical calving and nursery habitat consists of islands on large lakes (e.g., Lake Nipigon, Lac St. Joe, Lac Seul, Trout Lake) and treed "islands" within large peatlands, where cows can isolate themselves and their calves from predators (OWCRT 2008). Female caribou show a high degree of site fidelity (philopatry) to traditional calving/nursery areas, typically using them every year in the absence of disturbance such as wildfire (Schaefer et al. 2000). Unlike barren-ground caribou which calve in large aggregations, woodland caribou females calve in isolation, with calving areas typically dispersed at low density across the landscape as

an anti-predator strategy (Bergerud 1985). Individual females often make long distance movements every year from winter habitat to select safe calving refugia from wolves and bears (Cumming and Beange 1987).

No suitable locations for woodland caribou calving/nursery are found in or near the Project site. Bamoos Lake at the northern edge of the Property is by far the largest inland lake near the project site, and although it has several islands, it is only 180 ha in size. There are no known historic or current records of any use of Bamoos Lake as caribou calving/nursery habitat (OMNR caribou database; R. Tyhuis pers. comm.), nor are there any large peatlands that could serve as calving/nursery habitat.

4.2 Refuge Habitat

Caribou distribution and habitat selection is thought to be largely driven by predator avoidance (security/refuge habitat)(OMNR 2009a). Woodland caribou typically have large individual annual home ranges of approximately 200-4000 km^2 in large intact boreal forest and peatland landscapes (OWCRT 2008; OMNR 2009a). Caribou typically occur at low densities that are insufficient to support abundant populations of predators such as wolves and to a lesser extent, black bears. In addition, the older forests and peatlands that caribou typically occupy offer insufficient food for other prey such as moose and deer, which further protect caribou from wolf predation. Biologists believe that caribou disperse across the landscape in low numbers and actively select mature and older conifer-dominated forests to minimize contact with predators (OMNR 2009a).

Woodland caribou have persisted on the Slate Islands in the absence of predators and in the absence of sufficient lichen for the maintenance of health in seemingly most if not all winters (Bergerud et al. 2007). In the absence of wolves, caribou have also thrived for the past 30 years on Michipicoten Island, even though it is within the Great Lakes-St Lawrence Forest Region (Rowe 1972). There is no typical caribou habitat, with the dominant overstory species being mountain maple (*Acer spicatum*), sugar maple (*A. saccharum*), and red maple (*A. rubrum*), as well as white birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*). Canada yew (*Taxus canadensis*) and white pine (*Pinus strobus*) are also common and there are some boreal conifers on one ridge (Bergerud et al. 2007). In the Coastal Range caribou may use atypical (as defined by the OLT) habitats if they can find suitable refuge from predators, particularly islands and peninsulas (Bergurud 1989; R. Hartley pers. comm.).

Ontario's Landscape Tool (OLT) (Elkie et al. 2009b) is a FRI-based predictive model which was used to estimate the value of refuge habitat in the Project and adjacent ranges (Figure 22, Figure 23). In the OLT, refuge habitat consists of forest that may be suitable for caribou year-

round and includes low productivity winter sites with lichen as well as well-stocked upland mature and old conifer with little lichen abundance. Soils may be productive to very productive but the conifer cover has suppressed the growth of shrubs and forbs preferred by moose and deer. Age of onset for refuge is generally 40-60 years in fire-origin sites. Approximately 361 ha within 500 m of the Project was classified as refuge habitat using the OLT with the largest areas along the eastern uplands and scattered pockets on the southeast boundary (where they overlap with winter habitat)(Figure 39). Of these, only 88 ha overlapped the proposed pits, rock stockpile, or process solids management facility (tailings). The predominantly hardwood forest of the project site may support high moose and predator populations and therefore be unsustainable for caribou, although the larger landscape context within which the study area is located could be equally or more important than the habitat characteristics solely within the site.

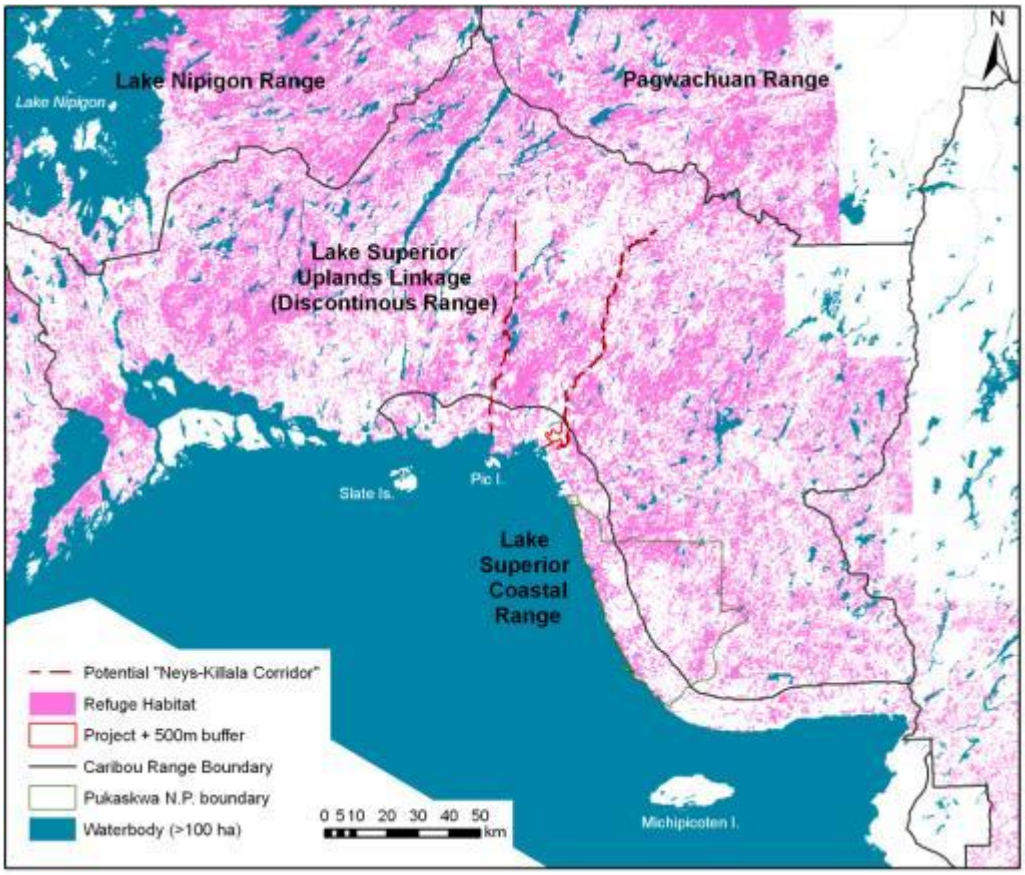

Figure 22. Caribou refuge habitat using OMNR's Ontario Landscape Tool (Elkie et al. 2009b) in the coastal, discontinuous and adjacent ranges.

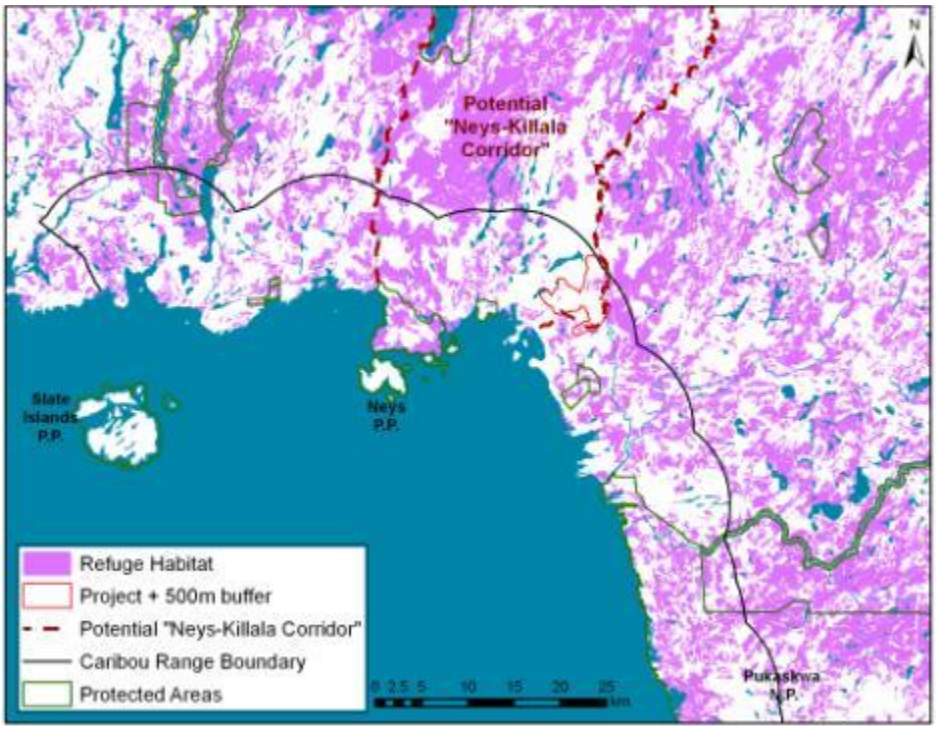

Figure 23. Caribou refuge habitat using OMNR's Ontario Landscape Tool (Elkie et al. 2009b) in relation to the Marathon PGM-Cu Project + 500m buffer (no data are available for Slate Islands P.P. and Pic Island portion of Neys P.P.).

4.3 Winter Habitat

The ground lichens found in old conifer-dominated stands are one of the main winter foods for caribou in much of Ontario, but are unsuitable forage for deer and moose which prefer younger forests with abundant browse such as willows (*Salix* spp.), red osier dogwood (*Cornus stolonifera*), and eastern white cedar (*Thuja occidentalis*) (OWCRT 2008). Arboreal lichens in older conifer forests along the Lake Superior coast provide similar winter forage for caribou, but not moose or deer. Nutrition is not thought to be a limiting factor for caribou in Ontario generally (NCASI 2007; OWCRT 2008), rather it is the predators that are associated with moose, deer, and beaver in younger mixedwood and hardwood forests. Woodland caribou will also use lakes in winter (Ferguson and Elkie 2005), cratering through snow to access meltwater, and often ruminating on the ice, perhaps as an anti-predator strategy (Ferguson and Elkie 2005). Caribou tracks and individuals have been observed in the coastal zone on lakes (OMNR unpublished data; Tyhuis pers. comm.). Ferguson and Elkie (2005) found that caribou selected winter ranges consisting of medium-sized lakes (5-100 ha) with considerable perimeter (3-6 km) relative to available lake feature. The Project property only has four, widely-spaced lakes meeting these criteria, limiting their value as escape habitat.

Areas that are classified as usable (capable) by the OMNR's Ontario Landscape Tool (OLT) are generally those where the soil and/or landform types are conducive to perpetuating conifer-

dominated forest, and may provide suitable winter habitat in the future. They are characterized in the uplands by generally lower primary productivity, shallow soil, exposed bedrock, or if underlain by deeper and richer soils, they have a strong conifer legacy. Winter suitable habitat consists of mature and old upland conifer stands dominated by jack pine (*Pinus banksiana*) and black spruce (*Picea mariana*), especially those on open stocked poorer site classes (i.e. lower productivity), and often rich in ground lichens (Elkie et al. 2009a). In the lowlands, capability is characterized by black spruce lowland, bogs and fens. Capability is independent of tree/stand age since it represents potential of the stand to become suitable for winter habitat at 40-60 years of age.

Very little of the coastal and discontinuous ranges is classified as preferred winter habitat by the OLT (Figure 25). Unlike refuge habitat, which is only marginally below the lower quartile, as of 2010 winter habitat was at the extreme lower end of the range of estimated natural variation for the Lake Superior Coastal Range (P. Elkie pers. comm.). As indicated in the Development of a Woodland Caribou Strategy for the Pic River Forest as part of the Pic River Forest 2011-2021 LTMD Analysis Package the simulated range of natural variation (SRNV) and Natural Benchmark run both indicate that the Pic River Forest is currently lacking immature, mature and old pure conifer forest units. This lack of conifer directly correlates with the reduced availability of winter caribou habitat. As demonstrated by the caribou on Michipicoten Island, caribou may use atypical habitats if they can find suitable refuge from predators. In the coastal zone, caribou may use “atypical” winter habitat (R. Hartley pers. comm.).

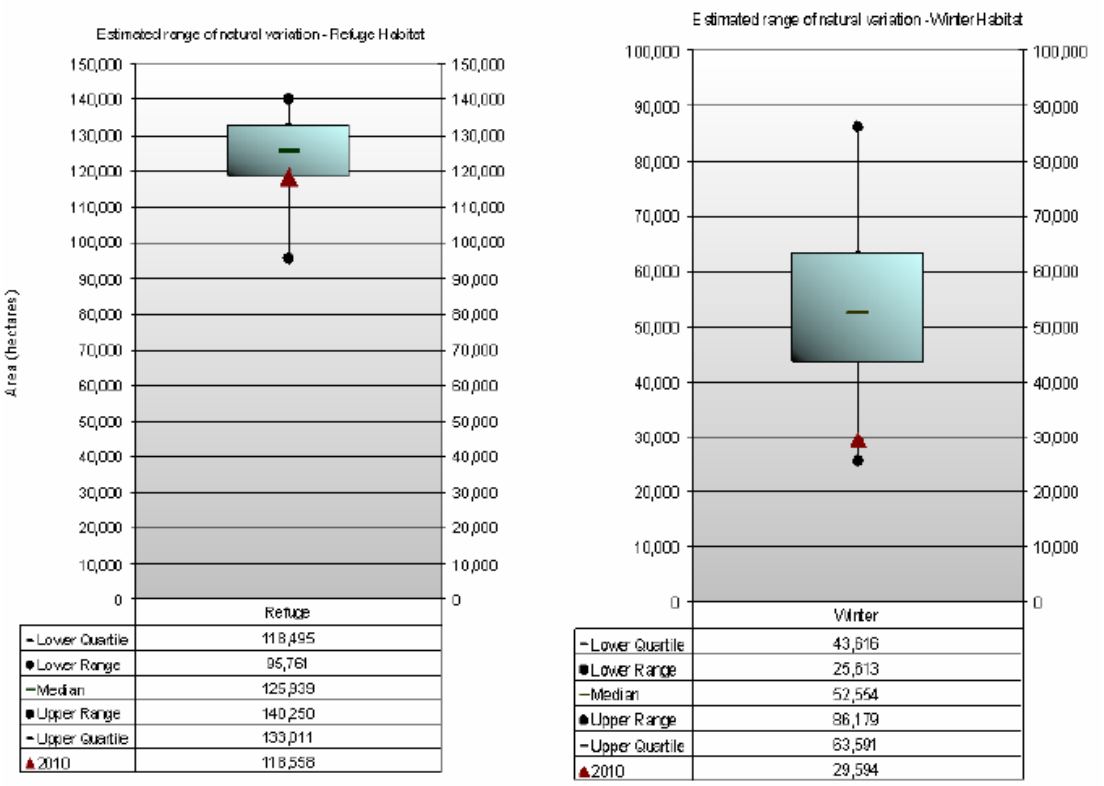

Figure 24. Current values and estimated range of natural variation for caribou refuge (left) and winter (right) habitat in the Lake Superior coastal range (P. Elkie pers. comm.).

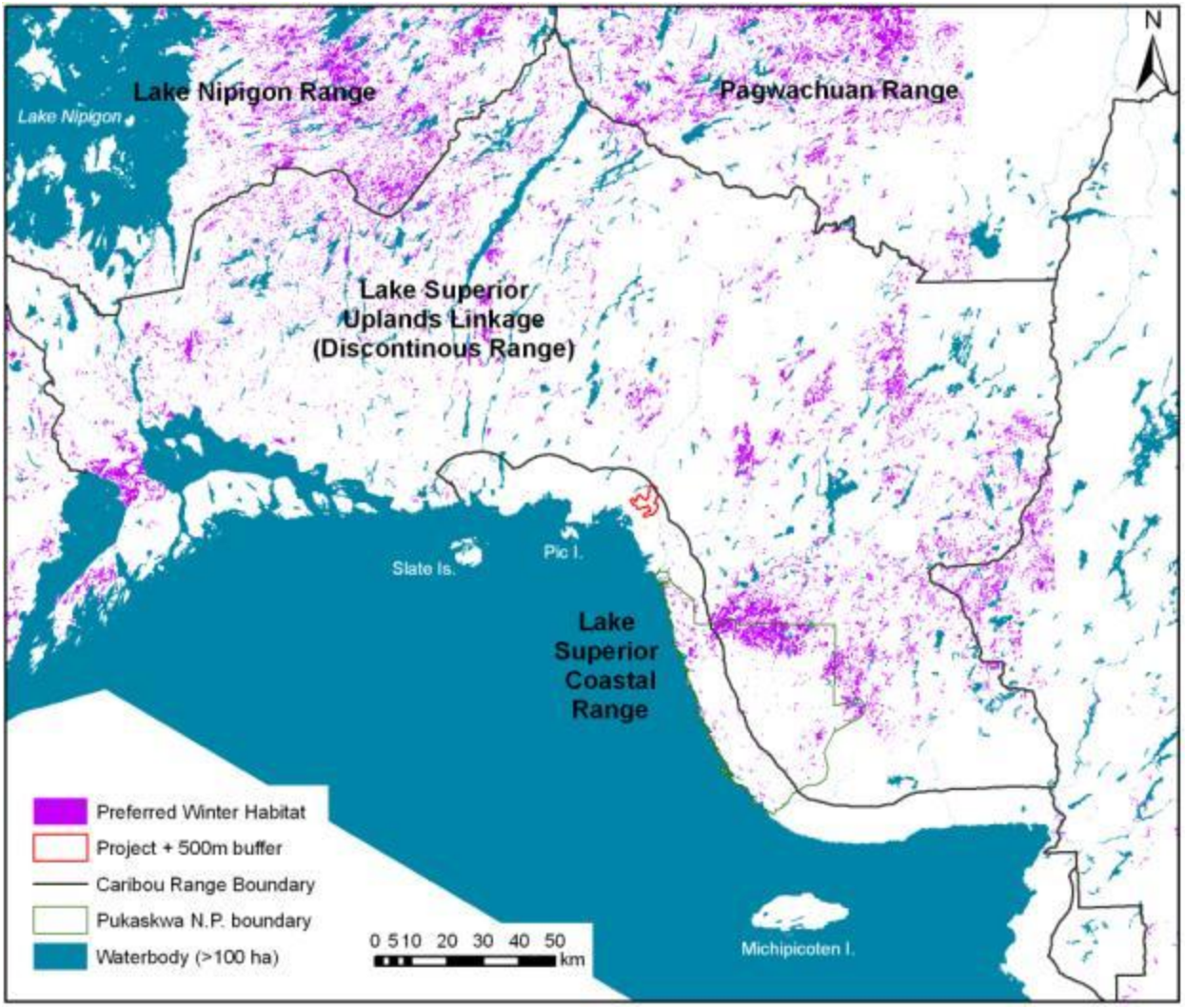

Figure 25. Preferred winter habitat for caribou in the coastal, discontinuous and adjacent ranges using OMNR's Ontario Landscape Tool (Elkie et al. 2009b).

As modelled by the OLT, there is no preferred winter habitat and only 66 ha of usable winter within 500 m of the Project, due to the low abundance of mature, conifer-dominated forests as well as other landscape attributes (Figure 26). Only 10.6 ha of usable winter habitat (as modelled by the OLT) overlaps the Project's pits, rock stockpile, or process solids management facility (tailings). In addition, there is very little usable or preferred habitat in the broader landscape immediately surrounding the study area. Some rocky hilltops with lichen cover are

potential winter habitat and could support caribou moving through area (

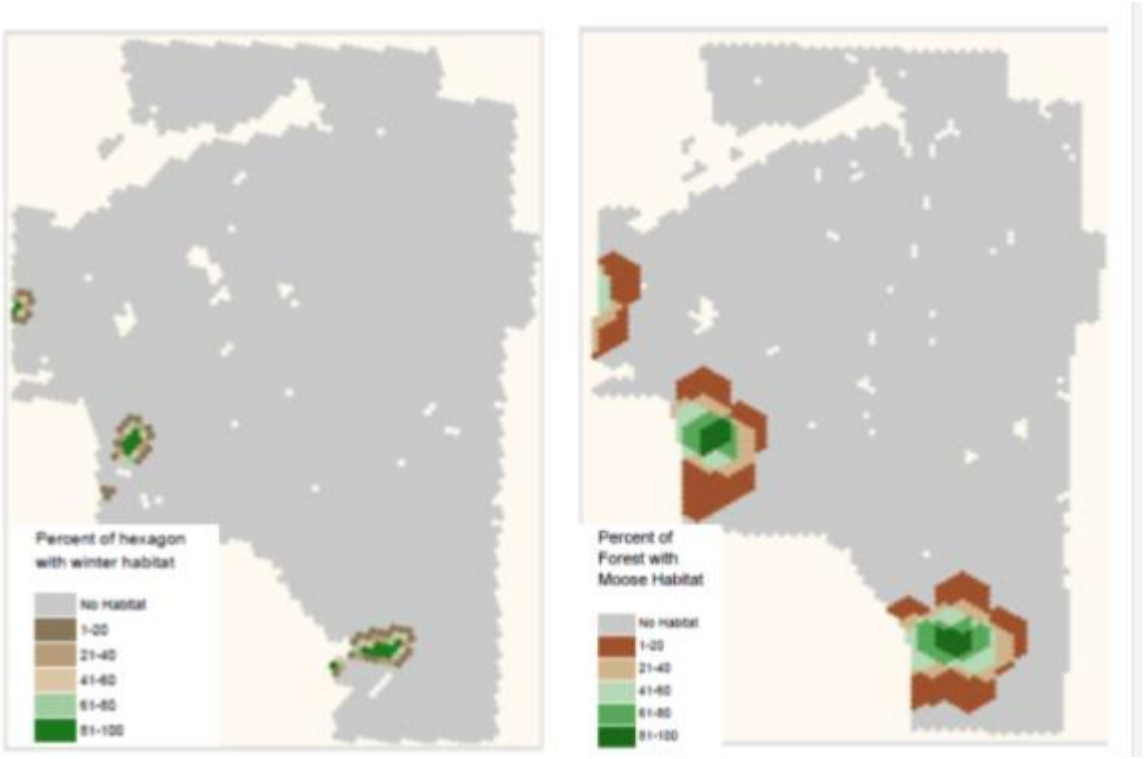

Figure 28). However, the winter habitat identified in

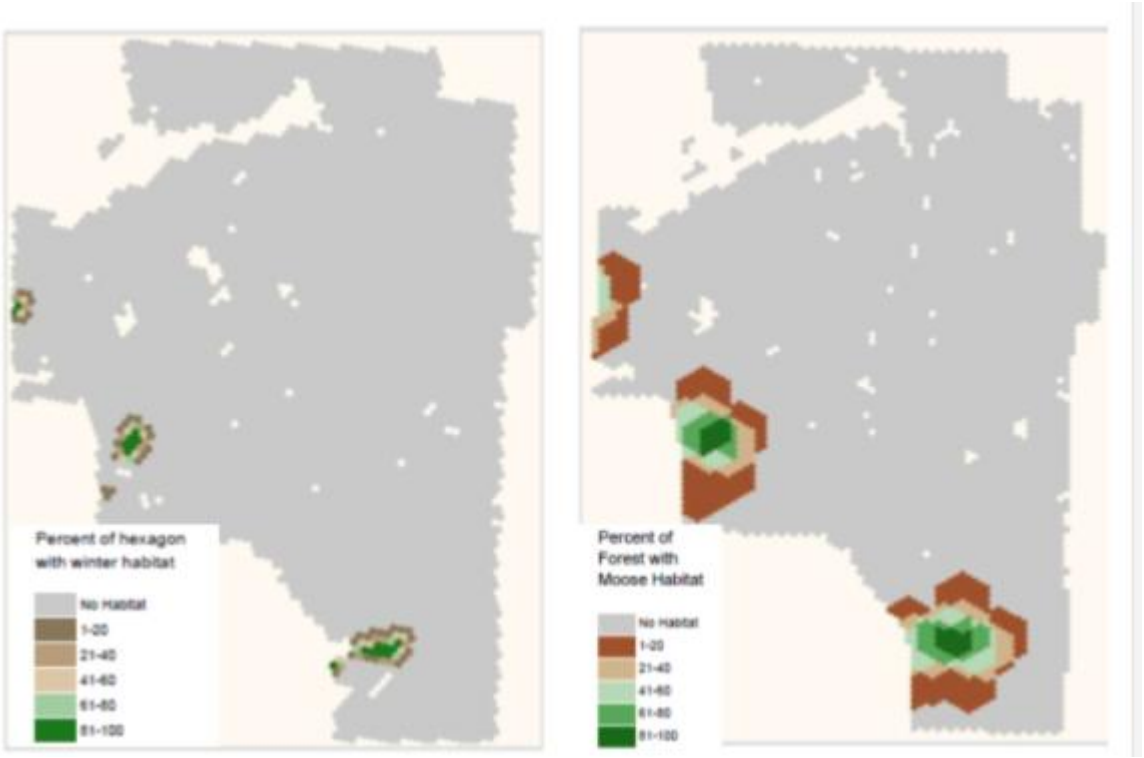

Figure 28 is in close proximity to the airport, hotels, Ministry of Transport highway maintenance/gravel station, Highway #17 and noise disturbance may deter use of this habitat

by caribou. In addition, approximately 11% of the Property land base is considered suitable habitat for moose winter cover (

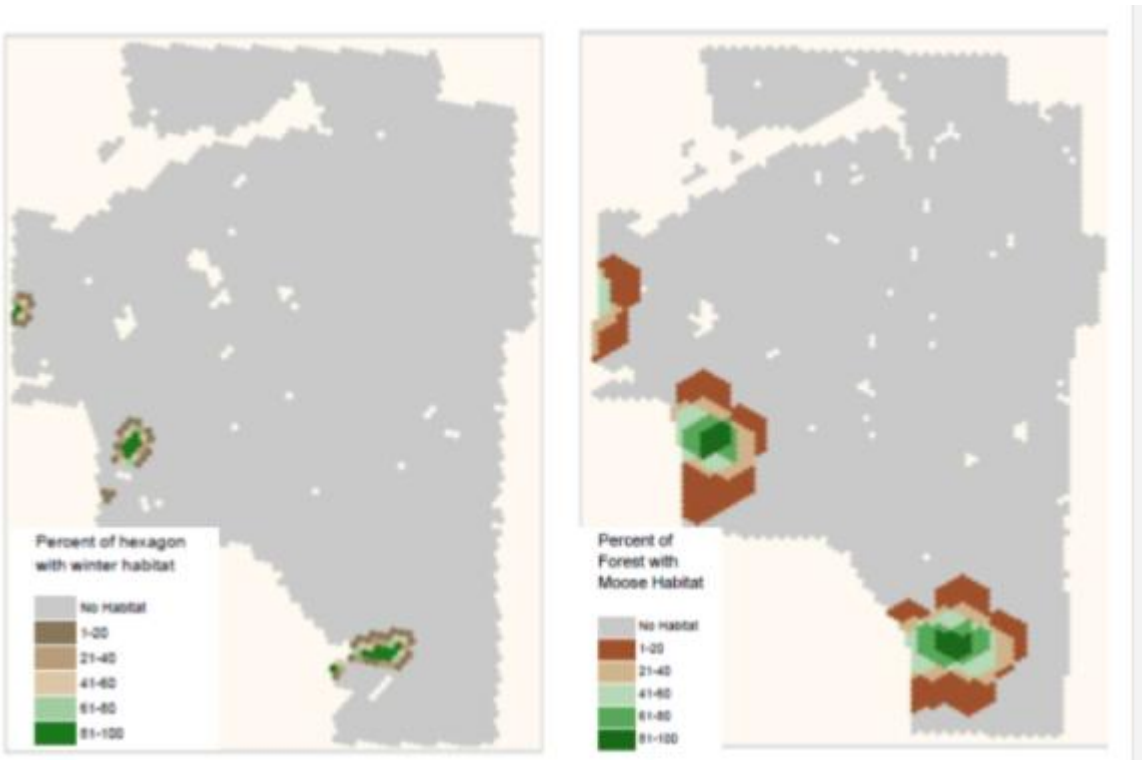

Figure 28), and these areas overlap with potential caribou winter habitat. Increased risk of predation by wolves attracted by higher moose densities in these areas could further limit the suitability for caribou.

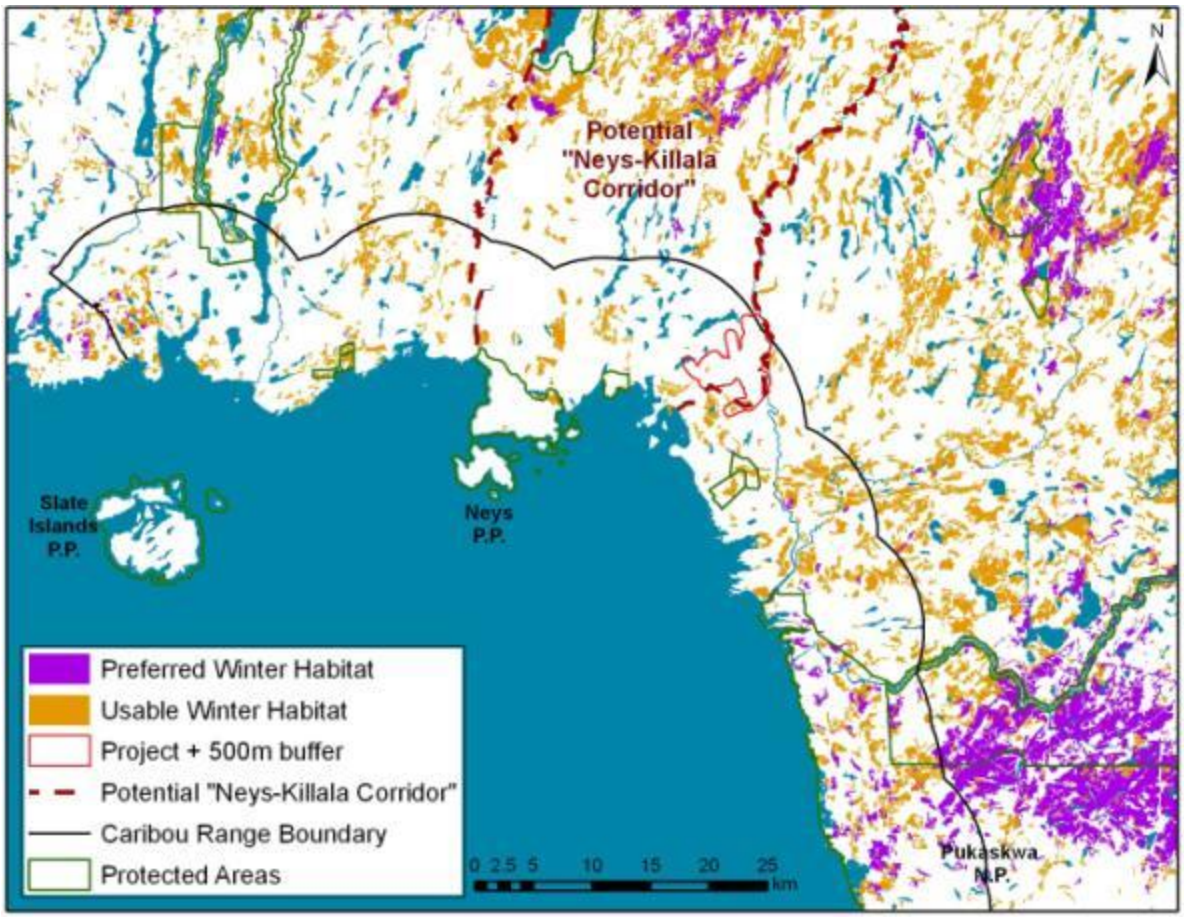

Figure 26. Preferred and usable winter habitat for caribou using OMNR's Ontario Landscape Tool (Elkie et al. 2009b) in relation to the Marathon PGM-Cu Project + 500m buffer (no data are available for Slate Islands P.P. and Pic Island portion of Neys P.P.).

Figure 27. Exposed bedrock slope on northeast portion of Project site with patches of ground lichen.

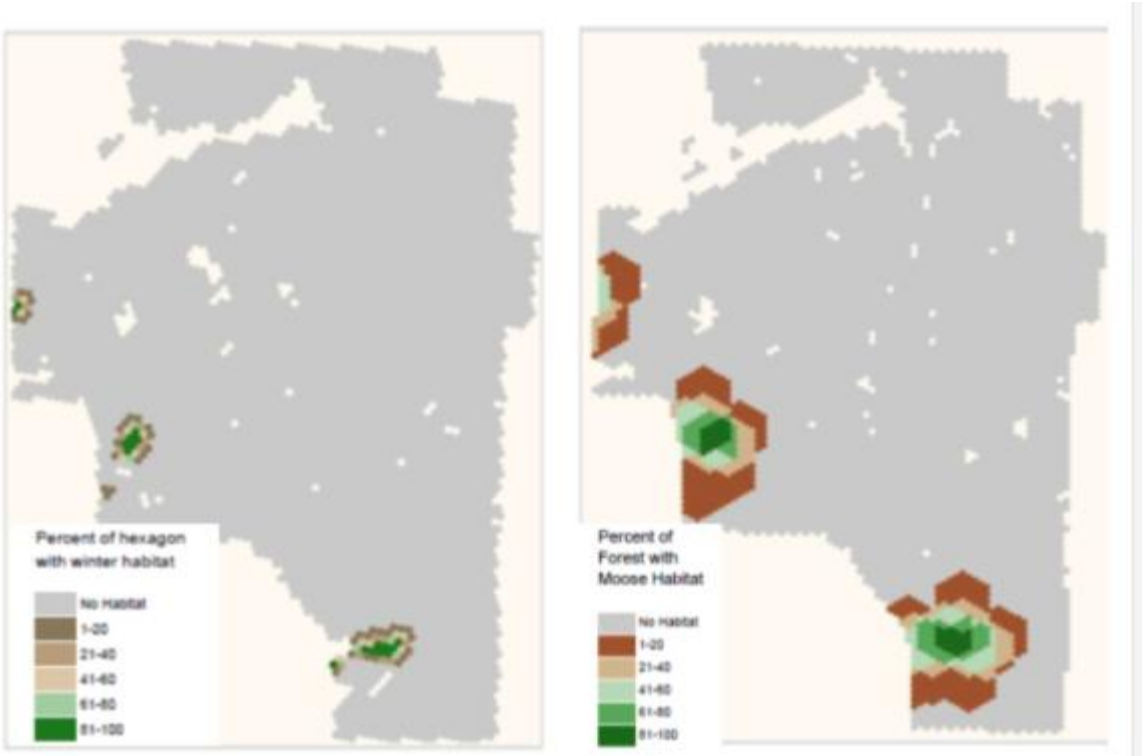

Figure 28. Forest Resource Inventory based suitability index (50 ha scale) for caribou (left) and moose (right) winter habitat in relation to the Marathon PGM-CU Project property based on OMNR's Ontario Landscape Tool (Elkie et al. 2009b). Grey shading approximates Stillwater property.

OMNR's Ontario Landscape Tool may not adequately model atypical caribou winter habitat that in the Coastal Range (G. Hooper pers. comm.). Although data are limited, it is thought that caribou in the Coastal Range may use lower quality winter habitat due to limited availability of "classic" winter habitat such as open jack pine stands on sandy glaciofluvial deposits (R. Tyhuis pers. comm.). The limited aerial surveys conducted in the winter in the Coastal Range and adjacent Discontinuous Range suggests that woodland caribou might use smaller pockets of lichen-rich openings bedrock knobs; it is thought the low productivity of these sites may contribute to lower moose use and hence lower risk of predation to caribou by wolves (G. Hooper pers. comm.). This hypothesis needs to be validated with additional data such as collected through the use of telemetry and aerial surveys. The OLT may therefore underestimate the availability of preferred and used winter habitat on the Property.

Aerial surveys conducted for this EA indicated the presence of such outcrops on the bedrock uplands of the Property and are visible on updated eFRI (Figure 30). Individual lichen-rich outcrops are too small (<1 ha) to be delineated in the FRI (the minimum polygon size for FRI is typically 7 ha). However, the most potentially suitable areas on the Property appear associated with ecosite B014TlVSn which is a white spruce or white birch dominated, dry ecosite with soils ≤15 cm deep. Field verification in 2012 with OMNR biologists showed these ground lichen-rich outcrops to be scattered in a matrix of dense balsam fir, with some white birch, black spruce and white spruce ($Bf_5Bw_2Sb_2Sw_1$)(Figure 29). These lichen outcrops are similar to ones elsewhere in the Coastal Range where cratering by caribou has been observed on some aerial

surveys (R. Tyhuis, pers. comm.). Although moose will browse on both birch and balsam fir, this ecosite was largely lacking preferred browse species of moose such as willows (*Salix* spp.), mountain maple (*Acer spicatum*), and red osier dogwood (*Cornus stolonifera*), and beaked hazel (*Corylus cornuta*). Moose sign was relatively infrequent and largely limited to access trails. Such ecosites might potentially provide winter or refuge habitat for woodland caribou even though the OLT did not show it as suitable. There is no evidence of actual use by caribou however.

Figure 29. Small, lichen-rich openings on bedrock with white birch, balsam fir, and black spruce (G. Hooper photo).

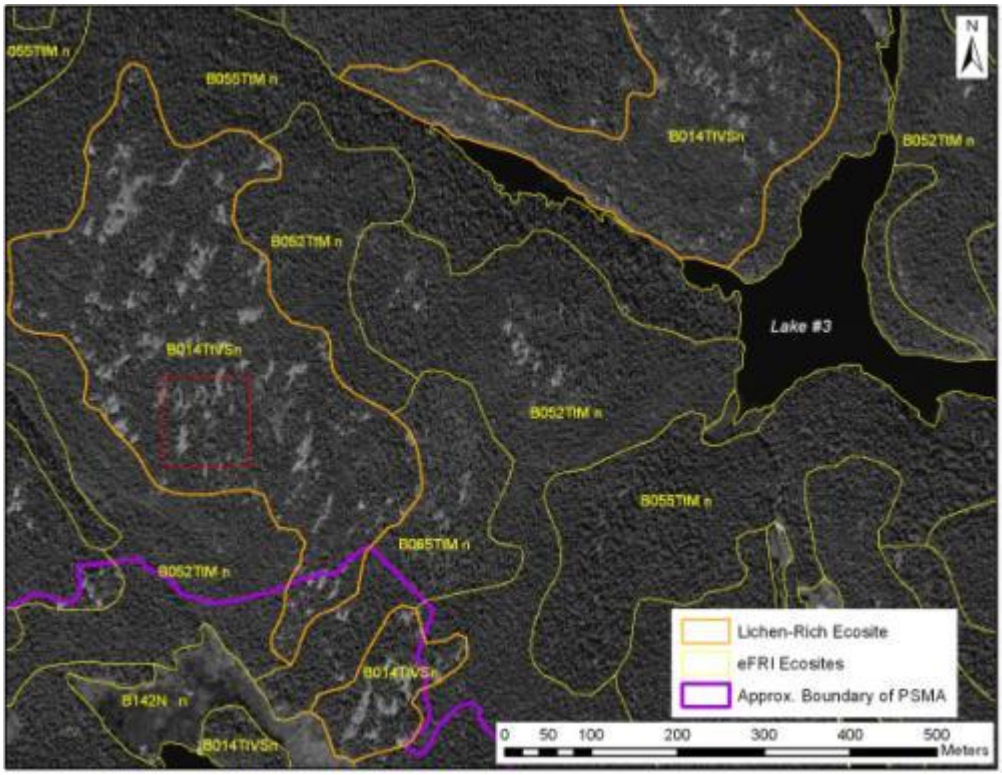

Figure 30. New 2007 Forest Resource Inventory (eFRI) showing updated ecosites in relation to the outer boundary of the proposed Process Solids Management Area (PSMA i.e., tailings) in the western portion of the Property. The red square (1 ha) denotes approximate locations of Figure 29.

The same lichen-rich ecosite (B014TlVSn) and other shallow-soiled ecosites area found on portions of the eastern half of the property near Malpa Lake (Figure 27, Figure 31). However, the deeper silty soils near the Pic River support abundant beaked hazel and mountain maple, which has been heavily browsed by moose. There is abundant moose activity (bed, browsed shrubs, tracks, pellets) in this area, which likely reduces its suitability as winter or refuge habitat. This heterogeneity makes it difficult to model caribou habitat at fine scales on the Property.

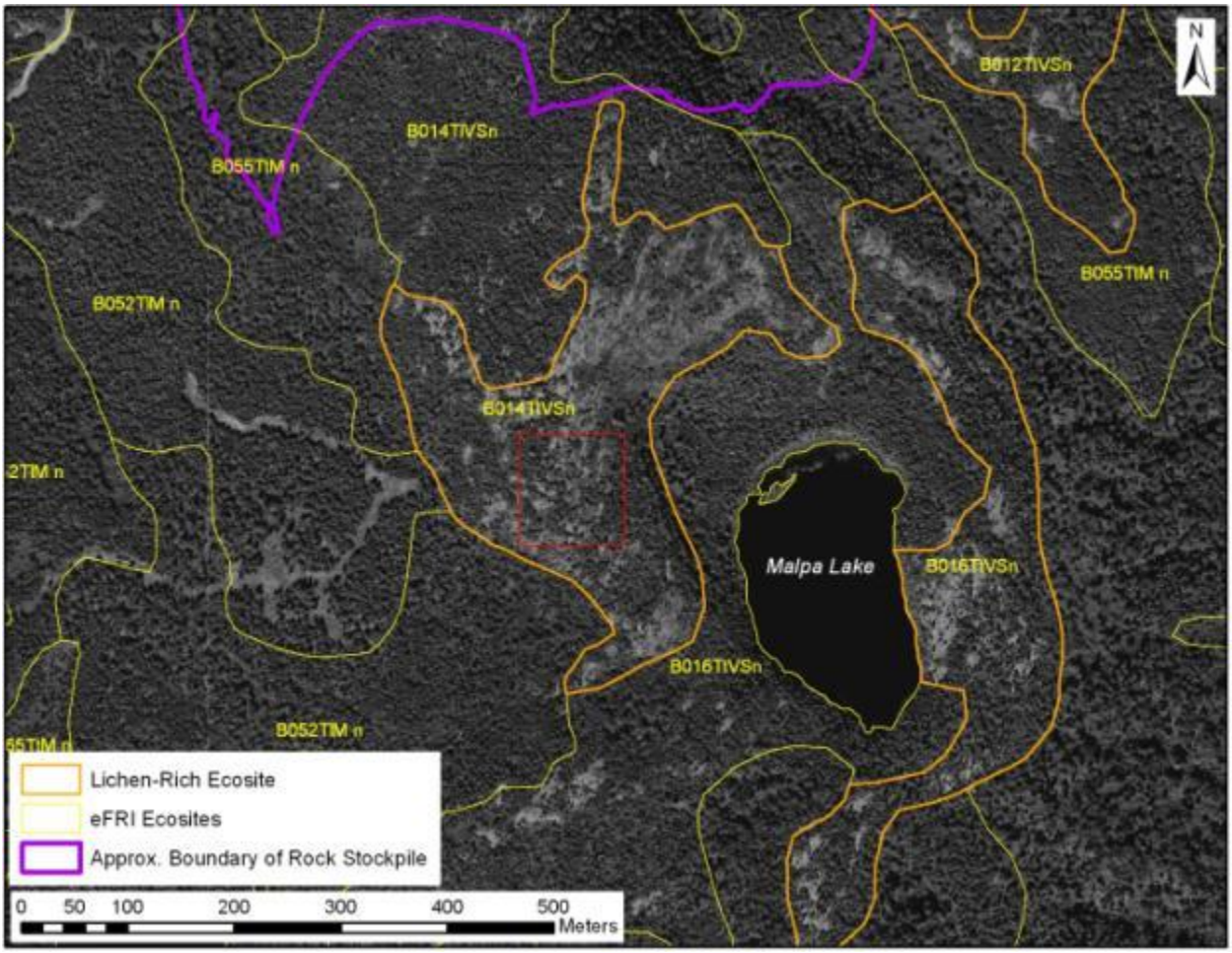

Figure 31. New 2007 Forest Resource Inventory (eFRI) showing updated ecosites in relation to the outer boundary of the proposed rock pile near Malpa Lake. The red square is 1 ha.

5 CUMULATIVE EFFECTS ASSESSMENT

5.1 Range Assessments

Consistent with the approach identified in the Cumulative Effects Assessment Practitioners Guide (Hegmann et al. 1999), prediction of any impact of the proposed development on caribou requires not only an understanding of the current status of the woodland caribou in the coastal range, but also what the likely status and trend in coastal woodland caribou populations is in the absence of the proposed development. Only in this context can the effect of the proposed mine be separated from potential outcomes that might otherwise occur in the near, medium, and long term. The range assessments conducted by OMNR and Environment Canada (2008, 2011a) help serve this function.

OMNR is committed to conducting cumulative effects assessments for all caribou population ranges. The results of these assessments will "evaluate range quality in terms of thresholds, probability of persistence, and habitat composition and structure" (OMNR 2009a). Additional disturbance in these ranges may push the range status to the point where it is insufficient to sustain caribou ("red category" in the CCP). A range assessment in the red category may not allow for approval of further developments. OMNR's approach considers both caribou populations and habitat, but does not directly address densities of alternate prey and predators, which have significant impact on caribou persistence, although it is anticipated that the full integrated range assessments mandated by the CCP will consider predators and alternate prey.

OMNR committed to conducting preliminary range assessments for the Lake Superior Coast and all other preliminary ranges within the first 6 months of the implementation of the CCP, which was released in the fall of 2009. These preliminary range assessment have been completed but results are not yet available publicly (P. Elkie pers. comm.). Detailed integrated range assessments have been conducted and are nearing completion for two ranges i.e., Lake Nipigon and Kesagami (Figure 4), and these draft products have not yet been released publicly. No detailed range assessment for the Lake Superior Coast Range has been done yet, which is unfortunate since the status of caribou habitat and populations at the population range level will guide decisions on resource management proposals, potential mitigation, and the need for recovery measures (OMNR 2009a).

The preliminary range assessment by OMNR used the best available science for examining caribou habitat disturbance using available data. A list of disturbance layers used in the analysis is presented in Appendix 1. The preliminary range assessment has some limitations and assumptions, perhaps most important in that 36 years is used as the age of young forest

that caribou may reoccupy; in practice this may not occur depending on moose and wolf density. A 250 m buffer around disturbance was used in the preliminary range assessments (as per Sorensen et al. 2008); this has been increased in recent OMNR range assessments to 500 m to match that used by Environment Canada (2008, 2011a) and the best available science (P. Elkie pers. comm.). Since the preliminary range assessments were done in early 2010 for the coastal and discontinuous ranges, there have been some changes to disturbance features that are not captured in the current analysis. For the purpose of this report, the 250 m buffered area was simply buffered an additional 250 m without updating the original disturbance layers with new roads, cutovers, and other disturbance. There likely has been relatively little disturbance in the coastal zone due to the recent downturn in the forest industry, so the update is not considered crucial for the purposes of this report.

The initial range assessment showed that the coastal range was 17% disturbed and the discontinuous range 35% disturbed (P. Elkie pers. comm.). Very little (<1%) was classified as natural disturbance. Most of the undisturbed areas were in large protected parks or conservation areas or areas with difficult access or rough topography (Figure 32). When the buffer width was increased to 500 m, 27% of the coastal range and 68% of the discontinuous range was classified as disturbed (Table 2). Within the coastal range, much of the disturbed area was located on the mainland northwest of Pukaskwa National Park (Figure 33). The 2011 federal critical habitat identification process, using somewhat different methods, indicated that the coastal Lake Superior range could be considered self-sustaining based upon low habitat disturbance (16%) and a population size of almost 500 caribou (pp. 30-31, Appendix 1 in Environment Canada 2011a). This ranking is heavily influenced by the size of the island caribou populations however.

Table 2. Area and proportion of disturbed within the discontinuous range and different parts of the coastal range.

Extent	Total Area		500 m Disturbance		
	(ha)	% of Total Range	Area (ha)	% of Total Disturbed Area	% of Total Range
Coastal Range					
Slate Islands	3,739	1.0	196	0.2	0.1
Mainland west of Pukaskwa N.P.	105,057	28.0	61,141	60.3	16.3
Pukaskwa N.P.	69,820	18.6	2,026	2.0	0.5
East of Pukaskwa N.P.	197,240	52	38,048	37.5	10.1
Entire	375,856	100	101,410	100.0	27.0
Discontinuous Range	2,995,673		2,035,299		67.9

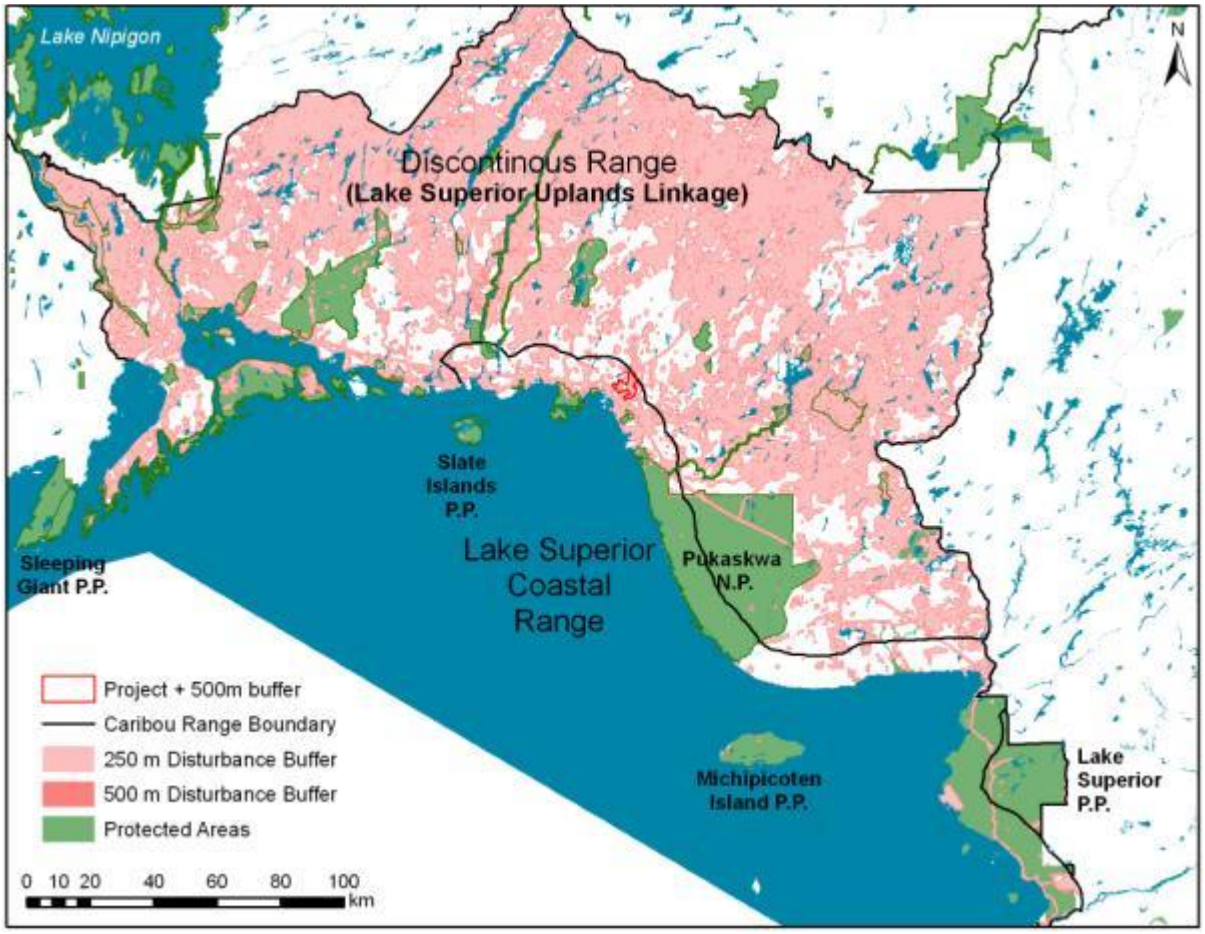

Figure 32. Disturbed areas in the Discontinuous Range and the Lake Superior Coastal Range.

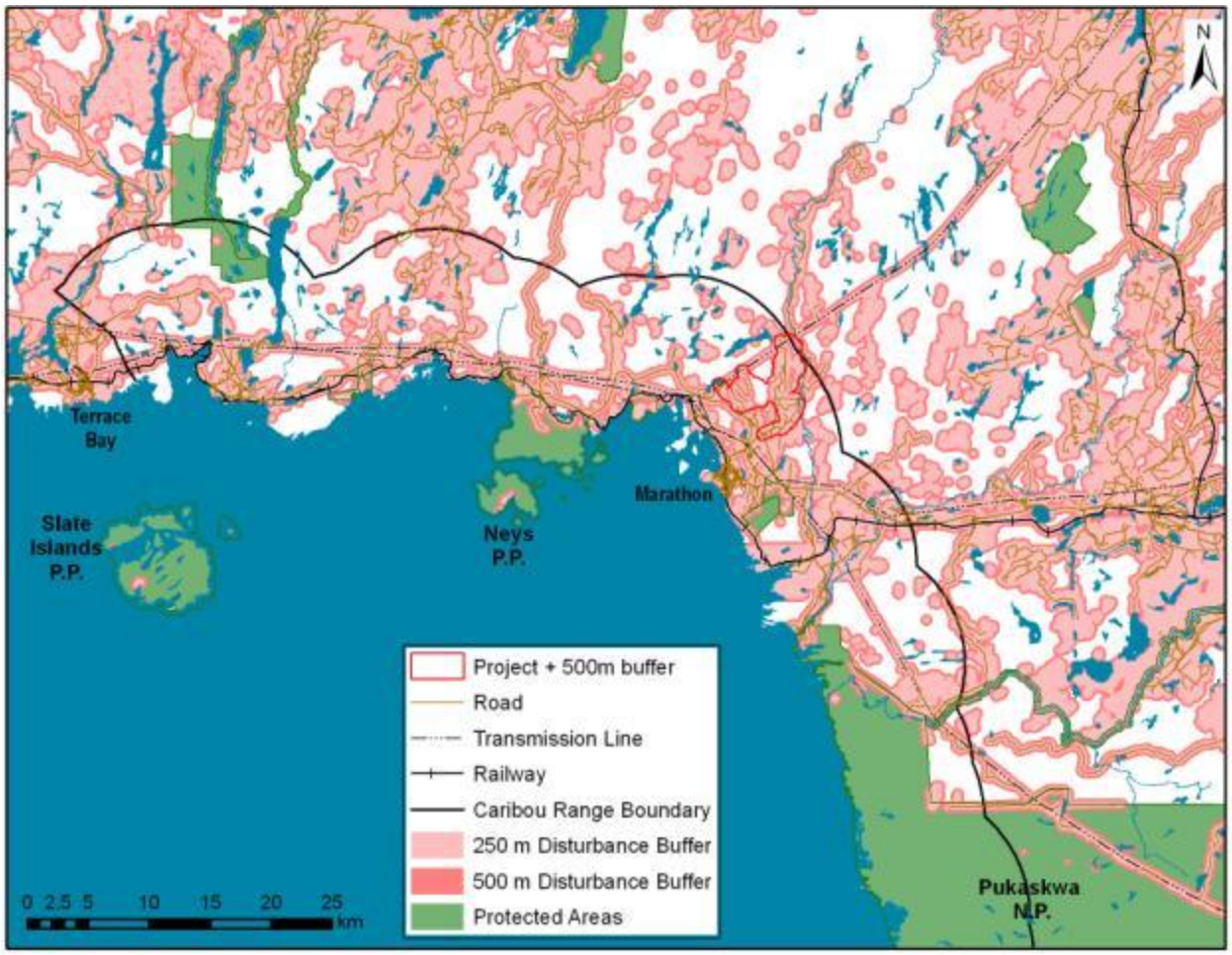

Figure 33. Disturbance buffers and main linear disturbances near the Marathon PGM-Cu Project + 500m buffer.

5.2 Other Stressors

Anthropogenic disturbance such as forestry, mining, hydroelectric dams, linear corridors and tourism infrastructure has a strong negative association with woodland caribou persistence (Environment Canada 2008, 2011a; Sorensen et al. 2008; Vors et al. 2007) with caribou occupancy often reduced within 1-10 km from disturbances (Duchesne et al. 2000; Edmonds 1987). Human encroachment may result in direct mortality from poaching and vehicle collisions, changes in predator–prey relationships, energetic costs associated with disturbance, barrier effects, displacement, and avoidance (Dyer et al. 2001). Caribou persistence may depend on the cumulative effects of wolf–prey interactions, productivity of the ecosystem, and impact of industry (Johnson et al. 2004; Weclaw and Hudson 2004). Individual caribou may have an immediate behavioural response to disturbance, such as avoidance of a linear corridor, and anthropogenic disturbance has a strong negative effect on caribou persistence at the population level as well (Vors et al. 2007).

Like much of northern Ontario, much of the coastal range west of Pukaskwa N.P. has mining claims (Figure 34, Figure 35). This area has potential for economically valuable minerals and base metals due to mineral-bearing complexes such as the Coldwell Formation and "greenstone" belts. Only a very small proportion of claims ever get developed into a mine that would require an environmental assessment (M. Smyk pers. comm.). However, disturbance can occur even from exploration e.g., clearing of trails, stripping down to bedrock, drilling, so there is the potential for cumulative effects in this portion of the coastal range. In addition to mining, there are two proposed hydroelectric facilities on both the Pic River and White River. Although the proposed generating stations are outside the coastal range, access roads and transmission lines will likely go through the coastal range, at least for the Pic River sites. A new 230 kV double-circuit transmission line connecting Thunder Bay and Wawa (East-West Tie) is being planned (OPA 2011), and may run through the coastal range. Two wind energy projects are also proposed within the Coastal Range, immediately north of Neys Provincial Park (Coldwell Wind Energy Project) and east of Craig's Pit (Superior Shore Wind Farm)(Pic River Energy 2012).

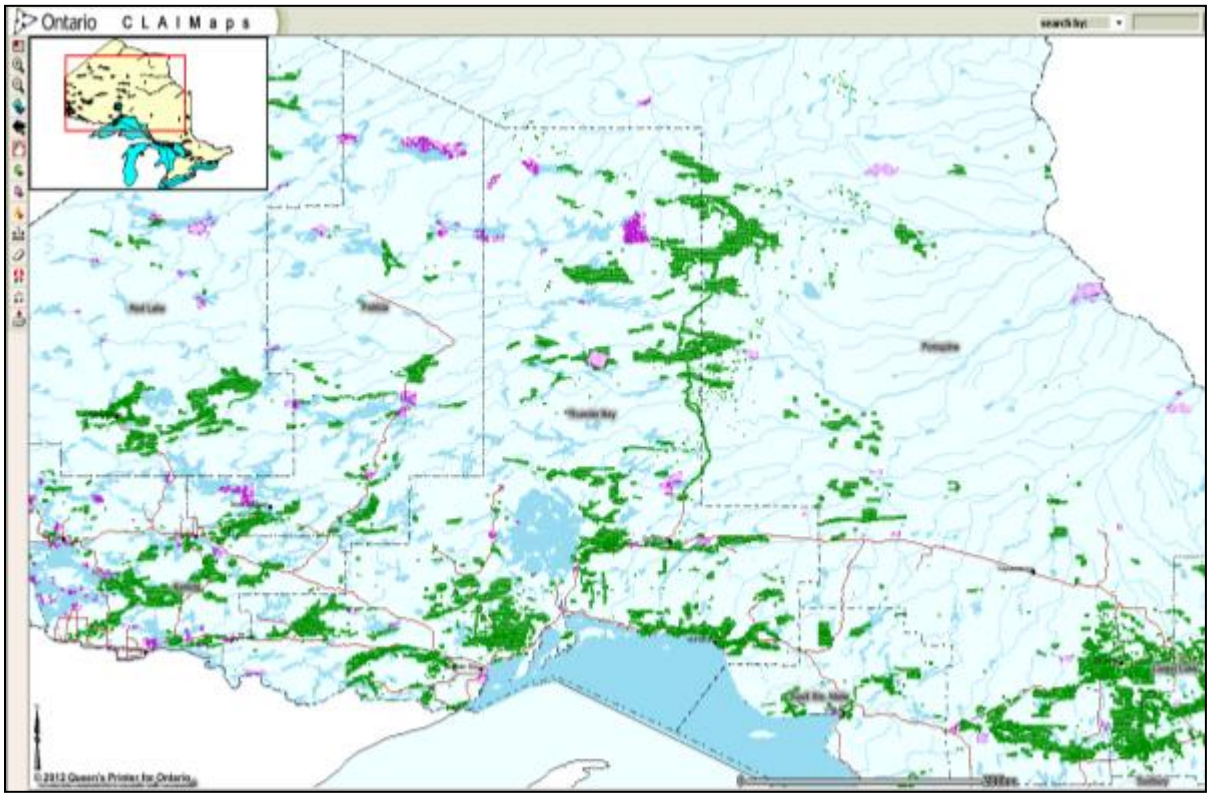

Figure 34. Active and pending mining claims (green) in the northern Ontario (OMNDMF 2011).

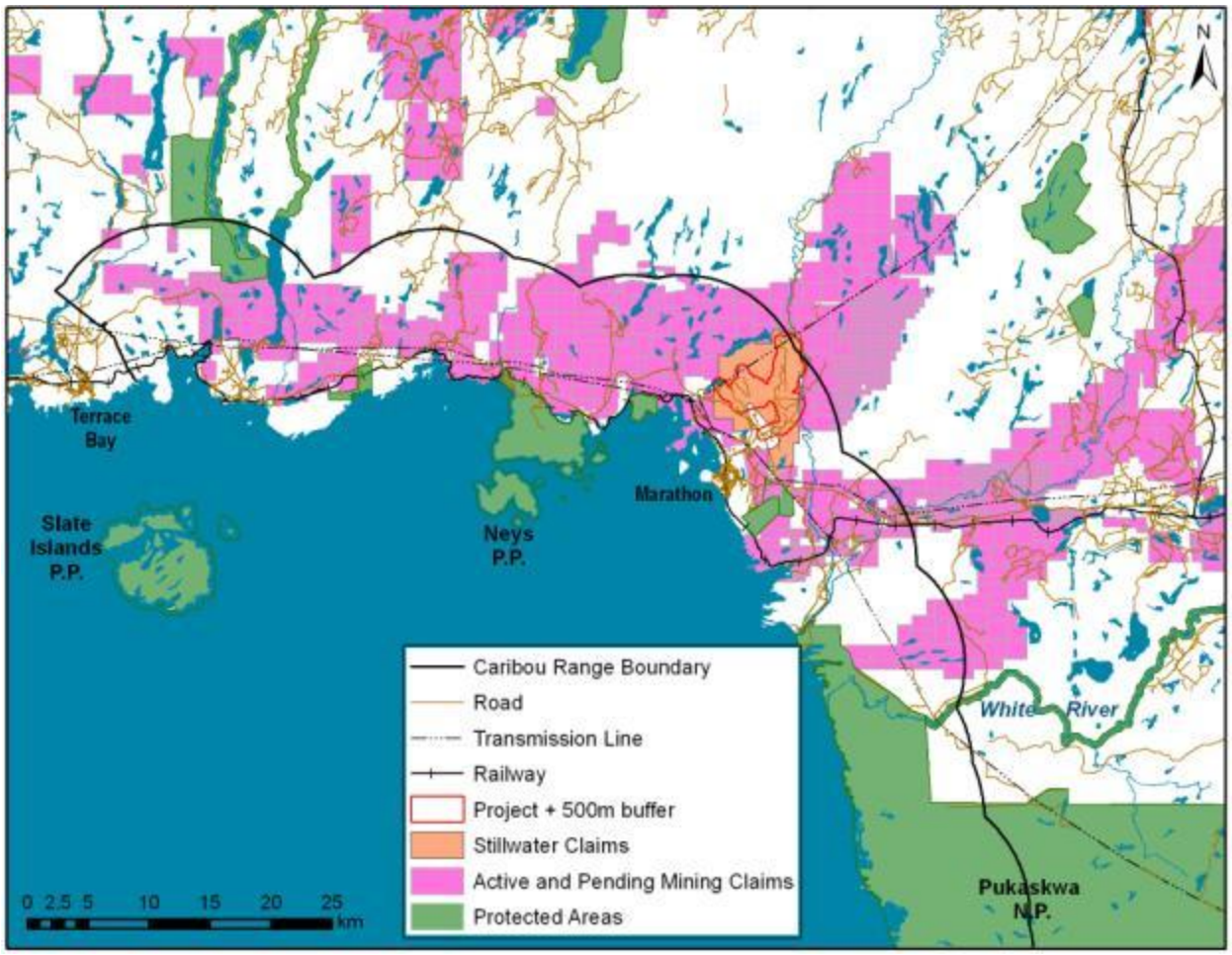

Figure 35. Active and pending mining claims in the coastal and discontinuous ranges west of Pukaskwa National Park (OMNDMF 2011).

5.2.1 Forestry

Vors et al. (2007) found a strong relationship between woodland caribou extirpation and distance to all anthropogenic landscape disturbances (e.g., cutovers, roads, railways, pits and quarries, trails, utility lines, mines). Cutovers was the strongest predictor of caribou extirpation, but there was an approximately 20 year lag between forest harvesting and caribou disappearance. This may represent the time during which moose increase to a density sufficient to support a large wolf population that may reduce caribou numbers below a minimum viable population. The threshold for cutovers of all ages was approximately 13 km. This does not mean that individual caribou are not found within 13 km of cutovers, rather it is a measure of continued occupancy near cutovers. Although there are deferral zones within the coastal zone, there are areas of planned harvest within the coastal range (Figure 8) that may negatively affect persistence of caribou, particularly if regenerating cutovers increase moose, and ultimately wolf densities. There are actually 818 ha allocated for forest harvest in several blocks overlapping the Project site in the 2007-2027 Big Pic FMP.

Ontario's caribou habitat management guidelines (Racey et al. 1999) were developed to address some of the negative implications of forest harvesting to caribou, specifically ensuring that there is a sufficient supply of current and future habitat in suitable-sized tracts for caribou to use. The CCP requires the development of dynamic caribou habitat schedules for all forest management units to plan for habitat provision and renewal (OMNR 2009a).

5.2.2 Other Sources of Mortality

Other sources of potential mortality in the coastal zone include collisions with vehicles or trains, poaching/illegal hunting and subsistence harvest. Highway 17 and the CPR rail line cut through much of the coastal range, and there are hundreds of kilometers of secondary roads as well and recreation trails. Although no collisions have been recently reported in the coastal range, a small group of caribou were hit by a train on the CN rail line north of Lake Nipigon in 1990s (OMNR unpublished data). Although caribou are a protected species, a female caribou was mistakenly shot by a moose hunter in the fall of 2011 near Neys Provincial Park (R. Tyhuis pers. comm.). The degree of First Nation harvest in the coastal range, if any, is unknown. Any additional losses from these factors would reduce already perilously low numbers of caribou in the coastal range.

5.2.3 Climate Change

Climate forecasts for the next century indicate increasing summer temperatures in northern Ontario with little change in precipitation (Parker et al. 2000). This may ultimately increase the amount of forest burned, reduce the area of older forest, alter distribution and abundance of forest tree species and plant communities, and increase abundance of alternate prey (Racey 2005). Climate change impacts appear to be of significant concern to moose as well as caribou (Racey 2005). The interaction of climate-induced forest change and forest management practices (e.g., increased fibre demand on mature stands) adds uncertainty to caribou conservation efforts at the southern edge of its current range.

5.3 Current Population Trends

5.3.1 Slate Islands and Michipicoten Island

In contrast to mainland populations, the caribou population on the Slate Islands appears to have been primarily limited by summer food supply affecting over-winter survivorship and parous percentages, with occasional stochastic interference by winter weather. Although caribou are vulnerable to the arrival of wolves from the mainland, Bergerud et al. (2007) stated that "the potential for future persistence seems positive", which is in agreement with the Environment Canada (2011a) assessment. The caribou population on Michipicoten Island appears equally secure, and has been expanding since the introductions in the late 1980s. Michipicoten Island is five times larger than the Slate Islands (18,847 ha vs. 3737 ha) and

presumably has a correspondingly higher carrying capacity; given that the peak number of caribou on the Slate Islands peaked was approximately 650 animals (Godwin 1996), it is likely that the Michipicoten Island population has continued room for growth. Blair (1911) documents a slaughter of 2400 caribou on Michipicoten Island in one winter during the 1800s.

5.3.2 Pukaskwa National Park

The most complete dataset for mainland woodland caribou in the Lake Superior Coastal Range is for Pukaskwa National Park. Despite its protected area status, aerial surveys conducted in the park since 1972 show an average annual decline of -4.5%, from a peak of 31 in 1979 to a low of four occurrences (live animals, tracks, or scat) observed in 2009 (Vance et al. 2008). Based on this trend, Bergerud et al. (2007) suggested that extirpation is likely by the year 2018 and below 10 animals a collapse to nil could be imminent. Bergerud (1989) concluded that the stability domain for woodland caribou abundance as imposed by wolf predation is between 15 and 24; park numbers have been below this threshold since 1993 and caribou are considered critically imperilled in the park (Parks Canada 2008), and recovery actions are being contemplated (Allen et al. 2010a,b; Euler 2010). Of particular concern is the lack of calves observed in surveys since 2001 (Euler 2010), which suggests limited recruitment, potentially due to predation by wolves, black bears, or lynx. One caribou calf was detected by remote wildlife camera in Pukaskwa National Park in 2010; this was the first calf observed in the park since 2001 (M. Allen, pers. comm.).

Wolves are thought to be primarily responsible for this decline. Eleven caribou were found dead between 1987 and 1999 and all but 1 or 2 were thought to have been killed by wolves (Wade 1998). Wolf predation in Pukaskwa National Park (PNP) appears to be at least partly density-dependent because caribou recruitment declined when numbers increased beyond 20 animals and adult mortality increased (Bergerud et al. 2007). The low encounter rates between wolves and the few remaining caribou may have allowed them to continue to persist in PNP, particularly as moose densities are low (Allen et al. 2010a), although stochastic factors such as snow depths and land fast ice were also considered to affect the contact rate between wolves and caribou. Therefore, in spite of abundant food in all seasons, the caribou of PNP show “little hope of future existence due to being flanked by healthy breeding wolf packs supported chiefly by moose as prey, and the threat of the arrival of white-tailed deer” (Bergerud et al. 2007).

5.3.3 Neys Provincial Park and Adjacent Mainland.

The woodland caribou population centred on Pic Island and the rest of Neys P.P. and adjacent mainland appears to have a very low probability of persistence. The population has significantly declined since the 1980s and is perilously low. Habitat in this portion of the coastal range is under more pressure from forestry, mining, wind farms, linear development, and other anthropogenic development than PNP. In Ontario, mainland caribou range has receded

approximately 34 km per decade between 1880 and 1990 (Schaefer 2003), although the pattern of Ontario's range recession is clearly not a simple linear decrease (Racey and Armstrong 2000). It is possible this rate has decreased somewhat since 1990 and may decrease in the future due to actions identified in the CCP. Caribou may have been able to persist to date in this coastal zone because disturbance thresholds have not yet been exceeded; Vors et al. (2007) found that in the coastal refugia the distance to forest cutovers of all ages is >10 km and the distance to cumulative cutovers up to 1970 is >40 km, although there are several other disturbance factors. Assuming a 2-decade time lag between disturbance by forestry and caribou extirpation (Vors et al. 2007), caribou may disappear from the mainland coastal range in the near future without any additional disturbance. Due to its very small size approximately 15 caribou, this population is very vulnerable to random demographic effects and the Allee effect (McLellan et al. 2010), particularly since there appears to be very low potential for immigration from the Slate Islands or other populations to increase numbers.

5.4 Projected Coastal Woodland Caribou Population Trends

Detailed range assessments or population viability analyses from the OMNR or Parks Canada are as yet unavailable, although Environment Canada (2011a) has conducted a more cursory range assessment based upon disturbance levels and population size. Parks Canada is currently working on a trend analysis that statistically assesses the 30 year decline of caribou in Pukaskwa National Park, and evaluating the potential for augmentation of the caribou population in the park (Euler 2010; Allen et al. 2010b). These reports are not yet publicly available.

Trends in woodland caribou populations in the coastal zone can still be examined however. For each Canadian woodland caribou populations with sufficient information, Environment Canada (2011) estimated the probability that the current range will support a self-sustaining population of boreal caribou based on integrated probability assignments using population trend and size, and level of disturbance associated with anthropogenic activities and fire. Environment Canada's analysis of the Coastal Range (Range #44, which includes Michipicoten Island, the Slates Islands, Pukaskwa and adjacent mainland shoreline and islands) found that current range conditions are likely to maintain a self sustaining population over time.

The 2011 Environment Canada analysis listed the coastal range as 16% disturbed (i.e., within 500 m of existing natural or anthropogenic disturbance), which is considerably less than the 27% found in this report; the discrepancy may be due to improved data sets (e.g. FRI) used in the current study. Based on Environment Canada's model, a caribou population on a landscape with 27% disturbance is likely to be self-sustaining (Figure 36). However, this scenario may be somewhat optimistic, since the only occupied coastal range is essentially Pukaskwa National

Park and west; Michipicoten Island (15 km offshore) is effectively a separate population (and has the greatest number of caribou). The actual proportion of disturbed habitat for western half of the Lake Superior Coastal Range (including Pukaskwa and areas west) is 35% (63,362 of 178,616 ha; Table 5); ranges with greater than 45% disturbance are not considered self-sustaining (Environment Canada 2011b). In this scenario, under the current CCP the coastal range is borderline self-sustaining.

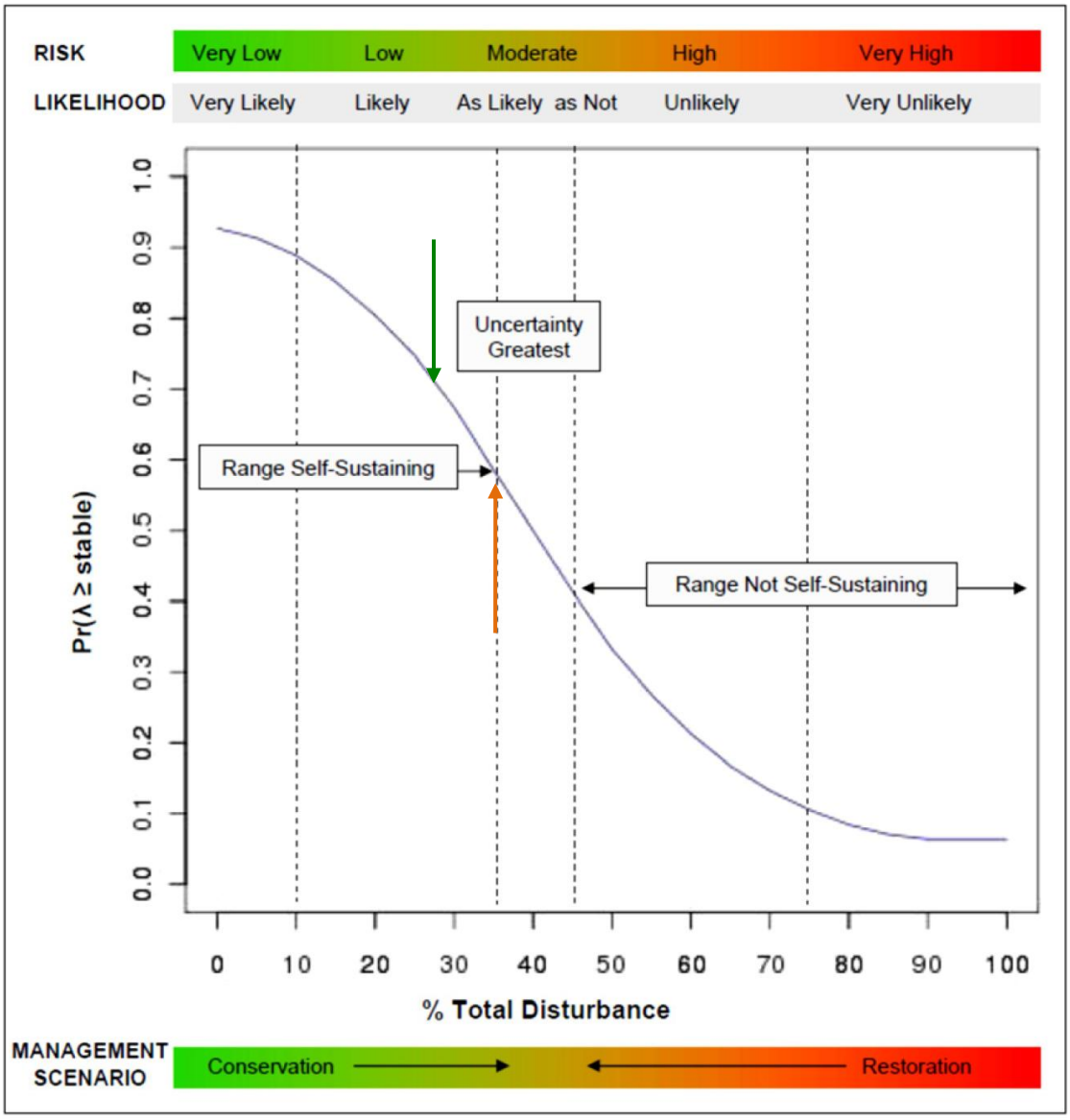

Figure 36. The disturbance-based population growth function used in conjunction with range-specific information to derive range-specific management thresholds once an acceptable level of risk by managers has been specified (adapted from Environment Canada 2011a). Green arrow denotes coastal population over entire Lake Superior Coastal Range; orange arrow denotes occupied range in Pukaskwa National Park and west only.

Sleeping Giant Provincial Park may foreshadow the potential fate of woodland caribou in the coastal range in coming decades if current trends are not arrested and if the broader landscape is not considered. This protected area, established in 1944 and located approximately 100 km west of the coastal range on the Sibley Peninsula, provides a fairly well-documented example of the decline of caribou along the along the north shore of Lake Superior. Despite being the predominate ungulate on the peninsula at the beginning of the 1900s, caribou had largely disappeared from Sibley by the mid-1950s as moose and wolf numbers increased, and hasn't been recorded in the park since the 1970s. A more recent arrival, white-tailed deer have now virtually supplanted moose from the park, likely due (at least in part) to effects of the nematode *Parelaphostrongylus tenuis*,. This parasite does not harm its deer host but is pathogenic to both moose and caribou. If global warming and habitat changes allow continued white-tailed deer expansion into the coastal range, this will likely have negative impacts on woodland caribou due to potential *P. tenuis* transmission and increased wolf predation (Bergerud 2007; Racey 2005). The situation in Sleeping Giant P.P. confirms the general observation that even large protected areas are not large enough by themselves to sustain caribou populations in absence of consideration of the broader landscape, although they can provide important anchors for the conservation of caribou (OMNR 2008). Pukaskwa National Park has seen its caribou population steadily decline even though ecosystems in the park have changed little over the past 50 years due to minimal disturbance by fire, logging, and insect outbreaks (Vance et al. 2008).

6 EFFECTS ANALYSIS

Based on OMNR records, field studies supporting this EA, or Traditional Ecological Knowledge, there is no evidence past or current use of the Property by woodland caribou. However, past and current use of the Project site cannot be ruled out, nor can potential future use by caribou. Potential effects could be direct, indirect, and/or cumulative and could potentially occur during construction, operation, or decommissioning phases of the Project. Potential impacts on the caribou and their habitat in the absence of mitigation are summarized in Table 3 and discussed below.

6.1 Caribou Individuals/Populations

Although there is no evidence of current use of the Property by woodland caribou, direct Project impacts on individual caribou could potentially include mortality or injury from collisions with vehicles and accidents in the mine site. As caribou generally avoid anthropogenic disturbance, these impacts appear to have low probability of occurrence and can be mitigated through appropriate techniques. Mahoney et al. (1991) documented a decrease in caribou densities within 3 km during mine construction, suggested that noise and disturbance at the mine site resulted in caribou avoiding the area. Multiple years of caribou monitoring on the claim block associated with the Ekati Mine in Northwest Territories shows relatively few indications of caribou impact (Ross 2006).

6.2 Caribou Habitat

There is no calving/nursery habitat in or near the Project that could potentially be impacted by the Project, however the Project could potentially have an impact on refuge or winter habitat.

These potential impacts could either be direct e.g., the habitat is replaced by infrastructure or indirect e.g., its use is impaired by nearby infrastructure (e.g., it is located within 500 m disturbance buffer used by MNR/Environment Canada). Any potential impacts would be predicated however, on the assumption that woodland caribou actually use the potential habitat; there is currently no evidence of caribou use on the Property. The landscape surrounding the Project is heavily disturbed along Lake Superior with the town site of Marathon, Highway 17, airport, rail line and several utility corridors (Figure 37). Most of the study area itself has a medium level of disturbance due to the presence of a hydro-electric transmission corridor, an old (but active) road network, recreational vehicles and active mining exploration. The lowest levels of disturbance are northwest and east of the study area where there are relatively large blocks of more or less roadless, inaccessible forest.

Table 3. Potential* interaction matrix for woodland caribou and the Marathon PGM-Cu Project.

Project Activities	Caribou Individuals	Connectivity	Calving / Nursery Habitat	Refuge Habitat	Winter Habitat
Construction Phase					
Forest Clearing	VL	VL		L	L
Access Road Construction	VL	VL		L	L
Transmission Line Construction	VL	VL		L	L
Construction of Open Pit	VL	VL		L	L
Construction of PWMF (tailings)	VL	VL		L	L
Heavy Equipment Traffic	VL	VL			
Vehicle Traffic	VL	VL			
Operational Phase					
Mining Operations	VL	VL	VL		
Milling	VL	VL			
Management of Waste Rock	VL	VL			
Operation of PWMF (tailings)	VL	VL			
Heavy Equipment Traffic	VL	VL			
Vehicle Traffic	VL	VL			
Decommissioning Activities					
Site Preparation and Restoration	VL	VL			
Road Removal	VL	VL			
Flooding of Pit	VL	L			
Transmission Line Removal	VL	VL			
Other Decommissioning Activities	VL	VL			
Closure					
Environmental Monitoring	VL	VL			
Vehicle Traffic	VL	VL			

*there are no resident caribou on the Project site and no evidence of use of the site by caribou, so interactions are considered potential.

VL=very low potential; L=low potential; M=moderate potential; H=high potential

The Project footprint of the mine pit, process solids management area, roads, and other infrastructure is approximately 647 ha (Figure 37, Table 4). The project footprint represents approximately 0.17% of the total Coastal Range area of over 375,000 ha (Table 5). This Project would potentially affect approximately 2975 ha using the 500 m disturbance buffer by Environment Canada (2011a) and OMNR for their critical habitat/ range assessments (Table 5). However, only 258 ha of this would be *new* disturbed buffer area however, since most (88%) overlaps existing buffered disturbance (Figure 38, Table 5). This 258 ha increase in disturbed area represents only 0.25% of the disturbance in coastal range and only 0.07% of the total coastal range (disturbed and undisturbed). Therefore, the incremental increase in the habitat disturbance footprint is not meaningful at the range scale.

Table 4. Summary of Project components and approximate area. See Figure 38 for location of components.

Feature	Length (m)	Approx. Width (m)	Area (m^2)	Area (ha)
Existing Road (to be decommissioned)	6754	20	135,085	14
Existing Road (to remain in place)	5320	20	106,403	11
New Road (to be decommissioned)	2362	20	47,233	5
New Road (to remain in place)	19886	20	397,721	40
Transmission Line (to be decommissioned)	4828	20	96,560	10
Conveyor (to be decommissioned)	994	20	19,888	2
Primary Pit			786,618	79
Process Solids Management Facility			2,592,731	259
Rock Stockpile			1,795,967	180
Runoff Catch Basins			44,553	4
Satellite Pits			443,444	44
Total				**647**

Table 5. Disturbance by the proposed Project with respect to the coastal range.

Extent	Total Area		500 m Disturbance		
	(ha)	% of Total Range	Area (ha)	% of Total Disturbed Area	% of Total Range
Project Infrastructure (new disturbance only)			258	0.25	0.07
Project Infrastructure	647	0.2	2,975	2.9	0.8
Coastal Range - entire	375,856	100	101,410	100.0	27.0

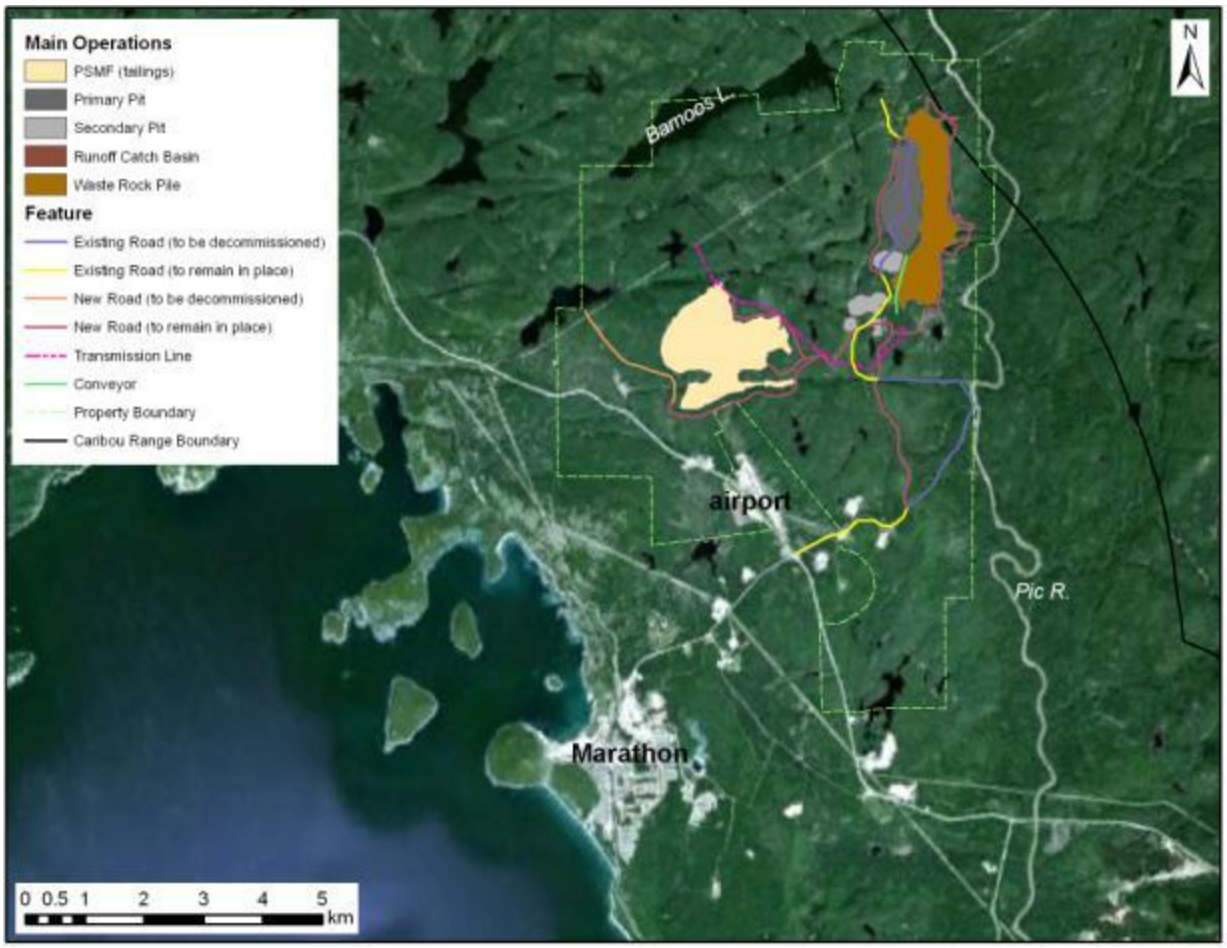

Figure 37. GoogleEarth Image (2005) with main industrial features during operations. Note: all post-2005 disturbance not shown.

The Project is expected to have minimal impact on caribou habitat. There are 361 ha of caribou refuge habitat within 500 m of the Project (according to the OLT), of which 88 ha overlapped the proposed pits, rock stockpile, or process solids management facility (tailings) (Figure 39). All but 12 ha is within the existing 500 m disturbance buffer however. According to the OLT, there is no preferred winter habitat within 500 m of the Project and only 66 ha of usable winter habitat, all of it within the existing disturbance buffer (Figure 40). Only one 10.5 ha patch is located in the Project footprint, specifically the process solids management area. There may be additional "atypical" winter habitat as described in *4.3 Winter Habitat* on the Project property that could potentially be affected directly or indirectly by the project, but current MNR habitat models are not capable of adequately quantifying or mapping it. The vast majority of this "atypical" winter or refuge habitat would fall within the existing 500 m disturbance buffer as well.

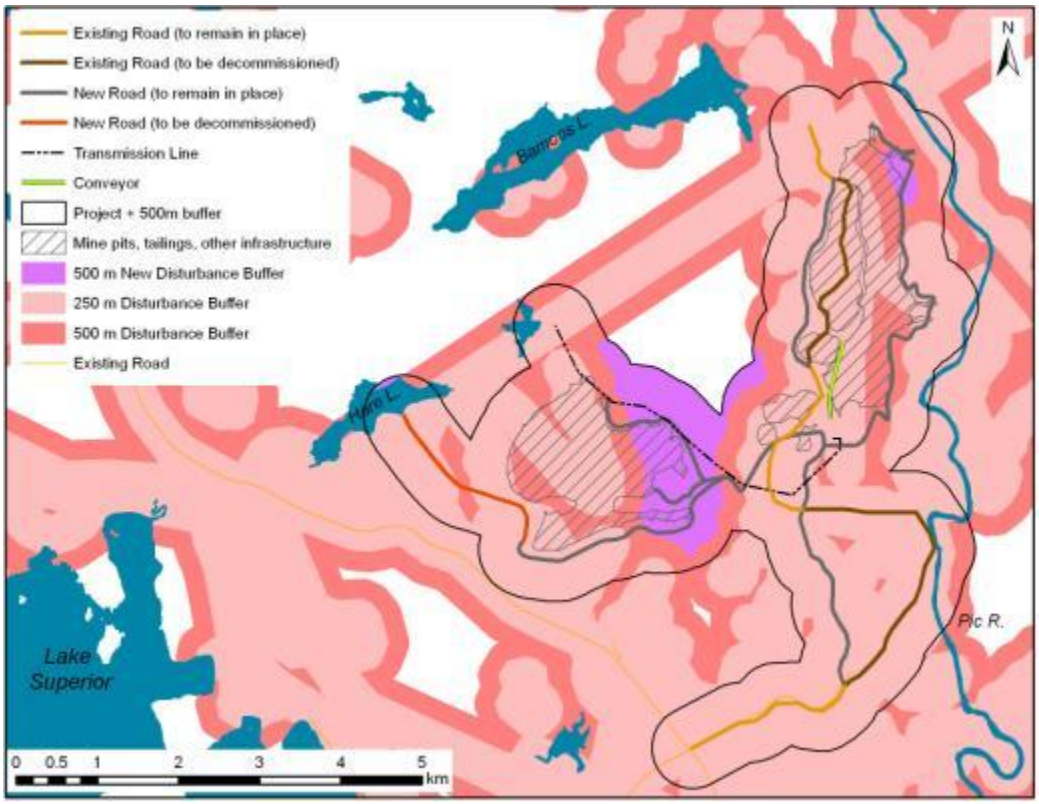

Figure 38. Projected increase in disturbance from Marathon PGM-Cu Project with respect to existing 500 m buffered disturbance from preliminary OMNR range assessment.

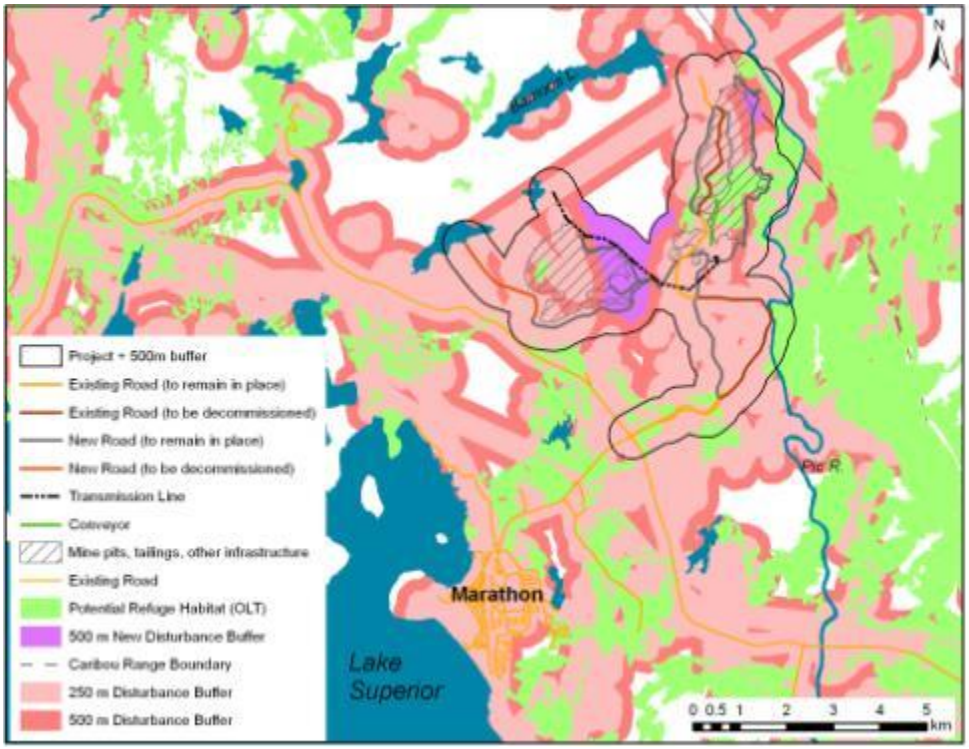

Figure 39. Projected increase in disturbance from the Project with respect to existing 500 m buffered disturbance and caribou refuge habitat as modelled by OMNR's Ontario Landscape Tool.

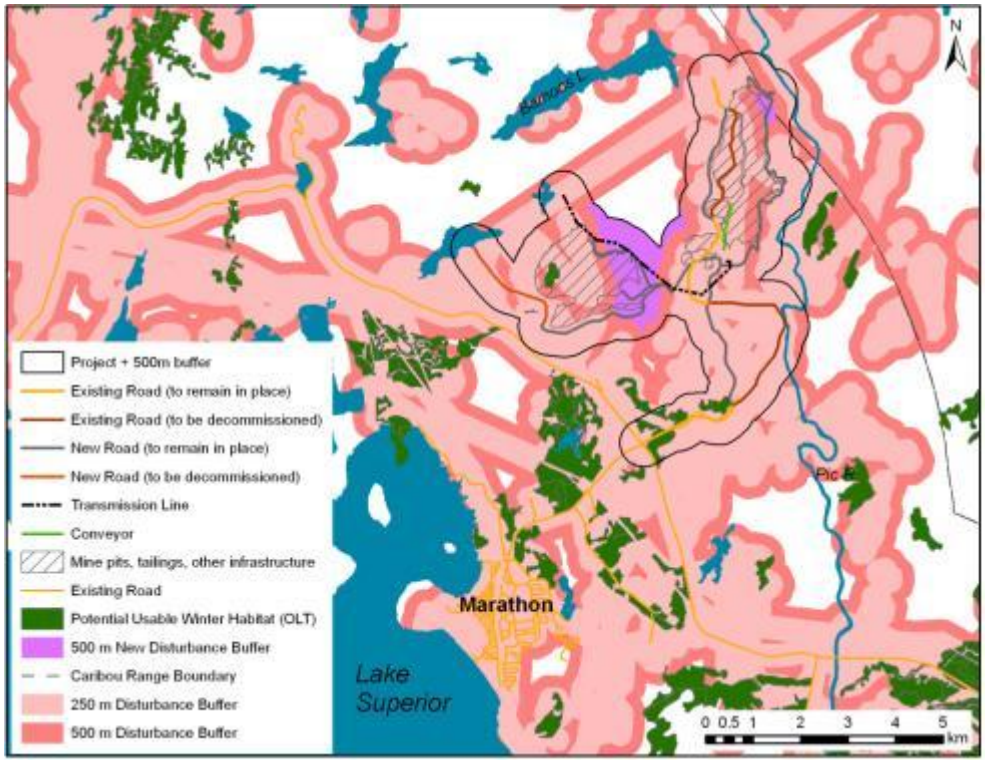

Figure 40. Projected increase in disturbance from proposed project with respect to existing 500 m buffered disturbance and usable caribou winter habitat (not preferred) as modelled by OMNR's Ontario Landscape Tool.

6.3 Connectivity

OMNR has expressed some concern that the Project might affect potential caribou movement within the coastal range, or between the coastal range and ranges further north.

6.3.1 Among Ranges (North-South)

The existing high level of disturbance along the Lake Superior coast south of the study area may restrict potential caribou movement in a north - south direction from Lake Superior. Woodland caribou populations within the coastal zone are considered isolated from northern ranges (OMNR 2009a). The CCP stated that Ontario will develop a management strategy for the discontinuous range management to enhance connectivity between the northern continuous range and the southern coastal Lake Superior populations. Discontinuous range will not be managed broadly for caribou habitat to support self-sustaining populations but will instead be managed with a focus on "specific landscapes that may support temporary caribou occupancy or movement between the continuous range and Lake Superior" (OMNR 2009a). This connectivity will hopefully improve the prospects for persistence of the coastal population.

Protected areas may provide undeveloped, stepping-stone habitat patches that can facilitate caribou movement between the Nipigon and Pagwachuan ranges and the coastal range; these include the Gravel River Conservation Reserve, Fishnet Lake Conservation Reserve, and Killala

Lake Conservation Reserve (OMNR 2011). During migration to and from wintering areas in northwestern Ontario, caribou were more likely to avoid open water, and disturbed and open areas, while utilizing mainly coniferous forests (Ferguson and Elkie 2004a,b). Spring movements of caribou to summer habitat on Lake Nipigon islands were not confined to specific travel routes (Cumming and Beange 1987), although cow caribou show philopatry to their calving habitat (Bergerud 2007).

In the 2011-2021 Pic River FMP, MNR identified a hypothetical linkage corridor between Neys Provincial Park and Killala Lake Conservation Reserve that has rugged topography, bedrock soils, and less anthropogenic disturbance. In the discontinuous zone connectivity between the continuous zone and the coast range is to be achieved primarily through the creation of a large deferral block (which also functions as a marten core) on the Big Pic Forest.

This 29,398 ha deferral area in the discontinuous zone of the Big Pic forest will be deferred from harvest and road-building activities for a 20 year period to maintain perceived high quality winter foraging habitat on the bedrock ridges and areas of suitable refuge habitat. This deferral area will potentially link with a large planned deferral block identified in the draft Stage 2 2012-2022 Pic River Ojibway FMP in a proposed corridor from Neys Provincial Park to the Killala Lake Conservation Reserve. Other parks and conservation reserves, as well as marten core deferrals will potentially serves as “stepping stones” to allow for travel opportunities for caribou (Figure 41). The project is within this proposed corridor, at the southeast corner. Whether caribou currently actually use or will use this potential corridor in the future is unknown. Recent (2011) aerial surveys by OMNR has identified some caribou activity (tracks) in this proposed corridor (R. Hartley pers. comm.), but it is not known if these are caribou from the Nagagami herd or from the coastal population.

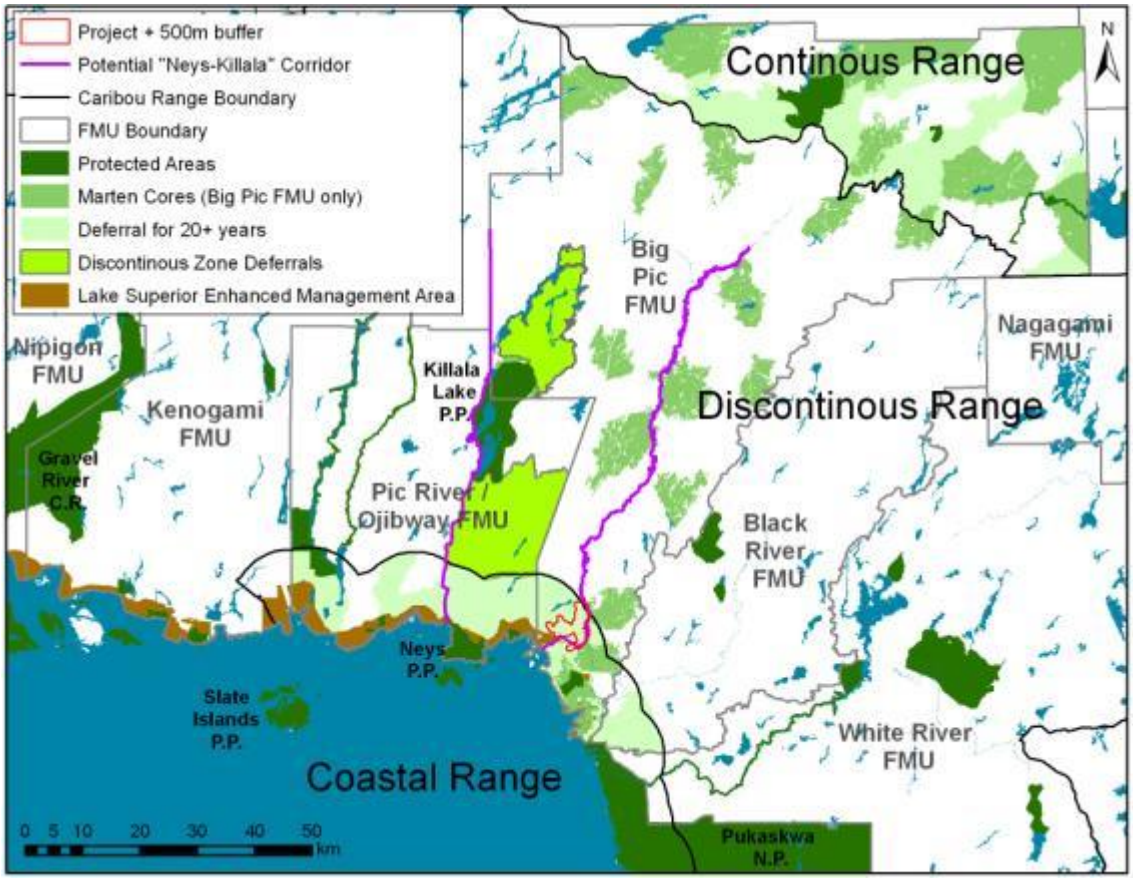

Figure 41. Draft location of deferrals and protected areas in the discontinuous range and marten cores on the Big Pic FMU in relation to the proposed "Neys-Killala corridor" and Marathon PGM-Cu Project + 500m buffer.

6.3.2 Within the Coastal Range (East-West)

Concern has been raised that the Project could potentially impede east-west connectivity within the coastal range, since the Marathon PGM-Cu Project straddles part of the coastal range north of the town of Marathon. This is based on the assumption that caribou would use the shortest possible route while crossing the minimum number of roads and avoiding other human disturbances. In its current condition, use of this corridor would involve crossing Highway 17 and several other roads and rail lines at least twice.

There is uncertainty with respect to potential connectivity through the Property with respect to woodland caribou including:

a) Do caribou move through the Property?
b) How many caribou move through the Property currently, or would potentially move through in the future in the absence of development?
c) If caribou do move through the Property, at what times of year and for what purpose (e.g., what age/sex distribution)?

d) Would caribou continue to pass through the Property if the development proceeds?
e) If there is impairment of movement through the Property, would caribou use alternate routes nearby and still pass through the landscape?
f) If movement is impaired, what are the impacts on individual survival and reproduction, demographics, or population genetics and what are the impactions on woodland caribou persistence?
g) If so, what, if any, mitigation would be appropriate and effective?
h) If caribou use were impeded during mine operation, would caribou use be re-established upon mine closure?

There is no evidence of historic or current caribou use of the site (aerial and ground surveys, OMNR data), nor any traditional ecological knowledge (TEK) from Pic River First Nation indicating use of the site. Although there are no data available to answer a), b), or c), it can be assumed that few, if any, caribou move through the Property, at least in recent times, simply because there are very few caribou in the coastal ranges. Caribou in Pukaskwa National Park had the smallest home ranges of any caribou any reported in the literature (Bergurud 1989) and female show high site fidelity, so it is possible that bulls seeking mates may be the most likely to pass through the area during the September/October rut. Some caribou are more tolerant than others of development, and may be observed closer to infrastructure, particularly bulls and yearling (Cameron et al., 1992; Nellemann and Cameron 1998).

As for d), caribou generally avoid anthropogenic disturbance, with 500 m often used as a buffer distance for spatial analyses of habitat. Caribou have been reported to generally avoid mines and linear corridors in other jurisdictions. Avoidance distances generally range from hundreds of metres to several kilometres depending of a variety of factors e.g., type of disturbance, landscape, season, sensitivity of herds, sex, and age distribution of animals (Vistnes and Nellemann 2007).

Caribou are the most wide-ranging terrestrial mammal (Schaefer et al. 2000) i.e., they are highly mobile animals, well-adapted for long-distance travel. Even individuals of the more sedentary forest-dwelling ecotype that is found in boreal Ontario are very capable of long-distance movement. For example, a tagged male caribou, translocated from the Slate Islands in October 1984 was eventually observed dead at the Swallow River in April 1987, a total straight line distance of approximately 200 km (Bergerud 1989). The caribou radio-collared across northwestern Ontario in the 1990s moved an average of 38 km between the centres of winter and summer ranges, and varied from 10-70 km (Racey et al. 1999). Three of five radio-collared caribou in Pukaskwa moved more than 50 km between seasonal ranges (Neale2000). Individuals can move significant distances in short time periods as well; a female caribou

documented with an OMNR camera trap on October 2, 2011 near Bottle Point on Lake Superior was shot six days later near Neys Provincial Park, a distance of at least 16 km (R. Tyhuis, pers. comm.).

The Stillwater Project footprint is about 5 x 5 km in its widest dimensions, with a transmission line corridor to the northwest, the Pic River to the east, and Highway 17 and Marathon airport to the south. Woodland caribou are easily capable of walking around the Project property. The Project footprint (including linear corridors of 20 m average width) is approximately 650 ha, which is many times smaller than the average wildfire size in boreal Ontario. The Project footprint is much smaller than the recommended minimum size for caribou mosaic blocks (10,000 ha) used by OMNR in forest management planning to emulate natural disturbance. However, it is recognized that the unique situation and limited dimension of the coastal range necessitate the management of smaller tracts of land, while still recognizing the larger landscape context. There is currently less disturbance north and east of the Property than on the Property itself, and there are marten cores southeast and northeast of the Property as well through which caribou could potentially move (Figure 41).

There are several possible east-west options for caribou movement in the vicinity of the project. If development proceeds, caribou could potentially use the forested corridor between the Marathon airport and the southern edge of the process solids management facility (800 m wide at its narrowest point), but would be less likely to pass through the more heavily impacted landscape near the mine (Figure 42). Caribou could also potentially pass east-west south of the project which is nearly 3000 m wide (between Highway 17 and the edge of the Town of Marathon) since they have been observed in and near the town of Marathon in the relatively recent past. A lone caribou was observed along the railway tracks west of Marathon Street in the Town of Marathon on October 26, 1996 (Pukaskwa N.P. unpublished data). At least five caribou were confirmed on Yser Point in Marathon Harbour during the winter in 1996 (Keale 2000) and caribou tracks were observed on a rock knoll on Ypres point on January 5, 2010 (OMNR unpublished data).

As for f), the impact on survival, reproduction, demographics, and genetics is difficult to predict. Possible mitigation would depend on the perceived or demonstrated impacts, and the appropriateness of any mitigation undertaken would depend on the nature, scale, scope, duration, frequency, etc., of the identified impacts. One potential mitigation technique could be translocation for example to maintain genetic interchange between fragmented populations. Any potential effects related to connectivity is assumed to be temporary or of relative short duration, and can potentially be assessed by monitoring (e.g., telemetry, camera traps).

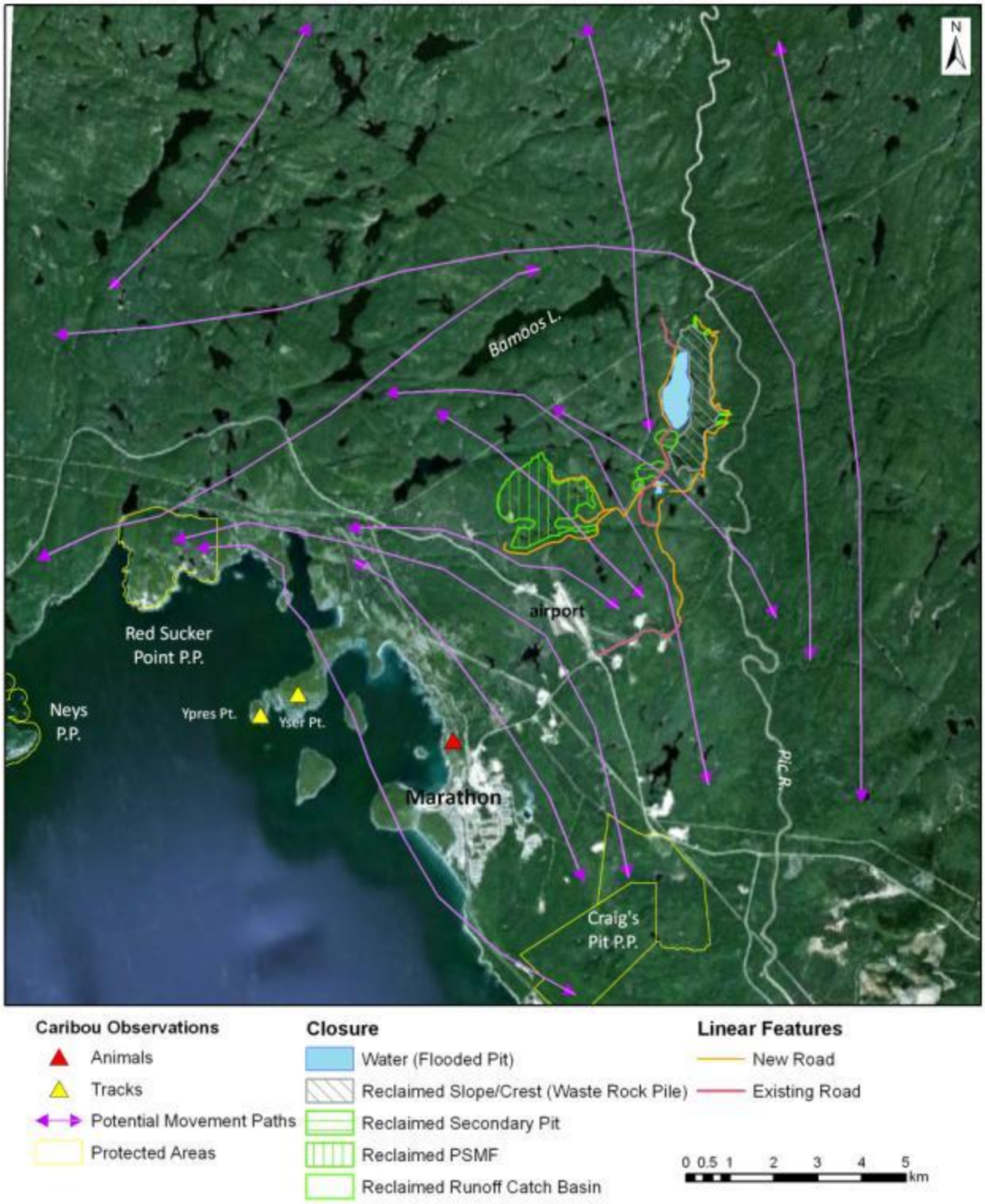

Figure 42. GoogleEarth Image (2005) with potential caribou movement paths in relation to conceptual closure features. Red triangle indicates sighting of lone caribou on October 26, 1996 and yellow triangles represent caribou tracks in 1996 and 2010.

6.4 Potential Mitigation Strategies

Although there is no documented use of the Property by caribou, the development, operation, and decommissioning of the Stillwater's Marathon PGM-Cu Project could potentially have impacts on caribou including:

- Winter habitat
- Refuge Habitat
- Calving/Nursery Habitat, and
- Connectivity

Mitigation measures will be taken to minimize the potential risk to caribou and their habitat.

In addition to on-site mitigation, if the scale of potential impact warrants it, mitigation/compensation measures could also be applied off-site within the adjacent Coastal or Discontinuous Range, since these measures would benefit coastal caribou that might potentially use the Project site and increase the probability of their persistence of caribou in the adjacent ranges. The type, location, and scale of mitigation/compensation conducted should be appropriate to the anticipated scale of potential impacts.

A variety of strategies and measures have been and will be employed to mitigate negative impacts and could potentially include mine site design and management, habitat management, linear disturbance management, alternate prey management, public education, translocation, and monitoring. A mitigation plan will be developed in consultation with government and possibly others during the environmental assessment and permitting process, based on a combination of the potential mitigation strategies discussed below.

6.4.1 Site Design and Management

The layout of the mine and associated infrastructure i.e., roads, transmission line, process solids management facility has been designed to minimize their ecological footprint as much as possible. In particular, as much existing forest as possible along the southern portion of the Property will be left intact in order to maintain potential linkages between landscapes to the east and west of the Stillwater Project property. This will maximize the potential for use as a movement corridor by caribou between areas to the east and west (Figure 32). Stillwater could also preserve the small amount of winter/refuge (especially winter) habitat on the Property where possible, and work to consolidate this into larger tracts over time that could potentially provide more suitable future winter habitat.

Other site management practices have been incorporated in the design that may benefit caribou such as:

- at closure site control (e.g. fencing/barriers) where necessary to prevent caribou access to pit or other potentially dangerous locations or infrastructure;
- appropriate speed limits will be posted and enforced on-site to prevent collisions with any caribou potentially passing through the site;

6.4.2 Habitat Management

6.4.2.1 On-Site

Appropriate vegetation management techniques during operation and after closure will be used to minimize possible impacts on potential caribou refuge habitat, winter habitat, and connectivity. The objective of mitigation measures is to maintain and/or restore native vegetation communities that existed on site prior to development. The Stillwater Project Property is part of the commercial forest on the Big Pic forest and habitat management after decommissioning will be dependent upon government direction and the closure planning in consultation with public and aboriginal communities.

It may be decided through consultation that final rehabilitation of the sites may focus on maximizing the potential for even-aged conifer forest, particularly jack pine and black spruce. Where appropriate, restoration with jack pine and black spruce would return the forest to a more natural condition that existed on-site prior to fire suppression activities during the 20th century. Restoring the conifer component would potentially benefit caribou by providing winter or refuge habitat on low productivity sites such as bedrock-dominated uplands.

On-site habitat management may include:

- During operations, herbicide applications could be used on recently cleared sites, right-of-ways, and transmission lines to minimize browse for moose and deer
- Non-native herbaceous/graminoid seed mixes may be used to for short-term erosion control during operations and initial decommissioning if suitable native seed mixes are not available commercially, but final rehabilitation of the sites will focus on restoring natural communities.
- Rehabilitation of the linear features (e.g. roads, transmission corridor) to conifer-dominated forest after decommissioning to benefit caribou.
- Based on the proposed closure plan, mine rock storage area will be rehabilitated as much as possible; the rocky, well-drained, shallow soils may be be suitable for jack pine and lichen communities.
- Stockpiled overburden will be spread out over portions of the mine rock storage area and revegetation will be undertaken using a combination of hydro-seeding, seeding, and hand planting of native shrub/tree seedlings. These areas will serve as propagule sources for colonization of the remainder of the mine rock stockpile over time.

- In addition to conventional mine rock stockpile revegetation programs, the feasibility of restoring *Cladina* lichen communities on portions of the rock stockpile will be investigated, with the intent of restoring potential winter habitat for woodland caribou.
- The process solids management facility will be revegetated with wetland areas and a channel draining south west connecting to Stream 6;
- The open pit will eventually flood and become a lake in approximately 40 years.

6.4.2.2 Off-Site

Off-site mitigation is a legitimate measure to enhance connectivity of the site with other areas of the Coastal Range more clearly used or that may be used by woodland caribou. Enhancement of caribou habitat elsewhere in the Coastal Range can also help to compensate losses of potential caribou habitat on site that cannot be fully mitigated, such as the loss of forest in what will become the open pit and will eventually become a lake after closure. One of nine measures Darby and Duquette recommended back in 1986 to help maintain Ontario caribou was to "*discourage moose and deer populations from increasing in or adjacent to caribou range. Application of herbicides to cutovers may do this while encouraging conifer regeneration."* This recommendation is still relevant today and is echoed in OMNR's Caribou Conservation Plan.

The current forest management plans that overlap the Coastal Range have specific objectives for maintaining or enhancing conifer component to benefit caribou. However, despite best intentions, FMP objectives are not always met and there will be considerable challenges in achieving targets in the coastal zone over the course of the plan due to:

- limited funds for silviculture in the trust fund due to limited harvest;
- low levels of harvest due to closure of Marathon mill, idling of Terrace Bay mill;
- high volumes of unmerchantable hardwood;
- poor harvest volumes;
- the fragmented nature of the forest;
- large amount of inoperable terrain (bypass);
- high road building costs; and
- reduced herbicide usage due to public concern / FSC certification.

Only about a third of the area targeted provincially for regeneration was prepared and/or subsequently tended by the forest management companies from 2004/05 to 2008/09 (Auditor General 2011). The 2009 independent forest audit for the Big Pic Forest (Arbex 2009) noted declining harvest levels on the forest and found inadequate tending practices that were leading to reductions in growth, yield, and stand densities for conifer.

Elsewhere within the coastal range there are opportunities that benefit caribou such as:

- harvesting to defragment blocks that are not deferred;
- road building to access stands that would not otherwise be harvested; and
- enhanced silviculture such as fill-in planting, aerial spray, manual release of competition (brushsaw), and pre-commercial thinning, to reduce hardwood browse and return even-aged conifer.

The magnitude of any off-site mitigation would be commensurate with the perceived potential impact of the Project on caribou habitat, while taking into account other mitigation efforts as well. The type, scale, timing, and location of off-site habitat management as a means of mitigation would be conducted in discussion with the OMNR and SFL holder, and would be consistent with current FMP direction and silvicultural ground rules. An administrative or minor amendment to an FMP could potentially be used as the mechanism for administering off-site habitat mitigation. Habitat mitigation could potentially have both short-term and long-term benefits, corresponding to short term impacts of the active mine and long term potential impacts after closure. For example, "clean-up" harvest of fragmented blocks or aerial spraying on past cutblocks that had ineffective release treatment in the past would potentially provide habitat benefits within the projected 11 year lifespan of the mine, whereas other habitat management might not yield benefits until forest stands mature (i.e., decades).

6.4.3 Linear Corridor Decommissioning

6.4.3.1 On-Site

Linear corridors such as roads, hydroelectric rights-of-way, seismic lines, and pipelines have a negative association with woodland caribou persistence (Environment Canada 2011; Vors et al. 2007). OMNR's 2009 CCP recognizes the potential impact that roads can have on caribou through increased predation, and is committed to developing policy to manage road densities (thresholds) of roads and other linear features (e.g. maximum km of roads per 100 km^2). Linear disturbance thresholds have not yet been developed for the Coastal Range, but there is a relatively high density of roads, transmission corridors, and other linear features in much of the Coastal Range west of Pukaskwa National Park. Where possible, linear corridors will be decommissioned on site after closure, include the power transmission line and access roads that are no longer needed. These decommissioned corridors restored to native vegetation, preferably conifer-dominated forest where site conditions permit. Depending on site conditions and potential use, decommissioned linear features will be scarified (site prepared), and seeded or planted with conifer.

6.4.3.2 Off-Site

Off-site mitigation is a legitimate measure to enhance connectivity of the Project site with other areas of the Coastal Range that may be used by woodland caribou. It can also help to

compensate potential losses of caribou habitat on site that cannot be fully mitigated, such as the primary pit (it will become a waterbody). The current forest management plans that overlap the coastal range have specific objectives for decommissioning roads to benefit caribou. The Project could potentially support the decommissioning of targeted linear features in the adjacent coastal range, particularly if enhanced caribou monitoring suggests that these efforts would benefit caribou that could potentially use or pass through the Property.

6.4.4 Alternate Prey Management

Densities of moose in the WMUs overlapping the coastal range near the Project are greater than what Bergerud (2007) predicted are sustainable for long-term persistence of caribou. Alternate prey control is identified as a high priority in the proposed national recovery strategy for woodland caribou (Environment Canada 2011b). Alternate prey management within or adjacent to ranges where boreal caribou local populations are declining is identified in Environment Canada (2011b) as a strategy to reduce other prey populations (e.g. moose, deer, beaver) that attract predators and/or function as resource competitors, to allow for the growth of boreal caribou populations (e.g., minimize human-caused range extensions of alternate prey). OMNR's Caribou Conservation Plan also recognizes the role that predators and alternate prey have on caribou population dynamics. For example, increased deer harvest through expanded seasons is identified as a mechanism to help slow deer range expansion within the area of caribou distribution.

Alternate prey control is also consistent with guiding principles of OMNR's Cervid Ecological Framework such as:

- Adaptive management;
- Using enabling and flexible approach to allow for local management decisions to address local circumstances and needs;
- Integration management of cervid populations and habitat;, and a
- Risk based approach to species management e.g., the species with the highest risk may be given management priority over those of lower risk in a given area.

Maintaining low moose and white-tailed deer on and adjacent to the Property by hunting is a potential measure, within the limits of public/worker safety and operational constraints. Potential partnership with adjacent aboriginal communities and a wider approach to alternate prey management in the adjacent coastal range on traditional land use areas could be considered in collaboration with OMNR. Habitat management (e.g. increasing conifer) to benefit caribou may indirectly reduce alternate prey by decreasing habitat suitability for moose, deer and beaver. Whether Aboriginals who prefer to hunt moose support measures to decrease moose populations is unknown.

In the case of the proposed Project, there should be a temporary reduction in beaver numbers during operations on the Marathon PGM-Cu Project property. In particular OMNR partnership with and support of aboriginal communities and local trappers to target beavers to a greater extent could be pursued.

6.4.5 Translocation

The feasibility of translocating woodland caribou to Pukaskwa National Park to bolster any remaining surviving caribou is currently being assessed by Parks Canada (Allen et al. 2010; Parks Canada 2011). OMNR's CCP has committed to a review of the feasibility of caribou translocations (OMNR 2009a). Michipicoten Island would be the likely donor population since the population is between 400 and 650 individuals and growing. In addition, the animals on Michipicoten are descendents of caribou translocated from the Slate Islands and of a bull that wandered to the island in 1982 (Bergerud 1989), so are genetically similar to the caribou in Pukaskwa National Park. Translocations have often been unsuccessful, and appear to only have prospect for success in limited situations (Bergerud and Mercer 1989). Predator control of some sort may be required if the translocation is to achieve even moderate success (Euler 2010). Translocation of animals to Pukaskwa with the financial support of SCI and other stakeholders could potentially mitigate any potential negative demographic or genetic effects of the Project if caribou movement is impeded.

6.4.6 Public Education

Additional signage (Figure 43), especially on Highway 17 or at the start of major secondary roads used for hunting might be useful in increasing public awareness of woodland caribou in the coastal range and mitigating accidental mortality from hunting and/or collisions. As the shooting of a caribou near Neys in 2011 by hunter who mistook it for a moose indicates, additional public education is warranted.

Figure 43. Public awareness sign for caribou in use in Nipigon District (OMNR photo).

6.5 Monitoring

Monitoring is required to evaluation the effectiveness of mitigation measures for potential impacts of the Project on woodland caribou. While many earlier studies on the impacts of development on caribou focussed on shorter term impacts relatively near the infrastructure, longer term studies of wider geographic and temporal scale are required to assess longer term population level impacts (Vistnes and Nellemann 2007).

While monitoring is routinely conducted on-sites for development projects, an enhanced monitoring program that goes beyond the Project site may be warranted, particularly given that there is no documented caribou use of the Property. Support for by SCI of woodland caribou in the adjacent Coastal Range and Discontinuous Range could help:

- Determine the number caribou existing on the mainland west of Pukaskwa National Park and potentially trends in abundance;
- Identify habitat use patterns that lead to a better description of "atypical" caribou winter and refuge habitat in the Coastal Range, which would in turn help evaluate potential winter and refuge habitat on the Project site.
- Provide a better understanding of how woodland caribou use and move through the Coastal Range, including the Project site;
- Help determine if caribou use the hypothetical "Neys-Killala Corridor" or other linkages to continuous ranges to the north;
- Identify critical habitat that may require protection from development;
- Determine the most appropriate location for any off-site habitat mitigation measures and help assess their effectiveness.

6.6 Residual Effects

Residual effects are those that remain after mitigative measures are applied to address potential negative impacts of a project. The Canadian Environmental Assessment Act (CEAA) requires an analysis of significance of residuals effects of the project. Various criteria that should be considered when describing potential environmental effects of the project include: direction, timing, scope, duration, frequency, magnitude, significance, ecological context, geographic extent, reversibility, and confidence (CEAA 2011; Hegmann et al. 1999).

There is a great deal of uncertainty regarding the potential impacts on caribou and their habitat due to limited data available on caribou and caribou habitat within the Coastal Range in general, and absence of movement and habitat use data for the Project site in particular. Dispersal rates between remnant populations east and west of the study area are unknown, but probably very low given the small population sizes and presence of existing dispersal barriers (highways, railroads, and other human activity). Natality, mortality, and other basic demographic data for coastal range caribou are also unknown. Nonetheless, given the lack of

documented use of the Project site by caribou and the very small population size in the mainland Coastal Range (estimated at less than 25 animals), it is our opinion that:

- The response of individual caribou (as opposed to habitat) to disturbance during the construction and operations phase is unknown, but expected to be insignificant, given the absence of documented use of the Project site by caribou. Potential disturbance to individuals would occur during construction and operations phase of the mine and would likely be negligible after decommissioning (c. 15 years).
- Potential residual effects on connectivity are expected to be negligible on north-south movement, and minimal on movement within the Coastal Range. Potential disturbance to individuals would occur during construction and operations phase of the mine and would likely be negligible after decommissioning. Existing mature forest cover suitable for corridor habitat remains to the north and south of the project site. If caribou dispersing between Pukaskawa to the Neys were to deflect north of the Project site, the potential increase in travel distance is minimal given the high mobility of caribou.
- No residual effects on calving/nursery habitat are anticipated since these habitats are not known to exist on the Property.
- Potential residual effects on refuge habitat are expected to be negligible and primarily during the construction and active phase of the mine life. Mitigation will be conducted after closure to reestablish or enhance caribou habitat as a means of reducing potential effects.
- Potential residual effects on winter habitat are not expected to be significant, and would primarily during the construction and active phase of the mine life. Mitigation will be conducted after closure to reestablish or enhance caribou habitat as a means of reducing potential effects.

In our opinion, significant residual effects on woodland caribou from the Project are unlikely.

We believe there are the opportunities to ensure overall benefit for woodland caribou in the Coastal Range by conducting additional off-site mitigation/compensation and enhanced monitoring that would not otherwise be conducted. Enhanced silviculture, road decommissioning, and other mitigation measures in habitats elsewhere in the range that caribou are known to use, coupled with additional monitoring and research, could more than compensate for any losses of potential caribou habitat on the Project site, and any potential interference with caribou connectivity.

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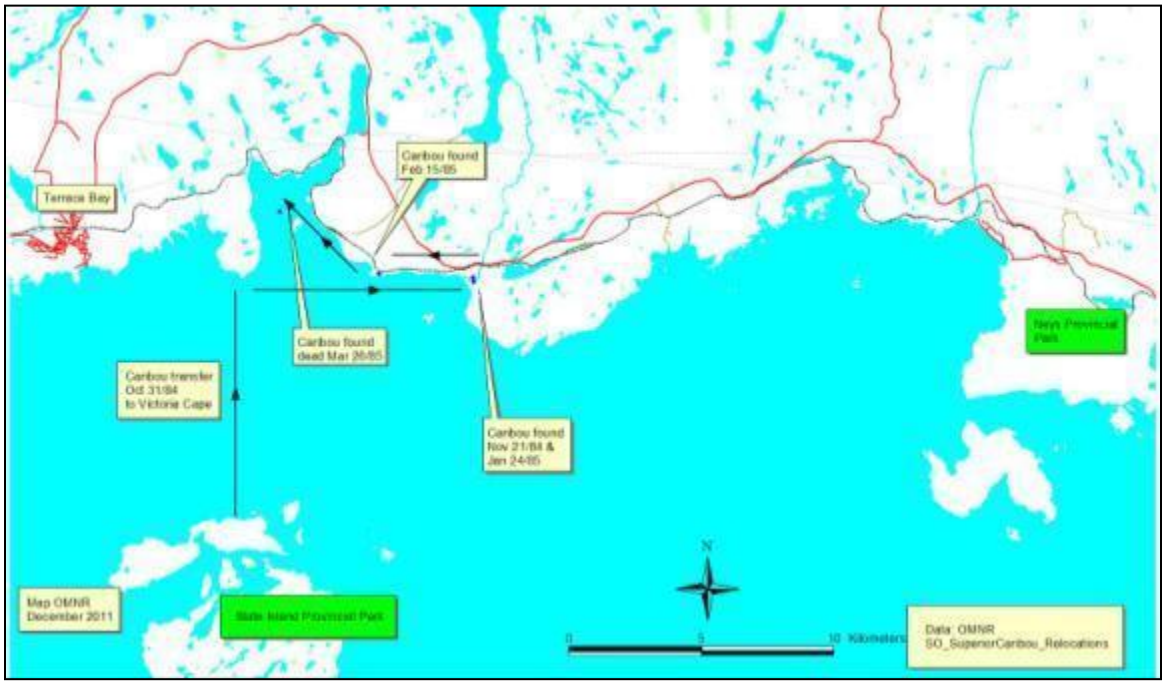
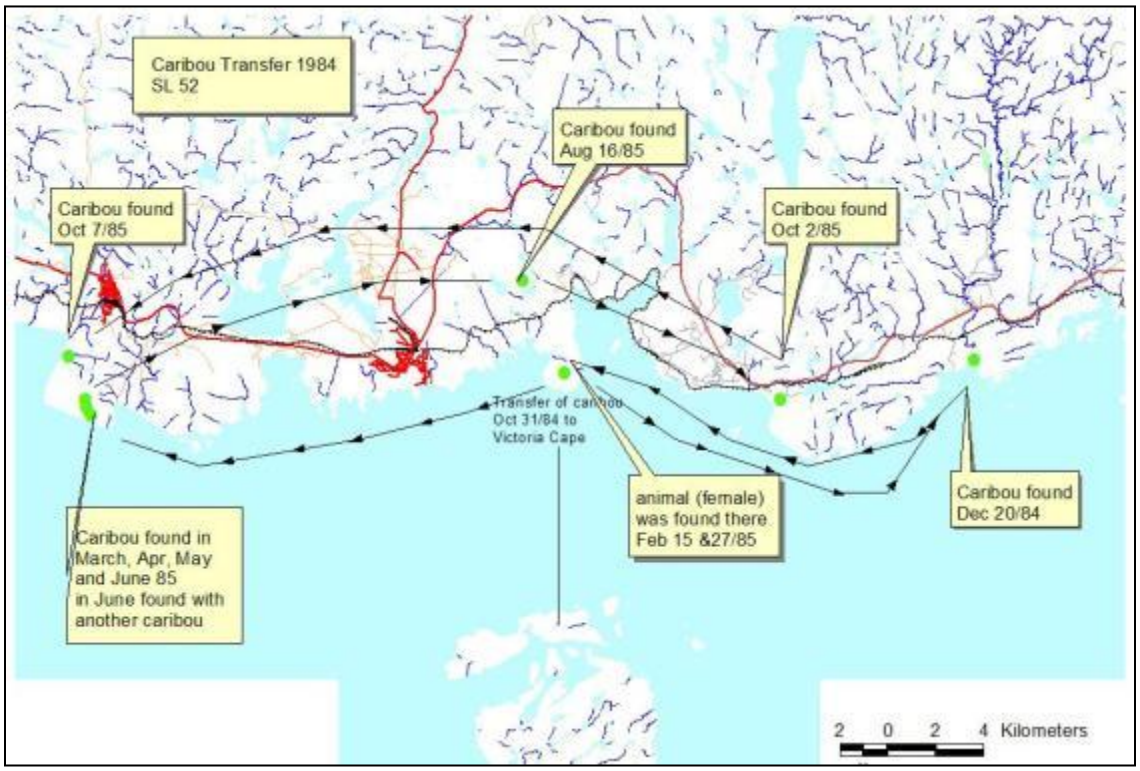
Appendix 1. Known movements of two woodland caribou after translocation from the Slate Islands to Victoria Cape, October 21 1984 (OMNR unpublished data provided by R. Tyhuis).



Caribou #SL54 (male)



Caribou #SL52 (female)

Appendix 2. Forshner's (2000) wolf study area and locations of radio-collared wolves in the Greater Pukaswka ecosystem.

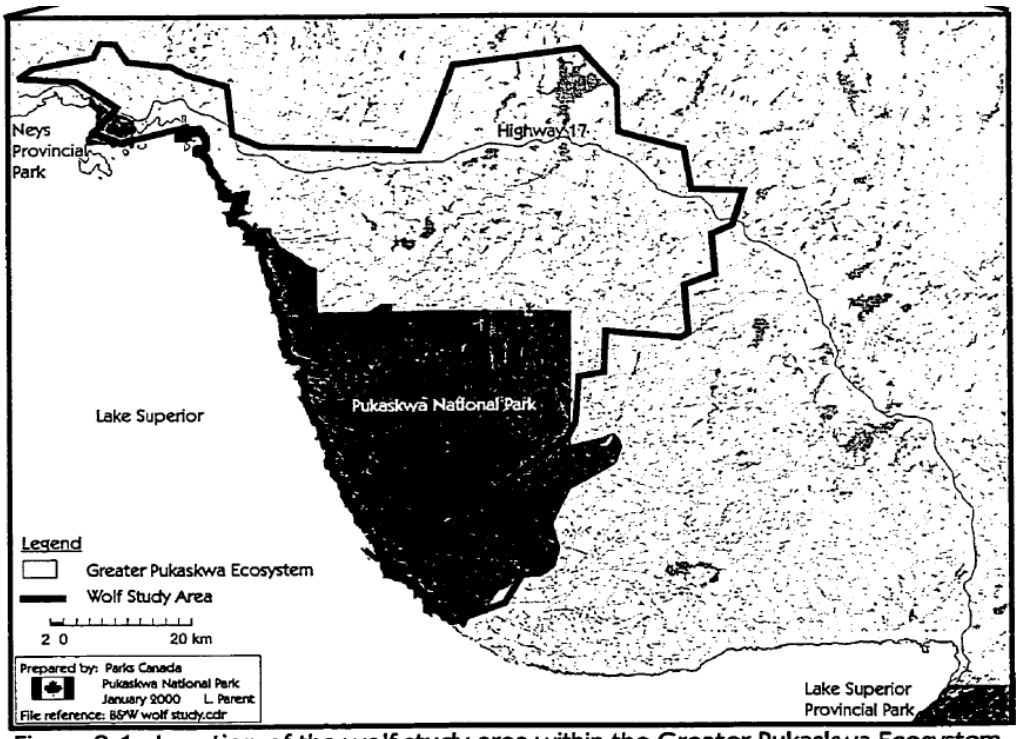


Figure 2-1. Location of the wolf study area within the Greater Pukaskwa Ecosystem, Ontario, Canada.

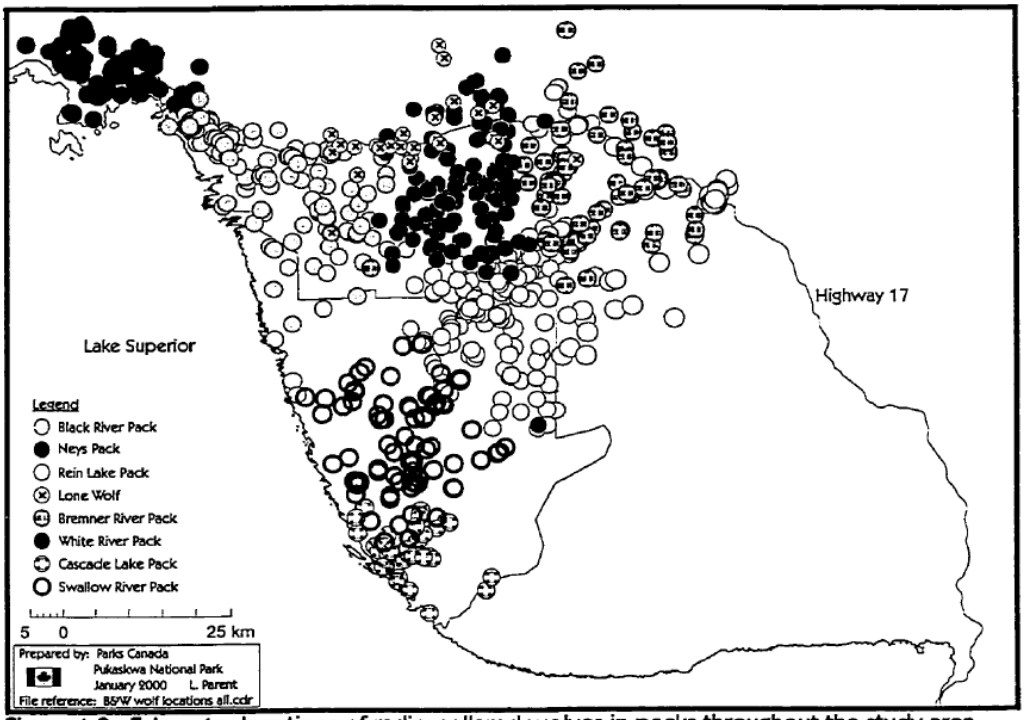


Figure 4-8. Telemetry locations of radio-collared wolves in packs throughout the study area, 1994 - 1998.