APPENDIX 5-C

Terrestrial Baseline Characterization Report

Agnico Eagle Mines: Meadowbank Division

Whale Tail Pit & Whale Tail Haul Road Terrestrial Baseline Characterization Report

November 2015

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1. EXECUTIVE SUMMARY

This Terrestrial Baseline Characterization Report has been prepared in support of the proposal by Agnico Eagle Mines Ltd. (Agnico Eagle) to develop the Whale Tail gold deposit as a satellite pit to the existing Meadowbank Gold Mine. The Whale Tail Pit site is located approximately 50 km northwest of the Meadowbank Mine, and approximately 150 km north of Baker Lake, Kivalliq Region, Nunavut. The studies for this report, undertaken in 2014 and 2015, document the existing flora and fauna observed or likely to exist within the Whale Tail Pit study area and along the proposed Whale Tail Haul Road alignment that would connect to the Meadowbank Mine.

Terrestrial baseline and monitoring studies for the Meadowbank Mine began in 1999, with monitoring continuing to the present. Relevant findings from these studies and information from the Government of Nunavut (GN)'s Kivalliq Ecological Land Classification Map Atlas (Campbell et al. 2012) have been used to supplement field data collected along the Whale Tail Haul Road proposed alignment in 2014 and 2015.

A Regional Study Area (RSA) and a Local Study Area (LSA) were established for the purposes of conducting the Whale Tail Pit and Haul Road baseline plant and wildlife surveys. For the purposes of this report, the Whale Tail Pit study area included the proposed pit, the proposed haul road alignment, and associated areas where infrastructure will be developed for the Whale Tail project. The RSA is a 50 km buffer centred on the study area (i.e., 25 km from all infrastructure) with a total area of 5,017 km^2 and the LSA is a 3 km buffer (i.e., 1.5 km from infrastructure) with a total area of 282 km^2.

Dougan & Associates staff, in conjunction with Nunavut Environmental staff and with assistance from local wildlife field technicians, conducted baseline field studies in 2014 and 2015. This field program included the following:

Vegetation

- Plot-based vegetation surveys to ground-truth existing ELC mapping, and collect information on vascular and non-vascular plants within the study area.

Wildlife

- Breeding bird surveys, including PRISM plots around the Whale Tail Pit study area and transects along the proposed Whale Tail Haul Road;
- Raptor nest and activity surveys;
- Waterfowl nest surveys of all shorelines within 100 m of the proposed road alignment and Whale Tail Pit study area;
- Ground reconnaissance surveys in targeted areas of eskers to document predatory mammal denning activity;
- Wildlife observation log sheet (2014/2015);
- Aerial survey of the road corridor (2014); and
- Incidental observations during all wildlife and vegetation field work.

Extensive field studies were carried out for the 2005 Meadowbank Baseline Terrestrial Ecosystem Report, and monitoring has been ongoing since 2007 in accordance with Meadowbank's Terrestrial Ecosystem Management Plan (TEMP). Where appropriate, information collected under these programs was used to supplement data collected during the Whale Tail field studies.

Ecological Land Classification (ELC) mapping for the study area was developed by the Government of Nunavut (GN) for the Kivalliq Ecological Land Classification Map Atlas (Campbell et al. 2012). The digital ELC data in Geographical Information Systems (GIS) format were used to develop ELC mapping for the RSA and LSA, and to create wildlife habitat suitability maps. The Map Atlas was also used in the ground-truthing exercise and to inform research on plant associations and general physiography of the Wager Bay Plateau, in which the study site lies.

During the Whale Tail vegetation baseline surveys, 138 vascular plants and 62 non-vascular plants were identified. The most common ELC unit in the RSA is Water, with 26% cover. The most common vegetated community in the RSA is Lichen/Rock Complex (23%), followed by Heath Upland (16%), Heath Tundra (11%), Boulder/Gravel (9%), and Lichen Tundra (4%). All other communities were <2% cover. In the LSA, proportions of ELC communities only differ in that Water is the second most abundant type at 21%, and the Lichen/Rock complex is higher at 27%, which is expected given that the road alignment has been developed to minimize impacts to water and wetlands.

During the Whale Tail baseline wildlife surveys, 45 terrestrial wildlife species (i.e., 10 mammals, 35 birds) were recorded through direct observation or sign. Across the 2014 and 2015 field studies, Barren-ground Caribou (*Rangifer tarandus* ssp. *groenlandicus*), Arctic Ground Squirrel (*Spermophilus parryii*), and Muskox (*Ovibos moschatus*) were the most commonly observed mammals, and Lapland Longspur (*Calcarius lapponicus*), Horned Lark (*Eremophila alpestris*), redpolls (Common and Hoary) (*Acanthis* sp.) and Snow Goose (*Chen caerulescens*) were the most commonly observed birds. These findings are consistent with the Meadowbank baseline terrestrial surveys.

Collaring data and knowledge of calving ground locations in Nunavut indicate that the study area is a migratory corridor in spring and fall, and is not close to any documented calving grounds (Campbell et al. 2012). The southern portion of the proposed esker #3 borrow area was actively used for Arctic Wolf (*Canis lupus*) denning in 2015 and all esker features located within the study area are considered to have high suitability for mammal denning, bird nesting, and wildlife movement.

Using the ELC mapping and wildlife habitat suitability rankings developed through extensive literature review, habitat suitability maps were generated for each terrestrial Valued Ecosystem Component (VEC).

The vegetation and wildlife findings of this report present a thorough baseline of vegetation and terrestrial wildlife conditions within the Whale Tail Pit and Haul Road study area. The data collected and presented will be useful in future project planning that may occur for the study area, and has been conducted in a way that is transferrable to future monitoring studies.

2. INTRODUCTION

2.1. BACKGROUND

Agnico Eagle Mines Limited: Meadowbank Division is proposing to develop Whale Tail Pit, a satellite deposit on the Amaruq property, in continuation of mine operations and milling of the Meadowbank Mine. The Amaruq Exploration property is a 408 (km^2 site located on Inuit Owned Land approximately 150 km north of the hamlet of Baker Lake and approximately 50 km northwest of the Meadowbank Mine in the Kivalliq region of Nunavut. The property was acquired by Agnico Eagle in April 2013 subject to a mineral exploration agreement with Nunavut Tunngavik Incorporated (NTI).

The Meadowbank Mine is an approved mining operation and Agnico Eagle is looking to extend the life of the mine by constructing and operating Whale Tail Pit (referred to in this document as the Project), which is located on the Amaruq exploration property. As an amendment to the existing operations at the Meadowbank Mine, it is subject to an environmental review established by Article 12, Part 5 of the *Nunavut Land Claims Agreement* (NLCA). Baseline data have been collected in support of the environmental review to document existing conditions and to provide the foundation for a qualitative and quantitative assessment of Project operations and the extension of the mine development, to be evaluated in the Environmental Impact Statement (EIS) for the Project.

This terrestrial baseline characterization report has been undertaken to document the existing flora and fauna observed or likely to exist along the proposed haul road alignment and within the Whale Tail study area. Terrestrial baseline and monitoring studies for the adjacent Meadowbank Mine began in 1999, with monitoring continuing to the present. Relevant findings from these studies and information from the Government of Nunavut (GN)'s Kivalliq Ecological Land Classification Map Atlas (2012; Map Atlas) have been used to supplement field data collected along the Whale Tail Haul Road proposed alignment in 2014 and 2015.

2.2. OBJECTIVES

The Nunavut Impact Review Board (NIRB) project guidelines give a framework for what information must be included in baseline data collection so that an Environmental Impact Assessment (EIA) can be prepared. The requirements under Section 4.13, Description of Biological Environment, were used to guide the preparation of this report.

The objectives of this study are to characterize baseline plant communities and wildlife use of the study area through a combination of field studies and literature review; this data to be used to support the EIA for the Whale Tail Pit and Haul Road. This study investigates the terrestrial Valued Ecosystem Components (VECs) of the study area, including:

- Vegetation;
- Ungulates;
- Predatory Mammals;
- Small Mammals;
- Raptors;
- Waterfowl; and
- Upland Breeding Birds.

Separate reports on terrain and soils were prepared by Golder Associates (Golder 2015).

2.3. SETTING

2.3.1. BIOPHYSICAL ENVIRONMENT

The Whale Tail study area is located in the Kivalliq Region of Nunavut, which comprises the most southern portion of mainland Nunavut. The Kivalliq Region is situated adjacent to Manitoba and the Northwest Territories, extending eastward to Hudson Bay, and encompasses Coats and Southampton islands to just north of Repulse Bay. The study site is located approximately 200 km inland from Hudson Bay and 150 km north of Baker Lake in an ecoregion known as the Wager Bay Plateau (see Figure 1). The Wager Bay Plateau is part of the northern Arctic, but the site is close to regions considered to be southern Arctic. The GN's Map Atlas (Campbell et al. 2012) describes the Wager Bay Plateau as follows:

> *Wager Bay Plateau is a large ecoregion covering the northeastern District of Keewatin extending westward from the northern portion of Southampton Island on Hudson Strait to Chesterfield Inlet in the south, and as far west as Back River. The mean annual temperature is approximately -11°C with a summer mean of 4.5°C and a winter mean of -26.5°C. The mean annual precipitation ranges from 200-300 mm. This ecoregion is classified as having a low arctic ecoclimate. It is characterized by a discontinuous cover of tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, Dryas spp., and Vaccinium spp. Taller dwarf birch, willow, and alder occur on warm sites; wet sites are dominated by willow and sedge. Lichen-covered rock outcroppings are prominent throughout the ecoregion, and towards the south the vegetation becomes a mix of tundra vegetation and open, dwarf coniferous forest. This ecoregion is composed of massive Archean rocks of the Canadian Shield that form broad, sloping uplands, plains, and valleys. It rises gradually westward from Chesterfield Inlet to 600 m above sea level elevation, where it is deeply dissected. Turbic and Static Cryosols developed on discontinuous, thin, sandy moraine and alluvial deposits are the dominant soils in the ecoregion, while large areas of Regosolic Static Cryosols are associated with marine deposits along the coast. Permafrost is continuous with low ice content. Characteristic wildlife includes Caribou, Muskox, Wolverine, Arctic hare, fox, walrus, seal, whale, polar bear, raptors, shorebirds, and waterfowl. Land uses include trapping, hunting, fishing, and mineral exploration and extraction. Repulse Bay and Baker Lake are the main settlements. The population of the ecoregion is approximately 1,700.*
>
> *(Campbell et al. 2012)*

The study area's landscape is comprised of rolling hills with many lakes and ponds. Habitats are primarily lichen and rock in the uplands and wet graminoid-dominated lowlands, with tundra of varying moisture regimes in between. Eskers occurring between the existing Meadowbank Mine and the Whale Tail study area are prominent linear features in the local landscape but are not common in the region.

2.3.2. HUMAN ENVIRONMENT

The closest community to the Whale Tail study area is the Hamlet of Baker Lake, which is located on the northwest shore of Baker Lake near the mouth of the Thelon River, approximately 75 km from the existing Meadowbank Mine. The population in 2011 was 1,865, an increase from 1,726 from the 2006 census (Statistics Canada 2012). The majority of the population are Inuit, with <10% identified as having non-Inuit ethnic origins (Statistics Canada 2012). The next closest communities to the study area are Rankin Inlet, Whale Cove, and Chesterfield Inlet. The community of Baker Lake is accessible by air year-round or by water in the summer when the route from Chesterfield Inlet to Baker Lake is ice-free.

The Hamlet of Baker Lake, Nunavut's only inland non-coastal Inuit community, was permanently established in the 1950s (CEDO 2011). Traditionally, the Inuit of the Baker Lake area were highly nomadic, moving with Caribou (*Rangifer tarandus* ssp. *groenlandicus*) from season to season. Hunting and trapping activity in the Meadowbank area is limited (ISL 1978), primarily because of its distance from Baker Lake, and because of the relatively low abundance of target species; however, important traditional Caribou hunting areas do occur throughout the region according to the Baker Lake Hunters' and Trappers' Organization (HTO) and Baker Lake elders (Cumberland Resources 2005a, Burt and Witteman 2014). Until relatively recently, subsistence hunting was the only human activity regularly carried out in the Kivalliq Region.

Mining exploration and mine development have been occurring in the Kivalliq Region since the 1950s when the North Rankin Nickel Mine was opened at Rankin Inlet (the mine closed in the early 1960s). Exploration of uranium deposits began in the 1970s and continues today with AREVA's Kiggavik project west of Baker Lake (AANDC 2014). The Meadowbank Mine, operational since 2010, is the first active mine near Baker Lake.

2.4. BASELINE STUDY AREAS

2.4.1. REGIONAL & LOCAL STUDY AREAS

A Regional Study Area (RSA) and a Local Study Area (LSA) were established for the purposes of conducting the Whale Tail Pit and Haul Road baseline plant and wildlife surveys. For the purposes of this report, the Whale Tail study area included the proposed pit, haul road alignment, and associated areas where infrastructure will be developed for the Project.

The RSA is a 50 km buffer centred on the study area (i.e., 25 km from all proposed infrastructure) and the LSA is a 3 km buffer (i.e., 1.5 km from infrastructure)(see Figure 2). Total areas of the RSA and LSA are 5,017 and 282 km^2, respectively.

2.4.2. FOCUS SPECIES

Terrestrial Valued Ecosystem Components (VECs) were established for the Meadowbank project in 2005 based on their abundance and conservation concern in the area. These VECs, which provided the focus for the current baseline study, are presented in Table 2-1.

The 2014 and 2015 baseline studies were conducted to determine the presence/absence, distribution, and abundance of the terrestrial vegetation and wildlife that comprise these VECs. Due to their high cultural importance, Caribou have been studied and discussed in this report in greater detail than the other VECs.

Table 2-1: Valued Ecosystem Components

VEC	Common Name	Scientific Name
Vegetation (Wildlife Habitat)	See Section 3	See Section 3
Ungulates	Barren-ground Caribou Muskox	*Rangifer tarandus* ssp. *groenlandicus* *Ovibos moschatus*
Predatory Mammals	Grizzly Bear Wolverine Gray (Arctic) Wolf Arctic Fox	*Ursus arctos* *Gulo gulo* *Canis lupus* *Vulpes lagopus*
Small Mammals	Arctic Hare Arctic Ground Squirrel (Sik Sik) Collared Lemming Northern Red-backed Vole	*Lepus arcticus* *Spermophilus parryi* *Dicrostonyx groenlandicus* *Clethrionomys rutilis*
Raptors	Peregrine Falcon Gyrfalcon Rough-legged Hawk Short-eared Owl Snowy Owl	*Falco peregrinus* ssp. *tundrius* *Falco rusticolus* *Buteo lagopus* *Asio flammeus* *Nyctea scandiaca*
Waterfowl	Tundra Swan Canada Goose Snow Goose Long-tailed Duck Sandpipers Loons	*Cygnus columbianus* *Branta canadensis* *Chen caerulescens* *Clangula hyemalis* *Calidris spp* *Gavia* spp.
Upland Breeding Birds	Rock Ptarmigan Lapland Longspur Horned Lark Savannah Sparrow Semipalmated Sandpiper	*Lagopus mutus* *Calcarius lapponicus* *Eremophila alpestris* *Passerculus sandwichensis* *Calidris pusilla*

3. VEGETATION

3.1. INTRODUCTION

3.1.1. BACKGROUND

The focus of this section is a discussion of vascular and non-vascular plant species, and vegetation community composition and distribution within the Whale Tail study area. Methods and findings of the 2014 and 2015 vegetation field surveys for the Whale Tail study area are described, as is information from background resources that were consulted to supplement the field data. Where appropriate, data from the Meadowbank baseline data collection work (1999 to 2005) and baseline report (Cumberland Resources 2005a) have been included.

3.1.2. GOALS & OBJECTIVES

Plants and plant communities were investigated in the LSA and RSA in order to fulfill a number of goals and objectives for this project:

1. **Goal**: Describe the ecological context of the Whale Tail Pit project.
    a. *Objectives*: Review background resources to summarize known information on ecozones, ecoregions, or other appropriate ecological areas.

2. **Goal**: Describe the local presence of plant species;
    a. *Objectives*: Conduct field studies to develop a baseline list of vascular and non-vascular plants for the study area.

3. **Goal**: Describe the local presence of vegetation communities;
    a. *Objectives*: Create Ecological Land Classification (ELC) mapping for the LSA and RSA using data provided by the GN and conduct plot-based vegetation surveys to confirm the accuracy of this mapping.

4. **Goal**: Describe the regional presence of species and communities.
    a. *Objectives*: Review available scholarly and government resources related to plant and plant community presence in the Kivalliq region.

5. **Goal**: Describe rare or regionally unique species or species assemblages, including species with federal, territorial, regional, or local designated status (e.g., vulnerable, threatened, endangered, extirpated, of special concern, as designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or other agencies);
    a. *Objectives*: Investigate rare species occurrences and the probability of occurrences within the Whale Tail study area.

The ELC mapping, confirmed through Goal 4, was used to develop wildlife habitat suitability maps for each wildlife VEC (see Sections 5.2.3 and 5.3.5).

These goals and objectives were developed through review of Section 4.13.1, Description of the Biological Environment, Vegetation, of the NIRB project guidelines for the Meadowbank Mine (NIRB

2004). Several of the NIRB requirements in Section 4.13.1, such as describing *"The health of these species/communities and their contaminant loadings"*, and *"Species that are valuable for cultural reasons known to the Inuit"*, are addressed in baseline reports by other disciplines.

3.2. METHODS

3.2.1. FIELD STUDIES

Baseline vegetation data were collected from August 28th to September 3rd, 2014 and July 3rd to 13th, 2015. Surveys involved botanical inventories and ELC classification verification within 5 x 5 m plots as well as documentation of notable vascular and non-vascular plants observed incidentally between plots. In order to encompass and examine the diversity of ELC communities within the study area, plotlocation was informed by the site selection process and field conditions.

Site Selection Process

The site selection process for vegetation plots aimed to ensure that each of the goals described above (Section 3.1.2) could be achieved through a comprehensive and efficient survey design. To do so, a sufficient number of plots needed to be sampled that represented both the variation in ELC types and captured the diversity of flora across the landscape. The number of vegetation plots was stratified per ELC type according to the percent area of each ELC type within the LSA, while ensuring that a minimum of seven (7) plots per ELC vegetation community type were sampled across both years. This approach ensured that a sufficient minimum sampling effort was applied to each ELC vegetation community type for accurate characterization and detection of potentially rare species. Additional plots for ELC vegetation communities with a low assignment accuracy based on preliminary results in 2014 (e.g., Sand) were conducted to take this inaccuracy into account. Plot locations were selected randomly within each ELC vegetation community type within each 1 x 1 km sampling area using ArcGIS. See Appendix 13 for coordinates for ELC plots surveyed in 2014 and 2015.

Field Sampling

During each sampling day, field ecologists travelled to and from pre-arranged drop-off points within the Whale Tail Pit study area by helicopter. Once on the ground, a Trimble GeoExplorer 6000 Series GeoXH high-accuracy GPS unit was used to review ELC mapping and lead staff to pre-defined plot locations.

Upon reaching plot coordinates, one of several decisions was made:

1) If the ELC community was correctly identified by remote sensing data, a plot would be established;
2) If the ELC community was not correctly identified by remote sensing data, a plot would be established and notes would be taken concerning what the appropriate ELC community type would be; and
3) If field staff identified an ELC community that was under-represented in the sampling efforts or displayed novel conditions or species, a new plot would be created using the *Trimble GeoXH* and the plot would be sampled.

A breakdown of the number of plots sampled and their corresponding ELC vegetation communities is provided in Table 3-1.

Table 3-1. Vegetation plots sampled, 2014 and 2015

ELC Vegetation Community	Plots Sampled		
	2014	2015	Total
Boulder/Gravel	3	4	7
Graminoid Tundra	4	5	9
Graminoid/Shrub Tundra	4	5	9
Heath Tundra	6	7	13
Heath Upland	5	10	15
Heath Upland/Rock Complex	3	7	10
Lichen Tundra	6	3	9
Lichen/Rock Complex	5	12	17
Sand	1	6	7
Shrub Tundra	7	5	12
Shrub/Heath Tundra	3	6	9
Water	0	0	0
Wet Graminoid	5	6	11
Total	**52**	**76**	**128**

Under the conditions for plot establishment, as described above, 128 plots were established and surveyed. Each plot was measured using a tape measure and wire flags were temporarily installed at the corners. Once established, recorded parameters included:

- Date, observers, and plot number;
- Quadrat location (lat/long), using the *Trimble GeoXH*;
- ELC type;
- General plot site information (slope percent, aspect, shape, and position, moisture regime, and rooting depth);
- Plot substrate information (percent bedrock, boulder, stone, gravel, bare soil, water, and vegetation);
- Vegetation cover percentages (tall shrubs, low shrubs, herbs, graminoids, mosses, lichen, and other);
- Summary of species dominance;
- Flora species list with layers, cover, and sample information; and
- Fauna and general observations.

The vegetation data sheet used for this work is included in Appendix 1.

Vascular plants were identified in the field using field guides and the knowledge of field ecologists; if plants could not be identified in the field, voucher specimens were collected and subsequently identified using taxonomic manuals in Dougan & Associates' in-house herbarium. Vouchers of commonly observed non-vascular plants (e.g., mosses and lichens) were collected during the 2015 field program and sent to experts for identification.

3.2.2. ECOLOGICAL LAND CLASSIFICATION (ELC)

The GN's Department of Environment (DoE) conducted a multi-year program to develop ELC for the Kivalliq Region based on classification of Landsat imagery. This mapping facilitated identification of ecological land classes, and ultimately, identification of important vegetation communities, which is critical to the sustainable management of the Kivalliq's ecological communities and the wildlife species utilizing these habitats. For the Whale Tail Pit project baseline data collection, the DoE's ELC mapping for the RSA and LSA was provided by Caslys Consulting in ArcGIS Shapefile format. These shapefiles are the basis for the ELC mapping in this report. Following is a brief explanation of how the ELC mapping was developed by the DoE.

A thorough ELC of the Kivalliq Region of Nunavut was completed by Caslys Consulting in 2012 on behalf of the GN in collaboration with data provided by Agnico Eagle (from the Meadowbank baseline studies) to the GN. Image classification is a statistical process that groups together pixels that have similar spectral characteristics. There are two methods of image classification: unsupervised and supervised. For this project, an unsupervised classification was performed. An unsupervised classification, where ArcGIS looks at spectral reflectance characteristics and assigns every pixel into a class, is useful when there is no prior knowledge of the classes in a landscape.

Both Landsat 5 TM (Thematic Mapper) and Landsat 7 ETM (Enhanced TM) satellite sensors were considered, with dates ranging from August 2000 to August 2009. A preliminary classification was then completed to identify distinct ecological areas within each scene, which were then used to delineate sample sites, stratified across each distinct area. The preliminary classification provided information to formulate draft class breakdowns, understand broad class distributions across the landscape, and plan field program logistics.

A field program carried out by the GN was designed to optimize quality and quantity of data, guide the ELC mapping process, and visit pre-defined sample site locations. Data and knowledge acquired during the field program were the basis for the final class descriptions. The imagery and sample data were analyzed to generate refined classes based on multiple factors. The image classifications were run a second time using the updated class definitions to achieve the greatest possible accuracy when compared to the actual sample locations. Numerical information in the image's spectral bands defined the spectral 'signature' of each class. Once the spectral signatures were determined, every pixel was compared to the signatures and labelled as the class to which it was mathematically closest. In addition to specifying the classes, two other parameters determined how close pixels' digital numbers must be to be considered in the same class. The classification was an iterative process where classes were combined and/or excluded based on the results in the classification report.

The ELC Units determined through this process for the Whale Tail Pit and Haul Road LSA and RSA are:

- Lichen/Rock Complex;
- Heath Upland;
- Heath Tundra;
- Boulder/Gravel;
- Lichen Tundra;
- Graminoid Tundra;
- Shrub/Heath Tundra;
- Graminoid/Shrub Tundra;
- Heath Upland/Rock Complex;
- Cloud/Shadow;
- Shrub Tundra;
- Wet Graminoid;
- Sand;
- Disturbance; and
- Water.

3.2.2.1. ACCURACY ASSESSMENT

During the 2014 and 2015 field surveys, not every plot that was surveyed accurately portrayed the ELC community to which it was assigned via the Landsat imagery analysis. Given this finding, the accuracy of the ELC model was tested using Cohen's Kappa (Cohen 1960).

Cohen's Kappa is a measure of prediction accuracy for a set of samples observed independently from multiple observed, and is corrected for chance agreement. The predicted and observed ELC types for 128 sample locations were organized into a confusion matrix. The confusion matrix provides a summary of locations that were correctly predicted (i.e., the diagonals of the matrix), versus those that were incorrectly predicted (i.e., off-diagonals). Cohen's Kappa is calculated from the confusion matrix using the accuracy measure and the chance agreement measure, where:

$$kappa = \frac{accuracy - chance\ agreement}{1 - chance\ agreement}$$

The statistic varies from -1 to +1, where values of less than 0 indicate a predictive model that is no better than chance, and +1 indicates perfect agreement (Allouche et al., 2006); Kappa values of 0.7 or more are typically indicative of models with a high degree prediction accuracy (Landis and Koch, 1977).

3.3. RESULTS & EXISTING CONDITIONS

3.3.1. OVERVIEW

The field work conducted in 2014 and 2015 along the Whale Tail Haul Road and in the vicinity of the Whale Tail Pit identified a total of 138 vascular and 61 non-vascular plants within 12 terrestrial ELC communities.

Natural Resources Canada (NRCan) has developed a series of maps of the terrestrial ecosystems of Canada; the ecozones map defines large ecological zones having characteristic landforms and climate. Nested within each ecozone are ecoregions, which are characterized by ecological features such as climate, soil, flora, fauna, and water (Campbell et al. 2012). The NRCan mapping (Marshall 1999) indicates that the Whale Tail study area lies within the Northern Arctic Ecoregion, near the border with the Southern Arctic Ecoregion. The more detailed Ecoregion that the site lies within is called the Wager Bay Ecoregion, the characteristics of which are presented in Section 2.3.1, Biophysical Environment.

Limited information is available in the general literature on the types and distribution of plant species in the Kivalliq Region. Academic studies available for this region began in the 1960s and include Hulten (1968), Cody et al. (1979), and McJannet (1993, 1995). Field work carried out for the Meadowbank project in 1999, 2002, and 2003 provided the most in-depth and up-to-date information available on the vascular and non-vascular plants in the vicinity of the Whale Tail Pit project. In addition, the Map Atlas (Campbell et al. 2012) provided a list of the plants most commonly found in each of the ELC communities in the Kivalliq Region.

3.3.2. PLANT SPECIES

The 2014 and 2015 vegetation surveys identified 138 vascular plants in the Project area, of which 107 were identified to species level and 31 were identified to genus level due to the condition and/or maturity of collected samples. Ten species were only observed incidentally. A total of 61 non-vascular plants, comprised of 20 bryophytes and 41 lichens, were identified from samples collected during the 2015 field surveys, with six (6) identified to genus level only. See Appendix 2 for the full list of vascular plants and Appendix 3 for the non-vascular plants list.

The most common and widespread vascular species found were Northern Labrador-tea (*Rhododendron tomentosum*) and Mountain Cranberry (*Vaccinium viti-idaea*), which were both observed in 99 of the 128 plots surveyed and present in all ELC types. Bog Bilberry (*Vaccinium uliginosum*), Arctic Dwarf Birch (*Betula nana*), Black Crowberry (*Empetrum nigrum*), Four-angled Mountain Heather (*Cassiope tetragona*), Bent-awned Alpine Sweetgrass (*Anthozanthum monticola* ssp. *alpinum*), and Arctic Willow (*Salix arctica*) were also very common and widespread, being present in at least 50% the plots surveyed and the majority of ELC types. In contrast, 27 species were observed only once, and 47 species were observed in less than four (4) of the 107 plots surveyed. Due to the large size of the LSA and RSA, the entire study areas were not surveyed; thus, the abundance and diversity of uncommon species may be under-estimated (i.e., these species may be widely distributed at a low abundance across the landscape). Section 3.3.4 discusses the rare plants and plant communities. The overall findings indicate that the majority of areas surveyed consist of low-diversity vascular plant communities dominated by fewer than 10 species.

3.3.3. ECOLOGICAL LAND CLASSIFICATION UNITS

A total of 15 Ecological Land Classification (ELC) units are present within the Whale Tail RSA and LSA, 12 of which are terrestrial communities. The ELC data compiled for the Kivalliq Region (see Section 3.2.2 for methods) were analyzed to determine what the quantity and proportion of each ELC community is for the Whale Tail RSA and LSA (see Table 3-3).

Table 3-3. Total Area and Percent Cover of ELC Units within the RSA & LSA

ELC CLASS	RSA		LSA	
	Area (ha)	Area (%)	Area (ha)	Area (%)
Water	125,876	25	6,016	21
Wet Graminoid	2,569	0.5	125	0.4
Graminoid Tundra	10,513	2	456	2
Graminoid/Shrub Tundra	7,496	1	397	1
Shrub Tundra	4,899	1	204	0.7
Shrub/Heath Tundra	8,327	2	493	2
Heath Tundra	56,449	11	3,434	12
Heath Upland	79,549	16	5,477	19
Heath Upland/Rock Complex	7,566	2	350	1
Lichen Tundra	20,861	4	1,370	5
Lichen/Rock Complex	115,945	23	7,714	27
Sand	2,274	0.5	169	0.6

Boulder/Gravel	46,098	9	2,011	7
Disturbance	762	0.2	0	0
Cloud/Shadow	12,512	2	0	0
Total	**501,696**	**100**	**28,216**	**100**

See Figure 3 for an illustration of where these ELC communities are located in relation to the LSA and RSA. The following descriptions of the ELC communities present in the Whale Tail LSA and RSA explain the typical biotic and abiotic features of each community, as well as dominant plant species.

Water (WA)

The Water class is the single most common ELC class in the study area. Specifically, any water body larger than 0.75 ha or watercourse wider than 75 m is distinguishable within the Landsat base data. Within the Kivalliq Region, Water represents approximately 24% of total cover (100,000 km^2), while within the RSA and LSA, it represents 25% (1,259 km^2) and 21% (60 km^2), respectively.

Wet Graminoid (WG)

The Wet Graminoid vegetation community, found in poorly drained areas where standing water is present, is often associated with lake and watercourse edges and typically occurs on a graminoid/peat substrate. Plots within the study area had moderate to deep soils with a wet moisture regime. The dominant species were Russet Sedge (*Carex saxatilis*), Water Sedge (*Carex aquatilis*), Capitate Sedge (*Carex capitata*), and Dwarf Willow (*Salix herbacea*). Within the Kivalliq Region, Wet Graminoid represents approximately 4.7% of total cover (19,360 km^2), whereas within the RSA and LSA, it represents 0.5% (25 km^2) and 0.4% (1.2 km^2), respectively.

Graminoid Tundra (GT)

Dryer than the Wet Graminoid land class, Graminoid Tundra represents graminoid-dominated communities in imperfect drainage, often on bottomlands. Found on graminoid/peat substrates, soil depth was observed to be moderate to deep and moisture regime was identified as mesic to wet. Tussock Cottongrass (*Eriophorum vaginatum*), with Cordlike Sedge (*Carex chordorrhiza*), Capitate Sedge, and Sphagnum Moss (*Sphagnum* sp.), form the basis of this community with moderately low percent associations of shrubs and lichens. Within the Kivalliq Region, Graminoid Tundra represents approximately 3.1% of total cover (12,800 km^2), while within the RSA and LSA, it represents 2.1% (105 km^2) and 1.6% (4.5 km^2) cover, respectively.

Graminoid/Shrub Tundra (GS)

The Graminoid/Shrub Tundra class represents a transition in cover from graminoids towards shrubs. Field observations indicated that this land class was often associated with bottomlands. Graminoid and moss/peat substrates were moderate to deep and a mesic moisture regime was typically observed. Dominant species were Short-anther Cottongrass (*Eriophorum brachyantherum*), Bog Blueberry (*Vaccinium uliginosum*), Northern Labrador Tea (*Vaccinium uliginosum*), and Dwarf Birch (*Betula nana*). Within the Kivalliq Region, this vegetation community type represents approximately 1.5% of total cover (6,000 km^2), while within the RSA and LSA, it represents 1.5% (75 km^2) and 1.4% (4 km^2) cover, respectively.

Shrub Tundra (ST)

Erect shrubs account for the main functional component of vegetation in the Shrub Tundra land class. Typically occurring on moss/peat substrates, field data indicate a typical soil depth of moderate to deep and moisture regime of mesic. Dominant species include Dwarf Birch, Bog Blueberry, and Northern Labrador Tea as well as significant cover of mosses, graminoids, and various other shrubs. Within the Kivalliq Region, this vegetation community type represents approximately 4.5% of total cover (18,560 km^2), while within the RSA and LSA, it represents 1% (49 km^2) and 0.7% (2 km^2) of cover, respectively.

Shrub/Heath Tundra (SH)

Occurring in areas with well to moderately well drained soils, Shrub/Heath Tundra is a transitional community containing elements of Shrub Tundra and Heath Tundra. Slope position was often midslope or on tablelands and the moderate to deep rooting depth into moss/peat soils typically had a mesic moisture regime. Dominant plant species included Dwarf Birch, Bog Blueberry, Arctic White Heather (*Cassiope tetragona*), and Northern Labrador Tea with a greater prominence of ericaceous shrubs than observed in Shrub Tundra plots. Within the Kivalliq Region, Shrub/Heath Tundra represents approximately 5.6% of total cover (23,100 km^2), compared to 1.7% (83 km^2) and 1.7% (5 km^2) of the RSA and LSA, respectively.

Heath Tundra (HT)

The prominent Heath Tundra land class occurs in areas with a variety of substrates including moss/peat, clay/silt, sand/gravel, and boulders. Slope position was variable (tablelands, bottomlands, and midslope), soil depths were shallow to moderate, and moisture regime was dry to mesic. Dominant species within this ubiquitous land class included a full suite of ericaceous shrubs such as Mountain Avens (*Dryas integrifolia*), Crowberry (*Empetrum nigrum*), Bearberry (*Arctous alpina*), Arctic White Heather, and Lingonberry (*Vaccinium vitis-idaea*). Within the Kivalliq Region, Heath Tundra represents approximately 9.5% of total cover (39,200 km^2), while in the RSA and LSA, it covers 11% (564 km^2) and 12% (34 km^2), respectively.

Heath Upland (HU)

Similar to Heath Tundra, but occurring in drier upland areas, Heath Upland was an important land class within the study area. This class may occur on a variety of substrate types, but is often associated with rocky soils (sand, gravel, boulders). Field studies indicated variable slope positioning (top of slope, midslope, and tableland) with shallow to moderate soil depth and a dry to mesic moisture regime. Dominant species were ericaceous shrubs such as Northern Labrador Tea, Bearberry, and Crowberry. Lapland Rosebay (*Rhododendron lapponicum*) was found to be exclusively associated with Heath Upland and Health Upland/Rock Complex areas. Lichens, such as *Flavocetraria* spp., *Cladonia* spp. and *Alectoria* spp., were also important components of this class. Within the Kivalliq Region, Heath Upland represents approximately 9.8% of total cover (40,600 km^2), compared to 16% (795 km^2) and 19% (55 km^2) of the RSA and LSA, respectively.

Heath Upland/Rock Complex (HR)

Very similar to Heath Upland, the Heath Upland/Rock Complex land class has strong associations with significant rock cover (boulders). Field observations indicated that slope position was typically midslope, while soil depths were shallow with a dry moisture regime. Dominant plant species were the lichen, *Flavocetraria* spp., Arctic White Heather, Northern Labrador Tea, and Alpine Holygrass (*Hierochloë alpina*). Within the Kivalliq Region, Heath Upland/Rock Complex represents approximately 8.4% of total cover (34,800 km^2), while in the RSA and LSA, it represents 1.5% (76 km^2) and 1.2% (4 km^2), respectively.

Lichen Tundra (LT)

While some cover from all vegetation functional groups may be present, lichens dominate the Lichen Tundra land class, which is found in dry, rocky, and upland areas. Slope position was typically midslope, soil depths were shallow to moderate, and moisture regime was dry to mesic. Dominant species were lichens; most notably *Cladonia* spp., *Flavocetraria* spp., *Stereocaulon* spp., *Thamnolia vermicularis,* and *Dactylina arctica*. Within the Kivalliq Region, Lichen Tundra represents approximately 2.3% of total cover (9,600 km^2), compared to 4% (209 km^2) and 5% (14 km^2) of the RSA and LSA, respectively.

Lichen/Rock Complex (LR)

The Lichen/Rock Complex land class is prominent within the study areas and is found on well-drained sites where rocky substrates are combined with significant cover from large rocky elements (boulders). Slope position was variable (on top of slope, tableland, or midslope), soil depths were very shallow, and moisture regime was typically dry. Dominant species in this class included a wide diversity of lichens. Rock-associated lichens such as *Ophioparma lapponica*, *Arctoparmelia centrifuga*, and *Umbillicaria mammulata* were prominent alongside *Flavocetraria* spp., *Cladonia* spp., and *Alectoria* spp. lichens. Within the Kivalliq Region, the Lichen/Rock Complex represents approximately 7.3% of total cover (30,200 km^2), while in the RSA and LSA it represents 23% (1,159 km^2) and 27% (77 km^2), respectively.

Sand (SA)

Rare on the landscape, the Sand land class occurs in midslope areas along ridges such as eskers, and in riverine and lacustrine areas. Soils were found to be shallow with a dry moisture regime. Apart from non-vegetated sandy substrate, the dominant functional vegetation cover for sand came from ericaceous shrubs and lichens. Within the Kivalliq Region, Sand represents approximately 0.3% of total cover (1,410 km^2), while in the RSA and LSA it represents 0.5% (23 km^2) and 0.6% (2 km^2), respectively. This land class was the least reliably identified by remote sensing data; three of the four plots established within areas mapped remotely as Sand were reassigned to a different land class based on field observations, so it may be even less common in the landscape than the RSA and LSA numbers suggest.

Boulder/Gravel (BG)

The Boulder/Gravel land class applies to areas dominated by boulders, stones, cobble, and gravel. Soil depth in these areas was very shallow with a dry moisture regime. Dominant plant species included the lichens *Umbillicaria mammulata*, *Arctoparmelia centrifuga*, and willows (*Salix* spp.). Within the Kivalliq Region, Boulder/Gravel represents approximately 6.8% of total cover (28,200 km^2), while in the RSA and LSA, it represents 9% (461 km^2) and 7% (20 km^2), respectively.

Disturbance (DI)

The Disturbance land class applies to anthropogenic disturbances, including residential, commercial, industrial, and resource extraction land uses. No plots were established within this land class. Within the Kivalliq Region, Disturbance represents approximately 0.1% of total cover (38 km^2), while within the RSA and LSA, it represents 0.2% (8 km^2) and 0% (0 km^2), respectively.

Shadow (SD)

The Shadow class applies to areas covered by clouds or their associated shadows within the source Landsat data. Within the Kivalliq Region, Shadow represents approximately 3.2% of total cover (13,150 km^2), while within the RSA and LSA, it represents 2% (125 km^2) and 0% (0 km^2), respectively.

3.3.3.1. ACCURACY ASSESSMENT

During the 2014 and 2015 field surveys, not every plot that was surveyed accurately portrayed the ELC community to which it was assigned via the Landsat imagery analysis. The accuracy of the ELC model was tested using Cohen's Kappa (Cohen 1960) as per the methods described in Section 3.2.2.1. The resulting table, called a confusion matrix, is based upon vegetation plot surveys in 2014 and 2015 and is included in this report as Appendix 4. Values for accuracy and chance agreement are not shown, but are calculated from the row and column probabilities shown.

Overall, the results suggest the ELC model has a moderate-substantial degree of prediction accuracy (kappa = 0.67) (Landis and Koch 1977), which is due to a wide range of prediction accuracy among the different the ELC types. For example, the Graminoid Tundra, Lichen Tundra, and Shrub/Heath Tundra ELC types had the lowest assignment prediction accuracies (<0.60), whereas Heath Upland, Shrub Tundra, and Wet Graminoid had the highest assignment accuracies (>0.80). The remaining ELC types had moderate prediction accuracies (60 to 80%).

3.3.4. RARE PLANTS & PLANT COMMUNITIES

3.3.4.1. RARE PLANTS

Federal Species-at-Risk are assessed and designated by the COSEWIC and listed by the *Species at Risk Act (SARA)*. The COSEWIC database identified one vascular and one non-vascular plant at risk in Nunavut, which are also listed by *SARA*:

Vascular Plant: Felt-leaf Willow (*Salix silicicola*)
Non-vascular Plant: Porsild's Bryum (*Haplodontium macrocarpum)*

Felt-leaf Willow has a rank of 'Special Concern' as of its last examination date in May 2000 (COSEWIC 2015). Felt-leaf Willow was not observed during the 2014 or 2015 field surveys and was not recorded in other studies conducted in the vicinity of the Whale Tail study area (Cody et al. 1989, Cumberland Resources 2005a, Larsen 1972). The Species at Risk Public Registry species profile for Felt-leaf Willow states that its preferred habitat is "large, open, active sand dunes" as well as "shallow shifting sands of gravel flats" and "broad sandy beaches and beach terraces" (GC, 2015); none of these habitats are present within the Whale Tail Pit study area. The known population is near Pelly Lake, on mainland Nunavut well to the northwest of the Whale Tail Pit site. Based on habitat requirements and the known distribution of Felt-leaf Willow in Nunavut, it is unlikely to be present in the Whale Tail study area.

Porsild's Bryum has a rank of 'Threatened' as of its last examination date in November 2003 (COSEWIC 2015). Porsild's Bryum was not one of the mosses collected and identified during the 2015 field surveys. The Species at Risk Public Registry species profile for Porsild's Bryum states that its preferred habitat is "cracks and cliffs of calcareous conglomerate rock, limestone, basalt, sandstone, and shale" (GC 2015). The known population of this moss in Nunavut is on Ellesmere Island. Based on habitat requirements and the known distribution of Porsild's Bryum in Nunavut, it is unlikely to be present in the Whale Tail study area.

Plant status at the provincial/territorial and local level is usually established by government agencies and/or interest groups. The most up-to-date publicly available reference that currently offers a systematic ranking of species rarity for Nunavut is the General Status list, which is updated every five years by the Canadian Endangered Species Conservation Council (CESCC). The most current list is called 'Wild Species 2010, the General Status of Species in Canada', which contains over 11,950 flora and fauna species in 20 taxonomic groups. The federal, provincial, and territorial governments are working together to produce the report; the CESCC seeks the assistance of experts to provide recommendations, and the conservation status of the species is approved by each government. Each species that has been assessed is ranked from 0.2 (extinct) to 8 (accidental), with an increasing number corresponding with a decrease in sensitivity.

On the Wild Species 2010 list, the only plant species in Nunavut listed as 'At Risk' is Porsild's Bryum, which is discussed above. Of the 107 confirmed vascular species observed in 2014 and 2015, 97 are considered 'Secure', six (6) are considered 'Sensitive', and three (3) are undetermined according to CESCC (2011)(Appendix 2). The Panarctic Flora Checklist also provides rankings for species occurring within the Central Canada and Hudson Bay Lowlands ecoregions (Elven et al. 2011). According to this list, within the central Canadian Arctic floristic region, 48 species are frequent, 30 species are scattered, and 18 species are rare, while in the Hudson Bay Lowlands, 55 species are frequent, 26 species are scattered, and 17 species are rare.

3.3.4.2. RARE PLANT COMMUNITIES

No resources have been developed to define the rare plant communities in Nunavut or the Kivalliq Region; however, the GN's Map Atlas (Campbell et al. 2012) provides a summary of the percentage of ELC classes in the Wager Bay Plateau, the ecoregion in which the study site occurs. This summary is useful in understanding ELC community composition in the landscape surrounding the study area.

Table 3-2 compares the percentages of ELC communities found in the LSA and RSA to those in the Wager Bay Plateau as a whole (GN 2012).

Table 3-2: ELC Community Coverage Comparison

ELC Unit	% of RSA	% of LSA	% of ELC Classes in Wager Bay Plateau
Water	25	21	24
Wet Graminoid	1	0	2
Graminoid Tundra	2	2	3
Graminoid/Shrub Tundra	1	1	1
Shrub Tundra	1	1	<2*
Shrub/Heath Tundra	2	2	No data
Heath Tundra	11	12	4
Heath Upland	16	19	9
Heath Upland/Rock Complex	2	1	14
Lichen Tundra	4	5	2
Lichen/Rock Complex	23	27	15
Sand	0	1	<2*
Boulder/Gravel	9	7	13
Disturbance	0	0	<2*
Cloud/Shadow	2	0	4
Rock	0	0	4
Graminoid/Heath Tundra	0	0	4
Dryas Tundra	0	0	1

* 2% of region was classified as 'Shrub/No Data/Sand/Shrub Tundra/Ice/Disturbance/Shrub Thicket'

Communities that are uncommon (<2%) in the RSA, LSA, and Wager Bay plateau are Wet Graminoid, Graminoid/Shrub Tundra, Shrub Tundra, and Sand.

3.3.5. PHENOLOGY STUDIES

Phenology is the study of timing of a periodic biological phenomenon in relation to climatic conditions (AHD 2015). For the Meadowbank Mine, baseline phenology studies were carried out to record data on vascular plant development during the 2003, 2004, and 2005 growing seasons. The preliminary results of the phenology studies were presented in table format in the 2005 Meadowbank Baseline Terrestrial Ecosystem Report, and are included here as Appendix 5. The Meadowbank phenology results were used to guide the timing of the 2014 and 2015 Whale Tail Pit vegetation field studies.

The Meadowbank baseline vegetation work was conducted primarily to aid in developing ELC maps for the mine site and road LSA and RSA (Cumberland Resources 2005a); as the GN has subsequently developed ELC mapping for Kivalliq Region (see Section 3.2.2). Phenology studies were not replicated in the 2014 and 2015 field season.

3.3.6. ELC SUMMARY & DISTRIBUTION OF ELC UNITS

Broad-scale patterns are visible for the ELC types present within the study areas. Most prominently, dozens of lakes of varying sizes are present throughout the RSA and LSA. The proposed road alignment traverses along the east side of Tasirjuaraajuk Lake (Pipedream Lake) for its first ~20 km northwest of the Meadowbank Mine. After approximately km 32 of the alignment, the lakes generally become smaller. Overall, these lakes contribute to one quarter (25%) of the RSA and more than one fifth (21%) of the LSA.

From approximately km 19 of the proposed alignment onwards, a broad swath of rocky lands crosses the study area roughly perpendicular to the road direction. These rock-associated land class types include Lichen/Rock Complex and Boulder/Gravel, which are associated with dry moisture regimes and a predominance of lichen species. Throughout the study area, rockier lands were often present on rises in the topography while the intervening valleys and tablelands were dominated by heath-affiliated land classes. Heath Upland and Heath Tundra, the third and fourth most prominent land cover types, form broad stretches along the study areas, particularly along the first (southerly) 17 km and the last (northerly) 8 km of the proposed road alignment. Heath lands have a more mesic moisture regime than the rocky lands and are dominated by the *Ericaceae* (heath family) of low shrubs such as Bearberry, Arctic White Heather, Dwarf Labrador Tea, and Crowberry.

The top five most prominent ELC types (i.e., Water, Lichen/Rock Complex, Heath Upland, Heath Tundra, and Boulder/Gravel) comprise 84% of the RSA and 87% of the LSA. Conversely the remaining 10 ELC units account for only 16% of the RSA and 13% of the LSA. Furthermore, these less common land classes do not occur in broad geographic areas, but rather are associated with specialized conditions. Lichen Tundra, accounting for 5% of the RSA and 4% of the LSA, occurs in transitional terrain between lands dominated by rock and lands dominated by heath elements. As implied by its title, Lichen Tundra forms diverse lichen communities often with an abundance of *Flavocetraria* spp., *Cladonia* spp., and *Bryoria* spp., while Graminoid Tundra (2% of both RSA and LSA) forms in areas with greater moisture (imperfect drainage), such as along lakeshores, and is dominated by cottongrasses (*Eriophorum* sp) and sedges

(*Carex* spp.). In areas of even poorer drainage, Graminoid Tundra transitions to Wet Graminoid (0.5% of RSA and 0.4% of LSA). Wet Graminoid is dominated by sedges, which are often in standing water in riverine and lacustrine areas.

Three transitional land classes (i.e., Shrub/Heath Tundra, Graminoid/Shrub Tundra, and Heath Upland/Rock Complex) were found scattered throughout the study areas. These land classes represent intermediate conditions between more commonly occurring land types (e.g., Graminoid/Shrub Tundra has intermediate drainage and vegetation cover conditions between Graminoid Tundra and Shrub Tundra; described in detail in Section 3.4.1). These three classes combined form less than 5% of the study areas and are found in conjunction with their associated land types. Shrub Tundra is quite rare at 1% of both RSA and LSA; however, small notable concentrations are present at approximately 7.7 km, 39.1 km, and 58.8 km (northerly) along the proposed road alignment. This land class is dominated by the low-lying deciduous Dwarf Birch.

Sand is described in detail in Section 3.3.3 and occurs on <1% of the study areas. The Sand class is associated with lacustrine areas as well as esker slopes. Furthermore, field surveys indicated that Sand was unreliably identified by the Landsat source imagery. Cloud/Shadow is present randomly in areas where cloud cover obscured the Landsat imagery sourced to create this mapping (i.e., 2% of RSA and 0% of LSA). Disturbance, accounting for just 0.2% of the RSA (0% of the LSA), represents anthropogenic disturbances to the landscape and, in this context, applies only to the Meadowbank Mine site and access road.

4. WILDLIFE

4.1. INTRODUCTION

4.1.1. BACKGROUND

The focus of this section is to provide the results of the investigation of wildlife abundance and distribution within the Whale Tail Pit and Haul Road study areas. The wildlife studied were from one of the following six VECs:

- Ungulates;
- Predatory Mammals;
- Small Mammals;
- Raptors;
- Waterfowl; and
- Upland Breeding Birds.

Wildlife have high ecological and cultural value in the Kivalliq Region of Nunavut. Compared to more southern locales, few terrestrial vertebrates are found in the vicinity of the Whale Tail LSA and RSA. Approximately 15 mammalian species, 62 avian species, and no amphibians or reptiles are expected to occur in the area (Cumberland Resources 2005a). The wildlife data presented in this report include surveys from 2014 and 2015, and data from previous years (i.e., Hunter Harvest Survey and Caribou collar analysis). This section describes the methods and findings of the 2014 and 2015 field surveys.

4.1.2. GOALS & OBJECTIVES

Wildlife VECs were investigated in the LSA and RSA in order to fulfill a number of goals and objectives for this project:

1. **Goal**: Establish baseline presence/absence of species in the LSA and RSA.
    a. *Objectives*: Review available background information and conduct field studies to develop a baseline record of wildlife VEC abundance and distribution.

2. **Goal**: Describe the relative trends in seasonal/annual abundance, and distribution of the VEC species' populations.
    a. *Objectives*: Review hunter harvest survey and traditional knowledge data to determine distribution and abundance of harvested species over time. For Caribou, determine the predicted presence in, and movement across, the RSA according to collaring data. For all other species, review and summarize available background information.

3. **Goal**: Determine and locate significant habitats for VECs within the study area.
    a. *Objectives*: Establish and map wildlife suitability within the RSA based on literature review of preferred habitats of the VECs. Conduct field studies in targeted high-suitability habitats to examine use of these features.

4. **Goal**: Describe wildlife management areas, sanctuaries, refuges, or similar areas for VECs within the study area.

a. Objectives: Review background resources to summarize known information on wildlife management areas, sanctuaries, refuges or similar areas in Nunavut.

5. **Goal**: Define habitats of any rare or regionally unique species or species with federal, territorial, regional, or local designated status (e.g., vulnerable, threatened, endangered, extirpated, of special concern) within the study area.
   a. *Objectives*: Investigate rare species occurrences and the probability of habitat for these species within the Whale Tail study area.

As with the goals and objectives for vegetation (Section 3.1.2), these goals and objectives were developed through review of the NIRB project guidelines for the Meadowbank Mine (NIRB, 2004). Sections 4.13.2 and 4.13.3 of the NIRB project guidelines refer to wildlife and birds, respectively.

4.2. METHODS

4.2.1. LITERATURE REVIEW

A variety of scientific data sources was used to characterize baseline conditions in in the Whale Tail study area, including:

- **Studies Related to the Meadowbank Gold Project** — the Meadowbank Gold Project provided extensive regional data. Terrestrial wildlife baseline studies were completed at Meadowbank from 1999 to 2005 (Cumberland Resources 2005a) and long-term monitoring studies have been conducted from 2006 to 2015 (refer to annual reports for 2006 to 2014).

- **Other Regional Studies** — regional studies included work conducted in the late 1970s on harvests and critical wildlife areas (ISL 1978*a, b*), and more recently from the Nunavut Wildlife Harvest Study (NWMB 2005). Other GN regional data included regional ELC data (provided under a data-sharing agreement with Agnico Eagle), Caribou collaring data, and the Caribou atlas (Campbell et al. 2012). Any literature relevant to regional wildlife conditions is referenced in VEC-specific sections in this report.

- **Territorial and Federal Sources** — information from territorial and federal government agencies was used to provide a regulatory context whenever necessary. In particular, databases from the COSEWIC (2015) and the *SARA* (2015) were accessed regarding the status of federally-listed species in the RSA. Territorial status ranks for wildlife species are referenced to provide a more regional frame of reference on priority species (CESCC 2011).

- **Books and journal articles** – a full list of literature used in the wildlife data compilation and analysis is presented in Section 5.

4.2.2. FIELD STUDIES

In 2014 and 2015, the following field studies were undertaken:

- PRISM plot surveys in 20 locations within the vicinity of the Whale Tail Pit study area to assess breeding status for terrestrial birds adjacent to the proposed pit, and 20 PRISM plots in a remote area used as a control (Note; control plots are the same as those used for the long-term Meadowbank monitoring program);

- Transect surveys in six (6) locations along the proposed Whale Tail haul road to assess breeding status for terrestrial birds in the vicinity of the proposed road;
- Shoreline surveys along all waterbodies within 100 m of all study area components (Whale Tail Pit and Haul Road, and borrow areas) to assess breeding status for shorebirds, waterfowl, and other waterbirds;
- Ground reconnaissance surveys along eskers in areas adjacent to Project components to evaluate use of these areas by Predatory Mammals, nesting Raptors, and other species;
- Height-of-land surveys for Ungulates, Predatory Mammals, and other species in the vicinity of vegetation monitoring plots; and
- Raptor nest surveys to determine locations of active and inactive Raptor nests in the RSA (completed by University of Alberta researchers).

Incidental observations of wildlife seen during all wildlife and vegetation field work in 2014 and 2015 were also recorded and mapped, and a wildlife log sheet was posted at the Whale Tail Pit exploration camp in 2014 and 2015 for Agnico Eagleworkers to record wildlife observations.

In addition to these field studies, information on wildlife presence and abundance in the Whale Tail study area was generated through review and analysis of the following resources:

- Meadowbank Hunter Harvest Study; and
- GN DoE-led Caribou satellite-collaring program data.

Extensive wildlife studies were carried out for the 2005 Meadowbank Baseline Terrestrial Ecosystem Report and have continued on an annual basis as a requirement of the Terrestrial Ecosystem Management Plan (TEMP). Where appropriate, this information was used to supplement the data collected during the 2014 and 2015 field studies. Methods used in conducting the 2014 and 2015 studies are presented below (see Section 4.3 for results).

Field studies in 2014 and 2015 were undertaken with assistance from local field technicians. These Inuit staff members, who live in Baker Lake, were involved with surveys including PRISM plots, bird transects, shoreline surveys, ground reconnaissance and height-of-land surveys. Baker Lake residents were consulted during the development and implementation of the 2014 and 2015 field programs.

4.2.2.1. UPLAND BREEDING BIRD PRISM PLOTS

Surveys for breeding birds were conducted in accordance with the Canadian Wildlife Service's (CWS) PRISM (Program for Regional and International Shorebird Monitoring) methodology (EC, 2012), which is a standardized methodology recognized as an effective technique for assessing breeding status for most terrestrial bird species (EC, 2012). The 400 x 400 m (16 ha) PRISM plots for the proposed Whale Tail Pit study area were selected between 100 m and 2 km from any proposed mine features. The ELC mapping was summarized for each of the 20 plots and compared to the control plots to ensure that there was equal representation of habitats. Within the Whale Tail features buffer (100 m to 2 km) and ELC habitats, plot locations were adjusted to account for field work conditions and access limitations.

The PRISM protocol involved thorough surveys of the plots. Each plot was subdivided into 17 north-south transects spaced 25 m apart. Adjacent transects were then surveyed in tandem with one surveyor walking along each parallel line. Surveyor orientation within plots was accomplished with the use of handheld GPS devices.

The PRISM methodology allowed for development of a high resolution survey (e.g., absolute abundance) of breeding birds within the plot boundaries. Using a grid map system, birds were recorded along with associated information such as position, species, sex, territoriality, nest or probable nest, distraction display, flyby etc. Significant geographic features within plots were also noted such as watercourses, snow drifts, cliffs, and boulder fields. Informed by the grid map data, breeding bird summaries were tallied for each plot.

Twenty PRISM plots were established and surveyed within the vicinity of the Whale Tail pit (<7 km) over four days in the second half of June 2015 (Figure 8; Table 4-1; Appendix 7).

Table 4-1: Whale Tail PRISM Plot Survey Dates

Date	Temp. (°C)	Precipitation	Wind (km/h)
19/06/2015	4 – 8	None	1 – 19
20/06/2015	4 – 5	Drizzle	6 – 11
26/06/2015	7 – 9	Brief drizzle/none	1 – 19
29/06/2015	9 – 12	None	6 – 19

Additionally, PRISM surveys were undertaken for 20 long-term control plots approximately 15 km west of the Meadowbank Mine (Figure 8; Table 4-2; Appendix 8), which are the same control plots used for the ongoing Meadowbank terrestrial monitoring studies.

Table 4-2: Control PRISM Plot Survey Dates

Date	Temp. (°C)	Precipitation	Wind (km/h)
21/06/2015	5 – 8	Drizzle	12 – 28
23/06/2015	5 – 8	None	1 – 11
28/06/2015	8 – 10	None	1 – 28

4.2.2.2. UPLAND BREEDING BIRD TRANSECTS

Transect locations were selected using orthographic imagery along the proposed Whale Tail Haul Road alignment prior to field investigations. Six, 3,000 m transects were designated for field investigation. Each transect was oriented directly along a west-east axis (south-north in the case of Transect 3) with an approximately perpendicular intersection to the proposed road alignment. Transect locations were spaced somewhat evenly along the length of the alignment, although major obstacles such as large lakes necessitated alterations to this spacing to conduct field work.

Each transect was surveyed twice in late June, 2015. Surveys involved a minimum of two field staff, including wildlife technicians from Baker Lake, walking each transect from west to east (south to north for Transect 3) and recording all wildlife observations within 100 m of the transect line (i.e., 200 x 3,000 m; 60 ha each). Additionally, the 3,000 m length of each transect was divided into 30 intervals (0 to 100 m, 100 to 200 m, etc.) and bird sightings were associated with these intervals. Orientation within intervals and along transects was achieved with handheld GPS units.

Data collected during surveys included species, number of individuals, sex, age, direction of travel, distance from observer, and any additional behaviours or comments noted.

Table 4-3: Whale Tail Haul Road Breeding Bird Transect Survey Dates

Date	Temp. (°C)	Precipitation	Wind (km/hr)
25/06/2015	4 – 7	None or drizzle	15 – 30
27/06/2015	7 – 10	None	15 – 20

4.2.2.3. SHORELINE SURVEYS

Prior to field investigations in 2015, wetland, lake, and watercourse edges within 100 m of the proposed Whale Tail Pit and Haul Road were identified through GIS analysis. Each shoreline unit was then assigned a unique label. A total of 62.8 km of shoreline was identified and surveyed (Figure 8; Appendix 10).

Field surveys were undertaken at the end of June and into the first week of July (Table 4-4). Shoreline surveys involved two observers walking parallel transects at 5 and 15 m from the water's edge and recording all wildlife observations. Data collected included coordinates, species, number of individuals, age, sex, habitat type, distance from observer, direction of travel, and any additional behaviours or comments noted.

Table 4-4: Shoreline Survey Dates

Date	Temp. (°C)	Precipitation	Wind (km/hr)
01/07/2015	13 - 16	None	<5
01/07/2015	9 - 13	None	<5
02/07/2015	12 - 14	None	15 – 20
03/07/2015	12 - 14	Clear, sunny	<10
04/07/2015	12 - 14	Clear, sunny	10
06/07/2015	8 - 12	None	<10
07/07/2015	3 - 9	None	15 – 20
08/07/2015	8	None	20 – 30

4.2.2.4. GROUND RECONNAISSANCE

Large portions of the proposed Whale Tail Pit and Haul Road project areas were surveyed incidentally in conjunction with PRISM plots, transects, and shoreline surveys (Sections 5.2.2.1 – 5.2.2.3). To fill in gaps and enhance understanding of high priority areas, ground reconnaissance surveys were employed (Table 4-5).

Ground reconnaissance involved meandering walking transects within the study area. The purpose of these surveys was to develop a comprehensive picture of potentially significant wildlife habitat within the study area. Once located, high suitability areas (such as the esker) were surveyed thoroughly to examine for the presence of significant features such as Ungulate movement corridors and refuge areas, and Predatory Mammal dens. All wildlife observations were recorded with associated data including coordinates, species, number of individuals, age, sex, habitat type, behaviour, distance from observer, direction of travel, and any other comments noted. Ground reconnaissance surveys were undertaken in the second half of June and first week of July 2015 (Table 4-5).

Table 4-5: Ground Reconnaissance Survey Dates

Date	Temp. (°C)	Precipitation	Wind (km/hr)
19/06/2015	4	None	Oct-15
20/06/2015	5 – 6	Drizzle	<5
01/07/2015	10 – 14	None	5 – 10
02/07/2015	9	None	15
03/07/2015	12	None	10 – 15
04/07/2015	12	None	10
06/07/2015	10	None	<10
07/07/2015	8	Drizzle	15
08/07/2015	8	None	20 – 30

4.2.2.5. HEIGHT-OF-LAND SURVEYS

In conjunction with the vegetation surveys, height-of-land surveys were undertaken in early September 2014 and in first half of July, 2015. Survey methodology involved accessing topographic highpoints such as rock ridges, eskers, and hills, and with the use of binoculars, scanning for wildlife. As with ground reconnaissance surveys (Section 4.2.2.4), height-of-land surveys were employed to examine for the presence of potentially significant wildlife habitat and movement corridors. Observation data included coordinates, species, number of individuals, age, sex, habitat type, behaviour, distance from observer, direction of travel, and any other comments noted.

4.2.2.6. RAPTOR NEST SURVEYS

In May 2015, researchers from the lab of Alastair Franke at the University of Alberta carried out Raptor nest surveys within the Whale Tail Pit and Haul Road RSA. Potential nesting locations were predetermined based on known topographic and habitat information, and surveyed by helicopter. The GPS locations of all identified nests (occupied or unoccupied) were recorded and data were recorded on the species occupying the nest. For unoccupied nest sites, nesting potential and/or obvious historical use (e.g., old stick nest or used nesting ledge) were recorded.

Incidental observations of Raptors, including location and species where identifiable, were recorded during all other vegetation and wildlife field surveys.

4.2.2.7. INCIDENTAL OBSERVATIONS

During field surveys, including vegetation surveys, in 2014 and 2015, data were collected for incidental wildlife observations, including wildlife sign such as scat, nests, remains, and trails. Observations were recorded in field staff notebooks along with associated coordinates for significant observations.

In addition to the field observations collected during the 2014 and 2015 field surveys, a helicopter reconnaissance was conducted on 18 October 2014 to evaluate large mammal occurrences along the proposed Whale Tail Haul Road alignment. Conditions were cool (-5^{0}C), windy, and overcast, with light snow flurries toward the end of the survey. All significant habitat features, potential den sites, and wildlife observations were recorded along with their UTM coordinates.

4.2.2.8. HUNTER HARVEST SURVEY

As a condition of the Nunavut Impact Review Board (NIRB) certificate for the Meadowbank Gold Project, in March 2007 a hunter harvest study (HHS) was initiated by Agnico Eaglein association with the Baker Lake HTO to monitor and document the spatial distribution, seasonal patterns, and harvest rates of hunter kills and angler catches before and after construction of the Meadowbank All-Weather Access Road (AWAR). The study is similar to the Nunavut Wildlife Harvest Study (NWMB 2005) and the Inuvialuit Harvest Study conducted between 1988 and 1997 (The Joint Secretariat 2003); however, it is focused on the Hamlet of Baker Lake and on four Meadowbank Mine VEC species (Muskox, Caribou, Wolverine, and fish) relevant to Inuit and northern culture.

The primary objectives of the Meadowbank HHS are to:

1. Gather information on Caribou, Muskox, and Wolverine harvest (i.e., animals retrieved) rates and Inuit-use patterns in the Baker Lake area;
2. Support creel surveys by gathering information on Arctic Char (*Salvelinus alpinus*), Lake Trout (*Salvelinus namaycush*), Lake Whitefish (*Coregonus clupeaformis*) and Arctic Grayling (*Thymallus arcticus*) catch rates and Inuit-use patterns in the Baker Lake area;
3. Understand regional distribution of hunting and fishing activity;
4. Investigate seasonal timing of hunting and fishing activity;
5. Determine whether increased harvest and catch rates are associated with the Baker Lake to Meadowbank Mine AWAR;
6. Assess overall impacts of project-related facilities on Caribou, Muskox, Wolverine, and fish populations; and
7. Help provide regulatory agencies with fish and wildlife harvest data in the Baker Lake area to verify that the key species are adequately protected.

The HHS is promoted within the community, and participation is encouraged through the use of raffles and prizes. Hunter harvest data are collected using a harvest calendar, which is handed out at the beginning of the year. Participating households use the harvest calendar to record harvest details for each hunting date, including number and type of animals, sex and age, and harvest location based on a reference map. Hunter interviews are typically conducted four times each year by the hunter administrator to ensure completeness of harvest data, and maintain a personal and respectful relationship with the hunters. The harvest study administrator also conducts radio addresses, and posts promotional material around the Hamlet of Baker Lake during the quarterly visits.

4.2.2.9. WILDLIFE LOG SHEET

A log sheet for recording wildlife observations was posted at the Whale Tail Pit exploration camp in 2014 and 2015. Workers who saw wildlife while on site were encouraged to log their observations. The log sheet included the following information:

- Date;
- Time (night/day);
- Species;
- Number of individuals;
- Place;
- Behavior;
- Observer name; and
  Action taken.

4.2.2.10. CARIBOU COLLARING DATA

Agnico Eagle has a long-term Memorandum of Understanding for the Ungulate monitoring and management studies led by the GN DoE and includes the GN DoE-led Caribou monitoring and satellite-collaring program. Collaring data to support the evaluation of impact predictions are collected on an annual basis within the Meadowbank RSA. The joint satellite-collaring program provides information on the distribution of Caribou occurring within the Meadowbank RSA and contributes data to other ongoing satellite-collaring programs for the Beverly, Qamanirjuaq, and other herds to assist the GN in Caribou management. The satellite-collaring program has become increasingly important as a monitoring and management tool. The satellite-collaring program and GN DoE regional data are serving to provide a regional perspective on Caribou activity near Meadowbank operations and natural changes in Caribou populations in the region.

Five deployments, consisting of a total of 68 collars, have been completed in the Baker Lake area since Agnico Eagle became involved in the collaring program, with the following number of collars successfully deployed: May 2008 (9 collars); November 2009 (21); April 2011 (13); April 2013 (15); and April 2015 (10). As of September 2015, 15 collars were still active, seven (7) from the 2013 deployment and eight (8) from 2015. Most collars were deployed west of Baker Lake, south of Aberdeen and Schultz lakes, and north of Baker Lake within the Meadowbank RSA. Collars deployed for this program in the Baker Lake area have been assigned by the GN to one of the five major sub-populations or herds that reside in the area: Ahiak, Beverly, Lorillard, Qamanirjuaq, and Wager Bay. Collars deployed up to the end of 2012 were included in a population distribution analysis performed for the GN (Nagy et al. 2011). Collar locations from 2010 to 2015 were used to generate figures for this report, which are the basis of the discussion on seasonal distribution and movement patterns of Caribou in the study area.

4.2.2.11. SPECIES DATA SUMMARY – TERRESTRIAL MAMMALS AND BIRDS

Wildlife data were recorded in the field, as described in Section 4.2.2, and location data were collected for GIS analysis. Overall species lists for the study areas encompass all direct and sign observations from the 2014 and 2015 field programs in conjunction with incidental observations from Agnico Eagle staff (Section 4.3.4.11). Using COSEWIC and Wild Species 2010 data, and the Meadowbank Baseline Terrestrial Ecosystem Report (Cumberland Resources 2005a), wildlife sensitivity and Species-at-Risk statuses have been assigned where applicable. A compiled wildlife list from the 2014 and 2015 field programs is displayed in Appendix 12.

4.2.3. HABITAT SUITABILITY

Wildlife habitat suitability rankings identify the importance of habitat types to wildlife. Habitat use is based primarily on the availability of food, which is considered the most limiting factor for wildlife in the study area. Other variables that have been incorporated into habitat suitability evaluation include preferred nesting/denning habitat, staging areas, and known movement corridors. To rank habitat suitability, ELC units were first developed to quantify the availability of various habitat types within the RSA and LSA (see Section 3.2.2 and Figure 3), followed by the ranking of these habitat types for different terrestrial wildlife.

Table 4-6: Wildlife Habitat Suitability Rating Scheme

Forage Habitat Quality Relative to 'Best in Territory' (%)[a]	4-class – Intermediate Knowledge of Habitat Use	
	Rating	Code
100–76	Moderately High to High	H
26–75	Moderate	M
1–25	Low	L
0	Nil	Nil

Source: RIC, 1999

(a) 'Best in Territory' is the territorial benchmark habitat for a species against which all other habitats for that species are rated.

The ELC units were ranked according to their seasonal suitability for each wildlife species or group (i.e., High, Moderate, Low, and Nil) (see Table 4-6 for definitions). This approach, adapted from British Columbia standards (RIC 1999), is also used by the GN DoE to assess habitat value or suitability for a species over a large regional area without ground-truthing the entire area. The approach is scientifically defensible, efficient, and compatible with regional programs, and is consistent with previous work done for Meadowbank. Habitat suitability rankings for each VEC were developed based largely on relevant literature on VEC habitat use and requirements, field data, professional experience and judgment, and discussions with wildlife biologists with experience in the Arctic.

The rating scheme presented in Table 4-6 was applied to the development of habitat suitability rankings for all wildlife VECs. The development of habitat suitability ratings for Caribou is discussed in greater detail in Section 4.2.3.1 due to the high cultural and ecological importance of this species.

4.2.3.1. CARIBOU HABITAT SUITABILITY

4.2.3.1.1 *OVERVIEW*

Caribou use of habitat is dynamic with suitable habitat not always used even if available, which makes delineating habitats in a specific area difficult. The reasons for suitable habitat remaining unused could be cyclical habitat use by a herd, abundance of other higher quality habitat, or random patterns of suitable quality habitat. Lack of use of suitable habitat during one year does not necessarily mean the habitat will remain unused in subsequent years.

Given the uncertainty and unpredictability of habitat use by Caribou, the literature was reviewed to determine habitat and food preferred by Caribou. This information was used to rate the suitability of different ELC habitat units available to Barren-ground Caribou in the RSA, and to identify and quantify the habitat that might be important to Caribou during important seasons of their annual life cycle.

Although the annual life cycle of Barren-ground Caribou has been described according to six seasons (see Table 4-7), for the purposes of this baseline habitat suitability assessment, habitat use during spring and summer (i.e., growing season), and fall and winter (i.e., winter season) was described since most of habitat selection modelling approximately follows these seasons and habitats are seasonally important for Caribou (i.e., important winter habitat is not necessarily important growing season habitat). A detailed discussion of habitat selection during these primary seasons is provided below.

4.2.3.1.2 *FALL AND WINTER (WINTER SEASON)*

September to December is the period of the year when Barren-ground Caribou start their migration south and shift to a predominantly lichen-based diet (Scotter 1965, Boertje 1984, Ferguson et al. 2001). Winter is the time of the year when populations of Caribou are most limited by habitat and may be subject to density-dependent forage availability (Ferguson et al. 2001, Tyler et al. 2008). The two factors that most affect habitat selection by Caribou during winter are snow condition and lichen availability. Snow depth and hardness are the limiting climatic conditions during winter making food acquisition more energetically costly because Caribou spend an increasing amount of their energy cratering for food and moving through deep snow (Adamczewski et al. 1988, Tucker et al. 1990, Turney and Heard 1991).

Lichen, which is the most important source of winter food for Caribou because it is relatively high in energy and highly digestible compared to other sources of food (Storeheier et al. 2002), comprises a large portion (greater than half) of a Caribou's winter food intake (Thompson and McCourt 1981, Boertje 1984, Storeheier et al. 2002). A close association has been documented between winter fat reserves in females and pregnancy rates (Thomas 1982). The most heavily used winter vegetation communities in order of preference are lichen steppes, lichen heath tundra, dwarf shrub-lichen tundra, and dwarf shrub-sedge tundra (Thompson et al. 1978). These communities are roughly equivalent, respectively, to the following ELC communities used in this report: Heath Upland, Heath Tundra, Shrub Tundra, and Graminoid Tundra

4.2.3.1.3 *SPRING AND SUMMER (GROWING SEASON)*

During the spring, energy requirements of pregnant female Caribou increase because of late-gestation and the start of lactation (Adamczewski et al. 1993). Female Barren-ground Caribou are more sensitive to disturbances during this period (Reimers and Colman 2006). Barren-ground Caribou migrate north from winter range in April and May and congregate in relatively discrete areas to calve. Calving is a critical time of the year for Caribou because calving cows require high quality food for production of milk. The timing of calving has evolved to coincide with the start of the growing season because newer growth provides the higher quality nourishment that calving and post-calving Caribou need to recover from the winter and feed their new calves (Post and Forchhammer 2008, Sharma et al. 2009).

Caribou select for habitats that have an earlier start of the growing season (Sharma et al. 2009). Habitats that contain open shrub, grasslands with sparse shrubs, and lichen veneer are preferred, while riparian shrub areas and treed habitat are avoided (Johnson et al. 2005, Sharma et al. 2009). Food is abundant during the summer season, so Caribou can feed on high quality vegetation and restore fat reserves required to survive the coming winter (Ouellet et al. 1997). Females in particular need to gain enough weight (fat) during the summer to be able to reproduce (Thomas 1982). In summer through to late fall Caribou feed on shrubs, grasses, lichens, and mushrooms (Boertje 1984).

4.2.3.1.4 *CARIBOU HABITAT SUITABILITY APPROACH*

The RSA was divided into ELC units that are recognizably different in vegetation content and geographic features (see Section 3.3.3 and Figure 3). As discussed above, Caribou generally feed on lichen during winter, and fresh shrubs (leaves and stems) and graminoids during the growing season (Adamczewski et al. 1988); therefore, habitat that contains these features will be of higher value to Caribou in the appropriate season.

The relative importance of each ELC unit for Caribou in the growing and winter seasons was rated as High, Moderate, or Low based on the ELC unit's maximum importance during the season in question (see Table 4-7). For example, Lichen Tundra is particularly important in late winter, but the value of this habitat unit was rated as High for the entire winter season, and Graminoid Tundra is important early in the growing season when vegetation quality is greatest, but is rated as High for the entire growing season.

The habitat suitability rankings for this Project for each ELC unit are presented in Table 4-7. Rankings are provided for the growing season (defined as June 1 to September 30), and for the winter season (defined as October 1 to May 31). These rankings were then used to develop habitat suitability maps and to estimate the areas of study areas important to Caribou in the winter and growing seasons.

Table 4-7. Summary of Relative Value of Ecological Land Classification Units to Caribou during the Growing and Winter Periods in the Whale Tail RSA

ELC Unit	Growing	Winter	Reasoning
Water	Nil	L	Water is not important Caribou habitat. Shorelines may provide some insect relief, but other habitats associated with elevation provide better relief.
Sand	M	L	Caribou select for Sand and Gravel to avoid insect harassment in the growing season (BQCMB 1999a, internet site). The value of Sand and Gravel in winter is low because the habitat contains limited food and there are no insects in winter.
Boulder/Gravel	M	L	Caribou select for Sand and Gravel to avoid insect harassment in the growing season (BQCMB 1999a, internet site). The value of Sand and Gravel in winter is low because the habitat contains limited food and there are no insects in winter.
Lichen/Rock Complex	L	L	Lichen/Rock Complex provides little usable habitat for Caribou as there is little available food.
Wet Graminoid	H	M	Wet Graminoid was categorized as high in the growing season because of high quality new growth that is high in energy content, easily digestible, and abundant. Caribou select graminoids in spring and summer; however, Caribou avoid areas containing sedges and peat bogs in fall. Nevertheless, the overall rating for the growing season is high.
Graminoid Tundra	H	M	Graminoid Tundra was categorized as high in summer because of high quality new growth that is high in energy content, easily digestible, and abundant. In winter, the quality of vegetation decreases, therefore, so does habitat value.
Graminoid/ Shrub Tundra	H	M	Graminoid/Shrub Tundra has a similar value to the Graminoid Tundra and Wet Graminoid ELC units because it contains high quality seasonal vegetation, as well as more open shrubs (compared to straight shrub habitat). It may be of higher value than Graminoid Tundra because of the diversity of food types that are selected by Caribou – shrub, lichen and graminoid.
Shrub Tundra	M	L	Shrubs (willows) form a large part of Caribou diet in the growing season and there is evidence that Caribou select riparian areas during post-calving season, but Caribou do not select this habitat type in winter.
Shrub/Heath Tundra	H	M	Shrub/Heath Tundra is considered important during the growing season because it contains willows as well as other sources of food. The value is lower in winter because Caribou focus more on areas where lichen is present.
Heath Tundra	M	H	This habitat type has all the vegetation used by Caribou in the growing season. Due to the presence of lichen the value is higher in the winter.
Heath Upland	M	H	This habitat type has all the vegetation used by Caribou in the growing season. Due to the presence of lichen the value is higher in the winter. Ridge tops my also provide areas of reduced snow depth.
Heath Upland/ Rock Complex	L	M	Relatively low value in the growing season because of the rock content, but is higher in winter because of lichen content.
Lichen Tundra	M	H	Lichen is the most important food source for Caribou in winter. In the growing season, when Caribou select for other food, lichen is still part of their diet and they still spend time in these areas, but not to the same extent.

Growing season is approximately June 1 to September 30 (four months).
Winter season is defined as approximately October 1 to May 31 (eight months).
H = High; M = Moderate; L = Low

See Tables 5-17a and 5-17b, Section 4.3.4 for habitat suitability ranking tables that include all VECs.

4.3. RESULTS & EXISTING CONDITIONS

4.3.1. OVERVIEW

A total of 15 mammal and 62 bird species are expected to occur in the Whale Tail study area based on the literature review conducted and the Meadowbank Baseline Terrestrial Ecosystem Report (Cumberland Resources 2005a, Naughton 2012, Richards and White 2008). Of these, 45 species (10 mammals, 35 birds) were recorded during the 2014 and 2015 field seasons (see Appendix 12).

Across the 2014 and 2015 field studies, Barren-ground Caribou, Arctic Ground Squirrel, and Muskox were the most commonly observed mammals, while Lapland Longspur, Horned Lark, redpolls (Common and Hoary), and Snow Goose were the most commonly observed birds. These findings are consistent with the Meadowbank baseline terrestrial surveys (Cumberland Resources 2005a).

Results from each data source (i.e., the 2014 vegetation plot field work, annual HHS, wildlife log sheet, and data from collared Caribou etc.) are described below in Sections 5.3.3.1 to 5.3.3.12. Section 4.3.2 contains a description of the RSA and LSA that links the key characteristics of each ELC community (vegetation, soils, and terrain) with potential wildlife habitat use. Wildlife habitat suitability maps have been created based on this information and suitability rankings previously created for the Meadowbank and Kiggavik projects (Section 4.3.4).

4.3.2. LOCAL AND REGIONAL STUDY AREA (LSA AND RSA)

All wildlife habitat types present in the region occur throughout the LSA and RSA (see Section 3.3.6 for detailed table). The proportions of each ELC type within the LSA are very similar to the RSA. Due to water crossing avoidance along the proposed road alignment, there is a slightly higher percentage of Health Upland and Lichen/Rock Complex and a lower percentage of Water land type within the LSA. As such, wildlife usage within the RSA is assumed to be generally similar to the field study results described below, which primarily assessed the LSA.

One notable difference between the LSA and RSA is the percentage of esker habitat. Esker land class accounts for only 0.05% of the RSA and 0.8% of the LSA (Golder, 2015). While in both cases this habitat is rare, the large majority of esker found within the RSA is also present within the LSA. As such, and due to its high suitability for denning and as a movement corridor, the esker represents significant wildlife habitat within close proximity to proposed Whale Tail development areas. As such, esker habitat was specifically targeted and thoroughly examined during wildlife surveys (Section 4.2.2.4).

4.3.3. FIELD STUDY RESULTS

4.3.3.1. UPLAND BREEDING BIRD PRISM PLOTS

Detailed breeding bird data were collected on 40 PRISM plots, which were divided between the proposed Whale Tail Pit area (20 plots) and a long-term control monitoring area (20 plots) approximately 15 km west of the Meadowbank Mine. Results for each dataset are described below.

Whale Tail Pit PRISM Plots

Thirteen (13) bird species were detected within the 20 Whale Tail PRISM plots surveyed in 2015. An additional five (5) bird species and two (2) mammal species were incidentally recorded during these surveys (outside of plots) (Table 4-8). Of the 13 species detected within plots, the majority were associated with strong breeding evidence such as direct observation of nests or probable nests deduced from parental behaviours.

The abundances and densities of the most common birds were similar to those of the control plots:

- 13.6 Lapland Longspurs/plot (13.0/plot in controls);
- 2.9 redpolls (Common and Hoary)/plot (1.1/plot in controls);
- 2.4 Horned Larks/plot (2.0/plot in controls); and
- 0.9 Rock Ptarmigan/plot (0.6/plot in controls).

These four species were found within 80 to 100% of all plots sampled. Nests of Lapland Longspur were the most commonly encountered, occurring in about one third of plots. Other observed nests included one each for American Pipit (*Anthus rubescens*), Horned Lark, Hoary Redpoll, redpoll species, and Rock Ptarmigan.

Semipalmated Sandpiper occurred at a density of 1.0 birds/plot and occurred in about half of the plots and Rock Ptarmigan was observed in just less than half of the plots at a density of 0.6 birds/plot.

Table 4-8: Whale Tail PRISM Plot Species and Number of Plots where Detected

Species	# Plots where Present
American Golden-Plover (*Pluvialis dominica*)	3
American Pipit (*Anthus rubescens*)	5
Common Redpoll (*Acanthis flammea*)	1
Horned Lark (*Eremophila alpestris*)	16
Hoary Redpoll (*Acanthis hornemanni*)	4
Lapland Longspur (*Calcarius lapponicus*)	20
Sandpiper species	2
Redpoll species (*Acanthis* spp.)	18
Rock Ptarmigan (*Lagopus muta*)	9
Sandhill Crane (*Grus canadensis*)	1
Savannah Sparrow (*Passerculus sandwichensis*)	7
Semipalmated Plover (*Charadrius semipalmatus*)	1
Semipalmated Sandpiper (*Calidris pusilla*)	9
Snow Bunting (*Plectrophenax nivalis*)	1

Control PRISM Plots

Sixteen (16) bird species were detected within the 20 control PRISM plots surveyed in 2015, and an additional eight (8) bird species and one (1) mammal species were recorded incidentally outside of plots during the surveys (Table 4-9). Of the 16 species detected within plots, the majority were associated with strong breeding evidence such as direct observation of nests or probable nests deduced from parental behaviours. A female Red-breasted Merganser (*Mergus serrator*) and a lone Red-necked

Phalarope (*Phalaropus lobatus*) of unknown sex were only observed swimming; therefore, breeding may not be associated with the plots where they were observed.

The most abundant bird species was Lapland Longspur, which occurred within all of the control plots and at an average density of 13.0 birds/plot. Lapland Longspur nests were the most commonly detected nest within control plots (nests located in 20% of plots). Horned Lark, redpolls and Savannah Sparrow were found at densities of between 1.5 and 1.95/plot and detected in at least 65% of plots.

Rock Ptarmigan was relatively common, occurring in 55% of plots and at an average plot density of 0.85 birds/plot.

Table 4-9: Control Plot Species and Number of Plots where Detected

Species	# Plots where Present
American Pipit (*Anthus rubescens*)	9
Dunlin (*Calidris alpina*)	1
Horned Lark (*Eremophila alpestris*)	16
Hoary Redpoll (*Acanthis hornemanni*)	4
Lapland Longspur (*Calcarius lapponicus*)	20
Least Sandpiper (*Calidris minutilla*)	1
Long-tailed Duck (Clangula hyemalis)	3
Red-breasted Merganser (*Mergus serrator*)	1
Redpoll species (*Acanthis* spp.)	18
Red-necked Phalarope (*Phalaropus lobatus*)	1
Rock Ptarmigan (*Lagopus muta*)	11
Sandhill Crane (*Grus canadensis*)	2
Savannah Sparrow (*Passerculus sandwichensis*)	13
Semipalmated Plover (*Charadrius semipalmatus*)	1
Semipalmated Sandpiper (*Calidris pusilla*)	11
White-crowned Sparrow (*Zonotrichia leucophrys*)	2

<u>Whale Tail and Control PRISM Comparison</u>

The control plots had a slightly higher diversity per plot and overall (Table 4-10). This difference may be associated with random plot location differences or may be slightly influenced by local environmental differences; Whale Tail plots are located approximately 35 km north of control plots. Slightly more nests and more probable nests were discovered within the control area compared to the Whale Tail plots (Table 4-10), which is likely due to random plot location variability. Overall, Whale Tail and control plots expressed comparable levels of breeding evidence and overall densities of birds/plot, with Whale Tail plots containing a slight higher average density than control plots.

Being small-bodied and relatively generalist species, Lapland Longspur and redpolls (Common and Hoary)(Baicich and Harrison 1997, Cadman et al. 2007), are able to occupy a variety of habitat types at high densities within the majority of control and Whale Tail plots surveyed (especially high densities for the Lapland Longspur). While also frequently observed, Horned Lark, American Pipit, and Savannah Sparrow were associated with more specific habitat types within both study areas (i.e., upland and rock for the lark and pipit; wetter graminoid lowlands for the sparrow).

Rock Ptarmigan was ubiquitous within control and Whale Tail study areas. Their territories were sufficiently large such that within the 400 x 400 m plots relatively low densities were observed (0.6 to 0.85 per plot). In several instances where Rock Ptarmigan were not observed on plot, they were noted incidentally outside of the survey area.

The three *Calidris* species (Semipalmated Sandpiper, Least Sandpiper, and Dunlin) were primarily observed in Graminoid Tundra and Wet Graminoid habitats. Due to significant breeding habitat specificity, these sandpipers were only observed in plots adjacent to creeks, ponds or lakes. Fifty-five (55) percent of Whale Tail plots and 65% of control plots contained at least one *Calidris* spp. Semipalmated Sandpiper occurred at a density of about 1.0 birds/plot in both Whale Tail and control areas, while Least Sandpiper and Dunlin occurred only within control plots at densities of 0.1 and 0.05 birds/plot respectively.

The remaining species found within control and Whale Tail pit plots, and those observed incidentally outside of plots, were typically uncommon to rare, occurring in just a handful of plots at low densities, and occasionally only as a single occurrence. Nesting densities for these species is low within both control and Whale Tail study areas.

Table 4-10: Breeding Bird Abundance, Density and Diversity in Whale Tail and Control PRISM Plots

	Whale Tail	Control
Number of Species	13	16
Average Species/Plot	6	7.9
Average Males/Plot	7.1	8.0
Average Females/Plot	1.4	0.9
Average Pairs/Plot	3.8	3.4
Average Nests/Plot	0.6	0.8
Average Prob. Nests/Plot	0.4	0.5
Average Unk. Sex/Plot	4.7	4.2
Average Birds/Plot	22.5	22.1

4.3.3.2. UPLAND BREEDING BIRD TRANSECTS

Sixteen (16) bird species and four (4) mammal species were detected on the six (6) breeding bird transects. An additional eight (8) bird and three (3) mammal species were observed incidentally outside of transects (Table 4-11), including Barren-ground Caribou, Muskox, and Wolverine.

Spatial distribution and abundance results were generally complimentary to the findings from the control and Whale Tail PRISM plots (Section 4.3.3.1). Within transects, the most abundant species was Lapland Longspur followed by the Horned Lark, redpolls (Common and Hoary), and Savannah Sparrow. White-crowned Sparrow, American Pipit, and Rock Ptarmigan were observed occasionally, while waterfowl and shorebirds were infrequently detected (Table 4-13).

Table 4-11: Transect Incidental Observations

Birds
Bald Eagle (*Haliaeetus leucocephalus*)
Cackling Goose (*Branta hutchinsii*)
Dunlin (*Calidris alpina*)
Greater White-fronted Goose (*Anser albifrons*)
Harris' Sparrow (*Zonotrichia querula*)
Herring Gull (*Larus argentatus*)
Rough-legged Hawk (*Buteo lagopus*)
Tundra Swan (*Cygnus columbianus*)
Mammals
Muskox (*Ovibos moschatus*)
Barren-ground Caribou (*Rangifer tarandus*)
Wolverine (*Gulo gulo*)

The number of observations varied within and between transects, likely due to differences in habitat such as lowland Graminoid Tundra, which contained higher densities of breeding birds than bedrock or boulder-strewn ridges. Total numbers of species observations within transects (including both replicate surveys) are displayed in Table 4-12, with darker shading corresponding to higher densities of observations. The interval columns of Table 4-12 represent 100 m increments along the transect; therefore, interval 1 is equal to 0 to 100 m, interval 2 is 100 to 200 m, etc.

Table 4 – 12: Density of Wildlife Observations by Transect Interval

Transect (Road Chainage km)	Density of Wildlife Observations by Transect Interval																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1 (5+900.00)	4	5		5	5		3	1	3	2	6	1	3	4	5	9	9	3	5	1	4	1	4	4	3	1	3	3	3	6
2 (12+500.00)	9	3	2	4	6	1	3	8	6	3	8	5	3	2	1	3	4	3	5	3	3	1	1	10	4	3	3	7	5	4
3 (29+325.00)	1	3		1	4	4		3		3	5	6	2	3	2			4	8	6	5	1	1	4	3	5	3	3	5	7
4 (37+200.00)	4	5	4	1	2	1	3		3	5	1	2	1	1	2	3		2	5	1	3	2	7	5		1	2		5	4
5 (42+850.00)	5		3	3		8	2	4	5	3	1	5		1	1		2				1		1	1	2			1	2	4
6 (56+550.00)	2			5	1	5	2			1	1	1	2	1	6	2	1	3	3	4	4	2	4		2	2	2	1	3	

Number of Obs.	0	1 – 3	4 – 6	7 – 9	10+

Transects 1, 2, and 3 had higher numbers of observations overall, with 1 and 2 in particular containing intervals with the highest concentrations of observations (Table 4-12). Transect 5 and 6 encompassed large areas of Lichen/Rock, Boulder/Gravel, and bedrock habitat types, which have lower wildlife diversity as can be seen in Table 4-12 in the contiguous stretches without any observations such as interval 18 to 20 and 26 to 27 on Transect 5 as well as 8 to 9 on Transect 6 (this applies across the two survey dates).

Along Transect 1, the area between 1,300 and 1,700 m contained a relatively high density of breeding bird activity (27 observations). In contrast, for Transects 2 and 5, the interval between 1,300 and 1,700 m presented only four and five wildlife observations respectively. As the intersection with the proposed road occurs at approximately 1,500 m along each transect, the segments mentioned above may serve as appropriate monitoring areas to examine the effects of development activities.

Table 4-13 displays the numbers of occurrences for each species observed within the Whale Tail transects across two surveys in 2015.

Table 4-13: Upland Breeding Bird Transect Species Observations

Species	Transect					
Birds	**1**	**2**	**3**	**4**	**5**	**6**
American Golden Plover (*Pluvialis dominca*)		2				
American Pipit (*Anthus rubescens*)	4	2	4	1	4	
Canada Goose (*Branta canadensis*)			1	1	1	1
Common Loon (*Gavia immer*)			1			
Common Redpoll (*Acanthis flammea*)		1				
Horned Lark (*Eremophila alpestris*)	19	15	8	13	9	4
Hoary Redpoll (*Acanthis hornemanni*)	1	8	1	5	4	2
Lapland Longspur (*Calcarius lapponicus*)	54	70	45	36	25	34
Least Sandpiper (*Calidris minutilla*)	1					
Long-tailed Duck (*Clangula hyemalis*)			2			
Redpoll species (*Acanthis* spp.)	13	5	9	10	5	11
Rock Ptarmigan (*Lagopus muta*)	3	6	4	3	2	3
Sandhill Crane (*Grus canadensis*)	1					
Savannah Sparrow (*Passerculus sandwichensis*)	5	8	7	4	1	2
Semipalmated Sandpiper (*Calidris pusilla*)		1	1	1		1
White-crowned Sparrow (*Zonotrichia leucophrys*)	2	5	8	1	3	
Mammals						
Arctic Fox (*Vulpes lagopus*)						2
Arctic Hare (*Lepus arcticus*)	3		1			
Voles and lemmings					1	
Ermine (*Mustela erminea*)			1			
Total Transect Observations	**106**	**123**	**93**	**75**	**55**	**60**
Total Species Diversity	11	11	14	10	10	9
Bird Species Diversity	10	11	12	10	9	8
Mammal Species Diversity	1		2		1	1

4.3.3.3. SHORELINE SURVEYS

Shoreline surveys examined 62.8 km along water features within 100 m of proposed development, including the Whale Tail Pit and Haul Road, esker borrow areas, and their associated access roads (see Figure 8). Features included a number of creeks and ponds as well as several larger lakes. Within the vicinity of the proposed Whale Tail Pit, the entire shorelines of Whale Tail, Mammoth, and Nemo lakes were investigated.

In total, 24 species of birds and five (5) species of mammals were detected during shoreline surveys (Figure 11). As with all survey types, Lapland Longspur was the most commonly encountered species. Redpolls (Common and Hoary), Horned Lark, and Savannah Sparrow were all relatively common as well. While relatively more abundant during shoreline surveys as compared with other survey types, waterfowl and shorebirds were encountered infrequently. The most abundant waterbird encountered during the shoreline surveys was Semipalmated Sandpiper (32 observations) followed by Long-tailed Duck (10), Herring Gull (6), and Semipalmated Plover (6). Cackling Goose , Canada Goose, Greater White-fronted Goose, Snow Goose, Red-throated Loon (*Gavia stellata*), Common Loon, Glaucous Gull (*Larus hyperboreus*), Red-breasted Merganser, American Golden Plover, Least Sandpiper, and Dunlin were rarely encountered.

Wildlife density within the shoreline survey areas was 11.6 birds/km, while for waterfowl and shorebirds, this density was 2.5 birds/km. Several nests were located during the course of shoreline surveys including, three (3) Semipalmated Sandpiper nests, two (2) Semipalmated Plover nests, one (1) Dunlin nest, one (1) Herring Gull nest, and one (1) Cackling Goose nest. The Cackling Goose and sandpiper nests (i.e., Semipalmated Sandpiper and Dunlin) were detected in low-lying graminoid areas (Graminoid Tundra/Wet Graminoid ELC types) in close proximity to water features. The one Herring Gull nest was observed from afar on a small rocky island within a mid-sized water feature. Both Semipalmated Plover nests were observed on sandy upland ridges (Esker/Sand ELC types) near water. No loon or duck nests were observed and no nesting concentration areas were detected within the survey area.

Water features with rock-dominated shorelines (such as Mammoth Lake – L10; Figure 8.1), had much lower densities of waterfowl (and wildlife in general). Productive waterfowl areas were low-lying graminoid habitats such as the shores of ponds P70 to P75 south of Nemo Lake (Figure 8). The highest densities of wildlife observed during shoreline surveys were at ponds P49, P41, and P48, which are small ponds surrounded by a primarily graminoid-dominated shoreline.

See Figure 11.1 – 11.7 for locations of nests and waterbirds observed during the 2015 shoreline surveys.

4.3.3.4. GROUND RECONNAISSANCE

Ground reconnaissance surveys detected 34 species (28 birds and 6 mammals). The eskers, surrounding the proposed borrow areas in particular, were thoroughly examined during these surveys.

Two canid dens were located within the study area in 2015 (Figure 9). An Arctic Fox den was observed on a sandy shoreline of Whale Tail Lake. This site appeared to have been active earlier in the season, but was unoccupied when observed. Within the proposed esker #3 borrow area, a series of Wolf dens were located. Two ground reconnaissance surveys in this area indicated that a small Wolf pack (three adults) was protective of an unknown number of juveniles. One recently used Wolf den site was located and the suspected location of both a second active den and later a pup nursery area were deduced based on territorial adult Wolf behaviour. Additionally, an older (likely previous year's) den was seen in the same vicinity. Incidental observations as well as sign (i.e., carcass remains, scat, tracks, etc.) detected in 2014 also indicate that wolves have been actively using the area within and directly adjacent to the proposed esker #3 borrow area for several years (Figure 9.3).

Individual and small groups of Caribou and Muskox were observed foraging and travelling throughout the study area. Spanning across several of the eskers in the east, Caribou trails were detected crossing the proposed Whale Tail Pit study area (Figure 9 – key map).

One Grizzly Bear was incidentally observed near the Meadowbank Vault Pit on June 16 by Agnico Eaglestaff, and substantial bear digging sign (i.e., excavation of ground squirrel colonies) was detected near proposed esker #7 borrow area (Figure 9.5). Furthermore, bear fur and tracks were observed along a rocky ridge on the north shore of Nemo Lake. This sporadic bear sign suggests that wide-ranging Grizzly Bears may occasionally occupy habitat overlapping with the proposed Whale Tail Pit, roads, and quarry areas, but bear densities are expected to be very low during all seasons. No bear overwinter or natal denning sites were detected during field investigations (Figure 9).

Three Wolverines, a mother with two juveniles, were observed near the eastern end of Transect 1 (Figure 8; Figure 9.7) and, while not located during field investigations, a den may have been present in the vicinity. Wolverines are wide-ranging throughout most of the year; however, mothers with kits are typically bound within smaller territories close to an active den (Naughton, 2012, May et al. 2012). Another adult Wolverine was observed on July 4 and another was seen during helicopter transit in the vicinity of the proposed esker #2 borrow area (Figure 9.6).

Several observations of Raptors (i.e., Bald Eagle, Rough-legged Hawk, and Peregrine Falcon) were made during ground reconnaissance surveys. All sightings were of flying adult birds (see Raptor nest data in Section 4.3.3.7).

4.3.3.5. INCIDENTAL OBSERVATIONS

Incidental observations were noted during all ground-based wildlife and vegetation surveys, and are described in the ground reconnaissance results section (see Section 4.3.4.4).

4.3.3.6. HEIGHT-OF-LAND SURVEYS

Height-of-land surveys bolstered survey coverage of the ground reconnaissance work during the first week and a half of July. Significant findings, including a group of Muskox, several Caribou, Raptors, and an adult Wolverine, are described in the ground reconnaissance results section (see Section 4.3.4.4).

4.3.3.7. RAPTOR NEST SURVEYS

Raptor researchers identified 106 nesting sites during the 2015 surveys. Of these, 30 were occupied and 76 were unoccupied. Of the occupied nests, the Raptor species observed were:

- Peregrine Falcon (23 occupied nests);
- Gyrfalcon (3 nests); and
- Rough-legged Hawk (4 nests).

Most occupied nests (21) were located on an east-west ridge located approximately 3 km north of the Whale Tail Pit site. Nine (9) occupied nests south of the Whale Tail Pit site (i.e., along the haul road portion of the RSA), were occupied by Peregrine Falcons; no occupied Rough-legged Hawk or Gyrfalcon nests were found south of the Whale Tail Pit site.

Within the LSA, only one occupied nest was observed. The remaining nine (9) nest observations within the LSA were either nests that were unoccupied in 2015 (5 observations) or sites with suitability for nesting but no indication of past use for nesting (4 observations) Table 4-14 summarizes these findings; see Figure 9 for the locations of all occupied and unoccupied nests found during the 2015 surveys.

Table 4-14, Raptor Nest Observations within LSA (2015)

Species	Nest observed?	Nest Status (2015)	Latitude	Longitude	Distance from feature	Feature type	Notes
Whale Tail Pit LSA							
Unknown	Y	Unoccupied	65.437996	-96.71108	4.4 km NW	North terminus of Whale Tail haul road	Small isolated cliff, no bird seen, old stick nest.
Unknown	Y	Unoccupied	65.439796	-96.67386	4.2 km NNW	North terminus of Whale Tail haul road	Nest site ; big cliff but too much snow
Peregrine Falcon	**Y**	**Occupied**	**65.431573**	**-96.677825**	**3.3 km NNW**	**North terminus of Whale Tail haul road**	**Nest site ; PEFA pair, female on ledge**
Unknown	Y	Unoccupied	65.431677	-96.677076	3.3 km NNW	North terminus of Whale Tail haul road	Nest site, cliff with orange lichen (indicating likely previous use by raptors)
Rough-legged hawk	Y	Unoccupied	65.434417	-96.668507	3.6 km N	North terminus of Whale Tail haul road	Old Rough-legged hawk nest, good cliff, facing north east, no bird observed
Unknown	N	Unoccupied	65.427521	-96.666835	2.8 km N	North terminus of Whale Tail haul road	Potential nest site, small rocky cliff south west oriented, no bird sign
Whale Tail Haul Road LSA							
Peregrine Falcon	N	Unoccupied	65.409835	-96.606492	400 m E	Esker #6 borrow area	Potential nest site, esker, Peregrine Falcon observed in this location. Not steep enough to be high suitability nesting site.
Unknown	Y	Unoccupied	65.342012	-96.499364	2.1 km SE (borrow site), 1.5 m NE (road)	Esker #5 borrow area, haul road km 51.7	One stick nest, facing east good cliff. Occupied nest 200m away NE of LSA boundary
Unknown	N	Unoccupied	65.273917	-96.450046	1 km NE	Haul road km 39.7	Potential nest site, rounded small cliff facing east, poor quality nesting site
Unknown	Y	Unoccupied	65.110917	-96.104477	500 m SW	Haul road km 6.7	Old Rough-legged hawk nest, or could have been used by Peregrine Falcon, unoccupied

The researchers commented that the low number of occupied Rough-legged Hawk sites likely indicated low lemming abundance in the area for 2015, and that the number of old Rough-legged Hawk nests found suggest that this species could more abundant in some years, following peak lemming abundance (P. Galipeau, pers. comm., 2015).

A total of 13 incidental sightings of Raptors were recorded during the wildlife and vegetation field surveys, with the following results:

- Peregrine Falcon (5 observations);
- Rough-legged Hawk (4); and
- Bald Eagle (4).

All Raptors were observed in flight or recently flushed; no new nests were found during the vegetation or non-Raptor specific wildlife field surveys.

4.3.3.8. HUNTER HARVEST STUDY

Up until the 2015 calendar year, the hunter harvest study area only extended into the southern half of the Whale Tail Pit RSA; nevertheless, harvest study data to date indicate a very low harvest north of Tehek Lake (see Figure 5). The primary reasons for these low harvest rates are limited access for hunters and the long distance from the Hamlet of Baker Lake. Although areas near Baker Lake were traditionally hunted, higher hunting pressure in the southwestern portion of the RSA is also related to access for hunters because of the Meadowbank AWAR (see Figure 5). The low hunting pressure north of the Meadowbank Gold Mine and in the vicinity of the Whale Tail Pit project area is also reflected in the Nunavut Wildlife Management Board harvest study (NWMB, 2005) (see Figure 6).

4.3.3.9. CARIBOU COLLARING DATA

4.3.3.9.1 *CARIBOU SEASONAL OCCURRENCE*

Barren-ground Caribou herds exhibit an annual nomadic life cycle over ranges that cover thousands of square kilometers (Gordon 2005). They are found in different areas of their annual range at different times of the year based on an annual life cycle with seven generally recognized 'seasons'. Those seasons are based on distinct movements and, for the purposes of this baseline report, include spring migration, calving, post-calving aggregation, summer dispersal, rut and fall migration, and a combined early and late winter season (Table 4-15).

Table 4-15: Mainland Barren-ground Caribou 'Seasons'

Activity	Dates	Notes
Spring migration	April 1 to May 25	Males migrate to traditional calving grounds about one month (April to June) after females and yearlings. Route depends on winter distribution.
Calving	May 26 to June 25	Most calves are born June 5 to 15. Condition of cows affects timing. The same region is used annually, but specific place varies.
Post-calving aggregation	June 26 to July 31	By early July, most cows and calves have left calving grounds. Animals gather in large groups to reduce insect harassment.
Summer dispersal	August 1 to September 15	By end of July, Caribou begin moving south. Groups break up when insect harassment decreases and scatter to avoid harassment from warble and nose botflies. Begin to regroup in late August and September.
Rut and fall migration	September 16 to November 7	Southward movement influenced by snowfall and ice formation. Rut occurs in late October. Following the rut, adult males separate from other Caribou and aggregate into separate groups.
Early and late winter	November 8 to March 31	Animals generally move away from areas with deep snow. Tundra-wintering Caribou seek range where snow is relatively shallow, such as ridge tops.

Collared Ahiak, Wager Bay, and Lorillard Caribou were the most frequently recorded herds in the RSA. Ahiak collared animals were most consistently observed across seasons, whereas Wager Bay animals were most common in spring migration and late summer, and Lorillard animals were most common during spring migration and in winter. Only single collared animals from the Qamanirjuaq and Beverly herds have been recorded in the Whale Tail Pit RSA; therefore, percentage of locations is nil or very low in all seasons.

Table 4-16: Use of RSA by Collared Individuals during Various Portions of the Caribou Life Cycle

Caribou Seasons	% of Satellite Transmission Locations in the RSA Based on Total Number of Collared Individuals				
	Beverly [(a)]	Ahiak[(b)]	Wager Bay [(c)]	Lorillard [(d)]	Qamanir-juaq[(e)]
Spring Migration (April 1 to May 25)	0.0	2.4	3.6	3.8	0.0
Calving (May 26 to June 25)	0.0	0.2	0.0	0.2	0.0
Post-calving (June 26 to July 31)	0.0	0.6	0.0	0.0	0.0
Summer Dispersal (August 1 to September 15)	0.2	1.6	13.9	0.0	0.0
Rut and Fall Migration (September 16 to November 7)	0.0	1.6	0.0	0.0	0.0
Early and Late Winter (November 1 to March 31)	0.0	0.3	0.7	1.4	0.0

Source: GNWT ENR, GNDoE, and Agnico Eaglecollars

[(a)] n = 34; [(b)] n = 31; [(c)] n = 4 [(d)] n = 17; [(e)] n = 96

The movements of collared Caribou (i.e., Baker Lake collared animals since 2010) for each season are presented in Figures 7.2 to 7.7. Summary descriptions of collared Caribou movements are provided below. For the purposes of this discussion, collar locations are considered generally representative of herd movements.

Spring Migration (April 1 to May 25)

Several Ahiak and Wager Bay collared animals moved through the Whale Tail RSA on their way to calving grounds to the northeast, and most Lorillard collared animals moved through the RSA in a general eastward direction from north of the Thelon River to an area between Chesterfield Inlet and Wager Bay (i.e., calving area) (see Figure 7.2). One Qamanirjuaq Caribou, collared south of Aberdeen Lake in April 2013, moved north through the RSA, then east, and finally south, crossing Chesterfield Inlet toward the Qamanirjuaq calving grounds. Beverly collared Caribou were not close to the RSA during the spring season.

Calving (May 26 to June 25)

Barren-ground Caribou cows have strong fidelity to specific calving grounds (Gunn and Miller 1986). Most cows arrive on their calving grounds in the last week of May or early June, and most calves are born from June 5 to 15 (BQCMB 2015, internet site, Russell et al. 2002). Two collared Ahiak Caribou and one collared Lorillard Caribou were still within the RSA during the early portion of the calving period; however, these animals moved rapidly to their respective calving grounds by mid-June (see Table 4-16 and Figure 7.3). The RSA is not in close proximity to any of the documented calving grounds (Nagy et al. 2011; Campbell et al. 2012; see Figure 7.1).

Post-Calving (June 26 to July 31)

By early July, most cows and calves have left the calving areas and begin to aggregate in larger groups that include adult males, to reduce harassment from mosquitoes and predation by wolves (Nixon and Russell 1990, BQCMB 2015, internet site). According to Figure 7.4 and existing knowledge on post-calving areas, the Whale Tail RSA is not in close proximity to post-calving areas. Beverly collared animals were generally far north and west of the RSA with only one collared animal moving from north to south approximately 25 km west of the western RSA boundary. Qamanirjuaq collared animals spread out in different directions from their calving grounds but none occurred north of the Thelon River. At least two of the collared Ahiak animals moved into the RSA, but most were well to the north or west (see Table 4-16 and Figure 7.4). Wager Bay collared animals remained near their calving grounds and Lorillard Caribou moved north to Wager Bay and south along Chesterfield Inlet (Figure 7.4).

Summer Dispersal (August 1 to September 15)

By the end of July, Beverly and Qamanirjuaq Caribou begin moving toward the tree line, and in August, scatter to avoid harassment from warble and nose botflies (Nixon and Russell 1990, Folstad et al. 1991, BQCMB 2015, internet site). One Beverly collared animal moved briefly into the southwestern portion of the RSA, but most Beverly animals were situated well to the west during this period (Figure 7.5). Qamanirjuaq collared animals were spread out during the summer dispersal period but none were located north of Baker Lake or the Thelon River. Some Ahiak collared animals moved through the northwestern portion of the RSA, with some crossing the Aberdeen Lake system (see Table 4-16 and Figure 7.5). Most Lorillard and Wager Bay remained well west and north, respectively, of the RSA (Figure 7.5). One Wager Bay collared animal did move slowly through the centre of the RSA during this period (Figure 7.5), accounting for a larger than expected percentage of Wager Bay collar locations in the RSA (see Table 4-16).

Rut and Fall Migration (September 16 to November 7)

Movement towards the tree line and/or southern wintering grounds on the barren-grounds occurs between September and November. Mating (the rut) occurs in late October (Lent 1965, Dauphine and McClure 1974), and usually near the tree line for migratory herds such as the Beverly and Qamanirjuaq (BQCMB 2015, internet site). Following the rut, bulls separate from other Caribou and aggregate into groups (BQCMB 2015, internet site). During this season, several Ahiak animals were within or moved through the Whale Tail RSA (Table 4-16; Figure 7.6). No Caribou from any of the other herds were within the RSA although Wager Bay animals were approaching from the north and Lorillard collared animals were approaching from the east. Beverly collared animals were well to the west and southwest, with the exception of one animal on the north shore of Schulz Lake, approximately 25 km from the RSA boundary (Figure 7.6).

Early and Late Winter (November 7 to March 31)

By November, most of the migratory Beverly and Qamanirjuaq Caribou are south of the tree line. Animals may continue to move until snow depth reaches >50 cm around February or March (BQCMB 2015, internet site). Several Beverly collared animals remained on the barren-grounds well west of the RSA where they mixed with some of the Ahiak, Lorillard, and Wager Bay animals (Figure 7.7). Collared individuals of the Ahiak, Lorillard, and Wager Bay herds, which typically do not migrate to the tree line, were within the RSA during this period, but most were aggregated to the east and west (see Table 4-16 and Figure 7.7).

4.3.3.10. IMPORTANT CARIBOU AREAS

4.3.3.10.1 *CALVING AREAS*

Department of Indian Affairs and Northern Development (DIAND) Caribou Protection Measures protect animals on designated calving grounds from May 15 to July 15. No government-designated or other formally identified calving areas are present within or close to the Whale Tail RSA (Nagy et al. 2011; Campbell et al. 2012), and the RSA is not within Caribou protection areas identified within Territorial Land Use Regulations (Figure 7.1).

4.3.3.10.2 *POST-CALVING AREAS*

Cows and calves are sensitive to disturbance and vulnerable to predation during a critical three-week period following calving. According to satellite-collaring data (see Figure 7.4), the Whale Tail RSA is not important to any of the herds during the post-calving period, which is likely because all known calving grounds are a considerable distance from the RSA (see Figures 7.1 and 7.3; Nagy et al. 2011, Campbell et al. 2012).

4.3.3.10.3 *WATER CROSSINGS*

Water crossings play an important role in many periods of the annual cycle for Caribou. During migration, Caribou follow natural geographic features, which cause them to concentrate at traditional water crossings (Williams and Gunn 1982). Activities within 5 km of water crossings designated by the Territorial Land Use Regulations are prohibited by the DIAND Caribou Protection Measures from May 15 to September 1. None of the water crossings identified by the DIAND (1992) or the Kivalliq Wildlife Board (Warren Bernauer, pers. comm., 2015) are within the Whale Tail Pit RSA.

4.3.3.11. MIGRATION PATTERNS

Understanding movement patterns of migratory and tundra-wintering Caribou in and around the RSA is challenging given variability in movements between seasons, herds, and individuals. Information from various sources, including IQ and engagement studies, baseline ground and aerial surveys, and telemetry data at local and regional scales in Nunavut and the NWT, has provided some evidence on how Caribou move in and around the RSA annually (see Figure 7.8). The RSA appears to predominantly provide a transit corridor (i.e., spring and fall migrations) between calving grounds and wintering grounds for the Ahiak and Lorillard herds (see Figures 7.2, 7.6, 7.9 and 7.10), and a wintering area for tundra-wintering herds such as the Ahiak, Lorillard, and Wager Bay herds (see Figure 7.7).

Spring and fall migration are major directional movements for Caribou in the region. For spring migration (April to June), areas of high use by collared Caribou are more contained (i.e., less spread out), and these corridors are quite clearly delineated on the way to and in proximity of calving grounds outside the RSA (Figures 7.2 and 7.9). Telemetry data indicate that most collared Caribou are moving in a northerly direction in the spring, but generally outside the RSA (Figure 7.2). For fall migration (September to November), as animals are migrating to wintering grounds, areas used by collared Caribou are more widely distributed (i.e., more spread out) (Figure 7.6). Fall migration corridors are also located closer to the Whale Tail study area than spring corridors, as herds generally move in a southerly direction from calving grounds (Figure 7.10).

Within the Whale Tail RSA, Caribou movements appear to be distributed across the study area, with a potential movement corridor between Third Portage and Pipedream lakes (Figure 7.8). A number of Caribou trails identified in this area during the October 2014 and June/July 2015 surveys, and traditional knowledge (Burt and Witteman, 2014), support this observation.

4.3.3.12. WILDLIFE LOG SHEET

Agnico Eagle provides a Wildlife Log Sheet that employees can use to track their wildlife observations. The information from this log sheet was provided to the study team for the Whale Tail Pit exploration camp and included wildlife records between May 13th and September 21st, 2014, and between June 4th and October 2nd, 2015.

Data from this log illustrate seasonal Caribou movement through the Whale Tail Pit exploration camp and vicinity. In 2014, groups of Caribou were first noted on August 23rd (20 individuals), which increased on the 24th (70) and then peaked for nine days between August 25th and September 2nd at 100 Caribou per day. On September 3rd, Caribou decreased to 50 individuals, 30 the following day, and then 10 for the two days following that (September 5th and 6th, 2014). In 2015, a similar pattern was observed. Individual Caribou were observed in July and August followed by small herds (10 to 20 individuals) throughout September.

Evidence of goose migration was also present in 2014 with the first flocks observed on August 21st, and increasing to a maximum of about 500/day passing by the Whale Tail Pit exploration areas from September 5th to 7th, 2014.

The Wildlife Log Sheet offered incidental observations of Predatory Mammals, which were infrequently observed during the 2014 and 2015 field seasons. Wolverine (Special Concern – COSEWIC) was observed at 3 am on May 13th, 2014 in the vicinity of the Amaruq exploration area. Individual Arctic Wolves were observed near the Amaruq exploration areas on September 6th, 2014, and June 21st, July 7th, and October 2nd, 2015. A pack of 10 Arctic Wolves was observed near the Amaruq exploration areas on September 14th, 2014 (this observation specifically indicated that these Wolves were observed close to the esker). Lastly, one Grizzly Bear was observed at the south end of the proposed road alignment (near the existing Meadowbank Vault Pit) on June 16th, 2015.

Other observations from the Wildlife Log Sheet include sporadic Muskox, Arctic Fox, Arctic Hare, Arctic Ground Squirrel, Sandhill Crane, ptarmigan, and a single Caribou.

4.3.4. HABITAT CONSIDERATIONS & SUITABILITY

Based on the wildlife habitat suitability rating scheme presented in Section 4.2.3, ranks of High (H), Medium (M), or Low (L) were assigned to each ELC unit present within the LSA and RSA for each of the wildlife VECs presented in Section 1.4.

Separate habitat suitability ratings were assigned to the growing season and the winter season for mammals but not birds, as the majority of birds are migratory and thus are not present in the winter months. The growing season is defined as approximately June 1st to September 30th (four months), and the winter season is defined as approximately October 1st to May 31st (eight months).

A separate ranking was developed for Predatory Mammal denning, as habitat preferences for this activity is different than for non-denning individuals. See Tables 5-16a and 5-16b for comprehensive VEC habitat suitability rankings. These rankings are based on those developed for the Meadowbank Terrestrial Baseline Characterization Report (Cumberland Resources 2005a) and Terrestrial EIA (Cumberland Resources 2005b), with updates to reflect the ELC communities in the GN's Kivalliq Ecological Land Classification Map Atlas (Campbell et al. 2012).

This information has been mapped as Figures 10.1 to 10.11, which show the habitat suitability rankings at a scale of 1:350,000 for each VEC in all of the ELC communities. It is important to note that the precise extents of the eskers are not well represented in the ELC mapping, as the ELC communities comprising these features are variable, but commonly include Boulder/Gravel, Lichen Tundra, Lichen/Rock Complex, Upland Tundra/Rock Complex, and Upland Tundra.

Table 4-17a: Habitat Suitability Rankings for VECs in ELC Units

ELC Unit	Valued Ecosystem Components						
	Ungulates				Carnivores		
	Caribou		Muskox		Predatory Mammals (except denning)		Predatory Mammals; Denning
	Growing	Winter	Growing	Winter	Growing	Winter	Jan-Sep
Water	-	L	-	L	-	L	-
Sand	M	L	L	L	L	L	H
Boulder/Gravel	M	L	L	L	M	M	H
Wet Graminoid	H	M	H	H	H	M	-
Graminoid Tundra	H	M	H	H	H	M	-
Graminoid/ Shrub Tundra	H	M	H	H	H	M	L
Shrub Tundra	M	L	M	M	M	M	M
Shrub/Heath Tundra	M	M	M	M	M	M	L
Heath Tundra	M	H	M	M	M	H	L
Heath Upland	M	H	M	M	M	H	L
Heath Upland/Rock Complex	M	H	L	L	M	H	M
Lichen Tundra	L	M	L	L	M	M	L
Lichen/Rock Complex	M	H	M	M	M	M	M

Table 4-17b: Habitat Suitability Rankings for VECs in ELC Units *(continued)*

ELC Unit	Valued Ecosystem Components			
	Small Mammals	Raptors	Waterfowl	Upland Breeding Birds
	Year Round	Growing	Growing	Growing
Water	L	M	H	L
Sand	H	M	M	M
Boulder/Gravel	H	M	M	M
Wet Graminoid	M	M	H	H
Graminoid Tundra	M	M	H	H
Graminoid/ Shrub Tundra	M	M	M	H
Shrub Tundra	M	H	L	H
Shrub/Heath Tundra	M	M	L	H
Heath Tundra	H	H	L	H
Heath Upland	H	H	L	H
Heath Upland/Rock Complex	H	M	L	M
Lichen Tundra	M	M	L	M
Lichen/Rock Complex	H	H	L	M

Tables 5-18 and Table 4-19 show the area in hectares and percentages, respectively, of High, Medium, and Low suitability habitats across the RSA for each VEC. A colour scheme has been applied to this table to increase readability, where darker shades of green correspond to larger quantities of suitable habitat (i.e., the growing season for Caribou has more Moderate suitability habitat than any other suitability).

Table 4-18: Area (hectares) of VEC Habitat Suitability in the RSA

VEC		H	M	L	Nil	No Data
Ungulates	Caribou (Growing Season)	20,577	321,107	20,861	126,638	12,512
	Caribou (Winter)	259,509	49,765	179,147	762	12,512
	Muskox (Growing Season)	20,577	265,169	76,799	126,638	12,512
	Muskox (Winter)	20,577	265,169	202,675	762	12,512
Carnivores	Predatory Mammals (Growing Season)	20,577	339,694	2,274	126,638	12,512
	Predatory Mammals (Winter)	143,565	216,707	128,150	762	12,512
	Predatory Mammals (Denning)	48,372	128,410	172,682	139,719	12,512
Small Mammals	Small Mammals (Year Round)	307,881	54,664	125,876	762	12,512
Raptors	Raptors (Growing Season)	256,841	231,580	0	762	12,512
Waterfowl	Waterfowl (Growing Season)	138,958	55,868	293,596	762	12,512
Upland Breeding Birds	Upland Breeding Birds (Growing Season)	169,801	192,744	125,876	762	12,512

Table 4-19: Area (percentage) of VEC Habitat Suitability in the RSA

VEC		H	M	L	Nil	No Data
Ungulates	Caribou (Growing Season)	4%	64%	4%	25%	2%
	Caribou (Winter)	52%	10%	36%	0.2%	2%
	Muskox (Growing Season)	4%	53%	15%	25%	2%
	Muskox (Winter)	4%	53%	40%	0.2%	2%
Carnivores	Predatory Mammals (Growing Season)	4%	68%	0.5%	25%	2%
	Predatory Mammals (Winter)	29%	43%	26%	0.2%	2%
	Predatory Mammals (Denning)	10%	26%	34%	28%	2%
Small Mammals	Small Mammals (Year Round)	61%	11%	25%	0.2%	2%
Raptors	Raptors (Growing Season)	51%	46%	0%	0.2%	2%
Waterfowl	Waterfowl (Growing Season)	28%	11%	59%	0.2%	2%
Upland Breeding Birds	Upland Breeding Birds (Growing Season)	34%	38%	25%	0.2%	2%

4.3.4.1. TERRESTRIAL MAMMALS

4.3.4.1.1 *UNGULATES*

Barren-ground Caribou - *Rangifer tarandus groenlandicus*

Status

The Barren-ground Caribou is listed as secure in Nunavut (CESCC 2011) and is not listed federally (COSEWIC 2015); however, communities and government have expressed concernregarding the declining numbers and health of herds (Beverly Qamanirjuaq Caribou Management Board, May 2015 meeting). Caribou are of high cultural value for the people of Baker Lake, both historically and currently (Burt and Witteman 2014).

Species Presence within the Study Areas

Based on the relative Caribou habitat suitability ratings applied to the ELC units, habitat suitability was quantified for the RSA and LSA for the growing and winter seasons (see Table 4-20). During the growing season, only a small amount of High suitability habitat is available in the RSA (i.e., ~4%; Table 4-20). Most of the habitat is rated as being of Moderate suitability (i.e., ~65%; Table 13). Most High suitability habitat in the growing season is situated in southern portions of the RSA, while Moderate suitability habitat is distributed throughout the RSA (see Figure 10.1).

A much higher proportion of High suitability habitat is available for Caribou during the winter season than in the growing season (i.e., ~52%; Table 4-20), while the availability of Moderate suitability habitat is much lower (i.e., 10%, Table 4-20). High quality habitat is concentrated in the northwestern and eastern portions of the RSA while Moderate suitability habitat is distributed more evenly throughout the RSA (see Figure 10.2)

Table 4-20: Overall Area of Caribou Habitat Suitability and Percentages

VEC, Season	Measurement	Habitat Suitability				
		H	M	L	Nil	No Data
Caribou, Growing Season	Area (ha) of RSA	20,577	321,107	20,861	126,638	12,512
	Percent of RSA	4	64	4	25	2
Caribou, Winter	Area (ha) of RSA	259,509	49,765	179,147	762	12,512
	Percent of RSA	52	10	36	0.2	2

The seasonal occurrence of Caribou in the RSA can be interpolated using satellite collaring data; an analysis of this data can be found in Section 4.3.3.7.2.

Reproduction and Behaviour

Detailed information about Caribou herd seasons, important Caribou areas, and migration patterns are presented in Section 4.3.3.7 and associated sub-sections.

Muskox – *Ovibos moschatus*

Status

Muskoxen are not listed as a Species-at-Risk federally (COSEWIC 2015) and are listed as secure in Nunavut (CESCC 2011). Current Muskox populations in Canada are stable to increasing (Ferguson and

Gauthier 1992), representing a rebound from overhunting in the early 1900s. This information is consistent with the findings of the traditional knowledge study (Burt and Witteman 2014), which indicated that Muskoxen are becoming more common in the Whale Tail study area and around Baker Lake.

Species Presence within the Study Areas
In total, 30 Muskoxen were observed during the 2014 and 2015 field program (Figure 9). Additionally, evidence of Muskox foraging was observed (scat) and of predation by wolves (damaged skull/Wolf scat). Data collected during the Meadowbank project baseline and monitoring studies suggest that a relatively stable population of 500 to 1,000 Muskoxen with herd sizes of up to 80 animals resides in the vicinity of the Meadowbank site (Cumberland Resources 2005a).

Graminoids and willows form an important part of Muskoxen diet; therefore, the graminoid-affiliate land classes (i.e., Wet Graminoid, Graminoid Tundra, and Graminoid/Shrub Tundra) provide the most important habitat within the study area (Figures 10.3 and 10.4) (Naughton, 2012). Muskoxen will also forage on blueberry (*Vaccinium* spp.), ground birch, and other shrubs. Similarly, preferred winter habitat is land with substantial graminoid cover (Pielou 1994). One of the most important determinants of winter foraging areas for Muskoxen is the extent to which wind removes snow cover from browsing areas; therefore, windswept plateaus and other graminoid-rich areas with reduced snow accumulation are important throughout the winter (Naughton 2012). Esker habitat is important as a movement corridor for Muskoxen, as was evidenced by the presence of a game trail and Muskox sign at the crest of the esker near borrow area #3.

Table 4-21: Overall Area of Muskox Habitat Suitability and Percentages

VEC, Season	Measurement	Habitat Suitability				
		H	M	L	Nil	No Data
Muskox (Growing Season)	Area (ha) of RSA	20,577	265,169	76,799	126,638	12,512
	Percent of RSA	4	53	15	25	2
Muskox (Winter)	Area (ha) of RSA	20,577	265,169	202,675	762	12,512
	Percent of RSA	4	53	40	0.2	2

Reproduction and Behaviour
Upland tussock areas and riparian drainages have been shown to be used as calving habitat; however, Muskox reproduction, both mating and calving, is expected to occur in a variety of habitats (Klein 2000). Muskoxen are not as migratory as Caribou, moving 10 km or less each day in the course of grazing. To conserve energy in winter, they move only as far as necessary to find forage and spend most of their time huddled together (Naughton 2012). Muskoxen (primarily females and their young) are social animals and are almost always seen in herds of 10 to 20 individuals.

4.3.4.1.2 *PREDATORY MAMMALS*

<u>Wolverine – *Gulo gulo*</u>

Status
Wolverine is considered relatively secure in Nunavut (CESCC 2011), but is listed as Special Concern federally (COSEWIC 2015). Due to its scavenging feeding behaviour, Wolverine is susceptible to hunting and trapping and has been largely extirpated from the southern parts of its historic range (Naughton

2012). Wolverines have been noted by local Elders as becoming more common within the Whale Tail study area in recent years (Burt and Witteman 2014).

Species Presence within the Study Areas

Wolverines occupy massive home ranges and are typically scarce to rare on the landscape (May et al. 2012). An Agnico Eagle employee near the Amaruq exploration camp reported a Wolverine on May 13th, 2014. Additional sightings within the Whale Tail Haul Road corridor were noted in 2015 on June 27th, July 4th and July 6th. These sightings involved a mother with two kits, a lone Wolverine observed from the air (in the vicinity of esker #2 borrow area), and another lone Wolverine near ground surveyors on the proposed road alignment (near to Vegetation plot 231; Figure 4.3). Habitat selection of Wolverines is determined primarily by the presence of suitable prey, which includes small game, carrion, and even larger game such Caribou under ideal conditions (injured, sick or encumbered by snow)(Naughton 2012). In the winter, they feed primarily on carrion and are closely linked to Caribou movement (Van Dijk et al. 2008, Naughton 2012). As such, and due to their massive home ranges (400 to 1,500 km^2), Wolverines utilize a wide variety of habitat types (May et al. 2012, Naughton 2012). By leaving carcasses on the landscape, the presence of Wolves may be important for Wolverine survival, which may be especially true in the winter when other food sources are scarce (Van Dijk et al. 2008).

During the 2014 traditional knowledge survey, Elders indicated that Wolverine numbers appear to be increasing (Burt and Witteman 2014).

Reproduction and Behaviour

Denning occurs between February and early June, the period when females with kits are most vulnerable to disturbance (May et al. 2012, Naughton 2012). Wolverines have been shown to preferentially avoid human activity during denning (May et al. 2012). Denning habitat often is in areas with rock matrices and deep snow (i.e., ELC land types: Lichen/Rock Complex, Boulder/Gravel). Eskers also provide denning habitat and movement corridors for Wolverines (Williston et al. 2004).

Table 4-22: Overall Area of Predatory Mammal Habitat Suitability and Percentages

VEC, Season	Measurement	Habitat Suitability				
		H	M	L	Nil	No Data
Predatory Mammals (Growing Season)	Area (ha) of RSA	20,577	339,694	2274	126,638	12,512
	Percent of RSA	4	68	0.5	25	2
Predatory Mammals (Winter)	Area (ha) of RSA	143,565	216,707	128,150	762	12,512
	Percent of RSA	29	43	26	0.2	2
Predatory Mammals (Denning)	Area (ha) of RSA	48,372	128,410	172,682	139,719	12,512
	Percent of RSA	10	26	34	28	2

Arctic Wolf – *Canis lupus*

Status

Gray Wolves, referred to as Arctic Wolves in northern Canada, are considered to be secure in Nunavut (CESCC 2011) and are not listed as a Species-at-Risk federally (COSEWIC 2015). The density of wolves in any given area within the Kivalliq Region may be very low given the immense range size that Wolf packs occupy (up to 75,000 km^2 annually) (Cluff et al. 2002).

Species Presence within the Study Areas

Caribou form the foundation of the Arctic Wolf diet and packs migrate seasonally through their territory in order to hunt Caribou (McLoughlin et al. 2004) (Appendix 6, Figures 10.5 to 10.7). Numerous other game items will also regularly be eaten, including insects, small mammals, birds, foxes, Wolverines, and Muskoxen (Naughton 2012).

Wolf sign, including scat and carcass remains, was observed in the LSA during the 2014 and 2015 baseline studies. Wolf sign was apparent along the eskers in multiple locations, but especially along their crests. Esker use is supported by the literature, which indicates that eskers are often used as movement corridors and denning habitat for Wolves (Mueller 1995, Williston et al. 2004, McLoughlin et al. 2004). On July 1st, 2015 a small pack of wolves (3) was observed exhibiting defensive behaviours in the vicinity of a den site near the esker #3 borrow area. This den site had developed into a nursery area and had shifted to the east by July 8th; two of the adult wolves were observed at that time. These observations coincide with various incidental reports of wolves in the vicinity of the esker #3 borrow site, and along the esker in general, throughout 2014 and 2015.

The RSA was indicated during traditional knowledge surveys to contain several important areas for wolves. The esker is known to be traditional denning habitat and two movement corridors for wolves have been reported within the study areas; one crosses north of Uiguklik and Tasirjuaraajuk (Pipedream) Lakes (east/west) and another trends southeast/northwest and passes just south of the Meadowbank Mine (Burt and Witteman 2014).

Reproduction and Behaviour

Denning for Arctic Wolves may occur within a variety of habitat types including the widespread heath-affiliate land classes (i.e., Heath Tundra, Heath Upland) (Cluff et al. 2002); however, preferred denning habitat is within sandy eskers, especially in areas with graminoid and forb cover (Mueller 1995). This is consistent with the Wolf dens located within the LSA. One recently used den (2015) and another older den (2014 or older) were located in the vicinity of the esker #3 borrow area; both were found within esker habitat with relatively southern facing aspect. Pups are typically born in April or May and remain in the den for at least four weeks, at which time they are transferred to a nearby nursery area (no longer in a den; Naughton 2012). The suspected location of the nursery was to the southeast of the den sites on a heath plateau surrounded by several esker ridges. By September to early October, Wolf pups are capable of traveling with adults and the pack moves from the denning area in search of caribou.

Barren-ground Grizzly Bear – *Ursus arctos*

Status

The Barren-ground Grizzly Bear is listed as Sensitive in Nunavut (CESCC 2011) and Special Concern in Canada (COSEWIC 2015). The primary cause of Grizzly Bear decline is thought to have been the fragmentation and destruction of their habitat, as these animals require massive territories (up to 1,000 km^2)(McLoughlin et al. 2002). Within approximately the last twelve years, local Inuit Elders have noted an increase in the numbers of Grizzly Bears seen between Baker Lake and the Back River (Burt and Witteman 2014).

Species Presence within the Study Areas

Grizzly Bears were not observed during the field program, although one individual was observed by Agnico Eagle staff just north of the Vault Pit in June 2015. Evidence of this species in the study area came from foraging sign (i.e., digs) in a patch of *Oxytropis* spp., a known favored food item (MacHutchon and

Wellwood 2003), and within Arctic Ground Squirrel colonies in many locations on the eskers. Bear fur and tracks were also observed along a rocky ridge north of Nemo Lake on June 26th, 2015. As a highly omnivorous species, Grizzly Bears consume the roots and vegetative parts of grasses and forbs, fruits of numerous shrubs, as well as fungi (McLoughlin et al. 2002, MacHutchon and Wellwood 2003, Naughton 2012). Arctic Ground Squirrels are an important part of their diet as are numerous other game including birds and Ungulates (McLoughlin et al. 2002). This varied diet means that Grizzly Bears can be found in a variety of habitat types throughout the growing season. In the winter, bears hibernate in dens typically located on south-facing esker slopes and areas with rock features (Mueller 1995).

Reproduction and Behaviour
Bear cubs are born while the female is hibernating (in January or February) and cubs emerge with their mother several months later (Naughton 2012). Preferred denning sites are, as with winter dens, on eskers and other south-facing slopes (Mueller 1995). Mothers with their cubs are particularly sensitive to disturbances at this time. Mother bears lactate for more than two years and remain with their cubs for four years (Naughton 2012). Grizzly Bears in the central Arctic typically enter their overwintering dens in the last two weeks of October. They emerge from hibernation in at the beginning of May, typically within the first week (McLoughlin et al. 2002). No evidence of overwintering or natal bear dens were located during 2014 and 2015 field studies.

Arctic Fox – *Vulpes lagopus*

Status
Arctic Fox is not listed federally (COSEWIC 2015) and is considered to be Secure in Nunavut (CESCC 2011). It is a small bodied wide-ranging predator and scavenger that feeds on a variety of small game and carrion (Naughton 2012). Although populations appear to be stable in North America, Scandinavian and Russian Arctic Fox populations have experienced historical and ongoing declines due, primarily, to overhunting (Naughton, 2012).

Species Presence within the Study Areas
Population densities of Arctic Foxes correlate to cycles in food source abundance; most importantly lemmings and voles (*Cricetidae*) (Macpherson 1969). These trends were confirmed by Elders during the 2014 traditional knowledge surveys (Burt and Witteman 2014). As with Wolverines, Arctic Foxes winter foraging success may be influenced by the presence of Arctic Wolves, which create carcasses on the landscape (Naughton 2012, Van Dijk et al. 2008). Home ranges during the breeding season typically encompass 10 to 21 km^2, although this may be much larger in the winter (Nielsen et al. 1994). Arctic Foxes are considered by local Elders to be very common within the study areas (Burt and Witteman 2014).

Reproduction and Behaviour
Arctic Fox denning in central Kivalliq has typically been shown to occur on vegetated, sandy gentle slopes such as eskers and near to river flats and valleys in particular (Macpherson 1969, Nielsen et al. 1994, Mueller 1995, Naughton 2012). Arctic Fox is an adaptive species that may den in other suitable habitat as well (Nielsen et al. 1994). Preferred sites seem to be areas above the permafrost layer that accumulate less snow than surrounding sites, have a sunny aspect, and are protected from prevailing winds (Naughton 2012, Macpherson 1969, Nielsen et al. 1994). One Arctic Fox den was observed during the 2015 field surveys in a sandy hill on the west shore of Whale Tail Lake (Figure 9).

4.3.4.1.3 *SMALL MAMMALS*

Status

In the Arctic, Small Mammals are a significant food resource for a variety of Predatory Mammals and birds. Several species, including Arctic Hare, Arctic Ground Squirrel, and Northern Collared Lemming, were observed during the 2014 and 2015 field program. Nearctic Brown Lemming (*Lemmus trimucronatus*), Northern Red-backed Vole, and Barren Ground Shrew (*Sorex ugyunak*) may also be present within the study areas (CESCC 2011, Naughton 2012). None of the small mammals within the study are considered Species-at-Risk (COSEWIC 2015) and all but the Barren Ground Shrew are listed as Secure in Nunavut (CESCC 2011). Barren Ground Shrew is a highly elusive and uncommon species that is listed as Undetermined in Nunavut (CESCC 2011). Very little is understood about the biology of this shrew species (Naughton 2012).

Species Presence within the Study Areas

Although some variety exists within the feeding strategies of Small Mammals, they primarily feed on a wide range of vascular plants, fungi, and mosses (Gruyer et al. 2010). Insect and meat consumption is typically a secondary and opportunistic feeding strategy for this group, with the exception of the Barren Ground Shrew, which likely primarily feeds on invertebrates although very little is known about its diet (Naughton 2012). Some important land class types for Small Mammals include Heath Tundra, Heath Upland, and Lichen/Rock Complex (Figure 10.8). Arctic Ground Squirrel was the most commonly observed Small Mammal during the 2014 and 2015 surveys.

Table 4-23: Overall Area of Small Mammal Habitat Suitability and Percentages

VEC, Season	Measurement	Habitat Suitability				
		H	M	L	Nil	No Data
Small Mammals (Year Round)	Area (ha) of RSA	307,881	54,664	125,876	762	12,512
	Percent of RSA	61	11	25	0.2	2

Reproduction and Behaviour

Reproduction rates for small mammals are typically very high with females of several species capable of producing multiple litters per year (Naughton 2012). Nesting can occur directly on open ground (Arctic Hare), in shallow burrows (Collared Lemming) or within extensive underground burrows (Arctic Ground Squirrel) (Naughton 2012). Some species may have parturition dates early enough in the year to have pups under snow cover (Naughton 2012). Nesting habitat for small mammals is present in most areas where suitable foraging habitat exists. Arctic Ground Squirrels are known to prefer burrow sites on sandy eskers (Mueller 1995).

Arctic populations of Small Mammals often exhibit cyclical patterns of increase and decline (Gruyer et al. 2010, Macpherson 1969). These cycles can be very important determinants of fitness for Small Mammal predators such as Arctic Fox, Snowy Owl, and Rough-legged Hawk (Galushin 1974). These predators have been shown to occur at lower densities when Small Mammal populations are low (Macpherson 1969, Galushin 1974, Gruyer et al. 2010). Also, at peak population densities, Small Mammals may consume as much as 15% of available vegetative forage (Krebs 1964), which may affect Ungulate grazing patterns.

4.3.4.2. BIRDS

4.3.4.2.1 *RAPTORS*

Status

Of the 10 Raptor species known to breed on mainland Nunavut (Richards et al. 2008), five species are expected to occur within the study areas: Short-eared Owl, Snowy Owl, Rough-legged Hawk, Peregrine Falcon, and Gryfalcon (Figure 10.9). In addition, Bald Eagle was observed during the field surveys. Of these, Peregrine Falcon and Short-eared Owl are listed as Special Concern federally (COSEWIC 2015); Short-eared Owl, Rough-legged Hawk, and Gyrfalcon are considered 'Sensitive' in Nunavut (CESCC 2011). Bald Eagle is considered 'Not at Risk' and 'Secure' in Canada and Nunavut, respectively (COSEWIC 2015, CESCC 2011). Elders have noted that, overall, there are more Raptors in the vicinity of the Project areas as compared with 20 years ago; however, owls are thought to be less common (Burt and Witteman 2014).

Species Presence within the Study Areas

Rough-legged Hawk, Peregrine Falcon, Gyrfalcon, and Bald Eagle were observed during the 2014 and 2015 field programs. Although owls were not observed, suitable habitat (i.e., high suitability habitat for Small Mammals) is present within the study area. Rough-legged Hawk, which was observed during the field program (Figure 9), has similar foraging habitat requirements as owls and primarily hunts Small Mammals. Peregrine Falcon and Gyrfalcon were both observed during the field program (Figure 9). These falcons specialize in hunting birds; therefore, habitats important to ptarmigan, waterfowl, and upland birds will be used for foraging (Court et al. 1988, NWT Species at Risk 2014).

Table 4-24: Overall Area of Raptor Habitat Suitability and Percentages

VEC, Season	Measurement	Habitat Suitability				
		H	M	L	Nil	No Data
Raptors (Growing Season)	Area (ha) of RSA	256,841	231,580	0	762	12,512
	Percent of RSA	51	46	0	0.2	2

Reproduction and Behaviour

Raptor nesting areas can be divided into ground-nesting habitat (i.e., Snowy and Short-eared owls) and cliff-nesting habitat (i.e., Rough-legged Hawk, Peregrine Falcon, and Gyrfalcon) (Pielou 1994, NWT Species at Risk 2014). Peregrine Falcon nests have been observed at heights of 4 to 26 m, typically on rocky outcrops and often near larger waterbodies (Court et al. 1988). Nest site fidelity is quite high for Peregrine Falcons, although the exact location of the nest may shift slightly on the same rocky outcrop (Court et al. 1988). Spacing of nests in a tundra environment has been observed to average 3.3 km, with no less than 700 m between nests (Court et al. 1988). Similarly, Gyrfalcons and Rough-legged Hawks also nest on rocky outcrops (Sale 2006). The Raptor nest surveys in 2015 found a total of 106 nesting sites, with 30 occupied and 76 unoccupied. Most occupied nests (21), which belonged to Peregrine Falcon, Gyrfalcon, and Rough-Legged Hawk, were on an east-west rocky ridge north of the Whale Tail study area. Unoccupied nests were found on this ridge as well. South of the Whale Tail site, only unoccupied and Peregrine Falcon nests were found.

4.3.4.2.2 *WATERFOWL*

Status

Eighteen duck species, six goose species, four loon species, and one swan species are confirmed as breeding within Nunavut (Richards et al. 2008, Pielou 1994). Of these, Canada Goose, Snow Goose, Long-tailed Duck, and loons were found to be the most abundant Waterfowl VECs. Of the Waterfowl species likely to occur within the Whale Tail study area, only Long-tailed Duck is listed as Sensitive in Nunavut (CESCC 2010). No Waterfowl species observed within the study areas is listed as a Species-at-Risk federally (COSEWIC 2015).

Species Presence within the Study Areas

The four goose species listed above feed primarily on plants such as grasses, sedges, legumes, horsetails, and various berries (Ehrlich et al. 1988). Important habitat is primarily concentrated around breeding, moulting, and staging areas (Latour et al. 2008). Graminoid-rich land classes (i.e., Wet Graminoid, Graminoid Tundra) provide staging habitat (Latour et al. 2008). Heath Tundra and Lichen/Rock Complex may also be utilized by geese as observed in the Meadowbank baseline terrestrial study (Cumberland Resources 2005a).

Geese are vulnerable to predation during their summer moult due to the temporary loss of flight feathers (Ehrlich et al. 1988). Known moulting areas in the region occur west of Aberdeen Lake along the Thelon River and east of Tehek Lake along the Tehert and Quoich rivers (Latour et al, 2008), both of which are outside of the study areas.

Long-tailed Duck and loons are deep diving species that feed on aquatic invertebrates and fish (Ehrlich et al. 1988). Important land classes for Long-tailed Duck and loons include Water, Wet Graminoid, Graminoid Tundra, Heath Tundra, and other lakeside areas.

Shoreline surveys located one Cackling Goose nest within the proposed development footprint of the Whale Tail Pit. No other waterfowl nests were detected within 100 m of any proposed development area and no feeding, moulting or breeding concentration areas were detected.

Table 4-25: Overall Area of Waterfowl Habitat Suitability and Percentages

VEC, Season	Measurement	Habitat Suitability				
		H	M	L	Nil	No Data
Waterfowl (Growing Season)	Area (ha) of RSA	138,958	55,868	293,596	762	12,512
	Percent of RSA	28	11	59	0.2	2

Reproduction and Behaviour

Geese within the study areas are primarily colonial or semicolonial breeders often forming associations with other goose species (Baicich and Harrison 1997). Nesting typically begins in early June and preferred sites are often grassy areas along rivers and lakes, and especially on islands (Baicich and Harrison 1997, Latour et al. 2008). Other breeding habitat may include land classes with low-lying vegetation including Heath Tundra (Cumberland Resources 2005a). Long-tailed Duck typically nests on Heath Tundra in close proximity to water bodies (often <10m) (Baicich and Harrison 1997, Ehrlich et al. 1988).

No Important Bird Areas (IBAs) are present within the study areas (BSC 2014), and evidence of Waterfowl breeding during the 2015 Waterfowl surveys was limited to a single Cackling Goose nest; no large colonies were observed. Furthermore, Canadian Wildlife Service has identified two key habitat sites for migratory waterfowl in the region, both of which are outside of the study areas (Alexander et al. 1991). Monitoring along the Meadowbank AWAR, which has occurred since 2005, suggests that low nesting occurrence of Waterfowl is typical in the area (Gebauer et al. 2013).

4.3.4.2.3 *UPLAND BREEDING BIRDS*

Status
Various upland breeding bird species, including Lapland Longspur, Horned Lark, American Pipit, White-crowned Sparrow, Savannah Sparrow, Snow Bunting, Willow Ptarmigan (*Lagopus lagopus*), and Rock Ptarmigan, were documented within Whale Tail study areas in 2014 and 2015 (Appendix 12). Several shorebirds including Semipalmated Sandpiper, Dunlin, Least Sandpiper, Semipalmated Plover, and American Golden Plover have also been observed in the study area.

Snow Bunting, American Pipit, White-crowned Sparrow, Semipalmated Sandpiper, and American Golden-Plover are listed as Sensitive in Nunavut (CESCC 2011), but none are listed federally (COSEWIC 2015). Elders in Baker Lake consider Upland Breeding Birds to be less common than they were in the past and attribute this to changes in climate (Burt and Witteman 2014).

Species Presence within the Study Areas
Upland Breeding Birds encompass a wide range of foraging guilds, including seed and insect feeding birds (e.g., Horned Lark and American Pipit), subterranean invertebrate feeders (e.g., Semipalmated Sandpiper), and more herbivorous feeders (e.g., Rock and Willow ptarmigan) (Custer and Pitelka 1977, Pielou 1994, Cadman et al. 2007); therefore, a wide range of ELC types are used (Figure 11).

Land types may include Heath Upland and Heath Tundra as well as rockier land classes such as Lichen/Rock Complex and communities found on the eskers (Figure 11) (Cumberland Resources 2005a, Cadman et al. 2007).

Lapland Longspur, Horned Lark, redpolls (Hoary and Common) and Savannah Sparrow, were the most abundant bird, and most frequently observed wildlife overall, throughout all study areas related to the Whale Tail Pit, borrow areas, and associated roads. Detailed abundance, density and diversity information for Upland Breeding Birds was gathered throughout the 2014 and 2015 field investigations (Appendices 7, 9, 10, and 12). The average breeding pair density for the Whale Tail Pit study area (and all associated borrow areas and roads) was found to be an average of 70 pairs per 100 ha. This is fairly consistent with findings from the Meadowbank study areas, which found a density of 63 pairs per 100 ha (Cumberland Resources 2005a).

Table 4-26: Overall Area of Upland Breeding Bird Habitat Suitability and Percentages

VEC, Season	Measurement	Habitat Suitability				
		H	M	L	Nil	No Data
Upland Breeding Birds (Growing Season)	Area (ha) of RSA	169,801	192,744	125,876	762	12,512
	Percent of RSA	34	38	25	0.2	2

Reproduction and Behaviour
Upland Breeding Birds arrive in the area between mid-April and mid-June. The period from egg-laying to fledging typically occurs between June and early August (Cumberland Resources 2005a). Nesting occurs for some species on well-drained areas with low, sparse vegetation (Pielou 1994, Baicich and

Harrison 1997); however, nesting habitat requirements are diverse for Upland Breeding Birds in general. Upland ELC types such as Lichen/Rock Complex, Heath Tundra, and Heath Upland are some examples of suitable nesting habitat. Specific nest sites can include scrapes on the ground hidden by vegetation), depressions or crevices along ridges and uplands, or within small shrubs (Baicich and Harrison 1997). During the 2015 field season, nests were located for various species including Lapland Longspur, Savannah Sparrow, American Pipit, Rock Ptarmigan, Semipalmated Plover, Semipalmated Sandpiper, Least Sandpiper, and Dunlin. The southward fall migration typically begins in mid-August (i.e., shorebirds) and continues until mid-September for later season migrants (i.e., Horned Larks)(Pielou 1994, Cumberland Resources 2005a).

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FIGURES

Legend

★ Whale Tail Pit & Haul Rd Project Location

Terrestrial Baseline Characterization Report

Project Location

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Nunavut ENVIRONMENTAL CONSULTING LTD

PROJECT: Whale Tail Pit & Haul Road

CLIENT: Agnico Eagle Mines Limited

N W E S UTM Zone 14 NAD83	DATE: NOVEMBER 2015
	SCALE: 1:8,000,000
	DRAWN BY: LC
	CHECKED BY: MAY

Figure:

1

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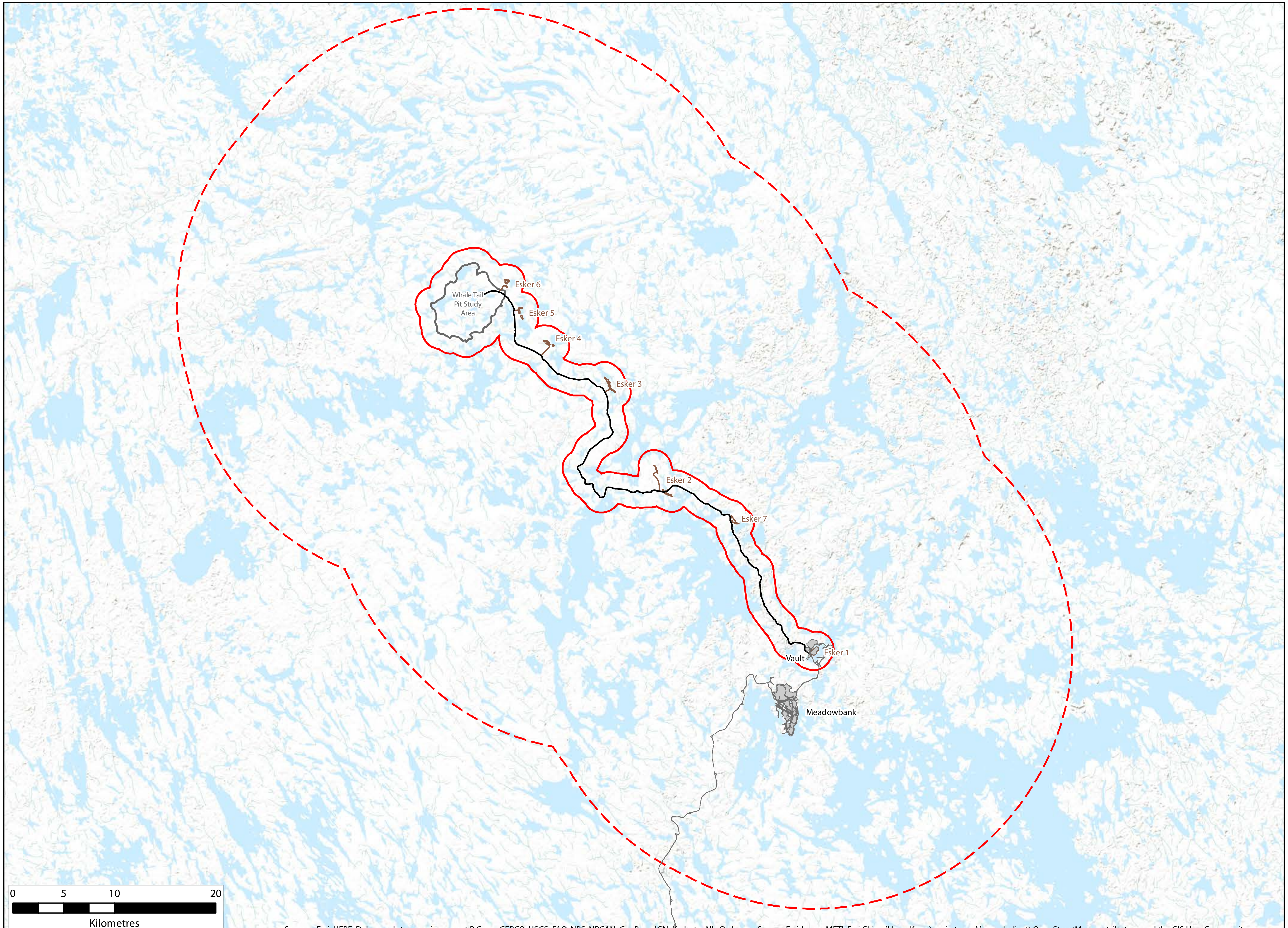

Legend

- Esker or Esker Access Road
- Proposed Haul Road (AEM, Nov. 2015)
- Mine Site
- Road
- Whale Tail Pit Study Area
- LSA Boundary
- RSA Boundary

Terrestrial Baseline Characterization Report

Baseline Study Area

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PROJECT: Whale Tail Pit & Haul Road

CLIENT: Agnico Eagle Mines Limited

N / S / W / E
UTM Zone 14 NAD83

DATE: NOVEMBER 2015
SCALE: 1:350,000
DRAWN BY: LC
CHECKED BY: MAY

Figure:
2

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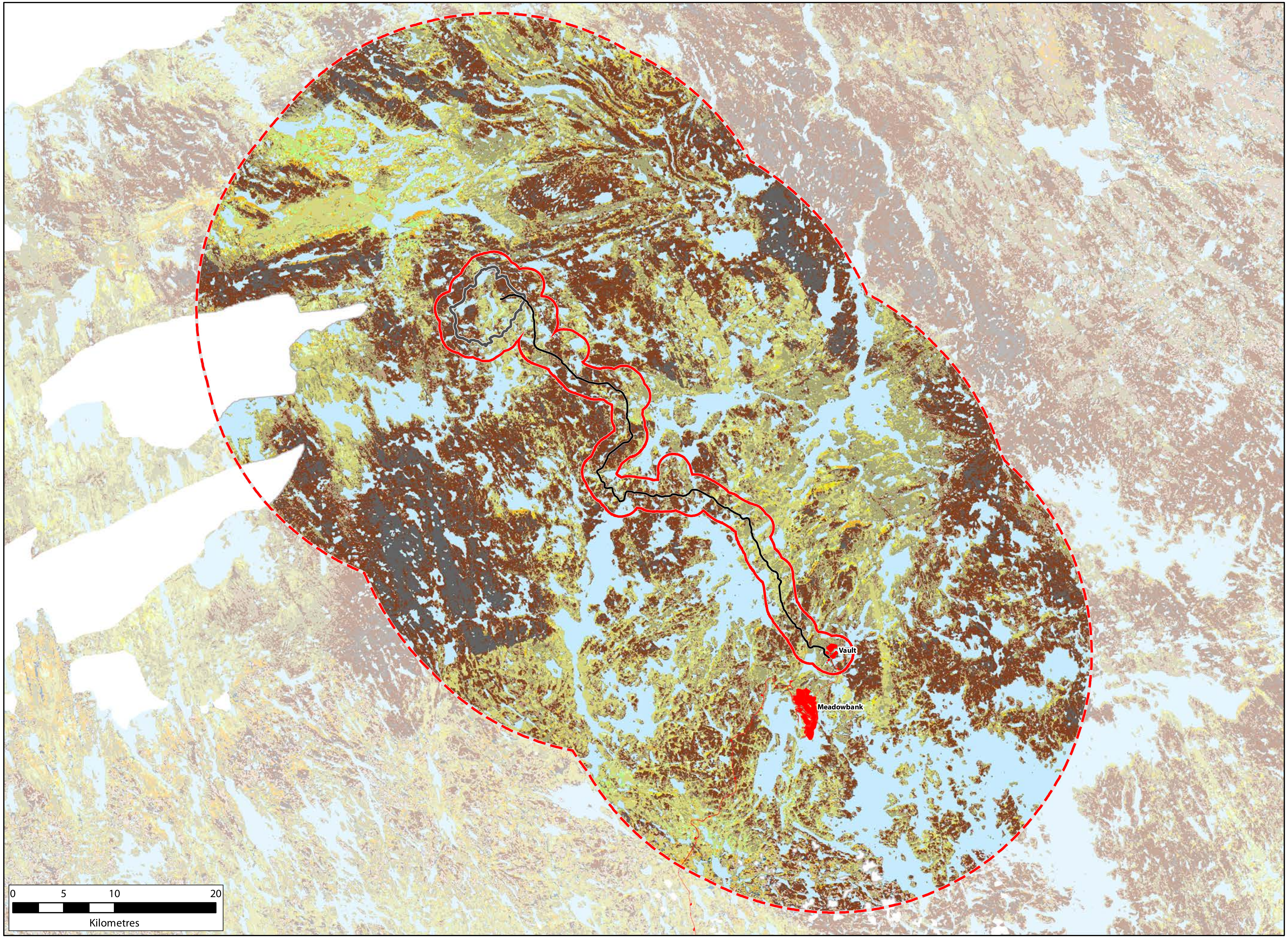

Legend

- Proposed Haul Road (AEM, Nov. 2015)
- Whale Tail Pit Study Area
- LSA Boundary
- RSA Boundary

ELC Class

- Water
- Wet Graminoid
- Graminoid Tundra
- Graminoid/Shrub Tundra
- Shrub Tundra
- Shrub/Heath Tundra
- Heath Tundra
- Heath Upland
- Heath Upland/Rock Complex
- Lichen Tundra
- Lichen/Rock Complex
- Sand
- Boulder/Gravel
- Disturbance *
- Cloud/Shadow

* The ELC disturbance labelled as 'Vault' is for display purposes only and is not reflected in the ELC Class calculations. The ELC Class data layer predates the construction of the Vault, Phaser & BB Phaser Pits.

Terrestrial Baseline Characterization Report

Ecological Land Classification

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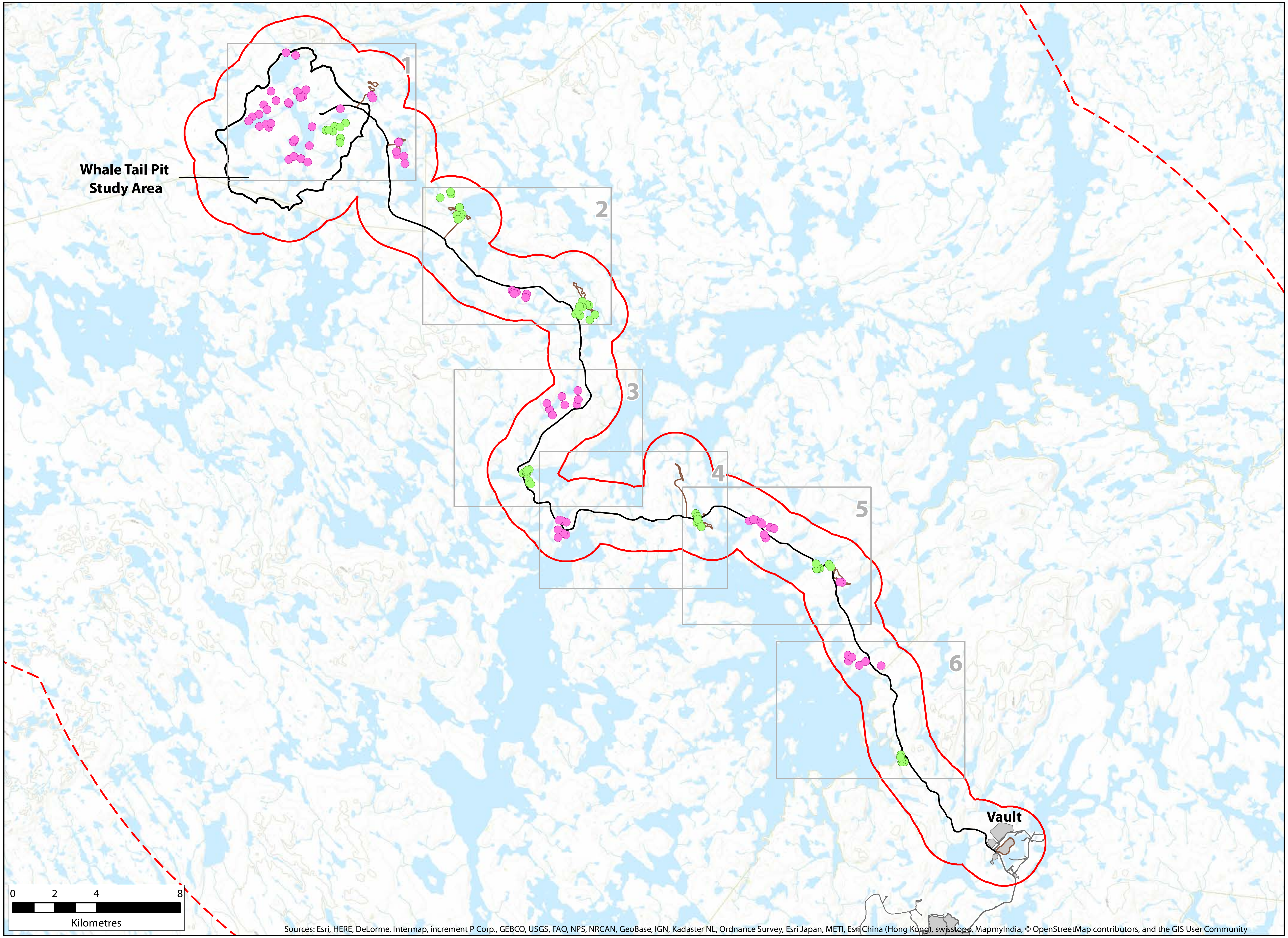
CLIENT: Agnico Eagle Mines Limited

N W E S
UTM Zone 14 NAD83

DATE: NOVEMBER 2015
SCALE: 1:350,000
DRAWN BY: LC
CHECKED BY: MAY

Figure:

3



Legend

- Esker or Esker Access Road
- Proposed Haul Road (AEM, Nov. 2015)
- Whale Tail Pit Study Area
- Mine Site
- Road
- Baseline Vegetation Plot Locations Map Extent
- LSA Boundary
- RSA Boundary

Vegetation Survey Plot

- 2014
- 2015

Terrestrial Baseline Characterization Report

Baseline Vegetation Plot Locations

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PROJECT: Whale Tail Pit & Haul Road

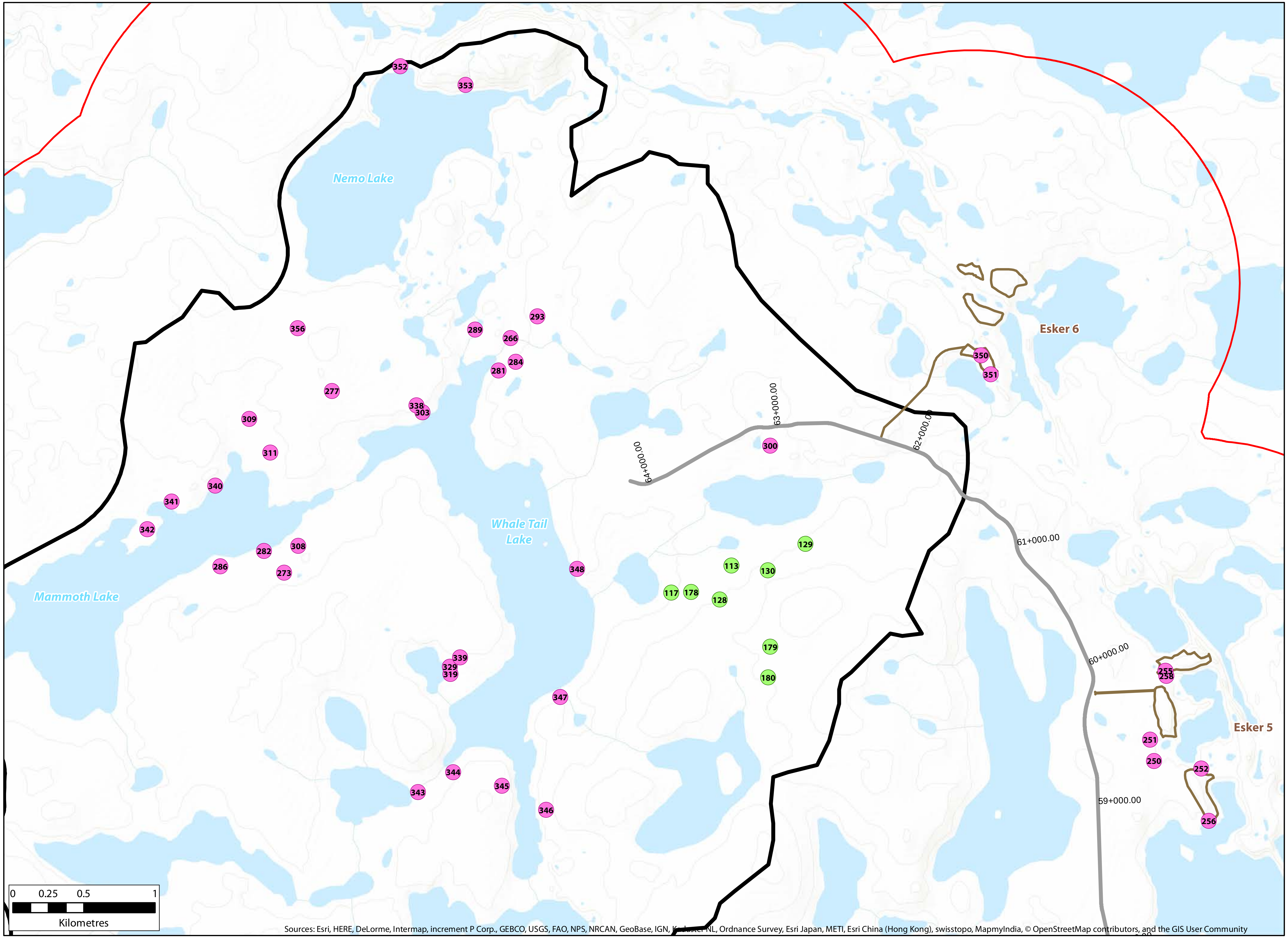
CLIENT: Agnico Eagle Mines Limited

N W E S
UTM Zone 14 NAD83

DATE: NOVEMBER 2015
SCALE: 1:170,000
DRAWN BY: LC
CHECKED BY: MAY

Figure:

4 - Key Map



Legend

Esker or Esker Access Road

Proposed Haul Road (AEM, Nov. 2015)

Whale Tail Pit Study Area

LSA Boundary

RSA Boundary

Vegetation Survey Plot

2014

2015

Terrestrial Baseline Characterization Report

Baseline Vegetation Plot Locations

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Nunavut ENVIRONMENTAL CONSULTING LTD

PROJECT: Whale Tail Pit & Haul Road

CLIENT: Agnico Eagle Mines Limited

N W E S
UTM Zone 14 NAD83

DATE: NOVEMBER 2015

SCALE: 1:25,000

DRAWN BY: LC

CHECKED BY: MAY

Figure:

4.1

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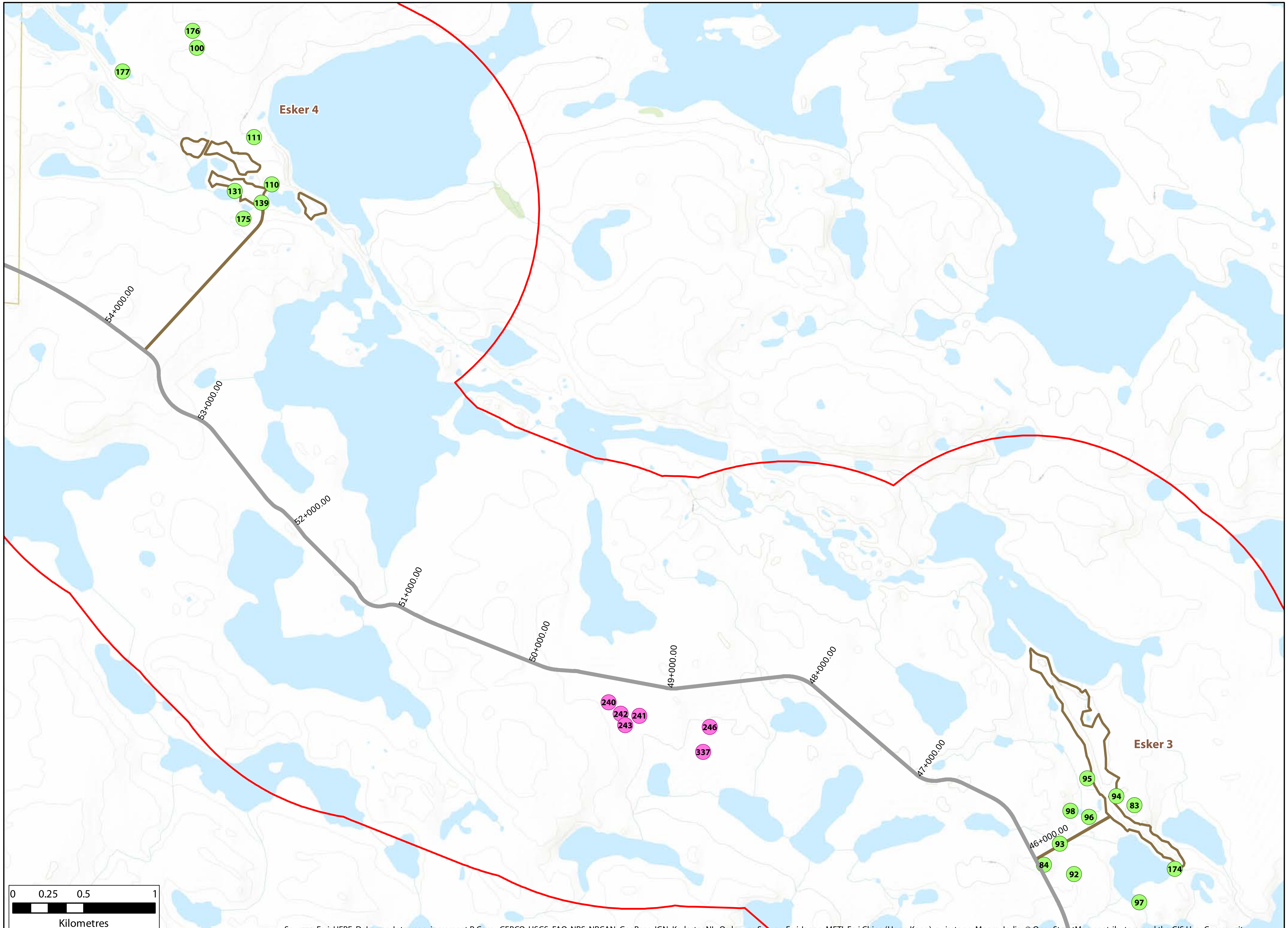

Legend

- Esker or Esker Access Road
- Proposed Haul Road (AEM, Nov. 2015)
- LSA Boundary
- RSA Boundary

Vegetation Survey Plot

- 2014
- 2015

Terrestrial Baseline Characterization Report

Baseline Vegetation Plot Locations

DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN

Nunavut ENVIRONMENTAL CONSULTING LTD

PROJECT: Whale Tail Pit & Haul Road

CLIENT: Agnico Eagle Mines Limited

N W E S
UTM Zone 14 NAD83

DATE: NOVEMBER 2015
SCALE: 1:25,000
DRAWN BY: LC
CHECKED BY: MAY

Figure:

4.2

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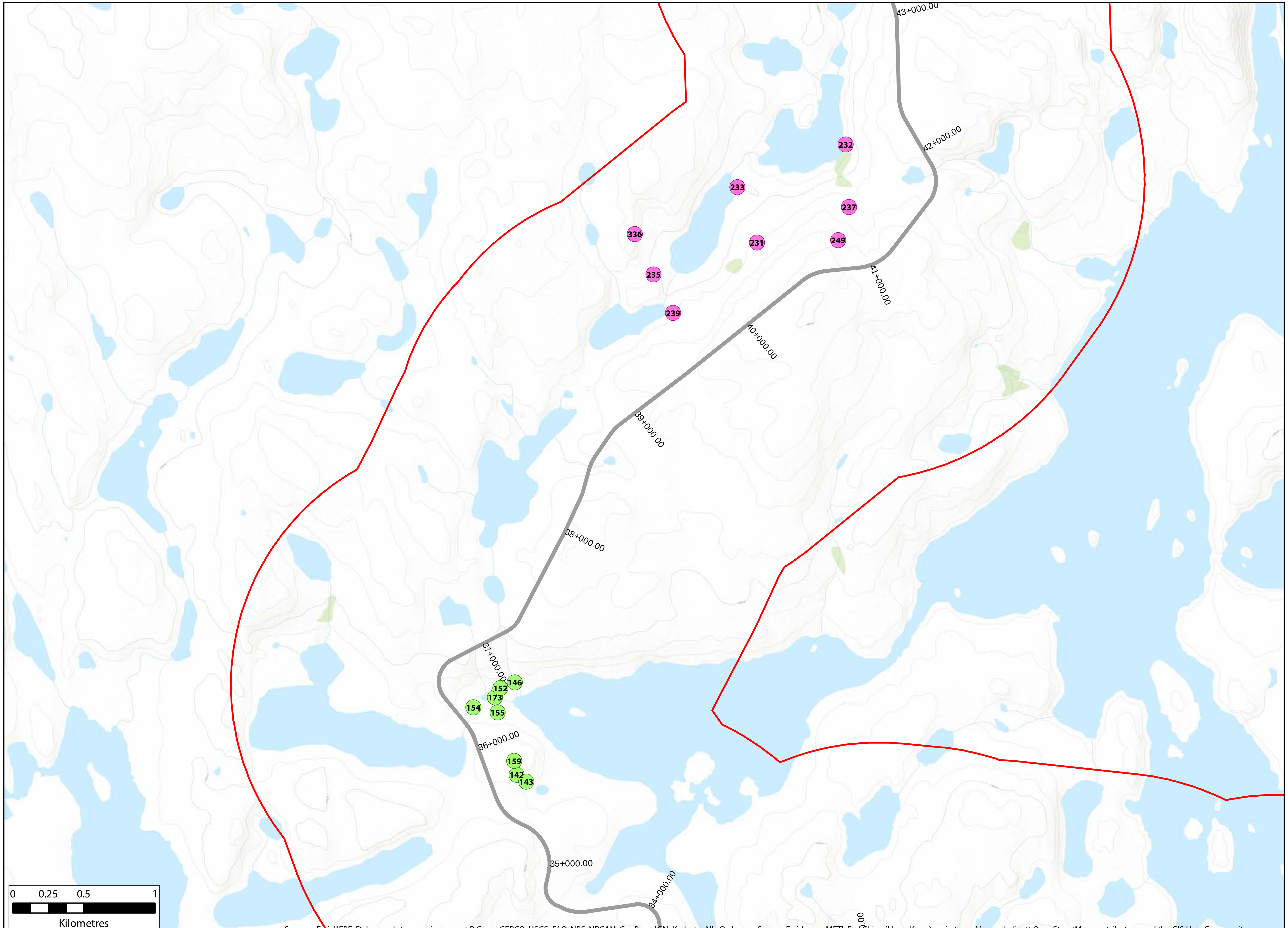

Legend

- Proposed Haul Road (AEM, Nov. 2015)
- LSA Boundary
- RSA Boundary

Vegetation Survey Plot

- 2014
- 2015

Terrestrial Baseline Characterization Report

Baseline Vegetation Plot Locations

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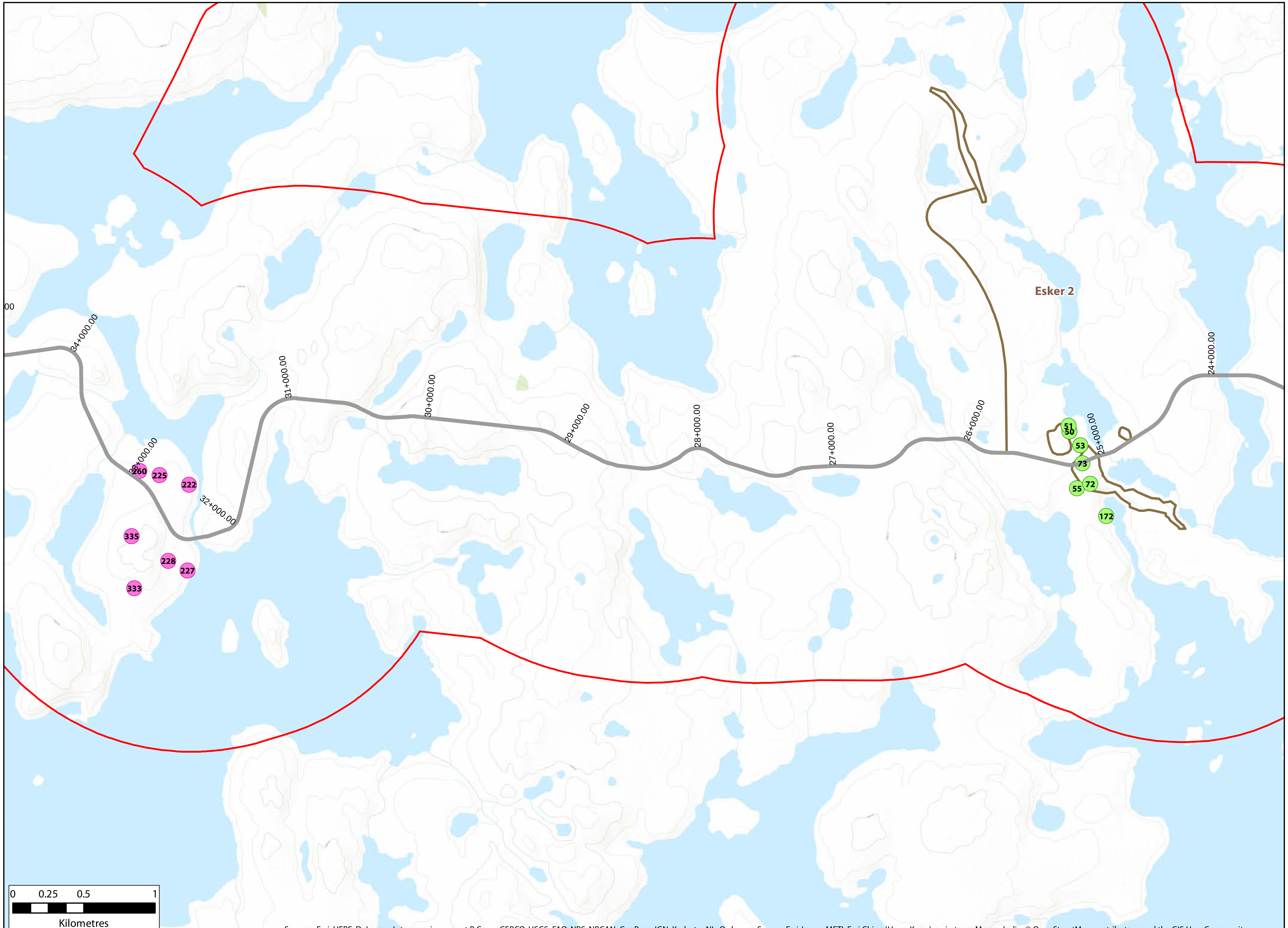
PROJECT: Whale Tail Pit & Haul Road

CLIENT: Agnico Eagle Mines Limited

N W E S
UTM Zone 14 NAD83

DATE: NOVEMBER 2015
SCALE: 1:25,000
DRAWN BY: LC
CHECKED BY: MAY

Figure: 4.3



Legend

- Esker or Esker Access Road
- Proposed Haul Road (AEM, Nov. 2015)
- LSA Boundary
- RSA Boundary

Vegetation Survey Plot

- 2014
- 2015

Terrestrial Baseline Characterization Report

Baseline Vegetation Plot Locations

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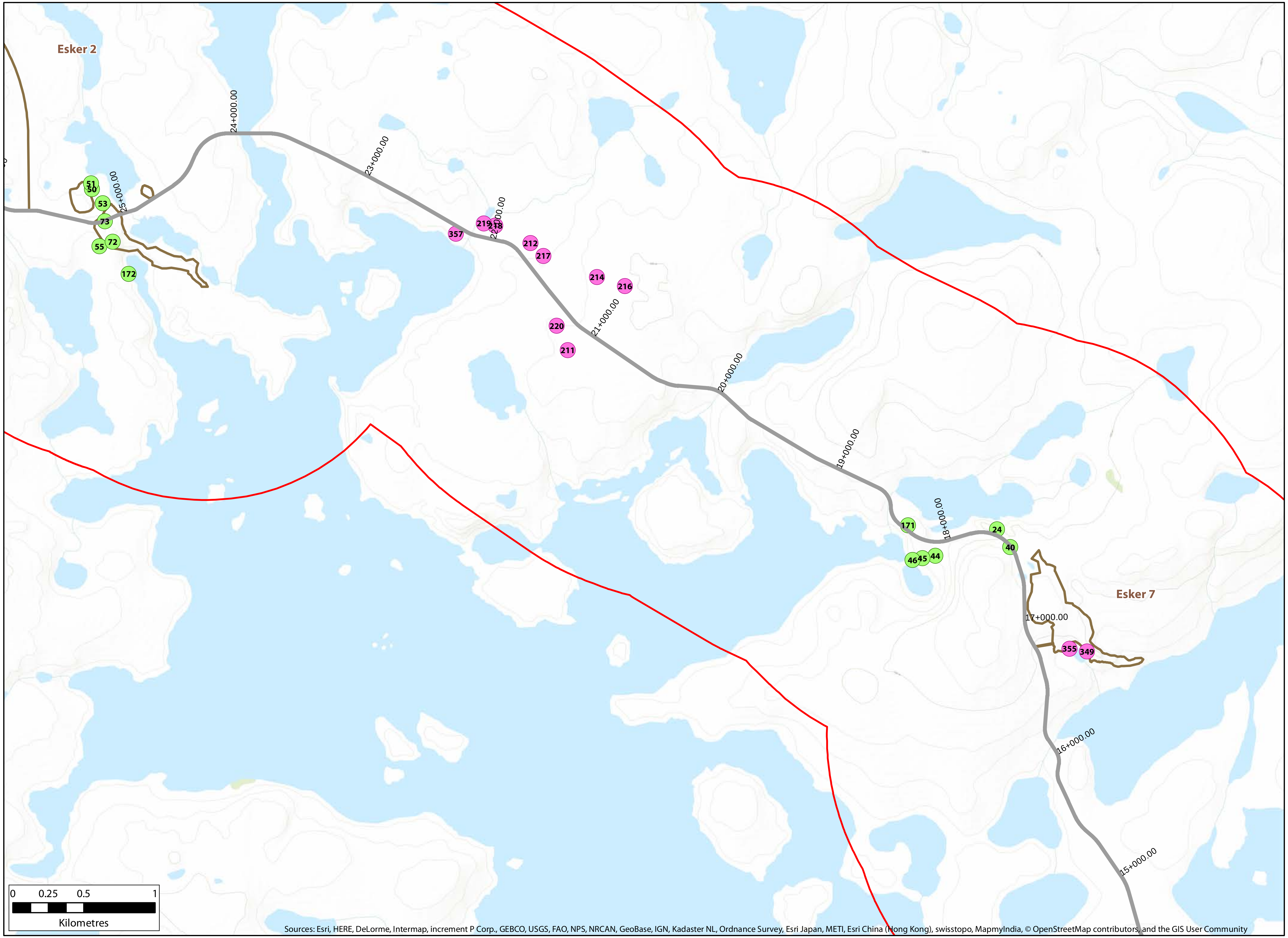
N W E S
UTM Zone 14 NAD83

DATE: NOVEMBER 2015
SCALE: 1:25,000
DRAWN BY: LC
CHECKED BY: MAY

Figure:
4.4



Legend

- Esker or Esker Access Road
- Proposed Haul Road (AEM, Nov. 2015)
- LSA Boundary
- RSA Boundary

Vegetation Survey Plot

- 2014
- 2015

Terrestrial Baseline Characterization Report

Baseline Vegetation Plot Locations

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PROJECT: Whale Tail Pit & Haul Road

CLIENT: Agnico Eagle Mines Limited

N S W E
UTM Zone 14 NAD83

DATE: NOVEMBER 2015

SCALE: 1:25,000

DRAWN BY: LC

CHECKED BY: MAY

Figure:

4.5

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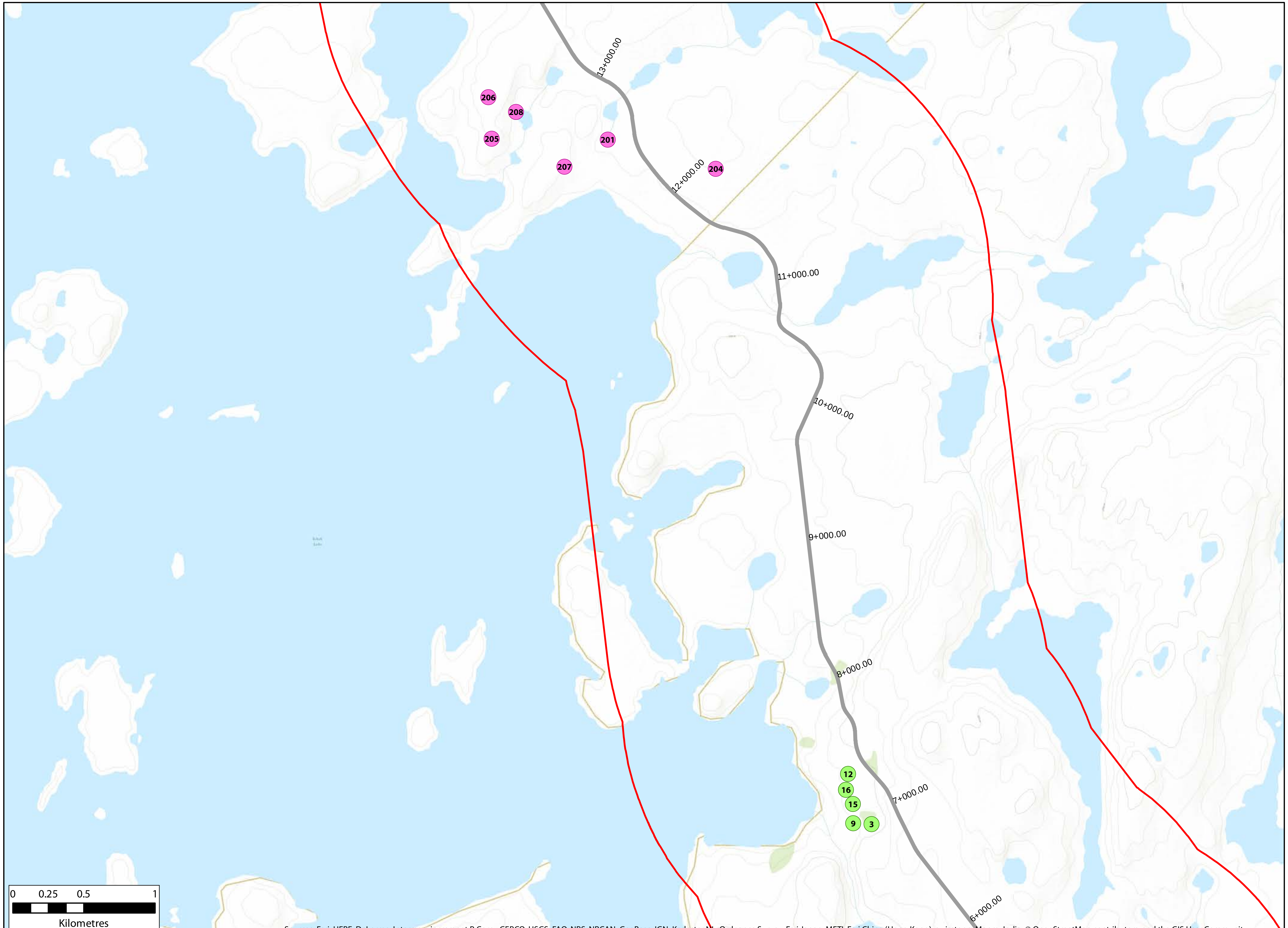

Legend

Proposed Haul Road (AEM, Nov. 2015)

LSA Boundary

RSA Boundary

Vegetation Survey Plot

2014

2015

Terrestrial Baseline Characterization Report

Baseline Vegetation Plot Locations

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Nunavut ENVIRONMENTAL CONSULTING LTD

PROJECT: Whale Tail Pit & Haul Road

CLIENT: Agnico Eagle Mines Limited

N W E S
UTM Zone 14 NAD83

DATE: NOVEMBER 2015
SCALE: 1:25,000
DRAWN BY: LC
CHECKED BY: MAY

Figure:
4.6

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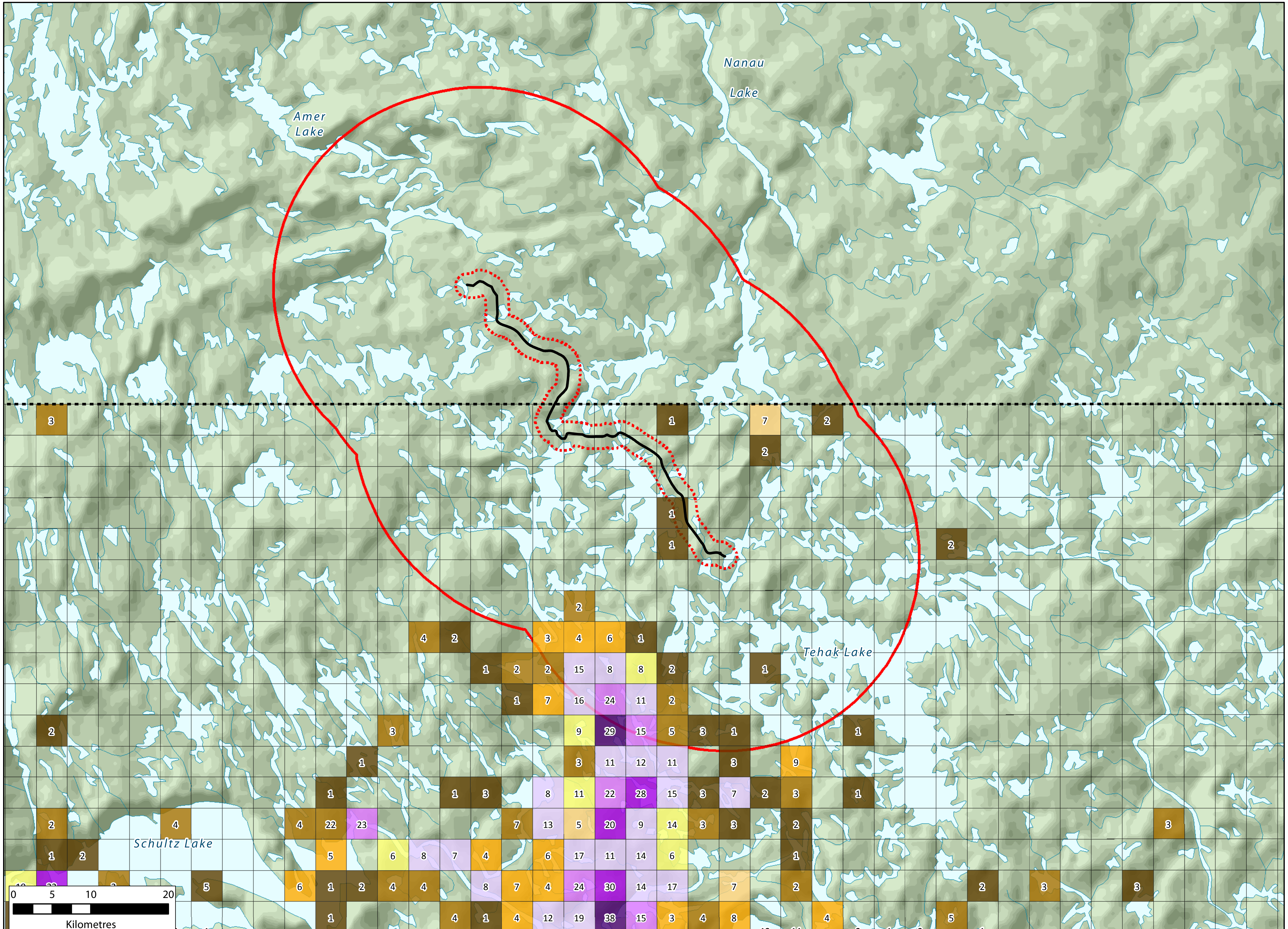

Legend

- Proposed Road
- RSA Boundary
- LSA Boundary
- 2014 Harvest Study Extent

Number of Trips*

- n No Harvest Reported
- 1
- 2
- 3
- 4
- 5
- 6 - 10
- 11 - 15
- 16 - 20
- > 20

* The number in each cell indicates the number of animals harvested. The colour of the cell indicates the number of trips to that cell.

Terrestrial Baseline Characterization Report
Baker Lake Hunter Harvest Study (2007 - 2014)

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Nunavut Environmental Consulting Ltd

CASLYS Consulting

PROJECT: Whale Tail Pit & Haul Road

CLIENT: Agnico Eagle Mines Limited

N W E S
UTM Zone 14 NAD83

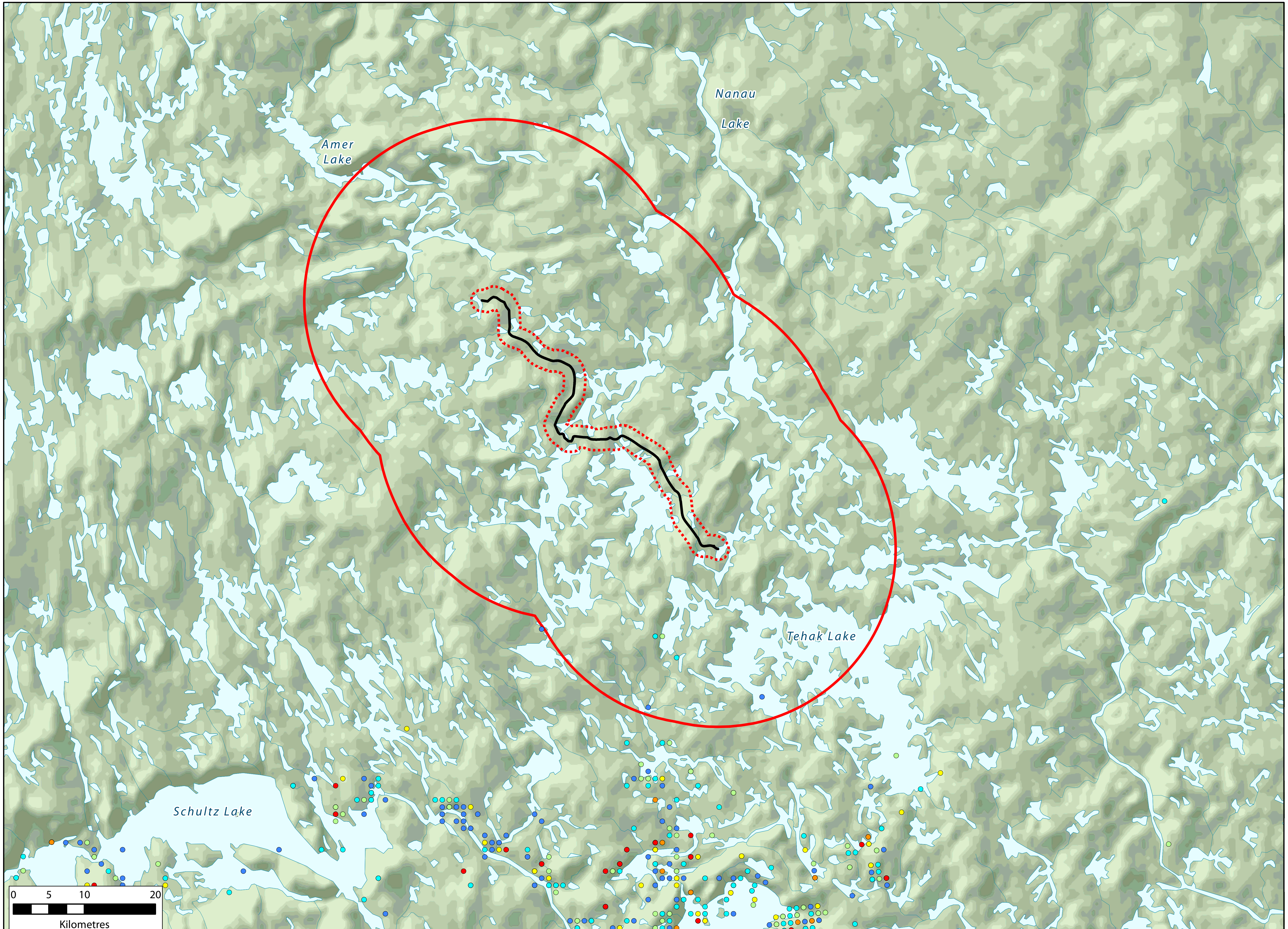
DATE: NOVEMBER 2015

SCALE: 1:458,046

DRAWN BY: Caslys

CHECKED BY: MG, MAY

Figure:
5



Legend

- Proposed Road
- RSA Boundary
- LSA Boundary

Number of Animals Harvested*

- 0
- 1
- 2
- 3
- 4
- 5
- >5

* Harvest distribution data are not available for the full extent of the Regional Study Area. The results depicted are for caribou, muskox and grizzly bear.

Terrestrial Baseline Characterization Report
Nunavut Wildlife Management Board (NWMB) Harvest Study (2005)

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CASLYS CONSULTING

PROJECT: Whale Tail Pit & Haul Road

CLIENT: Agnico Eagle Mines Limited

N W E S
UTM Zone 14 NAD83

DATE: OCTOBER 2015
SCALE: 1:500,000
DRAWN BY: Caslys
CHECKED BY: MG, MAY

Figure:
6

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