# Wildlife Baseline Report

# Kudz Ze Kayah Project

BMC-16-01-485_006_Wildlife Baseline Report_Rev0_161219

December 19, 2016

Prepared for:

BMC Minerals (No. 1) Ltd.

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# EXECUTIVE SUMMARY

The Kudz Ze Kayah (KZK) Project (the Project) is a proposed mine located in Yukon Territory, approximately 260 km northwest of Watson Lake and 115 km southeast of Ross River, within the Yukon Plateau-North Ecoregion, part of the Canadian Boreal Cordillera Ecozone. The Project lies within the traditional territory of the Kaska First Nation (Ross River Dena Council and Liard First Nation). In 2015, BMC Minerals (No. 1) Ltd. (BMC) retained Alexco Environmental Group Inc. (AEG) to conduct baseline wildlife studies at KZK, including terrestrial wildlife studies. In 2016, AEG completed a second year of baseline wildlife studies (at the request of BMC), to be used towards the submission of a project proposal to the Executive Committee of the Yukon Environmental and Socio-economic Assessment Board (YESAB). The report herein is a presents the 2015 and 2016 baseline monitoring and wildlife surveys, habitat suitability mapping, as well as a summary of existing information and historical studies previously completed at the Project site.

A focus of the baseline monitoring studies was the Finlayson caribou herd (FCH). The FCH is of ecological, economic, and cultural importance in the region, to both the Kaska First Nation (Kaska), public viewing, and resident or guided hunters. The herd is part of the Northern Mountain caribou population (*Rangifer tarandus caribou*), assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a species of special concern, and listed as such under the *Species at Risk Act* (SARA) in 2005. The FCH uses the uplands around KZK in the spring, summer, and fall for calving and rutting, and the lowlands of the Pelly River for overwintering. The Project is located in key caribou rut habitat (Department of Environment Map ID: ENV.WKA.104G Set 2). As part of the baseline study, four different surveys (early winter, late winter, post calving, and rut) were performed annually to assess the spatial and temporal distribution of FCH throughout the year within the Project area.

The 2015 late winter survey found a total of 19 caribou, compared to 142 during the 2016 late winter survey. One explanation for the difference in observations could be the low snowpack during the winter of 2016 near Finlayson Lake. The low snowpack in the northern half of the study area may have allowed the caribou to remain close to their post calving and rutting areas throughout the winter, rather than forcing them further west to their traditional winter range near Pelly River.

The 2015 post calving survey found a total of 12 calves and 61 cows. The lower number observed in 2015 may have been a result of poor weather conditions during the survey. During the post calving survey, up to 90% of caribou observations are made on snow patches where the animals congregate to avoid the heat and insects; however, when the weather is cool and windy, the caribou do not need the snow patches. In 2015, the survey was conducted during cool, damp, and windy conditions making caribou observations more difficult to obtain. During the 2016 post calving survey, a total of 147 caribou were observed of which there were 103 cows, 18 calves, 11 immature bulls, 11 mature bulls, and 4 unclassified. For comparison, the total number of cows observed in 1995, 2015, and 2016 was 184, 61, and 103, respectively, and the total number of calves observed was 120, 12, and 18, respectively. In 1995, the herd was larger due to the wolf control program.

The 2015 rut survey observed a total of 712 caribou (449 cows, 123 calves, 62 immature bulls, and 78 mature bulls) suggesting that caribou are present within and adjacent to the Project site during the rutting period. Observations resulted in a recruitment rate of 27:100 and a bull to cow sex ratio of 31:100. The sex ratio is below average for this herd, and just above the management guideline of a minimum of 30 bulls per 100 cows to ensure all females are bred. The recruitment rate was higher than the long-term average for the herd, and only slightly higher than the stable recruitment rate of 26 calves per 100 adult cows. Similar results were observed in the 2016 rut survey. In October 2016, a total of 660 caribou were observed in 60 groups with 27 calves per 100 cows and 39 bulls per 100 cows.

There were 64 and 86 separate caribou observations recorded in the KZK camp wildlife log during the 2015 and 2016 exploration field seasons, respectively. The highest frequency of observations occurred during late August and October. In October, large groups of caribou were observed (groups ranging from 5 to 30 individuals), coinciding with the rut period when caribou aggregate on alpine plateaus and ridges.

Likewise, moose (*Alces alces*) are a significant wildlife resource to the Kaska Nation, resident, and guided hunters alike. Two different surveys (late winter and post rut) were conducted to assess moose distribution patterns and abundance within the Project area. During the 2015 late winter survey, a total of 31 moose were observed, as compared to 152 during the 2016 late winter survey. Explanations for the difference in observations between years could be the amount of time spent performing each survey, the fresh snowfall prior to the 2016 survey allowed for easier detection, and the lower snowpack in 2016. Moose were primarily observed using flat or gently sloping terrain close to streams with plenty of shrub understory. In addition, moose were mainly found at higher elevations (particularly in 2016), and more bull moose were observed above treeline than cows. Furthermore, it was observed that moose make use of the Tote Road and drill trails for efficient movement through the Project area. Results of the 2015 and 2016 post rut aerial survey found a total of 114 and 154 moose, respectively. They were mainly utilizing the upland portion in the east, south and west of the Project site.

Thinhorn sheep (*Ovis dalli*) were not formally surveyed because the local study area (LSA) was not identified by Yukon Government to host any wildlife key areas for sheep. Incidental sheep observations were made in 2015 and 2016. A total of 36 observations were made in 2015, and eight were made in 2016. These observations were made on the mountains south of the North Lakes (approximately 6 km away from the Project). It is possible these sheep were observed more than once given the observations were made over multiple visits and sometimes in the same location.

Grizzly bear (*Ursus arctos*) den surveys were conducted in 2015 and 2016. In 2015, three bear den surveys were conducted on April 23, May 4, and May 15. An active den was found approximately 4.5 km southwest of the Project site. It was located on a south facing slope at approximately 1,500 m elevation, a few meters above the treeline. A sow and two cubs were observed about 500 m from the den site, and mud and tracks were observed around the den entrance. In 2016, two bear den surveys were conducted on April 19 and April 27. During the earlier survey, a grizzly sow and sub-adult cub (2+ years old) were observed, approximately 3.5 km from the Project site. During the second survey flight, an active grizzly bear den was discovered within 0.5 km of the grizzly bear observation made on April 19; the tracks by the den entrance indicated a sow grizzly with a young cub. Two freshly dug dens were observed during the 2016 caribou rut count.

Other predators within the Project area include black bear (*Ursus americanus*) and grey wolf (*Canis lupus*). Although no targeted surveys were conducted for these species other than a March 2016 snow track survey, multiple incidental observations have been recorded. Black bear observations have only been recorded at lower elevation sites along the Tote Road. Wolf sightings and tracks have been reported during various surveys, as well as by BMC employees and contractors. Wolf observations have been made throughout the LSA from alpine ridges to the boreal forest. Following the wolf control program in the 1980s, wolf populations in the Finlayson Lake area have recovered to regional pre-control numbers of approximately 240.

Other furbearer species, such as wolverine (*Gulo gulo*), red fox (*Vulpes vulpes*), and lynx (*Lynx canadensis*) are present within the LSA, though little is known about their abundance or distribution in the region. Incidental observations of these species are reported in addition to the March 2016 snow track survey. Evidence of historic use of Geona Creek and Finlayson Creek by beaver (*Castor canadensis*) is confirmed by the presence of old dams and lodges. In 2015, a beaver survey was conducted along Geona Creek; however, no sign of recent beaver activity was observed. In 2016, a follow-up beaver survey was conducted in the upper reaches of Geona Creek, and again there was no sign of active beaver use. However, there was evidence of recent beaver activity approximately 2.5 km upstream from the confluence with Finlayson Creek in the form of freshly gnawed willow stems and beaver trails.

Collared pika (*Ochotona collaris*) and hoary marmot (*Marmota caligata*) were observed on multiple mountains throughout the LSA; however, most observations were on mountains to the south and west of the proposed Project footprint. Pika were observed at high elevation sites that exhibited large, talus rock with crevices below that may provide cover. Although the COSEWIC conservation rank for collared pika is special concern, the Yukon conservation rank is listed as secure. Given the frequency of observations made in 2015 and 2016, it is suspected that collared pika and hoary marmot are present throughout the LSA at all high elevation sites with suitable habitat.

There are three species of bat known to exist in Yukon, only one of which is expected to be found in the LSA, the little brown bat (*Myotis lucifugus*). A bat detector was installed at a wetland in the Geona Creek valley for one week in August of 2015; no recordings were identified. It was suspected that the wetland may not be suitable bat habitat given the subalpine elevation. Therefore, two detectors were installed in 2016 at two different wetlands in boreal forest habitat along the Tote Road. Both detectors had successful recordings of *Myotis spp*, assumed to be *M. lucifugus*.

A total of 42 bird species were observed during surveys conducted in 2015, and 61 species were observed in 2016. Among these species, five are reported as at risk by COSEWIC (COSEWIC, 2002a). Olive-sided flycatcher (*Contopus cooperi)*, bank swallow (*Riparia riparia)*, and barn swallow (*Hirundo rustica)* are considered threatened, while red-necked phalarope (*Phalaropus lobatus)*, and rusty blackbird (*Euphagus carolinus)* are considered special concern. The most frequently observed species were white-crowned sparrow (*Zonotrichia leucophrys*), American tree sparrow (*Spizella arborea*) and Wilson's warbler (*Cardellina pusilla*). A total of five habitat types were surveyed including riparian, wetland, alpine, mixed subalpine, and boreal forest. The greatest diversity of birds was observed in the wetland habitat. A golden eagle (*Aquila chrysaetos)* nest was active in 2015 and 2016, presumably by the same pair. The nest is located within LSA. A northern harrier (*Circus cyaneus*) nest was also located in the LSA in the headwater wetlands of Geona Creek. Other raptor species observed in the Project area include bald eagle (*Haliaeetus leucocephalus*) and gyrfalcon (*Falco rusticolus*). Ptarmigan (*Lagopus* sp.) were frequently observed in the high elevation habitat around the Project area. Spruce grouse (*Falcipennis canadensis*) were often seen along the Tote Road.

Habitat suitability maps were prepared for the chosen valued subcomponents in the effects assessment, to assess habitat changes predicted to occur from Project development. Habitat suitability modelling, mapping, and verification for caribou and moose are presented in separate reports. Habitat suitability maps for grizzly bear, bat, collared pika, olive-sided flycatcher, waterfowl, and cliff-nesting raptors are included in this report in their respective sections.

This report provides the basis for the wildlife effects assessment and development of mitigation and management plans for the Project.

# LIST OF ACRONYMS

| | |
|---|---|
| AAH | Annual Allowable Harvest |
| AEG | Alexco Environmental Group Inc. |
| BBS | Breeding Bird Survey |
| BC | British Columbia |
| BMC | BMC Minerals (No. 1) Ltd. |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| DEM | Digital Elevation Model |
| EDI | Environmental Dynamics Inc. |
| FCH | Finlayson caribou herd |
| FLSA | Finlayson Lake Study Area |
| GIS | Geographic Information System |
| GMS | Game Management Subzone |
| GMZ | Game Management Zone |
| HSI | Habitat Suitability Index |
| IEE | Initial Environmental Evaluation |
| Kaska | Kaska First Nation |
| KZK | Kudz Ze Kayah |
| LSA | Local Study Area |
| masl | Metres above sea level |
| MMU | Moose Management Unit |
| NABCI | North American Bird Conservation Initiative |
| NMP | Northern Mountain Population |
| NT | Northwest Territories |
| RRDC | Ross River Dena Council |
| RSA | Regional Study Area |
| SARA | Species at Risk Act |
| VC | Valued Component |
| WNS | White-nose syndrome |
| WKA | Wildlife Key Area |
| YCDC | Yukon Conservation Data Centre |
| YESAB | Yukon Environmental and Socio-economic Assessment Board |
| YG | Yukon Government |
| ZOI | Zone of Influence |

# GLOSSARY

**Digital Elevation Map:** a digital model or 3D representation of a terrain's surface.

**Geographic Information System:** a computer system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.

**Committee on the Status of Endangered Wildlife in Canada:** a committee of experts that assesses and designates which wildlife species are in some danger of disappearing from Canada.

**Game Management Subzone:** a legal boundary delineated by creeks and rivers that defines an area within which big game management objectives can be met through the setting of area specific regulations. Together these form the larger Game Management Zones.

**Game Management Zone:** a legal boundary delineated by highway centerlines that defines an area within which big game management objectives can be met through the setting of area specific regulations, and are comprised of many Game Management Subzones.

**Habitat Suitability Index:** a tool for predicting the suitability of habitat for a given species based on known affinities with environmental parameters.

**Initial Environmental Evaluation:** a previous body of work completed at Kudz Ze Kayah in the 1990's by Norecol, Dames and Moore Inc., which included wildlife baseline surveys.

**Kaska First Nation:** a transboundary Nation involving Kaska people from the Ross River Dena Council and Liard First Nation in southeastern Yukon, and Daylu Dena Council, Dease River First Nation and Kwadacha Nation in northern British Columbia.

**Local Study Area:** the area encompassing a 3 km buffer surrounding the proposed project infrastructure and a 1.5 km buffer around the Tote Road.

**Moose Management Unit:** a designated boundary used to help manage moose populations in Yukon. The MMU can consist of as few as 1 or as many as 23 Game Management Subzones.

**Northern Mountain Population:** a distinct ecotype of woodland caribou that have unique habitat preferences and behaviour.

**Orographic:** of or relating to mountains, especially with regard to their position and form.

**Recruitment Rate:** the ratio of calves relative to the number of adult females.

**Regional Study Area:** the area encompassed by Game Management Subzone 10-07. This was the study area used for post rut moose and late winter ungulate surveys.

**Wildlife Key Area:** areas designated by Yukon Government as especially important for wildlife, specifically during certain seasonal life functions (e.g., rutting, lambing, and breeding).

**Yukon Environmental and Socio-economic Assessment Board**: an independent arms-length body, responsible for implementation of the assessment responsibilities under the Yukon Environmental and Socio-economic Assessment Act.

**Zone of Influence:** the spatial area of influence affecting an animal's behaviour caused from mining activities.

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# 1. INTRODUCTION

## 1.1 BACKGROUND

BMC Minerals (No. 1) Ltd. (BMC) retained Alexco Environmental Group Inc. (AEG) to conduct wildlife baseline studies at its Kudz Ze Kayah (KZK) property (i.e., the Project) to update and expand existing baseline information for the Project area. Previous wildlife surveys for the Project were conducted by Norecol, Dames and Moore Inc. in the 1990s, which supported the 1996 Initial Environmental Evaluation (IEE) for Cominco Ltd., then-owners of the KZK property (Appendix A). These data were submitted for regulatory review in March 1996 in support of Cominco's original project development application and contributed to a positive assessment and licensing outcome for the proponent at that time.

AEG conducted a review of the IEE in relation to current regulatory criteria contained in the Yukon Environmental and Socio-economic Assessment Board's (YESAB) *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions*, and the Yukon Water Board's *Type A and B Quartz Mining Undertakings Information Package for Applicants*. Data provided in the IEE were also compared to data submitted in other baseline studies for similar projects in Yukon. Furthermore, the 1996 surveying protocols were compared to the most recent protocols recommended by Yukon Government (YG).

It was determined that much of the 1990's wildlife baseline information required updating or was insufficient to meet the current standards. For example, the previous studies did not include surveys of the surrounding zone of influence (ZOI) which is important when assessing project effects on species that may be wide ranging or sensitive to disturbance. As well, the surveys were localized and mostly concentrated on the Tote Road and Project footprint or a smaller LSA. Study areas required adjustment to properly characterize wildlife resources to support the current Project proposal. Additionally, Project-specific wildlife surveys were conducted 19 years ago and changes to wildlife distribution patterns may have occurred.

Baseline data reported in the *Wolverine Project: Environmental Assessment Report (2005)* was also reviewed, as it was assumed that baseline wildlife data collected for the Wolverine environmental assessment report may add value to the baseline report for KZK due to the proximity of the two sites (approximately 25 km apart). However, the data used in the baseline report for the Wolverine environmental assessment was mostly historical data collected by YG biologists, which had already been incorporated into the KZK baseline program. The only field surveys completed for the Wolverine baseline study were aerial wetland and beaver lodge surveys. Incidental wildlife observations were recorded during these flights, but the results were not included in the baseline report.

Lastly, wildlife baseline data from the Ketza Mine (92 km to the northwest) were reviewed, but were not included as the study areas do not overlap and wildlife habitat and species use is dissimilar (EBA, 2008).

## 1.2 SCOPE AND OBJECTIVES

Based on the review of historical information, and with input from Environment Canada assessment officers and YG biologists, AEG developed a two-year (2015 and 2016) wildlife baseline program to include expanded study areas where appropriate, as well as resurveying areas close to and within the proposed Project footprint. The 2015-16 wildlife baseline program included directed surveys for caribou, moose, grizzly bear, beaver, collared pika, hoary marmot, bats, breeding birds, raptors, and other small mammals. No directed surveys were conducted for sheep or black bear, although incidental observations were recorded and reported. Wildlife cameras were also installed to capture incidental wildlife observations at selected locations. In addition to the collection of new data, the baseline report summarized and integrated historical data including data from the IEE and government survey data.

The objectives of the 2015-16 wildlife baseline program were to:

1) Identify wildlife valued components (VC) within the KZK area. These are species listed by SARA and/or have cultural and economic value that may be affected by mine development and operations;

2) Design and implement studies to ensure adequate information is collected so existing wildlife dynamics of the Project and adjacent lands are understood;

3) Identify high value wildlife habitat associated with VCs within the LSA; and

4) Quantify wildlife parameters in such a way that changes can be detected through regular monitoring, and management and mitigation measures can be developed to minimize effects.

For each wildlife species assessed in this report, the following information has been provided: i) a brief description of the species; ii) overview of any previous data; iii) description of the survey methodology; iv) results and observations; and v) discussion about the implications of the results and comparison to previous studies.

To further support the Project effects assessment, habitat suitability mapping was completed for species chosen as valued subcomponents. To this end, habitat suitability mapping was completed for caribou and moose and is presented in two separate reports (Appendices B and C). High level habitat suitability mapping was also completed and included in this report for grizzly bear denning, little brown bat, collared pika, olive-sided flycatcher, waterfowl, and cliff-nesting raptors.

# 2. PROJECT LOCATION

The KZK property is located in Yukon Territory, approximately 260 km northwest of Watson Lake and 115 km southeast of Ross River (Figure 2-1). The site is accessed by a 24 km, single lane gravel road, known as the Tote Road, from the Robert Campbell Highway near Finlayson Lake. The coordinates for the Project are 61°28' N latitude and 130°32' W longitude, located on map sheet 105G/7-10.

The Project is located within the northern foothills of the Pelly Mountains on the Yukon Plateau near the divide between the Pelly River and Liard River drainage basins. The Project is in the Finlayson River watershed which is tributary to the Liard River. The Project location is in a transitional zone bordering three ecoregions: Yukon Plateau-North, Liard Basin, and Pelly Mountains. Elevations of the Project footprint range from approximately 1,300 m to 2,000 masl (Smith et al., 2004).

The proposed Project footprint lies in subalpine and alpine zones, with surrounding topography consisting of rolling hills and steep mountains. The Project is within the discontinuous permafrost zone, with an active layer up to 2 m, beneath which ice is present (Geo-Engineering, 2000). There are a few small lakes and wetlands occupying the valley bottom in which the Project is proposed, with some larger lakes outside the Project site to the south and east. The Tote Road parallels the lower reaches of Finlayson Creek, passing mainly through boreal forest and occasional wetlands.

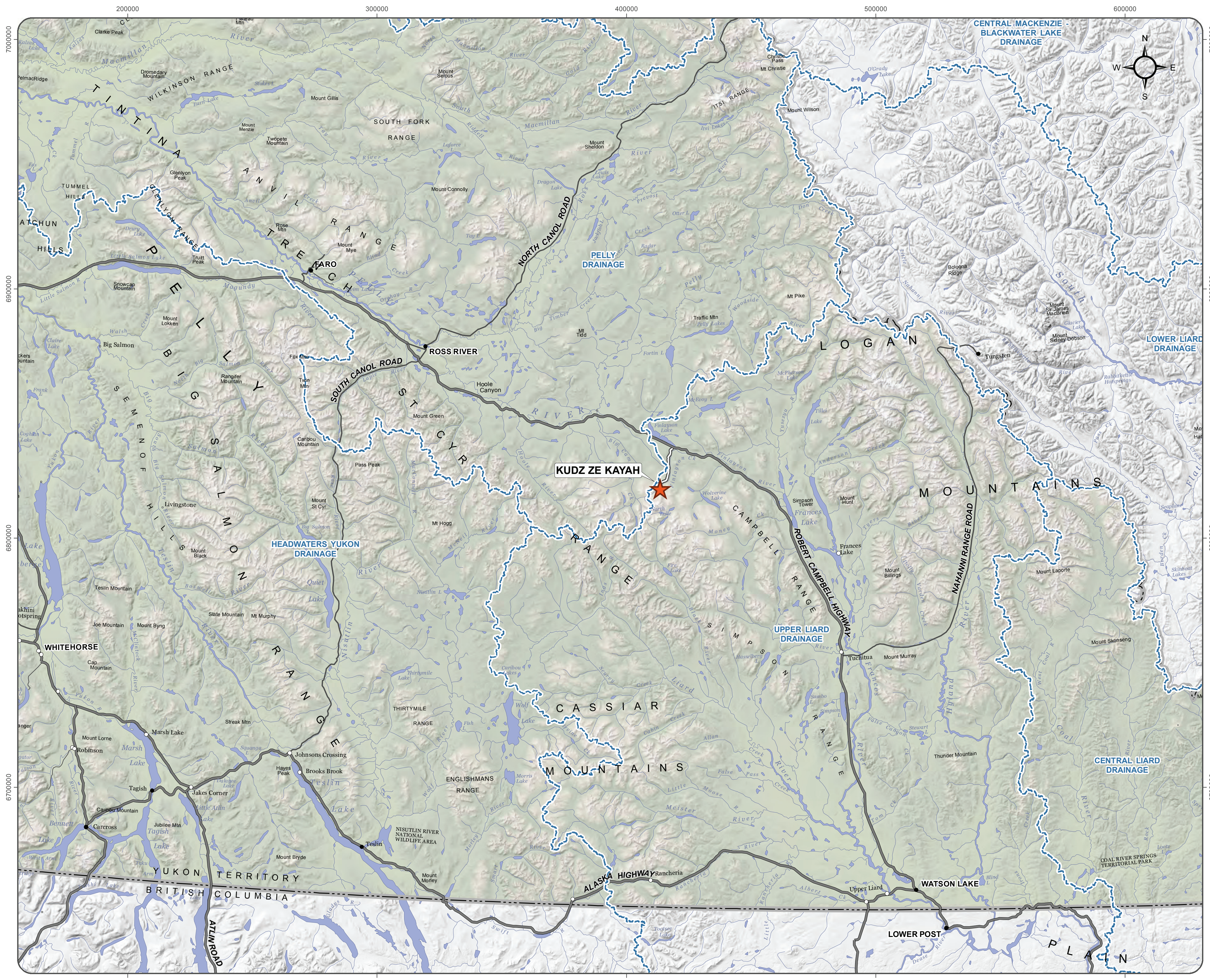
Shrub and herb cover dominate higher elevations and graduate to predominately boreal forest at lower elevations. Prevalent species at high elevations include scrub birch (*Betula sp.*), willow (*Salix spp*.), and various lichens and forbs. Forested areas consist of a mix of subalpine fir (*Abies lasiocarpa*) and white spruce (*Picea glauca*), with black spruce (*Picea mariana*) in wetter locations. Tall shrubs are the dominant vegetation cover at subalpine elevations and along riparian corridors.

## 2.1 STUDY AREA

Different size study areas were necessary for different species as some wildlife are highly mobile and utilize large ranges, and other species can satisfy all their seasonal needs within a confined spatial area. Therefore, selection of the study area for each species was based largely as a function of the species range and mobility as well as Yukon management units. The scale of the study area had to reflect the scale of the animals' distribution patterns.

Two main study areas with different spatial sizes were adopted to represent the species distribution and abundance. The smaller of the two study areas is referred to as the Local Study Area (LSA) and was defined as the area encompassing a 3 km buffer surrounding the proposed Project footprint, and a 1.5 km buffer on either side of the Tote Road (Figure 2-2). The area defined as the LSA is based on the Geona Creek watershed area and roughly follows the height of land to the east and west, and south to the outflow of the South Lakes. The LSA was used as the survey area for wildlife species with small home ranges and specific habitat requirements. The larger study area is referred to as the Regional Study Area (RSA) and was delineated for most larger species (except caribou) by the boundaries of Game Management Subzone (GMS) 10-07, which has a total area of 2,063 km$^2$ (Figure 2-3). A GMS is sizable enough to support a population of big game mammals and is used by the government to monitor changes in population size of wildlife species, as well as gauging the condition of their important habitat. By using GMS 10-07 as the RSA to collect wildlife baseline data for KZK, the information will complement data collected by YG biologists.

The RSA for caribou was further defined based on the Finlayson caribou herd (FCH) range and portions of the herd's range used for rut and post calving around the Project. The study area is discussed in more detail in Chapter 3.




## BMC MINERALS

KUDZ ZE KAYAH PROJECT
WILDLIFE BASELINE REPORT

## FIGURE 2 - 1
## PROJECT LOCATION

NOVEMBER 2016


★ KUDZ ZE KAYAH PROJECT

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.

Canvec compiled by Natural Resources Canada at a scale of 1:10,000 - 1:50,000. Reproduced under license from Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources Canada. All rights reserved.
Drainage areas obtained from National Hydrology Network 2011

Datum: NAD 83; Projection UTM Zone 9N

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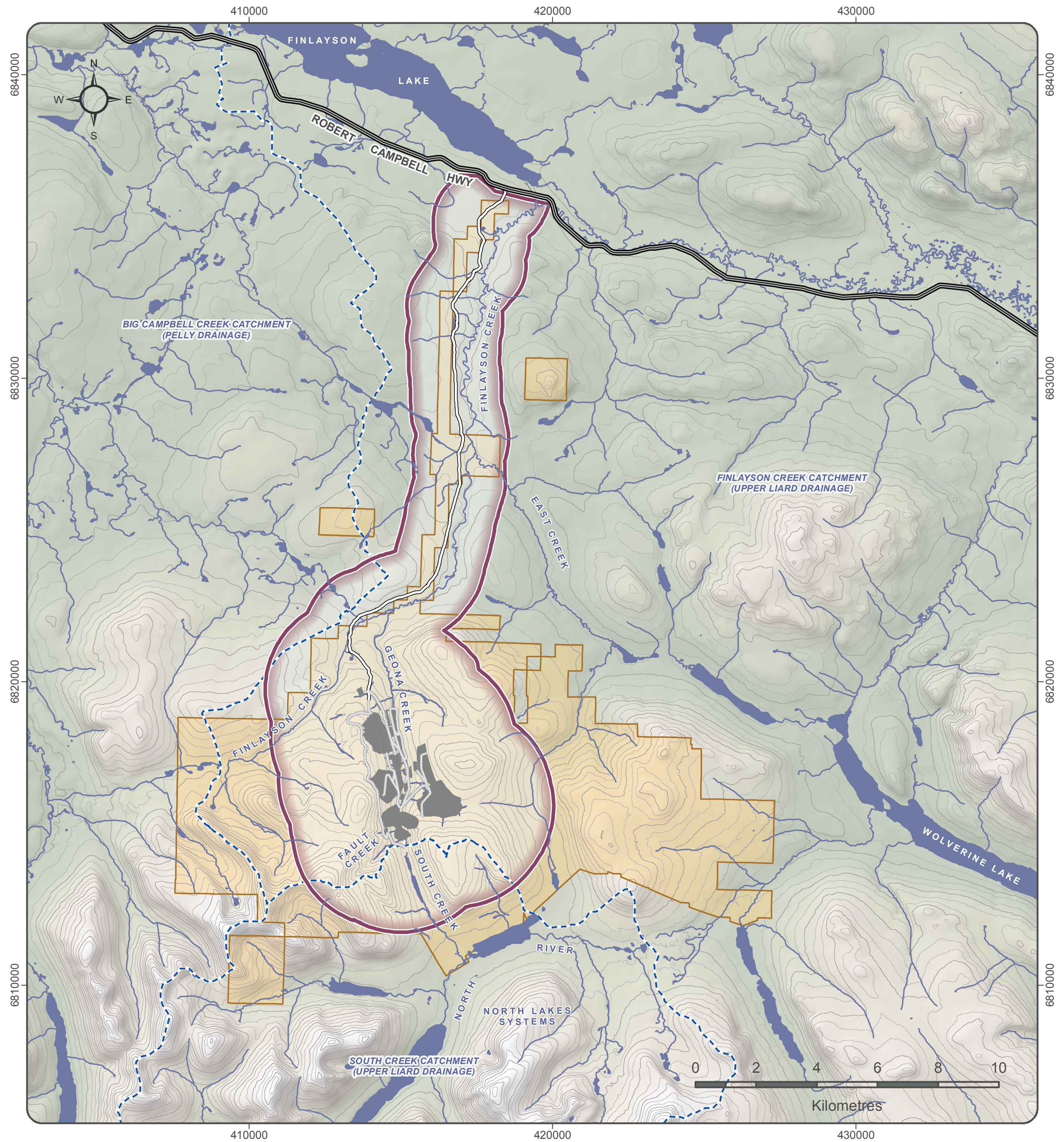


Local Study Area

Location of Proposed Mine Infrastructure

Major Drainages

BMC Minerals (No. 1) Ltd. Mineral Claim Areas

Tote Road/Proposed Access Road

Proposed Mine Road

Contour (40 m interval)

Watercourse

Waterbody

**KUDZ ZE KAYAH PROJECT**
**WILDLIFE BASELINE REPORT**

**FIGURE 2-2**

**LOCAL STUDY AREA (LSA) FOR KZK PROJECT**

FEBRUARY 2017


Datum: NAD 83; Projection: UTM Zone 9N

AEG



BMC MINERALS

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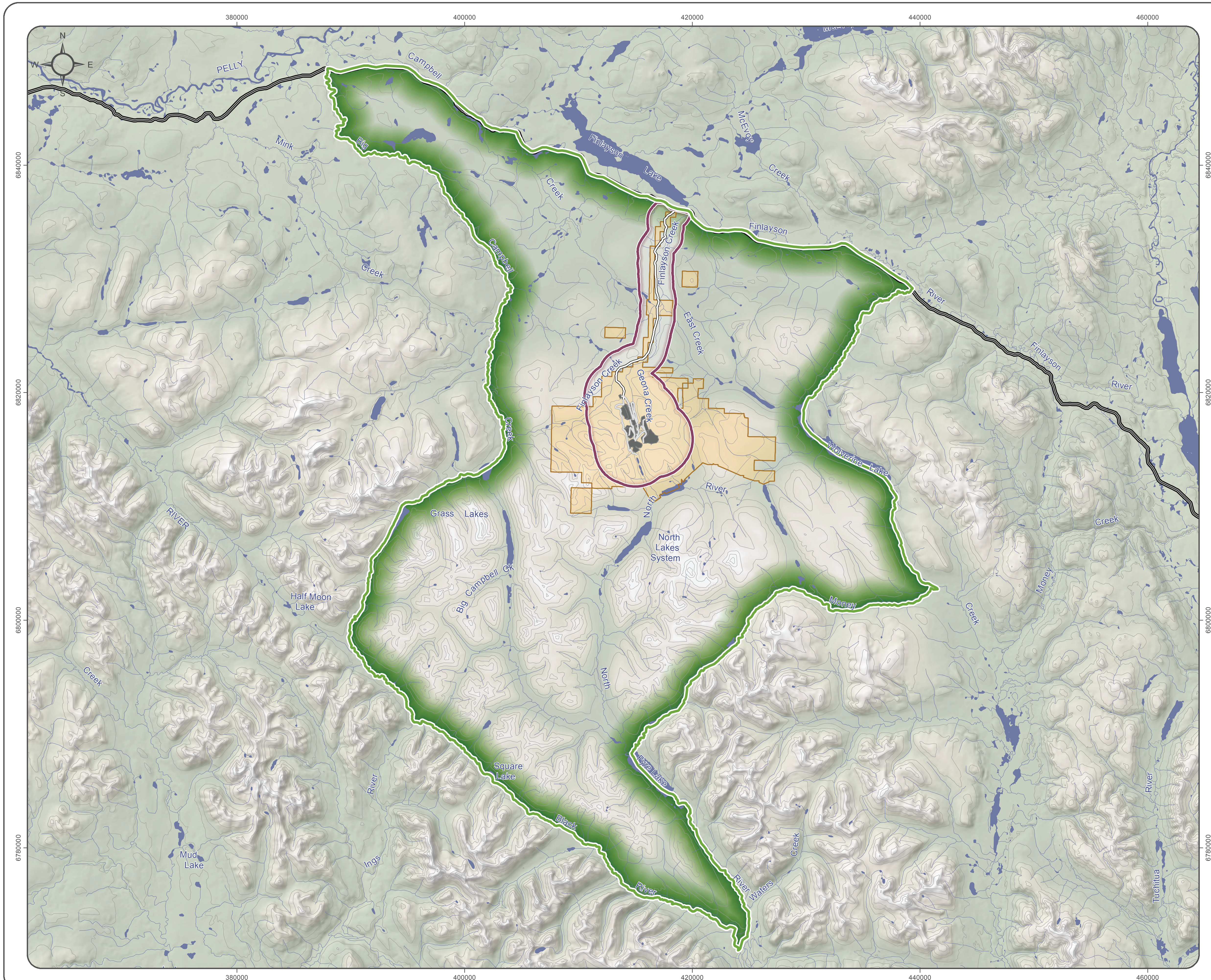
BMC MINERALS

# KUDZ ZE KAYAH PROJECT
# WILDLIFE BASELINE REPORT

## FIGURE 2-3
## REGIONAL AND LOCAL STUDY AREA FOR WILDLIFE

FEBRUARY 2017




Local Study

Regional Study Area (Game Management Subzone 10-07)

Location of Proposed Mine Infrastructure

BMC Minerals (No.1) Ltd. Mineral Claim Areas

Tote Road/Proposed Access

Proposed Mine Road

Highway

Watercourse

Waterbody

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



1:325,000 when printed on 11 x 17 inch paper

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## 2.2 SURVEY SCHEDULE

Table 2-1 summarizes the survey area, method, life cycle phase, and survey period for each wildlife species investigated during 2015 and 2016. Two years of data were collected for most species.

**Table 2-1: Area, Method, and Season for Wildlife Surveys, 2015 and 2016**

| Species | Survey Area | Survey Method | Life Cycle Phase | Survey Period 2015 | Survey Period 2016 |
|---|---|---|---|---|---|
| Caribou | RSA | Aerial | Late winter | March | March |
| | RSA; based on the 1995 IEE survey area | Aerial | Post calving | July | July |
| | RSA; based on previous YG surveys and collar data | Aerial | Rut | October | October |
| Moose | RSA | Aerial | Post rut | November | completed but data not available |
| | RSA | Aerial | Late winter | March | March |
| Grizzly Bear | 10 km radius centred on proposed mine site | Aerial | Emergence | April - May | April |
| Stone Sheep | Incidental observations only; recorded during other surveys | Aerial | no formal study | no formal study | no formal study |
| Beaver | Upper Geona Creek and tributaries | Aerial and ground-based | Rearing | July | August |
| Collared Pika & Hoary Marmot | LSA | Ground-based with helicopter support | Rearing | July | July |
| Bats | Upper Geona Creek wetland; Tote Road wetlands | Bat detector (acoustic recorder) | Rearing | August | July |
| Furbearers | LSA, including Tote Road | Ground-based track survey | Late winter | n/a* | March |
| Raptors | LSA, including Tote Road; reference sites outside LSA; and incidental observations during other surveys | Aerial and ground-based | Breeding | May - July | June & July |
| Songbirds | LSA, including Tote Road; reference sites outside LSA; and incidental observations during other surveys | Ground-based with helicopter support | Breeding | June | June |
| Waterfowl | Wetlands within LSA; reference wetlands outside LSA | Ground- based with helicopter support | Breeding | June | June and July |

# 3. CARIBOU

## 3.1 BACKGROUND

The caribou inhabiting the area around the KZK property are members of the FCH. The FCH are woodland caribou (*Rangifer tarandus caribou*) and part of the Northern Mountain Population (NMP) of woodland caribou (Designatable Unit 7) as identified by COSEWIC (COSEWIC, 2011). The NMP consists of 45 relatively discrete herds numbering about 44,000 caribou that range throughout the central and southern Yukon, the Mackenzie Mountains of the Northwest Territories (NT) and northern British Columbia (BC).

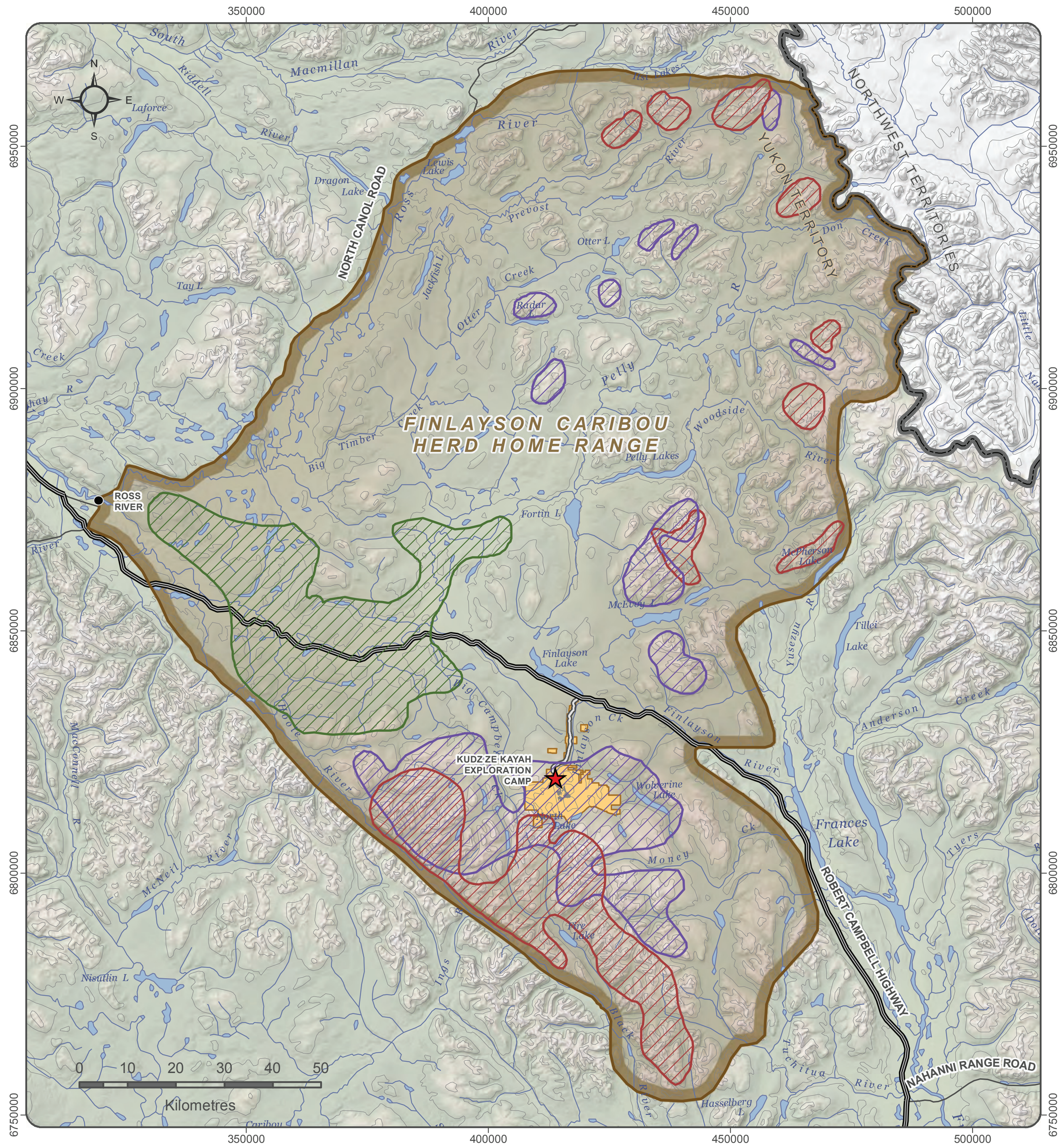
The NMP of caribou was assessed by COSEWIC in 2005 and deemed a species of special concern under the *Species at Risk Act* (SARA). Species designated as special concern are those that may become threatened or endangered because of a combination of biological characteristics and identified threats (SARA, 2002). As a species of special concern, these caribou require more intensive management of the species by the responsible jurisdictions. Responsible jurisdictions and stakeholders have developed a management plan for the NMP as required by the *Species at Risk Act*. Other woodland caribou ecotypes of western Canada – the Boreal Population and Southern Mountain Population – have declined sharply in recent decades and have been extirpated throughout much of their former range. These populations are designated “threatened” by COSEWIC and require national recovery planning. The cause of the caribou population declines is attributed to both natural limiting factors and widespread human development and activity (Thomas and Gray, 2002).

The NMP ecotype differs greatly from boreal caribou in other parts of Canada. Extensive research on boreal caribou shows that they range in very sparse numbers within closed, low elevation peat land habitats and simple predator-prey systems (Bradshaw et al., 1995; Fuller and Keith, 1981; Mallory and Hillis, 1998; Gray, 1999; Dzus, 2001; McLoughlin et al., 2003). They have evolved cryptic behaviours (i.e., widespread dispersion and sedentary behaviour) as anti-predation tactics. Boreal caribou are also vulnerable to higher predation rates as a result of an elevated alternate prey base from habitat modification. This has in turn elevated predators in response to the increased prey biomass (James et al., 2004). Human modification to landscapes may also be increasing the predation efficiency of wolves (Kuzyk, 2002). Boreal caribou have been shown to be quite sensitive to stresses caused by human encroachment and are declining throughout most of their range (Oberg, 2001; Ferguson and Gauthier, 1992; Bradshaw et al., 1995; Dyer et al., 2001; Rettie and Messier, 1998). Hunting has also played a substantial role in their range reduction throughout North America (Bergerud, 1974).

NMP caribou such as the FCH occur in diverse multi predator-prey systems. They exhibit gregarious behaviour and make extensive use of open upland habitats. The NMP ranges at northern latitudes that have not been as seriously altered by the spread of human settlement and development. In view of this there is less known about potential adverse effects on NMP caribou from anthropogenic disturbance. For these reasons, it should be cautioned that results from extensive research on boreal caribou may not be fully applicable to NMP caribou.

The FCH has a traditional home range of 23,000 $km^2$ in east-central Yukon, lying mainly in the Yukon Plateau-North and Pelly Mountains Ecoregions (Adamczewski et al., 2010). The FCH is the most significant wildlife in the Project area because it is an important resource for the people of the Kaska First Nation (Kaska). The FCH is also important to maintaining a healthy ecosystem in the area, as caribou is food source for wolves, grizzly bears, Kaska hunters, and local hunters. The Yukon economy also benefits from the FCH via the guiding industry.

The FCH is migratory and moves to different habitats within their home range along seasonal routes to meet specific life cycle needs (Figure 3-1; reproduced from Adamczewski *et al.,* 2010). In the spring, two-thirds of the herd begin moving from their wintering grounds in the forested lowlands east of the Pelly River to the Pelly Mountains in the southeast. The remaining one-third of the herd travels to the mountains north of Finlayson Lake. As summer approaches, female caribou disperse in the mountains to calve on ridges and upper plateaus to avoid predators (Bergerud *et al.*, 1984; Bergerud and Page, 1987; Bergerud, 1992). They remain dispersed in small bands in the uplands through summer, and seek out snow patches to escape insect harassment and warm temperatures (Morshel and Klien, 1997). The FCH's summer and fall ranges are primarily on alpine plateaus south of Finlayson Lake, which overlaps the Project area. A number of caribou utilize the areas adjacent to KZK for post calving and rutting, as identified by YG as Wildlife Key Areas (WKA) located south of the Project (Environment Yukon, 2013a).




Kud Ze Kayah Exploration Camp
Core Post Calving Range
Core Rut Range
Core Winter Range
Community
Tote Road/Proposed Access Road
Rober Campbel Highway
Secondary Road
Contours (1000 m)
Watercourse
Waterbody
Location of Proposed Mine Infrastructure
BMC Minerals (No.1) Ltd. Mineral Claim Areas

## KUDZ ZE KAYAH PROJECT
## WILDLIFE BASELINE REPORT

## FIGURE 3-1

## FINLAYSON CARIBOU HERD SEASONAL DISTRIBUTION AND HABITAT RANGES

NOVEMBER 2016


Wildlife Key Area data compiled by the Yukon Department of Environment. Publication Date: May 2009
Obtained from Geomatics Yukon. Datum: NAD 83; Projection: UTM Zone 9N



AEG

BMC MINERALS

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## 3.2 HISTORICAL STUDIES AND EXISTING INFORMATION

The FCH has been well studied by the Yukon Government since 1982, when hunters began complaining they had difficulty finding the caribou. In 1982, YG surveyed the herd and confirmed that the population was declining (WCMPRC, 2011). It was suspected that a combination of wolf predation and human harvest were responsible for the decline in caribou numbers, which lead to the initiation of a recovery program. As part of the recovery program, a wolf control program was implemented from 1983 to 1989. That program removed 451 wolves from the FCH range, achieving a removal of approximately 85% of the local wolf population (Adamczewski *et al.*, 2010; WCMPRC, 2011). As well in 1983, licensed harvest was reduced from one caribou of either sex from August 1 to October 31, to one male caribou from August 1 to October 10. During this time, First Nations residents of Ross River and Watson Lake also voluntarily restricted their caribou harvest and it is believed that First Nation harvest was significantly reduced during the recovery program.

The recovery program resulted in the FCH tripling its population from an estimated 2,000 animals in 1982 to nearly 6,000 in 1990, with an increase in survival of both calves and adults. Furthermore, regional moose numbers were estimated to have almost tripled from 3,000 to 9,000. It was suspected that changes to the FCH population during this time was the result of the recovery program (i.e., wolf control and human harvest) because ecological conditions remained constant while treatment effects were limited to wolf predation and human harvest (Farnell et al., 2008). By 1994, five years after the end of the wolf control program, the wolf population had re-established itself around 240 members and the FCH population began to decline, especially calf survival. As wolves recovered during post wolf control, the herd declined to 4,537 in 1996, then to 4,130 in 1999, and to 3,077 ± 5.6% in March 2007 (Adamczewski et al., 2010; WCMPRC, 2011).

The FCH recovery program provided compelling evidence that wolves and hunting were the primary factors limiting the numbers of both caribou and moose in the area (Hayes *et al.*, 2003). In conjunction with wolf control, sport hunting was limited to bull caribou and First Nation hunters were encouraged to select bull rather than cow caribou (Norecol, Dames and Moore, 1996). The program showed that lethal wolf control for a defined period (i.e., seven years) could not establish a long-term recovery of moose and caribou. Once wolf reduction measures ended, the population increased and pack size recovered in six years (Hayes *et al.*, 2003). Seven years after wolf reduction stopped and caribou harvest resumed, moose and caribou numbers began to decrease. Licensed hunters continue to harvest Finlayson caribou through the permit system for this area. Currently there is no dedicated First Nation harvest monitoring program for this area (WCMPRC, 2011).

### 3.2.1 YUKON GOVERNMENT SURVEYS

#### *3.2.1.1 Late winter Surveys*

From 1986 to 2007, five late winter population censuses were completed for the FCH, and a population estimate in 1982 (Figure 3-2). The methods used for these late winter surveys, conducted by YG biologists, have been consistent. Note that the population was highest in 1990 (5,950 ± 17.7%), a year after the wolf control program ended. The three censuses that followed in 1996, 1999, and 2007 showed a declining trend. The demographics derived from the March 2007 survey found that the FCH had 62.9% cows, 13.6% calves, 9.8% young bulls, and 13.2% mature bulls, indicating a ratio of 22 calves per 100 cows and 37 bulls per 100 cows (Farnell, 2009). While the herd's winter range does not usually include the Project site, the late winter 2007 census showed a concentration of bulls around the Tote Road. This may have been a result of an unusually low snowpack further east of Ross River (Adamczewski *et al.*, 2010). Since 2007, YG has not conducted a late winter census of the FCH; however, a late winter census is scheduled for March 2017.

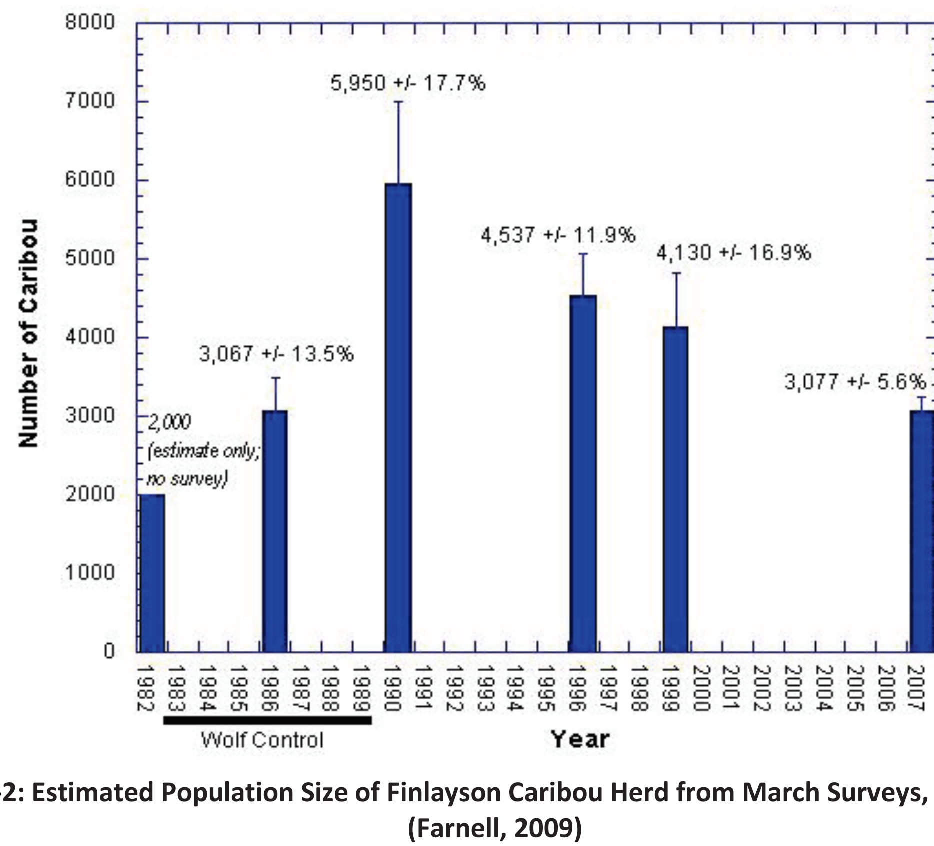



**Figure 3-2: Estimated Population Size of Finlayson Caribou Herd from March Surveys, 1982 to 2007 (Farnell, 2009)**

It is important to note that the FCH winter range corresponds to a rain and snow shadow region on the lee side of the Pelly Mountains, which forms an orographic barrier to precipitation originating in the Gulf of Alaska (Wahl et al., 1987). There is marked variation in precipitation across the range of the FCH. The

St Cyr Range typically receives 40-50 cm of precipitation annually, while the foothills of the Logan Range at the north end of the FCH range receive approximately 75 cm annually. Between these ranges, the rain and snow shadow region receives <30 cm each year (Smith et al., 2004).

Late winter snow accumulation data measured at eight snow stations established along the Robert Campbell Highway between Ross River and Finlayson airstrip, from 1982 to 1999, 2010, and 2012, showed that snowpack on the FCH winter range averages 40 cm. Figure 3-3 presents these snow depth data (referred to as Robert Campbell Highway) along with snow course data for the Finlayson Lake airstrip station from 1987 to 2015 (Environment Yukon, 2016a). March snow depth averaged 51 cm at the Finlayson airstrip. Snow depth varied from year to year; however, March snow depths are significantly higher at the Finlayson airstrip station than the Robert Campbell Highway stations ($p<0.05$). The average 40 to 50 cm snow depths are markedly less than values reported to impede the mobility of solitary (50-60 cm) or groups (80-90 cm) of caribou (Russell and Martell, 1984).

Abundant lichens and low snow cover provide a highly suitable winter range for the FCH with little or no alternate adjacent range available. The FCH's traditional winter range is the result of an obligatory response to environmental conditions and is therefore considered to be critical habitat for the herd (Farnell and McDonald, 1989).

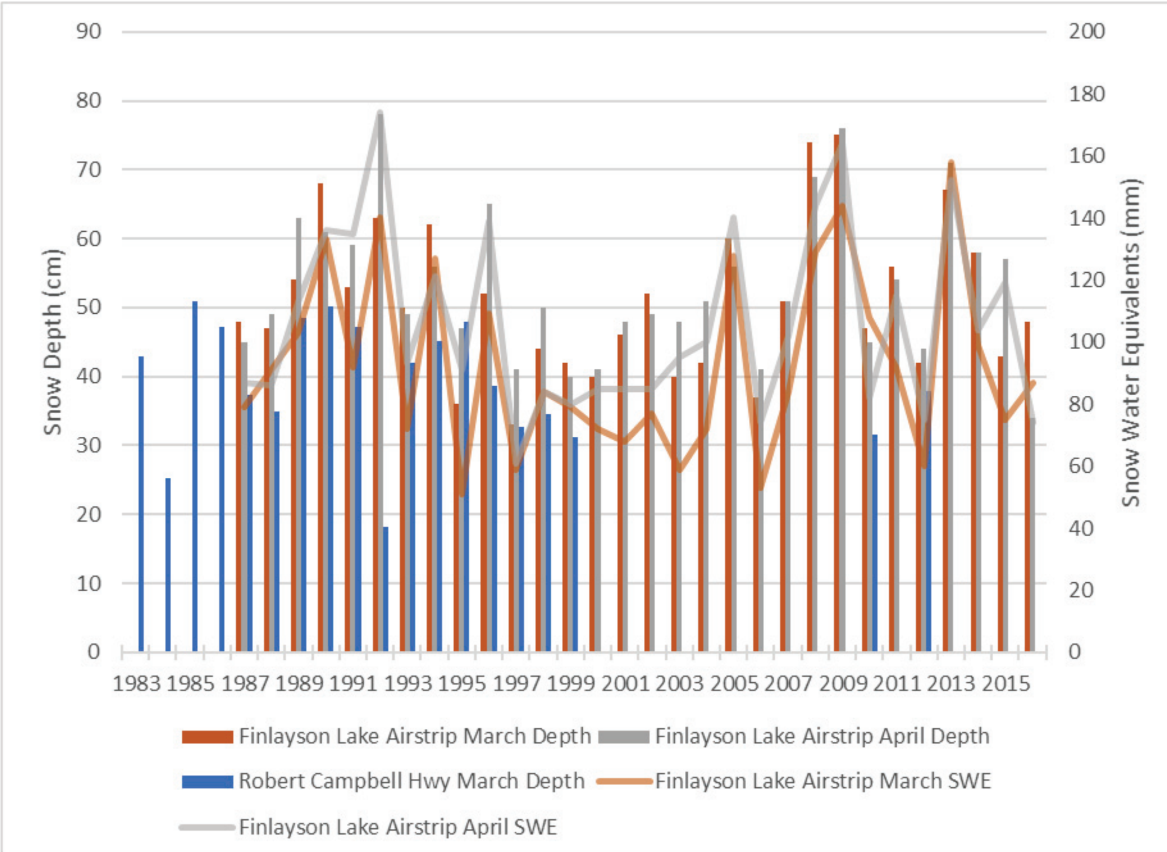



**Figure 3-3: Historical Average Snow Depths Along Robert Campbell Highway**

### *3.2.1.2 Post Calving Surveys*

The calving period for woodland caribou in Yukon is from May 7 to June 8 with a median peak of calving occurring between May 16 and 20 (Chisana Caribou Recovery Team, 2010). Mountain caribou have evolved a spacing strategy to disperse into relatively safe sites away from predators during the calving period; surveys during the calving period yield a limited sample size and insight into calving dynamics. Instead, a greater focus of surveys are directed at the post calving period in mid-July, when caribou aggregate in large numbers in the alpine, yielding better insight into the use of the area.

Seven post calving surveys were carried out in summers from 1982 to 1998. Surveys occurred across the summer range of the herd to determine the distribution and habitat usage. The post calving surveys from 1989 to 1993 showed the herd was small relative to available habitat but rebounding due to intensive management. From 1994 onwards, the herds' population has been decreasing (unpublished data Environment Yukon). Post calving locations were documented in mid-June to mid-July from 1982 to 1985 based on radio collared cow caribou. The radio collared caribou were tracked to the areas around Grass Lakes and east of the North Lakes. No radio collared caribou were tracked in the Project footprint or the immediate vicinity during this period (Norecol, Dames and Moore, 1996).

#### *3.2.1.3 Rut Surveys*

Rut surveys for the FCH have been conducted by YG each year from 1982 to present. There are two main rutting areas utilized by FCH; one is north of the Robert Campbell Highway in the mountains around McEvoy Lake, and another larger one south of the Highway that overlaps the LSA and extends in the mountains to the east, south, and west. Maps produced by YG for the annual rut surveys demonstrate that caribou rut on the upper ridges of the Geona Valley, including the ridges around the KZK exploration camp (Adamczewski et al., 2010). The largest numbers of rutting caribou in the Project area appear to be on the ridges to the west of Geona Creek.

The YG annual rut surveys follow a standard procedure. Surveys are conducted by helicopter along high alpine plateaus where caribou breeding occurs. When groups of animals are encountered they are classified into one of four categories: calves, cows, immature males, or mature males. The tallies in each category are used to calculate the adult sex ratio (i.e., bull to 100 cows), and the recruitment rate (i.e., calf to 100 cows) (Hegel, 2014). Historically, rut surveys of the FCH conducted by YG biologists have been very consistent in area and intensity.

The recruitment rates from the rut surveys from 1982 to 2015 are shown in Figure 3-4. There was a noticeable increase in calf survival during the years of the wolf control program (1983 to 1989). However, in the years immediately following the end of the recovery program, the recruitment rate returned to pre-wolf control program numbers. From 1990 to 2015, the average recruitment rate was lower than the stable recruitment threshold ratio of 26 calves per 100 cows (Farnell, 2009).

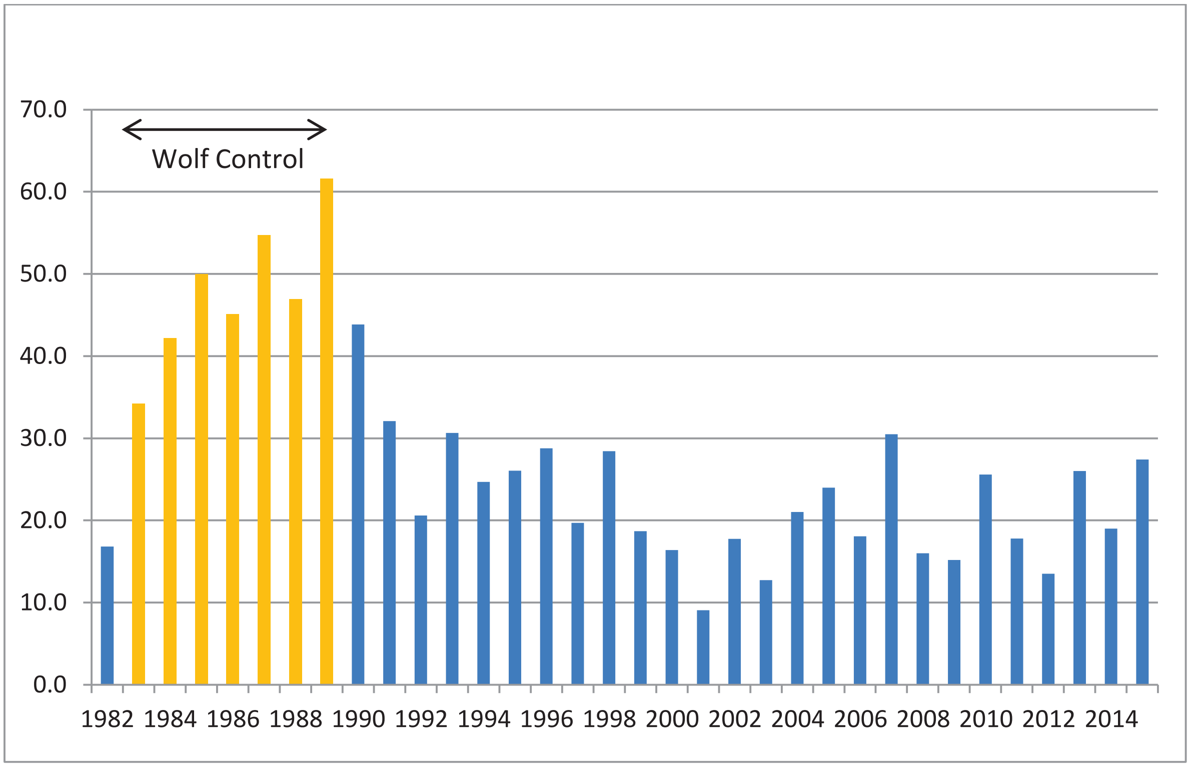



**Figure 3-4: Ratio of Calf per 100 Cows in the FCH from 1982-2015**

### 3.2.2 INITIAL ENVIRONMENTAL EVALUATION (1995)

During the 1995 Initial Environmental Evaluation (IEE), Norecol, Dames and Moore Inc. undertook several aerial surveys to assess FCH distribution, use of the Project area, and form a wildlife baseline study. Late winter, calving, post calving, and rut surveys were flown in March, May, June, and October of 1995, respectively. General information regarding caribou use of the region was gained through telephone discussions and meetings with Fish and Wildlife Branch staff prior to conducting the surveys. This information was used to develop the methodology for various surveys at different times of the year.

The IEE report concluded that caribou movement to their winter range (Pelly River lowlands) was well underway by early December. Late winter surveys showed that no caribou activity occurred in areas above 1,100 m elevation. In spring, caribou were calving in the uplands south of the Project footprint. During post calving surveys no significant groupings of caribou were found in the immediate area around the proposed Project footprint. Results from the rut survey found caribou in alpine and subalpine habitats, including ridges immediately east and west of the headwaters of Geona Creek. An early-winter moose study in mid-November found large numbers of caribou that had begun their migration northwest back towards the Pelly River lowlands.

Details regarding the 1995 calving, post calving, rut, and post rut caribou survey are presented below.

The caribou calving survey occurred from May 20 to 27, 1995, tracking 42 calving caribou. The peak calving date was May 27 with a ratio of 50 calves per 100 cows. The progression of calves per 100 cows during that week was as follows: May 20 (5:100), May 21 (3.5:100), May 24 (24:100), May 25 (34:100), and May 27 (50:100).

The post calving survey was flown on June 27 to 29, 1995. Surveyed areas for the post calving survey consisted of uplands to the east between Waters Creek and Whitefish Lake, west of North River, south and west of Fire Lake, and the Simpson Range east of Black Lake. A total of 472 caribou were observed and categorized as follows: 184 cows, 120 calves, 117 immature bulls, 51 mature bulls, and four unclassified caribou. Therefore, the recruitment rate for this survey was 65 calves per 100 cows. It is expected that the recruitment rate for the post calving survey will be higher than the recruitment rate for the rut surveys. This is because significant calf mortality occurs from predation and other factors during summer and early fall prior to the rut surveys.

During the rut survey conducted on October 1, 1995, a total of 152 caribou were counted in the rut survey area of the Project (Figure 3-5). The caribou were categorized as follows: 86 cows, 12 male calves, 20 female calves, 11 immature bulls, and 23 mature bulls. Among these, 47 were observed on the ridges immediately west of the headwaters of Geona Creek and 32 were observed on the ridges immediately east of the headwaters of Geona Creek. The October 1 survey in the Project area accounted for approximately 10% of the total 1,439 FCH individuals counted during the 1995 rut survey.

Caribou were also observed during the post rut moose survey conducted November 14 to 16, 1995. A total of 441 unclassified caribou in 36 groups were observed in the Project area. The direct observations and tracks in the snow showed that the caribou were moving northwest across the core study area during the previous week. This migration corridor extended approximately 4 km above the Geona Creek-Finlayson Creek confluence to approximately 4 km below this confluence. Numerous fresh trails were also noted down the East Creek valley.

### 3.2.3 WOLVERINE PROJECT

A wildlife baseline assessment was undertaken in 2005 by AXYS Consulting Ltd. for the Wolverine Project, now owned by Yukon Zinc. The FCH was assessed by reviewing the existing survey data that YG had previously collected, and by reviewing data collected by other studies associated with the wolf control program. No ungulate-specific field surveys were completed as part of the baseline study for the Wolverine Project.

## 3.3 SURVEY METHODS (2015 - 2016)

Three seasonal surveys were conducted for two years to assess the spatial and temporal distribution of the FCH in 2015 and 2016. Late winter surveys were completed in March to document both caribou and moose locations around the Project area. Post calving surveys were completed in July to document post calving distribution. Rut surveys were completed in October to document recruitment rates, adult sex ratios, and locations of important rutting areas. FCH survey areas are shown on Figure 3-5. In addition, an early winter survey for moose also resulted in large numbers of caribou documented in the following subsections.

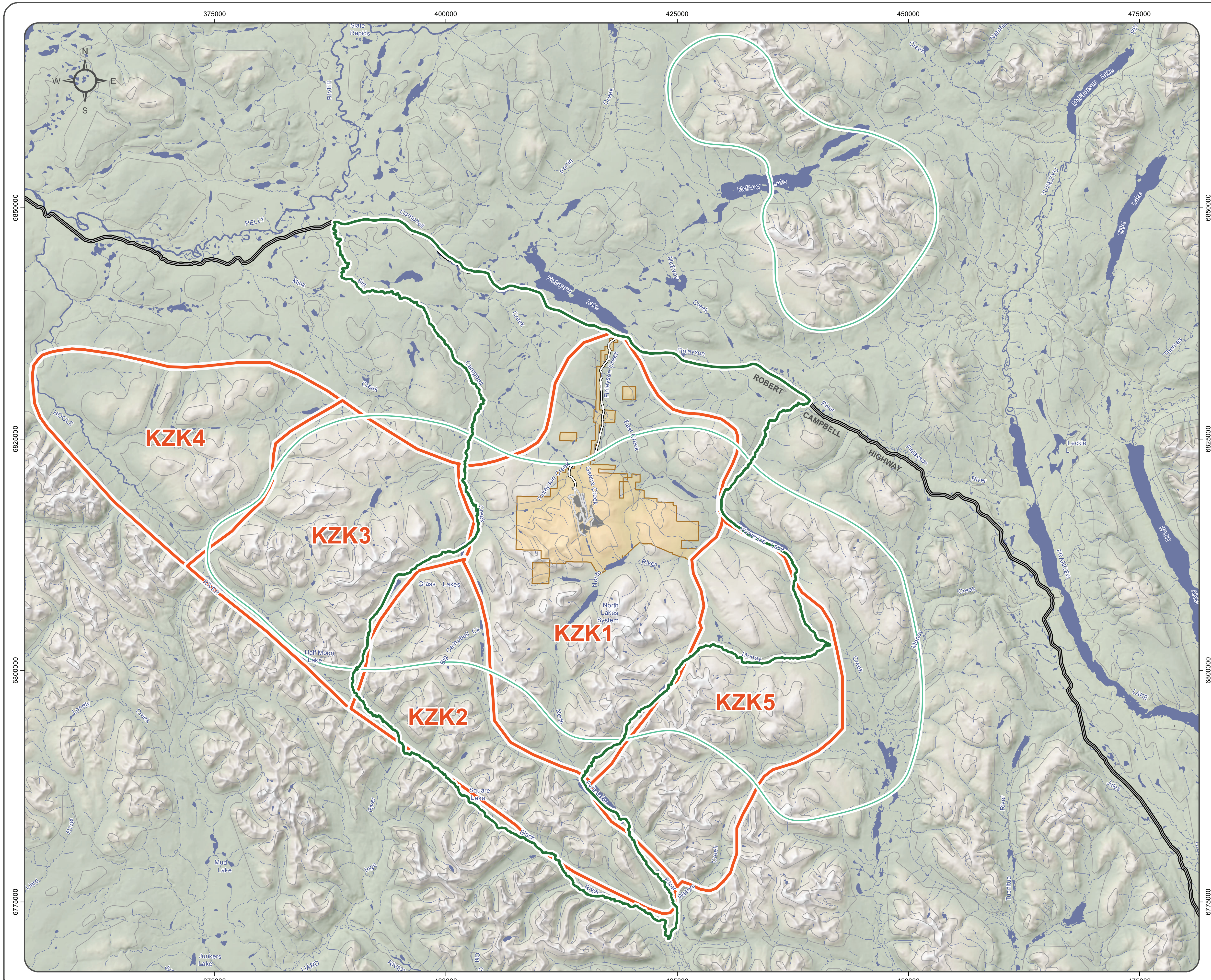
### 3.3.1 LATE WINTER

The study area for the late winter ungulate surveys was the RSA (defined as GMS 10-07). A study area of this regional scale helps to gauge the potential cumulative effects, and documents caribou population distributions at a regional scale. High elevation terrain was not flown because ungulates are known not use these habitats during the late winter in this area. This study area was developed through discussions with YG biologists. The main objective for this survey was to gather information on the presence of ungulates (moose and caribou) to understand the locations of important late winter habitat. It is also noted that RRDC requested that the late winter survey be conducted.

The March 25 to 27, 2015 late winter ungulate survey was conducted by Environmental Dynamics Inc. (EDI). The March 2016 late winter ungulate survey was conducted by AEG. In 2015, the survey was completed using a Cessna 206, flown at 120 to 150 km/h, at an elevation of 200 to 300 m above ground. The total time taken to accomplish the survey was 14.2 hours. A Jet Ranger helicopter was used for the 2016 survey and was flown at an average speed of 80 to 90 km/h and at an average elevation of 200 m above ground level. The total time taken to accomplish the survey was 25.5 hours.

For the 2016 survey, navigation was facilitated by a Garmin GPS and Avenza Systems Application. The Avenza Application allowed the helicopter's position to be viewed in real-time, enabling the pilot to replicate flight lines used during the 2015 surveys. If fresh tracks or animals were observed, the helicopter would slow down to facilitate gender identification and obtain accurate counts. The helicopter would circle groups to gain an accurate count. Every effort was made to minimize wildlife disturbance to reduce animal stress while still collecting quality data.

Wildlife observations, tracks, and the flight route were recorded to the extent possible for the 2015 and 2016 surveys using a handheld GPS (Figure 3-7). Recorded observations included species, group size, age class, and gender. Only fresh tracks that crossed directly under the flight path were recorded during the survey. Tracks observed outside the flight path were not recorded; this is consistent with protocol developed by Environment Yukon for moose track data. Track records included species and a count of the group size. Habitat type and aspect were recorded for each observation of tracks. Incidental wildlife sightings were recorded of non-target species (i.e. wildlife other than caribou or moose) during the survey and during flights from Ross River to the Project area.

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## WILDLIFE BASELINE REPORT

### FIGURE 3-5

### AREAS USED FOR THE 2015-2016 FINLAYSON CARIBOU HERD SURVEYS

FEBRUARY 2017

- 2015/2016 Caribou Rut Survey Area
- 1995-2015 Caribou Post-Calving Survey Blocks
- 2015-2016 Late Winter Ungulate Survey (RS or GMS 10-7)
- Tote Road/Proposed Access Road
- Proposed Mine Road
- Watercourse
- Waterbody
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas

No caribou were found in KZK4 in 1995 and the habitat was determined to be unsuitable; therefore, KZK4 not surveyed in 2015 or 2016.

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



1:400,000 when printed on 11 x 17 inch paper

0 5 10 15 20

Kilometres

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### 3.3.2 POST CALVING

The post calving survey was conducted in mid-summer when the caribou congregate in large numbers in the alpine after they have calved. It is more effective to survey animals during post calving than during the calving period when cows are dispersed and camouflaged against a vegetated background.

The 2015 and 2016 post calving surveys covered a similar study area as the 1995 caribou post calving survey. The survey locations used in 1995 were based on post calving locations documented by YG surveys from 1982 to 1986 from radio-collared caribou data. The surveys covered five "blocks," of which the Project footprint was KZK Block 1 (Figure 3-5). Block 4 was removed from the program because it was primarily lowland habitat that was at an elevation too low to contain suitable post calving habitat and because no caribou were found there in 1995.

The 2015 post calving survey took place on July 10 and 15 by an EC120 helicopter. The entire survey was planned for July 10, but due to inclement weather (low cloud, heavy rainfall and high winds), only Blocks 1 to 3 were completed. The surveyors returned on July 15 and completed Block 5 for a total of 6.8 hours of flight time covering approximately 2,800 $km^2$. Each unit of the study area was surveyed in a systematic contour flight pattern over alpine and subalpine areas in mountainous terrain.

The post calving survey in 2016 was completed on July 6. The methodology used in 2016 was the same as that used in 2015. The total flight time for the 2016 survey was 8.1 hours.

Habitat suitability mapping was completed for caribou post calving. The methods and results are presented in Appendix B.

### 3.3.3 RUT

Caribou are highly segregated in distribution by sex and age classes during all life cycle periods except the fall rut. In fall (approximately September 28 through October 10) caribou aggregate into breeding groups on alpine plateaus where they become homogeneously mixed. This provides an opportunity for biologists to conduct unbiased surveys in highly observable habitats to acquire large sample size data on annual patterns of survival. Additionally, these data provide baseline information on the relative abundance, group dynamics, and population characteristics of caribou.

Caribou rut count surveys were carried out by helicopter on October 2 to 4, 2015 and October 3 to 4, 2016, in collaboration with the Yukon Department of Environment. Caribou rut count surveys for the FCH have been conducted annually since 1982 and provide comparative data in this area traditionally used by the herd.

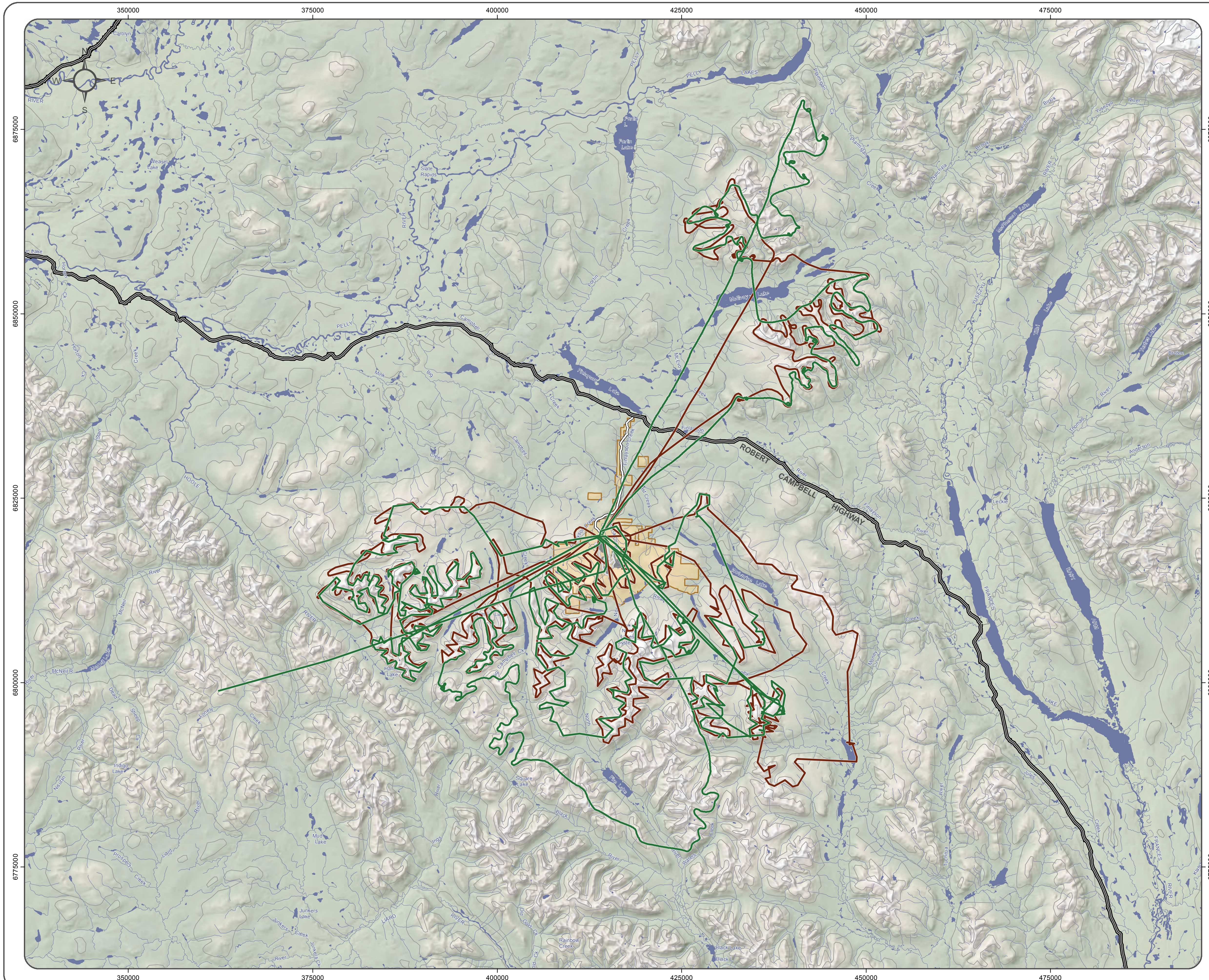
In 2015, a total of 60 survey blocks were created within the known range of the FCH to cover core rutting areas. During the aerial survey, three blocks north and 25 blocks south of the Robert Campbell Highway were covered, the same area covered during previous YG rut counts. The 2016 study included areas of interest in the vicinity of the Project, as well as a known rutting area north of the Robert Campbell Highway that have been traditionally included in the surveys conducted by YG biologists. This additional northern area allowed for population level comparisons with previous rut surveys.

Search effort was concentrated on subalpine and alpine areas where the ability to locate animals was greater and where the caribou are known to congregate. Figure 3-6 shows the flight tracks for the 2015 and 2016 surveys. Groups of caribou observed were classified as cows, calves, and adult or immature bulls. Incidental observations of other wildlife were also recorded. A contour flight pattern was followed over alpine and subalpine areas in mountainous terrain. Total survey flight time was 10.3 and 11.1 hours in 2015 and 2016, respectively.

Habitat suitability mapping was completed for caribou rut. The methods and results are presented in Appendix B.

### 3.3.4 Early-Winter Ungulate Surveys

The early winter ungulate survey was intended primarily to track the relative abundance and distribution of moose in the Project area. However, incidental caribou observations were also recorded during these surveys and were useful in determining range use by caribou during early winter – a period when caribou are rarely recorded. The study area for the early winter ungulate surveys was the RSA. Using the same methodology as that used in the late winter survey, both high and low elevation terrain was flown because ungulates are known to inhabit both habitats at this time of year. Caribou observations were a total count as caribou were not segregated into sex and age when tallied. Total survey flight time was 14.1 hours from November 18 through 22$^{nd}$ and 12.0 hours on December 5$^{th}$ and 6$^{th}$ in 2015 and 2016, respectively.

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WILDLIFE BASELINE REPORT

**FIGURE 3-6**

**FINLAYSON CARIBOU HERD RUT SURVEY TRACKS 2015-2016**

DECEMBER 2016

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



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## 3.4 SURVEY RESULTS (2015-16)

The following sections present the results of the 2015 and 2016 caribou late winter, post calving, and rut surveys.

### 3.4.1 LATE WINTER

The late winter ungulate survey is used primarily to track the distribution of moose in the Project area. However, incidental caribou observations were also recorded during these surveys and were useful in determining habitat use by caribou during late winter. Generally, the FCH core winter habitat is located further north and west than the Project footprint, in the lowlands closer to the Pelly River. Therefore, it was anticipated there would be few caribou sightings during the survey.

Results from the 2015 late winter ungulate survey are included in Appendix D. During the 2015 survey, a total of 19 caribou were observed, along with numerous tracks in the low elevation habitat in the northwest section of the Project site on lakes and meadows.

During the 2016 survey more caribou were utilizing the Project area, with a total of 142 caribou observed. Of those 142 animals, there were 109 cows, 16 bulls, 10 calves, and 7 unknown sex (Table 3-1). Recruitment rate could not be calculated for the limited count. Compared to observations made during the 2015 survey, the caribou observed in 2016 were further east than typically found near the Pelly River core winter habitat. Late winter 2016 caribou observations and track sightings are presented in Table 3-1. Photo 3-1 and Photo 3-2 show caribou observed during the 2016 late winter survey.

**Table 3-1: Caribou Observations during the 2016 Late Winter Ungulate Survey**

| Waypoint | Band Size | Cows | Calves | Bulls | Unknown |
|---|---|---|---|---|---|
| 250 | 18 | 15 | 1 | 2 | |
| 140 | 13 | 12 | | 1 | |
| 404 | 11 | 9 | 2 | | |
| 132 | 9 | 7 | | 2 | |
| 342 | 9 | 4 | 1 | 3 | 1 (adult) |
| 389 | 9 | 7 | 2 | | |
| 345 | 8 | 8 | | | |
| 160 | 7 | 3 | 2 | 2 | |
| 349 | 7 | 7 | | | |
| 122 | 6 | 5 | 1 | | |
| 263 | 6 | 5 | | 1 | |
| 300 | 6 | 5 | 1 | | |
| 85 | 5 | 5 | | | |

| Waypoint | Band Size | Cows | Calves | Bulls | Unknown |
|---|---|---|---|---|---|
| 329 | 4 | 2 | | 2 | |
| 341 | 4 | 4 | | | |
| 385 | 4 | 4 | | | |
| 158 | 3 | | | 2 | 1 (immature) |
| 343 | 3 | 3 | | | |
| 406 | 3 | 2 | | 1 | |
| 484 | 3 | 2 | | | 1 |
| 436 | 4 (dead) | | | | 4 (harvested) |
| Totals: | 142 | 109 | 10 | 16 | 7 |

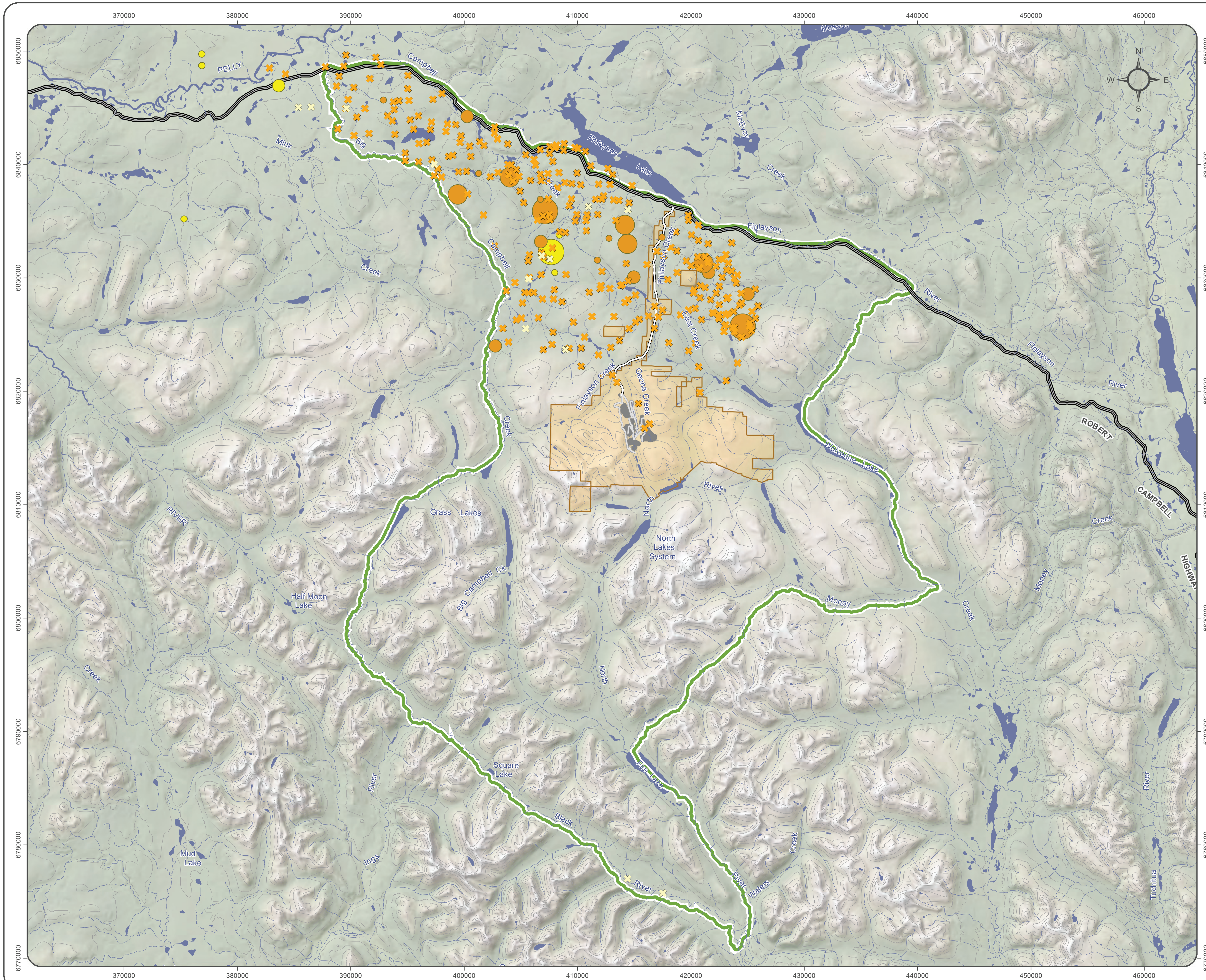


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**FIGURE 3-7**

**COMPARISON OF MARCH 2015 AND 2016 LATE WINTER CARIBOU OBSERVATIONS**

NOVEMBER 2016

| 2015 Late Winter Ungulate Survey Caribou Sighting | 2016 Late Winter Ungulate Survey Caribou Sighting |
|---|---|
| 1 - 4 (5) | 1 - 4 (6) |
| 5 - 7 (1) | 5 - 7 (6) |
| 8 - 11 (0) | 8 - 11 (5) |
| 12 - 19 (1) | 12 - 19 (2) |
| Caribou Tracks (13) | Caribou Tracks (266) |

- Location of Proposed Mine Infrastructure
- Regional Study Area (Game Managment Subzone 10-7)
- BMC Minerals (No.1) Ltd. Mineral Claim Areas
- Tote Road/Proposed Access Road
- Proposed Mine Road
- Watercourse
- Waterbody

* Numbers in brackets represent the number of groups seen of this size range

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



1:325,000 when printed on 11 x 17 inch paper

0 3 6 9 12 15

Kilometres

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*(Last edited by: mducharme; 11/19/2016/12:08 PM)*

**Photo 3-1: Group of Finlayson Caribou on Lake**

**Photo 3-2: Group of Caribou in Mature, Open Spruce Forest**

### 3.4.2 POST CALVING

During the 2015 post calving survey a total of 93 caribou were observed in Blocks 1, 2, and 5. No caribou were observed in Block 3 (Table 3-2). Of those 93 animals, there were 61 cows, 12 calves, 8 immature bulls, and 12 mature bulls. Most (> 50%) caribou were observed in Block 2, comprising 50 of 93 observations. Block 1 had 31 of 93 caribou observations, and Block 5 had 12 of 93 observations. Locations of caribou observations from the post calving survey are presented in Figure 3-8.

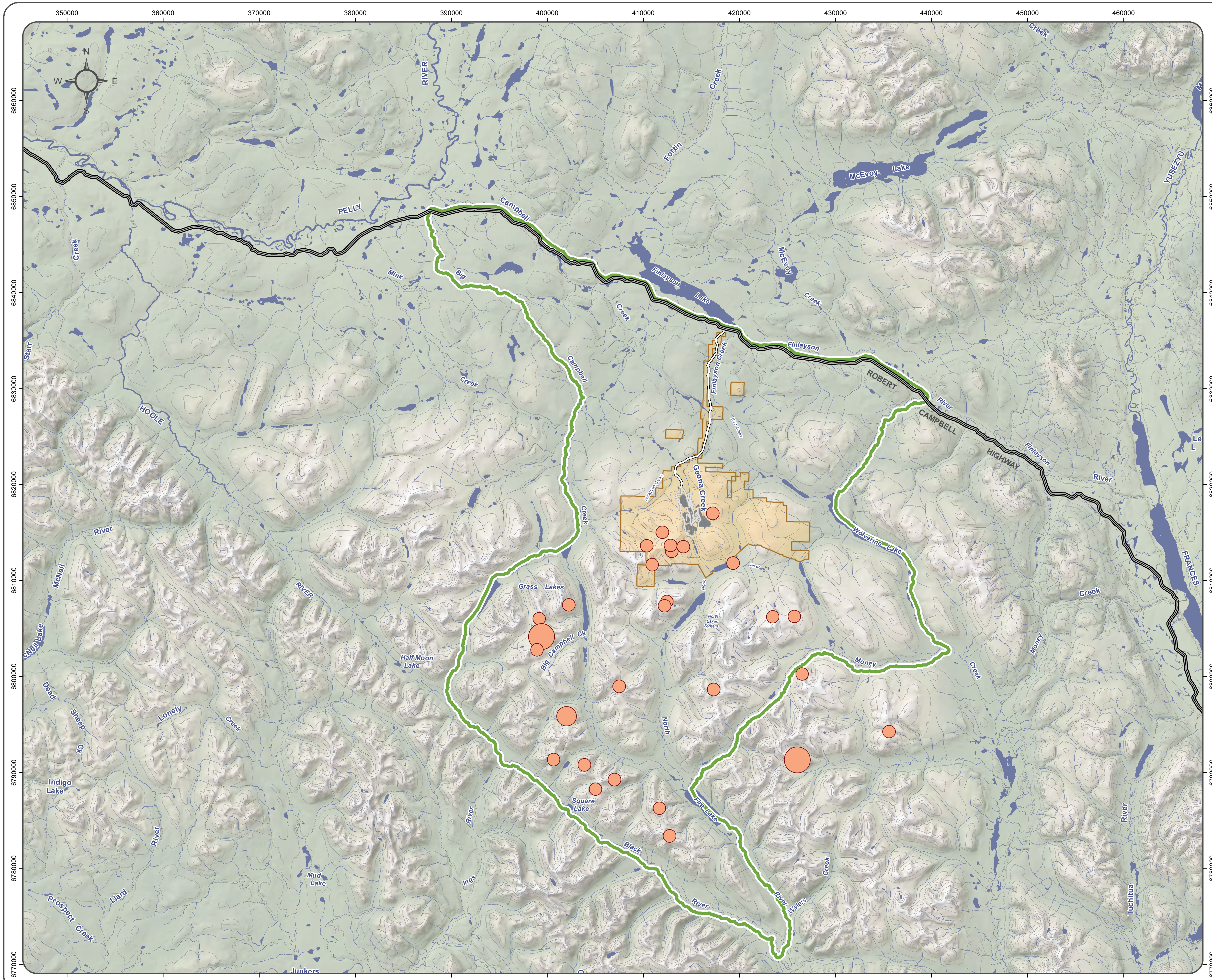
During the 2016 post calving survey, a total of 147 caribou were observed in Blocks 1, 2, 3, and 5 (Table 3-2). Of those 147 animals, there were 103 cows, 18 calves, 11 immature bulls, 11 mature bulls, and 4 unclassified. As was observed in 2015, the largest proportion of caribou sightings were observed in Block 2, comprising 56 of 147 observations. Block 3 had 43 of 147 caribou observations, Block 1 had 27 of 147 observations, and Block 5 had 21 of 147 observations.

A comparison of the total number of cows observed in 1995, 2015, and 2016 was 184, 61, and 103, respectively. A comparison of the total number of calves observed in 1995, 2015, and 2016 was 120, 12, and 18, respectively. Significant aggregations of post calving caribou were not observed in the immediate area of the proposed Project footprint in 1995, 2015, or 2016 (Norecol, Dames and Moore, 1996).

**Table 3-2: Post Calving Caribou Survey Data (2015 and 2016)**

| Date | Survey Block | Band Size | Cows | Calves | Immature Bulls | Mature Bulls |
|---|---|---|---|---|---|---|
| Jul-10-15 | KZK 1 | 7 | 6 | | 1 | |
| Jul-10-15 | KZK 1 | 3 | | | 2 | 1 |
| Jul-10-15 | KZK 1 | 3 | | | | 3 |
| Jul-10-15 | KZK 1 | 1 | | | | 1 |
| Jul-10-15 | KZK 1 | 1 | 1 | | | |
| Jul-10-15 | KZK 1 | 1 | 1 | | | |
| Jul-10-15 | KZK 1 | 4 | 4 | | | |
| Jul-10-15 | KZK 1 | 2 | 2 | | | |
| Jul-10-15 | KZK 1 | 1 | 1 | | | |
| Jul-10-15 | KZK 1 | 2 | | | | 2 |
| Jul-10-15 | KZK 1 | 1 | 1 | | | |
| Jul-10-15 | KZK 1 | 1 | 1 | | | |
| Jul-10-15 | KZK 1 | 4 | | | 2 | 2 |
| Jul-10-15 | KZK 2 | 4 | 4 | | | |
| Jul-10-15 | KZK 2 | 2 | | | 2 | |
| Jul-10-15 | KZK 2 | 3 | 3 | | | |
| Jul-10-15 | KZK 2 | 2 | 1 | | | 1 |
| Jul-10-15 | KZK 2 | 2 | 2 | | | |
| Jul-10-15 | KZK 2 | 19 | 14 | 4 | | 1 |
| Jul-10-15 | KZK 2 | 2 | 2 | | | |
| Jul-10-15 | KZK 2 | 1 | 1 | | | |
| Jul-10-15 | KZK 2 | 8 | 6 | 2 | | |
| Jul-10-15 | KZK 2 | 2 | 1 | 1 | | |
| Jul-10-15 | KZK 2 | 5 | 4 | 1 | | |
| Jul-15-15 | KZK 5 | 10 | 5 | 4 | | 1 |
| Jul-15-15 | KZK 5 | 1 | 1 | | | |
| Jul-15-15 | KZK 5 | 1 | | | 1 | |
| **Totals** | | **93** | **61** | **12** | **8** | **12** |

| Date | Survey Block | Band Size | Cows | Calves | Immature Bulls | Mature Bulls |
|---|---|---|---|---|---|---|
| Jul-06-16 | KZK 1 | 1 | | | | 1 |
| Jul-06-16 | KZK 1 | 2 | | | | 2 |
| Jul-06-16 | KZK 1 | 1 | 1 | | | |
| Jul-06-16 | KZK 1 | 1 | 1 | | | |
| Jul-06-16 | KZK 1 | 1 | 1 | | | |
| Jul-06-16 | KZK 1 | 10 | 7 | 3 | | |
| Jul-06-16 | KZK 1 | 3 | | | 1 | 2 |
| Jul-06-16 | KZK 1 | 1 | | | 1 | |
| Jul-06-16 | KZK 1 | 1 | 1 | | | |
| Jul-06-16 | KZK 1 | 1 | | | 1 | |
| Jul-06-16 | KZK 1 | 1 | 1 | | | |
| Jul-06-16 | KZK 2 | 2 | 1 | 1 | | |
| Jul-06-16 | KZK 2 | 16 | 13 | 2 | 1 | |
| Jul-06-16 | KZK 2 | 7 | 5 | 1 | | 1 |
| Jul-06-16 | KZK 2 | 1 | 1 | | | |
| Jul-06-16 | KZK 2 | 1 | 1 | | | |
| Jul-06-16 | KZK 2 | 2 | | | 1 | 1 |
| Jul-06-16 | KZK 2 | 1 | | | 1 | |
| Jul-06-16 | KZK 2 | 2 | 2 | | | |
| Jul-06-16 | KZK 2 | 7 | 6 | | 1 | |
| Jul-06-16 | KZK 2 | 4 | 2 | 2 | | |
| Jul-06-16 | KZK 2 | 6 | 6 | | | |
| Jul-06-16 | KZK 2 | 3 | 2 | | 1 | |
| Jul-06-16 | KZK 2 | 3 | 3 | | | |
| Jul-06-16 | KZK 3 | 1 | 1 | | | |
| Jul-06-16 | KZK 3 | 1 | 1 | | | |
| Jul-06-16 | KZK 3 | 4 | 3 | | 1 | |
| Jul-06-16 | KZK 3 | 2 | 1 | 1 | | |
| Jul-06-16 | KZK 3 | 2 | 2 | | | |
| Jul-06-16 | KZK 3 | 2 | 2 | | | |
| Jul-06-16 | KZK 3 | 3 | 3 | | | |
| Jul-06-16 | KZK 3 | 1 | 1 | | | |
| Jul-06-16 | KZK 3 | 3 | 3 | | | |
| Jul-06-16 | KZK 3 | 1 | 1 | | | |
| Jul-06-16 | KZK 3 | 1 | | | 1 | |
| Jul-06-16 | KZK 3 | 1 | 1 | | | |
| Jul-06-16 | KZK 3 | 4 | 3 | 1 | | |
| Jul-06-16 | KZK 3 | 1 | | | | 1 |
| Jul-06-16 | KZK 3 | 2 | 1 | 1 | | |
| Jul-06-16 | KZK 3 | 3 | 3 | | | |
| Jul-06-16 | KZK 3 | 2 | 2 | | | |
| Jul-06-16 | KZK 3 | 5 | 5 | | | |
| Jul-06-16 | KZK 3 | 1 | 1 | | | |
| Jul-06-16 | KZK 3 | 2 | | | | 2 |
| Jul-06-16 | KZK 3 | 1 | 1 | | | |
| Jul-06-16 | KZK 5 | 1 | 1 | | | |
| Jul-06-16 | KZK 5 | 7 | 4 | 3 | | |
| Jul-06-16 | KZK 5 | 8 | 6 | 2 | | |
| Jul-06-16 | KZK 5 | 1 | 1 | | | |
| Jul-06-16 | KZK 5 | 3 | 2 | 1 | | |
| Jul-06-16 | KZK 5 | 1 | | | 1 | |
| **Totals** | | **143** | **103** | **18** | **11** | **11** |

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## FIGURE 3-8
## FINLAYSON CARIBOU HEARD POST CALVING OBSERVATIONS 2015-2016

NOVEMBER 2016

NUMBER OF OBSERVATIONS

**Caribou Post Calving Survey**

- 1 - 6
- 7 - 16
- 17 - 49
- 50 - 103

OTHER MAP FEATURES

- Tote Road/ Proposed Access Road
- Proposed Mine Road
- Watercourse
- Waterbody
- Game Management Sub Zone 10-07
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Area

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



1:385,000 when printed on 11 x 17 inch paper

0 5 10 15 Kilometres

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*(Last edited by: mducharme; 11/23/2016/20:31 PM)*

### 3.4.3 Rut

During the October 2015 aerial rut survey caribou were observed throughout the LSA, as well as to the west, the southeast, and north (i.e., across the Robert Campbell Highway). A total of 712 caribou were observed during the survey and were categorized as follows: 449 cows, 123 calves, 62 immature bulls, and 78 mature bulls. This results in a recruitment rate of 27 calves per 100 cows and a sex ratio of 31 bulls per 100 cows.

Comparable results were observed in October 2016, with a total of 660 caribou observed in 60 groups with 27 calves per 100 cows and 39 bulls per 100 cows. These survey results clearly show that caribou are present in and adjacent to the Project site during the rutting period.

Results of the 2015 and 2016 rut surveys are summarized in Table 3-3.

**Table 3-3: 2015 and 2016 FCH Rut Survey Summary**

| Year | Cows | Calves | Immature Bulls | Mature Bulls | Total | Recruitment Rate (calves/100 cows) | Sex Ratio (bulls/100 cows) |
|---|---|---|---|---|---|---|---|
| 2015 | 449 | 123 | 62 | 78 | 713 | 27 | 31 |
| 2016 | 398 | 107 | 73 | 82 | 660 | 27 | 39 |

Within the immediate LSA 92 caribou were observed on alpine plateaus within approximately 10 km of the KZK exploration camp in 2015. They occurred in seven rutting groups ranging in size from 4 to 25 individuals and averaged 13 caribou per group. Sixty caribou were observed in this area in 2016. They were in three rutting groups ranging in size from 4 to 32 caribou and averaged 20 caribou per group.

Caribou rut surveys have been carried out around the Project area since 1982. Due to the potential detriment to caribou by providing location data during hunting season, YG has requested that the caribou rut location information not be made public. Instead, the caribou distribution data is presented in terms of relative distance from the Project without providing direction. Location data was compiled for the period from 1982 through 2016 and is presented as a percentage of distribution within 5 km, 10 km, and 15 km from the Project footprint.

Figure 3-9 and Figure 3-10 graph the counts of individuals and groups located in three distance ranges (5 km, 10 km, and 15 km) from the Project footprint for data from 1982 to 2016. The high number of caribou counted from 1990 to 2002 relative to other years has been interpreted as the lag effect following the wolf control program. The herd was larger in those years. As expected, the number of groups, count of individuals, and their average group sizes did not vary substantially with distance from the proposed Project footprint (Table 3-4; Figure 3-11). Caribou were present around the Project in all survey years.

**Table 3-4: Caribou Distribution Around Project During Rut Surveys 1982-2016**

| Radius from Project | Percent of Groups | Percent of Individuals | Mean Group Size |
|---|---|---|---|
| 5 km | 8.2% | 9.6% | 22.7 |
| 10 km | 10% | 10.4% | 22.2 |
| 15 km | 10% | 9% | 20.6 |

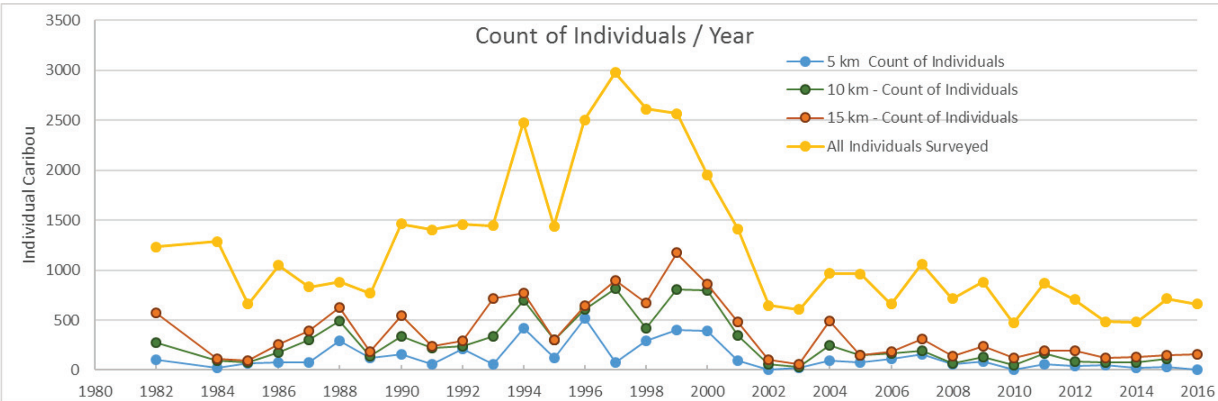



**Figure 3-9: Rut Surveys Individual Counts and Locations Relative to the Project 1982 to 2016**

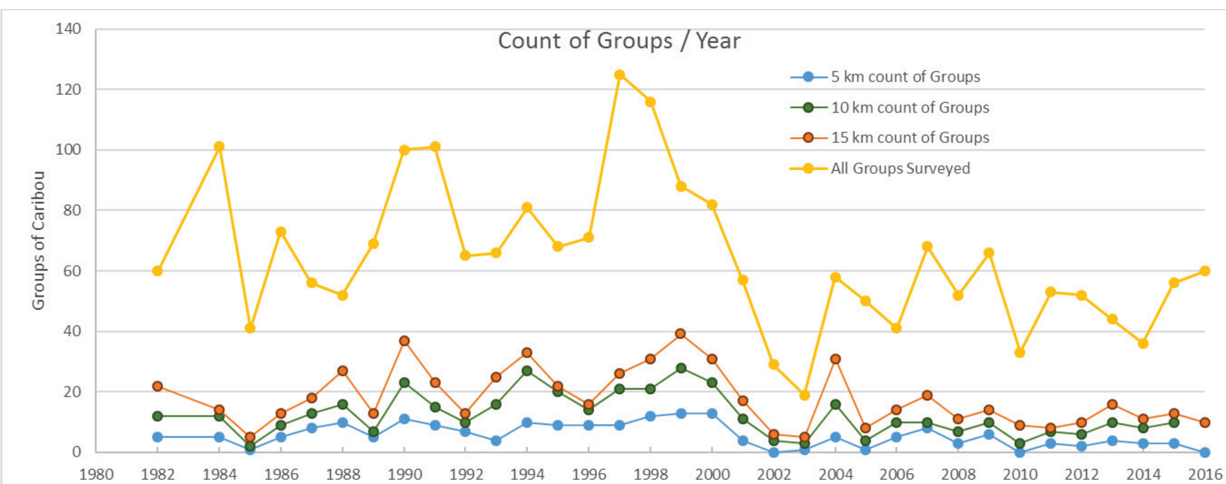
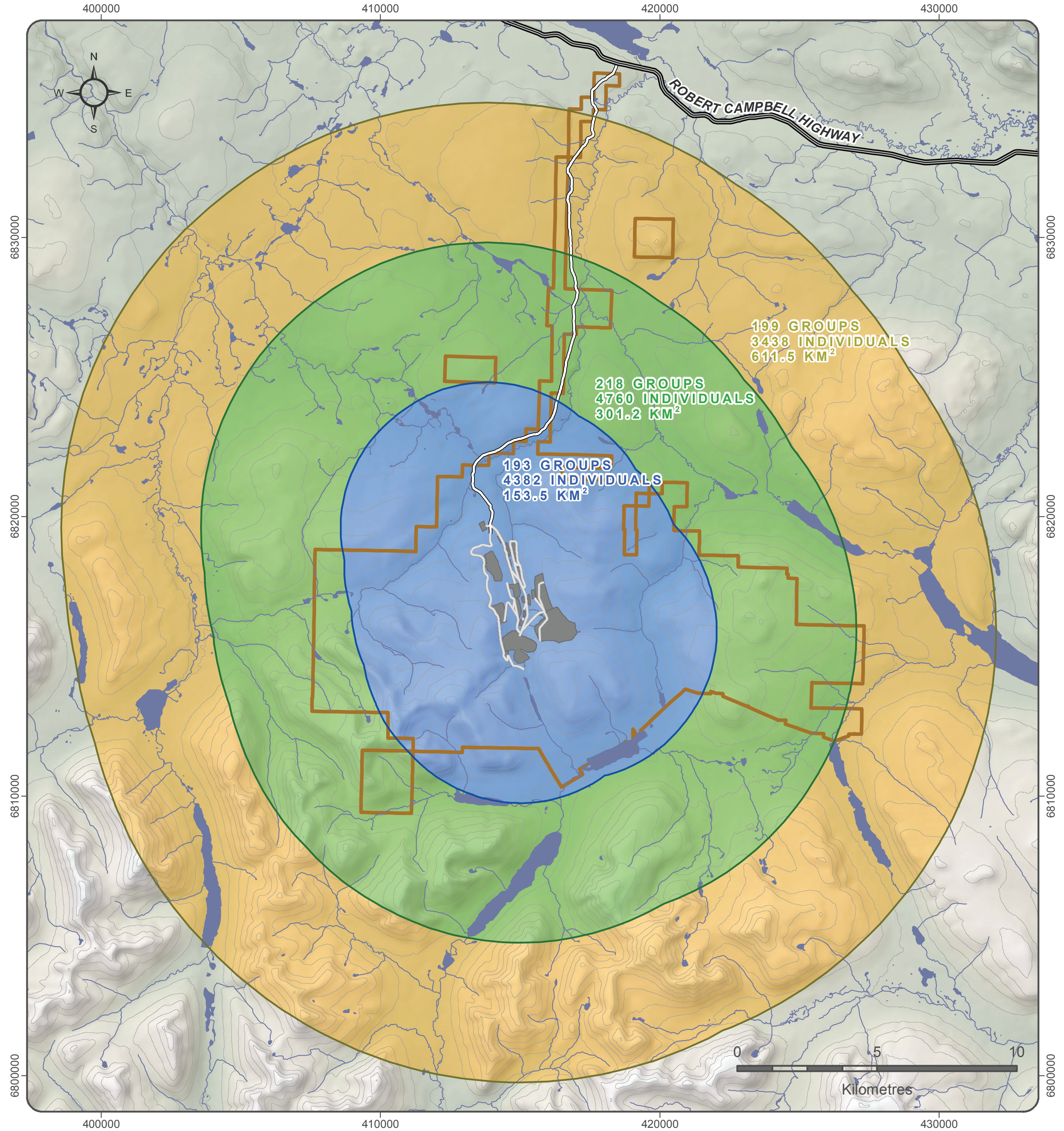



**Figure 3-10: Rut Surveys Group Counts and Locations Relative to the Project 1982 to 2016**




5 Kilometre Buffer

10 Kilometre Buffer

15 Kilometre Buffer

Tote Road/Proposed Access

Proposed Mine Road

Contour (120 m interval)

Location of Proposed Mine

BMC Minerals (No.1) Ltd. Mineral Claim

**KUDZ ZE KAYAH PROJECT**
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## FIGURE 3-11
## NUMBER OF CARIBOU OBSERVED DURING RUT SURVEYS IN VARYING ZONES OF INFLUENCE


Datum: NAD 83; Projection: UTM Zone 9N

AEG



BMC MINERALS

FEBRUARY 2017

D:\Project\AllProjects\Kudz_Ze_Kayah\Maps\03_Study\Wildlife\Caribou\05-Env_Assessment\Rut_ZOI\MineSiteBuffer_vs_RutSurveyObservations_20161121.mxd (*Last edited by: amatlashevska;*

### 3.4.4 EARLY WINTER SURVEYS

In November 2016, a total of 116 caribou where found. Of the groups encountered 63% were in lowland and 37% were in upland habitats. Contrary to 2015 only 8% of groups were found in lowlands while 92% were found in upland landscapes. From these observations, three (19% of total) groups were found in the Project claim block area in 2015 and eight (16% of total) in 2016.

### 3.4.5 INCIDENTAL OBSERVATIONS

There were 76 and 104 separate caribou records totalling 354 and 416 individuals counted in the KZK camp wildlife log during the 2015 and 2016 exploration field seasons, respectively (Appendix G). These observations demonstrate that caribou are using the area around the Project throughout the summer months and into the early winter. The highest frequency of sightings occurred during late August and October, with the largest bands observed in October. Large groups in October coincide with the rut period when the caribou aggregate on the alpine plateaus and ridges.

There were four to six sets of caribou tracks observed separately along the lower reaches of Finlayson Creek during the first bear den survey (April 23, 2015), indicating that members of the FCH were starting to move towards their calving and summer grounds south of the Project area. Caribou tracks were observed at higher elevations later in the spring during the second bear den survey (May 4, 2015). As well, more caribou tracks were observed along the tote road, riparian corridors, and foothills in May than the April bear den survey, indicating that caribou begin moving from their wintering grounds to the upland calving areas in April and peaking in May.

Caribou were also observed during the post rut moose survey that occurred from November 18 to 21, 2015. During this time of year, caribou were beginning their migration towards their wintering grounds. The majority of observations were in the northern section of the LSA and were mostly small groups. A number of these groups and associated tracks were observed either on or near frozen ponds. Wolves and wolf sign were often associated with these caribou observations.

### 3.4.6 CARIBOU HARVEST DATA

Caribou harvest data is provided to help interpret the FCH population and distribution. Within the RSA (GMS 10-07) the caribou harvest season is August 1 to September 24, with an area limit of one male caribou per harvester (Environment Yukon, 2016b). The harvest data from 1995 to 2014 for GMS 10-06, 10-07, 10-08, and 10-09 are shown in Table 3-5. Numbers reflect the caribou harvested through permit allocation by resident, non-resident, and guided hunters, but do not include First Nations harvest numbers as they are not required to report their harvest.

**Table 3-5: Reported Caribou Harvest Data from 1995 to 2014 Within GMS 10-06, 10-07, 10-08, and 10-09**

| Year | GMS 10-06 | GMS 10-07* | GMS 10-08 | GMS 10-09 |
|---|---|---|---|---|
| 1995 | 11 | 19 | 2 | |
| 1996 | 5 | 3 | | |
| 1997 | | 2 | 3 | |
| 1998 | 3 | 1 | | 10 |
| 1999 | 2 | 2 | | |
| 2000 | | 5 | | |
| 2001 | 1 | 3 | | |
| 2002 | 1 | 6 | | |
| 2003 | | 2 | | |
| 2004 | 1 | 4 | | |
| 2005 | | 3 | | |
| 2006 | | 3 | | 1 |
| 2007 | | 4 | | |
| 2008 | 1 | 4 | 1 | 3 |
| 2009 | 2 | 7 | | 2 |
| 2010 | 2 | 6 | | |
| 2011 | 1 | 2 | 1 | |
| 2012 | 2 | 1 | 1 | |
| 2013 | 3 | 5 | | |
| 2014 | | 6 | | |
| 2015 | 1 | 4 | 2 | |
| 2016 | 2 | 1 | | |
| Harvest Total | 35 | 88 | 8 | 16 |

** Project is located in GMS 10-07, highlighted in yellow*

The harvest of caribou is the highest in the GMS 10-07, compared with the other surrounding subzones. There are numerous popular fly-in lakes in subzone GMS 10-07 that may help explain the higher harvest numbers. A full-time gatekeeper has stayed at the gatehouse from April to October since 1998 and prevents hunters from utilizing the Tote Road. Limited access was based on an agreed mitigation measure with Yukon Government, Ross River Dena Council, and Project owners to prevent additional hunting pressure from gaining easy access to the herd.

## 3.5 DISCUSSION

### 3.5.1 LATE WINTER SURVEYS

Most caribou observations made during the 2015 late winter surveys were in the open on wetlands or small lakes where they were easily observed and counted. There were also extensive fresh tracks throughout the lowlands of the Project footprint, suggesting that the area was being well utilized.. The conditions for the survey were good to excellent, with recent snow allowing fresh tracks to be distinguished from older tracks. Only fresh caribou tracks and sign were tallied when intercepted by the flight path. Older tracks, feeding craters, and beds were also observed, but not counted as they would have been more than 72 hours old. Caribou in forested areas were difficult to see due to tree cover; therefore, the counts in the forested areas are likely lower than the actual numbers present. The forested areas in the lowlands were primarily comprised of mature to old growth white and black spruce, with many wetlands and small lakes.

In March of 2016, there were many more caribou utilizing the lowlands north of the Project footprint compared to results from March 2015. Both surveys had good observation conditions and fresh snow had fallen within three days of the initial day of each survey. It is suspected that the low snowpack in 2016 allowed more caribou to remain in the lowlands north of the Project footprint rather than retreating to the lowland forests near the Pelly River where they typically overwinter (Adamczewski et al., 2010). The snowpack within the northern half of the study area (i.e., along the Tote Road) was approximately 40 cm or less, which is near the historical average for this area (Figure 3-3). Some of the steeper, south facing slopes had bare patches and there was no snow under the larger trees in low lying areas. Research has shown there is annual variability in the use of seasonal ranges by populations of woodland caribou, often linked to annual fluctuations in snow conditions (Terry and Wood, 1999; Culling et al., 2005; Jones et al., 2007).

### 3.5.2 POST CALVING SURVEYS

The post calving period is one of the important life history stages that affects the population status and health. The results of numerous studies on caribou during the post calving season have suggested that during warm summers, insects have a pronounced effect on caribou behaviour and group dynamics by decreasing the amount of time spent feeding and increasing energy expenditure, thus limiting summer nutrition and body condition (White et al., 1975; Roby, 1978; Downes et al., 1986; Messier et al., 1988; Nixon, 1991). Caribou have a limited time span during the summer for growth and building new fat reserves for the coming winter. Females need to compensate for energy costs of gestation and lactation (Gerhart, 1995), while males need to build body reserves for the rut (Skoog, 1968). Constraints on the ability of caribou to feed optimally during this period of high forage quality and availability could have a negative effect on their body condition (White et al., 1975). Body condition of females in turn affects their probability of becoming pregnant in fall and calf survival the following year (Gerhart, 1995). Temperature seems to be a key factor determining activity budgets and also the amount of body reserves that caribou are able to accumulate during the summer (Morshel and Klein, 1997). Variations in summer temperature directly influence caribou behaviour during the post calving season. Further, different types and abundance of insects, insect-relief habitat, and different weather patterns cause additional variations in caribou behaviour.

A comparison of recruitment rates between 1995, 2015, and 2016 found lower recruitment rates and lower overall caribou observations in 2015 and 2016. The lower recruitment rate in 2015 may be the result of two factors. Excluding variability in population size, Caribou make extensive use of snow patches on warm summer days during the post calving period for thermoregulation and escaping fly harassment; this makes them highly observable. Up to 90% of all caribou observed on post calving surveys were found on snow patches during warm summer days (Farnell pers. comm. 2015). In 2015, the study was undertaken during very cool, damp, and windy conditions that may have greatly reduced use of snow patches by caribou making their presence more difficult to detect. Second, it is possible that the caribou simply did not inhabit the 2015 study area in appreciable numbers because of annual distribution variability. It is conceivable that the herd ranged further south across the Hoole and Black Rivers of the Tintina Trench during the post calving period in 2015.

Typically, a comparison of recruitment rates during the post calving and rut periods show a declining trend. This is because the ratios during the post calving survey reflects only neo-natal calf mortality, while counts during the rut survey incorporate mortalities from wolf predation and other misfortune during the summer and early fall prior to the rut surveys. In this instance, the recruitment rate during the post calving survey is lower than the rut survey. This may be due to the factors mentioned above and because focussing the post calving survey around the Project site did not capture calving of the whole FCH.

### 3.5.3 RUT SURVEYS

In 2015, a recruitment rate of 27 calves per 100 cows was found for rutting caribou in the KZK RSA. This recruitment rate is lower than the recruitment rate of 36 calves per 100 cows found in 1995 in the same study area. A recruitment rate of 26 calves per 100 cows was found for rutting caribou in the wider study area conducted by YG in 1995. A recruitment rate of 27 calves per 100 cows during the fall rut is sustainable. A stable population generally requires an average fall recruitment level of 26 calves per 100 adult cows (Hayes et al. 2003). Recruitment in this herd has exceeded 20 calves per 100 cows only seven times in the last nineteen years. Incidental observations of caribou during the post rut moose survey show a recruitment rate of 33 calves per 100 cows; however, given this survey was not conducted in the same area, the sample sizes were different, and the survey was not targeting caribou, it is difficult to draw direct comparisons between the recruitment rates because of unknown accuracy of the surveys.

The adult sex ratio in 2015 was compared to ratios calculated in 1995 for the caribou in the KZK study area and caribou in the wider study area surveyed by YG. Results in 1995 in the KZK study area found a sex ratio of 41 bulls per 100 cows, and a ratio of 45 bulls per 100 cows in the wider study area. These ratios are both above the adult sex ratio of 31 bulls per 100 cows documented during the aerial rut survey in October 2015. The ratio in 2015 is well below the average of 44 bulls per 100 cows for the FCH (Environment Canada, 2012).

### 3.5.4 EARLY WINTER SURVEYS

Surveys of caribou in early winter (a time when caribou are not normally scheduled for surveys) show that there is indeed annual variation in their post rut movements towards winter range. While November was assumed to be the fall migration period of the FCH to winter range, these surveys clearly show that these conditions can vary a great deal – possibly due to late fall weather conditions. In essence, this means that significant exposure to Project effects can last from the rutting period to well into early winter.

### 3.5.5 POPULATION DYNAMICS

A review of the demography of the FCH is informative to placing the potential effects of the Project in the context of ongoing caribou population trend. During the wolf control years of 1986 to 1990 calf recruitment was very high at a mean 50.4 calves per 100 cows (SD=7.53) resulting in an exponential annual rate of growth of ř=17% to roughly 6,000 caribou indicating that wolf predation is likely a very strong driving force in the FCH's population dynamics. However, between 1991 and 1996, as wolves recovered on the herd's range, calf recruitment declined to a mean 27.1 calves per 100 cows (SD=4.22) resulting in an annual rate of decline of ř=-4.6%. The declining trend continued between the population estimate years of 1997 to 1999 (mean recruitment 22.3 calves per 100 cows (SD=5.34); ř=-9.4%) and 2000 to 2007 (mean recruitment 18.7 calves per 100 cows (SD=6.63); ř=-3.7%) to roughly 3,000 caribou. Over the ensuing eight years since the 2007 population estimate mean calf recruitment has been 20.1 calves per 100 cows (SD=5.47) suggesting further decline in herd numbers (Environment Yukon unpublished data).

The degree to which additive mortality from human hunting has played a role in the observed FCH population dynamics is uncertain. While licensed harvest is strictly controlled by quotas and permit hunt authorizations for bull caribou, the First Nation harvest is not recorded. Nevertheless, since about 1991 harvest of the FCH does not appear sustainable and represents a challenge for stakeholders and wildlife managers to resolve. Further, the sex ratio found on the recent survey (31.2 bulls to 100 cows) is near threshold levels (30 bulls to 100 cows) set out in the Yukon Caribou Management Guidelines (1986) and could be the result of selective unsustainable hunting pressure.

## 3.6 CONCLUSIONS

Data collected in 2015 and 2016 has assisted in quantifying the FCHs use of the Project area. It appears the rutting to early winter period is when there is the most likely an interaction of caribou within the Project area. Calving caribou were not found near the proposed Project footprint. However, there may also be interaction between caribou and the Tote Road during spring and fall when caribou make an elevational movement from low elevation wintering grounds to higher elevation calving and rutting areas.

It will prove valuable to revisit the population status of the herd to continue to track population trends. YG Wildlife Branch has proposed a late winter survey for the winter of 2017. The census will estimate population size, composition, and distribution. Due to generally low recruitment rates, hunting pressure, and other ecological factors, the FCH remains a management priority for Environment Yukon (Environment Yukon, 2015a).

# 4. MOOSE

## 4.1 BACKGROUND

Moose (*Alces alces*) are the second most abundant large mammal species in the Project area and are regionally important as a subsistence food source for both First Nations and Yukon resident hunters. The region provides highly suitable moose habitat (Appendix C). Moose are dispersed throughout the LSA during the year, utilizing different habitats throughout the seasons. In the spring, summer, and fall, they prefer shrub-dominated ecosystems near forest cover such as treeline edges, riparian, or wetland complexes, and regenerating burn areas (Franzmann et al., 2007). The wetland and riparian corridors within the LSA are particularly important moose habitat as they provide an abundant food supply. Moose are not generally found in alpine habitats because they provide little cover and food availability. During the rut and post rut, moose occupy subalpine basins with tall shrub vegetation types and open canopy subalpine fir forest. During winter, they prefer forested vegetation types at lower elevation sites along Finlayson Creek where the snowpack is not as deep (Norecol, Dame and Moore, 1996). The Finlayson Creek area around the confluence with Geona Creek is recognized by Environment Yukon (Environment Yukon, 2013b) as a WKA.

A variety of limiting factors have been identified as important for moose in the region. Gasaway et al. (1992) identified the factors of nutrition, weather, hunting, disease, and predation in limiting moose populations in Alaska and Yukon. This study emphasized that reduced recruitment of calves and poor adult survival is not necessarily exclusive to nutritional stress. Deep snow and predation may also have a substantial effect on population growth patterns. Weather conditions, primarily snow accumulation and summer rainfall, may have a variety of effects on moose and their habitat, and thereby influence population growth. Plant growth and nutritional quality during summer affect moose body growth and fat storage. Summer may be a critical season for moose because the size of fat and protein stores determines how long animals survive in a negative energy balance during winter (Schwartz et al. 1988). Peterson (1977) and Mech et al. (1987) stressed the role of snow accumulation as a limiting factor for moose on Isle Royale, Michigan. Coady (1974) indicated that 90 cm of snow represented a critical depth for adults, in that movement restricted access to adequate food sources. Hunting is a major limiting factor of many moose populations. High harvest rates have contributed to moose population declines in Yukon (Hayes et al., 2003) and Alaska (Gasaway et al., 1983). Moose are known hosts of a variety of disease and parasites (Lankester, 1987) but these have seldom been implicated as major limiting factors in population growth. Increase in moose numbers in the absence or scarcity of large predators and long-term failure of moose to increase to higher densities in the presence of naturally regulated predator populations have been interpreted as strong evidence of predator limitation in Yukon and Alaska moose populations (Van Ballenberge 1987, Gasaway et al. 1992).

## 4.2 HISTORICAL STUDIES AND EXISTING INFORMATION

Moose densities throughout Yukon range between 100 and 250 moose per 1,000 km$^2$ of suitable habitat; however, densities in excess of 400 moose per 1,000 km$^2$ have been recorded in a few areas (Environment Yukon, 2015b). Densities of Yukon moose populations are relatively low when compared to those in other parts of North America. This is due to moose in Yukon co-existing with relatively intact predator populations of wolves, grizzly bears, and black bears (Environment Yukon, 2015c). According to Czetwertynski et al. (2012), the current average Yukon-wide density of moose is about 155 moose per 1,000 km$^2$.

### 4.2.1 YUKON GOVERNMENT SURVEYS

In 1996, the moose management team of the YG Fish and Wildlife Branch, developed the "Moose Management Guidelines." . Currently, moose are managed in 67 Moose Management Units (MMU) in Yukon and survey efforts are focused in MMUs where harvest rates are high or where moose populations have declined (Environment Yukon, 2015b). KZK lies within MMU 43, the Big Campbell/Wolverine unit; to the southeast lies MMU 42, the Pelly Mountains unit (Environment Yukon, 2015b). No surveys have been performed for either area since 1996, as harvest rates are low due to limited access to these two remote MMUs (Environment Yukon, 2015c).

Moose surveys completed by Yukon Environment in 1996 for the Finlayson-Frances Lake area resulted in a density of 310 moose/ 1000 km$^2$. Late winter calf recruitment data was collected in the Finlayson area during a government trend survey from 1986 to 1996. Recruitment rates ranged from 30.8% in 1986 to 12% in 1994 and showed a measurable response to the wolf control program (unpublished data, Yukon Department of Environment).

### 4.2.2 INITIAL ENVIRONMENTAL EVALUATION (1995)

The information in this section was summarized from the 1996 report titled Initial Environmental Evaluation Kudz Ze Kayah Project, Yukon Territory authored by Norecol, Dames and Moore Inc. (Appendix A).

Norecol, Dames and Moore Inc. conducted moose surveys for he Project. These surveys were conducted in March and November of 1995. A reconnaissance survey was also conducted in December 1994 to orient the biologists from Norecol, Dames and Moore Inc. to the area and to develop a preliminary understanding of the types of wildlife and habitats available in the Project vicinity. The moose sightings collected during this survey could be considered incidental, but did confirm moose were near the Project area during the early winter. A short aerial wildlife survey was also conducted along the Tote Road in early May of 1995. The objective of this survey was to determine the degree of wildlife interaction with the roadway.

#### *4.2.2.1 Late Winter Survey, March 1995*

This survey was flown by helicopter from the junction of the Robert Campbell Highway and the Tote Road. The flight path crossed the Finlayson Creek valley repeatedly and extended up the larger drainages. The mountainous area surrounding KZK was flown by contouring the Geona and upper Finlayson Creek valleys and adjacent drainages. The total survey area covered was 172 $km^2$.

Moose observations ranged from the lower elevations along Finlayson Creek to the subalpine valley of upper Geona Creek. Most moose were observed in subalpine valleys and appeared to congregate in groups, generally to the highlands west of Geona Creek. Observations ranged from elevations of 1,370 to 1,615 masl. Snow conditions were low during the survey, and did not appear to impede movement of moose throughout the study area. A total of 43 moose were counted. No moose were observed in the area of upper Geona Creek valley.

#### *4.2.2.2 Post Rut Survey, November 1995*

The post rut survey used the same methodology and covered the same general area as the late winter survey, but the flight pattern was more intense. In cooperation with YG biologists, the study area was delineated into eight polygons representing the terrain and habitat types the government was utilizing in post rut moose surveys being undertaken at that time in other areas (Norecol, Dames and Moore, 1996).

A total of 82 moose were observed including 30 bulls, 36 cows, and 15 calves in 33 groups. Moose were observed in three main areas: upper Finlayson Creek (population density: 0.5 to 0.27 moose per $km^2$), the western lake of North Lakes (population density: 3.0 moose per $km^2$), and East Creek (no density comparison possible). The population density calculations are based on a small and specific area in relation to the Project and should not be extrapolated to other parts of the GMS.

Norecol, Dames and Moore Inc. compared results of their 1995 survey to the 1991 YG post rut survey where survey polygons were equivalent, and reported that no measurable changes in population density had occurred. Both surveys were completed after the wolf control program had finished, and the moose population in the region had presumably rebounded because of this predator management.

#### *4.2.2.3 Road Survey, May 1995*

Six bull moose were observed during this survey including two near Finlayson Creek, and four in the pond at the headwaters of East Creek. Additional incidental observations include two moose at the headwaters of Geona Creek and two in a pond on East Creek (Norecol, Dames and Moore, 1996).

#### *4.2.2.4 Incidental Observations*

During a later reconnaissance flight in December 1995, nine moose were noted in the immediate Project footprint adjacent to upper Geona Creek and a subalpine basin (Norecol, Dames and Moore, 1996). These observations suggest that moose spend at least the early-winter period in the upper Geona Creek catchment and subalpine areas.

The wildlife observation log at camp also reported moose observations in the upper Geona Creek valley from mid-June to mid-August (Norecol, Dames and Moore, 1996). It was suspected that the abundance of willow provided browse and cover for moose in this area, and they appeared to reside in and move through the valley throughout the summer (Norecol, Dames and Moore, 1996).

During the caribou rut survey, thirteen moose were observed including three in a subalpine basin east of the former KZK camp at 1,600 masl (Norecol, Dames and Moore, 1996). Most other observations took place in subalpine habitat above upper Finlayson Creek, northwest of camp. It was concluded that moose rut in subalpine basins and on upper slopes, then remain in these habitats through the post rut period from late October to the end of November.

### 4.2.3 WOLVERINE PROJECT

In 2005, AXYS Consulting Ltd. undertook a wildlife baseline assessment for the Wolverine Project now owned by Yukon Zinc. No ungulate-specific field surveys were completed as part of the baseline study for the Wolverine Project.

## 4.3 SURVEY METHODS (2015 - 2016)

Moose surveys were completed to assess the spatial and temporal distribution of moose in the Project area. Late winter surveys were conducted by EDI in March 2015 and by AEG in March 2016. A post rut survey was conducted by AEG in November 2015 and 2016.  a second post rut survey is scheduled for 2016; however, it was not completed at the time of report preparation.

The study area for both the late winter and post rut surveys was defined as the RSA (i.e., GMS 10-07). GMS 10-07), was thought to be an appropriate study area as the subzone boundaries generally follow creeks and rivers representing the natural watershed boundaries that tend to define habitat regions. Baseline data collected on the distribution of moose at the scale of the GMS was comparable to other statistics currently utilized by YG, such as harvest data. This study area was selected in consultation with YG biologists from the Fish and Wildlife Branch.

Navigation for the late winter and post rut surveys was facilitated by the use of a Garmin GPS and Avenza Systems Application. The Avenza Application allowed the aircrafts position to be viewed in real time, enabling the pilot to follow flight lines used during previous surveys. If fresh tracks or animals were observed, the helicopter would slow down to enable gender identification and an accurate count. The helicopter would circle the wildlife to achieve an accurate count for groups and in dense forest sites. Every effort was made to minimize harassment of wildlife to reduce animal stress while still collecting quality data.

Wildlife observations, tracks, and the flight route were recorded to the extent possible using a handheld GPS. Recorded observations included species, group size, age class, and gender. Only fresh tracks that crossed directly under the flight path were recorded during the survey. Tracks observed outside the flight path were not recorded; this is consistent with protocol developed by Environment Yukon for moose track data. Track records include species and a count of the group size. Habitat type and aspect were recorded for each observation of tracks. Incidental wildlife sightings were recorded of non-target species during the survey, and during flights from Ross River to the Project site.

### 4.3.1 LATE WINTER

The main objective for this survey was to gather information on the presence of ungulates (moose and caribou) and their distribution within the Project area to understand the locations of important late winter habitat usage. High elevation terrain was not flown because ungulates do not use these habitats during the late winter. The flight path was back and forth, roughly east-west over the lowlands in the northern section of the Project area. As the terrain became more mountainous, a contour flight pattern was adopted. The flight pattern followed the same protocol as was usedused for the late winter and post rut surveys.

In March 25 to 27, 2015, the survey was conducted using a Cessna 206, flown at 120 to 150 km/h, and an elevation of 200 to 300 m above ground. The total time taken to accomplish the survey was 14.2 hours.

In March 22 to 23, 2016, a Jet Ranger helicopter was used for the survey, and flown at an average speed of 80 to 90 km/h, at an average elevation of 200 m above ground level. The total time taken to accomplish the survey was 25.5 hours. The observation conditions during the survey were excellent. Approximately 6 cm of fresh snow had fallen in the 24 hours prior to the start of the survey. Skies were mostly clear with some high cloud; the temperature ranged from -10 to -3$^{o}$C, with light winds.

Habitat suitability mapping was completed for moose late winter. The methods and results are presented in Appendix C.

### 4.3.2 POST RUT SURVEY

The November (date)2015 post rut survey was conducted using a Cessna 208 (Caravan) and an AS350-B2 A-star helicopter. The helicopter was necessary for part of the survey because the winds were too strong for a fixed wing plane to continue the survey. Surveys were flown at an average elevation of 200 m above ground; forested areas were flown at lower elevations compared to open spaces such as alpine habitats. The average speed during the survey was 105 km/h. The total time taken to accomplish the survey was 15 hours. On December 2016 the post-rut survey was replicated using the same protocols for 16 hours of survey flight time.

Habitat suitability mapping was completed for moose post rut. The methods and results are presented in Appendix C.

## 4.4 SURVEY RESULTS (2015-16)

### 4.4.1 LATE WINTER

**2015**

A total of 31 moose were observed during the survey, including five cow/calf pairs. A density of 20 moose/1000 km$^2$ was calculated; however, this estimate includes unsuitable high terrain, that was not corrected for sightability (the ability to view an object of interest). These results seem particularly low, which is not uncommon for late winter surveys when animals are seeking shelter in treed areas and are often difficult to count. Given tracks were observed in both the eastern and western section of the study area (i.e., Grass Lakes and Money Creek, respectively), it is likely some animals were present but not counted. It should be noted that the presence of wolf packs in these areas may also have driven moose away and resulted in the low count. Figure 4-1 shows the locations of moose and wolf observations and signs.

Moose were primarily observed using flat or gently sloped terrain, close to streams and habitat that contained shrub understory. All moose observations were north of the Project footprint. Two individuals were observed near the Tote Road after it crosses Finlayson Creek and turns north. A number of tracks were observed east of the road in the East Creek valley. No moose were observed elsewhere within the Project footprint. Fresh moose tracks were observed in the lower Geona Valley and just west of South Lakes, both near the Project footprint. Other fresh moose tracks were scattered throughout the Project area at lower elevations, and a total of eight tracks were seen within the Project footprint.

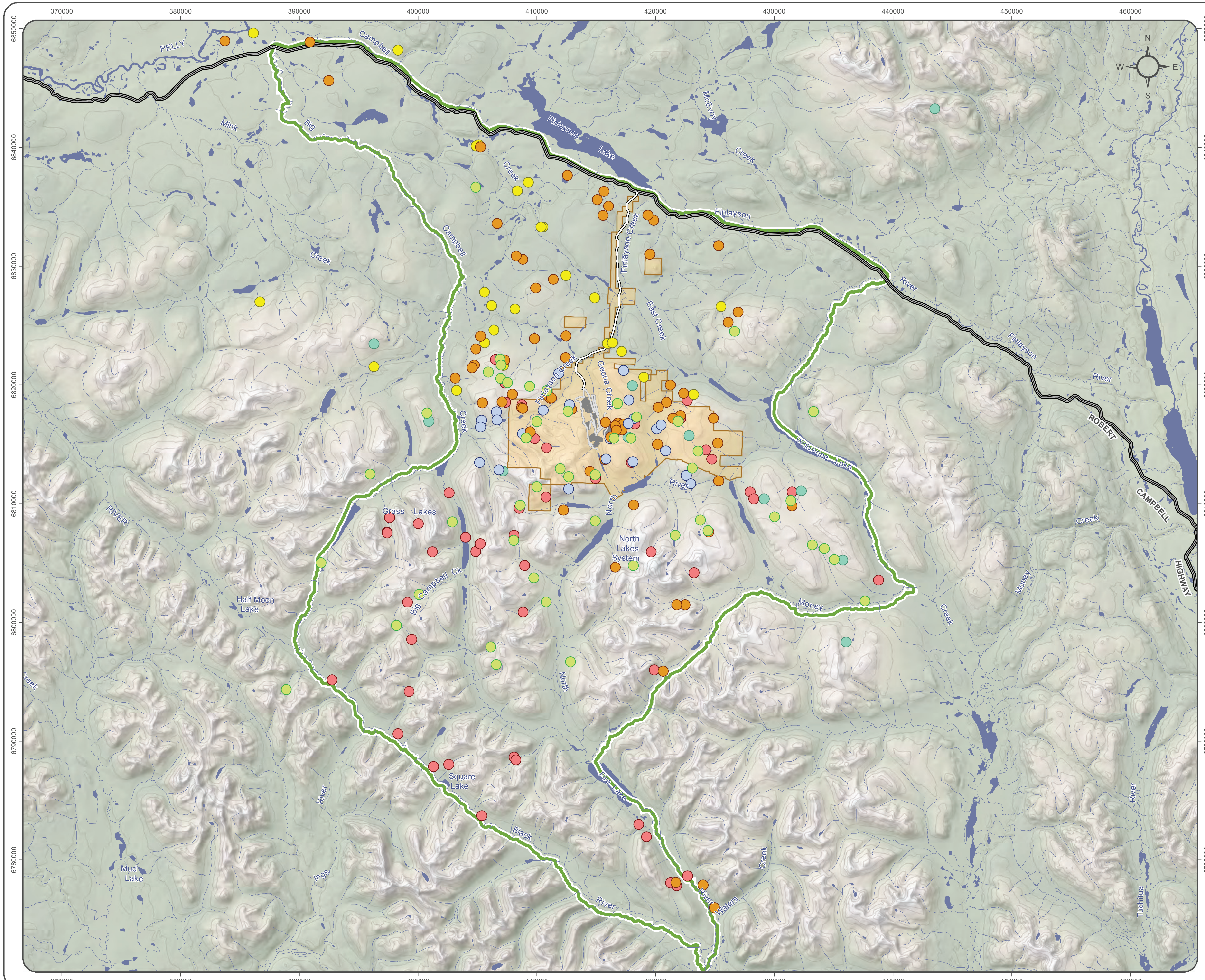
**2016**

A total of 115 moose were counted including 60 bulls, 37 cows, 16 calves, and 2 unknown sex (Table 4-1). Bull and cow moose were rarely seen together during this survey. Bulls were encountered in groups more often than cows; groups of two or more cows were only observed twice, while groups of two or more bulls were observed fourteen times. Most observations were of single moose or small groups. The largest group observed was composed of one cow and five bulls. Although not grouped together, this group was observed in a wide, shrub dominant subalpine bowl. Moose were mainly found at higher elevations throughout the study area. More bull moose were observed above treeline than cows. Moose tracks were plentiful in the northern portion of the Project area where the snowpack was shallower and movement would be easier. South of North Lakes in the Pelly Mountain Range, the snowpack was deeper (approximately 1 m) and tracks were observed much less frequently. The density of moose based on observations was 0.06 moose per km$^2$. Once again, the actual density is likely higher as steep, rocky, alpine areas surveyed are not considered suitable habitat for moose in late winter.

### Table 4-1: Moose Observations During the 2016 Late Winter Survey

| Waypoint # | Bulls | Cows | Calves | Unknown | Group Size |
|---|---|---|---|---|---|
| 3 | 1 | | | | 1 |
| 24 | 2 | | | | 2 |
| 73 | | 1 | | | 1 |
| 97 | | 1 | 1 | | 2 |
| 98 | 1 | | | | 1 |
| 127 | | 1 | | | 1 |
| 149 | 1 | | | | 1 |
| 150 | | 1 | | | 1 |
| 166 | 1 | | | | 1 |
| 179 | | | | 1 (kill site) | 1 |
| 201 | | 1 | 1 | | 2 |
| 214 | 1 | | | | 1 |
| 219 | | 1 | 1 | | 2 |
| 221 | 1 | | | | 1 |
| 226 | 2 | | | | 2 |
| 228 | 2 | | | | 2 |
| 229 | | 1 | 1 | | 2 |
| 234 | | 1 | 1 | | 2 |
| 236 | 2 | | | | 2 |
| 252 | | 3 | 1 | | 4 |
| 254 | 1 | | | | 1 |
| 258 | 1 | | | | 1 |
| 293 | 1 | | | | 1 |
| 295 | | 1 | 1 | | 2 |
| 331 | 2 | | | | 2 |
| 332 | 2 | | | | 2 |
| 344 | 2 | | | | 2 |
| 350 | 2 | 1 | 1 | | 4 |
| 360 | | 1 | 1 | | 2 |
| 361 | 1 | | | | 1 |
| 376 | | 1 | 1 | | 2 |
| 443 | | 1 | 1 | | 2 |
| 480 | | | | 1 (kill site) | 1 |
| 483 | | 1 | | | 1 |
| 501 | 1 | | | | 1 |
| 503 | | 1 | 1 | | 2 |
| 505 | | 1 | 1 | | 2 |
| 510 | 2 | | | | 2 |
| 512 | 2 | | | | 2 |
| 535 | 1 | | | | 1 |
| 536 | | 1 | | | 1 |
| 537 | | 1 | | | 1 |
| 538 | 1 | 1 | | | 2 |
| 542 | | 1 | | | 1 |
| 544 | | 1 | 1 | | 2 |
| 548 | 1 | 1 | | | 2 |
| 549 | 1 | | | | 1 |
| 564 | | 1 | | | 1 |
| 566 | | 1 | | | 1 |
| 583 | | 1 | | | 1 |
| 625 | 1 | | | | 1 |
| 626 | | 1 | | | 1 |
| 628 | 1 | | | | 1 |
| 632 | 1 | | | | 1 |
| 637 | 1 | | | | 1 |
| 638 | 1 | | | | 1 |

| Waypoint # | Bulls | Cows | Calves | Unknown | Group Size |
|---|---|---|---|---|---|
| 641 | 5 | 1 | | | 6 |
| 652 | 1 | | | | 1 |
| 665 | 3 | 1 | | | 4 |
| 675 | 3 | | | | 3 |
| 678 | | 1 | 1 | | 2 |
| 679 | | 1 | 1 | | 2 |
| 688 | | 1 | | | 1 |
| 695 | 1 | 2 | | | 3 |
| 708 | 1 | | | | 1 |
| 717 | | 1 | | | 1 |
| 720 | 1 | | | | 1 |
| 722 | 1 | | | | 1 |
| 724 | 2 | | | | 2 |
| 726 | 1 | | | | 1 |
| 728 | 1 | | | | 1 |
| Total | 60 | 37 | 16 | 2 | 115 |




BMC MINERALS

KUDZ ZE KAYAH PROJECT
WILDLIFE BASELINE REPORT

**FIGURE 4-1**

**LATE WINTER AND POST RUT MOOSE OBSERVATIONS, 2015 AND 2016**

DECEMBER 2016

- 2015 Late Winter Ungulate Survey Sighting (25)
- 2016 Late Winter Ungulate Survey Sighting (69)
- 2015 Post Rut Moose Survey Sighting (49)
- 2016 Post Rut Moose Survey Sighting (49)
- 2015 Caribou Rut Survey Sighting (11)
- 2016 Caribou Rut Survey Sighting (0)
- Incidental Sighting (23)
- Regional Study Area (Game Management Subzone 10-07)
- Tote Road/ Proposed Access Road
- Proposed Mine Road
- Location of Proposed Mine Infrastructure
- BMC Minerals (No.1) Ltd. Mineral Claim Areas

* Numbers in brackets represent the number of individuals

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



1:310,000 when printed on 11 x 17 inch paper

0 3 6 9 12 15 Kilometres

D:\Project\AllProjects\Kudz_Ze_Kayah\Maps\03_Study\Wildlife\Moose\03-Baseline_Report\01-All_Observations\All_Moose_Observations_20161215.mxd
(*Last edited by: mheynen; 12/16/2016/09:09 AM*)

### 4.4.2 POST RUT

**2015**

A total of 113 moose were observed including 40 bulls, 45 cows, 15 calves, and 13 unknown sex (Table 4-2). These observations result in a recruitment rate of 33 calves per 100 cows, and a sex ratio of 89 bulls per 100 cows; however, it should be noted that there were 13 moose of unknown sex. In a study area of 2,063 $km^2$ this equates to density of 0.06 moose per $km^2$. Moose in the study area were mainly utilizing the upland portion of the landscape in areas east, south, and west of the Project footprint. The most significant use of the Project area occurred during the post rut period with 11 moose observed in the vicinity of the Project. Moose were observed in either small groups or solitary. The largest group was 12 individuals located in a valley approximately 1 km south of the proposed Project infrastructure.

Eleven moose were observed in four separate groups in a 2004 burn area in the far southeastern portion of the study area. The old burn habitat is preferred moose habitat due to the presence of early successional species such as willow. Two bulls were observed in a 1994 burn located near Money Creek on the southwestern part of the study area. No other burn areas were recorded within the study area. Other preferred habitat types for moose were subalpine valleys close to treeline with tall cover composed of mainly willow.

**2016**

A total of 154 moose were observed including 31 bulls, 100 cows, and 23 calves in 49 groups. (Table 4-3). These observations result in a recruitment rate of 23 calves per 100 cows, and a sex ratio of 31 bulls per 100 cows. These results should be used with caution, however, as many bulls had cast their antlers by early December and were recorded as cows. This skews the data for useful ratio assessment. All but two moose (1.3%) were found in upland shrub zone and treeline area in a similar distribution to 2015 (Figure 4-1). Forty-eight moose were found within the Project claim block area. Group sizes ranged from solitary to 12 individuals and averaged 3.1 moose. The 2016 survey was carried out over two days and did not cover all of GMS 10-07 therefore comparisons of density estimates were not carried out.

### Table 4-2: Post Rut Moose Count, 2015

| Observation # | Bulls | Cows | Calves | Unknown | Group Size | Habitat/Behaviour |
|---|---|---|---|---|---|---|
| 16 | 1 | | | 3 | 4 | In high boreal shrubby young forest. Ran into treed area before gender and age of 3 determined. |
| 17* | 2 | | | | 2 | Running through subalpine open shrub area. |
| 18 | 2 | 2 | | | 4 | Running through subalpine open shrub area. |
| 19 | 1 | | | | 1 | Standing in subalpine shrub area. |
| 21* | | 3 | | | 3 | Standing just above treeline. |
| 22* | | 1 | | | 1 | Standing in shrubby subalpine drainage. |
| 24* | 1 | 5 | | | 6 | Walking just above treeline near Campbell Creek tributary. |
| 25* | | 1 | | | 1 | Running towards treeline. |
| 26* | 3 | | | 9 | 12 | Browsing in shrubby open forest. Difficult to identify due to vegetation cover. |
| 29 | | 1 | 1 | | 2 | Standing in old burn with standing snags. |
| 30 | 1 | | | | 1 | Standing in old burn with standing snags. |
| 31 | | 1 | 2 | | 3 | Standing/running in old burn with standing snags. |
| 32 | 1 | | | | 1 | Standing in old burn with standing snags. |
| 33 | 4 | | | | 4 | Walking in old burn with standing snags. |
| 34 | 1 | | | | 1 | Walking in old burn with standing snags. |
| 35 | | | | 1 | 1 | Standing in shrubs along small drainage. |
| 36 | | 2 | 1 | | 3 | Standing in open forest. |
| 37 | 1 | 1 | 1 | | 3 | Standing in Black River valley. |
| 38 | | 1 | | | 1 | Standing open subalpine forest. |
| 40 | | 1 | | | 1 | Upper valley open subalpine forest. |
| 41 | | 2 | | | 2 | Black River valley, standing in shrubs. |
| 43 | 2 | 1 | 1 | | 4 | Along shrubby mid-elevation drainage. |
| 44 | 2 | 1 | | | 3 | Upper Black River valley shrub dominate. |
| 45 | | 3 | 1 | | 4 | Side valley south of Grass Lakes open forest. |
| 46 | 2 | 1 | | | 3 | Walking through open forest near moose in observation #45. |
| 47 | | 3 | | | 3 | Subalpine riparian zone. |
| 48 | | 1 | | | 1 | Upper Big Campbell Creek. |
| 49 | | 1 | | | 1 | Side valley south of Grass Lakes open forest. |
| 50 | 1 | 2 | 2 | | 5 | Standing in subalpine riparian zone shrub dominate. |
| 52 | 1 | | | | 1 | Toe of mountain slope open forest, walking. |
| 53 | | 1 | | | 1 | Standing in shrub area between two frozen lakes. |
| 54 | 1 | | | | 1 | Big Campbell Creek Valley bottom shrub dominate. |
| 55 | 1 | | | | 1 | Upper drainage shrub dominant. |
| 56 | 1 | | | | 1 | Upper drainage shrub dominant. |
| 57 | 2 | 1 | | | 3 | Walking open forest. |
| 58 | 1 | 1 | | | 2 | Running open forest. |
| 59 | 1 | 1 | | | 2 | Laying down open forest. |
| 60 | 1 | | | | 1 | Above treeline in bowl standing. |
| 74* | | 1 | 1 | | 2 | Walking shrub dominate valley bottom. |
| 75 | 1 | | | | 1 | Laying down in shrub dominate plateau area. |
| 76* | | 1 | | | 1 | Standing in small shrubby drainage. |
| 80* | | 1 | 1 | | 2 | Standing in small alpine drainage. |
| 82* | | 1 | 1 | | 2 | Standing in small alpine drainage. |
| 83* | | 1 | | | 1 | Standing in shrub dominate large valley bottom. |
| 84 | 2 | | | | 2 | Standing in burn area. |
| 85 | | 1 | 1 | | 2 | Near bulls in burn area (may not have been marked). |
| 86 | 1 | | | | 1 | Big bull in subalpine near small drainage. |
| 89 | 2 | | | | 2 | Laying near treeline of small drainage. |
| 90 | | 1 | 2 | | 3 | Standing in small trees and shrubs at treeline. |
| Totals: | 40 | 45 | 15 | 13 | 113 | |

** Indicates sighting within BMC Project site*

**Table 4-3: Post Rut Moose Count, 2016**

| Observation # | Cows | Bulls | Calves | Group Size | Habitat/Behaviour |
|---|---|---|---|---|---|
| 2 | 1 | | 1 | 2 | bedded down, open spruce hillside |
| 34 | 7 | 3 | | 12 | large group located in alpine |
| 35 | 1 | | | 1 | Located in alpine |
| 38 | 3 | | | 3 | |
| 39 | 3 | | | 4 | |
| 42 | 1 | | | 2 | |
| 43 | 3 | | | 3 | |
| 45 | 1 | | | 2 | |
| 48 | 4 | 1 | | 7 | Bedded down |
| 49 | 4 | | | 6 | Subalpine |
| 51 | 1 | | 1 | 2 | Subalpine |
| 54 | 2 | | 2 | 2 | Hillside; subalpine |
| 55 | 1 | | | 1 | Hillside; subalpine; running |
| 56 | 1 | | | 1 | Standing; subalpine |
| 60 | 7 | 1 | 1 | 9 | Subalpine |
| 62 | 1 | | 1 | 1 | |
| 65 | 1 | 3 | | 4 | Running; subalpine |
| 66 | 2 | | 1 | 2 | Running; alpine |
| 67 | 1 | 1 | 2 | 2 | alpine |
| 73 | 2 | | 2 | 2 | Standing near alpine |
| 74 | 1 | | 1 | 2 | Standing, subalpine |
| 77 | 3 | | | 3 | Alpine - plateau |
| 79 | 2 | | | 3 | |
| 82 | 4 | | | 5 | Alpine - plateau |
| 83 | 2 | | 1 | 2 | Alpine - plateau |
| 84 | 1 | 1 | | 3 | Standing at treeline |
| 85 | 1 | 1 | | 2 | Standing; riparian area at subalpine |
| 91 | 2 | | | 2 | near alpine |
| 92 | 2 | 1 | | 3 | near alpine |
| 93 | 2 | | | 2 | near alpine |
| 94 | 1 | | 1 | 2 | Subalpine fir valley |
| 95 | 2 | 1 | | 4 | Bedded down at treeline |
| 96 | 5 | 6 | 1 | 11 | |
| 97 | 7 | 2 | 1 | 10 | Subalpine valley |
| 98 | 1 | | | 1 | Subalpine valley |
| 99 | 1 | 1 | 1 | 2 | Subalpine valley |
| 100 | | 2 | | 2 | Subalpine valley |
| 101 | 1 | | | 1 | Subalpine - hillside |
| 103 | | 2 | | 2 | Subalpine valley bottom |
| 104 | 1 | | | 2 | Subalpine valley bottom |
| 106 | 5 | | 1 | 5 | alpine |
| 107 | 1 | | 1 | 1 | Subalpine valley bottom |
| 108 | 1 | | | 1 | |
| 109 | 1 | | 1 | 1 | Near treeline |
| 110 | | 3 | | 3 | riparian, valley bottom |
| 111 | 1 | | | 1 | Near treeline |
| 114 | 2 | 1 | | 4 | Near treeline |
| 116 | 1 | | | 2 | Alpine valley |
| 117 | 2 | 1 | | 4 | Valley bottom |
| **Totals:** | **100** | **31** | **23** | **154** | |

### 4.4.3 INCIDENTAL OBSERVATIONS

Many incidental moose observations were made during the 2015 and 2016 field work seasons. Eleven moose observations were made during the caribou rut survey in October 2015 and 20 were made south of the Robert Campbell Highway in 2016. Four of the 2015 observations were outside the RSA boundary, while three were within the RSA, and the remainder are within the LSA but southeast and southwest of the proposed Project infrastructure. There were 74 and 86 moose records in the wildlife logs totalling 146 and 136 moose observed in 2015 and 2016, respectively.

Twelve incidental moose observations were made during three bear den surveys, and one incidental observation occurred during the bird survey in 2015. Six observations occurred within the Project footprint, while the remainder were west, south and east of the Project fooprint. Twelve sets of fresh moose tracks were observed during the bear den survey within the Project area, three in proximity to proposed Project infrastructure.

A remote motion-activated wildlife camera (Reconyx PC800 HyperFire) was installed at a known mineral lick in 2015 and 2016. In 2015, the camera captured a total of 290 images of moose at the mineral lick on 17 occasions from August 1 through October 8, 2015. The majority of images were cow and calf moose; it was not possible to identify if these images were of the same cow-calf pair. One bull was photographed on October 8, 2015. The wildlife camera indicated that in late summer and early fall the mineral lick area is used predominately by cow and calf moose. In 2016, bull, cow, and calf moose were also observed at the mineral lick.

A single observation of a cow and calf moose were observed on July 23, 2016, by a wildlife camera installed in subalpine habitat at the headwaters of Geona Creek. Moose Harvest Data

The Moose Management Guidelines (1996), based on Yukon and Alaska management experience and analysis, sets out moose population management guideline 62 which states, *"Allowable harvest rates for Yukon moose populations can range from 2 to 5%. The Annual Allowable Harvest (AAH) for naturally regulated, relatively stable moose populations of average density are 3 to 4%."*

Within the RSA (GMS 10-07) moose harvest season is August 1 to October 31, with a bag limit of one bull moose per harvester (Yukon Environment, 2016).

The moose harvest data for the GMS 10-06, 10-07, 10-08 and 10-09 (Table 4-4) reflect the number of moose harvested through permit allocation by resident, non-resident, and guided hunters, but does not include First Nations harvest. This is the extent of the YG harvest data for these GMS.

**Table 4-4: Reported Moose Harvest Data for 1995 to 2014 Within GMS 10-06, 10-07, 10-08, and 10-09**

| Year | GMS 10-06 | GMS 10-07 | GMS 10-08 | GMS 10-09 |
|---|---|---|---|---|
| 1995 | 1 | 18 | 3 | |
| 1996 | 1 | 4 | 6 | 1 |
| 1997 | 1 | 2 | 3 | |
| 1998 | 1 | 9 | 3 | 6 |
| 1999 | | 4 | 4 | |
| 2000 | | 5 | 3 | 1 |
| 2001 | | 2 | 2 | |
| 2002 | | 9 | 2 | 1 |
| 2003 | | 1 | 3 | |
| 2004 | 1 | 6 | 1 | 1 |
| 2005 | 1 | 6 | 2 | |
| 2006 | | 6 | 1 | |
| 2007 | 4 | 5 | | |
| 2008 | 5 | 3 | 1 | 4 |
| 2009 | 4 | 5 | | |
| 2010 | 2 | 8 | 1 | |
| 2011 | 2 | 2 | 4 | 1 |
| 2012 | 3 | 2 | 2 | |
| 2013 | 1 | 5 | 1 | |
| 2014 | 4 | 3 | 2 | |
| 2015 | 1 | 8 | 2 | 1 |
| 2016 | 3 | 8 | 2 | 2 |
| Total | 31 | 105 | 44 | 15 |

** Project is in GMS 10-07, highlighted in yellow*

The other subzones of Game Management Zone (GMZ) 10 are included for comparison to the 10-07 subzone where the Project site is situated.

## 4.5 DISCUSSION

### 4.5.1 LATE WINTER SURVEYS

There was a significant difference between the 2015 and 2016 late winter surveys of the number of moose observed. The 2016 survey observed 115 moose, while the 2015 survey observed only 31 moose. One explanation for the difference could be the fresh snowfall prior to the commencement of the 2016 survey that aided in the detection of moose. Another reason for the difference in counts could be more moose utilizing the study area due to favourable weather and snowpack conditions during 2016. Snow depth in late March 2016 was less than snow depth in late March 2015, which was approximately the same time as the early April snow survey data collected at the Finlayson Lake airstrip station that measured snow depth at 57 cm in 2015 and 34 cm in 2016 (Figure 3-3).

Fresh and old moose tracks crisscrossed the valley bottom where there were extensive willow copses, a primary food source was located. The frozen wetlands and creek make travel along the valley bottom easy. In addition, moose made use of the Tote Road and drill access roads at the Project site allowing for efficient movement throughout the Project site resulting in many counted tracks.

The locations of the 2016 late winter moose survey observations are similar to locations reported in 2015 by EDI, and 1995 by Norecol, Dames and Moore Inc. In all three surveys, moose were found either in the Geona Creek valley or to the west, while sightings to the east of Geona Creek valley were few. The snow depths were considered low in 1995, similar to snow depth in 2016. In 1995, moose found in the upper Geona Creek area were in the 1,370 masl to 1,615 masl elevation range, which was similar to elevations of observations made in 2016.

Snow conditions in the vicinity of the Project as mentioned above are below threshold levels for moose. Peterson (1977) and Mech et al. (1987) stressed the role of snow accumulation as a limiting factor for moose. Coady (1974) indicated that 90 cm of snow represented a critical depth for adults, in that movements are restricted such that accessibility to adequate food may be limited or prevented. Peterson (1977) documented poor calf survival during winters of deep snow, primarily associated with wolf predation.

### 4.5.2 POST RUT SURVEYS

The moose density in 2015 (0.06 moose per km$^2$) was on the lower spectrum of the moose density calculated for the open boreal forest north of the Project area (and adjacent to the Tote Road) in 1991 by Larsen and Ward. They calculated a density ranging from 0 to 0.75 moose per km$^2$; however, these results should not be considered directly comparable. The moose density of 0.06 per km$^2$ was for the entire study area, whereas the density in 1991 was specific to the boreal forest adjacent to the Tote Road (approximately 160 km$^2$).

Looking at a broader scale, densities of 381+80 moose per 1,000 km$^2$ were found during the 1991 survey in the Frances Lake area, whereas the results of the 2015 post rut survey indicated densities of 55 moose per 1,000 km$^2$. It should be noted that the 2015 study area covered the entire region, including potentially unsuitable habitat, while the earlier study classified areas above 1,525 masl as “unsuitable moose range.” No sightability correction factors were used in calculating the 2015 densities; it is unclear if these were used in other studies. Regardless of the density calculations, historic and recent surveys in combination with incidental observations have shown that moose are utilizing the Project site throughout the year, with more use during the post rut period.

# 5. THINHORN SHEEP

## 5.1 BACKGROUND

There are two subspecies of thinhorn sheep found in Yukon; the white coated Dall sheep (*Ovis dalli dalli*), and the darker, less abundant Stone's sheep (*Ovis dalli stonei*). The Dall sheep occurs in Alaska, Yukon, NT and northern BC. Stone's sheep occupy a much smaller range in Yukon, but occur throughout much of northern BC.

Thinhorn sheep spend the summer in alpine meadows on mountain peaks. During July and August, they graze on grasses, sedges and forbs, building up fat stores to help them through the winter. In late August and September, sheep begin their migration toward winter range that can be few or many kilometres away. They use the same migration routes generation after generation, moving slowly in the alpine, but quickly across valley bottoms as they are exposed to predation by wolves, coyotes, and grizzly bears.

Sheep spend the winter on south-facing slopes at fairly low elevations, which offer scree slopes and broken cliffs nearby for escape routes and for spring lambing grounds. Key winter range is located farther south of the Project site (Environment Yukon, 2013c). In spring and early summer, sheep visit mineral licks to resupply micronutrients lost during the winter. They spend days or weeks near the licks before following the line of snowmelt and newly sprouted green shoots back up to alpine summer ranges. Pregnant females head for the lambing grounds' steep cliffs in May and early June. They remain there for three to four weeks until all new lambs are born, then together with their young, they climb to summer range once more.

Thinhorn sheep were not considered a focal wildlife species for the Project baseline as the LSA does not overlap with any sheep WKA. A population of thinhorn sheep inhabits the mountains to the south of North Lakes (approximately 7 km south of the ABM Deposit). It is unknown whether this population is Dall's or Stone's sheep. Because thinhorn sheep were not expected to occur in the Project site, direct surveys for this species were not conducted. Incidental observations of thinhorn sheep were recorded outside the LSA during other surveys. Incidental observations of sheep were considered important, as this information was useful for determining if any mitigations for Project effects on sheep are necessary, particularly from aircraft disturbance.

## 5.2 HISTORICAL STUDIES AND EXISTING INFORMATION

Environment Yukon produced a map showing the known key areas of sheep seasonal use patterns in the area surrounding the Project . Of particular importance are the lambing areas approximately 13 km southeast near Money Creek, and further south near Fire Lake (Figure 5-1).

In 1995, sheep were observed approximately 7 km south of the ABM Deposit in the mountains south of North Lakes. Also in 1995, another population of sheep was observed at the headwaters of Money Creek (Norecol, Dames and Moore, 1996).

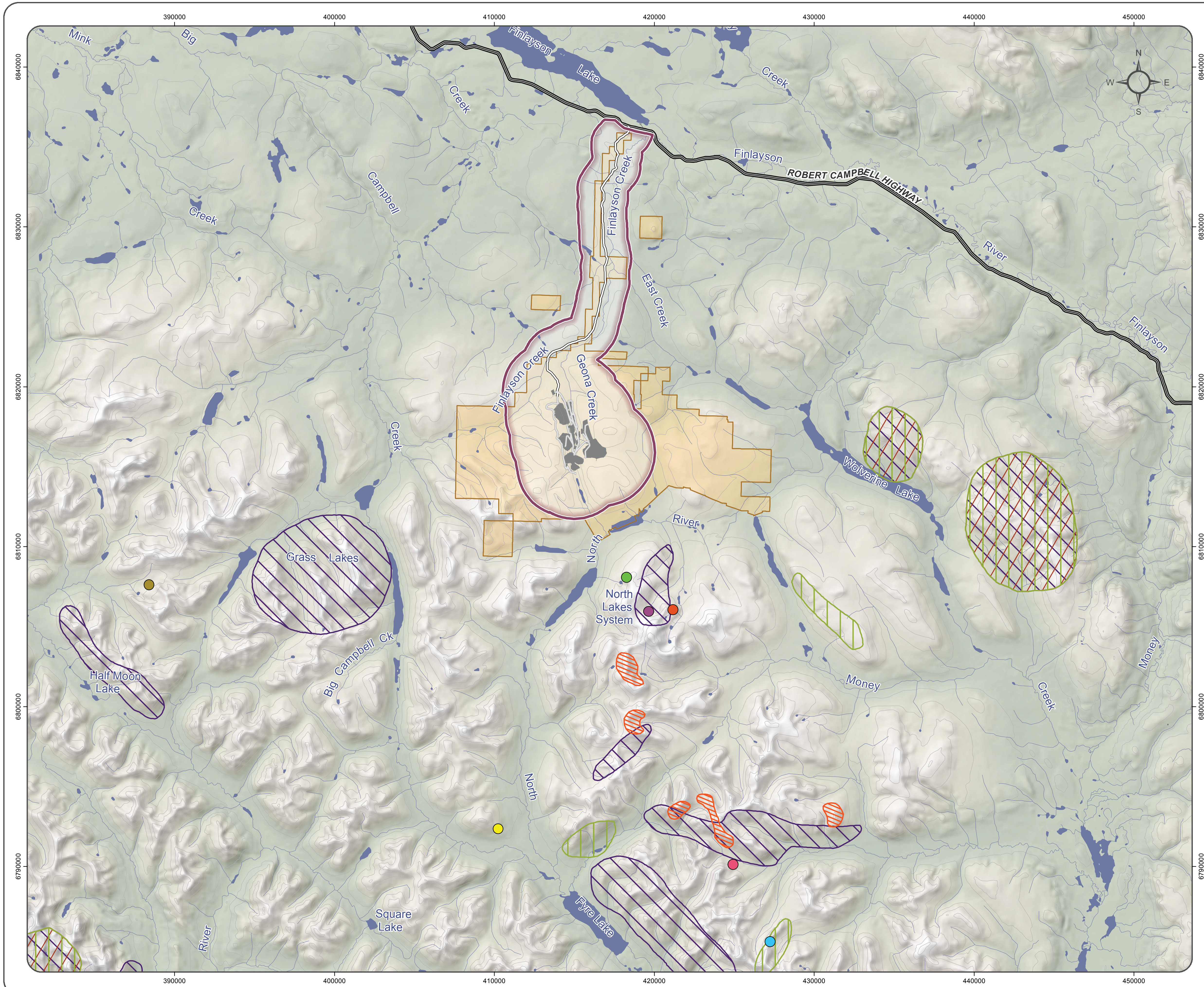
## 5.3 OBSERVATIONS (2015-16)

Although thinhorn sheep were not formally surveyed, they were observed during five separate wildlife baseline surveys in 2015 and 2016 (Figure 5-1). Those observations are as follows:

- Late winter ungulate survey (March 25, 2015)): possible tracks;
- Bear den survey (April 24, 2015): group of 6 or 7, unclassified;
- FCH post calving survey (July 15, 2015): 3 ewes, 3 lambs;
- FCH rut survey (October 2, 2015): 4 ewes, 3 lambs;
- FCH rut survey (October 3, 2015): 2 ewes, 3 lambs; and
- Post rut moose survey (November 19, 2015)): group of 12, unclassified.
- FCH rut survey (October 3, 2016): 2 ewes and 4 ewes; and
- FCH rut survey (October 4, 2016): 12 sheep (1 ram).

Overall, there was a total of 36 thinhorn sheep observed during the 2015 wildlife baseline aerial surveys. Groups were composed of ewes and lambs; no rams were observed.

In 2016, seven rams were observed in Block 5 of the post calving caribou survey.

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## FIGURE 5-1

## THINHORN SHEEP - WILDLIFE KEY AREAS AND INCIDENTAL OBSERVATIONS

FEBRUARY 2017

**SHEEP OBSERVED DURING:**

- 2015 Bear Den Survey (6)
- 2015 Caribou Post Calving Survey (6)
- 2015 Caribou Rut Survey, Sighting (5)
- 2015 Caribou Rut Survey (7)
- 2015 Late Winter Ungulate Survey, Possible Tracks
- 2015 Post Rut Moose Survey, (12)
- 2016 Caribou Post Calving Survey ( 7)

- Thinhorn Sheep Spring lambing
- Thinhorn Sheep Early winter rut
- Thinhorn SheepWinter range
- Thinhorn Sheep Winter range

- Local Study Area
- Location of Proposed Mine Infrastructure
- Tote Road/Proposed Access Road
- Proposed Mine Road
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas

* Numbers in brackets represent the number of individual sighted.

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



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## 5.4 DISCUSSION

The observations and mapped locations for thinhorn sheep were from incidental observations made during other wildlife surveys. The only sheep-focused work involved checking areas shown to be sheep WKAs closest to the Project to confirm the presence of sheep. It was found that sheep were using some of these areas; however, these WKAs are not in close proximity to the proposed Project infrastructure or on the flightpath from the Whitehorse to Finlayson Lake airstrip. There are winter range and spring lambing WKAs on the flight path between Watson Lake and the Finlayson Lake airstrip.

The WKA map indicates that the mountainous area south and east of North Lakes is wintering habitat for sheep (Figure 5-1; Environment Yukon, 2013c). Based on the incidental observations, it is also being used as nursery habitat, so sheep are likely to occupy the area for most of the year. Twenty-four observations of sheep were made there in April, October, and November 2015. It is likely some sheep were observed more than once as the observations were made over time, and in the same locations. Ewes and lambs were observed north of Fire Lake in July, suggesting that is a nursery area, although it is mapped as a winter habitat WKA.

The region near Money Creek, southeast of the Project, has been indicated as a lambing and nursery WKA. It was surveyed during the FCH post calving survey and no sheep were seen at that time. Ewes and lambs were observed west of the Project site in October, north of Half Moon Lake, near the WKA designated as winter habitat.

# 6. GRIZZLY BEAR

## 6.1 BACKGROUND

Grizzly bears (*Ursus arctos*) are an iconic species in Yukon and have significant importance from a cultural and ecological perspective. Many Yukon First Nations believe that grizzly bears possess great spiritual powers and have ascribed human attributes to them, which influenced some people to avoid killing or eating them. Grizzly bears were traditionally hunted for pelts and food, but were not considered a major food source (Clark and Slocomb, 2009). Grizzly bears are presently hunted by resident and non-resident hunters; the latter are required to pay large fees for a guided grizzly bear hunt.

Although Yukon has a healthy population of grizzlies, they are constantly under threat from human activities as they are not well-adapted to habitat degradation, and their search for food often results in human-bear conflicts (Environment Yukon, 2015g). Because of this, grizzly bears are listed as a COSEWIC species of special concern and are listed in Schedule 3 of the federal *Species at Risk Act* (COSEWIC, 2012). Currently, the Yukon Conservation Data Centre (YCDC) lists the grizzly bear as vulnerable in Yukon with an estimated population of 6,000 to 7,000 (YCDC, 2015).

Grizzly bears have large home ranges preferring open valleys and subalpine regions, and may occur in all habitat types as they move through their range. Grizzlies are known to occupy the subalpine valleys and alpine plateaus of the LSA and RSA where they feed on vegetation, berries, small mammals, and ungulates. There is limited historical information on grizzly bear distribution or abundance in the Project area. Accurate densities for the Project area are unknown; however, Larsen et al. (1989) estimated densities between 10 to 16 bears per 1,000 km$^2$, based on studies completed in the Southern Lakes region of Yukon. It is anticipated that the density of grizzly bears is higher in the east-central Yukon, compared to the Southern Lake region, as there is less human effect on wilderness, fewer roads, and lower hunting pressure compared with the Southern Lakes region (Desrochers et al., 2002; Environment Yukon, 2005).

Grizzly bear denning habitat is generally located in alpine and subalpine habitats. Grizzly bears typically select denning locations with deeper soils and vegetation that prevents roofs from caving in (Libal et al., 2012). Denning habitats tend to be on 20 to 40° slopes, and are most likely to be found on south facing slopes (Pearson, 1975; Pigeon et al., 2014). Permafrost and increased soil moisture reduces suitability of potential den sites (Ciarniello et al., 2005; Ciarniello et al., 2007).

Latitude influences denning dates, with bears in northern latitudes denning earlier and longer than bears in southern latitudes (Haroldson et al., 2002). Emergence dates from the den in the spring also varies based on the gender and the occurrence of cubs. Male grizzly bears are the first to emerge in early spring with females following shortly after. Pregnant females tend to den at higher elevations, and following emergence, remain at higher elevation until late May (Haroldson et al., 2002). Males, sub-adults, solitary females, and females with yearlings or two-year-olds usually leave the vicinity of their den within a week of emergence, while females with new-born cubs remain in the general vicinity of the den for several more weeks (Haroldson et al., 2002). Male and female grizzly bears appear to have comparable habitat requirements when selecting dens, and at the largest scale, grizzly bears avoid wetlands, and selected high-elevation, dry conifer stands (Pigeon et al., 2014).

## 6.2 HISTORICAL STUDIES AND EXISTING INFORMATION

Observations recorded in the 1995 KZK camp log included one adult grizzly digging for ground squirrels in a basin 2 km south of camp (June 8), and one grizzly in the uplands 2 km southeast of camp (September 7). No bear den sites were observed during the aerial surveys and none were reported during other Project related work in the area (Norecol, Dames and Moore, 1996).

Incidental grizzly sightings recorded during the 1995 wildlife aerial surveys included:

- May 20: one sow with two yearlings;
- May 20: one sow with one two-year old;
- May 21: one sow with two yearlings;
- May 23: one sow with two yearlings;
- May 27: one sow with one yearling;
- June 28: one sow with one two-year old; and
- June 28: two individual sub-adults.

## 6.3 SURVEY METHODS (2015-16)

Bear den surveys of the area surrounding the Project were conducted to determine if the Project encroached on grizzly bear denning habitat and if so, to develop appropriate mitigation and monitoring procedures to protect this SARA listed species from disturbance. To increase efficiency of the den survey and increase probability of locating dens, a desktop exercise was conducted to highlight suitable bear habitat within the study area. A model was created to help stratify good denning habitat from less suitable areas.

Prior to fieldwork, a model displaying high to moderately suitable grizzly denning habitat in the study area was completed. The model was created using a geographical information system (GIS), a digital elevation model (DEM), and aerial photogrammetry. The parameters to model and map grizzly bear den habitat suitability were assessed based on the following criteria:

- 20 to 40° slopes;
- 600 to 1,500 masl elevation; and
- Exclusion of wet habitat types.

The study area for the model was centred on the proposed Project footprint and extended out in a 10 km radius to balance the large range of these animals with the inclusion of suitable landscape elements and potential habitat. The total area surveyed was 314 $km^2$ (Figure 6-1). The 2015 bear den surveys consisted of three one-day aerial surveys spaced at approximately 10-day intervals to cover the grizzly bear den emergence period on April 23, May 4, and May 15. The 2016 surveys took place on April 19 and April 27. The 2015 and 2016 surveys were conducted by helicopter with each survey taking two to three hours. The helicopter contoured the mountainsides along the treeline at approximately 200 m above ground. The focus of the surveys was placed on the areas modelled as moderate to high quality denning habitat, and was adjusted based on conditions observed at the time of surveying. When bear tracks were located, the crew determined the direction of travel and followed the tracks back to try and locate the den. All active dens, bear sign, and other significant wildlife observations were documented and mapped.

Grizzly bear dens and incidental observations and signs were recorded during ungulate, bird, small mammal, and vegetation studies. The exploration camp wildlife log was also used to record incidental grizzly bear observations.

## 6.4 SURVEY RESULTS (2015-16)

Results from the aerial surveys conducted in the spring of 2015 and 2016 are presented below.

### 6.4.1 2015 DEN SURVEYS

No tracks, sightings, or dens were observed during the first den survey on April 23. The northeast quadrant was not fully surveyed, as tracking lines were difficult to see on the helicopter GPS. The navigator felt that the northern-most potential bear habitat had already been covered in other quadrants of the survey. Furthermore, this area was surveyed in subsequent bear den surveys. This survey was undertaken during ideal survey conditions with approximately 90% snow cover throughout the study area, although steep south-facing slopes had patchy snow cover with bare sections. Snow had fallen within 48 hours prior to the survey, which made fresh tracks easily visible.

An active bear den was located during the second den survey on May 4 (Photo 6-1). The den was located approximately 4.5 km southwest of the Project footprint. It was located on a south facing slope at approximately 1,500 masl elevation, a few metres above the treeline. Extensive tracks were conspicuous in the snow, as they were dirty from walking through the pile of excavated soil in front of the den entrance. The dominant vegetation cover in the area surrounding the den was mostly willow and scrub birch. Approximately 500 m from the den site, a sow and two yearling cubs were observed heading downslope (Photo 6-2).

**Photo 6-1: Active Grizzly Bear Den Found May 4, 2015**

**Photo 6-2: Sow Grizzly Bear with Two Yearling Cubs, approximately 500 m from Den Site**

No additional bear dens were observed on the final survey on May 15. Furthermore, no observations were made, although bear diggings were observed south of Fault Creek. The diggings consisted of a dug-out pit of rock and soil, which suggested that grizzlies were using this area to prey on small burrowing animals such as marmots or ground squirrels.

A bear den was also identified during the fall 2015 caribou rut survey.

### 6.4.2 2016 DEN SURVEYS

A sow and two-year old cub were observed during the den survey on April 17. They were observed on a steep slope, approximately 5 km west of the proposed Project footprint. There were several rocky outcroppings and caves which could have acted as a den, near where the bears were observed. The bears tracks were followed and it appeared they had moved higher in elevation from a location lower on the slope. No other tracks were seen that indicated the sow and cub had entered the valley from another direction. It is possible they may have denned at a lower elevation on the same slope they were observed. The sow and cub were observed in the same location approximately 2.5 hours later. It should be noted that the slope in question had less than 40% snow cover and the valley below had less than 60% snow cover, so tracks were not easy to follow.

During the second den survey on April 27, tracks of a sow and small cub were observed in a subalpine valley approximately 4 km from the proposed Project footprint. The tracks were followed and a den was discovered at mid slope (Photo 6-3). The location of this den was close to where the sow and sub-adult were observed during the previous survey on April 17. This den location was also near the location of the den that was discovered in 2015 that was occupied by a sow and two sub-adults.

The dens observed in 2015 and 2016 have been outlined by a large buffer area in Figure 6-1. Specific denning locations are not identified in this figure to protect the bears.

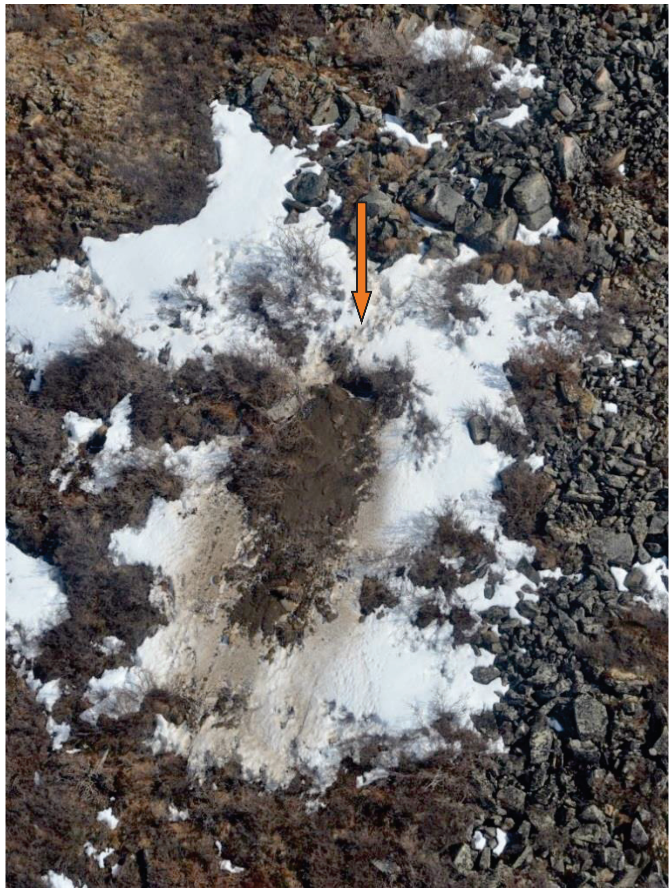

**Photo 6-3: Active Grizzly Bear Den Found April 29, 2016**

### 6.4.3 INCIDENTAL OBSERVATIONS

Incidental grizzly observations are also shown in Figure 6-1.

One incidental grizzly bear observation was made within the LSA during the breeding bird survey on June 24, 2015. Four more observations were made in 2015 during the caribou rut survey, all of which were outside the LSA. There were 11 grizzly bear sightings noted in the wildlife log from July 23 to November 16, 2015.

Two incidental grizzly bear observations were made during the 2016 field programs. The first observation was made on June 16 in subalpine habitat in a drainage east of Geona Creek. The observation was a lone bear, sex undetermined, and appeared to be a sub-adult. The second observation was made on July 14 in subalpine habitat on a hillside east of the wetlands at the Geona Creek headwaters. This observation was also a lone bear, suspected to be a sow and appeared to be a sub-adult. This bear was observed very close to the drilling operations and was not deterred by the loud noise made from the drilling activity. Both observations were made within the LSA. In addition, a the camp log for the 2016 field season indicated a total of 23 grizzly bear observations recorded from May 10 to September 29. The locations of observations ranged from the lower Tote Road (i.e., boreal forest) to the alpine ridges surrounding the Project footprint. All of these incidental observations were made in the LSA. Incidental observations were made by a combination of contracted helicopter pilots and BMC personnel.

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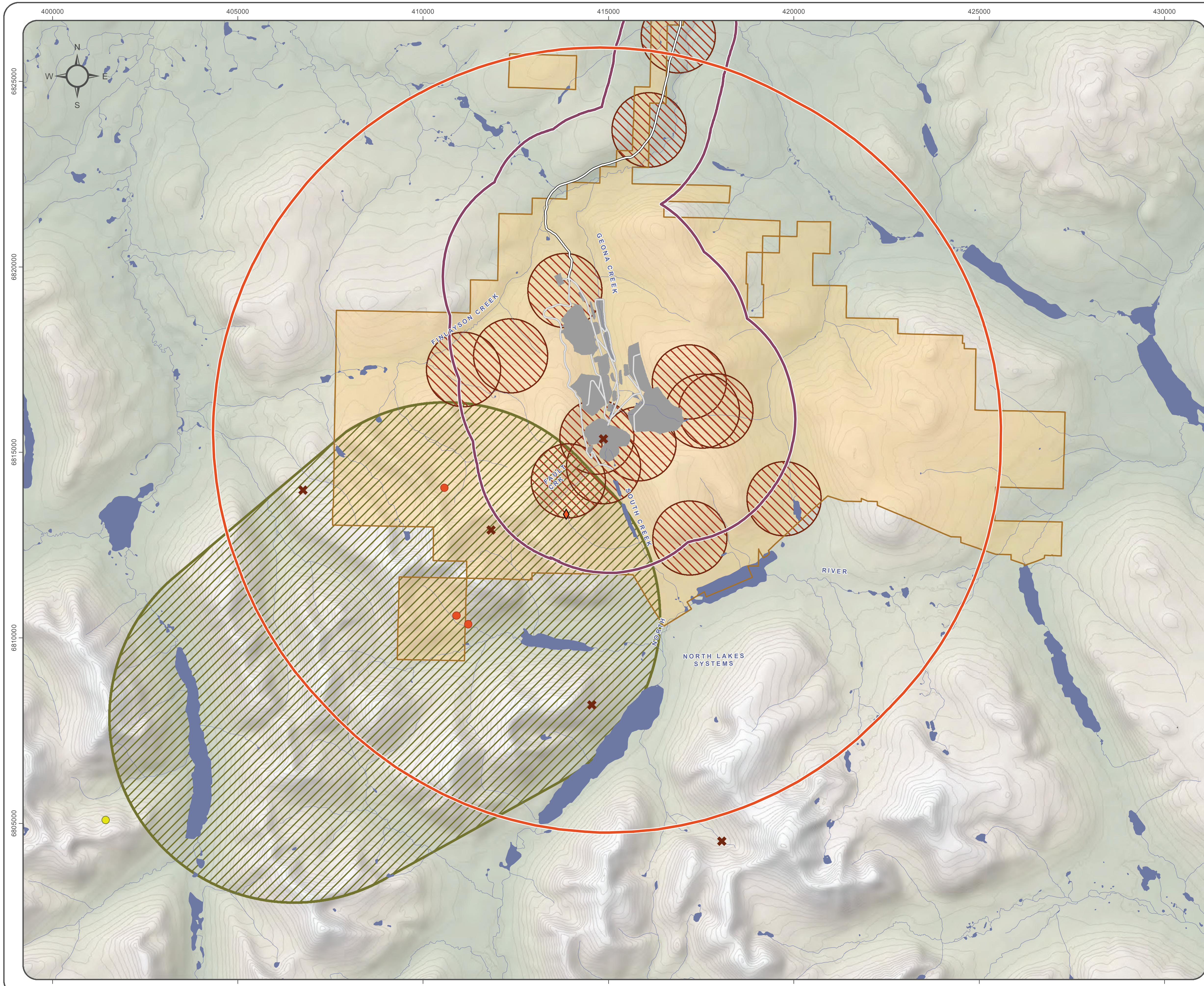
**FIGURE 6-1**

**GRIZZLY BEAR OBSERVATIONS**

NOVEMBER 2016




- Grizzly Bear Sightings (Spring) (3)
- Grizzly Bear Sighting (Fall) (1)
- Spring Grizzly Bear Tracks (5)
- Spring Grizzly Bear Signs (1)
- Approximate Location of Incidental Sightings from Observation Log (14)
- Area in which 3 bear dens have been located
- Local Study
- Bear Den Study
- Tote Road/Proposed Access Road
- Proposed Mine Road (20)
- Contour (40 m interval)
- Watercourse
- Waterbody
- Location of Proposed Mine Infrastructure
- BMC Minerals (No.1) Ltd. Mineral Claim

* Numbers in brackets represent the number of groups of this size range

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



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### 6.4.4 HARVEST DATA

The grizzly harvest data for the RSA (GMS 10-07) which encompasses the Project footprint, is shown in Table 6-1 (Milligan, 2015).

**Table 6-1: Grizzly bear harvest for 1995 to 2016 in RSA (GMS 10-07)**

| Year | 1995* | 1999* | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012* |
|---|---|---|---|---|---|---|---|---|---|
| Kills | 5 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 |

**Where a year is missing from the series, it indicates that no grizzly bears were harvested in that year (i.e. no grizzly harvest in 1996-1998, 2000-2005, 2013-2016).*

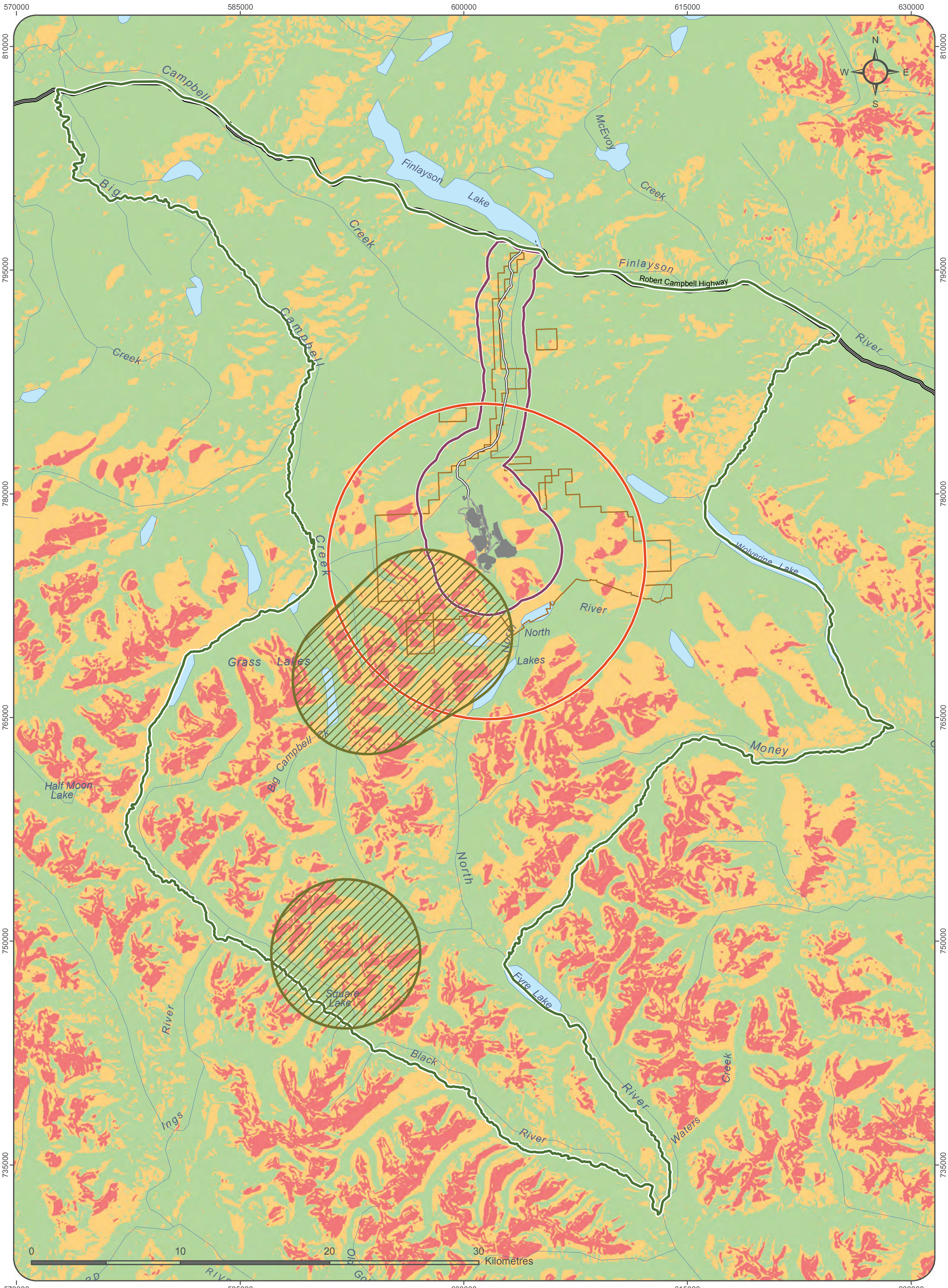
The total number of grizzly bears killed from 1995 to 2014 in the RSA was 15.

## 6.5 HABITAT SUITABILITY MAP

A habitat suitability map was prepared for grizzly bear to provide a baseline of habitat from which to assess habitat changes. The regional predictive ecosystem map and the terrestrial ecosystem map for the LSA were used in combination with sets of criteria that define the quality of habitat and predict areas that grizzly bear likely use during denning. Table 6-2 summarizes the denning criteria used to prepare Figure 6-2. Grizzly bear prefer denning in alpine areas with a south-southeast aspect. For feeding and growing, preferred areas centred around vegetation units that provide good forage for grass and herbs, and provide potential forage for berries and small mammals (Hamilton, 1989; Riddell, 2005; RISC, 1998). Habitat suitability for feeding is also likely linked to caribou and moose use in the Project site. Grizzly bear observations and dens were plotted on the suitability maps and aligned well with the predicted areas of suitable habitat; however, the den sites are not displayed in this report to protect bears that may continue to use these sites.

**Table 6-2: Grizzly Denning Habitat Suitability Criteria**

| Suitability Rank | Slope (degrees) | Aspect | Materials | Elevation |
|---|---|---|---|---|
| High | 30-38 | South and Southeast | Colluvium/Moraine | Alpine |
| Medium | 22-29 or 39-40 | South and Southeast | Colluvium/Moraine | Alpine/Subalpine |
| Low | All other | All other | All other | All other |




**Grizzly Bear Denning Suitability**

- Low
- Medium
- High

- Area in which 3 bear dens have been located
- Regional Study Area (Game Management Subzone 10-07)
- Local Study Area
- Bear Den Study Area
- BMC Minerals (No.1) Ltd. Mineral Claim Areas
- Location of Proposed Mine Infrastructure
- Tote Road/Proposed Access Road
- Proposed Mine Road

**Contours, waterbodies and watercourses** compiled by Natural Resources Canada at a scale of 1:50,000. Reproduced under license from Her Majesty the Queen, as represented by the Minister of Natural Resources Canada. All rights reserved.

Datum: NAD 83; Projection: UTM Zone 9N



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**FIGURE 6-2**
**GRIZZLY BEAR DENNING HABITAT SUITABILITY**

NOVEMBER 2016

## 6.6 DISCUSSION

The two dens located in 2015 and 2016, and all of the associated incidental observations made during the den surveys were reported in the same area. This area is approximately 4 to 5 km south and west of the proposed Project footprint. This area is located outside the LSA and is characterized by high elevation ridges and steep slopes with narrow valleys separating them. The east side of the Project footprint is different than the west side, which has rounded mountains with a lack of steep slopes and broader valleys between them. The observations of the two located dens were consistent with the literature, which found steep slopes at mid to high elevations with dry conifer stands and abundant high quality spring food as preferred denning sites (Pigeon et al., 2014). Furthermore, Ciarniello et al. (2005) found most dens in the mountains were primarily located in the alpine followed by the upper reaches of the subalpine, and most dens were excavated into the sides of steep slopes. Dens with durable or permanent structures are known to be re-used more often, while excavated den use is much less likely (Ciarniello et al., 2005).

Due to the low snowpack in the late winter of 2016, only two den surveys were completed. Presence of snow is essential while performing the den survey to allow surveyors to detect dens and the associated tracks. During the second den survey, the remaining snow was patchy so animal tracks were melting making identification difficult. It is suspected that there are more grizzly bears using the Project site than just the sow and two cubs that were observed near the den. Multiple sets of tracks were observed in different areas suggesting they were made by single bears in each case. Likewise, many of the incidental observations made during the 2016 field season were of individual bears (sex unknown). An accurate estimate of number of bears using the Project site is hard to estimate; however, results of these baseline studies can accurately confirm grizzly bear are denning within a 5 km radius of the Project footprint and multiple grizzly bears are using the LSA for foraging and as a movement corridor to access other habitats.

# 7. BLACK BEAR

## 7.1 BACKGROUND

Within Yukon, the black bear (*Ursus americanus*) is ubiquitous, having a distribution from the border of BC to the Old Crow Flats, with the highest densities occurring in southern Yukon (Environment Yukon, 2015e). Black bear was assessed by COSEWIC in 1998 and 1999 and was designated as Not at Risk (COSEWIC, 2002b). Within Yukon, black bear is considered secure (YCDC, 2015), with an approximate population of 10,000 (Environment Yukon, 2015e).

## 7.2 HISTORICAL STUDIES AND EXISTING INFORMATION

No historical species-specific surveys have been conducted for black bear for the Project; consequently, all observations are incidental. One black bear was observed in 1995 southwest of the camp (Norecol, Dames and Moore, 1996). Black bears are not expected to be common around the Project as they prefer forested areas at lower elevations, compared to the alpine and subalpine habitats around the proposed Project footprint.

## 7.3 OBSERVATIONS (2015-16)

No species-specific surveys were conducted for black bear during the 2015 and 2016 field programs; therefore, all observations are incidental.

One mature black bear was observed at the gatehouse in May 2015. As well, several black bear scat piles were seen on the lower portion of the Tote Road during the vegetation survey in July 2015. Five individual black bear were noted in the 2015 wildlife log, four of which were on the Tote Road, a sow and two cubs at km 12 and an individual at km 21.

Four incidental black bear observations were reported in the 2016 camp wildlife log. Three of these observations were made along the Tote Road at km 1 and km 5. One black bear observation was made at km 22.5 along the Tote Road.

## 7.4 DISCUSSION

Based on the incidental observations of black bear in 2015 and 2016, it can be concluded that black bears are mostly found along the lower Tote Road within boreal forest habitat, and are occasionally observed in subalpine habitat within the proposed Project footprint. The number of bears observed in 2015 and 2016 is similar to the number of bears observed during the 1995 study. Based on results from this baseline program and that performed in 1995, it can be concluded that the Project site does not support a large population of black bears.

# 8. FURBEARERS

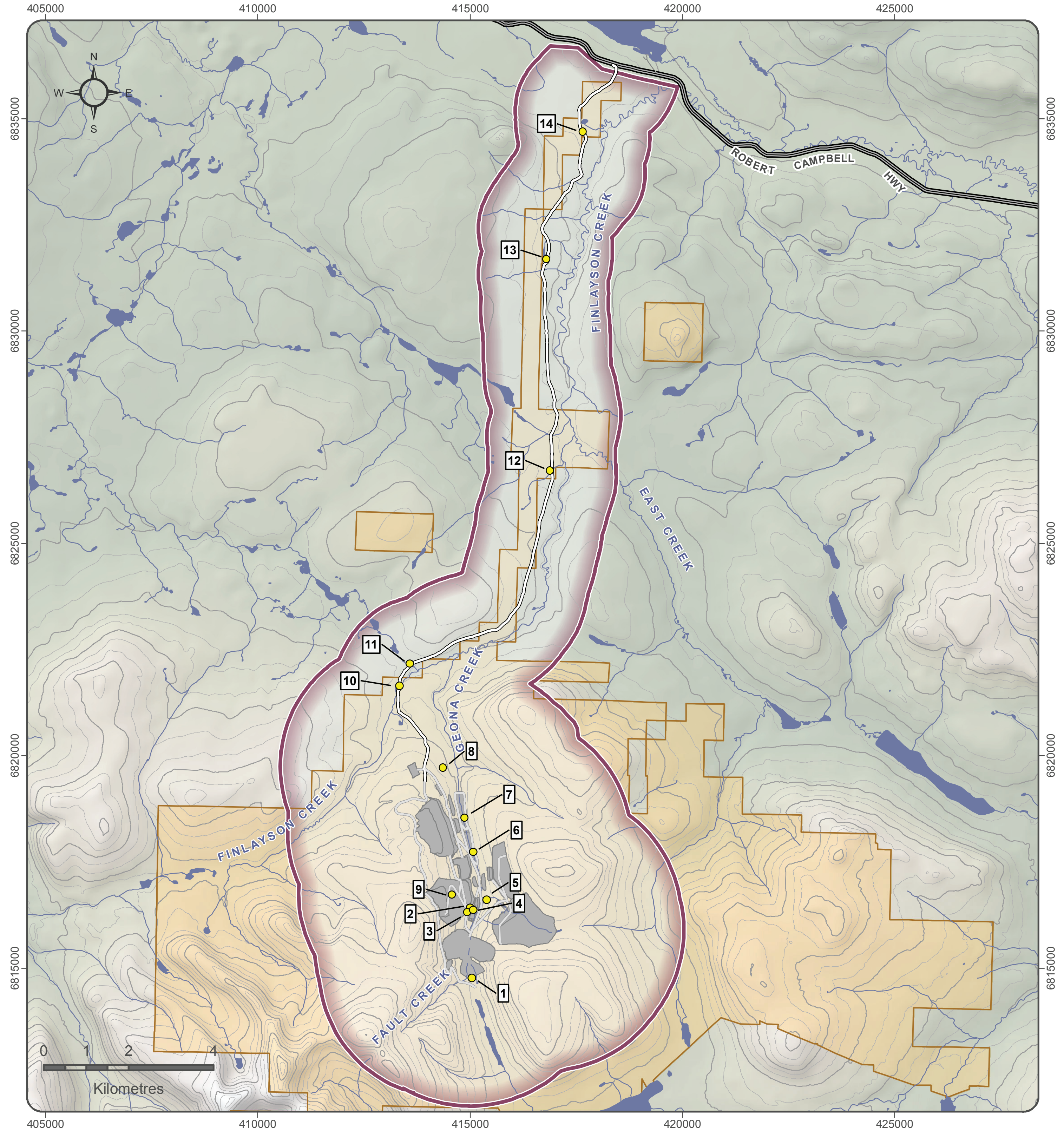
There are many known and suspected furbearing species present in the LSA including wolf (*Canis lupus*), wolverine (*Gulo gulo*), red fox (*Vulpes vulpes*), lynx (*Lynx canadensis*), coyote (*Canis latrans*), marten (*Martes americana*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), river otter (*Lontra canadensis*), and weasel (*Mustela nivalis*). Wolf, wolverine, and red fox are discussed in detail below, while the IEE report mentions that the other species are known to occur in the region (Norecol, Dames and Moore, 1996).

## 8.1 SNOW TRACK SURVEY

A winter snow track survey was conducted in March 2016 and will be repeated in 2017. The survey consisted of establishing fourteen 75 m transects, and identifying and recording the number of tracks per mammal species that intersected within 2 m either side of the transect. Nine of the transects were located around the proposed Project footprint in the upper Geona Creek valley and five transects were located along the Tote Road (Figure 8-1). The protocol used for this survey was based on the British Columbia RISC Committee Ground Based Inventory Methods for Ungulate Snow-track Survey (MOE, 2006). Transects were established in habitat types that commonly occur within the LSA to assess habitat use in the area directly affected by the Project.

The 14 transects resulted in a total of 1,200 m surveyed with a total of 242 track observations. A total of six species were observed along the transects of the proposed Project footprint (Table 8-1). Snowshoe hare and ptarmigan were the most commonly observed tracks in this area, followed by weasel and marten. A total of eight species were observed along the transects of the Tote Road. The most abundant species were ptarmigan (or grouse), red squirrel, snowshoe hare, and grey wolf, respectively. Other tracks observed during the survey included red fox and porcupine. Incidental observations included moose and caribou tracks. Moose tracks were noted mainly in the proposed Project footprint, while numerous caribou tracks were seen along the Tote Road including numerous road crossings. It was expected that more tracks would be encountered on the road, as many animals use roads and trails as movement corridors because they are a path of least resistance.

Snow track observations are discussed further in the following species-specific sections.




- Location of Start of Transect
- Tote Road/Proposed Access Road
- Proposed Mine Road
- Contour (40 m interval)
- Watercourse
- Local Study Area
- Waterbody
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas

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## FIGURE 8-1

## LOCATIONS OF SNOW TRACK TRANSECTS, MARCH 2016

FEBRUARY 2017


Datum: NAD 83; Projection: UTM Zone 9N

AEG



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## Table 8-1: Snow Transects Results

| | | | Number of Tracks and Species | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Transect number** | | **Habitat** | **Snowshoe hare** | **Weasel** | **American Marten** | **Red fox** | **Porcupine** | **Grey Wolf** | **Red Squirrel** | **Ptarmigan** | **Incidental Observations** |
| | | | *Lepus americanus* | *Mustela sp.* | *Martes americana* | *Vulpes vulpes* | *Erethizon dorsatum* | *Canis lupus* | *Tamiascurus hudsonicus* | *Lagopus sp.* | |
| 1 | Proposed Mine infrastructure | Shrub (willow scrub birch), scarce spruce | 5 | 2 | - | 3 | - | - | - | 5 | Vole, moose |
| 2 | | Scrub birch (some willow) and sub alpine fir | 5 | - | 3 | - | - | - | - | 2 | - |
| 3 | | Shrub (willow scrub birch), no trees | 3 | 1 | 1 | 1 | - | - | - | 5 | Moose |
| 4 | | Mixed shrubs and subalpine fir | 5 | 2 | 2 | - | - | - | - | - | Moose |
| 5 | | Riparian, high birch and some willow (30%) | 2 | - | 1 | - | - | - | - | 15 | Moose |
| 6 | | Riparian, willow birch and graminoid | 10 | 4 | - | - | - | - | - | 2 | - |
| 7 | | Riparian, subalpine fir with willow and scrub birch | 7 | 5 | 2 | 5 | - | - | - | 4 | Vole |
| 8 | | Spruce tree old stand, willow and birch understory | 2 | 4 | 2 | - | 1 | - | - | - | Vole |
| 9 | | Subalpine fir, some white spruce with shrub undercover, some riparian | 8 | - | 4 | - | - | - | - | 4 | Grey Jay |
| | | *Subtotal* | *47* | *18* | *15* | *9* | *1* | - | - | *37* | - |
| 10 | Tote Road | Open riparian, tall shrubs, graminoid | - | - | 2 | 5 | - | 3 | - | 10 | Caribou, Vole, ptarmigan kill |
| 11 | | Mature white spruce, open shrubby understory | 4 | 1 | 1 | - | - | 3 | 6 | 9 | Caribou |
| 12 | | Mature white spruce, some shrubs, drainage | 2 | - | - | - | 2 | 2 | 1 | 11 | Caribou |
| 13 | | Edge of wetland, carex and shrubs, some trees | - | 3 | - | - | - | - | - | 6 | Caribou |
| 14 | | Mature white spruce, willow shrub | 4 | | 4 | - | 1 | 2 | 6 | - | Caribou |
| | | *Subtotal* | *10* | *4* | *7* | *5* | *3* | *10* | *13* | *36* | |
| | | **Total** | **104** | **40** | **37** | **23** | **5** | **10** | **13** | **110** | |

## 8.2 WOLF

### 8.2.1 HISTORICAL STUDIES AND EXISTING INFORMATION

Wolves in the general vicinity of the LSA were the subject of government studies in relation to their interaction with the FCH. A wolf control program was undertaken by the Yukon Government between 1983 to 1989 and reduced the wolf population in the area between 81% and 85% (Norecol, Dames and Moore, 1996). Shortly after the cessation of control measures, the wolf population rebounded to near pre-control levels (Norecol, Dames and Moore, 1996).

Based on the wolf study in the Finlayson area by Hayes and Harestad (2000), approximately three wolf packs and dens were located in the KZK Project RSA out of the 23 to 28 wolf packs identified in the 23,000 $km^2$ Finlayson study area.

The IEE stated that wolves and wolf sign were seen infrequently and noted two sightings of wolves occurring in the lower Geona Creek valley and northwest of camp (Norecol, Dames and Moore, 1996). It was hypothesized that exploration activities in 1995 may have resulted in wolves avoiding the area.

### 8.2.2 OBSERVATIONS (2015-16)

The winter 2016 track survey was conducted for furbearers as part of this baseline program. In addition, numerous incidental sightings occurred in 2015 and 2016. Figure 8-2 shows locations of incidental observations of wolf, wolverine and fox.

During the 2015 late winter ungulate survey, two separate wolf packs were observed. One pack was observed approximately 10 km west of the Project and included seven black wolves. The other pack was observed approximately 20 km southeast of the Project and included five black wolves and one grey wolf. As well, a wolf kill site (moose) was observed in the upper Big Campbell Creek area confirming that wolf packs are preying on moose in the area.

During the 2015 bear den survey, wolf tracks were observed along the Tote Road in the Geona Creek drainage, made by a pack of three or four individuals. Tracks were also observed during the post rut moose survey and were often found in association with caribou tracks in the lowlands.

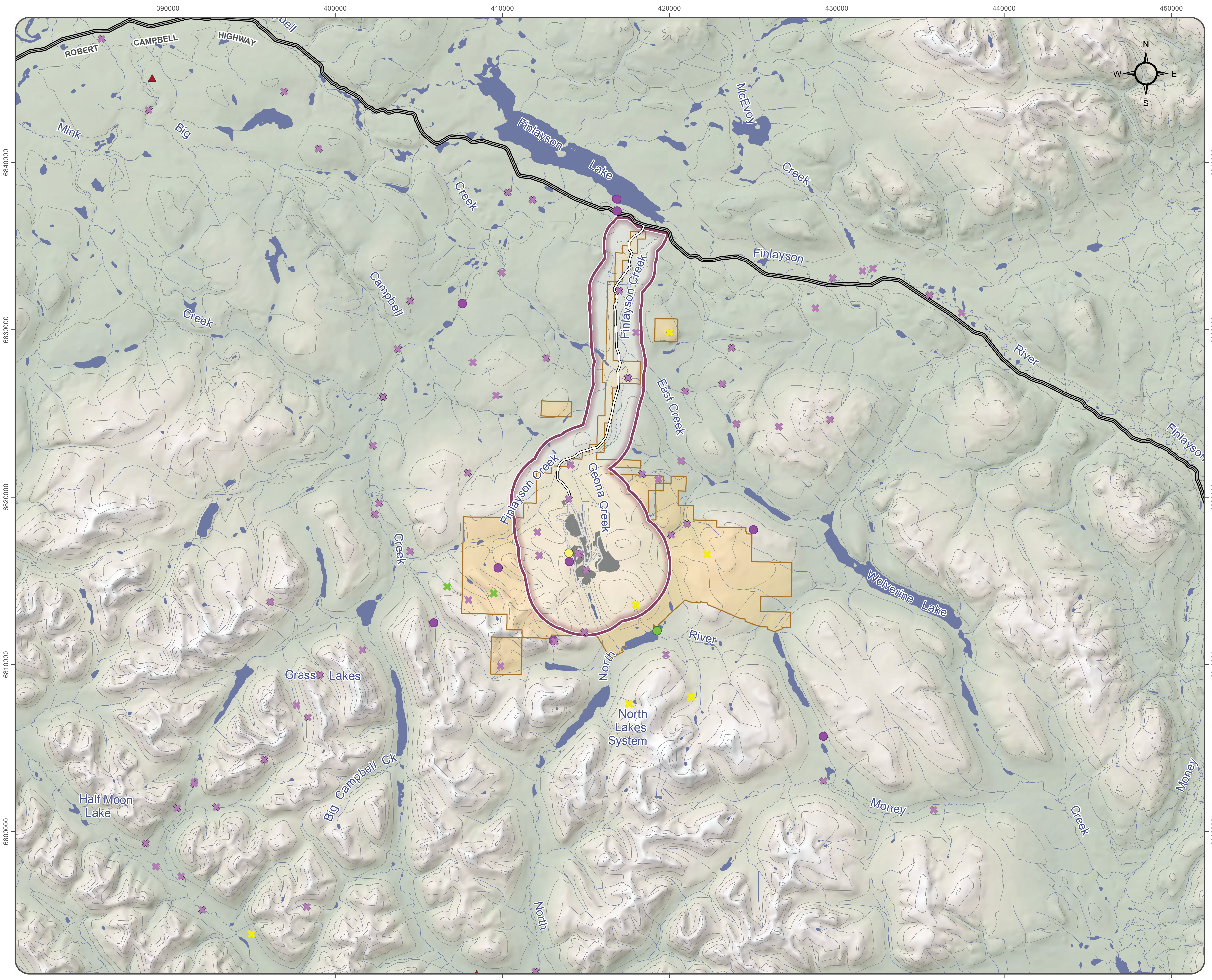
During the 2016 late winter ungulate survey, wolves and their tracks were observed. One wolf was seen at a kill site (moose) in the far northwest portion of the RSA. On March 22, a pack of four wolves was observed approximately 5 km southwest of camp. During the snow track survey on March 23, wolf tracks were common along the Tote Road, often superimposed on caribou tracks. Furthermore, images of wolves were captured several times on the wildlife cameras located near North Lakes and South Lakes.

The March 2016 snow track survey identified 10 wolf tracks at four of five transect locations on the Tote Road, but no wolf tracks were found in the nine transects at the Project site.

During 2016 field studies, incidental wolf sightings and tracks were observed within the LSA along the Tote Road south of camp and along the Geona Creek valley near the headwaters. Four incidental observations of wolves were recorded in the 2016 wildlife observation log. Three of the four observations were made along the Tote Road, while the fourth observation was made along the lower road parallel to Geona Creek.

During the 2016 post rut ungulate survey, nine wolves were observed; two on Finlayson Lake near the access road gate house; four in the alpine immediately above the Project site; and, three on a moose kill near Fire Lake. The snow trail of a wolf pack was observed on the access road from about the gate house to the Project site.

Based on the observations made in 2015 and 2016, wolves appear to be common throughout the LSA and RSA and presumably a limiting factor on moose and caribou populations.

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**WILDLIFE BASELINE REPORT**

## FIGURE 8-2

## INCIDENTAL OBSERVATIONS OF WOLF, WOLVERINE AND FOX, 2015-2016

DECEMBER 2016

- Wolf Sighting (9)
- Wolf Tracks (68)
- Wolf Kill Site (2)
- Wolverine Sighting (1)
- Wolverine Sign (6)
- Fox Sighting (1)
- Fox Tracks (2)
- Tote Road/ Proposed Access Road
- Proposed Mine Road
- Contour
- Watercourse
- Waterbody
- Local Study Area
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas

* Numbers in brackets represent the number of groups of this size range

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



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## 8.3 WOLVERINE

Wolverines are listed as a COSEWIC species of special concern (COSEWIC, 2014). The YCDC lists the wolverine as vulnerable with no current population estimate for the Yukon (YCDC, 2015; Environment Yukon, 2015j).

### 8.3.1 HISTORICAL STUDIES AND EXISTING INFORMATION

The IEE reports that wolverines were observed west of camp in June 1995, and tracks were observed north of camp in April of the same year (Norecol, Dames and Moore, 1996).

### 8.3.2 OBSERVATIONS (2015-16)

The winter 2016 track survey was conducted for furbearers as part of this baseline program in addition to incidental observations during other surveys and in the camp wildlife log. Figure 8-2 shows locations of incidental observations of wolf, wolverine and fox.

Only one wolverine was observed during formal baseline field surveys, which was an adult being chased by a golden eagle (*Aquila chrysaetos*). Many tracks were observed in the snow during the bear den surveys and early-winter moose surveys on alpine and subalpine slopes. No wolverine tracks were found during the March 2016 track survey.

Two incidental wolverine observations were recorded in the 2016 wildlife observation log at km 22 and km 23 along the Tote Road. Also, a fisher observation was recorded in the wildlife log in alpine habitat, which is suspected to be a wolverine given the fact that fishers are very rare in Yukon and are found in dense coniferous forest.

## 8.4 RED FOX

### 8.4.1 HISTORICAL STUDIES AND EXISTING INFORMATION

Red fox were observed either directly or through signs during field work conducted for the IEE. Incidental observations reported fox in the spring of 1995 around the camp area and several kilometres north of camp (Norecol, Dames and Moore, 1996).

### 8.4.2 OBSERVATIONS (2015-16)

The winter 2016 track survey was conducted for furbearers as part of this baseline program in addition to incidental observations during other surveys and in the camp wildlife log. Figure 8-2 shows locations of incidental observations of wolf, wolverine and fox.

During the bear den survey, fox tracks were observed, but not always recorded in detail. Red fox tracks were tallied during the snow track survey for furbearers on March 23, 2016. Nine fox tracks were recorded for the Project site, and 23 tracks were recorded for the Tote Road. Fox tracks were not entered into the GPS during the 2016 late winter ungulate survey due to the high volume of ungulate observations.

A total of 67 fox observations were made in the 2016 camp wildlife observation log. Most of these observations occurred near human habitations, including camp, the incinerator, and the drilling areas. There was one fox known to reside around the camp and core processing area in 2015 and 2016. Many of the observations commented on how tame and friendly the fox was, including observations of the fox stealing food from the drillers. Observations in 2016 indicated it also feeds on surrounding small birds and mammals including squirrel, gopher, marmot, muskrat, rabbit, and ptarmigan. A few fox observations were also made along the lower Tote Road in boreal forest habitat.

## 8.5 OTHER FURBEARERS

### 8.5.1 HISTORICAL STUDIES AND EXISTING INFORMATION

Historical survey data does not exist for coyote, lynx, weasel, river otter, ermine, mink, or marten, although the IEE does mention these species are known to occur in the region (Norecol, Dames and Moore, 1996).

### 8.5.2 OBSERVATIONS (2015-16)

The winter 2016 track survey was conducted for furbearers as part of this baseline program in addition to incidental observations during other surveys and in the camp wildlife log.

During the bear den surveys, weasel tracks were common in the LSA. Weasel tracks were also observed in the Geona Creek valley and along the Tote Road during the snow track survey conducted on 23 March 2016. Muskrat pushups were observed on North Lakes during an aerial fly over of the lake as part of the bear den survey. Finally, a pair of river otter were observed outside the LSA in a wetland at the headwaters of Big Campbell Creek.

The 2016 camp wildlife log recorded small numbers of observations of lynx, weasel, ermine, marten, and muskrat.

# 9. BEAVER

## 9.1 BACKGROUND

There is no population estimate for beaver (*Castor canadensis*) in Yukon; however, they are common and found in places where aspen, poplars, or other deciduous trees grow near water (Environment Yukon, 2015d). Beavers create and modify wetlands by building effective dams up to three metres high and hundreds of metres long (Environment Yukon, 2015d). Behind the dam, beavers build a lodge, which is a mound of logs and mud containing a nesting chamber accessed through an underwater tunnel (Environment Yukon, 2015d). Beaver signs include the obvious dams and lodges, as well as signs of construction such as pointed tree stumps and underwater brush piles (Environment Yukon, 2015d). Once trapped extensively for its pelt, the beaver is no longer as valuable a furbearer as in the past; however, trapping still occurs and the beaver is still valued for food by some First Nations (Environment Yukon, 2015d).

## 9.2 HISTORICAL STUDIES AND EXISTING INFORMATION

Although no quantifiable data were collected, the IEE notes that beavers were considered *"moderately abundant"* and observed in Finlayson, Geona, and North Lake drainages (Norecol, Dames and Moore, 1996). The report states that upper Geona Creek represents poor beaver habitat, but the area still had obvious signs of recent beaver activity. Furthermore, beaver activity was observed on most of the small ponds in the upper Geona Creek valley and the North Lakes drainage to the south.

Anderson et al. (2001) mentions that beavers could be expected to occur throughout the lower and mid-elevation streams and ponds within the Wolverine Mine Advanced Exploration Program area. However, this area does not overlap with the Project site.

## 9.3 SURVEY METHODS (2015-16)

A Habitat Suitability Index (HSI) was used for Geona Creek to determine the suitability of the creek for beaver occupancy. The HSI was based on the 1982 habitat assessment model developed by A. Allen from the U.S. Department of Fish and Wildlife (Allen, 1982). To assess the quality of beaver habitat, a desktop and field examination of the Geona riparian corridor system was undertaken and interpreted based on four criteria:

- Stable hydrological system providing adequate water (number of deep pools);
- Channel gradient of less than 15%;
- Quality food species present in sufficient quantity; and
- Signs of beaver occupancy.

Stable hydrological system means there is a regular and constant flow of water throughout the year, and there are pools deep enough so beavers can swim to access food and cover during winter. A channel gradient of less than 15% is required, a preferable gradient is usually less than 6% (Allen, 1982). Quality food species in order of preference are aspen (*Populus tremuloides*), willow (*Salix spp*.), cottonwood (*Populus balsamifera*), and alder (*Alnus spp*.) (Allen, 1982). Beavers switch to herbaceous vegetation during the summer, but are reliant on caches of woody vegetation to feed them during the winter. Lastly, evidence that beaver are actually living and breeding in the area is a strong indicator that the habitat is of sufficient quality to support a colony.

Maps and aerial photography were examined prior to fieldwork. Images were reviewed to see where stream morphological changes occurred and to determine the structural class of the vegetation within the riparian corridor, a distance of 50 m on either side of the waterway. It was determined that the extent of the beaver habitat survey should be from the headwaters of Geona Creek to the confluence with Finlayson Creek.

A localized beaver survey was completed for the upper Geona Creek valley on July 7, 2015. Several passes were flown over the creek and all beaver sign (dams, lodges, caches) were marked on GPS and photographed from the air. Beaver sign, such as lodges, dams, and construction material caches, are easily noted from the air.

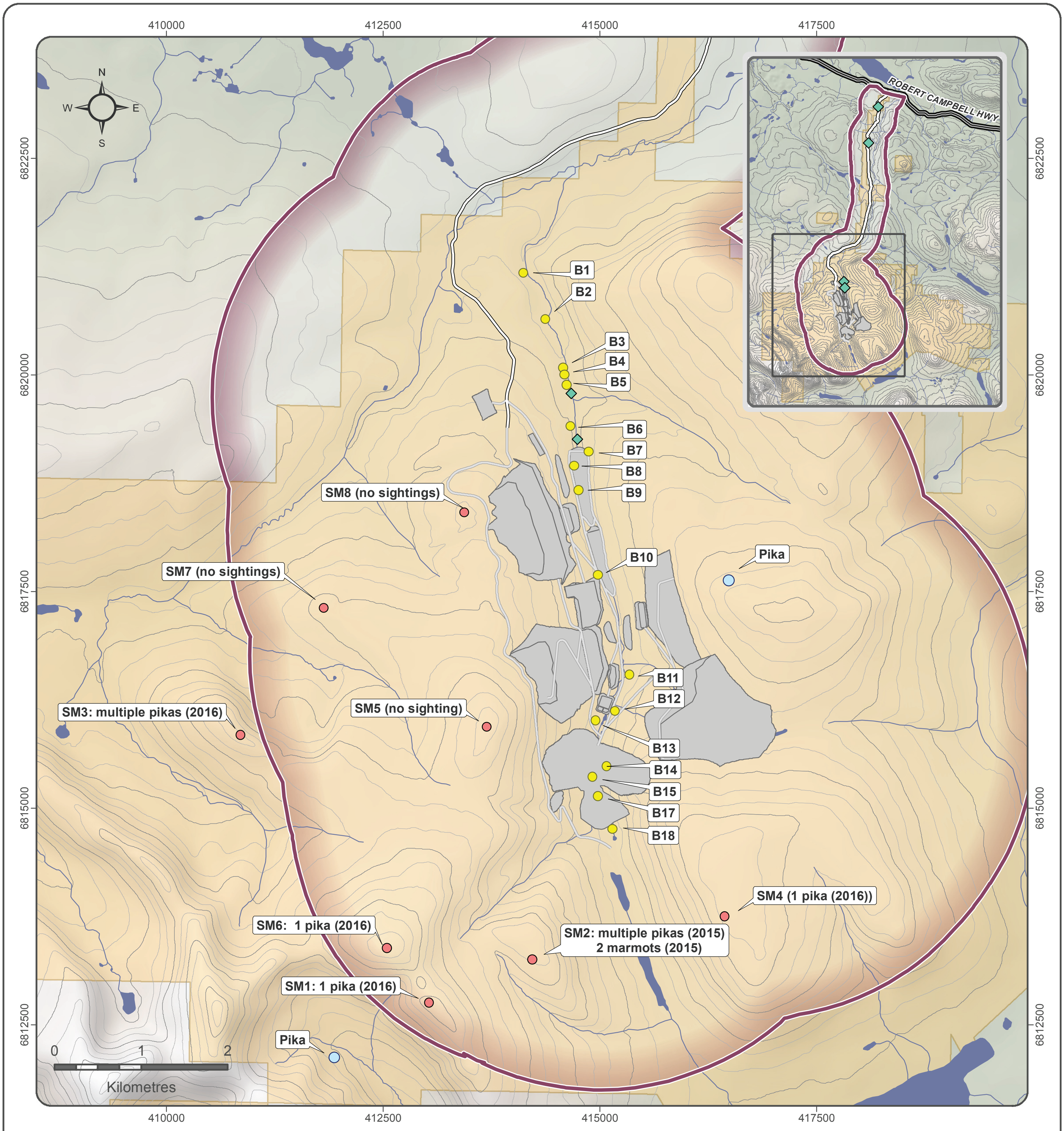
Vegetation cover and signs of beaver activity were also recorded within the riparian corridor on the ground during the rare plant surveys and vegetation baseline study. Furthermore, the lower reaches of Geona Creek were assessed for beaver sign during the fish and aquatic surveys. A reach assessment was carried out on Geona Creek that collected information on channel characteristics, stream morphology, riparian vegetation, and other instream features. This information was used to augment the beaver habitat assessment.

## 9.4 SURVEY RESULTS (2015-16)

The aerial survey of the upper Geona Creek valley, from the confluence with Finlayson Creek to the headwaters of Geona Creek, yielded 18 observations of beaver activity. Most of the beaver structures were old, vegetated, and beginning to deteriorate (Photo 9-1 and Photo 9-2). Only four of the eighteen observations appeared to have been constructed within the last two years. The only direct sighting of a beaver took place on June 24, 2015 when a beaver was observed in a wetland associated with Geona Creek; a dam and lodge were also noted in this location. Figure 9-1 shows the locations of beaver structures.

The best beaver habitat observed during this survey was in the lower 1.2 km of Geona Creek (upstream of the confluence with Finlayson Creek). This area had forest within 10 m of the water channel, abundant willow, and deep pools (average 0.8 m deep) created by resident beavers. There were also signs of current beaver use in this area, and it was classified as moderate grade habitat.

Beaver habitat from 1.2 km to 6 km upstream was poor quality. Although there were pools, they were shallow with minimal vegetation complexity. The upper 2.7 km of Geona Creek was rated poor to moderate quality habitat because of the high number of wetlands in the area, which provided cover and ample food for beavers; however, pond depth was shallow, averaging 0.3 m deep.




Small Mammal Survey
Beaver Structures Observed
Incidental Sighting
Bat Detector Location
Local Study Area
Contour (40 m interval)
Tote Road/Proposed Access Road
Proposed Mine Road
BMC Minerals (No.1) Ltd. Mineral Claim Areas

## KUDZ ZE KAYAH PROJECT WILDLIFE BASELINE REPORT

### FIGURE 9-1

### BEAVER STRUCTURE LOCATIONS, SMALL MAMMAL SURVEY SITES AND BAT DETECTORS

FEBRUARY 2017


Datum: NAD 83; Projection: UTM Zone 9N

AEG



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### Table 9-1: Aerial Observations of Beaver Signs, July 7, 2015

| Site | Observations |
|---|---|
| B1 | Small, old dam (vegetated). Incompletely blocking Geona Creek such that creek diverted around dam. |
| B2 | Old dam (vegetated). Incompletely blocking Geona Creek such that creek has diverted around dam. Small wetland/widening of creek upstream of dam. |
| B3 | Difficult to observe due to riparian vegetation, but some beaver-created structure is impeding creek creating a large riffle zone. |
| B4 | Dam, wetland upstream. |
| B5 | Old lodge (now in a riparian area). Densely vegetated old dam creating wetland. |
| B6 | Old dam partially blocking main channel, creating riffle zone. |
| B7 | Breached small dam on main channel in a braided/wetland area with multiple channels. |
| B8 | Breached small dam on main channel in a braided/wetland area with multiple channels. Wetland upstream of dam has drained. |
| B9 | Small dam on main channel in wetland area, creating riffle zone. |
| B10 | Extensive dam creating large wetland. Lodge, suspected to be unoccupied, entirely surrounded by water. |
| B11 | Old signs, breached dam and building materials in water/along shore of main channel near well-established wetland. |
| B12 | Small dam on main channel in a braided/wetland area with multiple channels. |
| B13 | Old dam (densely vegetated) in wetland with a small channel of water passing through. |
| B14 | Lateral extension of previous structure (B13), 'arm' of old dam. No longer containing wetland, water passing around end of dam. |
| B15 | Old dam and building material cache. |
| B16 | Small dam creating minor riffle zone. |
| B17 | Old lodge on edge of wetland. |
| B18 | Old dam and small wetland. |

**Photo 9-1: Old Beaver Dam and Drained Wetland**

**Photo 9-2: Unoccupied Beaver Lodge**

## 9.5 DISCUSSION

There is ample evidence that Geona Creek has been historically occupied by beavers; however, in most cases the dams have been breached and the lodges are in a state of disrepair. No signs of freshly harvested shrub or tree boles or limbs were observed during the survey, as well as no scat or signs of actively used trails were present. The lack of poplar stands in this area probably prevent the habitat from being highly suitable for beaver usage; beaver are limited to using large willow for building dams or lodges and for winter diet. The higher quality and active beaver habitat was observed in the lower reach of Geona Creek.

# 10. COLLARED PIKA AND HOARY MARMOT

## 10.1 BACKGROUND

The collared pika (*Ochotona collaris*) is a small mammal in the same order as rabbits and hares (i.e., Lagomorphs). In Canada, the pikas range is restricted to talus slopes and meadows in the alpine areas of northwestern BC, Yukon, and NT. The talus-meadow habitat provides shelter from predators and weather, and easy access to food (COSEWIC, 2011). The collared pika is a habitat specialist that limits the dispersal ability of the species (Environment Yukon, 2015f). Pika are acutely vulnerable to a changing climate and habitat disturbance. A thorough understanding of baseline population trends and the extent and severity of changes to habitat due to a changing climate is unknown (COSEWIC, 2011).

The hoary marmot (*Marmota caligata*) is the largest member of the squirrel family, weighing up to 5 kg and measuring approximately 0.5 m in length (Environment Yukon, 2015h). Hoary marmot are found in alpine areas across most of Alaska and the Yukon and will live in coastal areas where suitable habitat exists (ADFG, n.d.). Hoary marmots den in similar habitat to collared pika, such as talus slopes and boulder fields; however, they require areas with soil in which they can dig dens (ADFG, n.d.). A social animal, the hoary marmot lives in colonies of up to a dozen members (Environment Yukon, 2015h).

## 10.2 HISTORICAL STUDIES AND EXISTING INFORMATION

The collared pika population size within Yukon is unknown (Environment Yukon, 2015f). One study looking at pika populations in the Ruby Range of southwestern Yukon showed that substantial variation in population size occurred over time (Morrison and Hik, 2007). The YCDC lists the collared pika as S3, or vulnerable (YCDC, 2015). COSEWIC listed the collared pika as species of special concern in 2011 because the potential for negative effects on the persistence of this species over the long-term, due to climate change, is substantial. Collared pika has cultural significance to Yukon First Nations where they are known as coney or rock rabbits (Environment Yukon, 2015f). They are hunted in Alaska and Yukon by some First Nations as they provide an important food source in alpine areas where other wild meats may not be as accessible (COSEWIC, 2011).

Likewise, the hoary marmot population within Yukon is unknown, and its conservation status within the territory is S4, or apparently secure (Environment Yukon, 2015h). The hoary marmot was traditionally eaten by First Nations, while hides were used for clothing and as a form of currency among the Tlingit First Nations (ADFG, n.d.). Currently in Yukon, hoary marmots are protected from hunting except by First Nations people (Environment Yukon, 2015h).

Prior to undertaking surveys in 2015, there appeared to be no regional or project-derived survey data on distribution or abundance of collared pika and hoary marmot. Neither species was mentioned in the IEE (Norecol, Dames and Moore, 1996).

## 10.3 SURVEY METHODS (2015-16)

Prior to beginning the 2015 fieldwork, a desktop exercise was conducted to identify areas of highly to moderately suitable pika habitat within and adjacent to the LSA. As collared pika inhabit primarily alpine boulder fields interspersed with meadow areas (Yukon Environment, 2015g). These areas were selected in the desktop exercise for field investigation. Pika population densities are generally higher on slopes with a southern aspect (Franken and Hik, 2004), likely because of higher primary productivity; therefore, south-facing slopes were highlighted for detailed investigation. Similar to pika, areas of highly to moderately suitable hoary marmot habitat within and adjacent to the LSA were identified. Also, similar to pika, hoary marmot use alpine, southern slopes for feeding and denning. Therefore, sites that were selected for pika surveys were also suitable to be surveyed for marmot habitat.

In July 2015, four suitable alpine locations in the LSA were identified and surveyed. In July 2016, the four survey locations from 2015 were resurveyed, and an additional four sites were identified and surveyed based on results from the 2015 surveys. The 2015 and 2016 surveys were conducted with a Bell Jet Ranger helicopter.

Surveys consisted of the helicopter landing and powering down near the survey site. The surveyors slowly walked the perimeter of the identified habitat looking and listening for approximately half an hour to record the presence of any small mammals. This involved listening for alarms calls, observing animals using a spotting scope or binoculars, and looking for signs of small mammal burrows. When available, animals were photographed and locations marked with a GPS.

As neither species was mentioned in the 1996 IEE, it was not possible to assess or revisit survey areas used in the 1990s.

## 10.4 SURVEY RESULTS (2015-16)

Collared pika were observed on multiple mountains throughout the LSA; however, most observations were on mountains to the south and west of the proposed Project footprint (Figure 10-1; Table 10-1; Photo 10-1; Photo 10-2). Hoary marmot were also observed, although less frequently. During the 2016 surveys, no marmots were encountered, although an incidental observation of a marmot was made during the breeding bird survey at the alpine site BB_17. This site is above a hoary marmot den that was identified in 2016 in the bank of the Tote Road near km 22. A hoary marmot was observed in 2015 at site KZKW2, and suitable habitat and possible burrows were observed at other sites (Photo 10-3 and Photo 10-4). Incidental observations of marmot and pika occurred in 2015 and 2016 during the vegetation surveys. Arctic ground squirrels (*Spermophilus parryii*) and least chipmunks (*Tamias minimus*) were also observed at these survey sites in 2015 and 2016.

### Table 10-1: Observations of Collared Pika and Hoary Marmot at Various Survey Sites in the LSA

| Site | Site Description | Observations | |
|---|---|---|---|
| SM1 | West side of ridge is steep and rocky, east side is vegetated and gradually sloping. Elevation 1,951 m. | 2015 | No animals observed on southwest facing slope so surveyors moved to northeast facing slope. Two unknown animal burrows observed at that location. Rocky ridge to the north had many trails but no animals or activity observed. |
| | | 2016 | Surveyed southwest side of ridge: heard 1 pika calling from distance. Inactive hoary marmot burrow; did not look active as vegetation was growing inside. Visibility was limited as mountain was socked in and conditions were windy. Pilot observed 1 caribou on east side of mountain. |
| SM2 | Gradually sloping mountain top. Mostly vegetated with some rocky areas. Elevation 1,728 m. | 2015 | Surveyed southwest side of mountain: multiple pika observed on rocks; 2 marmot observed at southern end of ridge near burrows; Arctic ground squirrels also observed. Habitat in this area less rocky and more vegetated. Possible sheep scat. |
| | | 2016 | Surveyed northwest side of mountain: no pika observed. Found large pit dug by grizzly bear, likely from last year. Also observed 20+ ptarmigan. |
| SM3 | Flat, vegetated ridge, gradually sloping on SW side, steep rocky slope on NE side. Elevation 1,779 m | 2015 | Ground squirrel heard. Burrow observed. |
| | | 2016 | Heard at least 4 pika, heard 1 ground squirrel, and observed 1 chipmunk amongst rocks on northeast slope. Found multiple caribou antler sheds, appears to be caribou rutting grounds. Excellent wildlife habitat, including pika habitat. Other observations include large flock of ptarmigan. |
| SM4 | Large, rounded mountain. Gradually sloping to east, steep sloped on west side. Elevation 1,743 m. | 2015 | Ground squirrels heard and observed. Burrows observed. Digging areas observed downslope from ridge summit. Caribou tracks and hair found along ridge summit. |
| | | 2016 | Heard at least 1 pika calling, and observed 1 ground squirrel and 2 chipmunks. Other observations include a northern harrier and 2 trumpeter swans on North Lakes. |
| SM5 | Rounded, vegetated mountain top; some exposed outcrops and exposed boulders. Elevation 1,779 m. | 2015 | Site was established in 2016 so was not surveyed in 2015. |
| | | 2016 | Minimal pika habitat. No pika or marmot observed, 1 ground squirrel observed. Other observations include American golden-plover and northern harrier. |
| SM6 | | 2015 | Site was established in 2016 so was not surveyed in 2015. |

| Site | Site Description | Observations | |
|---|---|---|---|
| | Large, tall rounded mountain top.<br>Elevation 2,038 m. | 2016 | Heard 1 pika calling. Observed 1 caribou in distance towards KZKW3. |
| SM7 | No exposed rock. Hilltop was rounded and vegetated.<br>Elevation 1,575 m. | 2015 | Site was established in 2016 so was not surveyed in 2015. |
| | | 2016 | Not good pika habitat. No exposed rock, too low elevation. |
| SM8 | No exposed rock. Hilltop was rounded and vegetated.<br>Elevation 1,521 m. | 2015 | Site was established in 2016 so was not surveyed in 2015. |
| | | 2016 | Not good pika habitat. No exposed rock, too low elevation. |

**Photo 10-1: Adult Pika Observed in Alpine Boulder Field, KZKW2**

**Photo 10-2: Pika Habitat (Talus) on Southwest-facing Slope, KZKW1**

**Photo 10-3: Hoary Marmot Perched Beside its Burrow, KZKW2**

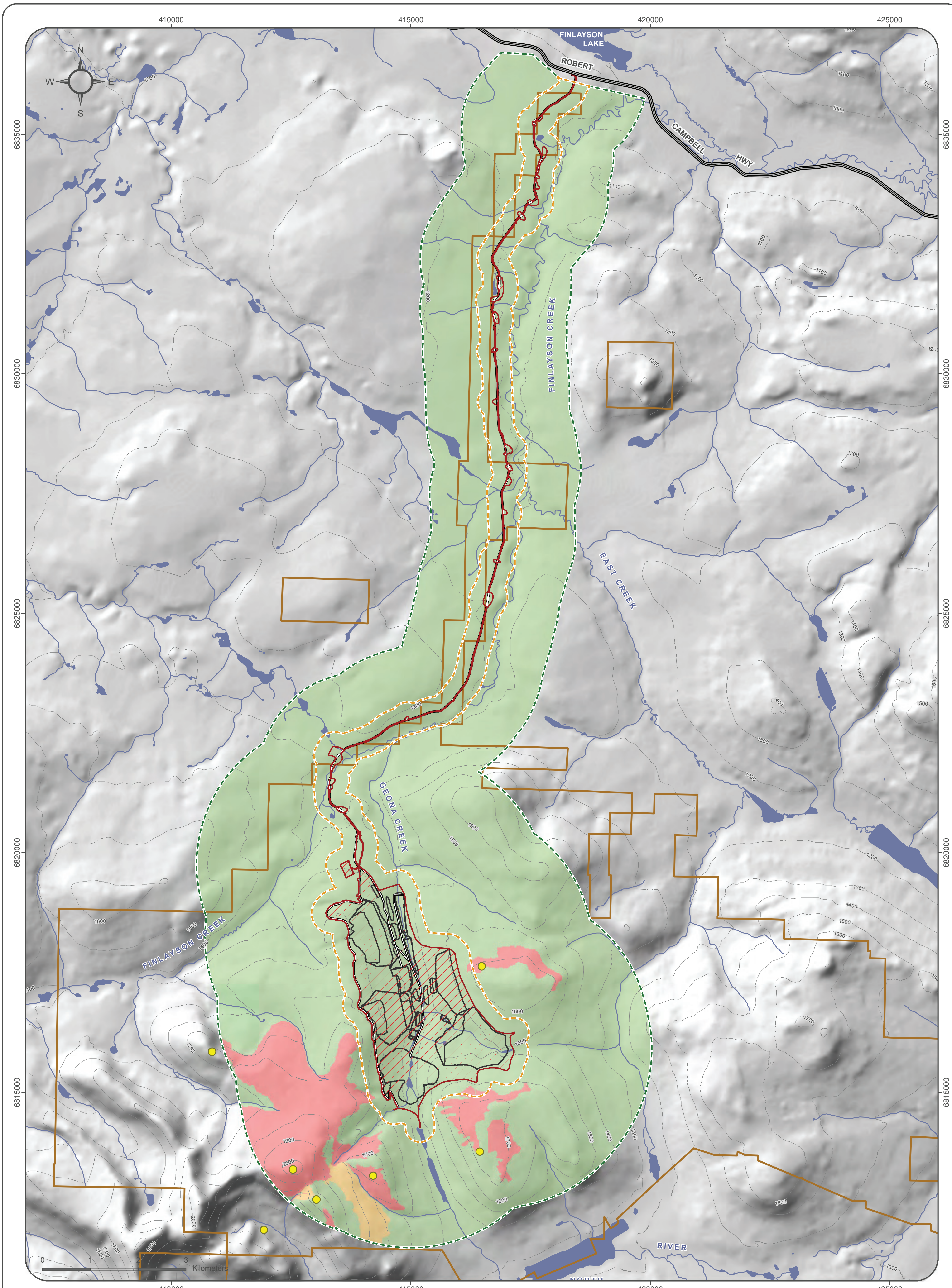
**Photo 10-4: Inactive Hoary Marmot Burrow, KZKW1**

## 10.5 HABITAT SUITABILITY MAP

A habitat suitability map was prepared for collared pika to provide a baseline of habitat from which to assess habitat changes for the Project effects assessment. The terrestrial ecosystem map for the LSA was used in combination with a set of criteria that define the quality of habitat and predict areas that collared pika likely use. Table 10-2 summarizes the criteria used to prepare Figure 10-1. Highly suitable pika habitat was defined as alpine habitat (greater than 1,550 masl) that contained talus slopes adjacent to alpine meadow ecosystems dominated by Carex sp. Moderately suitable pika habitat was defined as alpine habitat that contained talus slopes but was not in association with alpine meadow ecosystems. Low suitable pika habitat was defined as all other habitat types. These suitability rankings for preferred collared pika habitat were based on the habitat description provided in the Assessment and Status Report on the Collared Pika (*Ochotona collaris*) in Canada (COSEWIC, 2011). Collared pika observations were plotted on the suitability map and aligned well with the predicted areas of suitable habitat.

**Table 10-2: Collared Pika Habitat Suitability Criteria**

| Suitability Rank | TEM Polygon | Bioclimate Subzone |
|---|---|---|
| High | Contains talus and leading ecosite 21, 31, 33 | Alpine |
| Medium | Contains talus and leading ecosite 13, 45, 36, 42, 48 | Alpine |
| Low | Everything else | Boreal Subalpine |




**Collared Pika Habitat Suitability**

- High
- Moderate
- Low
- Collared Pika Observations

- Tote Road / Proposed Access Road
- Proposed Site Road
- Contour (100 m interval)
- Watercourse
- Waterbody

- Local Study Area
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas
- Indirect Disturbance Area
- Direct Disturbance Area

Contours, waterbodies and watercourses compiled by Natural Resources Canada at a scale of 1:50,000. Reproduced under license from Her Majesty the Queen, as represented by the Minister of Natural Resources Canada. All rights reserved.

Surficial Geology recieved from Yukon Geological Survey mapped by Jackson, 1993, Rainbow Creek, GSC Mp 1797A

Outlines of the WRSA C (PAC), WRSA B (WPAG) reproduced (hand-digitized) from Figure 2-16 of the Initial Environmental Assessment Report (Cominco, 1996) and represent the Year 9 configuration. They are presented here for context only.

Datum: NAD 83; Projection: UTM Zone 9N



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FIGURE 10-1

COLLARED PIKA
HABITAT SUITABILITY

NOVEMBER 2016

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## 10.6 DISCUSSION

The survey conducted on July 14, 2016 was on a rainy, cool day, which may have affected activity of animals, especially marmot which are more active during warm, sunny weather (Environment Yukon, 2015h).

Collared pika were observed at alpine sites that exhibited large, talus rock with crevices below, that could act as cover. They were most commonly encountered on mountains to the south and west of the proposed Project footprint. Pika were likely found on these mountains because they are steep and have exposed talus slopes and large boulders adjacent to alpine meadows, which is preferred habitat for collared pika (Yukon Environment, 2015g). Most pika observations were of vocalizations, although a small number of visual observations were also made. Although the COSEWIC conservation rank for collared pika is special concern, the Yukon conservation rank is listed as Apparently Secure. Given the frequency of observations made in 2015 and 2016, it is suspected that collared pika are present throughout the LSA at all high elevation sites with suitable habitat.

These mountains also provide suitable habitat for hoary marmot, as marmot and pika often utilize the same habitat. Elevations ranging near 1,700 masl were those preferred by pika and marmot, although marmot were observed at lower elevations, including a den along the Tote Road. The proposed Project footprint occurs mostly around 1,200 masl elevation, so it is unlikely that observations of these small mammals will occur there.

# 11. SMALL MAMMALS

The winter 2016 track survey was conducted for small mammals as part of this baseline program in addition to incidental observations during other surveys and in the camp wildlife log.

## 11.1 PORCUPINE

Sightings and tracks were observed of the North American porcupine (*Erethizon dorsatum*) in the LSA. One porcupine was observed running towards a burrow in the alpine on May 4, 2015 during the bear den survey. Also, geology staff working at camp witnessed numerous porcupines around the core shack area. Core boxes were damaged due to porcupines feeding on the wood and metal labelling tags.

## 11.2 ARCTIC GROUND SQUIRREL

Many observations of Artic ground squirrels (*Spermophilus parryii*) were made in alpine areas during the pika and marmot surveys. They were also observed around camp and along the Tote Road and are considered abundant within the LSA. Ground squirrels were also observed in subalpine areas in 1995 (Norecol, Dames and Moore, 1996).

## 11.3 SNOWSHOE HARE

Numerous snowshoe hare (*Lepus americanus*) were observed in the LSA, especially while driving along the Tote Road. As well, tracks and scat were often recorded during other wildlife surveys. In 1995, snowshoe hares were documented to occur throughout the region, but the report noted that few were observed in the Project site that year, as populations are known to be cyclical, this reduction in observations could possibly be due to the occurrence of a population crash during that time (Norecol, Dames and Moore, 1996).

# 12. BATS

## 12.1 BACKGROUND

Three species of bat have been documented in Yukon, although it is suspected that others exist but have not yet been detected (Slough and Jung, 2008). The three confirmed species are: little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*), and big brown bat (*Eptesicus fuscus*) (Jung et al., 2006; Slough and Jung, 2008). The little brown bat is the only species whose range overlaps the Project site (Environment Yukon, 2015i). The little brown bat is considered to be endangered (COSEWIC, 2013), and the YCDC considers the little brown bat to be S1S3, critically imperilled and vulnerable (YCDC, 2015).

Little brown myotis populations are at risk of decline due to their low reproduction rate, communal hibernating behaviour, and the recent spread of a fatal fungus (*Pseudogymnoascus destructans*) known as white-nose syndrome (WNS), a fungal pathogen that has been devastating bat populations across eastern North America. It grows on the muzzle, ears, and wings of hibernating bats, spreading quickly between individuals that roost together. WNS causes bats to prematurely arouse from hibernation in the winter, which subsequently leads to death from starvation due to lack of food. It is estimated that 94% of the population in the eastern half of the country has died over the last few years from WNS, and the disease is moving westward at a rate that may see them extirpated within as little as 12 years (Forbes, 2012). To date, there have been no reported cases of WNS in Yukon.

Little brown bats play an important role as predators of night flying insects and are efficient hunters capable of catching over 1,000 insects an hour. Little brown bats concentrate on insects that have an aquatic larval stage, such as mosquitoes, midges, and mayflies. Consequently, they prefer roosts in the vicinity of water. Although they prefer to forage over water, they will also hunt in open areas where they catch moths, beetles, and other flying insects (Environment Yukon, 2015i).

Little brown bats are cavity roosters, with known roost sites in Yukon including buildings, rock crevices, tree cavities, under tree bark, and abandoned mine adits (Slough and Jung 2008; Randall et al. 2014). Males and females are known to lead separate lives and roost in different areas. Males roost alone or in small colonies, often in cooler locations and higher elevations, while females roost in warmer locations with much larger colonies (largest had more than 800 bats) (Government of Yukon, 2016). Very few studies have investigated roost site selection and behaviour of little brown bats in Yukon.

## 12.2 HISTORICAL STUDIES AND EXISTING INFORMATION

Prior to undertaking surveys in 2015, there appeared to be no regional or project-derived survey data on distribution or abundance of bats. There were no recorded observations of bats in the IEE (Norecol, Dames and Moore, 1996). Since surveys for the little brown bat were not conducted for the IEE, it was not possible to assess or revisit study areas used in the 1990s.

## 12.3 SURVEY METHODS (2015-16)

Prior to undertaking the bat studies for this baseline monitoring program, Environment Yukon's Conservation Data Center and Wildlife Species Inventory databases were searched for information on bat occurrence within or near the Project site. Conversation with the YG small mammal biologist, Thomas Jung, revealed that at the elevation of the Project, it was unlikely that the little brown bat would be present. If bats were present in the LSA, they would most likely be found near wetlands along the Tote Road, as these are lower elevation sites with an abundance of aerial insects.

To survey for the presence of bats, Anabat SD2 active bat detectors were installed to monitor the ultrasonic echolocation calls of bats for species identification and activity monitoring. Different bat species have specific call patterns and frequencies. These calls can be recorded using an ultrasonic detector and translate those high-frequency sounds into humanly audible output. The bat detectors were installed in 2015 and 2016 in different locations each year. In 2015, two units were installed in subalpine wetlands at the northern end of the Geona Creek valley. The elevations of the two detectors were 1,303 masl and 1,315 masl, and were approximately 4 km north of the proposed Project footprint. The devices were installed on August 14 and left for a week to record the presence of bats. To install the device, an ultrasound receiver was secured to the end of a 6.5 m pole, which was connected to the Anabat recorder housed in a waterproof container near the ground (Photo 12-1). The recorder was timed to operate between dusk and dawn, a 6-hour period each night for a total of 42 hours. Although not an ideal location for bat occurrence, the detectors were installed here to confirm that no bats were present near the proposed Project footprint.

**Photo 12-1: Anabat Installation at a Subalpine Wetland, 2015**

In 2016, two detectors were installed at two different wetlands in boreal forest habitat along the Tote Road at an elevation of 1018 masl and 1102 masl. One Anabat was installed at a wetland at km 1, while the other was installed at a wetland at km 5. They were both installed on July 13 and left for 18 days to record the presence of bats. The devices were mounted in waterproof containers on wooden platforms attached to spruce trees adjacent to the wetland (Photo 12-2). The microphones were hung approximately 5 m in the tree with a rigid sheet of plastic mounted on a 45$^{o}$ angle below the microphone to amplify any bat calls into the microphone, as per the installation instructions.

**Photo 12-2: Anabat Installation at a Boreal Forest Wetland, 2016**

## 12.4 SURVEY RESULTS (2015-16)

Recordings from the Anabat detector were digitally analysed to identify bat calls at high intensity frequencies between 80 to 40 kHz. No bat calls were detected on the recordings in 2015.

In 2016, both detectors had successful recordings of *Myotis* spp. The detector established at the wetland at km 5 along the Tote Road had "*several incidences*" of *Myotis* spp. on July 20, 23, and 27. It is unknown how many bats "*several incidences*" equates to. The detector established at the wetland at km 1 along the Tote Road had one incident of *Myotis* spp. on July 24. Both detectors had substantial "*noise*" associated with the files, which may be the result of weather conditions, vibrations or intense clutter caused from bats, but not the main target recording for the detectors. The specific species of *Myotis* were unable to be determined, but due to the Project location, it was suspected they were little brown bat.

However, northern long-eared bat has been found in the southeastern part of the territory, including Watson Lake (Government of Yukon, 2016).

## 12.5 HABITAT SUITABILITY MAP

A habitat suitability map was prepared for little brown bat to provide a baseline of habitat from which to assess habitat changes. The terrestrial ecosystem map for the LSA was used in combination with a set of criteria that define the quality of habitat and predict areas that little brown bat likely use. Table 12-1 summarizes the criteria used to prepare Figure 12-1. The little brown bat prefers to roost and forage in mature/old growth boreal forest (structural stage 6 and 7), adjacent to wetlands (Randall et al., 2014). Little brown bats are cavity roosters, known to roost in a wide variety of structures, including buildings, rock crevices, behind flaking bark, and within tree cavities (Slough and Jung, 2008; COSEWIC, 2013; Randall et al., 2014; Environment Canada, 2015). Availability of suitable roost sites is a limiting factor for little brown bat abundance.

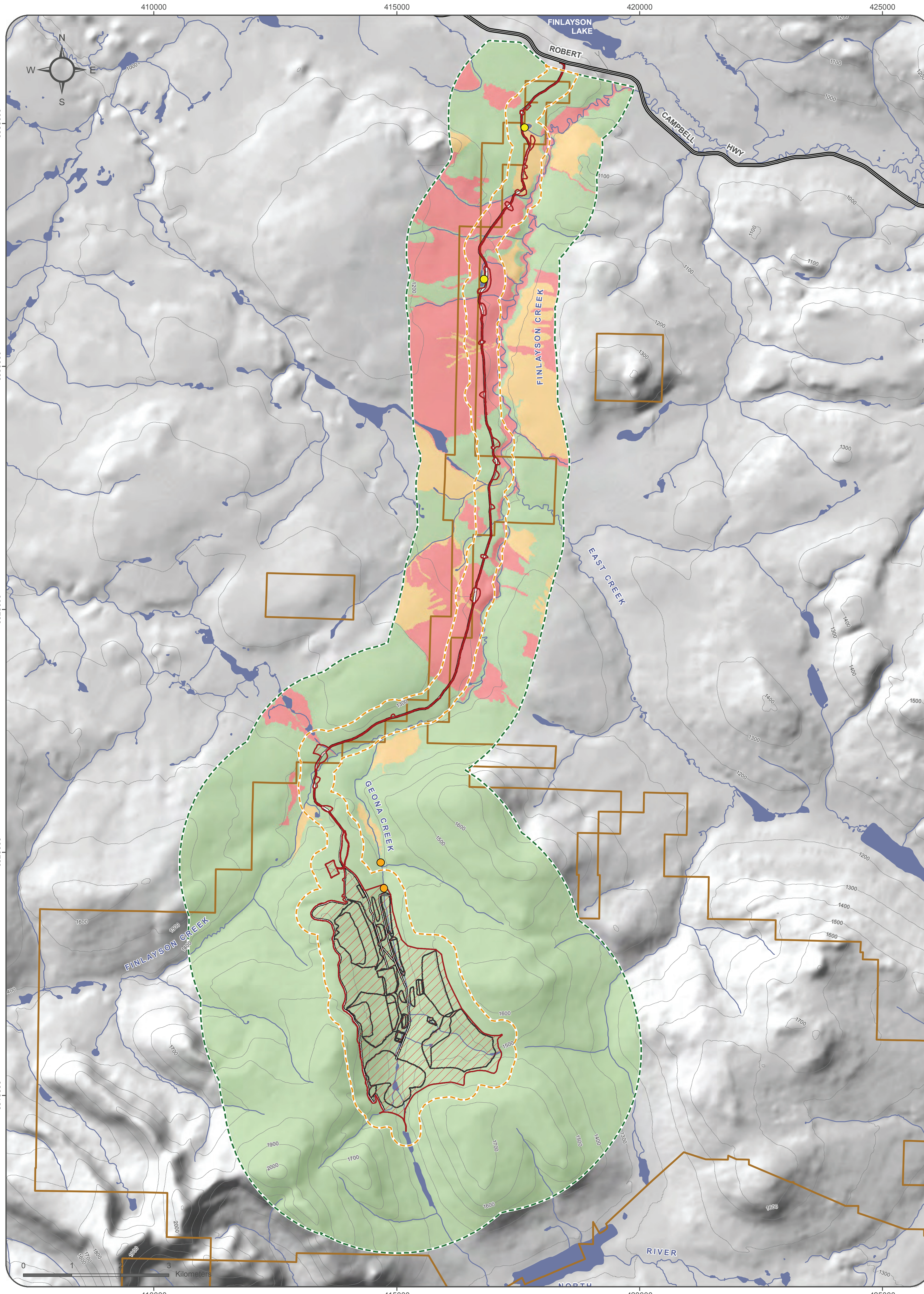
Little information has been published on little brown bat movement patterns from roost sites to foraging areas, specific to northwestern Canada and Alaska. Randall et al. (2014) found female bats moved more than 5 km between their diurnal roost site and evening foraging area. This is consistent with other studies of bats that showed nightly foraging distances greater than 5 km by adult females (Zahn et al., 2005). Little brown bats often forage in areas near bodies of water such as lakes, rivers, streams, and small ponds in both open and forested habitats (Wund, 2006). This suggests that all spruce and aspen forest within the LSA may contain bat foraging sites or roosting sites, with a particular emphasis on sites near wetlands.

The little brown bat is migratory, leaving the territory in September or October to find suitable hibernacula during the winter. Biologists are unsure where Yukon bats overwinter but suspect they move to areas where there is more moisture, like Alaska's coast or near hot springs. Yukon's winter air is so cold and dry that bats would probably freeze solid or dry out before spring arrives (Government of Yukon, 2016).

Boreal high zones are at an elevation that is the upper range of known habitat; however, the habitat criteria conservatively extended to the upper elevation of Boreal High, 1,300 masl. Little brown bat were detected at the northern two survey locations and not at the southern detectors which aligned with the predicted areas of suitable habitat.

**Table 12-1: Little Brown Bat Habitat Suitability Criteria**

| Suitability Rank | Structural Stage | Bioclimate Subzone |
|---|---|---|
| High | Leading ecosite >=70% structural stage 6 or 7 | Boreal High |
| Medium | Leading ecosite <70% structural stage 6 or 7 | Boreal High |
| Low | Everything else | Boreal High, Boreal Subalpine, Alpine |




**Little Brown Bat Roosting Habitat**

- High
- Moderate
- Low
- Bat Detector (Bats Detected)
- Bat Detector (No Bats Detected)
- Tote Road / Proposed Access Road
- Proposed Site Road
- Contour (100 m interval)
- Watercourse
- Waterbody
- Local Study
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas
- Indirect Disturbance
- Direct Disturbance



Surficial Geology recieved from Yukon Geological Survey mapped by Jackson, 1993, Rainbow Creek, GSC Mp 1797A

Outlines of the WRSA C (PAC), WRSA B (WPAG) reproduced (hand-digitized) from Figure 2-16 of the Initial Environmental Assessment Report (Cominco, 1996) and represent the Year 9 configuration. They are presented here for context only.

Datum: NAD 83; Projection: UTM Zone 9N



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**FIGURE 12-1**

**LITTLE BROWN BAT HABITAT SUITABILITY**

NOVEMBER 2016

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## 12.6 DISCUSSION

The results of the bat detector surveys confirmed the presence of bats within the Project LSA, in the boreal forest habitat found along the Tote Road in July, 2016. A population estimate of bats in the Project site is not possible due to the limited survey efforts. Non-detect results from the detectors installed at the subalpine wetlands in 2015 confirmed that no bats were present at this location, probably due to the high elevation of the site. Yukon Government reported that little brown bats are not found at elevations higher than 1,000 masl (Government of Yukon, 2016). The elevations of the detectors installed in 2015 were 1,303 masl and 1,315 masl. The detectors installed in 2016 were placed adjacent to wetlands at elevations of 1,018 masl and 1,102 masl, and given those recordings were suspected to be little brown bat calls, the observation locations would be at the upper known limit of preferred elevation for the species.

# 13. BIRDS

## 13.1 BACKGROUND

The Project site is located adjacent to the Tintina Trench, a continuation of the Rocky Mountain Trench in British Columbia, and runs in an almost straight line across the Yukon for 725 km from Watson Lake to Dawson City (Sinclair et al., 2003). This trench serves as a critical migration corridor for sandhill crane and many species of songbirds and waterfowl breeding in Yukon and Alaska (Sinclair et al., 2003). Due to the location of the Project site in relation to the Tintina Trench, the LSA and RSA are likely to host many different species throughout the various seasons. Wetlands in the area are used for breeding and staging by loons, swans, geese, and a variety of waterfowl. Many breeding songbirds nest in the alder and willow thickets adjacent to marshy lakes and riparian areas, as well as a variety of shorebirds. Multiple raptor species nest in the boreal forests of the valley bottoms, and the cliff faces in the alpine areas. Ptarmigan are abundant in the alpine regions providing a food source for nesting raptors (Smith et al., 2004). Sandhill cranes fly over the Project site by the thousands in spring and fall during their annual migration, sometimes landing in surrounding slopes to feed and rest. The Yukon Government's list of known bird species to occur in the Faro and Ross River region is included in Appendix E.The Project LSA consists of multiple habitats; therefore, the diversity of breeding birds is expected to be high. For example, the LSA consists of boreal forest habitat in lower elevation areas along the Tote Road, subalpine habitat in Geona Creek valley where the camp and proposed Project footprint lies, and alpine habitat in the mountains in the south, east, and west of the LSA. The Tote Road runs parallel to Finlayson Creek, which provides excellent riparian habitat for a variety of bird species. The occurrence of small lakes and wetlands adjacent to the Tote Road that drain into Finlayson Creek provide open-water habitat for ducks, geese, and shorebirds. The proposed Project footprint lies in a subalpine valley with associated habitat consisting of tall shrubs and open-canopy forest, as well as the headwaters of Geona Creek, which consist of riparian habitat mixed with a series of connecting wetlands. The mountains surrounding the valley have alpine habitat with limited vegetation. Cliff faces suitable for nesting raptors are limited as the surrounding mountains have rolling slopes or steep talus. Large water bodies (i.e., North Lakes) are present to the south, outside the LSA, and provide excellent habitat for a variety of water birds.

Passerine, waterfowl, and raptor surveys were conducted in June of 2015 and 2016. The objective of the surveys was to establish baseline conditions of passerines, waterfowl, and raptors using the Project site, documenting the diversity of species during the breeding season. All habitat types were surveyed in an attempt to document all species using the Project site during those two years. Particular interest was paid to species at risk, as identified by a variety of programs including YCDC, North American Bird Conservation Initiative (NABCI), COSEWIC, and *Species at Risk Act* (SARA).

Specifically, the survey objectives were to:

- Conduct passerine surveys along the Tote Road and the area surrounding the proposed Project footprint to obtain baseline conditions of passerine diversity;

- Document waterfowl and other aquatic birds using the wetlands along the Tote Road and within the proposed Project footprint for nesting and staging;
- Identify and survey suitable nesting raptor habitat and document all raptor observations, especially nesting; and
- Survey reference sites outside the zone of influence to be used for future monitoring as project development continues.

## 13.2 HISTORICAL STUDIES AND EXISTING INFORMATION

### 13.2.1 FINLAYSON LAKE BREEDING BIRD SURVEY

Monitoring birds (including waterfowl) in Yukon is completed using the North American Roadside Breeding Bird Survey (BBS), a cooperative effort between the U.S. Geological Survey and Environment Canada (USGS, 2001). As many as 45 standardized survey routes exist in Yukon; however, many are not completed annually. While numerous species are encountered annually, they may not be observed in adequate numbers to calculate population trends.

A North American Roadside BBS route exists for Finlayson Lake (located approximately 30 km northeast of the proposed mine site) for which data has been collected non-continuously from 1992 to 2014 (USGS, 2014). During that time, 70 species have been recorded, including passerines, waterfowl, and raptors. Not all 70 species are observed each year. The average number of species observed annually over the 19 years of data collection is 37 (USGS, 2014). Raptors observed during the 23 years of Finlayson Lake BBS include bald eagle (*Haliaeetus leucocephalus*), red-tailed hawk (*Buteo jamaicensis*), sharp-shinned hawk (*Accipiter striatus*), and American kestrel (*Falco sparverius*) (USGS, 2014).

Although the BBS route is not within the Project site, data from these surveys are applicable for comparison to the bird diversity and abundance occurring within the LSA. The habitat surveyed for the Finlayson Lake BBS are in boreal forest, similar to the habitat surveyed along the Tote Road. The habitats encountered in the proposed Project footprint are subalpine and alpine, which may host a slightly different bird assemblage, although similar observations will occur.

A summary of observations from the Finlayson Lake BBS (1992-2014) can be found in Appendix H.

### 13.2.2 1996 INITIAL ENVIRONMENTAL EVALUATION (IEE)

No breeding bird surveys were conducted for the Project during the IEE; therefore, no background data exists for upland songbird populations in the immediate Project footprint, LSA, or RSA. Similarly, no surveys specific to ptarmigan (*Lagopus* spp.) were conducted for the IEE; however, ptarmigan were noted as abundant in the upper Geona Creek valley and around the camp. The IEE reported that the Project site is of limited suitability to waterfowl due to the upland nature, and that wetlands in the upper Geona Creek valley were used during migration; however, no direct observations of waterfowl breeding were reported.

Ducks were observed at the North Lakes drainage including mallard (*Anas platyrhynchos*), harlequin duck (*Histrionicus histrionicus*), mergansers (*Mergus* spp.), and scoters (*Melanitta* spp.). A pair of harlequin duck were also observed on lower East Creek. Trumpeter swans (*Cygnus buccinator*) were observed on the North Lakes and the lakes north of the Project site. A common loon (*Gavia immer*) was heard from camp, and migrating red-necked phalarope were recorded on the wetlands near camp (Norecol, Dames and Moore, 1996).

The IEE reports a total of 26 golden eagle (*Aquila chrysaetos*) observations, including possible repeat sightings during a May caribou calving survey. Golden eagles were also reported in uplands near the camp from early May to mid-June. Bald eagle observations included a sighting in upper Geona Creek valley and a bird fishing in one of the North Lakes. A pair of gyrfalcon (*Falco rusticolus*) were observed southeast of Wolverine Lake during a 1995 aerial survey. The IEE states that no raptor nest sites or family groups were found in the immediate Project site in 1995 (Norecol, Dames and Moore, 1996).

## 13.3 SURVEY METHODS (2015-16)

### 13.3.1 PASSERINE SURVEYS

Survey locations were determined by using a desktop exercise selected to include all habitat types present in the LSA: boreal forest, riparian, wetland, subalpine, and alpine. All boreal forest sites were located along the Tote Road. Riparian and wetland sites were located along the Tote Road as well as within the proposed Project footprint. Subalpine sites were found in the vicinity of the proposed Project footprint, and alpine sites were located on the mountains surrounding the valley where the proposed Project footprint lies.

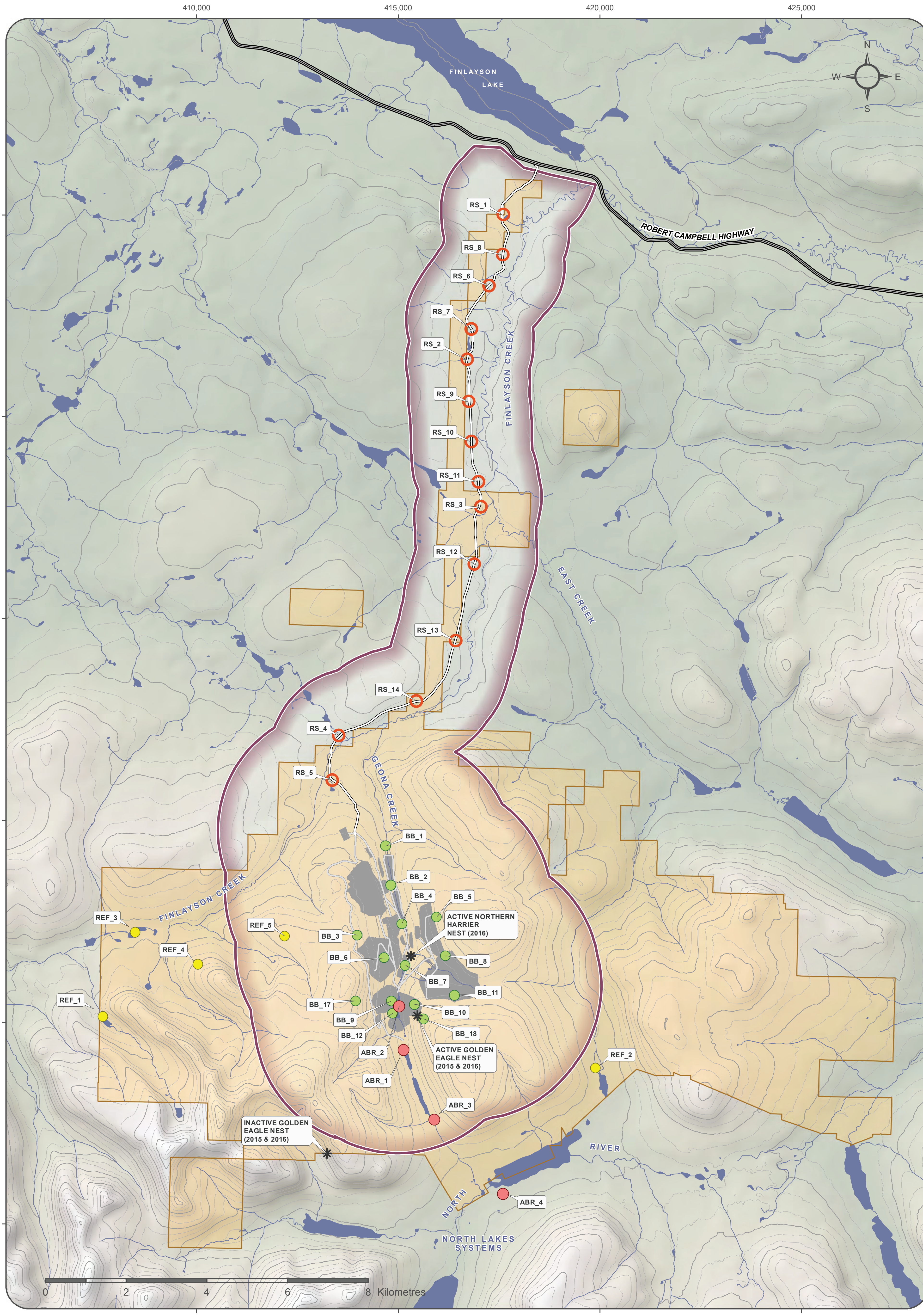
A standardized point-count survey methodology was used to conduct the passerine surveys in June 2015 and 2016. A point-count survey was conducted by a qualified biologist capable of identifying songbirds based on their visual appearance and mating songs. A point-count consisted of an observer remaining stationary and silent at the designated site for a 5-minute interval recording all birds detected by sight and sound. This is a modification of the North American Breeding Bird Survey (BBS) 3-minute methodology used by the Canadian Wildlife Service and United States Geological Survey (USGS, 2001; Environment and Climate Change Canada, 2016). When the surveyor arrived at a station, one minute of recovery time was taken to allow the birds to settle. Point-count surveys were completed on June 23 and 24 in 2015, and June 14, 15, and 16 in 2016. Point-counts were conducted between sunrise and mid-day to maximize bird detection, as birds become less active in the afternoon heat. Locations of each point-count station were recorded with a GPS. Bird species identified between point-count sites were also recorded.

The distance between the point-count sites varied, but was a minimum of 200 m. Most point-count sites were accessible by foot. Sites that were not accessible by foot were accessed with a Bell Jet Ranger Helicopter. The helicopter landed and powered down at a safe location near the point-count site. The observers walked to the point-count site and began the survey. In addition to the 19 existing point-count sites established in 2015, 11 more sites were surveyed in 2016 for a total of 30 sites. These included seven more sites along the Tote Road, two more alpine sites within the LSA, and two alpine reference sites outside the LSA. The seven new sites along the Tote Road were added to provide more thorough coverage of all habitat types along the road. Additional reference sites located outside the LSA, were established to provide a baseline for long-term monitoring of species assemblage in non-disturbed sites.

### 13.3.2 WATERFOWL AND AQUATIC BIRD SURVEYS

The waterfowl and aquatic bird surveys were conducted on wetlands within the LSA, as well as reference wetlands outside the LSA. A total of seven wetlands were surveyed within the LSA: two wetlands along the Tote Road (km 1 and km 5), two wetlands at the headwaters of South Creek, and three wetlands at the headwaters of Geona Creek. The three reference wetlands were outside the LSA and were selected in similar valleys to the east and west of the proposed Project footprint valley. The reference wetlands were selected to attempt to replicate the wetlands within the LSA as much as possible with similar elevation, vegetation, and topography. These reference sites will be used in the future to monitor and evaluate changes in bird diversity that could be caused from the development of the Project. For example, the observations at reference sites can be compared to post-reclamation sites in the Project site to monitor the effectiveness of site reclamation.

The methodology used to survey the wetlands consisted of either a walk around the wetland or a scan of the wetland surface area using binoculars and a spotting scope, as well as a 5-minute point-count at each wetland following the methodology described in section 13.3.1 for passerines. The combination of these survey methods allowed for a thorough documentation of passerines, waterfowl, and other aquatic birds using the wetland. Nesting waterfowl were determined by identifying a female duck with her brood of flightless young.




- Tote Road Survey Location
- Wetland Survey Location
- Reference Habitat Survey Location
- Breeding Bird Survey Location
- Raptor Nest
- Tote Road/Proposed Access Road
- Proposed Mine Road
- Contour (40m interval)
- Watercourse
- Waterbody
- Local Study Area
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas

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## FIGURE 13-1

## BIRD SITE SURVEY LOCATION 2015-2016



Datum: NAD 83; Projection: UTM Zone 8N



AEG

NOVEMBER 2016

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### 13.3.3 RAPTOR SURVEYS

A desktop review of topographical maps was conducted to identify potential habitat for cliff-nesting raptors. Cliff-nesting raptor habitat consisted of rock outcrops on steep slopes and cliff faces. These habitat types were identified based on tight contour lines on the map. While in the field, the pre-identified potential nesting habitat was examined with binoculars and spotting scope for signs of nesting. In addition to land based surveys, biologists flew over potential raptor nesting habitat with a helicopter surveying for signs of nesting, including stick nests and whitewash from bird droppings on rock outcrops.

During the passerine survey and small mammal survey, the sky was scanned repeatedly for raptors. Anytime a raptor was spotted, surveyors observed the raptor for as long as possible to determine if it may have a nesting site in the vicinity. When a raptor landed, the surrounding area was surveyed to determine if a nest was present.

## 13.4 SURVEY RESULTS (2015-16)

A total of 42 species were observed during all bird surveys conducted in 2015, and 61 species were observed in 2016. Between 2015 and 2016, a total of 67 species were observed in the Project site. Among those 67 species, five are reported as “at risk” according to COSEWIC (COSEWIC, 2002a). This included the Olive-sided flycatcher (*Contopus cooperi)*, bank swallow (*Riparia riparia)*, and barn swallow (*Hirundo rustica)* which are considered “threatened”, while red-necked phalarope (*Phalaropus lobatus)*, and rusty blackbird (*Euphagus carolinus)* are considered special concern.

A summary of observations collected during the passerine, waterfowl and aquatic birds, and raptor surveys in 2015 and 2016 can be found in Appendix F.

### 13.4.1 PASSERINE SURVEYS

A total of 45 species were recorded during the 2015 and 2016 passerine survey, not including waterfowl, aquatic birds, and raptors. The three most common species in both years of surveys were American tree sparrow (*Spizella arborea),* white-crowned sparrow (*Zonotrichia leucophrys)*, and Wilson’s warbler (*Cardellina pusilla)* with each of these species reported at least 20 times in each year. These were the most common species in all habitat types, except alpine, and were especially abundant in the subalpine habitat in the proposed Project footprint.

Among the species at risk, olive-sided flycatchers were most abundant being observed four times in 2015 and nine times in 2016. These observations were made in the subalpine habitat along the Tote Road, and throughout the Geona Creek valley. In 2016, two pairs of barn swallows nested within the camp infrastructure, including underneath the overhang of the cook shack, and inside a sea-can container. Also in 2016, a pair of bank swallows were observed feeding along the Tote Road. In 2015, a pair of rusty blackbirds were observed at a reference wetland outside the LSA. Two red-necked phalarope were observed briefly on the wetland at the headwaters of South Creek, while at least nine were observed on the reference wetland in the valley east of South Creek.

A summary of passerine survey results for all point-count sites in 2015 and 2016 is presented in Table 13-1. The results are grouped according to the five habitat types that were surveyed: wetland, riparian, boreal forest, subalpine forest, and alpine. In 2015 and 2016, the wetland habitat type had the highest diversity of bird species per site with values of 4.3 and 4.1, respectively. Similarly, the riparian habitat type had the second highest diversity of species per site with values of 3.8 and 3.1, respectively. Boreal forest had the lowest diversity of species per site in 2016 with a value of 2.0. Boreal forest data was not analyzed in 2015 so the number of species per site could not be calculated. The number of species per site was similar between 2015 and 2016.

**Table 13-1: Summary of Passerine Survey Data for all Point-Count Sites in 2015 and 2016**

| Habitat Type | # of sites | | # of species | | average # species per site | |
|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2015 | 2016 | 2015 | 2016 |
| Wetland | 4 | 7 | 17 | 29 | 4.3 | 4.1 |
| Riparian | 5 | 7 | 19 | 22 | 3.8 | 3.1 |
| Boreal Forest | -- | 10 | -- | 20 | -- | 2.0 |
| Subalpine | 8 | 7 | 24 | 21 | 3.0 | 3.0 |
| Alpine | 3 | 6 | 10 | 13 | 3.3 | 2.2 |

### 13.4.2 WATERFOWL AND AQUATIC BIRD SURVEYS

A total of 20 species of waterfowl and other aquatic birds were observed during the surveys conducted in 2015 and 2016. This included seven species of duck, seven shorebird, three gull, one loon, one swan, and one goose species. Predominant waterfowl using the wetlands within the LSA and reference wetlands were scaup (*Aythya* spp.) and goldeneye (*Bucephala* spp.*)*. Other waterfowl include green-winged teal (*Anas crecca)*, northern pintail (*Anas acuta*), mallard, bufflehead (*Bucephala albeola*), and red-breasted merganser (*Mergus serrator)*. Waterfowl nesting on the wetlands within the LSA include mallard, green-winged teal, and northern pintail. Waterfowl nesting on the reference wetlands outside the LSA include goldeneye, scaup, and an unidentified dabbling duck (Table 13-2). Trumpeter swans were observed in 2015 and 2016 on reference wetlands outside the LSA. It is assumed they are nesting on those wetlands given their defensive behaviour and the timing of observations. In addition, two juvenile trumpeter swans were observed with adults at the east end of North Lakes on July 10 and August 1, 2015.

Seven species of shorebird were observed within the LSA. Among those seven species, it is suspected that six were nesting including spotted sandpiper (*Actitis macularius*; Photo 13-1), semipalmated plover (*Charadrius semipalmatus)*, lesser yellowlegs (*Tringa flavipes*), solitary sandpiper (*Tringa solitaria*), least sandpiper (*Calidris minutilla*), and American golden-plover (*Pluvialis dominica*). These species were suspected to be nesting because they were either observed with young, or were acting defensively or territorially, which is a behaviour that suggests nesting is occurring. Furthermore, shorebirds were actively incubating eggs or raising young during June and July so any shorebirds observed during that period were likely nesting in that area. The one species of shorebird that did not display this behaviour was the red-necked phalarope (*Phalaropus lobatus);* however, they were observed using the same wetlands in 2015 and 2016, and were observed on the same wetland during subsequent field trips in the 2016 breeding season.

**Photo 13-1: Adult Spotted Sandpiper - ABR_1 July 2016**

**Table 13-2**: **Breeding Aquatic Birds Survey Results, 2016**

| Site | Breeding Species | Observation |
|---|---|---|
| RS_1 | Solitary Sandpiper (*Tringa solitaria*) | Defensive/territorial behaviour |
| | Mallard (*Anas platyrhynchos)* | Brood of eight observed on June 14, approximately one-week old |
| RS_5 | Solitary Sandpiper (*Tringa solitaria*) | Defensive/territorial behaviour, likely two nesting pairs, aggressive birds observed on each end of the wetland |
| RS_7 | No signs of breeding | |
| ABR_1 | Green-winged Teal (*Anas crecca)* | Brood of seven observed on July 13, approximately one-week old |
| | Northern Pintail (*Anas acuta*) | Brood of two observed on July 13, approximately four-weeks old |
| | Semipalmated Plover (*Charadrius semipalmatus)* | Defensive/territorial behaviour |
| | Lesser Yellowlegs (*Tringa flavipes*) | Defensive/territorial behaviour, nesting in small wetland north of this site |
| | Spotted Sandpiper (*Actitis macularius)* | Defensive/territorial behaviour |
| ABR_2 | Semipalmated Plover (*Charadrius semipalmatus)* | Observed nesting pair and fledglings |
| | Lesser Yellowlegs (*Tringa flavipes*) | Observed pair, defensive/territorial behaviour |
| | Spotted Sandpiper (*Actitis macularius)* | Defensive/territorial behaviour |
| ABR_3 | Unidentified dabbling duck | Brood of one observed on July 13, approximately two-weeks old |
| | Northern Pintail (*Anas acuta*) | Brood of four observed on July 13, approximately two-weeks old |
| | Semipalmated Plover (*Charadrius semipalmatus)* | Defensive/territorial behaviour |
| | Least Sandpiper (*Calidris minutilla*) | Defensive/territorial behaviour |
| | Spotted Sandpiper (*Actitis macularius)* | Defensive/territorial behaviour |
| REF_1 | Semipalmated Plover (*Charadrius semipalmatus)* | Observed on wetland, likely nesting given timing of observation |

| Site | Breeding Species | Observation |
|---|---|---|
| REF_2 | Common Goldeneye (*Bucephala clangula*) | Brood of four observed on July 14 |
| | Scaup (*Aythya* spp.) | Brood of four observed on July 14 |
| | Semipalmated Plover (*Charadrius semipalmatus)* | Pair observed, likely nesting given timing of observation |
| | Lesser Yellowlegs (*Tringa flavipes*) | Pair observed, likely nesting given timing of observation |
| REF_3 | Scaup (*Aythya* spp.) | Two broods of unknown numbers observed on July 14 |
| | Goldeneye (*Bucephala* spp.) | Unknown brood # observed on July 14 |
| | Unidentified dabbling duck | Unknown brood # observed on July 14 |

### 13.4.3 RAPTOR SURVEYS

Based on the desktop analysis conducted in 2015, it was determined that high quality habitat for nesting raptors is not abundant in the LSA. This was confirmed during field surveys in 2015 and 2016. In 2015, a fly-over of the area found one active golden eagle nest on a rocky outcrop close to treeline on a hillside, east above the wetlands at the headwaters of Geona Creek (Photo 13-2). Another inactive raptor nest was found on a rock face in a valley to the west of North Lakes, outside the LSA.

**Photo 13-2: Golden eagle nest with two eaglets, June 2016. (Credit: S. Macneill)**

During the 2016 raptor survey, both nests were visited and it was determined that the active golden eagle nest from 2015 was active again in 2016, and the inactive nest from 2015 was inactive again in 2016. The active golden eagle nest had two eaglets approximately three weeks old. A follow-up survey of the nest on July 14, 2016 found the two eaglets were still present in the nest. The chicks were almost fully grown and were developing their flight feathers.

In addition to the active golden eagle nest, an active northern harrier (*Circus cyaneus*) nest was located in the riparian zone of Geona Creek near the water quality monitoring station KZ-6. Male and female adult harriers were spotted within the LSA during the 2015 and 2016 passerine and raptor surveys. It is likely that northern harriers nested in the LSA in 2015 as well.

Although suitable raptor habitat exists along the Tote Road, no raptors were observed during the 2015 and 2016 passerine and raptor surveys. Two small unidentified raptor species were observed in the subalpine and alpine habitats above Geona Creek in June 2016. Two incidental observations of bald eagle were made in 2015: one was southwest of the historical core shacks, and another was captured by a wildlife camera installed near North Lakes.

## 13.5 HABITAT SUITABILITY MAP

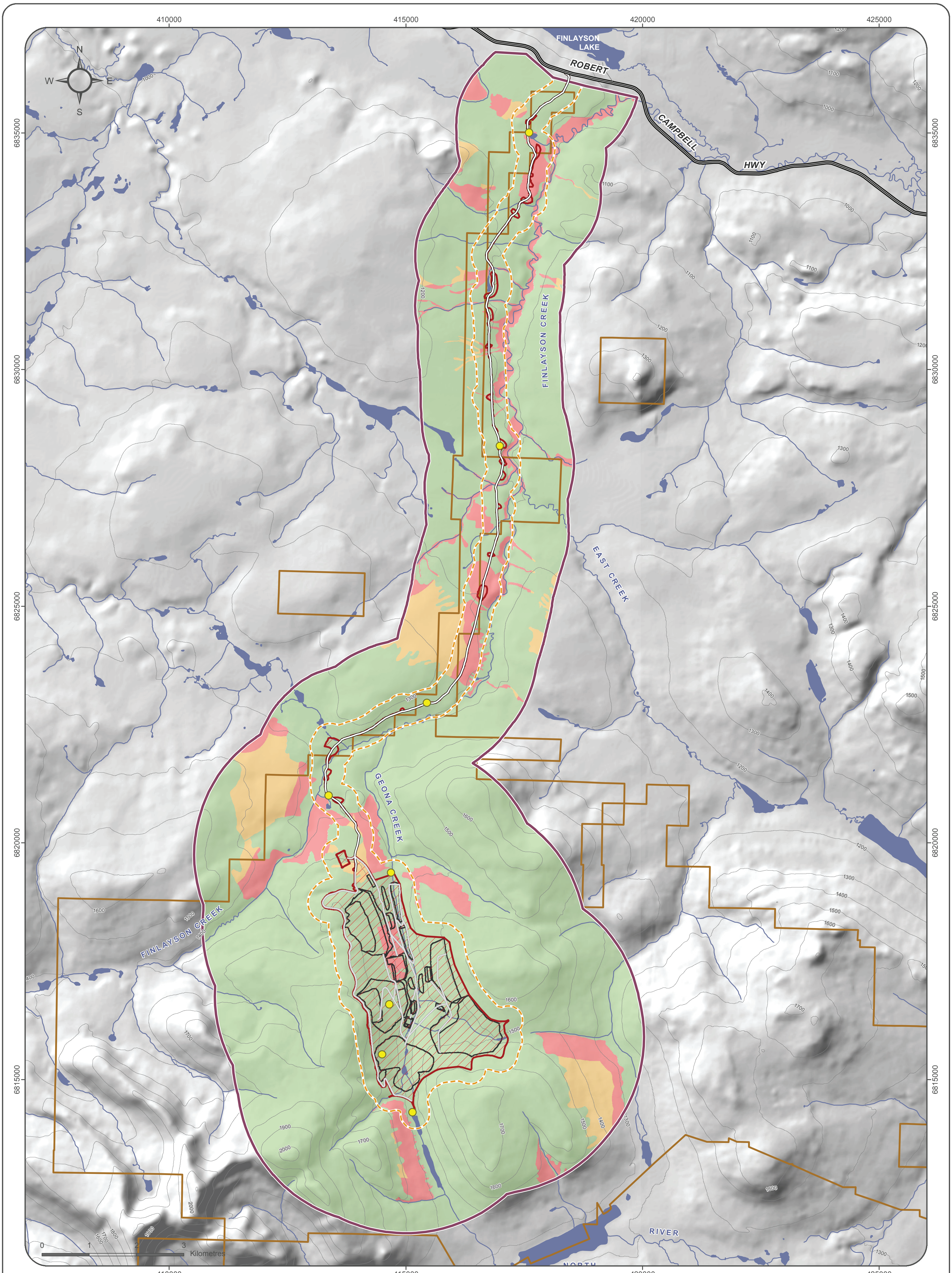
### 13.5.1 OLIVE-SIDED FLYCATCHER HABITAT SUITABILITY MAP

It is recognized that habitat suitability for passerines varies by species and the niches that they inhabit. Due to the large number of passerines found at the Project site, the olive-sided flycatcher was chosen as a representative species for passerines to simplify the assessment process.

A habitat suitability map was prepared for olive-sided flycatcher to provide a baseline of habitat from which to assess habitat changes. The terrestrial ecosystem map for the LSA was used in combination with a set of criteria that define the quality of habitat and predict areas that olive-sided flycatcher likely use. Table 13-3 summarizes the criteria used to prepare Figure 13-2. Olive-sided flycatcher is a migratory bird that comes to the Yukon for nesting and feeding prior to migrating south for the winter. Olive-sided flycatcher nest at the edges of mature and old growth forests. Open areas may be forest clearings, forest edges located near natural openings, burned forest or openings within old-growth forest stands. Tall, live trees or snags for perching are associated with mature trees and large dead trees (i.e., structural stage 6, 7). Generally, forest habitat is either coniferous or mixed wood. In the boreal forest, suitable habitat is more likely to be in or near wetland areas (COSEWIC, 2007). Suitable habitat for olive-sided flycatcher may occur in subalpine and boreal forest. Olive-sided flycatcher were heard or observed at locations in the LSA that aligned well with the predicted areas of suitable habitat.

**Table 13-3: Olive-sided Flycatcher Habitat Suitability Criteria**

| Suitability Rank | Structural Stage | Bioclimate Subzone | Watercourses |
|---|---|---|---|
| High | Leading ecosite >=50% structural stage 6 or 7 | Boreal High-Boreal Subalpine | <500 m from waterbody |
| Medium | Leading ecosite >=50% structural stage 6 or 7 | Boreal High- Boreal Subalpine | >500 m from waterbody |
| Low | Everything else | Boreal High- Boreal Subalpine | Everything else |




**Olive-sided Flycatcher Suitable Nesting Habitat**

- High
- Moderate
- low
- Olive-sided Flycatcher Observation

- Tote Road / Proposed Access Road
- Proposed Site Road
- Contour (100 m interval)
- Watercourse
- Waterbody

- Local Study Area
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas
- Indirect Disturbance Area
- Direct Disturbance Area



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FIGURE 13-2

OLIVE-SIDED FLYCATCHER HABITAT SUITABILITY WITHIN LOCAL STUDY AREA

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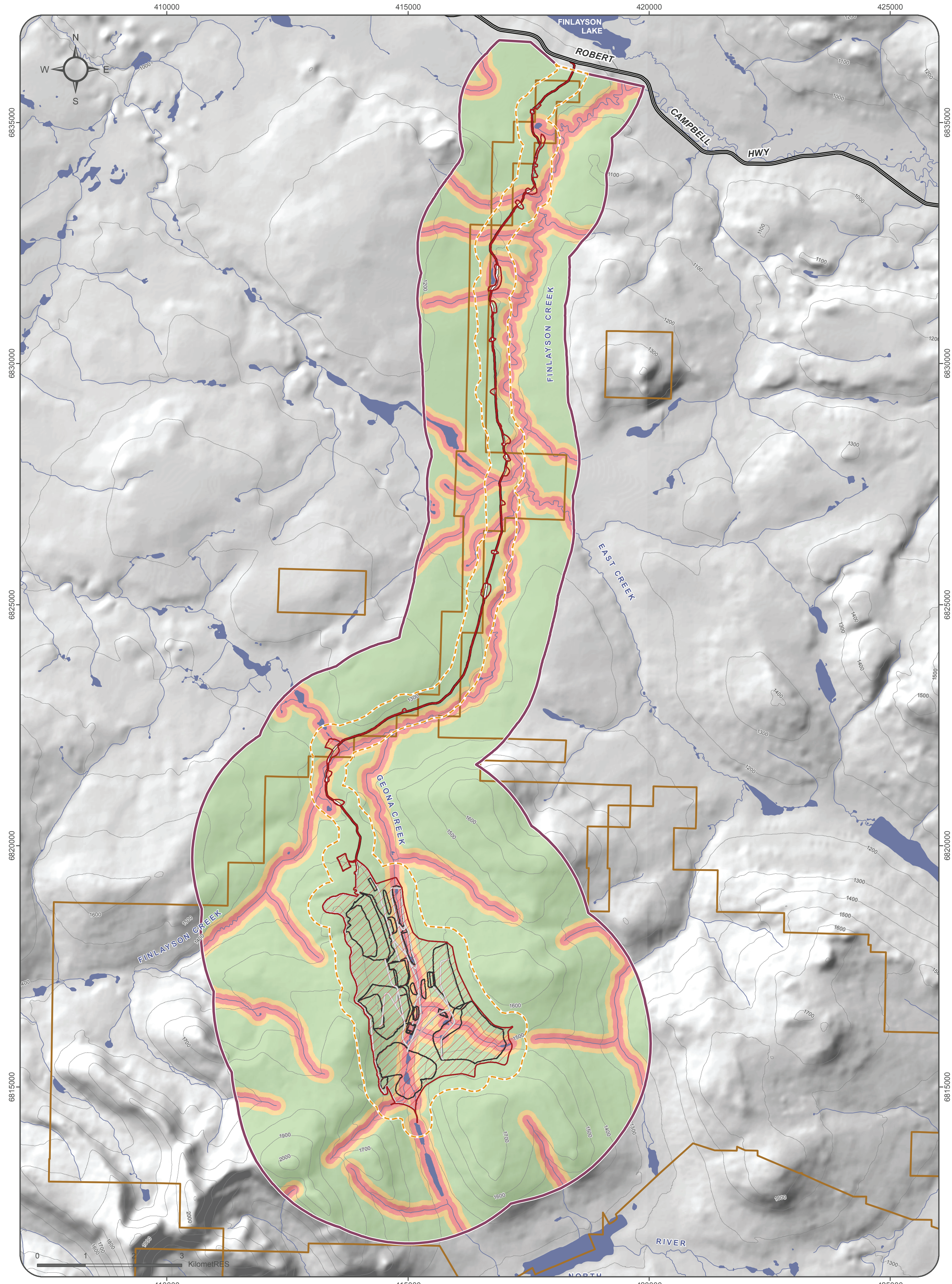
### 13.5.2 WATERFOWL HABITAT SUITABILITY MAP

A habitat suitability map was prepared for waterfowl to provide a baseline of habitat from which to assess habitat changes. The terrestrial ecosystem map for the LSA was used in combination with a set of criteria that define the quality of habitat and predict areas that waterfowl likely use. Table 13-4 summarizes the criteria used to prepare Figure 13-3. Highly suitable waterfowl habitat was defined as any habitat type within 100 m of a water body (i.e., wetland and creek), including the water body itself. Moderately suitable waterfowl habitat was defined as any habitat type within 100 to 200 m from a waterbody. Low suitable waterfowl habitat was defined as all other habitat that does not meet the high or moderate ranking. These suitability rankings for preferred waterfowl habitat were based on data from Hickie (1985), which states that most nests in or near wetlands occur within 100 m of water. Waterfowl were observed using wetlands in the LSA which aligned with the predicted areas of suitable habitat.

**Table 13-4: Waterfowl Habitat Suitability Criteria**

| Suitability Rank | Wetland Type | Nesting Area Around Wetland |
|---|---|---|
| High | Wetland / creeks | 100 m |
| Medium | Wetland / creeks | 100-200 m |
| Low | Everything else | All other |




**Waterfowl Nesting / Feeding Habitat**

- High
- Moderate
- Low

- Tote Road/Proposed Access Road
- Proposed Mine Road
- Contour (100 m interval)
- Watercourse
- Local Study Area
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas
- Indirect Disturbance Area
- Direct Disturbance Area



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**FIGURE 13-3**

**WATERFOWL HABITAT SUITABILITY**

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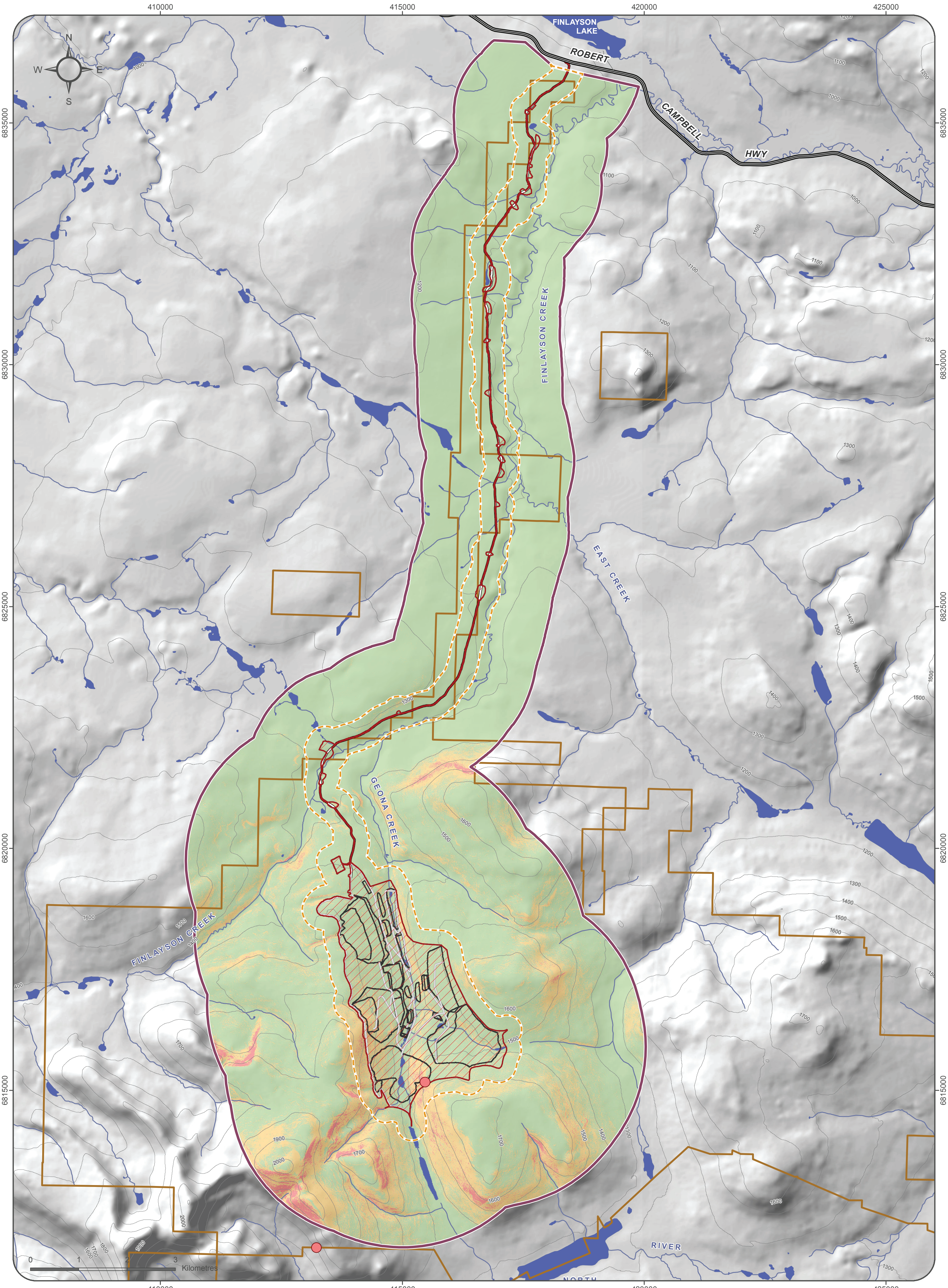
### 13.5.3 RAPTOR HABITAT SUITABILITY

A habitat suitability map was prepared for cliff-nesting raptors to provide a baseline of habitat from which to assess habitat changes. The terrestrial ecosystem map for the LSA was used in combination with a set of criteria that define the quality of habitat and predict areas that raptors likely use for nesting. Table 13-5 summarizes the criteria used to prepare Figure 13-4. Highly suitable cliff-nesting raptor habitat was defined as any habitat that displayed a slope greater than 30$^{o}$ and was at an elevation greater than 1,300 masl. Moderately suitable cliff-nesting raptor habitat was defined as any habitat that displayed a slope between 15$^{o}$ and 30$^{o}$ and was at an elevation greater than 1,300 masl. Low suitability cliff-nesting raptor habitat was defined as any habitat that displayed a slope between 0$^{o}$ and 15$^{o}$ and covered all ranges of elevation. The parameters for suitability rankings for preferred cliff-nesting raptor habitat were based on a known preference for cliff-nesting raptors to select nest sites on steep rock faces or rocky outcrops, as well as reviewing actual nest site locations around the Project site.

**Table 13-5: Cliff-Nesting Raptors Habitat Suitability Criteria**

| Suitability Rank | Slope (degrees) |
|---|---|
| High | >30 |
| Medium | 15-30 |
| Low | <15 |




**Cliff-nesting Raptor Nesting Habitat**

- Low
- Moderate
- High
- Raptor Nest Observation

- Tote Road/Proposed Access Road
- Proposed Mine Road
- Contour (100 m interval)
- Watercourse
- Local Study Area

- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas
- Indirect Disturbance Area
- Direct Disturbance Area



Datum: NAD 83; Projection: UTM Zone 9N



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**FIGURE 13-4**

**CLIFF-NESTING RAPTOR NESTING HABITAT SUITABILITY**

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## 13.6 DISCUSSION

### 13.6.1 PASSERINE SURVEYS

The Project site encompasses five major habitat types including riparian, wetland, boreal forest, subalpine forest, and alpine. Within each of these habitat types, certain birds are adapted to thrive, and are unlikely to be found to any extent outside of that niche. However, some species are known as habitat generalists and can thrive in a number of different habitats. For example, species such as the American tree sparrow, white-crowned sparrow, and American robin (*Turdus migratorius*) are considered generalist species that can be found in many different habitat types. The fact that these species are generalists explains why they were the most commonly observed species in the LSA. For example, these species were observed in all habitat types including the alpine. These species were among the most commonly observed species during the 2015 and 2016 surveys. On the contrary, species such as American golden-plover and horned lark (*Eremophila alpestris*) nest in alpine or tundra habitat, and are therefore, only encountered at the alpine survey sites. Species such as these are much more sensitive to disturbance as they are limited to only one habitat type.

The results of the 2015 and 2016 passerine survey were consistent with results from the Finlayson Lake Breeding Bird Survey. All songbird species observed in the LSA in 2015 and 2016 have been observed during the Finlayson Lake BBS since 1992, except golden-crowned sparrow (*Zonotrichia atricapilla)*, horned lark, American pipit (*Anthus rubescens*), violet-green swallow (*Tachycineta thalassina)*, black-capped chickadee (*Poecile atricapillus)*, and hermit thrush (*Catharus guttatus)*. Golden-crowned sparrow, horned lark, and American pipit are alpine species, so it was expected these species would not be observed during the Finlayson Lake BBS, as the point-count sites for that survey were established along the Robert Campbell Highway.

There was consistency in the species of conservation concern observed during the 2015 and 2016 bird survey programs. Similarly, the species of conservation concern observed in the Project site were consistent with the data and detection frequency for the area found in the Finlayson Lake BBS (USGS, 2014). Four of the five species of conservation concern observed at the Project have a strong affinity to wetlands (Sinclair et al., 2003).

### 13.6.2 WATERFOWL AND AQUATIC BIRD SURVEYS

The wetlands within the proposed Project footprint are in the headwaters for Geona Creek. These are small, shallow wetlands that are confined to the valley bottom. Although there are large waterbodies surrounding the LSA (i.e., North Lakes), there are no large waterbodies within the LSA. Therefore, the waterfowl and aquatic birds that may be present within the LSA are limited to birds that select for small, shallow wetlands. These wetlands are also located at a subalpine elevation, which may limit the species that use them. The wetlands at the headwaters of Geona Creek are fish bearing; however, the only fish eating bird observed in those wetlands was a lone male red-breasted merganser.

Waterfowl and aquatic birds observed at the Project site in 2015 and 2016 were consistent with those observed during the Finlayson Lake BBS. For example, the spotted sandpiper, semipalmated plover, lesser yellowlegs, and solitary sandpiper were all observed at least once during the Finlayson Lake BBS. These four species were the most abundant shorebird species observed in the LSA and were all found to be nesting. Similarly, the three duck species reported during the Finlayson Lake BBS were also observed in the LSA, including mallard, bufflehead, and green-winged teal.

An additional reference site was established for wetland habitat in 2016. It was important to establish and survey wetlands outside the LSA because wetlands are one of the more sensitive ecosystems that could be affected by the proposed mine infrastructure. As certain birds are limited to the open-water habitat of wetlands for breeding, feeding, and brooding, it is important to establish reference wetland sites prior to disturbance to establish baseline conditions and track changes over time. Establishment of reference sites will be particularly useful during reclamation and closure to assess whether species that occurred pre-development return to reclaimed areas post-disturbance.

### 13.6.3 RAPTOR SURVEYS

Due to the limited forest habitat around the proposed Project footprint, the type of raptors likely to nest in the Project site are cliff-nesting raptors. During the 2015 and 2016 field surveys, it was determined that suitable habitat for cliff-nesting raptors within the LSA is limited. The mountains within the LSA are generally vegetated with gradually sloping peaks. Above treeline, the rock is loose talus with large and small boulders. There are few cliffs or rock outcrops that cliff-nesting raptors select for nesting (McIntyre and Schmidt, 2012).

A well established, active golden eagle nest has been identified directly in the area that is proposed for mining activity. A lack of other nesting raptors near the proposed Project footprint may be due to interspecies competition for nesting territory. Based on the size of the nest, it can be concluded that the area has been used for many years as an active nesting territory by golden eagles. Given that golden eagles often use traditional nesting territories for decades (McIntyre and Schmidt, 2012), it has possibly been the same eagles using that nest, or offspring from the original pair of nesting eagles, that have carried on use of the nest. Observations of golden eagles using the Project site in 1995 may suggest that this nest has been active since then, although no mention of an active golden eagle nest was reported in the 1996 IEE (Norecol, Dames and Moore, 1996).

Migratory golden eagles in Yukon return to their nesting grounds from late February to early April (McIntyre and Schmidt, 2012). This is the time they are most susceptible to human disturbance and nest abandonment because they have not yet laid eggs, and therefore, do not have a vested interest to remain in an area with human disturbance. Disturbance to the nest site from human activity during parts of the nesting season when eagles are most likely to abandon their nests is from April to early June. However, an increasing amount of human disturbance over the course of the nesting season may prompt the eagles to abandon that nest site the following year and select a new nesting territory. The disturbance must be significant and persistent as individual eagles are not likely to abandon nesting territories even after they become unsuitable for raising young because of limited nesting opportunities elsewhere.

Long-term surveys in several parts of the western United States have shown declines in nesting golden eagle populations associated with human activity and habitat degradation (Steenhof et al., 2014). An increase in motorized activity could disturb eagles directly by flushing them and by preventing them from tending eggs or young. Findings from this study found that golden eagle responses to motorized vehicles on the ground differ from responses to aircraft; helicopters flying near nests did not adversely affect golden eagle reproduction in Idaho and Utah. Studies have found that golden eagles react to human disturbance within 400 m of nesting sites to as far as 1,500 m (Steenhof et al., 2014).

A study by McIntyre and Schmidt (2012) in interior Alaska found that nesting golden eagles are heavily dependent on snowshoe hare (*Lepus americanus*) and willow ptarmigan (*Lagopus lagopus*), particularly during the early nesting season. Golden eagles are long-lived raptors, exhibiting high fidelity to nesting territories, therefore, the availability of healthy prey populations is an important component of successful reproduction (McIntyre and Schmidt, 2012). Therefore, it is important to manage for healthy populations of ptarmigan and snowshoe hare as a way to maintain breeding success of golden eagles in the LSA. Arctic ground squirrel and hoary marmot are also consumed by nesting golden eagles, but are not available as a food source until after egg-laying has occurred (McIntyre and Schmidt, 2012).

It is unlikely that raptor species other than golden eagle and northern harrier are nesting near the proposed Project footprint. One reason being the availability of suitable nesting habitat for raptors is limited. The other reason is that golden eagle and northern harrier were the only raptors observed during the wildlife surveys in June and July of 2016. Given the amount of time spent surveying for raptors during the breeding season, it is likely individuals would have been observed if they were nesting in the area.

# 14. MISCELLANEOUS WILDLIFE OBSERVATIONS

Various wildlife observations were documented on an ad-hoc basis as they were not part of a species-specific survey.

## 14.1 CAMP WILDLIFE OBSERVATION LOG

BMC and Equity Exploration maintained a wildlife observation log at the KZK camp in 2015 and 2016. All personnel (including contractors) who are on-site were required to record wildlife observations. In 2015, the log was used between July 23 and November 16, and a total of 227 observations were reported. Among these 227 observations, there were 74 moose, 50 caribou, seven grizzly bear, three black bear, and three wolves. Several small mammals and birds were also recorded.

In 2016, a total of 633 observations were recorded in the log from April 3 to October 1. The observations recorded were wide ranging from bumblebee to fisher. The most often reported species were caribou and moose with 102 and 85 observations made respectively. It should be noted that some of these observations were made by two observers who subsequently both recorded the observation in the log. Other notable observations were 18 grizzly bear, four black bear, five lynx, 67 fox, three pika, four wolf, two wolverine, and one fisher (which is suspected to be a wolverine based on the habitat location of the observation - alpine). As well, many bird species and small mammals were also recorded.

Since observations were made by personnel with a variety of backgrounds, it is likely that some animals were misidentified. Despite that, it is difficult to extrapolate abundance based on these records because some sightings are likely the same animal seen multiple times by the same person at different times, or the same animal being recorded multiple times by different people. However, the log does provide a crude indication of wildlife diversity and abundance using the LSA, including the Tote Road during the spring, summer, and fall. Details from the wildlife observation logs can be found in Appendix G.

## 14.2 WILDLIFE CAMERAS

Motion activated wildlife cameras were installed in various locations around the LSA in 2015 and 2016. Two cameras were installed at two different locations throughout the late summer and early fall in 2015 for a total of four camera locations one at a mineral lick, two at wetlands, and one on a wildlife trail. In 2016, cameras were set up at the mineral lick and on two wildlife trails. The locations of the wildlife cameras are not presented as the locations for installation were selected based on important wildlife features in the area. The cameras were used as a tool to gain a better understanding of what species use that area and how they are using it. The cameras used were Reconyx PC800 HyperFire. This model can take colour daytime images, and black and white images after dark. There is no flash with this camera, so wildlife were not startled by a bright light. Night-time illumination is generated by an array of infrared LEDs. The LEDs do produce a faint red glow, which the wildlife may notice because they sometimes looked directly at the camera. The camera was setup to take images in bursts of three once movement triggered the shutter.

### 14.2.1 CAMERA LOCATION #1: MINERAL LICK

A wildlife camera was installed at a mineral lick located south of the LSA in both 2015 and 2016. In 2015, the camera was installed August 1 and removed October 14. In 2016, the camera was installed on April 26 and removed June 17. The selection of this site for a camera was recommended by YG biologists. A tripod was built to support the camera as there were no trees available near the mineral lick. The purpose of the camera was to document: if the lick was active, the species using the lick, the sex of the species, the time of year, and the duration of use. Images captured during the two seasons of use included bull, cow, and calf moose; bull, cow, and calf caribou; wolves, sandhill cranes, bald eagles, mallard, and common raven. These images provided evidence of the importance of this mineral lick as a valued resource for a variety of wildlife.


**Photo 14-1: Cow and Calf Moose Observed August 6, 2015 at Mineral Lick**

### 14.2.2 CAMERA LOCATION #2 AND #3: WETLANDS

Two cameras were installed at two different wetlands July 7, 2015, and dismantled July 15, 2015. The first camera was installed on the west shore of the wetlands commonly referred to as "South Lakes" located in the southern portion of the LSA. The camera was placed on a mound of rocks near the location of numerous ungulate track observations. The objective of this camera location was to determine the animals using the wetlands adjacent to the proposed Project footprint. Wildlife images captured by this camera included two separate wolf visits on July 14.

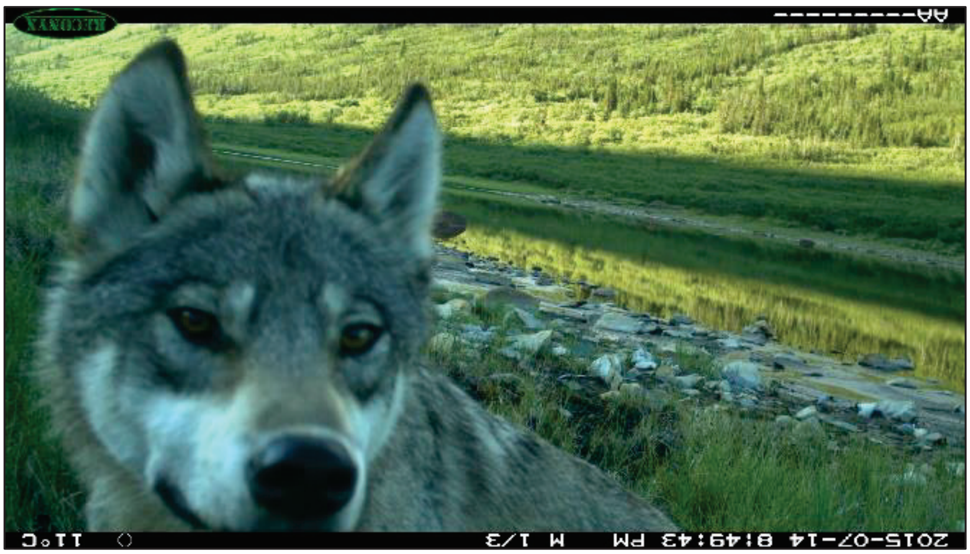

**Photo 14-2: Grey Wolf Observed July 14, 2015 at South Lakes**

The second camera was installed in a small spruce tree at the edge of a wetland, east of the Tote Road in a proposed waste rock storage area. The objective of placing the camera in this location was to determine what wildlife species were using this wetland. Wildlife images captured by this camera included two separate moose visits on July 13.

**Photo 14-3: Cow Moose Observed July 13, 2015 at Wetland East of Tote Road**

### 14.2.3 CAMERA LOCATION #4, #5 AND #6: WILDLIFE TRAIL

Three cameras were installed along three different wildlife trails in 2015 and 2016. One camera was installed August 2, 2015 along a heavily-used wildlife trail that crosses the Tote Road north of camp. The trail is near a moose wallow used during the rut. The objective of the camera location here was to gain a better understanding of how moose use the area, and to document potential high hazard wildlife crossing areas along the Tote Road. The camera was attached to a small spruce tree with a view of the trail. Images captured during the 26 days of operation included a cow and calf moose, and a bull moose.

The other two wildlife trail cameras were installed in 2016. One of the cameras was installed along a wildlife trail along the top of the bluff overlooking Finlayson Creek, adjacent to km 17 of the Tote Road. This camera was installed July 12 and removed October 1. The objective of this camera was to assess the diversity and abundance of wildlife using wildlife trails next to the Tote Road to document potential high hazard wildlife crossing areas. The only wildlife images captured by this camera were the occasional hare.

The second wildlife camera that was installed along a wildlife trail in 2016 was located in the Geona Creek valley adjacent to km 23 of the Tote Road. This camera was installed July 13 and removed October 1. The objective of this camera location was to assess the Geona Creek valley as a wildlife movement corridor. Although multiple species' tracks were observed during the camera installation, only a single cow and calf moose were caught on camera.


**Photo 14-4: Cow and Calf Moose Observed July 23, 2016 in Geona Creek Valley**

### 14.2.4 2015 Mineral Lick Soil Analysis

A soil sample was collected from the mineral lick on August 1, 2015 and shipped to Maxxam Laboratory for analysis of chemical composition, conductivity, texture, pH, and total metals present. The results of the soil analysis are presented in Table 14-1.

**Table 14-1: Analysis of Soil Sample from Mineral Lick, August 1, 2015**

| Parameter | Units | Result | Reportable Detection Limit |
|---|---|---|---|
| NPKS (Available, Plus Texture, pH & EC) - Nutrients | | | |
| Available ($NH_4F$) Nitrogen (N) | mg/kg | <2.0 | 2.0 |
| Available ($NH_4F$) Phosphorus (P) | mg/kg | <1.0 | 1.0 |
| Available ($NH_4OAc$) Potassium (K) | mg/kg | 56 | 2.0 |
| Available ($CaCl_2$) Sulphur (S) | mg/kg | 32 | 2.0 |
| NPKS (Available, Plus Texture, pH & EC) - Soluble Parameters | | | |
| Soluble Conductivity | dS/m | 0.58 | 0.020 |
| Soluble ($CaCl_2$) pH | pH | 7.34 | N/A |
| Saturation % | % | 70 | N/A |
| NPKS (Available, Plus Texture, pH & EC) - Physical Properties | | | |

| Parameter | Units | Result | Reportable Detection Limit |
|---|---|---|---|
| % sand by hydrometer | % | 38 | 2.0 |
| % silt by hydro | % | 32 | 2.0 |
| Clay Content | % | 30 | 2.0 |
| Texture | N/A | CLAY LOAM | N/A |
| Chemical Analysis | | | |
| Cation exchange capacity | cmol+/Kg | 26 | 10 |
| Miscellaneous - Inorganics | | | |
| Total Carbon | % | 8.4* | 0.20 |
| CSR/CCME Metals in Soil – Physical Properties | | | |
| Soluble (2:1) pH | pH | 8.50 | N/A |
| CSR/CCME Metals in Soil – Total Metals by ICPMS | | | |
| Total Aluminum (Al) | mg/kg | 2300 | 100 |
| Total Antimony (Sb) | mg/kg | <0.10 | 0.10 |
| Total Arsenic (As) | mg/kg | 2.64 | 0.50 |
| Total Barium (Ba) | mg/kg | 504 | 0.10 |
| Total Beryllium (Be) | mg/kg | <0.40 | 0.40 |
| Total Bismuth (Bi) | mg/kg | <0.10 | 0.10 |
| Total Cadmium (Cd) | mg/kg | 0.237 | 0.050 |
| Total Calcium (Ca) | mg/kg | 262000 | 100 |
| Total Chromium (Cr) | mg/kg | 16.5 | 1.0 |
| Total Cobalt (Co) | mg/kg | 23.2 | 0.30 |
| Total Copper (Cu) | mg/kg | 5.12 | 0.50 |
| Total Iron (Fe) | mg/kg | 18600 | 100 |
| Total Lead (Pb) | mg/kg | 3.51 | 0.10 |
| Total Lithium (Li) | mg/kg | 18.1 | 5.0 |
| Total Magnesium (Mg) | mg/kg | 5230 | 100 |
| Total Manganese (Mn) | mg/kg | 773 | 0.20 |
| Total Mercury (Hg) | mg/kg | <0.050 | 0.050 |
| Total Molybdenum (Mo) | mg/kg | 0.27 | 0.10 |
| Total Nickel (Ni) | mg/kg | 483 | 0.80 |
| Total Phosphorous (P) | mg/kg | 296 | 10 |
| Total Potassium (K) | mg/kg | 714 | 100 |
| Total Selenium (Se) | mg/kg | <0.50 | 0.50 |
| Total Silver (Ag) | mg/kg | <0.050 | 0.050 |
| Total Sodium (Na) | mg/kg | 415 | 100 |
| Total Strontium (Sr) | mg/kg | 1420 | 0.10 |

| Parameter | Units | Result | Reportable Detection Limit |
|---|---|---|---|
| Total Thallium (Tl) | mg/kg | 0.052 | 0.050 |
| Total Tin (Sn) | mg/kg | 0.25 | 0.10 |
| Total Titanium (Ti) | mg/kg | 213 | 1.0 |
| Total Uranium (U) | mg/kg | 4.89 | 0.050 |
| Total Vanadium (V) | mg/kg | 8.9 | 2.0 |
| Total Zinc (Zn) | mg/kg | 35.3 | 1.0 |

**Detection limits raised due to dilution to bring analyte within the calibrated range.*
*N/A = Not Applicable.*

Analytes of note are calcium and sodium, which at 262,000 mg/kg and 415 mg/kg respectively, were the highest levels contained in all of the 21 soil samples taken at the KZK site. Wildlife are attracted to the salty taste of these elements and use the mineral lick area as a dietary supplement.

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# APPENDIX A

## INITIAL ENVIRONMENTAL EVALUATION – WILDLIFE SECTION

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# INITIAL ENVIRONMENTAL EVALUATION
# KUDZ ZE KAYAH PROJECT

## YUKON TERRITORY

### Volume 1: Report

February 1996

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## 3.9 WILDLIFE

### 3.9.1 Background and Summary

A program of wildlife studies for the Kudz Ze Kayah project was initiated in November 1994. Initial studies focused on the immediate project area and were subsequently expanded to address a broader study area occupied by the Finlayson caribou herd. Detailed studies focused on the regionally significant Finlayson caribou herd. The Ross River Dena's reliance on this herd for sustenance was an important factor in the wildlife program.

Wildlife resources in the project area and surroundings include the Finlayson caribou herd, moose, black bear, grizzly bear, wolf, fox, coyote, wolverine, marten, mink, river otter, beaver, several raptors, ptarmigan, various waterfowl, and a variety of other birds. The lakes and small ponds/wetlands provide breeding and migratory habitats for waterfowl and other aquatic birds. The Finlayson Lake/River area and the east slope of the Pelly Mountains are also known as a migration corridor for waterfowl and other waterbirds (including trumpeter swans and sandhill cranes).

The most notable wildlife resource in the area is the Finlayson caribou herd, which has been the subject of a significant management effort by the Yukon Government since the early 1980s. Their studies have included detailed population surveys and radio collaring. Annual rut surveys are flown by YTG Renewable Resources to monitor the caribou population. This herd has substantial value as a subsistence base for the Ross River Dena, for resident sport hunters, and for the Yukon guiding industry.

Aerial surveys were flown in March, May, June and October 1995 to document caribou distribution and numbers at key periods of the year, corresponding to late winter, calving, post-calving aggregation, and rutting activity. Additional information on caribou was also obtained during a November 1995 moose survey. The survey data provided key population characteristics (such as peak calving date, post-calving calf:cow ratio, and numbers on rutting range). The survey data indicate that little calving and post-calving aggregation activity occurs in or immediately adjacent to the Kudz Ze Kayah project area. Rutting occurs in October on the ridges and plateaus to the east and west of Geona Creek and caribou remain in the project area until at least mid-November in most years. Caribou migrate through the Geona Creek valley from their summer and fall ranges to the south and move northward to their winter ranges in the Pelly lowlands to the north, adjacent to the Robert Campbell Highway.

There is relatively little background information on moose populations and movements in this region. Moose are also an important resource for the same user groups, including the Ross River Dena. Data on moose distribution and numbers were obtained through aerial surveys flown in March and November 1995, to document late-winter and post-rut distribution. Additional data on moose were obtained during the course of caribou surveys. Some calving occurs in the upper Geona Creek valley. Moose are well dispersed in the project area during summer and early fall and congregate in post-rut groups in the upper elevations of the project area. The information indicates that moose spend early winter in the project area and may remain into late winter during some years.

Wolves have been the subject of study in the region since the early 1980s, because of their predation on caribou. Recent information suggests that the wolf population has rebounded after the end of the control program in 1989. Wolves are known to occur in the project and surrounding area although few observations were recorded during 1995 surveys for the project.

Information on other wildlife is largely absent from prior studies, apart from some anecdotal sources. Stone's sheep inhabit the higher elevations to the south of the Kudz Ze Kayah project area (between the southern North Lake and Wolverine Lake). Black bears occur in the lower elevation forests, and grizzly bears inhabit the region, occupying sub-alpine habitats and open scrub forest.

### 3.9.2 Scope and Objectives

***Scope***

Wildlife studies for the Kudz Ze Kayah project were designed to fill specific information gaps that were apparent from a review of available information from YTG Renewable Resources' Fish and Wildlife Branch sources, discussions with residents of Ross River and observations during a preliminary reconnaissance survey conducted in early December 1994. The program has evolved since November, 1994, through ongoing discussions with YTG biologists and through Cominco's participation at several open houses and meetings with the Ross River Dena.

Development of the wildlife program recognized that the major species of concern were caribou (of the Finlayson herd) and moose. The study program that was developed in consultation with Yukon Fish and Wildlife Branch biologists and the Ross River Dena reflects the concerns that were identified during the consultation process. Several additional caribou surveys (peak calving survey and post-calving aggregation survey) were added to the study program to provide specific data (peak calving date and cow:calf ratio, respectively) that would be useful in assessing potential impacts following mine development and for future caribou population monitoring. The study area was also significantly expanded for the additional caribou surveys in order to provide population-wide data for the part of the Finlayson herd utilizing the area around the project.

A moose post-rut survey was included in the Kudz Ze Kayah wildlife program and was carried out in mid November, 1995.

The wildlife study program was developed to provide the information necessary to assess wildlife resources and habitat values in the study area, and to provide the basis for an assessment of the impact of mine development, operation and decommissioning. The intent of the program was not to provide a complete inventory of all wildlife in the project area, but rather to identify critical species and their habitats and to provide or supplement the existing information base. This was necessary to formulate management strategies for dealing with potential impacts related to mine development and to provide a baseline for future monitoring activities.

### *Objectives*

Specific objectives of the Kudz Ze Kayah project baseline wildlife study program were to:

- describe and map habitat in the mine development area, tote road, and possible airstrip location (see Section 3.8 for habitat (vegetation) mapping);
- identify habitat types that are valuable to wildlife;
- identify any critical wildlife areas (e.g., caribou calving, post-calving, rutting; moose calving, rutting, post-rutting; bear dens; raptor nesting sites) that may occur in the project area;
- describe seasonal distribution of major wildlife species (caribou and moose) in the project area;
- document specific population characteristics (calving areas and dates) or activities (movements) that may be affected by mine development and operation; and
- describe wildlife use of the small ponds at the headwaters of Geona Creek and North Lakes Creek.

The program would also provide the basis to:

- assess potential impacts on wildlife and habitat from mine development and the access road, airstrip and concentrate hauling;
- recommend mitigation measures to avoid or lessen impacts to wildlife populations and habitat; and
- recommend a monitoring program for wildlife.

### *Study Area*

Wildlife studies were undertaken in the project area and immediate surroundings, including the tote road and locations for mine related sites. An assessment of potential impacts related to the airstrip to be located adjacent to the Robert Campbell Highway was also included. Together, these areas are referred to as the core wildlife study area, shown on Figure 3-31. An expanded study area was used for the caribou surveys to provide data for a broader geographic area. The expanded study area is shown on Figures 3-33 and 3-34.

### 3.9.3 Approach and Methodology

***Personnel and Resources***

The wildlife program was developed by a long-time Yukon wildlife specialist, and carried out by trained biologists and experienced wildlife specialists. Surveys were carried out in March, May, June, October and November, 1995. Members of the Ross River Dena and staff from YTG Renewable Resources' Fish and Wildlife Branch participated on several of the surveys.

***Surveys Undertaken***

Surveys carried out specifically for the wildlife program included the following:

- November 30 to December 4, 1994 reconnaissance survey of the project area and tote road corridor;
- March 10 and 12, 1995 late-winter aerial survey of the project area, East Creek, and the tote road corridor (Appendix 3.9a; Figure 3-32). Snow profiles were also completed for the late winter survey and data are presented in Appendix 3.9a;
- May 20 to 27, 1995 caribou calving survey of the project area and expanded study area to document calving areas and peak calving date (Appendix 3.9b; Figure 3-33);
- June 27 to 29, 1995 survey of caribou post calving aggregation areas and calf:cow ratio in the project area and expanded study area (Appendix 3.9c; Figure 3-34);
- August 7 to 10, 1995 vegetation/habitat survey to describe and map wildlife habitat in the immediate proposed mine area, the tote road, and the proposed air strip location;
- October 1, 1995 caribou rut survey to document rutting areas and number of caribou in the project area and vicinity (Appendix 3.9d; Figure 3-35); and
- November 14 to 16, 1995 moose post-rut survey to document distribution and numbers of moose in the project area and vicinity (Appendix 3.9e; Figure 3-36).

All aerial survey work for the Kudz Ze Kayah wildlife program was flown with a helicopter.

In addition to the field surveys, a wildlife observation log was initiated at the Kudz Ze Kayah camp in May, 1995 to record significant wildlife observations made by exploration personnel, helicopter pilots, contractors, and environmental survey crews. A map grid system was established to tie observations to general geographic locations.

### *YTG Information*

Information resources used for the wildlife study included results of YTG Fish and Wildlife Branch caribou studies (Farnell and McDonald 1987; Farnell and Hayes 1992), wolf studies (Hayes and Harestad 1994), and moose surveys (Jingfors 1988; Larsen and Ward 1991). These sources include published and unpublished (draft manuscript) reports, preliminary maps of caribou survey data and population distribution, radio-tracking results, and results of the 1995 caribou rut survey. General information on wildlife in the region and Kudz Ze Kayah area in particular, was gained through telephone discussions and meetings with Fish and Wildlife Branch staff.

## 3.9.4 Results

### *Caribou*

*Background*

The most significant wildlife feature of the study area is the Finlayson caribou herd which has been the subject of study by YTG since 1982. Caribou of the Finlayson herd are important from a social and economic perspective as a subsistence food source by First Nations. This caribou herd is also important to Yukon resident hunters and to the Yukon guiding industry. Previous studies of caribou have included extensive aerial surveys to document population status (during the rut), calving areas and wintering grounds. Radio-collaring and tracking studies have also been carried out by YTG to provide data on caribou distribution and movements.

The impetus for the Finlayson caribou studies was the declining state of the herd during the early 1980s. Concern for the declining caribou population led to a wolf control program which was implemented by YTG in 1982/83 and 1989/90. The wolf population was reduced in the area occupied by the Finlayson caribou herd. In conjunction with wolf control, sport hunting was limited to bull caribou, and First Nations hunters were encouraged to select male over female caribou. Annual monitoring of the caribou herd by YTG is continuing. Results of the 1994 survey indicate that the Finlayson herd has rebounded from a low of approximately 2,000 in the early 1980s to an estimated 8,000 caribou by the mid-1990s. Of the estimated 8,000 in the herd, approximately 1,000 to 2,000 inhabit the general region around the project area. As many as 552 caribou were counted in the project area during annual rut surveys.

*Seasonal Range Use and Movements*

The general pattern of seasonal range use and distribution is described below based on information from maps produced by Yukon Fish and Wildlife Branch, and information from the seasonal surveys flown for the Kudz Ze Kayah project. Summer, rutting and wintering ranges of the Finlayson caribou herd are shown on Figures 3-37, 3-38, and 3-39, respectively (produced from YTG mapping).

Caribou calve on ridges and upper slopes of basins in late May and by mid-June form aggregations in the uplands. They remain dispersed in small bands in the uplands and upper forests through summer. During late spring through summer, caribou utilize many of the shrub and herb vegetation types that were identified in the vegetation study as well as the open-canopy sub-alpine fir forest on valley slopes.

Caribou form rutting aggregations in early October and occupy the uplands (ridges and plateaus), including the upper elevations of the project area. At this time, caribou may utilize any of the alpine shrub vegetation types (e.g., dwarf birch dwarf shrub, willow dwarf shrub, alpine dwarf shrub) and alpine herb vegetation types (e.g., woodrush herb, mesic mixed herb). After the rut, caribou disperse throughout the area and inhabit the alpine, sub-alpine and upper forests until late fall (mid November). At this time, they utilize a wide range of vegetation types. By mid-November, caribou start to move down into the boreal forest which includes the open-canopy black spruce forest vegetation types.

By December-January, caribou have moved down to their traditional winter range in the Pelly River lowlands. Their winter range includes the boreal forest along the Robert Campbell Highway, to the north of the project area. By early to mid-May, caribou move upward, following the receding snow to the uplands on their way to calving areas.

A more detailed description of seasonal range use and results of specific caribou surveys that were conducted for the project follow.

*Winter Distribution*

a) Early Winter (1994)

Observations during the November 30 to December 4, 1994 reconnaissance survey indicate that caribou remained on the ridges and lower slopes of Geona Valley until at least early December. The 1994/95 winter has been regarded as a low snow depth winter, therefore, the observations during 1994 may not be typical of a more "normal" winter. Normal conditions (i.e., earlier and deeper snow) are expected to induce caribou to move out of the uplands sooner than early December in most years. In December 1994, caribou were observed in small numbers in open scrub forest along upper Geona Creek and up to the alpine ridges, mostly on the east side of Geona Creek. Tracks and feeding craters were observed on the ridge crest east of the creek. Tracks were also observed frequently in the open scrub forest south of the proposed tailings dam location.

In early December, 1994, small numbers of caribou and tracks were observed along Finlayson Creek, from above the confluence with Geona Creek down to approximately the confluence with East Creek. Caribou tracks were also observed in the boreal forest northwest of the Finlayson Creek-Geona Creek confluence. It was apparent that movement to winter range was well underway by early December, 1994.

b) Winter/Late Winter (1995)

Based on winter locations determined from radio collars during 1982 to 1986, the Finlayson caribou herd winters in the spruce forests of the Pelly River lowlands on both sides of the Robert Campbell Highway and to the northwest of Finlayson Lake. YTG survey data for February (1983, 1984, and 1986) indicate that the majority of caribou are located on this winter range. March and April location data (1982 and 1983), corresponding to the late-winter period, indicate the same distribution as in February. None of the YTG radio-collar location surveys documented any caribou in the project area during the winter period.

A survey to document late-winter conditions and animal distribution in the project area and along the tote road route was flown March 10 and 12, 1995. Survey results are shown on Figure 3-32 and are detailed in Appendix 3.9a. Snow depth in the project area was light (33 to 63 cm in valleys; 24 cm or more on upper slopes) compared to "normal" years. Two caribou (a cow and calf) were seen near the confluence of Finlayson Creek and East Creek. Caribou tracks were only observed at lower elevations along Finlayson Creek and in the boreal forest to the north of the project area. No evidence of caribou activity was observed above the 1,100 m elevation during this survey.

*Calving Distribution and Timing*

Information on distribution of caribou during the early calving period was provided by YTG's radio collar surveys for late-May (1982, 1983, 1985, and 1986 plus June 1, 1986). Data from these surveys indicate that caribou are well dispersed by this time. No radio collared caribou were recorded near the project area during the late May 1982 to 1986 surveys. The closest radio collared caribou was near the southern North Lake.

A peak calving survey was requested by YTG to establish peak calving date (i.e., date when 50% of cows have calved). According to YTG biologists, the peak calving date is unique for each of the caribou herds in the Yukon, and can be used as an indicator of changes to population dynamics in subsequent years. The need for such a survey was discussed with YTG biologists and representatives of the Ross River Dena. The survey was carried out between May 20 and May 27, 1995 (details provided in Appendix 3.9b).

The survey covered five "blocks", of which the Kudz Ze Kayah project area was block KZK 1 (Figure 3-33); an expanded survey area was chosen to provide a wider geographical area for establishing the peak calving date for the Finlayson herd. The survey was flown over individual survey blocks on successive days, with some overlap of blocks on some days. The methodology included finding gravid cow caribou and relocating these on subsequent days to determine when the calf was born. Numbers of cows with calves were counted in a particular block, and an overall calf/100 cow ratio established for each successive day. The greatest success was found in survey block KZK 5, which was subsequently resurveyed to establish the peak calving date.

Forty-two calving caribou were located. The peak calving date (in 1995) was found to be May 27. The ratio of calves/100 cows progressed as follows: May 20 (5:100), May 21 (3.5:100), May 24 (24:100), May 25 (34:100), May 27 (50:100). The survey was ended at the 50% ratio, as is usual practice. On May 27, a disparity in calving ratio was evident between survey block KZK 5 (69:100) and survey blocks KZK 1, 2 and 3 (19:100); however, the overall ratio for May 27 was 50:100. The difference in calving ratios on May 27 seems to suggest a cline (or trend) in both calving density and ratio of calves/100 cows, with increasing density and calving ratio from west to east. The peak calving day appeared to be one or two days later in blocks KZK 1, 2 and 3 relative to block KZK 5.

The calving distribution of the Finlayson herd appears to have been far more widely dispersed in 1995 than in other years, likely the result of the low snow depths and an early spring which opened up more upper elevation areas for calving caribou. The wider dispersion may partially account for the differences in the calving peak between geographic areas (e.g., KZK 1, 2 and 3 relative to KZK 5). Most caribou were found to calve in the uplands south of the project area (Figure 3-33). Direct observations of caribou calving in the vicinity of the project area were few, with isolated cow/neonate pairs above 1770 m to the southwest (10-15 km). One notable exception, however, was the observation of a cow/neonate pair near the junction of Geona and Finlayson Creeks (May 21, 1995).

*Post-Calving Aggregations*

Post-calving locations were documented by YTG surveys in mid-June to mid-July 1982 to 1985 from radio collared caribou. Radio collared caribou were in the area around Grass Lakes and to the east of North Lakes. No radio collared caribou were recorded in the project area or immediate vicinity during this time period.

At the request of the YTG, and following consultation with representatives of the Ross River Dena, a survey to document post-calving population growth (recruitment) and caribou aggregation was added to the Kudz Ze Kayah wildlife program. The purpose of the survey was to provide baseline data on the calf/100 cow ratio. The ratio can also be used to monitor future population dynamics. YTG biologists believe the annual post calving aggregation calf/100 cow ratio could be used to monitor possible disturbance-induced depression of neo-natal calf survival (potentially due to stress resulting from development activity in the region).

The post-calving aggregation survey was flown June 27 to 29, 1995 and included an expanded study area to the west, south and east of the project area (see Figure 3-34; details are provided in Appendix 3.9c). A total of 472 caribou were classified (184 cows, 120 calves, 117 immature bulls, and 51 mature bulls) plus 4 unclassified caribou were counted.

The complete results for the three days and the overall calf:100 cow ratio were as follows:

| | | |
|---|---|---|
| June 27 | block | KZK 5 and adjacent uplands to the east between Waters Creek and Whitefish Lake: 59 calves and 74 cows = 80:100 ratio; |
| June 28 | block | KZK 1 west of North River and KZK 2 south of Fire Lake, Simpson Range east of Black Lake, and the surveyed portion of Campbell Range: 27 calves and 34 cows = 79:100 ratio; and |
| June 29 | block | KZK 2 west of Fire Lake and KZK 3: 34 calves and 76 cows = 45:100 ratio. |

Cumulative total; 120 calves and 184 cows = combined ratio of 65 calves: 100 cows.

Significant post-calving aggregations of caribou were not observed in the immediate area of the proposed Kudz Ze Kayah mine development (Figure 3-34).

*1995 Rut Survey*

YTG has flown an annual rut survey for the Finlayson caribou herd since 1982. Maps produced by YTG for the annual rut surveys show that caribou rut on the upper ridges of the Geona Valley, including the ridges around the Kudz Ze Kayah camp. The largest numbers of rutting caribou in the project area appear to have been on the ridges to the west of Geona Creek.

The locations of radio collared caribou determined by YTG during late-September to early-October 1982, 1983 and 1985 indicate that caribou rut in the areas around North Lakes and Grass Lakes. However, no radio collared caribou were recorded in the immediate area of Geona Creek during those years.

A rut survey of the project area was flown on October 1, 1995 in conjunction with the annual YTG rut survey which was completed October 2 to 3, 1995. Results of the Cominco portion of the survey suggest that the rut was in its early stages on October 1 and large aggregations had not formed yet (the largest band size observed was 27 caribou). A total of 152 caribou (comprised of 86 adult cows, 12 male calves, 20 female calves, 11 immature bulls, and 23 mature bulls) were observed in the survey area. Of these, 47 were on the ridges immediately west of the headwaters of Geona Creek and 32 were on the ridges immediately to the east of the headwaters of Geona Creek (Figure 3-35 and Appendix 3.9d). All of the caribou were in alpine or sub-alpine habitats.

Based on observations of well-used trails during the survey, recent movements of caribou occurred to the south and east of the project area. Rutting bands of 50 or more caribou on the lower alpine plateaus south of Wolverine Lake were reported by a pilot.

The Cominco portion of the rut survey was incorporated into the overall YTG survey for 1995. A total of 1441 caribou were observed during October 1 to 3. A comparison of the survey data between the Cominco Kudz Ze Kayah portion and the total survey data is provided in Table 3-23.

A comparison of numbers of caribou rutting in the project area between 1984 and 1995 is provided in Table 3-24. These numbers reflect the annual variation that occurs in distribution and band size. The data were provided by YTG Renewable Resources (Fish and Wildlife Branch) from a data base for the annual caribou rut surveys conducted for the Finlayson Lake caribou herd.

These data suggest that considerable natural variability occurs in numbers of caribou rutting in this area, ranging from 66 in 1984 to 552 in 1994. The count of 144 in 1995 (144 were counted within the specified area and another 8 just outside of this area) falls within this range. The count in 1993 was only 204, not much higher than in 1995. Further, the 1995 survey was flown early in the rutting period and only small aggregations of caribou were observed. This appeared to be the case for the larger area surveyed by YTG also. Therefore, the 1995 count is considered to be a reflection of natural variability in the distribution of caribou during the rut, and/or a function of timing of the survey. Variation in survey methodologies between years may also be a factor.

*Post-Rut/Early Winter Distribution (1995)*

Additional information on caribou distribution was obtained incidental to the November 14 to 16, 1995 moose post-rut survey (Appendix 3.9e). Conditions were generally similar to the late November/early December 1994 reconnaissance survey, except that the 1994 survey was during what has been considered "a very low snow winter".

A total of 441 unclassified caribou in 36 groups were observed in the project area. Evidence on the ground indicated the north westerly movement of large numbers of caribou across the core study area during the previous week. Crossings of the Geona Creek-Finlayson Creek valley were particularly evident in a corridor extending from approximately 4 km above the Geona Creek-Finlayson Creek confluence to a point approximately 4 km below this confluence. Further evidence of strong movements were noted above and below this corridor at tailings dam site "D" and at the confluence of East Creek and Finlayson Creek, respectively. Strong, fresh trails were also noted following down the East Creek Valley.

The large number of caribou on the core area would indicate that the movement to lower elevation winter ranges was in full progress during this mid November survey with the vanguard of the movement having progressed as far west as Mink Creek.

Potential impacts of mine development on caribou are discussed in section 5.3.

### *Moose*

*Background*

Moose are the second most abundant large mammal species in the project area. Moose are regionally important as a subsistence food source for First Nations and also for sport hunting by Yukon resident hunters and guided non-resident hunters. Moose populations in the region have been the subject of study by YTG since the early 1980s. Moose populations have also benefited from the wolf control program carried out by YTG between 1982 and 1989 and have increased since the wolf population was controlled.

*Seasonal Distribution*

Moose occur on the Kudz Ze Kayah property in the spring, summer, fall and early winter. Winter ranges have not been clearly established.

Moose utilize the forested vegetation types (open-canopy sub-alpine fir, open-canopy black spruce mineral soil, open-canopy white spruce) during much of the year, although primarily in the winter when they inhabit the lowlands along Finlayson Creek down to the Robert Campbell Highway. The tall shrub vegetation types (e.g., willow tall shrub) are also utilized into the winter period when moose occur in the upper Geona Creek valley. During spring to fall, moose are widely distributed throughout the area and can occur in any of the vegetation types, except that the alpine types receive little use (due to their poor cover and food availability for moose). During the rut and post-rut, moose occupy upper sub-alpine basins and utilize the tall shrub vegetation types (e.g., willow tall shrub, willow-dwarf birch tall shrub herb rich, sub-alpine fir tall shrub) and the open-canopy sub-alpine fir forest.

a) Early Winter

Observations during a reconnaissance survey on December 4, 1994 noted nine moose in the immediate project area. Moose were sighted adjacent to upper Geona Creek as well as one group of four in an upper sub-alpine basin. These observations suggest that moose spend at least the early winter period in the upper Geona Creek drainage, including sub-alpine basins. These sub-alpine basins are used during the post-rut period. Snow conditions in early winter, 1994, were very light compared to "normal years", which may have accounted for moose still being present in the upper elevations of the project area at that time.

b) Late Winter

During the March 10 and 12, 1995, late winter survey, moose were observed in the lowlands along Finlayson Creek and up to the sub-alpine of the upper Geona Creek basin (Figure 3-32, Appendix 3.9a). Snow conditions during the March, 1995 survey were very light (snow depth 33 to 63 cm in valleys; 24 cm or more on upper slopes and basins) compared to "normal" winter conditions and did not appear to significantly impede movement of moose in the project area. A total of 43 moose were counted, of which 20 were classified as bull, 20 as cows and 3 as calves.

Moose tracks were abundant along Finlayson Creek up to the confluence with East Creek. Two adult cow moose were observed on the slopes (1400 m elevation) on the west side of Finlayson Creek between East Creek and Geona Creek, and one bull moose was observed at the confluence of Finlayson Creek and Geona Creek. Groups of two and four moose were observed in open spruce/shrub habitat on lower slopes (elevation range from 1340 m to 1460 m) above upper Finlayson Creek.

Moose in the upper Geona Creek area were in the 1370 m to 1615 m elevation range. Sightings included three moose along the lower valley of Geona Creek (sighting 2 on March 12), and four moose at the top end of North Lakes Creek (sighting 22 on March 10). Moose were also observed in the broad valley around the North Lakes (four moose at "east" North Lake and four moose at "west" North Lake; elevation 1300 m). This broad valley has extensive growth of willow and birch shrub.

Most observations of moose during the late winter survey, however, were in sub-alpine basins where moose appeared to congregate in groups. These groups were mostly to the west of Geona Creek. During the March 10, 1995 survey, four groups of moose (ranging from four to seven animals) were observed in the upper sub-alpine basins (elevations ranging from 1500 m to 1600 m; southwest and northwest aspects) to the west of Geona Creek. Four moose were observed on the upper slopes (1550 m; north aspect) on the east side of Geona Creek on the same day.

None of the moose observations during the March 10 or 12, 1995, surveys were in the immediate area of the proposed mine development in the upper Geona Creek valley, although some tracks were observed on the lower valley slopes.

c) Spring

Moose were observed during the May 20 to 27, 1995 caribou calving survey (Figure 3-33, Appendix 3.9b). This survey included a much larger area than the project area and focused on caribou. Few moose were observed within the project area during this survey. One observation of a new calf was recorded on May 20, indicating that moose calving had started by at least this date.

A separate survey for moose along the tote road was flown on May 28, 1995 (Appendix 3.9b). A total of six bull moose were observed; two near Finlayson Creek above the confluence with East Creek and four in the lake at the head of East Creek. Incidental observations included a cow moose and yearling above upper Geona Creek behind the Kudz Ze Kayah camp, and two bull moose in a pond at the head of East Creek.

Moose were frequently reported in the project area in the spring (April through June), including numerous sightings in the Geona Creek valley during the course of other work. New calves were observed on May 24 (upper East Creek), May 26 (upper Finlayson Creek), May 17 (west-facing slopes above lower Geona Creek), and June 13 (basin immediately northeast of camp; two calves 1.5 km north of camp). Observations suggest that the moose calving period extends from at least May 20 through to June 13. Moose with new calves were generally observed on lower elevation slopes.

d) Summer

Information on summer distribution of moose in the area around the Kudz Ze Kayah camp was provided by the camp wildlife observation log. Sightings of moose were common in the upper Geona Creek valley from mid-June into mid-August and moose were frequently seen near the camp. The valley of Geona Creek and the lower sub-alpine basins provide an abundance of browse and some cover for moose. Moose appear to reside in and move through the upper Geona Creek valley throughout the summer.

e) Fall

Thirteen moose were observed during the October 1, 1995, caribou rut survey of the project area (see Appendix 3.9d and Figure 3-35). The observations included one bull and two cows in a sub-alpine basin east of the Kudz Ze Kayah camp (at 1600 m elevation). Most other moose (9 out of a total of 13) were observed in sub-alpine habitat above upper Finlayson Creek, to the northwest of the camp. Moose rut in sub-alpine basins and upper slopes and appear to remain in these habitats through the post-rut period (late-October to the end of November).

*1995 Post-Rut Survey*

At the request of YTG, a post-rut survey was added to the wildlife program and was flown November 14 to 16, 1995. The purpose of the post-rut survey was to document the location and numbers of moose on the Kudz Ze Kayah property and, in particular, the proposed mine development area.

The moose survey covered the core study area (Figure 3-36; Appendix 3.9e). Survey methodology required the modification of core area boundaries to conform to established YTG survey polygon boundaries (see Figure 3-36) where necessary.

Early in the survey, it became evident that moose were concentrated in sub-alpine habitats and a decision was made to focus the effort on these areas.

Eighty-two (82) moose were observed in three concentrations: Upper Finlayson Creek, "western" North Lake and East Creek. In aggregate 37 cows, 15 calves and 30 bulls were observed in 33 groups.

Comparative results with those of previous years are possible for the Upper Finlayson Creek area where blocks 196 (22 sq km) and 199 (22 sq km) were surveyed in their entirety, yielding 11 moose and 6 moose, respectively. Resulting moose densities of 0.5 moose/km$^2$ (Block 196) to 0.27 moose/km$^2$ (Block 199) compare to those noted by Larsen & Ward (1991).

A much higher density was encountered in the "western" North Lake area. Block 197 of which only 2/3 was surveyed, produced 46 moose resulting in a density of approximately 3.0 moose/km$^2$ which confirms previous survey results (>1.5 moose/km$^2$, Larsen & Ward 1991) and previous observations.

Fourteen (14) moose were observed in the upper and middle reaches of East Creek. No direct comparison with previous survey results is possible as Block 227 (where most of these moose are located) has not been previously inventoried. Block 227 is to be surveyed by YTG in 1996.

Observations by a helicopter pilot indicate that the East Creek and Upper Finlayson Creek groups were in their same general locations on December 16, 1995 and on January 10, 1996. Extreme and protracted periods of cold weather in December 1995 and January 1996, with low levels of precipitation and a strong thermal inversion at higher elevations on the core study area, likely explain the sedentary behaviour of these moose.

Results of the November, 1995, moose post-rut survey indicate a density range of 0.27->1.5 moose/km$^2$. The highest densities were found in Block 197 and lowest densities in the Block 199. Compared to 1991 survey results for comparable survey polygons, the 1995 data indicate that no measurable density changes have occurred.

*Population Status*

Moose surveys are carried out every five years in the area by YTG. The latest survey was in November, 1991 (Larsen and Ward 1991). The Frances Lake survey area includes a section from the Robert Campbell Highway south to the North Lakes, and to the west of Geona Creek. In 1991, moose densities in the Frances Lake survey area were 383 moose/1000 km$^2$, which was among the highest recorded in the Yukon (Larsen and Ward, 1991). Areas above 1525 m, classified as "unsuitable moose range", include uplands on the west side of Geona Creek. The broad valley adjacent to the western and southern shores of the North Lakes was estimated to have a density of >1.5 moose/km$^2$. The open boreal forest north of the project area (and adjacent to the tote road) was estimated to have a density of 0.0 to 0.75 moose/km$^2$ (Larsen and Ward 1991).

The moose population in the region has rebounded significantly with the wolf control program. The overall estimated population for the Frances Lake area increased by 93% between 1987 and 1991, although population recruitment dropped from 29% in 1987 to 21% in 1991 (Jingfors 1988). A reduction in calf ratio (from 69 to 44) and yearling ratio (from 54 to 38) were apparent between 1987 and 1991 and were attributed to an increase in the numbers of wolves (after the wolf control program between 1982 and 1989).

Population data from the November, 1995, moose survey can be used for general comparison of overall moose densities between 1991 and 1995. The 1995 data suggest that moose densities in the broad area have remained stable. The next moose survey by YTG is planned for November, 1996, and will provide reliable moose population growth and recruitment rates.

In terms of numbers of moose using the immediate project area (i.e., upper Geona Creek and adjacent uplands), this probably ranges between 10 and 20 at various times of the year.

Potential impacts on moose are discussed in section 5.3.

***Stone's Sheep***

A population of Stone's sheep inhabits the uplands to the south of North Lakes (approximately 7 km south of the Kudz Ze Kayah camp) and toward the west side of Wolverine Lake (approximately 15 km south-east of the camp). Direct surveys for Stone's sheep were not flown as part of the Kudz Ze Kayah wildlife program in 1995, as sheep are not known to occur in the project area. Indirect observations were recorded during the course of other surveys. Observations of Stone's sheep during the 1995 aerial surveys included:

| | |
|---|---|
| May 20 | 2 ewes |
| May 23 | 7 ewes and 1 new lamb |
| May 23 | 7 rams, 2 yearlings, 2 ewes and 1 lamb |
| May 24 | 2 rams |

All of these observations were to the south of the project area (in the uplands east of the "southern" North Lakes).

Incidental observations of sheep were also recorded during helicopter supported exploration activity. These observations were all in the uplands to the east of the southern North Lakes. Sheep were observed there as early as April 11 (mixed ages and sexes). A group of 14 ewes and lambs with 5 rams was observed on May 20 in the same general area.

A sheep survey was flown by YTG on July 4, 1995. The survey area generally corresponded to previous surveys flown in 1986 and 1988, and extended from Fire Lake east to Wolverine Lake and from North Lakes south to Waters Creek. A total of 41 sheep were counted in 1995 (comprised of 24 nursery sheep, 11 lambs, and 6 rams (a ratio of 46 lambs/100 nursery sheep) compared to 72 sheep in 1988 (comprised of 53 nursery sheep, 19 lambs, and 2 rams (a ratio of 36 lambs/100 nursery sheep)). The distribution in 1995 was centered at the headwaters of Money Creek. This area is located to the south-east of the southernmost North Lake and in the same general area that incidental sheep sightings were recorded during 1995. The relatively few rams observed on both 1988 and 1995 surveys is likely due to differential range use as rams utilize more rugged terrain to the south of Waters Creek.

All of the sheep observations were outside of the project area.

***Bears***

Grizzly bear (*Ursus arctos*) and black bear (*Ursus americanus*) inhabit the region and were occasionally observed near the project area during the 1995 aerial surveys. Grizzly sightings on these surveys included:

| | |
|---|---|
| May 20 | 1 sow with 2 yearlings |
| May 20 | 1 sow with 1 two-year old |
| May 21 | 1 sow with 2 yearlings |
| May 23 | 1 sow with 2 yearlings |
| May 27 | 1 sow with 1 yearling |
| June 28 | 1 sow with 1 two-year old; 2 individual sub-adults. |

Grizzlies range throughout the open valleys and sub-alpine of the region, and may occur in any portion of the project area. Grizzly home ranges are generally large. In the interior mountains of southwestern Yukon, grizzly bear density was estimated as one grizzly per 26 $km^2$ (Pearson 1975). Observations recorded in the 1995 Kudz Ze Kayah camp log included one adult grizzly digging for ground squirrels in a basin 2 km south of the camp (June 8), and one grizzly in the uplands 2 km south-east of the camp (September 7). It is likely that one or two grizzlies include the project area as part of their home ranges. No bear den sites were observed during the aerial surveys and none were reported during other project related work in the area

Only one black bear was reported in the Kudz Ze Kayah area in 1995. This was an adult on the slopes approximately 3 km southwest of the Kudz Ze Kayah camp (July 15). Black bears are more abundant in the lower forests toward Finlayson Lake and the Robert Campbell Highway. Black bear are not expected to be common in the project area because of the primarily sub-alpine and alpine habitats.

***Wolves***

Wolves (*Canis lupus*) have been the subject of study by YTG in conjunction with surveys of the Finlayson caribou herd. The wolf control program between 1983 and 1989 reduced the wolf population by 81%-85% (Farnell and Hayes 1992). The wolf population has been the subject of study to monitor its recovery after control (Hayes and Harestad, in progress). Numbers appear to have recovered to near the pre-control population.

Wolves or their sign were infrequently observed during the aerial surveys flown for the 1995 wildlife program. One wolf was observed on May 28 in the lower Geona Creek valley, approximately 2.2 km south of the confluence of Finlayson and Geona creeks. Two wolves were spotted on a ridge 6.5 km northwest of the Kudz Ze Kayah camp on May 16. Wolves travel throughout the region and are expected to utilize the upper Geona Creek valley and adjacent uplands. Exploration related activities in 1995 may have kept wolves out of the upper Geona Creek area.

***Smaller Carnivores and Furbearers***

Smaller carnivores observed in the project area, either through direct observation or through sign, include fox *(Vulpes vulpes*), wolverine (*Gulo gulo*), and least weasel (*Mustela nivalis*). Foxes were observed often in April and May, 1995, near the Kudz Ze Kayah camp and 2 to 3 km north of camp. Both red and silver phase foxes were observed. Two wolverines were observed in the uplands 1.5 km west of the camp on June 12, 1995. Fresh tracks were observed in early April on the west-facing slopes of the Geona Creek valley 6 km north of the camp. One least weasel was observed in the lower Geona Creek valley in mid-April.

Beavers (*Castor canadensis*) are moderately abundant in the project area's creeks, small lakes and ponds. The best beaver habitats occur along Finlayson Creek. The upper Geona Creek valley represents poor beaver habitat but is still utilized, as are small drainages throughout the lower to mid-elevations of the region. Beaver activity was observed on most of the small ponds in the upper Geona Creek valley and the North Lakes drainage to the south.

Other furbearers which were not recorded during the 1995 program but which are known to occur in the region (and are expected in at least parts of the project area) include coyote (*Canis latrans*), lynx (*Lynx canadensis*), marten (*Martes amaricana*), ermine (*Martes erminea*), mink (*Mustela vison*), and river otter (*Lontra canadensis*).

***Small Mammals***

No direct information was collected for small mammals which occur in the project area. Snowshoe hares (*Lepus americanus*) occur throughout the region and inhabit the open treed habitat units and the lower elevation shrub units (such as occur along the valley floor of Geona Creek). Little evidence of snowshoe hare activity was noted during 1995 field work. Snowshoe hare populations appear to have crashed in the early 1990s and should rebound during the mid-1990s.

Ground squirrels (*Spermophilus parryii*) occur on sub-alpine slopes in the area. One observation of a grizzly bear foraging for ground squirrels was recorded in the Kudz Ze Kayah project area. Both snowshoe hares and ground squirrels represent an important food base for avian and mammalian predators.

## *Birds*

### *Waterfowl/Waterbirds*

Waterfowl use of the immediate project area is limited due to the extensive uplands. Suitable wetlands are restricted to the small lakes and ponds at the top end of Geona Creek and South Creek and these are utilized during migration. No direct observation of waterfowl breeding was recorded in the project area in 1995. Ducks were reported on the lakes at the top of the North Lakes drainage (including mallard, scotters, mergansers, and harlequin). One pair of harlequin ducks was reported on lower East Creek on May 22.

Trumpeter swans were observed on lakes north of the project area on June 8, 11 and 12, 1995 and one pair on the easternmost of the North Lakes on May 24 (one swan with a green and black collar). Trumpeter swans are known to breed in the lakes and potholes throughout the Pelly lowlands and to migrate through the Finlayson River valley.

Whitefronted geese migrate through the Pelly River and Finlayson River valleys in significant numbers from late August until mid September.

One common loon was heard near the Kudz Ze Kayah camp on May 22. Migrating northern phalaropes were observed in small numbers on ponds near the Kudz Ze Kayah camp between May 23 and 26, 1995.

### *Sandhill Crane*

Approximately 200,000 Alaskan and Siberian breeding sandhill crane migrate through the study area in May and June and from late August into late September. Large numbers of these birds are particularly evident in the general Kudz Ze Kayah area during the fall migration along the Tintina Trench.

### *Raptors*

Golden eagles were observed on numerous occasions during the May caribou calving survey. A total of 26 golden eagle observations were recorded, however, some of these may have been repeat sightings. Golden eagles were recorded on several occasions in the uplands near the Kudz Ze Kayah camp in early May to Mid-June. A Bald eagle sighting was also recorded in the upper Geona Creek valley on May 3 and one was reported foraging for fish in the easternmost of the North Lakes on May 15.

One pair of gyrfalcons was observed at an aerie south-east of Wolverine Lake during the May 23, 1995, aerial survey.

No raptor nest sites or family groups were observed in the immediate Kudz Ze Kayah project area in 1995.

*Ptarmigan*

Ptarmigan were observed frequently in the project area. Ptarmigan were observed in small flocks during the early December, 1994, reconnaissance survey and during the March 10 and 12, 1995, aerial surveys. All three species of ptarmigan (willow, rock, and white-tailed) may occur in the project area. Willow ptarmigan were abundant in the upper Geona Creek valley and were frequently seen around the Kudz Ze Kayah camp in April, when the males were establishing territories. The various willow, willow/birch, and sub-alpine fir shrub units provide abundant cover and food for willow ptarmigan during the breeding season and into the fall. Shrub units are utilized in the winter for food and cover by all three species. Ptarmigan were noted to be abundant and were often observed in the uplands of the project area during the October 1, 1995, caribou rut survey. One very large flock of several hundred birds (not identified as to species) was observed during that survey.

***Critical/Sensitive Habitats***

No critical or especially sensitive habitat types were identified in the Kudz Ze Kayah project area during the study. Habitat types that occur in the valley bottom of upper Geona Creek, including the small ponds, are common throughout the region.

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## TABLE 3-23

## FINLAYSON CARIBOU HERD 1995 RUT SURVEY - POPULATION DATA

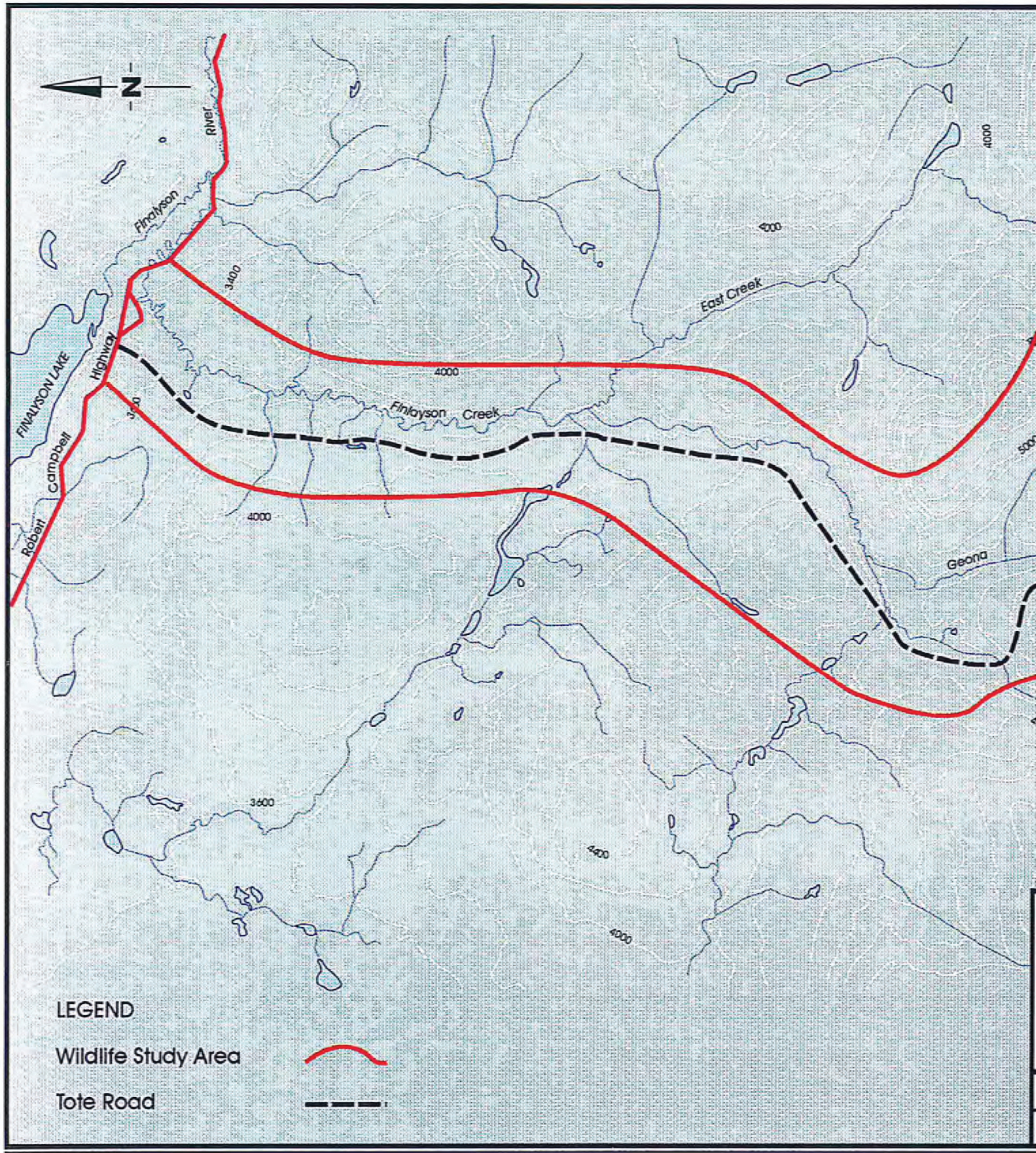
| Population Characteristic | Total Survey Area | Kudz Ze Kayah Survey Area |
|---|---|---|
| Total Observations | 69 | 12 |
| Total Cows | 840 | 86 |
| Total Calves | 220 | 31 |
| Total Immature | 186 | 13 |
| Total Mature | 194 | 22 |
| Unclassified | 0 | 0 |
| Unclassified Calf | 1 | 0 |
| Total Count | 144 | 152 |
| Calf/100 Cow Ratio | 26.2 | 36.0 |
| Calf Sex Ratio | 56.6 % Female | 64.5 % Female |
| Bull/100 Cow Ratio | 45.2 | 40.7 |
| % Calves | 15.3 | 20.4 |
| % Mature Bulls | 51.1 | 62.9 |

**TABLE 3-24**

**ANNUAL CARIBOU RUT SURVEY RESULTS FOR KUDZ ZE KAYAH PROPERTY, 1984 TO 1995**

| Year* | Count | Maximum Band Size |
|---|---|---|
| 1984 | 066 | 27 |
| 1986 | 107 | 64 |
| 1987 | 247 | 72 |
| 1988 | 489 | 112 |
| 1989 | 122 | 96 |
| 1990 | 240 | 76 |
| 1991 | 087 | 24 |
| 1992 | 157 | 74 |
| 1993 | 204 | 51 |
| 1994 | 552 | 117 |
| 1995 | 144 | 46 |

* No data for 1985




**WILDLIFE STUDY AREA**

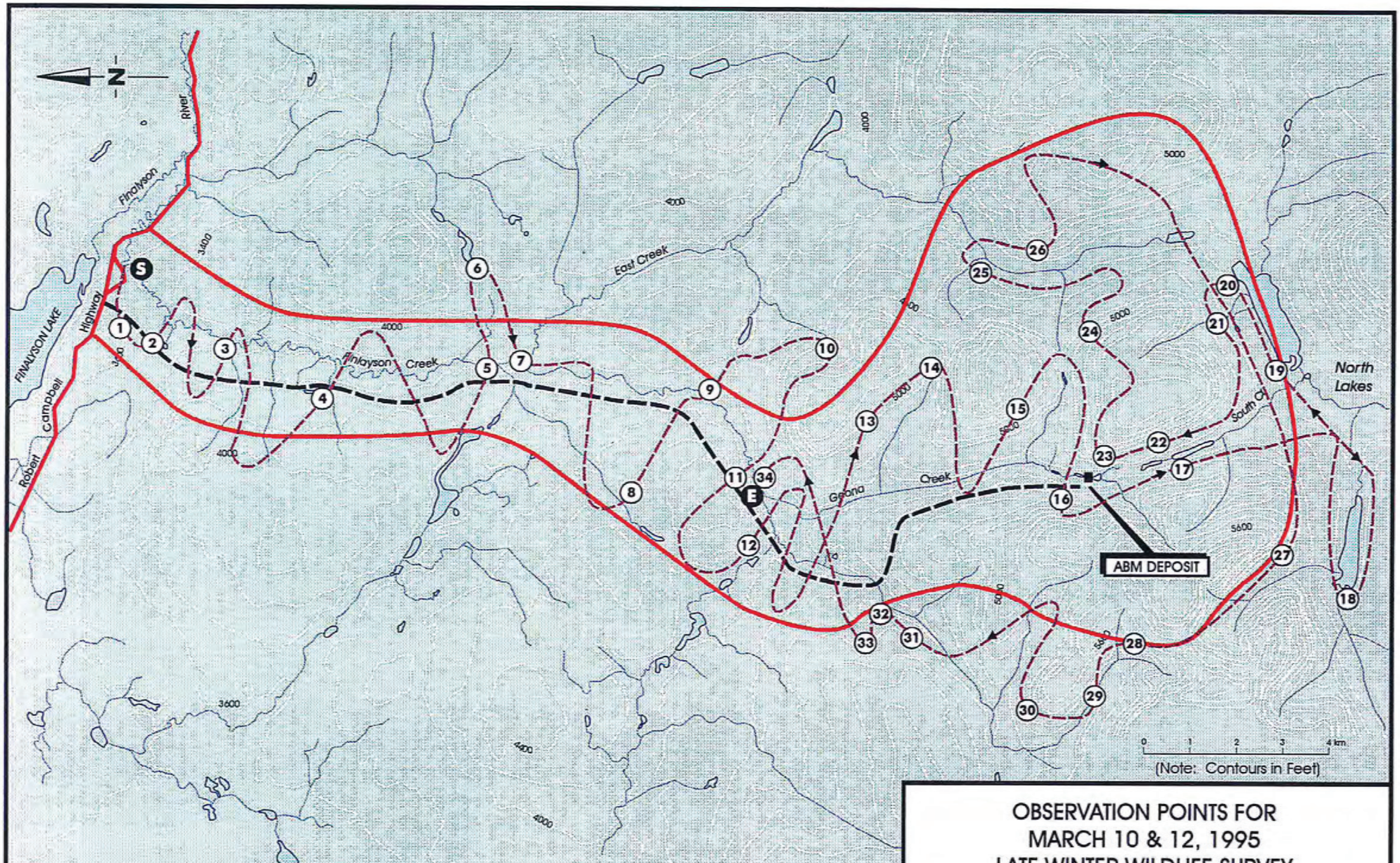
KUDZ ZE KAYAH PROJECT

COMINCO

| | |
|---|---|
| FEBRUARY 1996 | FIGURE 3-31 |

95-310-25141-023-jan96331

NORECOL, DAMES & MOORE, INC.




LEGEND

Wildlife Study Area

Tote Road

Survey March 10 & 12, 1995 Start S End E

Note: Observation points 1 refer to specific animal locations. See data tables in APPENDIX 3.9a.

OBSERVATION POINTS FOR
MARCH 10 & 12, 1995
LATE WINTER WILDLIFE SURVEY

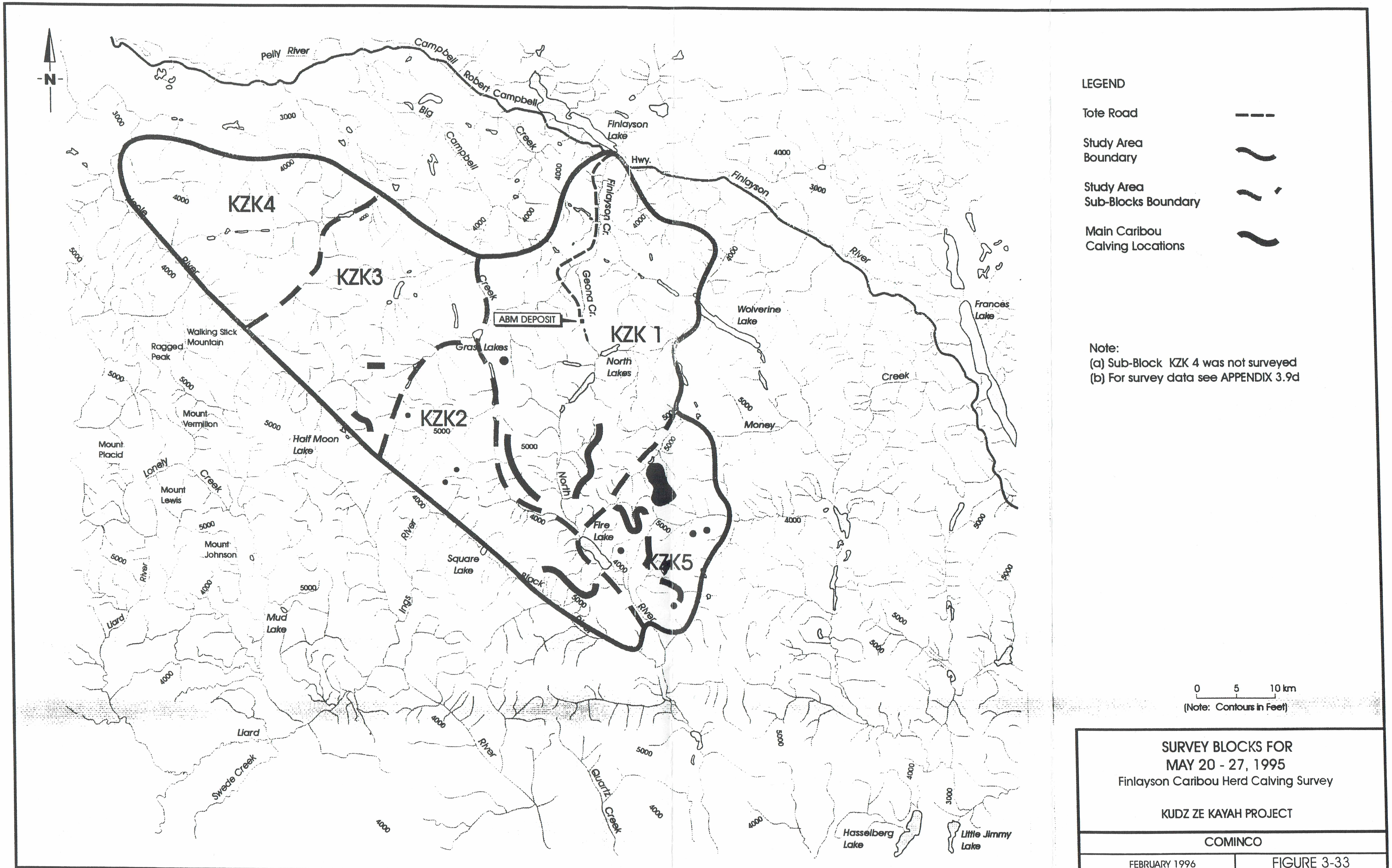
KUDZ ZE KAYAH PROJECT

COMINCO

FEBRUARY 1996 | FIGURE 3-32

95-310-25141-023-jan332

NORECOL, DAMES & MOORE, INC.




SURVEY BLOCKS FOR
MAY 20 - 27, 1995
Finlayson Caribou Herd Calving Survey

KUDZ ZE KAYAH PROJECT

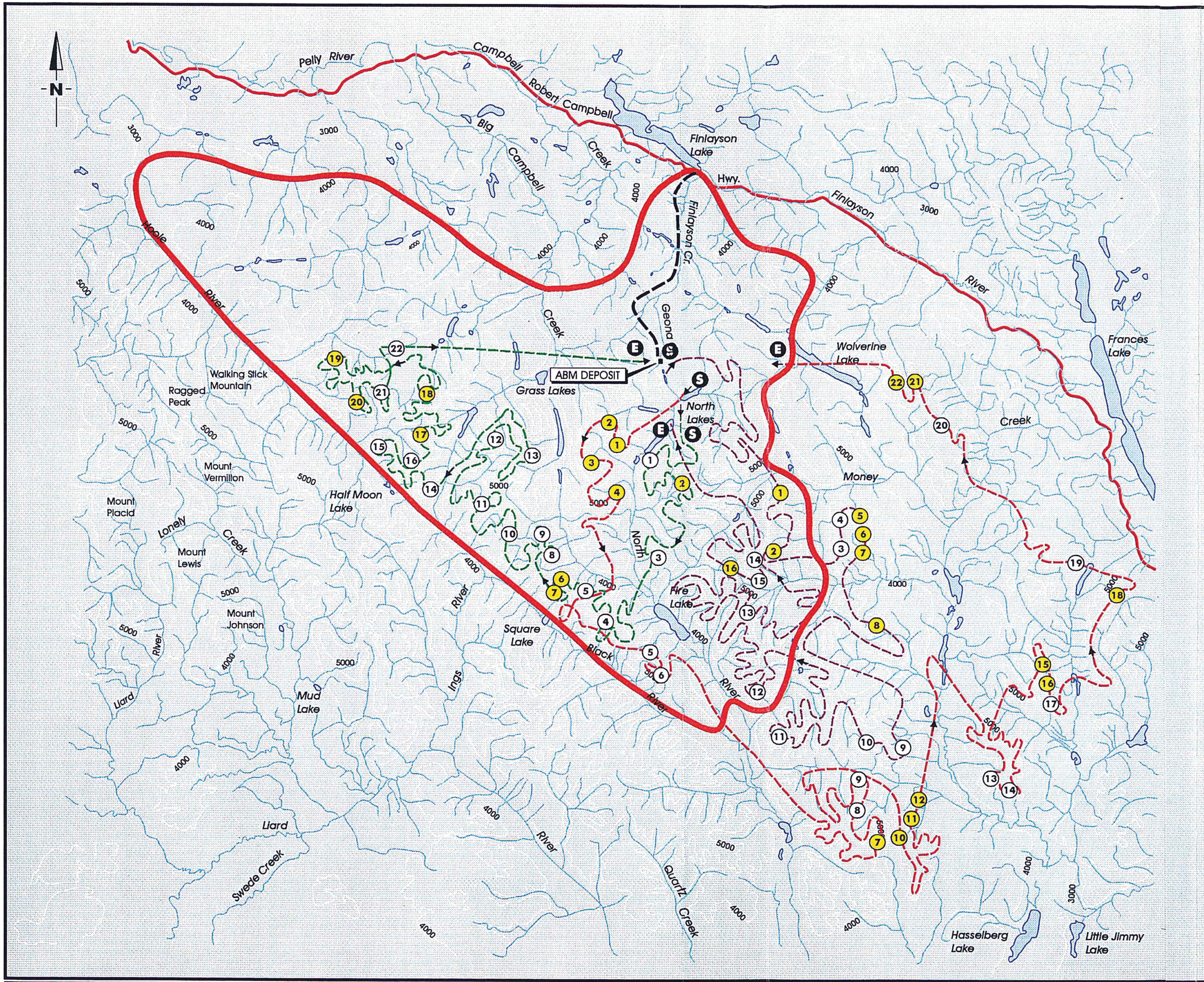
COMINCO

FEBRUARY 1996

FIGURE 3-33

95-310-25141-023-jan96333

NORECOL, DAMES & MOORE, INC.




LEGEND

Tote Road

Study Block

SURVEY DATES:

Start and End of Surveys S E

June 27, 1995

June 28, 1995

June 29, 1995

Note: Observation points refer to specific caribou classification data - see data tables in APPENDIX 3.9c.

Highlighted 18 points indicate those groups of caribou dominated numerically by males.

0 5 10 km

(Note: Contours in Feet)

SURVEY BLOCK AND OBSERVATION POINTS FOR JUNE 27-29, 1995

Finlayson Caribou Herd Post-Calving Aggregation Survey

KUDZ ZE KAYAH PROJECT

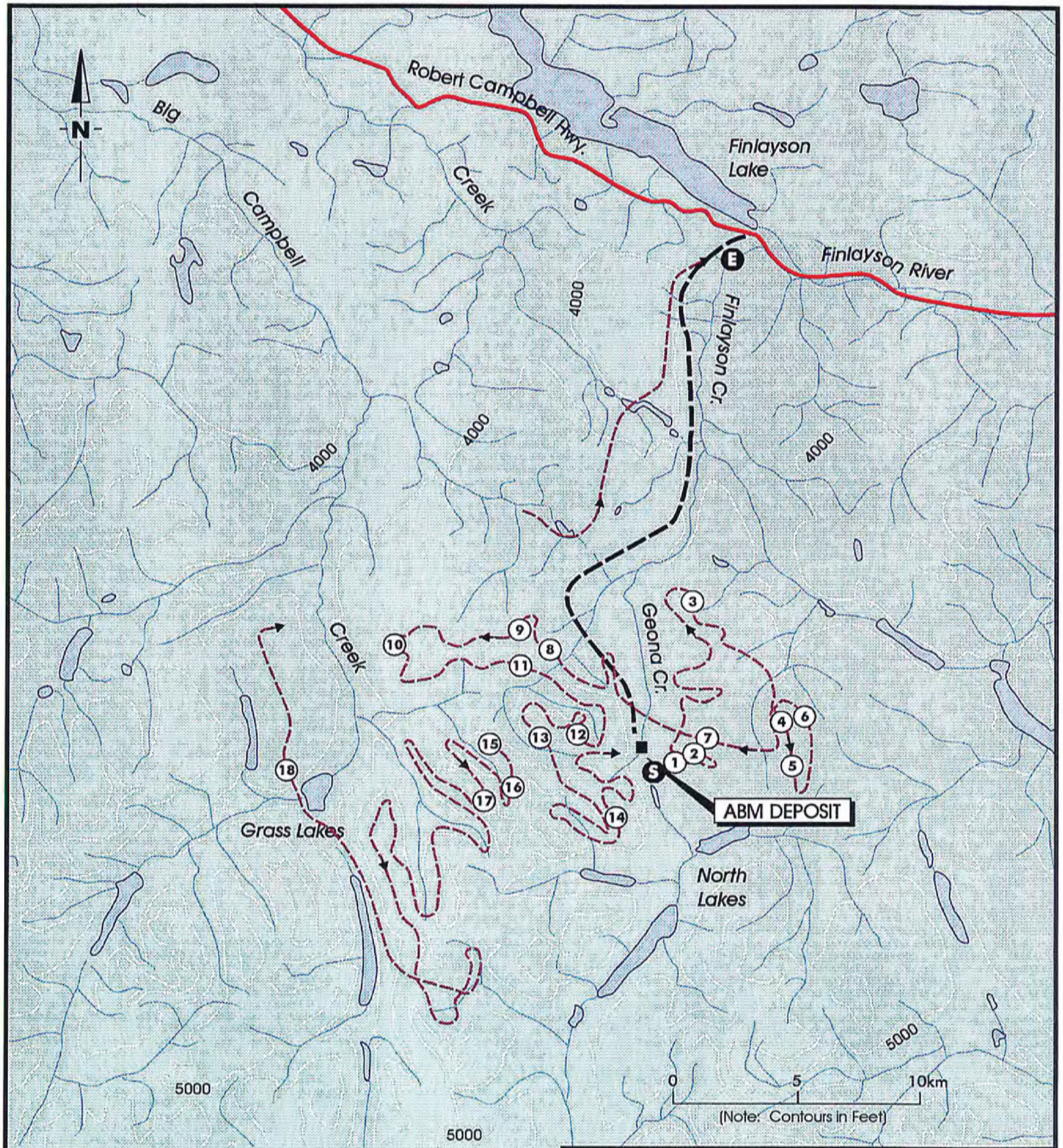
COMINCO

FEBRUARY 1996

FIGURE 3-34

95-310-25141-023-jan96334

NORECOL, DAMES & MOORE, INC.




LEGEND

Tote Road

Survey October 1, 1995 — Start S — End E

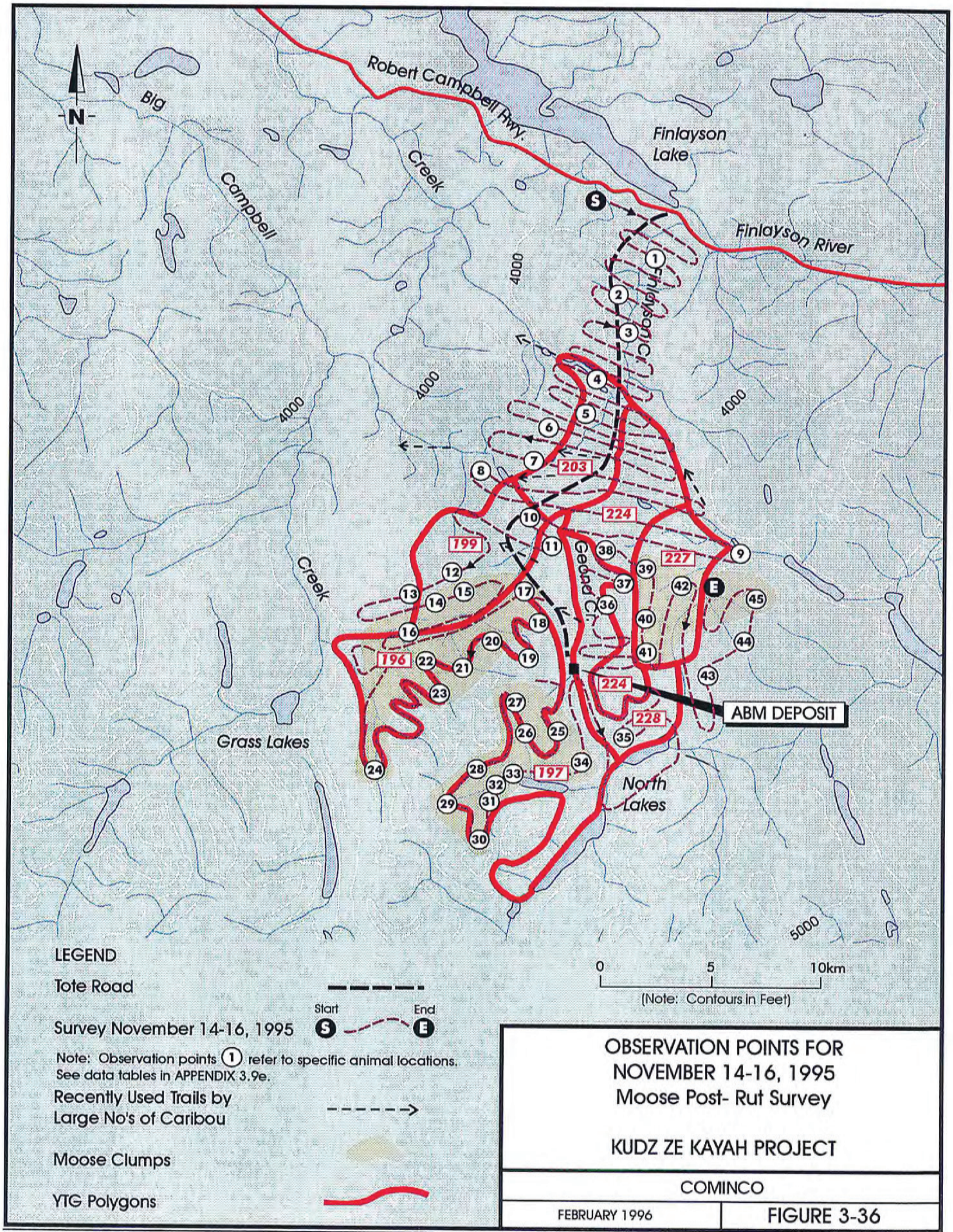
Note: Observation points (1) refer to specific animal locations. See data tables in APPENDIX 3.9d.

**OBSERVATION POINTS FOR OCTOBER 1, 1995**
**Caribou Rut Survey**

**KUDZ ZE KAYAH PROJECT**

COMINCO

FEBRUARY 1996 | **FIGURE 3-35**




OBSERVATION POINTS FOR
NOVEMBER 14-16, 1995
Moose Post- Rut Survey

KUDZ ZE KAYAH PROJECT

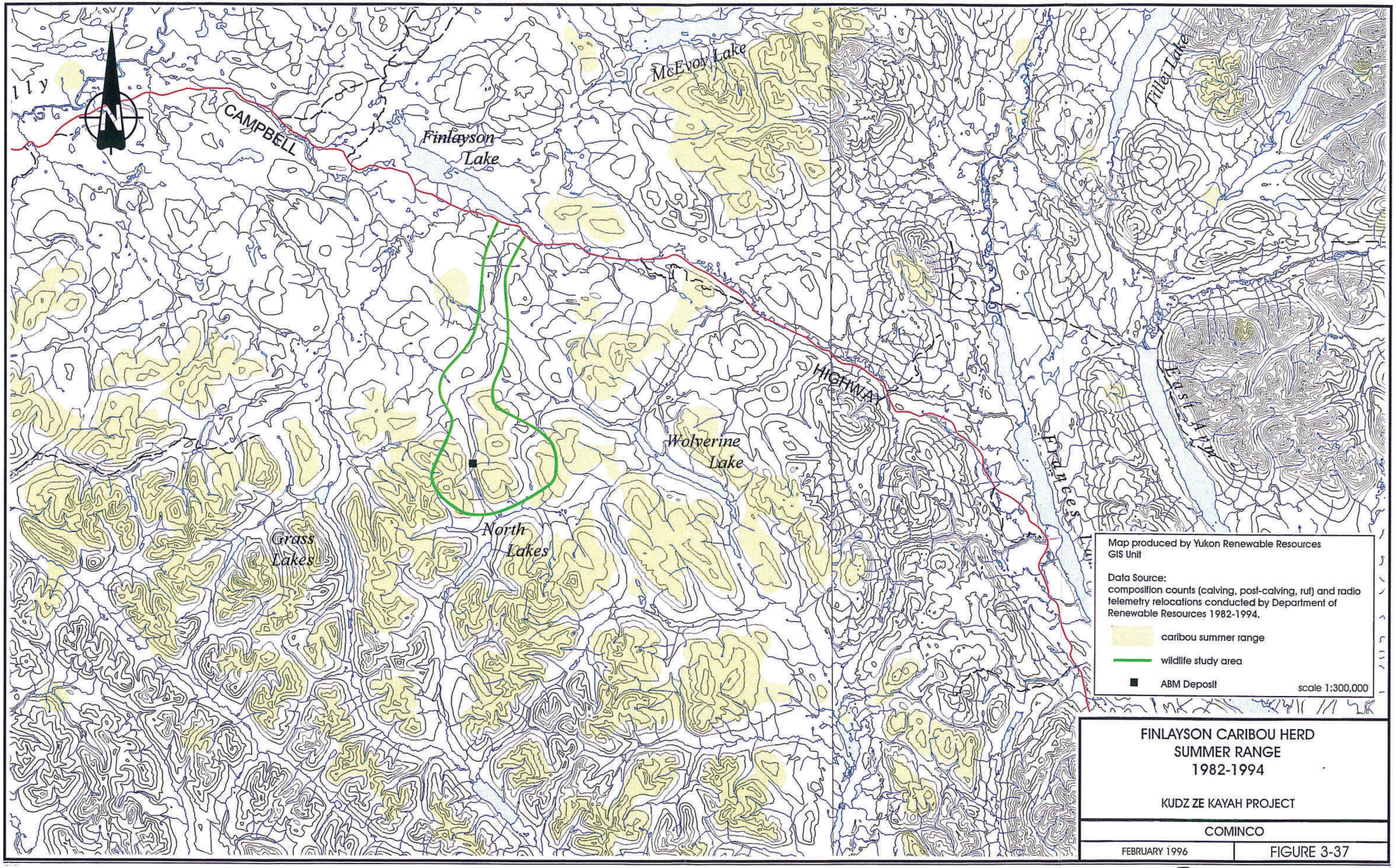
COMINCO

FEBRUARY 1996

FIGURE 3-36

95-310-25141-023-jan96336

NORECOL, DAMES & MOORE, INC.




FINLAYSON CARIBOU HERD
SUMMER RANGE
1982-1994

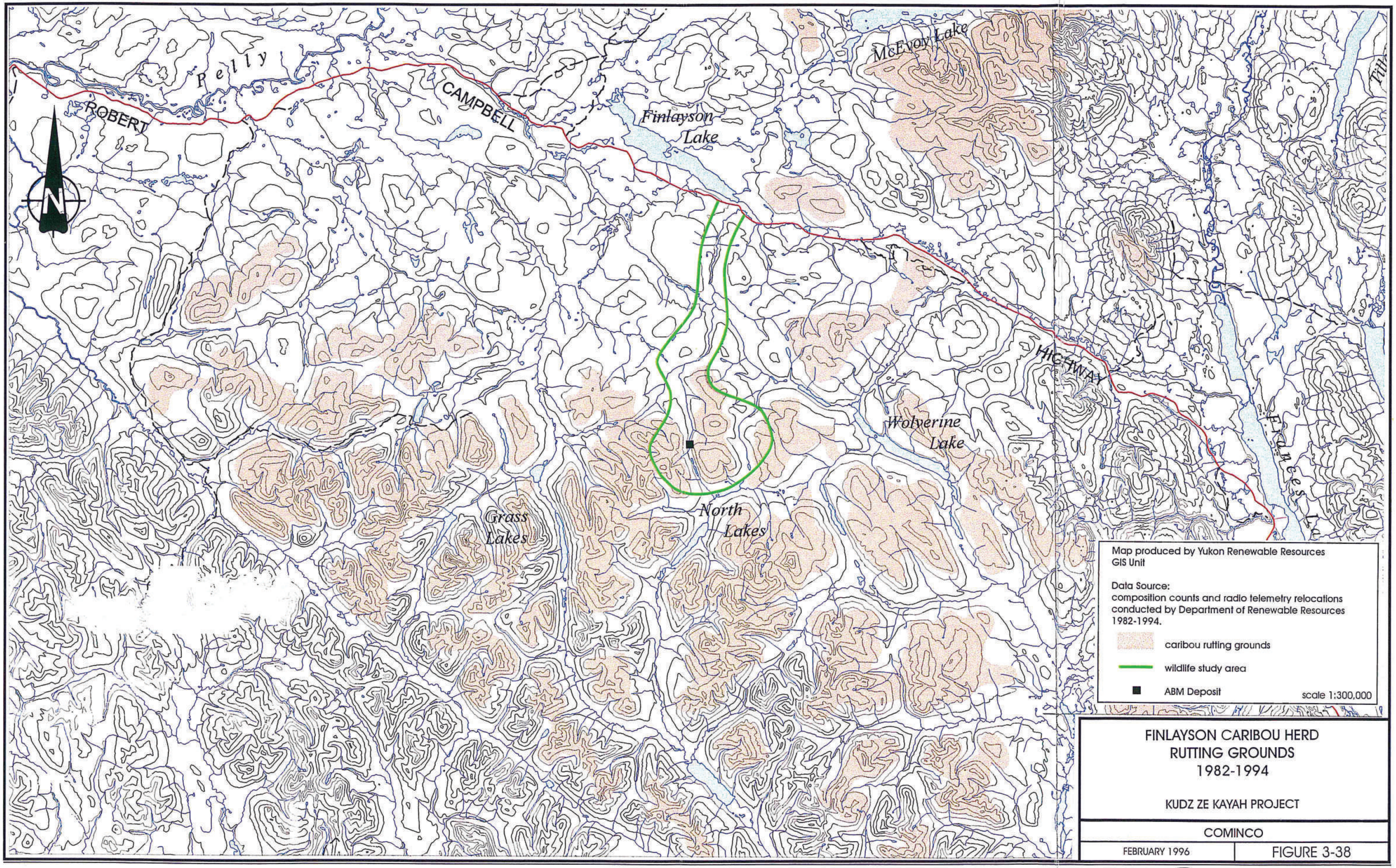
KUDZ ZE KAYAH PROJECT

COMINCO

FEBRUARY 1996

FIGURE 3-37

NORECOL, DAMES & MOORE, INC.




FINLAYSON CARIBOU HERD RUTTING GROUNDS 1982-1994

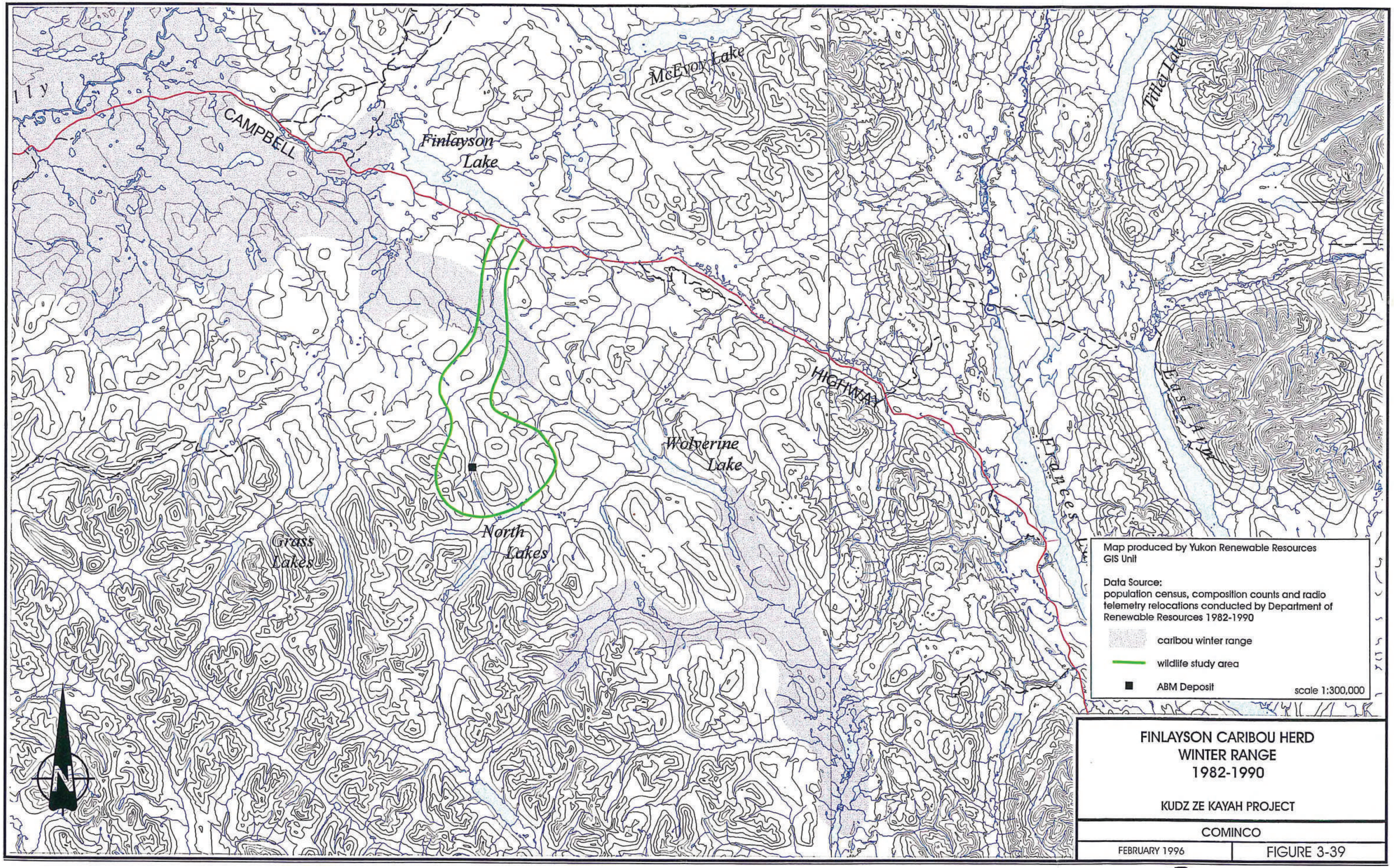
KUDZ ZE KAYAH PROJECT

COMINCO

FEBRUARY 1996

FIGURE 3-38

NORECOL, DAMES & MOORE, INC.




FINLAYSON CARIBOU HERD
WINTER RANGE
1982-1990

KUDZ ZE KAYAH PROJECT

COMINCO

FEBRUARY 1996

FIGURE 3-39

NORECOL, DAMES & MOORE, INC.

# APPENDIX B

## CARIBOU HABITAT SUITABILITY REPORT

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# CARIBOU HABITAT SUITABILITY REPORT

# KUDZ ZE KAYAH PROJECT

BMC-15-01-845_026_Caribou Habitat Suitability Report_Rev0_161219

December 2016

Prepared for:

**BMC MINERALS (NO. 1) LTD.**

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## EXECUTIVE SUMMARY

The Kudz Ze Kayah (KZK) Project is a proposed mine located in Yukon Territory, approximately 260 km northwest of Watson Lake and 115 km southeast of Ross River, within the Yukon Plateau-North Ecoregion, part of the Canadian Boreal Cordillera Ecozone. The Finlayson caribou herd (FCH), part of the Northern Mountain caribou population (*Rangifer tarandus caribou*), is of particular ecological, economic and cultural importance in the region to the Kaska First Nation, the general public, resident, and guided hunters alike. The herd is assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a Species of Special Concern, and was listed as such under the *Species at Risk Act* (SARA) in 2005. As part of the baseline studies, late winter, post calving, and rut surveys were performed to assess the spatial and temporal distribution of FCH throughout the year within the Project area.

As additional support to the baseline studies, a habitat suitability index (HSI) model was prepared to predict habitat selection of the FCH for the post calving and rut periods. This report provides the background, methods, and statistics involved in modelling habitat selection of the FCH. The resulting habitat suitability maps displayed important habitats relative to the Project footprint, Local Study Area, and traditional FCH range. The information and maps produced are meant to aid in the development of mitigation measures and management plans to minimize disruption of important caribou habitat during the development and operation of the proposed KZK Project and to assist in assessing the potential residual effects.

The data used to create the habitat suitability maps were collected over the last thirty years by Yukon Government biologists and recent survey data collected by Alexco Environmental Group Inc. (AEG) in 2015 and 2016. In addition, expert knowledge was gathered through interviews with several individuals, from Environment Yukon, AEG, and other consultants regarding caribou habitat usage. The HSI model variables chosen to determine habitat preference were vegetation cover, elevation, slope, and aspect. The classes within each variable were ranked based on their significance for caribou during the post calving and rut period. Both satellite and telemetry data were combined and used to calibrate the model variables, while aerial data from thirty-four years of surveys were used to evaluate the effectiveness of the model.

Model evaluation was carried out using the non-parametric Kendall tau test to determine whether the final suitability ranking (divided into 6 rank classes) and observation density were correlated. The model with the highest value tau coefficient (strongest correlation) was selected as the final habitat suitability model. The post calving HSI (p-value = 0.0014) suggests a statistically significant (significant if $p < 0.05$) correlation between rated habitat suitability and number of occurrences within each class while the strength of the correlation is strong (tau correlation coefficient = 1). The rut HSI (p-value = 0.0278) suggests a significant correlation between related habitat suitability and occurrence within each class while the strength of the correlation is strong (tau correlation coefficient = 0.7333).

Approximately 17% (357,715 ha) of the FCH range is moderately high to high suitability rut habitat. Approximately 11% (229,567 ha) of the FCH range is moderately high to high suitability post calving habitat. Of the moderately high to high suitability rut habitat within the entire range, approximately 0.42% (777 ha) will be directly affected by the Project footprint, and 2.72% (4,771 ha) could be indirectly affected based on disturbance within the LSA. Of the moderately high to high suitability post calving habitat within the entire range, approximately 0.12% (118 ha) will be directly affected by the Project footprint, and 2.39% (2,778 ha) could be indirectly affected based on disturbance within the LSA.

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# ACRONYMS

AEG ........ Alexco Environmental Group Inc.

BMC ........ BMC Minerals (No. 1) Ltd.

COSEWIC ........ Committee on the Status of Endangered Wildlife in Canada

DEM ........ Digital Elevation Model

FCH ........ Finlayson Caribou Herd

GIS ........ Geographic Information System

ha ........ hectares

HSI ........ Habitat Suitability Index

KFN ........ Kaska First Nation

KZK ........ Kudz Ze Kayah

LSA ........ Local Study Area

masl ........ metres above sea level

NMP ........ Northern Mountain Population

PEM ........ Predictive Ecosystems Map

SARA ........ Species at Risk Act

YG ........ Yukon Government

ZOI ........ Zone of Influence

# GLOSSARY

**Aspect:** the direction that something faces or points towards.

**Digital Elevation Model:** a digital model or 3D representation of a terrain's surface.

**Expert Opinion:** a belief or judgement about a topic given by an expert on the subject.

**Geographic Information System:** a computer system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.

**Habitat Suitability Index:** a tool for predicting the suitability of habitat for a given species based on known affinities with environmental parameters.

**Kaska First Nation:** a transboundary Nation involving Kaska people from the Ross River Dena Council and Liard First Nation in southeastern Yukon, and Daylu Dena Council, Dease River First Nation and Kwadacha Nation in northern British Columbia.

**Linear Fuzzy Membership**: reclassifies the input data to a 0 to 1 scale based on the linear relationship of being a member of a specified set. 0 is assigned to those locations that are definitely not a member of the specified set, 1 is assigned to those values that are definitely a member of the specified set, and the entire range of possibilities between 0 and 1 are assigned to some level of possible membership (the larger the number, the greater the possibility).

**Local Study Area:** the area encompassing a 3 km buffer surrounding the proposed Project infrastructure and a 1.5 km buffer around the tote road.

**Non-parametric Kendall Tau Test:** a statistic used to measure the correlation between two ranked variables.

**Northern Mountain Population:** a distinct ecotype of woodland caribou that have unique habitat preferences and behaviour.

**Predictive Ecosystems Map:** a modelled approach to ecosystem mapping, whereby existing knowledge of ecosystem attributes and relationships are used to predict ecosystem representation in the landscape.

**Zone of Influence**: the spatial area of influence affecting an animal's behaviour caused from mining activities.

# 1 INTRODUCTION

The Finlayson caribou herd (FCH) is of particular ecological, economic and cultural importance in the region to the Kaska First Nation (KFN), resident, and guided hunters alike. Therefore, conservation and effective management of this herd has been identified as a key concern by many stakeholders, including federal and territorial governments, First Nations, and the general public. The herd is part of the Northern Mountain caribou population (*Rangifer tarandus caribou*), assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a Species of Special Concern, and was listed as such under the *Species at Risk Act* (SARA) in 2005. There has been considerable research on the Northern Mountain population (NMP) of caribou in recent years given increasing industrial development within their range resulting in their declining numbers.

The federal government has published a Management Plan for the Northern Mountain Population (NMP) of Woodland Caribou (*Rangifer tarandus caribou*) in Canada**.** The main goal of the plan is to prevent the NMP from becoming threatened or endangered by engaging responsible agencies to manage the NMP caribou and their habitat carefully. Two of the objectives of the management plan are:

- Identify and assess the quality, quantity and distribution of important habitats for the population; and
- Manage and conserve important habitats to support caribou herds.

In order to identify and assess the quality, quantity and distribution of important habitats of the FCH population at the Kudz Ze Kayah (KZK) Project site (the Project), a habitat suitability index (HSI) model was developed.

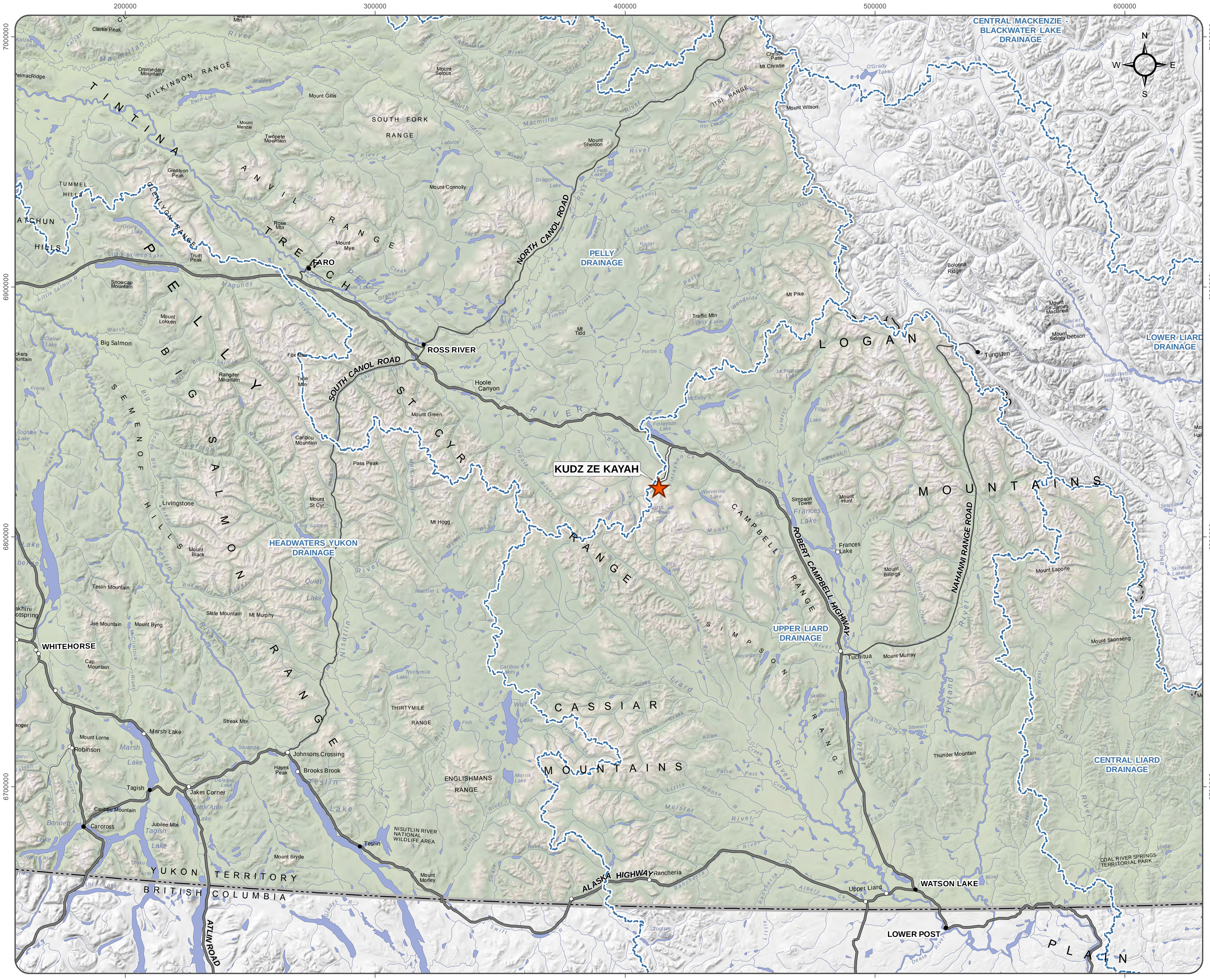
Generally, at least two life requisite seasons are mapped to understand the availability of suitable habitat for a species to grow, reproduce, and survive (RIC, 1999). For caribou, the rut period and post calving period were the chosen life requisites. These two periods are when caribou congregate in visible areas where an accurate count can be obtained. In addition, these two periods have the longest periods of survey records by the Yukon Government so trends in the population can be tracked.

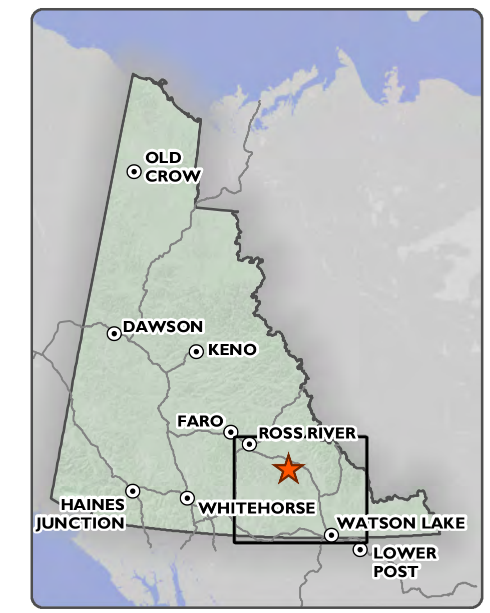
The purpose of the HSI was to predict the location of caribou post calving and rut habitat within the Local Study Area (LSA), as well as the traditional home range of the FCH. The LSA was defined as the area encompassing a 3 km buffer surrounding the proposed Project footprint, and a 1.5 km buffer on either side of the Tote road. The herd has a traditional home range of 23,000 $km^2$ in east-central Yukon, lying mainly in the Yukon Plateau-North and Pelly Mountains Ecoregions (Adamczewski et al., 2010). The information and maps produced are meant to aid BMC's development of avoidance measures, mitigation measures, and management plans to minimized the disruption of important caribou habitat during the development and operation of the proposed Project. It will also be utilized to assess the potential residual effects to caribou where avoidance of disruption to important caribou habitat is not practicable.

# 2 Environmental Setting

The KZK Project (the Project) is located in the northeastern foothills of the Pelly Mountains, approximately 260 km northwest of Watson Lake, 115 km southeast of Ross River and 24 km south of Finlayson Lake, Yukon (Figure 2-1). The Project is in the Geona Creek valley, situated primarily within the subalpine, extending marginally into the lower alpine. The surrounding montane landscape consists of rounded mountaintops, ridges, and high plateaus, with secondary and tertiary creek systems. Wetlands are concentrated along the Geona Creek drainage. The lower valley slopes host open to sparse white spruce (*Picea glauca*) and subalpine fir (*Abies lasiocarpa*) forest with a well-developed shrub understorey. The treeline occurs at approximately 1,550 masl, giving way to a tall shrub and meadow matrix of the upper subalpine. Beyond 1,700 masl, dwarf shrub, graminoid, and lichen cover defines the alpine tundra zone. The Tote Road corridor parallels the lower reaches of Finlayson Creek. Approximately 18 km of this road goes through open white and black spruce (*Picea mariana*) forest and intercepts a few small wetlands and streams.

Two slightly different, but overlapping study areas were outlined to capture baseline information on caribou post calving and rut usage within the vicinity of the Project (Figure 2-2). The post calving study area included the preferred higher elevation terrain, extending further southwest than the rut study area. The rut study area extended further east to include the preferred lower subalpine rut habitat. The post calving study area consisted of 2,036,919 ha, while the rut study area consisted of 2,037,259 ha.




BMC MINERALS

KUDZ ZE KAYAH PROJECT
CARIBOU HABITAT SUITABILITY

**FIGURE 2-1**
**PROJECT LOCATION**

NOVEMBER 2016

★ KUDZ ZE KAYAH PROJECT

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.

Canvec compiled by Natural Resources Canada at a scale of 1:10,000 - 1:50,000. Reproduced under license from Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources Canada. All rights reserved.
Drainage areas obtained from National Hydrology Network 2011

Datum: NAD 83; Projection UTM Zone 9N

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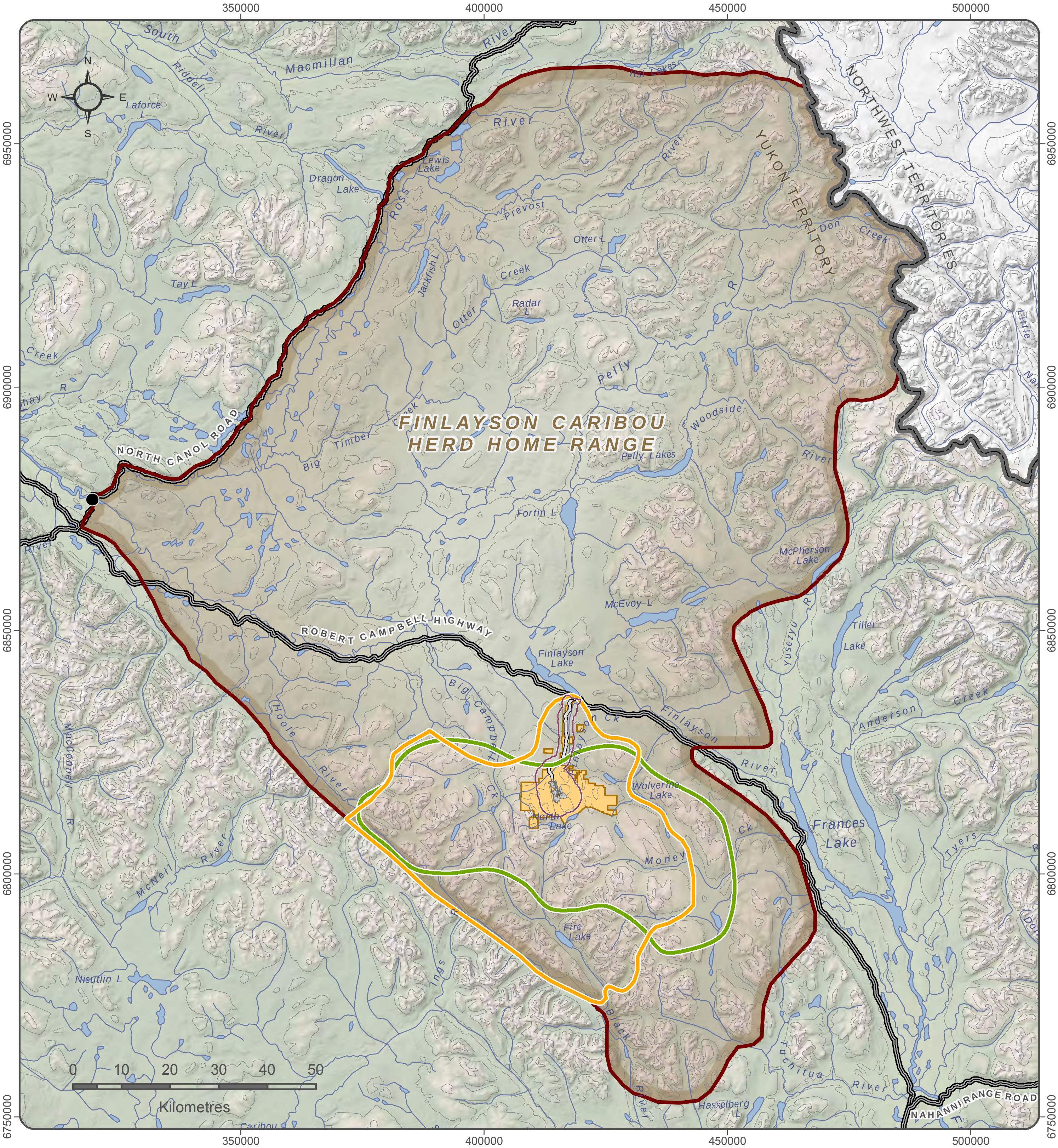


- Local Study Area
- Caribou Post Calving Study Area
- Caribou Rut Study Area
- Finlayson Caribou Herd Home Range
- Location of Proposed Mine Infrastructure
- BMC Minerals (No.1) Ltd. Mineral Claim Areas

National topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Reproduced under license from Her Majesty the Queen, as represented by the Minister of Natural Resources Canada. All rights reserved.
Wildlife Key Area data compiled by the Yukon Department of Environment. Publication Date: May 2009
Obtained from Geomatics Yukon. Datum: NAD 83; Projection: UTM Zone 9N



AEG

BMC MINERALS

KUDZ ZE KAYAH PROJECT

**FIGURE 2-2**
**FINLAYSON CARIBOU HERD HOME RANGE AND STUDY AREAS**

NOVEMBER 2016

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# 3 HABITAT SELECTION

The FCH is an elevational, migratory ecotype that moves to different habitats along traditional seasonal routes to meet specific life cycle needs (Thomas and Gray, 2002). In the spring, two thirds of the herd begin moving from their wintering grounds in the forested lowlands in near the Pelly River to the Pelly Mountains in the southeast. The remaining one third of the herd travels to the mountains northeast of Finlayson Lake. As summer approaches, female caribou disperse in the mountains to calve on ridges and upper plateaus to avoid predators (Bergerud et al., 1984; Bergerud and Page, 1987). They remain dispersed in small bands in the uplands through summer seeking out snow patches to escape insect harassment and warm temperatures (Mörschel and Klein, 1997). The FCH's summer and fall ranges are primarily on alpine plateaus and mountain ridges south of Finlayson Lake which overlap the KZK Project area. Moreover, a number of caribou utilize the areas adjacent to KZK for post calving and rutting.

The habitat suitability maps for the FCH represent the preferred habitat types for post calving and rut periods. Winter habitat suitability maps were not produced for caribou, as the traditional core winter range is approximately 100 km northwest of the Project site, and therefore, not considered within the zone of influence (ZOI) of the Project. Moderate numbers of the FCH have been observed ranging in the mature forested areas south of Finlayson Lake, adjacent to the Project's lower access road, during years when the snow pack is shallow as was seen during the 2015 late winter survey (Adamczewski et al., 2010; EDI, 2015).

The FCH habitat requirements for the spring, summer and fall seasons are detailed below.

***Spring Habitat:*** Spring (April to June) is the migratory and calving period for the FCH, as they travel from their traditional winter habitat in the Pelly River lowlands to calve in the highlands of the Pelly Mountains in the southeast. As the snow disappears, the caribou move to the upper mountain slopes and ridges to browse on the new growth of herbaceous plants such as sedges, grasses, forbs, and dwarf shrubs. Caribou will forage on mostly green vegetation in the spring and growing season. Caribou require access to large quantities of nutritious vegetation for growth, to be in good reproductive condition for the rut, and to amass enough fat stores to survive the winter (Gerhart et al., 1996; Skoog, 1968).

The calving period is from May 7 to June 8 with a median peak of calving from 16 to 20 May (Chisana Caribou Recovery Team, 2010). Northern mountain caribou prefer solitary calving sites that are distant from alternate prey species such as moose, and decrease food abundance for predator species (Bergerud and Page, 1987). Female caribou will use high elevation alpine areas with good visibility, or subalpine habitats with sufficient cover to reduce detection by predators (Fenger et al., 1986). Later in June, the cows and newborn calves may aggregate in groups, although some cows with or without calves may remain on their own over the summer (Cichowski, 1993; Bergerud and Page, 1987).

**Summer Habitat:** June to September is the post calving and growth period for northern mountain caribou. Summer range consists primarily of upper elevation subalpine and alpine habitats where caribou disperse into small groups (Stevenson et al., 1994). Summer diet for woodland caribou is known to consist of forbs, deciduous leaves, lichens, fungi, grasses, and sedges. In the Kluane Range in Yukon Territory, Oosenbrug and Theberge (1980) reported that caribou selected birch-sedge meadows, sedge meadow communities, and habitats with high sedge component (i.e., making up more than 50% of vegetation in sampled fecal matter). The authors also reported dominant landforms used by caribou during the summer as ridges, plateaus, and upper elevation streams.

Numerous studies on caribou during the post calving season have shown that during warm summers insects have a pronounced effect on caribou behaviour and group dynamics. Vexation from biting insects decreases the amount of time spent feeding and increases energy expenditure, thus limiting summer nutrition and body condition (Mörschel and Klein, 1997). Caribou have a limited timespan during the summer for growth and building new fat reserves for the coming winter. Females need to compensate for energy costs of gestation and lactation (Gerhart et al., 1996), and males have to build body reserves for the rut (Skoog, 1968). Constraints on the ability of caribou to feed optimally during this period of high forage quality and availability could have a negative effect on their body condition (Parker et al., 2009). Body condition of females affects their potential of becoming pregnant in fall, and also affects calf survival the following year (Gerhart et al., 1996). To find relief from insects and high temperature stress, caribou seek the exposed windy ridges and snow patches (Ion and Kershaw, 1989). Variations in summer temperature between and among years should directly influence caribou behaviour during the post calving season. Further, the variety and amount of insects, insect-relief habitat, and different weather patterns should cause additional variations in caribou behaviour.

**Fall Habitat:** During the rut, northern mountain caribou aggregate in open alpine and subalpine habitats (Morgan, 2015). The rut generally occurs in the fall and is at its peak by mid-October. Woodland caribou then begin to migrate to their winter range after the peak of the rut with most caribou on the winter range by mid-November (MacLean, 2003). However, the 2015 and 2016 early winter ungulate surveys for KZK have found that in the Project area caribou stay on their rutting grounds until mid-December.

**Migration Habitat:** In the late fall, the FCH migrate back from their rutting range in a northwest direction towards the Pelly lowlands. During this seasonal movement, the caribou traverse through a variety of ecosystems. The caribou’s diet changes as the FCH migrate to lower elevations and herbaceous plants begin to die. The availability of forbs, sedges, and other deciduous plants decrease and caribou become more reliant on the winter staple of terrestrial lichens found in the mature forests (Johnson et al., 2004). Lichen make up 70% of the FCH diet in winter (Environment Yukon, unpublished data). In the spring, the direction of travel reverses as does their source of food as they move through boreal forest, subalpine, shrub land, and eventually to the alpine tundra zones.

# 4 Methods

The methods used to generate the caribou habitat suitability index was developed based on the available data covering the FCH home range extent. Furthermore, the variable inputs used to develop the model were limited as they had to cover the entire extent of the FCH home range. The HSI models were developed using four environmental variables and were evaluated with an existing record of caribou observation locations. The following sections list and describe the data and approach used to produce an HSI for caribou rut and post calving seasons.

## 4.1 Data source

Data inputs for the model included spatial data and expert knowledge obtained from multiple agencies including Environment Yukon, Geomatics Yukon, AEG, and Makonis Consulting and Associates. Spatial data used to create and evaluate the model are listed below in Table 4-1.

**Table 4-1: Habitat Suitability Index Data Sources**

| Dataset | Description | Source |
|---|---|---|
| Digital Elevation Model (DEM) | Elevation raster dataset; resampled to 25 m | Geomatics Yukon, Yukon Government |
| Slope | Slope raster data measuring degrees of slope generated from the DEM (25 m cell size) | Created by AEG based from Geomatics Yukon, Yukon Government data |
| Aspect | Aspect raster data measuring aspect in degrees generated from the DEM (25 m cell size) | Created by AEG based from Geomatics Yukon, Yukon Government data |
| Vegetation Cover | Main vegetation cover derived from Ross River Dene Council Predictive Ecosystem Mapping Project (25 m cell size) (Grods et al., 2013) | Makonis Consulting and Associates, provided by Environment Yukon, Yukon Government |
| Caribou Satellite Collar Points | Satellite collar locations of Finlayson herd from 2004-2011 | Environment Yukon, Yukon Government |
| Caribou Relocation Collar Points | Telemetry collar locations of Finlayson herd from 1982-1987, 2004 | Environment Yukon, Yukon Government |
| Caribou Aerial Survey Points (YG) | Aerial Survey locations of Finlayson herd from 1982-2014 | Environment Yukon, Yukon Government |
| Caribou Aerial Survey Points (AEG) | Aerial Survey locations of Finlayson herd from 2015 and 2016 | AEG (Project acquired data) |

The caribou location data provided by Yukon Government, along with the survey data collected by AEG, were used to generate and evaluate the HSI. Each of the three datasets are of a different survey method, which included satellite collar data, telemetry relocation collar data, and aerial survey data. A summary of data inputs by type and season are presented in Table 4-2. Due to the nature and method of the surveys, there are varying levels of accuracy and biases associated with each dataset.

**Table 4-2 Input Survey Location Data Summary**

| Survey Methodology | Caribou Rut Season | Caribou Post Calving Season |
|---|---|---|
| Satellite collar | 15 | 17 |
| Telemetry relocation | 104 | 51 |
| Aerial survey[1] | 2,129 | 577 |
| **Total** | **2,248** | **645** |

[1]Areal Survey data represent observation point but do not include band size

The satellite collar location data was collected for the years 2004 to 2011; however, only location data pertaining to the rut and post calving seasons for the years 2005 to 2006 were available. These data are of the highest accuracy within the three datasets but contain the lowest frequency of observations. Furthermore, the objective of the satellite collar study was to monitor the adjacent Nahanni caribou herd, and only three individuals from the Finlayson herd were collared. This created a bias as the three individuals that were collared were often integrated with the Nahanni herd whose range is most often to the east of the FCH home range.

The relocation telemetry data were collected for the years 1982 to 1987 and for 2004, but only captured the rut season from 1982 to 1986, and the post calving season from 1983 to 1985. The method for collecting these data utilized a fixed wing aircraft flying transects to locate a collar signal, and then marking the animal location once the collar was located. This method presented a lower accuracy than the satellite collar data as the location of the animal was recorded from the air rather than an exact location on the ground.

The aerial survey data have been collected continuously by Yukon Government from 1982 to 2014, and by AEG for 2015 and 2016. The rut season has been surveyed for the entire duration of the program, while the post calving season was surveyed by Yukon Government from 1982 to 1985, 1995, 1996, 1998 and by AEG in 2015 and 2016. The survey method utilized a helicopter to target preferred areas expected to be used by caribou during the specific season. The accuracy of the location data was not as precise as the satellite collar data since position is recorded from the helicopter that may be up to 200 m away. Furthermore, the intention of the survey was to target areas of high use and band size for demographic analysis biasing the data and over-representing those specific areas. For the purpose of developing the model, the satellite and relocation data were combined and used to calibrate the model variables while the aerial survey data were used to evaluate the effectiveness of the model.

## 4.2 VARIABLES

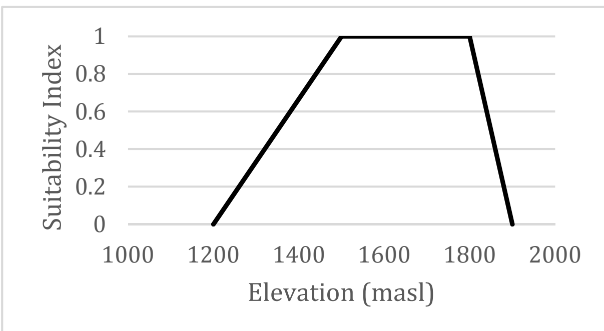
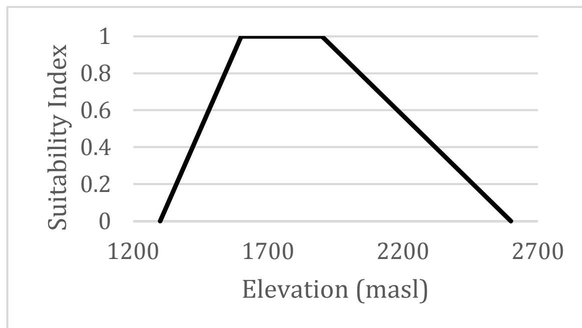
The four variables: elevation, slope, aspect, and vegetation cover were selected as model parameters to develop the caribou HSI for the rut and post calving seasons. These parameters describe the geographical context for habitat requirements and were the most readily available for assessing habitat suitability for the large range area being assessed. Other parameters such as minimum area, isolation, adjacency, and edge can also be used for suitability mapping (Clarke, 2012); however, the geographical context parameters captured key caribou habitat preferences described in the literature. The data used for model calibration and validation determined whether these four parameters provided an accurate model.

For each season the respective variables were divided into classes ranging from 0 to 1, with 0 representing not suitable habitat (nil) and 1 representing highly suitable habitat (high). The classes within the variable were ranked based on their significance for caribou during the specific season. Significance of each class was determined using the distribution and frequency of observations from the calibration dataset.

## 4.3 ELEVATION

Elevation data was interpreted from the 25 m DEM and was computed as a continuous variable for the purpose of the HSI. A linear fuzzy membership function was applied to determine the suitability ranking between suitable and not suitable habitat, based on elevation breaks derived from the frequency of occurrences of satellite and relocation data points at a given elevation. Suitable habitat for caribou during the post calving season is at a higher elevation than the rut season as caribou avoid predation, heat, and insects on high elevation ridges and plateaus (Ion and Kershaw, 1989). The equation and function used for post calving and rut seasons are shown in Table 4-3.

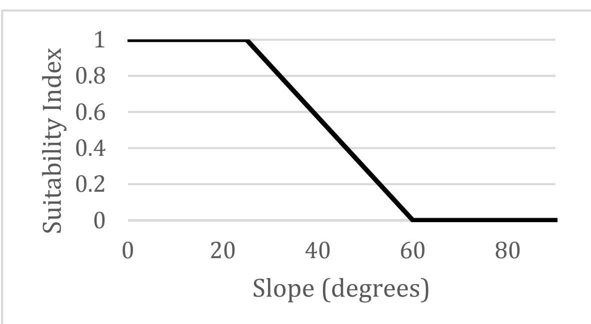
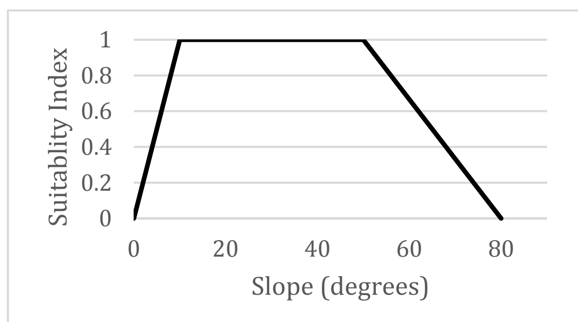
**Table 4-3: Fuzzy Membership Function and Class Ranking for Elevation Suitability**

| Caribou Rut Season | Caribou Post Calving Season |
|---|---|
| Lower elevation linear function<br>$f(x) = \begin{cases} 0, x \leq 1200 \\ \left(\frac{x-1200}{1500-1200}\right) \quad 1200 < x < 1500 \; x \in X \\ 1, 1500 \leq x \leq 1800 \end{cases}$<br>Upper elevation linear function<br>$f(x) = \begin{cases} 0, x \geq 1900 \\ \left(\frac{x-1800}{1900-1800}\right) \quad 1800 < x < 1900 \; x \in X \\ 1, 1500 \leq x \leq 1800 \end{cases}$ | Lower elevation linear function<br>$f(x) = \begin{cases} 0, x \leq 1300 \\ \left(\frac{x-1300}{1600-1300}\right) \quad 1300 < x < 1600 \; x \in X \\ 1, 1600 \leq x \leq 1900 \end{cases}$<br>Upper elevation linear function<br>$f(x) = \begin{cases} 0, x \geq 2700 \\ \left(\frac{x-1900}{2700-1900}\right) \quad 1900 < x < 2700 \; x \in X \\ 1, 1600 \leq x \leq 1900 \end{cases}$ |
|  |  |

## 4.4 SLOPE

Slope, or terrain steepness, was derived from the 25 m DEM using ArcGIS 10.4 and was modelled in degrees of slope between neighbouring raster cells. Slope was treated as a continuous variable for the purpose of the HSI model using a linear fuzzy membership function to derive the values between suitable and not suitable habitat. Functions of slope suitability were interpreted using frequency of occurrence of animals based on the satellite and relocation data for the respective seasons (Table 4-4).

**Table 4-4: Fuzzy Membership Function and Class Ranking for Slope Suitability**

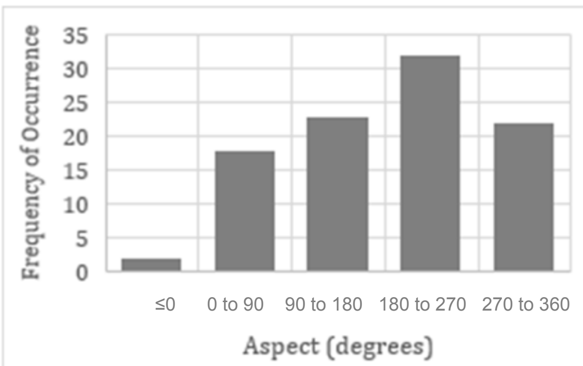
| Caribou Rut Season | Caribou Post Calving Season |
|---|---|
| Slope linear function<br>$f(x) = \begin{cases} 0, & x \geq 60 \\ \left(\frac{x-25}{60-25}\right) & 25 < x < 60 \;\; x \in \mathrm{X} \\ 1, & x \leq 25 \end{cases}$ | Lower slope linear function<br>$f(x) = \begin{cases} 0, & x \leq 0 \\ \left(\frac{x-0}{10-0}\right) & 0 < x < 10 \;\; x \in \mathrm{X} \\ 1, & 10 \leq x \leq 50 \end{cases}$<br>Upper slope linear function<br>$f(x) = \begin{cases} 0, & x \geq 80 \\ \left(\frac{x-50}{80-50}\right) & 50 < x < 80 \;\; x \in \mathrm{X} \\ 1, & 10 \leq x \leq 50 \end{cases}$ |
|  |  |

## 4.5 ASPECT

Aspect was derived from the 25 m DEM using the aspect tool in ArcGIS. Aspect was classified into four quadrants of cardinal direction and treated as a discrete variable for the HSI. The satellite and relocation collar data was used to calibrate the aspect variable and provided the distribution shown in Table 4-5. Aspect did not show as strong of a variance between class values and as a result received a lower variable weighting in comparison to the other variables.

**Table 4-5: Distribution and Class Ranking for Aspect Suitability**

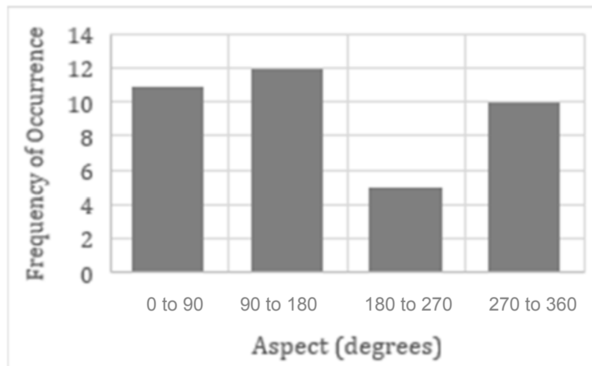
**Caribou Rut Season**




* x-axis represents range of values within a bin width of 90 degrees

| Variable Class | Suitability Index Ranking |
|---|---|
| 0-90 | 0.5 |
| 90-180 | 0.7 |
| 180-270 | 0.7 |
| 270-360 | 0.5 |
| ≤0 | 0.4 |

**Caribou Post Calving Season**




* x-axis represents range of values within a bin width of 90 degrees

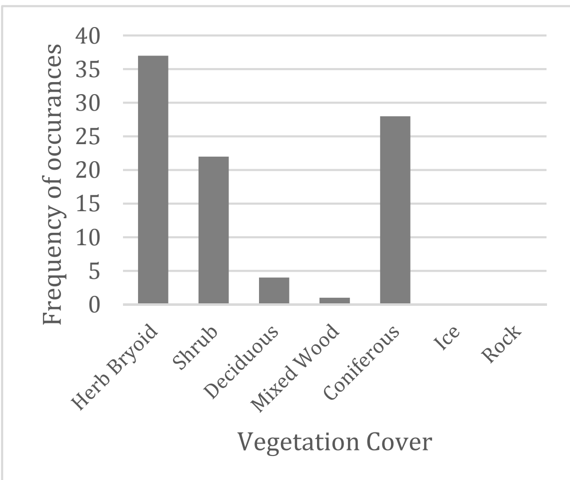
| Variable Class | Suitability Index Ranking |
|---|---|
| 0-90 | 0.7 |
| 90-180 | 0.7 |
| 180-270 | 0.2 |
| 270-360 | 0.5 |
| ≤0 | 0.4 |

## 4.6 VEGETATION COVER

Vegetation cover type was classified based on the *Regional Ecosystems of East-Central Yukon Predictive Ecosystem Map* (PEM) that was completed in 2013 by Makonis Consulting Ltd (Grods et al., 2013). The PEM spatial data and methodology was received from Environment Yukon. The PEM product was developed using land cover, surficial material, and base features (watercourses, waterbodies, and elevation) as a means to predict the broad ecosystem units in the defined study area. The final product was evaluated by ground-truthing, polygon interpretation through ecosystem plots measurements, and boundary traverses. The PEM is recommended to be used at a scale of 1:100,000 or smaller (Grods et al., 2013). For the purpose of the model, the PEM was classified into the dominant vegetation cover, not utilizing the landscape classification as these aspects were already addressed in the model. Satellite and relocation data were intersected with the PEM and the suitability index rating was developed based on the data distribution and expert knowledge as shown in Table 4-6.

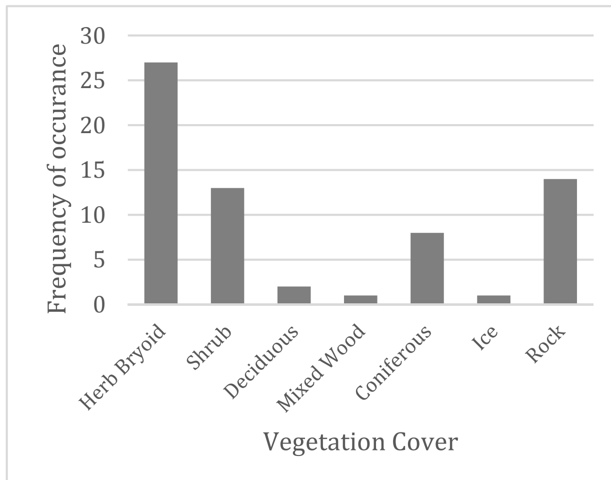
**Table 4-6: Distribution and Class Ranking for Vegetation Cover Suitability**

**Caribou Rut Season**




| Variable Class | Suitability Index Ranking |
|---|---|
| Herb Bryoid | 1.0 |
| Shrub | 0.8 |
| Deciduous | 0 |
| Mixed Wood | 0 |
| Coniferous | 0.5 |
| Ice | 0 |
| Rock | 0 |

**Caribou Post Calving Season**




| Variable Class | Suitability Index Ranking |
|---|---|
| Herb Bryoid | 1.0 |
| Shrub | 0.5 |
| Deciduous | 0 |
| Mixed Wood | 0 |
| Coniferous | 0.1 |
| Ice | 0 |
| Rock | 0.3 |

## 4.7 MODEL DEVELOPMENT

The caribou HSI model was developed by combining the different environmental variables to predict the habitat suitability for the rut and post calving seasons. The result of the model is two raster datasets; one for each season at a 25 m cell size resolution for the outlined FCH home range study area. The final layers are represented by six habitat index rankings, from nil to high suitability, based on the British Columbia Wildlife Habitat Rating Standards (RIC, 1999). The model development and flowchart are described below and visually represented in Figure 4-1.

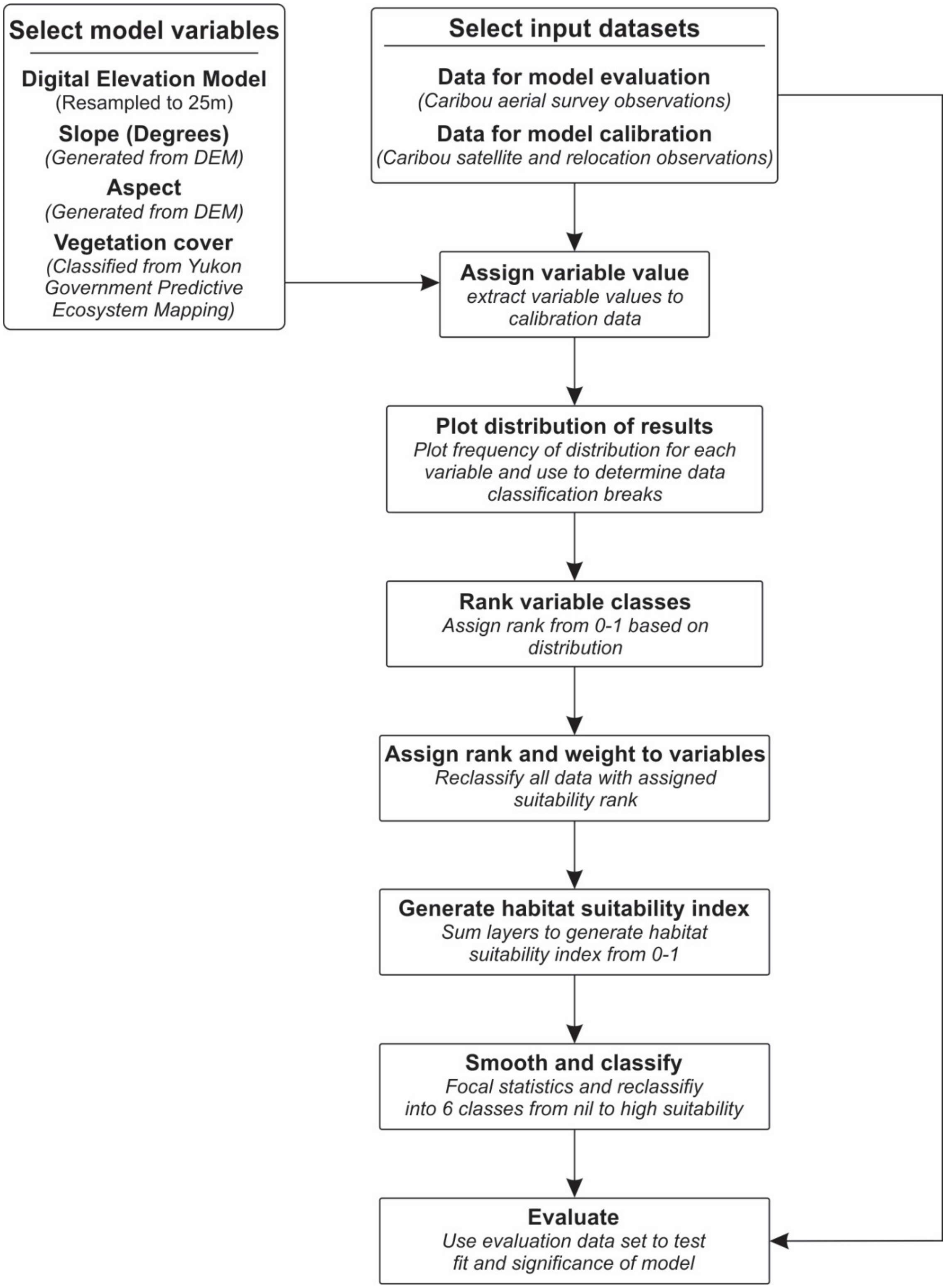


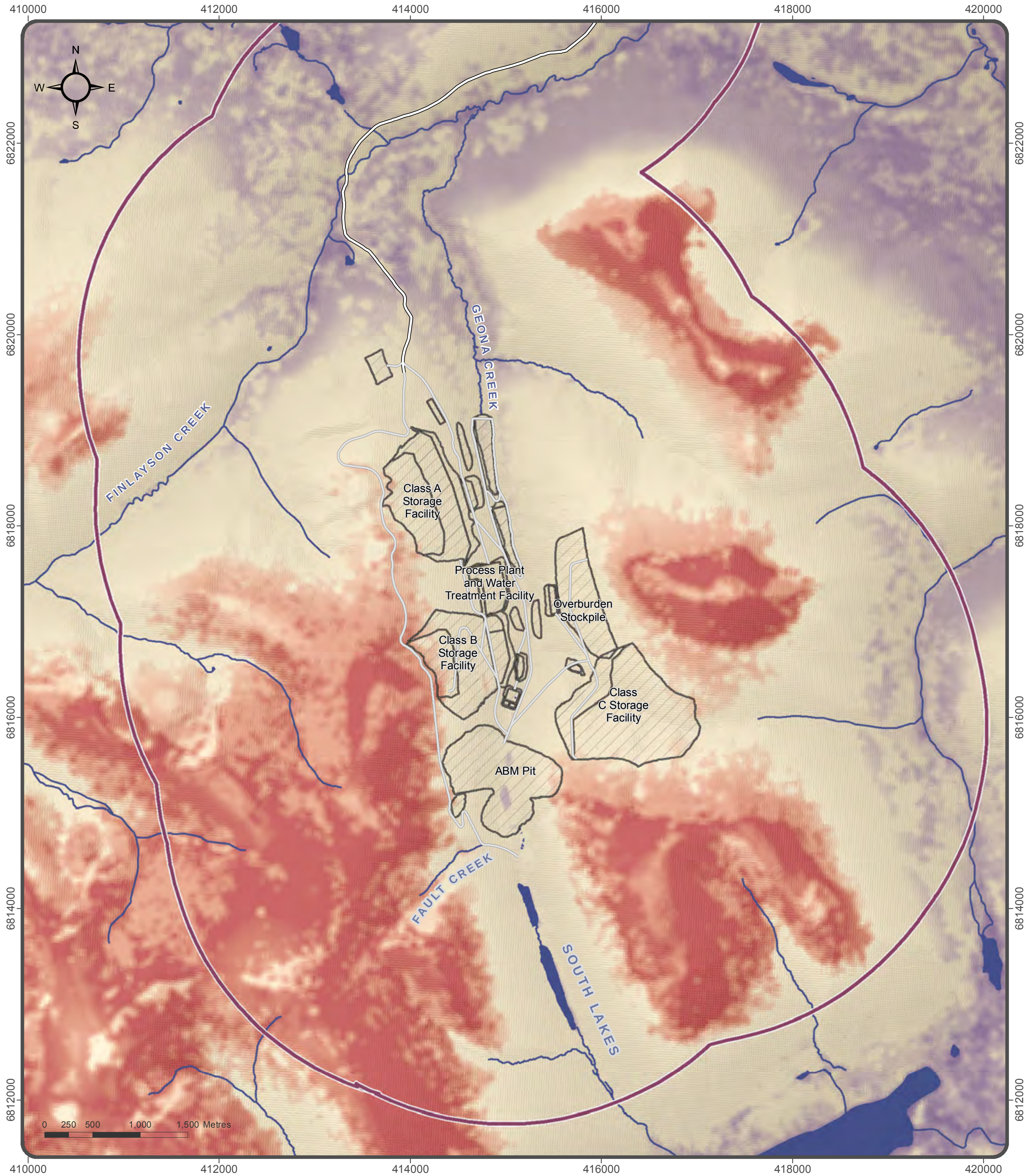

**Figure 4-1: Habitat Suitability Index Process Workflow**

The HSI model development involved two initial steps. The first to determine the variables that would be used as inputs for the model, and the second to stratify the caribou location data into a dataset for model calibration and a dataset for model evaluation. Splitting the datasets allowed for cross-validation of the model using an independent dataset approach to calibrate and evaluate the model. This approach utilized the satellite collar and relocation collar data as the calibration dataset, and the aerial survey data to evaluate the strength of the model (Guisan & Zimmermann, 2000). The satellite collar data had the highest accuracy, but too few data points so it was combined with the relocation data which had sufficient data points for validation but more survey bias than the lower altitude aerial survey data.

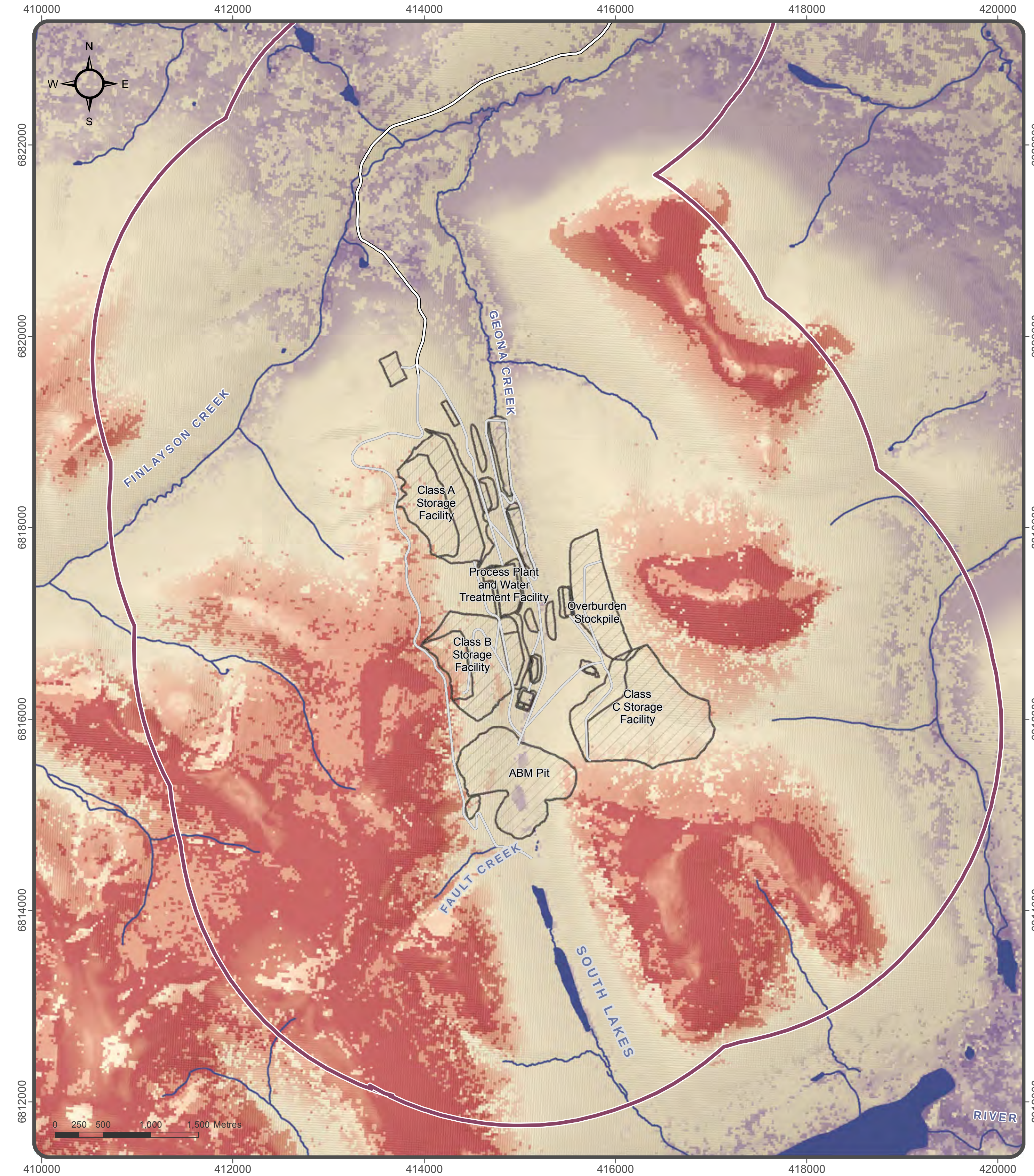
The input model variables were converted into raster datasets with equal cell size of 25 m so the corresponding variable values would align spatially for analysis. The calibration dataset was intersected with each of the variables and the values were extracted to each point in the calibration dataset. The variable values corresponding to the calibration dataset were independently plotted as histograms representing the frequency of occurrence for each variable (e.g., the number of times a caribou observation concurred with each variable class). Based on the frequency of occurrence the variables were classified from 0 to 1, with 0 being 'not suitable' and 1 being the 'most suitable' habitat. Elevation and slope variables were treated as continuous variables with the values between 0 and 1 calculated using a linear fuzzy membership equation. The variables aspect and vegetation cover are discrete in nature and were treated as such in the model. These variables were divided into classes and assigned a value between 0 and 1 based on frequency of occurrence and validated by expert opinion on habitat selection by FCH.

After each variable was reclassified based on the exported location values, they were assigned a weight based on their importance as a factor influencing suitability of habitat. Each classified layer was multiplied by its weight and then added together to achieve a final suitability rating from 0 to 1. Focal statistics with a 100 m (4 cell) radius were run on the output HSI to smooth small groupings of isolated cells that were artifacts of the data. The result better represents continuous raster of the landscape (Figure 4-2).

## HABITAT SUITABILITY INDEX WITH FOCAL STATISTICS




## HABITAT SUITABILITY INDEX WITHOUT FOCAL STATISTICS




Datum: NAD 83; Map Projection: UTM Zone 9N



AEG

- Tote Road/Proposed Access Road
- Proposed Mine Road
- Watercourse
- Waterbodies
- Local Study Area
- Location of Proposed Mine Infrastructure

**Post Calving Habitat Suitability**

High Suitability

Low Suitability

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**FIGURE 4-2**
**COMPARISON OF POST CALVING HABITAT SUITABILITY INDEX USING FOCAL STATISTICS**

NOVEMBER 2016

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The final HSI rasters were divided into 6 equal classes ranging from 0 to 1 and were evaluated against the aerial survey point data to test the correlation and significance of the models.

## 4.8 EVALUATION

Model evaluation was carried out using the non-parametric Kendall tau test to determine whether the final suitability ranking (divided into 6 rank classes) and observation density were correlated. A non-parametric test was used since data did not follow a normal distribution and the Kendall tau test for rank correlation was chosen rather than the Spearman's test because the Kendall tau is less sensitive to error and is more accurate with smaller data sets (Statistics Solutions, 2016). Observation density was obtained from the evaluation dataset (aerial survey data), which was independent from the data used for the model development. The p-value was used to determine whether the correlation was significant or not at a 95% confidence level ($\alpha = 0.05$) and the Kendall tau coefficient was used to determine the strength of the correlation. The tau coefficients obtained for various iterations of the model were compared and the model with the highest value (strongest correlation) was selected as the final habitat suitability model. All statistics were generating using R, a statistical computing software program (R Core Team, 2014).

# 5 Results

Evaluation of the HSI models indicate that there is a strong correlation between the suitability classes of the model and the number of occurrences of caribou within each class. The post calving HSI (p-value = 0.0014) suggests a statistically significant (significant if $p < 0.05$) correlation between rated habitat suitability and number of occurrences within each class and the strength of the correlation is strong (tau correlation coefficient = 1). The rut HSI (p-value = 0.0278) suggests a significant correlation between related habitat suitability and occurrence within each class while the strength of the correlation is strong (tau correlation coefficient = 0.7333). The model calculated the habitat suitability for a total area of 2,037,259 ha, which covers the extent of the FCH home range. The values listed in Table 5-1 represent the total area as the six habitat suitability classes for the rut and post calving seasons.

**Table 5-1: Habitat Suitability Results for FCH Home Range**

| | Caribou Rut Season | | | Caribou Post Calving Season | | |
|---|---|---|---|---|---|---|
| **Habitat Suitability Index** | **Area (Ha)** | **Percent of total area (%)** | **Occurrences per class** | **Area (Ha)** | **Percent of total area (%)** | **Occurrences per class** |
| Nil | 2,938 | 1 | 2 | 467,929 | 23 | 2 |
| Very low | 631,895 | 31 | 29 | 1,012,818 | 50 | 12 |
| Low | 830,922 | 41 | 89 | 224,298 | 11 | 14 |
| Moderate | 213,789 | 10 | 149 | 102,307 | 5 | 59 |
| Moderately High | 192,737 | 9 | 474 | 101,316 | 5 | 124 |
| High | 164,978 | 8 | 1381 | 128,251 | 6 | 337 |
| Total | 2,037,259 | 100 | 2124 | 2,036,919 | 100 | 548 |

Compared to the total area, Table 5-2 and Table 5-3 show the amount of each HSI class that will be directly affected and how much will be indirectly affected in the ZOI or LSA.

**Table 5-2: Distribution of Suitable Rut Habitat Within FCH Home Range**

| FCH Home Range Habitat Suitability Index Study Area | | | | |
|---|---|---|---|---|
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of FCH home range (HSI)** | |
| Nil | 47008 | 2938 | 0% | |
| Very Low | 10110325 | 631895 | 31% | |
| Low | 13294756 | 830922 | 41% | |
| Moderate | 3420620 | 213789 | 11% | |
| Moderately High | 3083798 | 192737 | 9% | |
| High | 2639640 | 164978 | 8% | |
| | | | | |
| **Caribou Habitat Rut Zone of Influence (Caribou Rut ZOI from Alexco 2015-2016 survey)** | | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of FCH home range (HSI)** | |
| Nil | 7456 | 466 | 16% | |
| Very Low | 166764 | 10423 | 2% | |
| Low | 763176 | 47699 | 6% | |
| Moderate | 684855 | 42803 | 20% | |
| Moderately High | 806453 | 50403 | 26% | |
| High | 908059 | 56754 | 34% | |
| | | | | |
| **Indirectly Affected Suitable Caribou Rut Habitat area within LSA** | | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of FCH home range (HSI)** | **Percent of Rut RSA (HSI)** |
| Nil | 57 | 4 | 0.1% | 1% |
| Very Low | 18413 | 1151 | 0.2% | 11% |
| Low | 56740 | 3546 | 0.4% | 7% |
| Moderate | 29584 | 1849 | 0.9% | 4% |
| Moderately High | 31860 | 1991 | 1.0% | 4% |
| High | 44481 | 2780 | 1.7% | 5% |
| | | | | |
| **Directly Affected Suitable Caribou Rut Habitat within Project Footprint** | | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of FCH home range (HSI)** | **Percent of Rut RSA (HSI)** |
| Very Low | 68 | 4 | 0.0% | 0.0% |
| Low | 1007 | 63 | 0.0% | 0.1% |
| Moderate | 2434 | 152 | 0.1% | 0.4% |
| Moderately High | 9104 | 569 | 0.3% | 1.1% |
| High | 3320 | 208 | 0.1% | 0.4% |

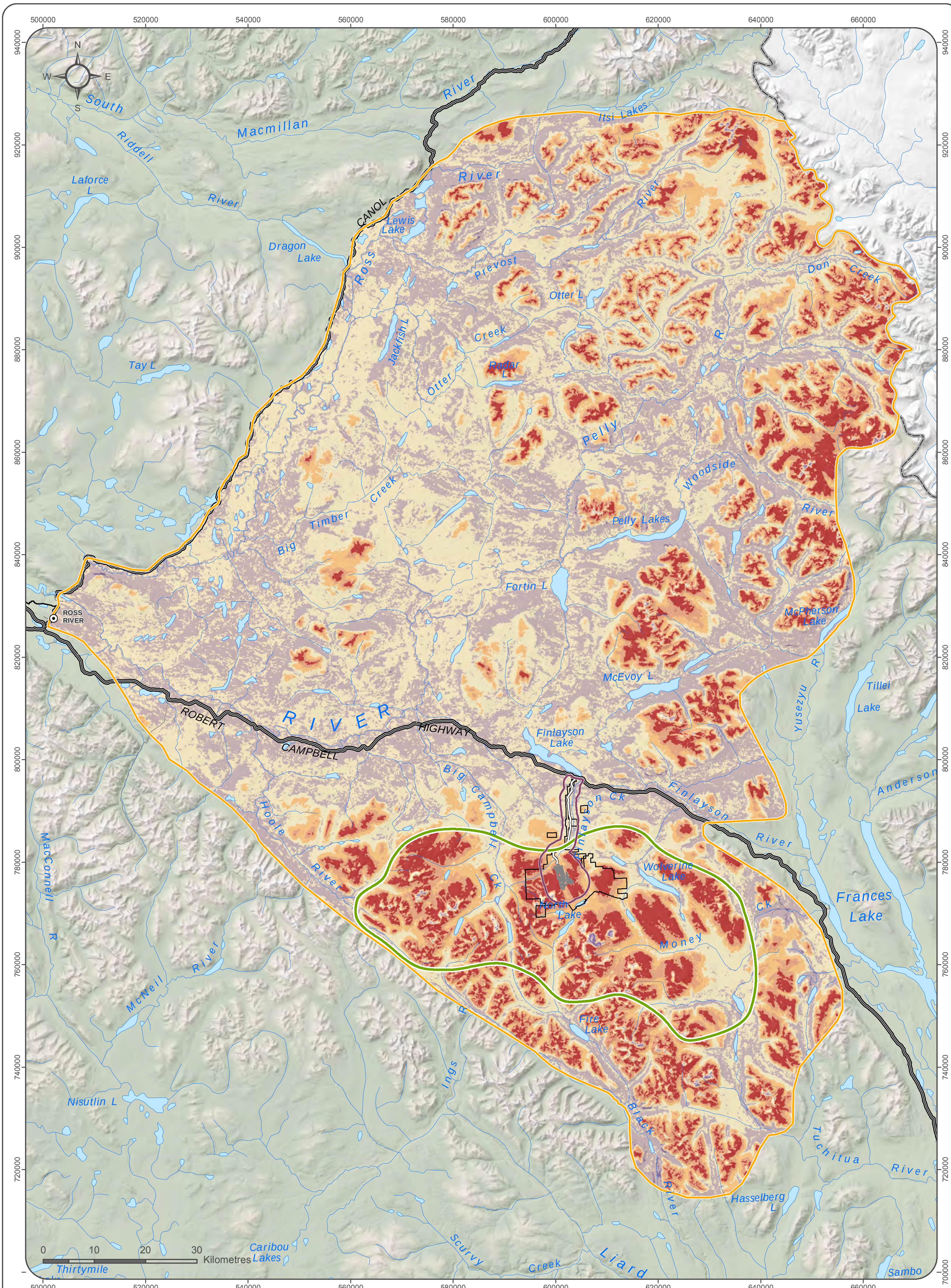
**Table 5-3: Distribution of Suitable Post Calving Habitat Within FCH Home Range**

| FCH Home Range Habitat Suitability Index Study Area | | | | |
|---|---|---|---|---|
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of FCH home range (HSI)** | |
| Nil | 7486866 | 467929 | 23% | |
| Very Low | 16205085 | 1012818 | 50% | |
| Low | 3588769 | 224298 | 11% | |
| Moderate | 1636904 | 102307 | 5% | |
| Moderately High | 1621049 | 101316 | 5% | |
| High | 2052016 | 128251 | 6% | |
| | | | | |
| **Caribou Habitat Post Calving Zone of Influence (Caribou Post Calving ZOI from Alexco 2015-2016 survey)** | | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of FCH home range (HSI)** | |
| Nil | 208446 | 13028 | 3% | |
| Very Low | 1264139 | 79009 | 8% | |
| Low | 609162 | 38073 | 17% | |
| Moderate | 485006 | 30313 | 30% | |
| Moderately High | 521512 | 32595 | 32% | |
| High | 824417 | 51526 | 40% | |
| | | | | |
| **Indirectly Affected Suitable Caribou Post Calving Habitat area within LSA** | | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of FCH home range (HSI)** | **Percent of Post Calving RSA (HSI)** |
| Nil | 20296 | 1269 | 0.27 | 9.7% |
| Very Low | 68287 | 4268 | 0.42 | 5.4% |
| Low | 28047 | 1753 | 0.78 | 4.6% |
| Moderate | 20063 | 1254 | 1.23 | 4.1% |
| Moderately High | 17738 | 1109 | 1.09 | 3.4% |
| High | 26704 | 1669 | 1.30 | 3.2% |
| | | | | |
| **Directly Affected Suitable Caribou Post Calving habitat within Project** | | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of FCH home range (HSI)** | **Percent of Post Calving RSA (HSI)** |
| Nil | 87 | 5 | 0.0% | 0.0% |
| Very Low | 1114 | 70 | 0.0% | 0.1% |
| Low | 6942 | 434 | 0.2% | 1.1% |
| Moderate | 5902 | 369 | 0.4% | 1.2% |
| Moderately High | 1789 | 112 | 0.1% | 0.3% |
| High | 99 | 6 | 0.0% | 0.0% |

Figure 5-1 and Figure 5-2 show the extent of the rut and post calving HSI modelled areas respectively, relative to the FCH home range and corresponding study areas.

Based on the habitat suitability map, the percentage of moderately high and high valued habitat across the FCH range for rut is 17% (357,715 ha), and 11% for post calving (229,567 ha). Within the ZOI, which is the LSA around the Project site and Tote Road, the percentage of moderately high and high value habitat for the rut was 4.5% (4,771 ha), and 3.3% for the post calving habitat (2,778 ha), as presented in Figure 5-3 and Figure 5-4, respectively.

At the scale shown in Figure 5-3 and Figure 5-4, the proposed mine footprint overlapping with moderately high and high rut habitat was 776 ha, or approximately 15% of the same quality habitat within the ZOI. Post calving habitat directly affected by mine infrastructure is 118 ha, or approximately 4% of the same quality habitat available within the ZOI (Figure 5-3 and Figure 5-4).




**HABITAT SUITABILITY INDEX**

- Nil
- Very Low
- Low
- Moderate
- Moderately High
- High

- Local Study Area (Indirect Zone of Influence)
- Caribou Rut Study Area
- Finlayson Caribou Herd Home Range
- BMC Minerals (No.1) Ltd. Mineral Claim Areas
- Location of Proposed Mine Infrastructure



Datum: NAD 83; Projection: UTM Zone 9N



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CARIBOU HABITAT SUITABILITY

**FIGURE 5-1**

**FINLAYSON CARIBOU HERD RUT HABITAT SUITABILITY HOME RANGE AND STUDY AREA**

NOVEMBER 2016

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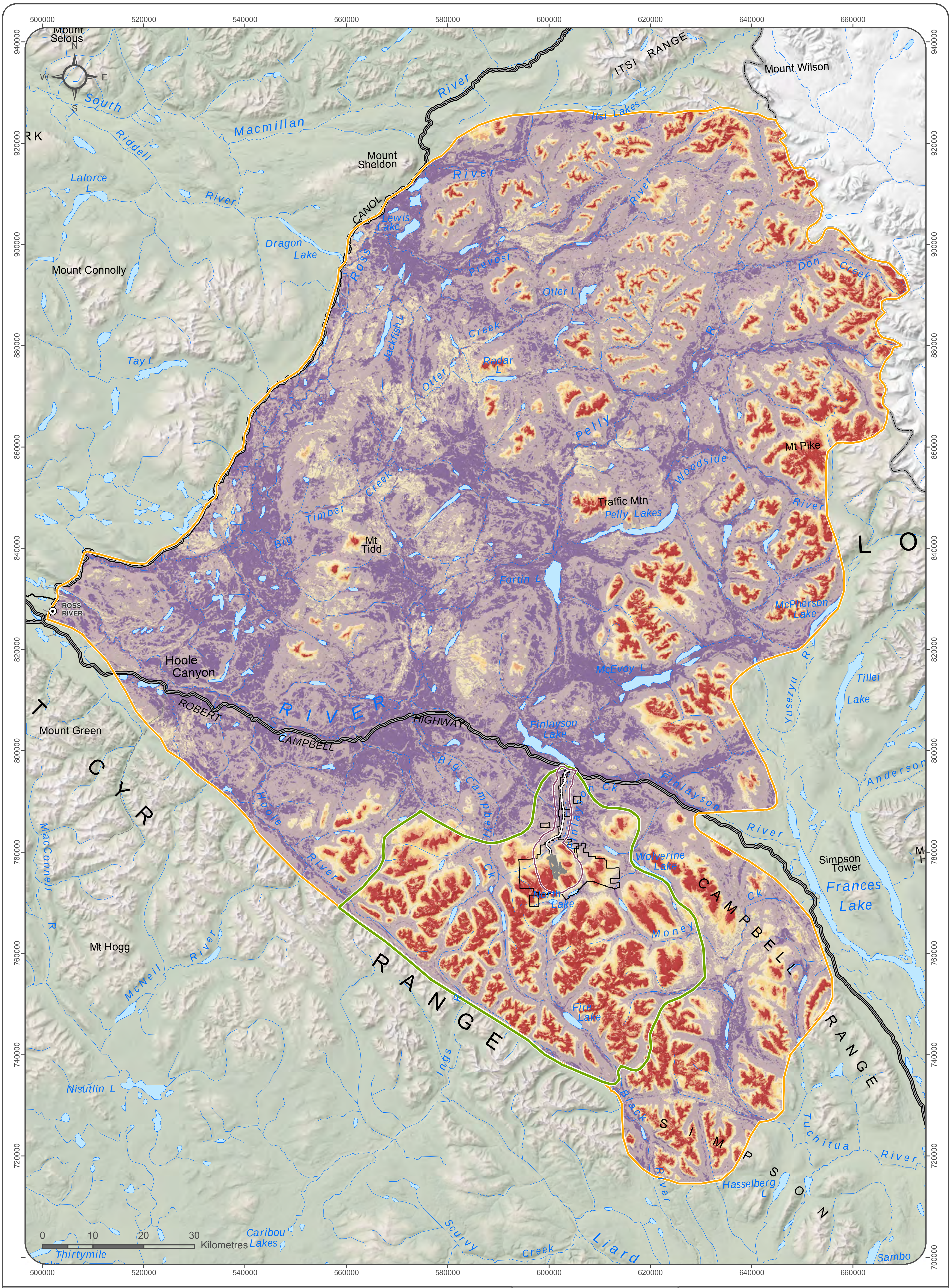


**HABITAT SUITABILITY INDEX**

- Nil
- Very Low
- Low
- Moderate
- Moderately High
- High

- Local Study Area (Indirect Zone of Influence)
- Caribou Post Calving Study Area
- Finlayson Caribou Herd Home Range
- BMC Minerals (No.1) Ltd. Mineral Claim Areas
- Location of Proposed Mine Infrastructure

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**KUDZ ZE KAYAH PROJECT**
**CARIBOU HABITAT SUITABILITY**

**FIGURE 5-2**
**FINLAYSON CARIBOU HERD POST CALVING HABITAT SUITABILITY HOME RANGE AND STUDY AREA**



Datum: NAD 83; Projection: UTM Zone 9N



ALEXCO ENVIRONMENTAL GROUP

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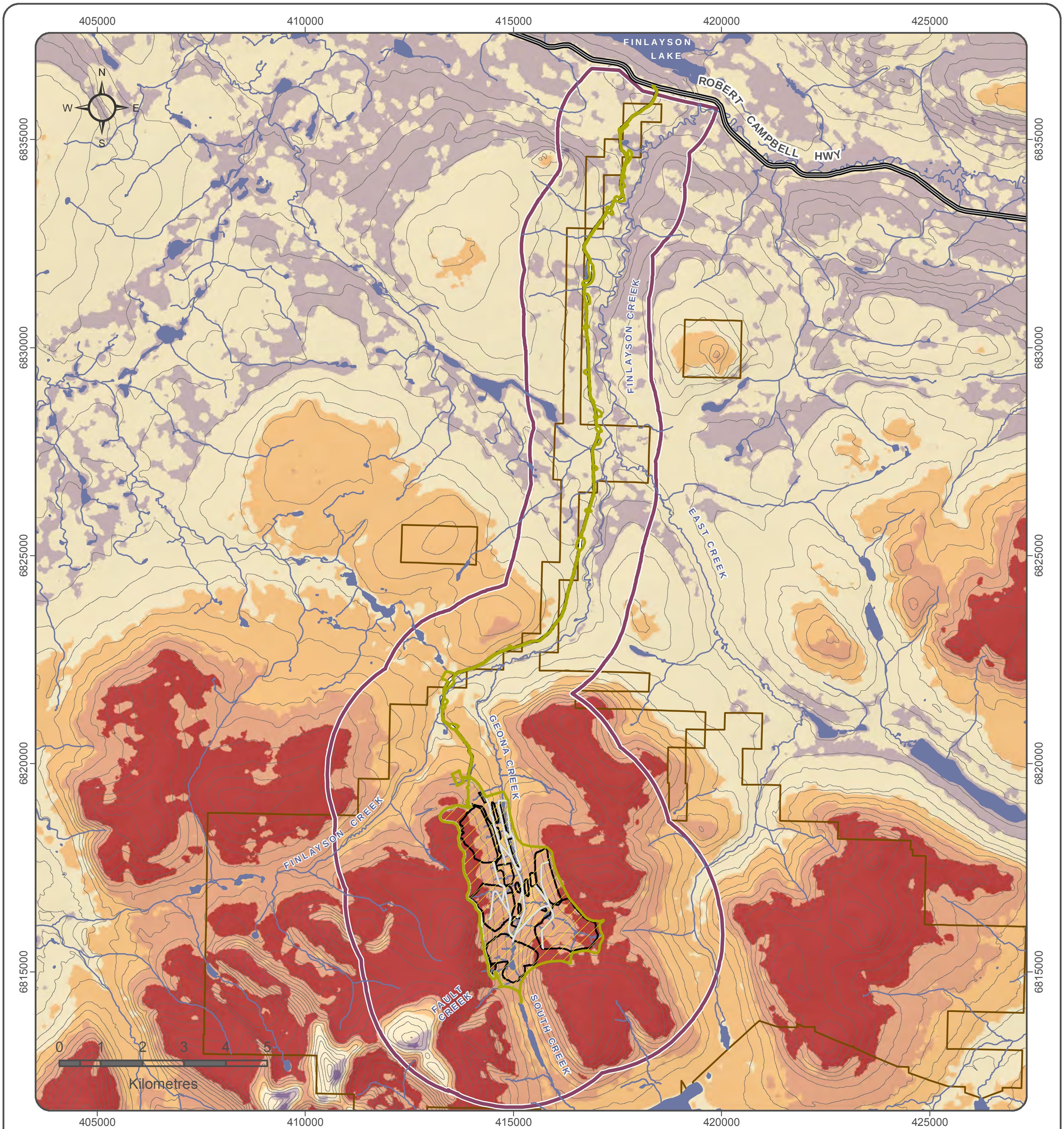


## HABITAT SUITABILITY INDEX

- Nil
- Very Low
- Low
- Moderate
- Moderately High
- High

- Tote Road/Proposed Access Road
- Proposed Mine Road
- Direct Disturbance Area
- Local Study Area (Indirect Zone of Influence)
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas

# KUDZ ZE KAYAH PROJECT CARIBOU HABITAT SUITABILITY

## FIGURE 5-3

## RUT HABITAT SUITABILITY LOCAL STUDY AREA AND PROPOSED MINE FOOTPRINT

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Datum: NAD 83; Projection: UTM Zone 9N

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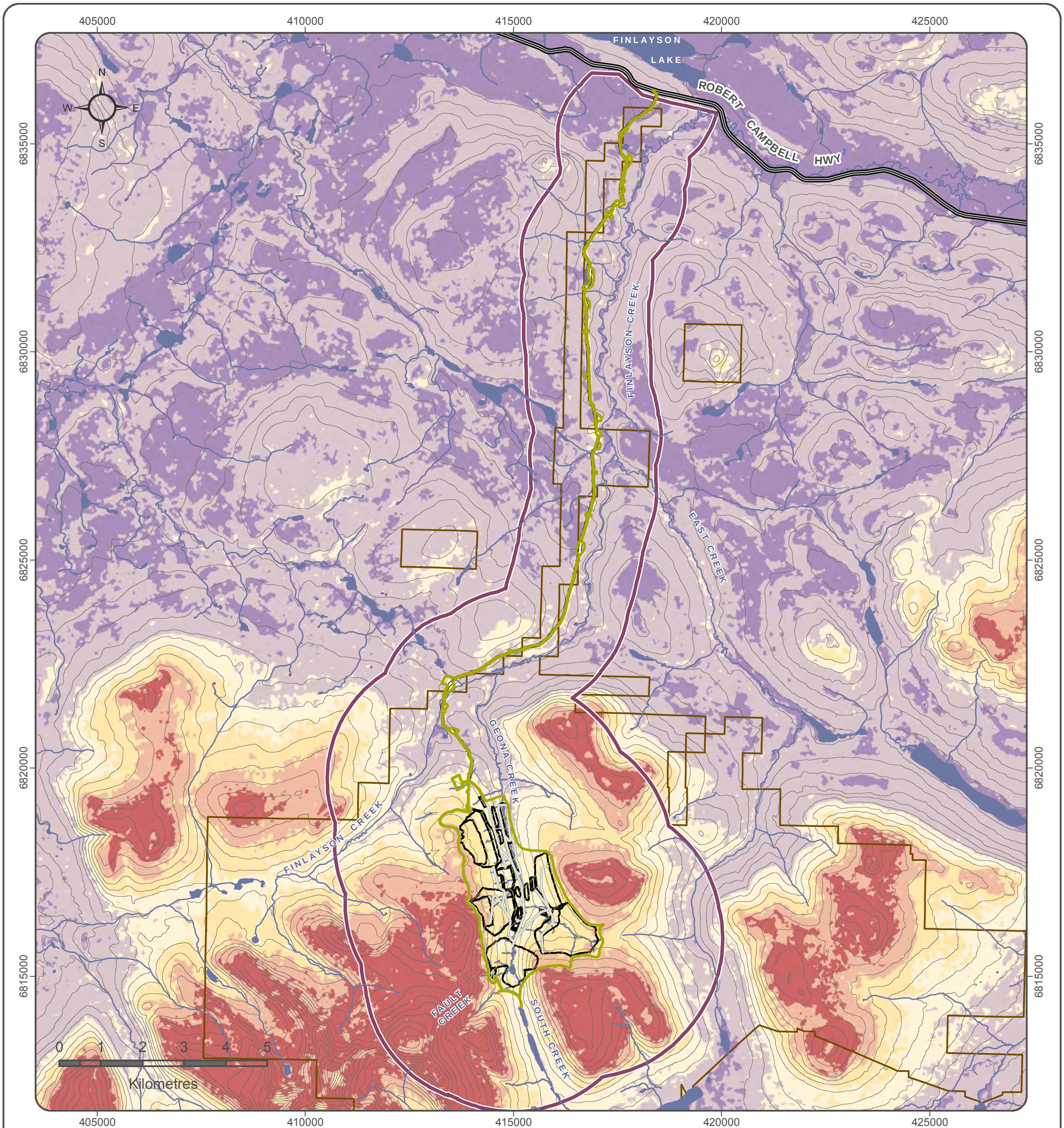


## HABITAT SUITABILITY INDEX

- Nil
- Very Low
- Low
- Moderate
- Moderately High
- High

- Tote Road/Proposed Access Road
- Proposed Mine Road
- Direct Disturbance Area
- Local Study Area (Indirect Zone of Influence)
- Location of Proposed Mine Infrastructure
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas

## KUDZ ZE KAYAH PROJECT
## CARIBOU HABITAT SUITABILITY

### FIGURE 5-4

### POST CALVING HABITAT SUITABILITY LOCAL STUDY AREA AND PROPOSED MINE FOOTPRINT

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Datum: NAD 83; Projection: UTM Zone 9N

AEG



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# 6 DISCUSSION

In conclusion, the LSA has high quality rut and post calving habitat. The HSI model and maps provide the baseline and have been used to help assess the direct and indirect environmental effects and mitigation measure for the Project. There are other factors that can influence caribou use of suitable habitat that may not be reflected in the HSI model and maps. For example, the model does not reflect year to year variability in weather or climate change. Burn areas will also factor into habitat suitability and movement throughout the FCH range (http://climatetelling.ca/community/ross-river-caribou/).

# 7 LIMITATIONS

HSI models are predictive tools that aim to produce a continuum of preferred habitat for a selected species using available data. The following is a list of limitations associated with the HSI for caribou rut and post calving seasons:

- Only a few of the caribou location points were from satellite collars which provide exact locations on the ground. The remaining data has a location accuracy of approximately 200 m which affects the variable values for each location;
- The HSI is a knowledge based model that incorporates quantitative data with expert opinion. The model reflects some biases related to expert opinion; and
- The model was constructed using data for animal presence while not taking into consideration absence of animal data.

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# APPENDIX C

## MOOSE HABITAT SUITABILITY REPORT

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# MOOSE HABITAT SUITABILITY REPORT

# KUDZ ZE KAYAH PROJECT

BMC-15-01-845_025_Moose Habitat Suitability Report_Rev0_161219

December 2016

Prepared for:

**BMC MINERALS (NO. 1) LTD.**

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| Report reviewed by: | Scott Keesey, B.Sc., EP<br>Senior Environmental Manager | 12/16/2016 |

## EXECUTIVE SUMMARY

The Kudz Ze Kayah (KZK) Project is a proposed Mine located in Yukon Territory, approximately 260 km northwest of Watson Lake and 115 km southeast of Ross River, within the Yukon Plateau-North Ecoregion, part of the Canadian Boreal Cordillera Ecozone. Moose (*Alces alces*) are a significant wildlife resource in this region to First Nation, resident, and guided hunters alike. As part of the baseline studies, late winter and post rut surveys were conducted to assess moose distribution patterns and abundance within the Project area. As additional support to the baseline studies, a habitat suitability index (HIS) model was prepared to predict the location of moose post rut and late winter habitat within the Project Regional Study Area (RSA) and Local Study Area (LSA). The information and maps produced are meant to aid BMC management planning to minimize disruption of important moose habitat during the development and operation of the proposed Project and to assess the residual effects.

The four variables: elevation, slope, aspect, and vegetation cover were selected as model parameters to develop the moose habitat suitability index (HSI) for the post rut and late winter periods in the regional study area (RSA) (Game Management Subzone (GMS) 10-07). The classes within each variable were ranked based on their significance for moose during the specific season. Significance of each class was determined using existing site specific observations, expert opinion and previously conducted moose HSI models.

The moose HSI models were developed by weighting the environmental variables in different combinations based on expert knowledge of moose habitat preference. Elevation and slope variables were treated as continuous variables calculated using a linear fuzzy membership equation. The variables, aspect and vegetation cover are discrete in nature and were treated as such in the model.

Model evaluation was carried out using the non-parametric Kendall tau test to determine whether the final suitability ranking (nil, low, moderate, moderately high, and high) and observation density were correlated. Observation density was obtained from the evaluation dataset (aerial survey data). The p-value was used to determine whether the correlation was statistically significant or not at a 95% confidence level ($\alpha = 0.05$) and the Kendall tau coefficient was used to determine the strength of the correlation. The tau coefficients obtained for various iterations of the model were compared and the model with the highest value (strongest correlation) was selected as the final habitat suitability model.

Approximately 42% (87,573 ha) of the RSA is moderately high to high suitability post rut moose habitat. Approximately 63% (129,549 ha) is moderately high to high suitability late winter moose habitat. Of the moderately high to high suitability post rut moose habitat, approximately 1.1% (935 ha) will be directly affected, and 7.2% (6,327 ha) could be indirectly affected by the Project. Of the moderately high to high suitability late winter moose habitat, approximately 0.6% (837 ha) will be directly affected, and 6.4% (8,301 ha) could be indirectly affected by the Project.

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# ACRONYMS

AEG ........ Alexco Environmental Group Inc.

BMC ........ BMC Minerals (No. 1) Ltd.

COSEWIC ........ Committee on the Status of Endangered Wildlife in Canada

DEM ........ Digital Elevation Model

GIS ........ Geographic Information System

ha ........ hectares

HSI ........ Habitat Suitability Index

KFN ........ Kaska First Nation

KZK ........ Kudz Ze Kayah

LSA ........ Local Study Area

masl ........ metres above sea level

NMP ........ Northern Mountain Population

PEM ........ Predictive Ecosystems Map

SARA ........ Species at Risk Act

YG ........ Yukon Government

ZOI ........ Zone of Influence

# GLOSSARY

**Aspect:** the direction that something faces or points towards.

**Digital Elevation Map:** a digital model or 3D representation of a terrain's surface.

**Discontinuous Permafrost Zone:** an environment where 30-80% of the ground surface is underlain by permafrost. The areas of discontinuous permafrost increases progressively in size and number from north to south.

**Expert Opinion:** a belief or judgement about a topic given by an expert on the subject.

**Geographic Information System:** a computer system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.

**Game Management Subzone:** a legal boundary delineated by creeks and rivers that defines an area within which big game management objectives can be met through the setting of area specific regulations, and together form the larger Game Management Zones.

**Habitat Suitability Index:** a tool for predicting the suitability of habitat for a given species based on known affinities with environmental parameters.

**Life Requisites:** the special requirements of an animal for sustaining and perpetuating the species (RIC, 1999).

**Linear Fuzzy Membership**: reclassifies the input data to a 0 to 1 scale based on the possibility of being a member of a specified set. 0 is assigned to those locations that are definitely not a member of the specified set, 1 is assigned to those values that are definitely a member of the specified set, and the entire range of possibilities between 0 and 1 are assigned to some level of possible membership (the larger the number, the greater the possibility).

**Local Study Area:** the area encompassing a 3 km buffer surrounding the proposed Project infrastructure and a 1.5 km buffer around the tote road.

**Non-parametric Kendall Tau Test:** a statistic used to measure the correlation between two ranked variables.

**Predictive Ecosystems Map:** a modelled approach to ecosystem mapping, whereby existing knowledge of ecosystem attributes and relationships are used to predict ecosystem representation in the landscape.

**Regional Study Area:** the area encompassed by Game Management Subzone 10-07. This was the study area used for post-rut moose and late-winter ungulate surveys.

# 1 INTRODUCTION

The habitat suitability index (HIS) model, presented in this report, was developed to predict the location of moose post rut and late winter habitat within the Project Regional Study Area (RSA) and Local Study Area (LSA). The LSA was defined as the area encompassing a 3 km buffer surrounding the proposed Project footprint, and a 1.5 km buffer on either side of the Tote road. The RSA was delineated by the boundaries of Game Management Subzone (GMS) 10-07, which has a total area of 2,063 km$^2$ (Figure 2-2). The information and maps produced are meant to aid BMC management planning to avoid disruption of important moose habitat during the development and operation of the proposed Kudz Ze Kayah (KZK) Project. It will also be utilized to assess the residual effects to moose where avoidance of disruption to important moose habitat is not practicable.

Generally, at least two life requisite seasons are mapped to understand the availability of suitable habitat for a species to grow, reproduce, and survive (RIC, 1999). For moose, the post rut period and late winter are the most important life requisites. Trend surveys have been flown during the early winter, post-rut period by Yukon Government to monitor fluctuations in relative moose abundance and composition between intensive census surveys, and to detect early population change in areas subject to high levels of predation, hunting, and land-use activities. Post-rut forage habitat is important for moose after expending energy during the rut. Moose then aggregate to forage and restore their fat reserves for winter (Rea and Child, 2007). Available forage habitat during late winter is also important since forage is more difficult to access and is important to their survival (Rea and Child, 2007).

Moose rely on different seasonal habitats based on changing food availability, and the presence of cover for thermal security and protection from predation (Dussault et al., 2005). Scientific studies on moose food sources show that in spring, moose rely on emerging fresh willow buds as well as forbs, grasses, and horsetails. As summer proceeds, aquatic plants become part of their diet, particularly yellow pond lily (*Nuphar* sp.) and pondweed (*Potamogeton* sp.). As the herbaceous plants die off in the fall, the moose shift back to browsing on shrub twigs, particularly willow; this woody material is hard to digest and is nutrient poor compared to the herbaceous plants. The moose need to have built up nutrient reserves during the spring and summer for the energy outputs of the rut and winter. By late winter moose nutrient reserves have diminished and they are reliant on the lean diet of twigs and deciduous bark. Therefore, good late winter habitat is vital to moose survival. Modeling the suitable habitat for the post rut and late winter life requisites helps to understand potential limiting factors of moose survival and what type of habitat the Project will be affecting.

During the baseline studies, moose were primarily observed using flat or gently sloping terrain close to streams with plenty of shrub understory. In addition, moose were mainly found at higher elevations, and more bull moose were observed above tree line than cows. Furthermore, it was observed that moose are making use of the Tote road and drill access roads for efficient movement through the Project area. During the 2015 late-winter survey, a total of 31 moose were observed, as compared to 152 during the 2016 late-winter survey. Results of the 2015 post-rut aerial survey found a total of 114 moose. They were mainly utilizing the upland portion of the Project area in areas to the east, south, and west.

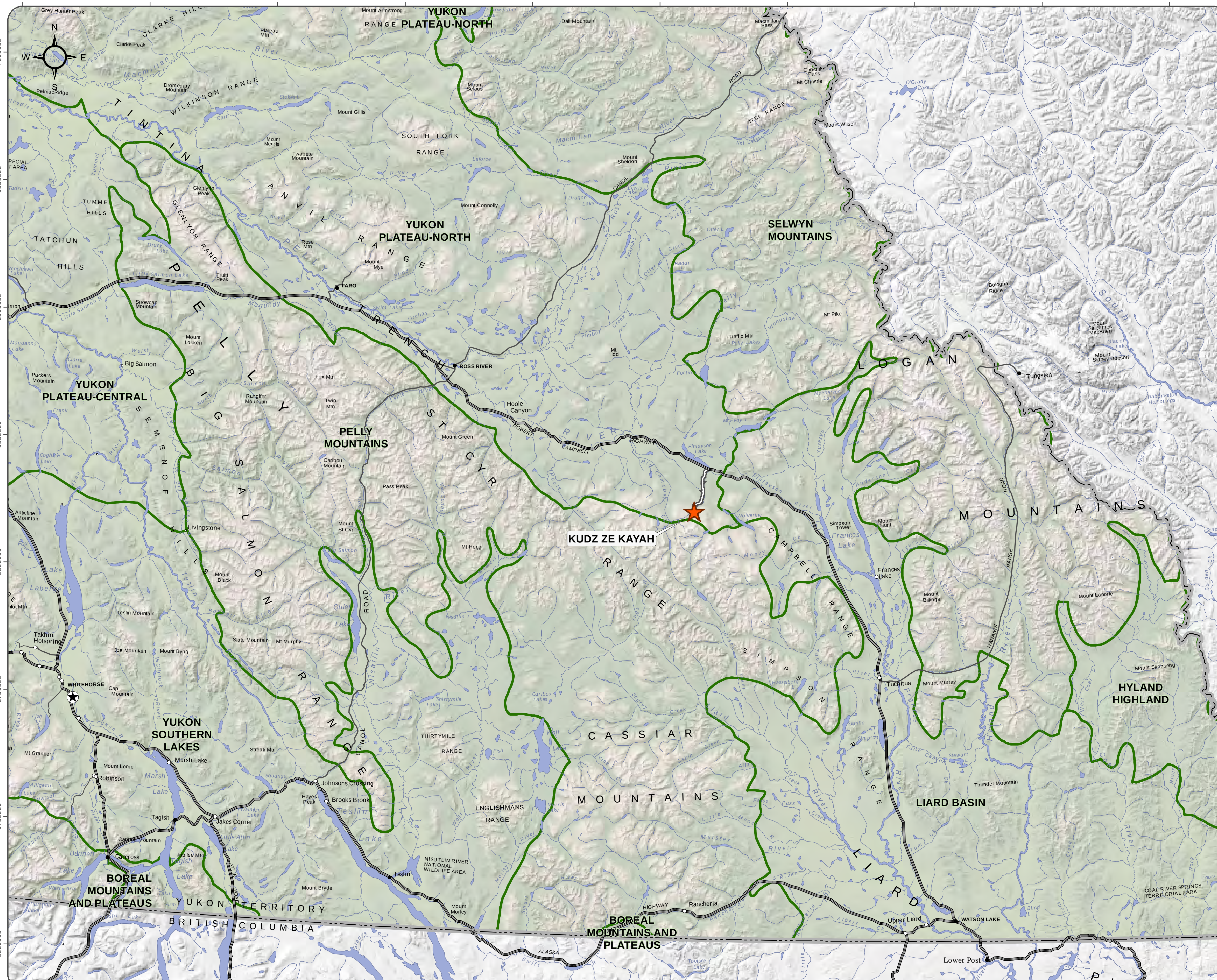
# 2 ENVIRONMENTAL SETTING

The Project is situated in a transitional climatic zone bordering on three different ecoregions: Yukon Plateau-North; Liard Basin to the east; and the higher elevation Pelly Mountains Ecoregion to the south (Yukon Ecoregions Working Group, 2004). The Tote Road is mainly within the Yukon Plateau-North Ecoregion. The Project is just within the northern portion of the Pelly Mountains Ecoregion (Figure 2-1).

The topography of the Project area consists of mainly rounded glaciated mountains with wetlands and creeks occupying valley bottoms. Elevations in the vicinity of the proposed Project site range from approximately 1,300 m in the valleys to about 1,900 m on the peak located above Fault Creek, to the southwest of the proposed Mine footprint. The Project is within a discontinuous permafrost zone, with an active layer of up to 2 m, beneath which ice is present (Geo-Engineering, 2000).

The most common vegetation species found within the RSA include scrub birch (*Betula glandulosa*), willows (*Salix sp*.), sub-alpine fir (*Abies lasiocarpa*), and open stands of white spruce (*Picea glauca*) at lower subalpine elevations. At lower elevations, on gentle to moderate slopes, a mixed forest of white and black spruce (*Picea mariana*) is the main vegetation community. These are mature old forests, as there have been very few fires in the area. The shrub understory is well developed with feathermoss ground cover; in drier conditions lichens and grasses are more abundant.

The riparian systems within the RSA are of two basic types: slow flowing creek/fen complexes with associated wetlands, or faster flowing creeks confined to deep valleys with definitive floodplains, such as Finlayson Creek. The first type of riparian system contains organic substrates derived from sphagnum mosses and sedges. Acid tolerant plants such as Labrador tea (*Rhododendron groenlandicum*), bog blueberry (*Vaccinium uliginosum*), and cloudberry (*Rubus chamaemorus*) grow in amongst the moss hummocks. The second type of riparian system has a rocky substrate; sediment is composed mostly of gravel, cobbles, and boulders. The vegetation associated with this system are tall willows, balsam popular (*Populus balsamifera*), and white spruce on upper terraces.




BMC MINERALS

KUDZ ZE KAYAH PROJECT
MOOSE HABITAT SUITABILITY

## FIGURE 2-1
## LOCATION OF KUDZ ZE KAYAH PROJECT AREA

NOVEMBER 2016


★ KUDZ ZE KAYAH PROJECT

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.

Canvec compiled by Natural Resources Canada at a scale of 1:10,000 - 1:50,000. Reproduced under license from Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources Canada. All rights reserved.
Drainage areas obtained from National Hydrology Network 2011

Datum: NAD 83; Projection UTM Zone 9N

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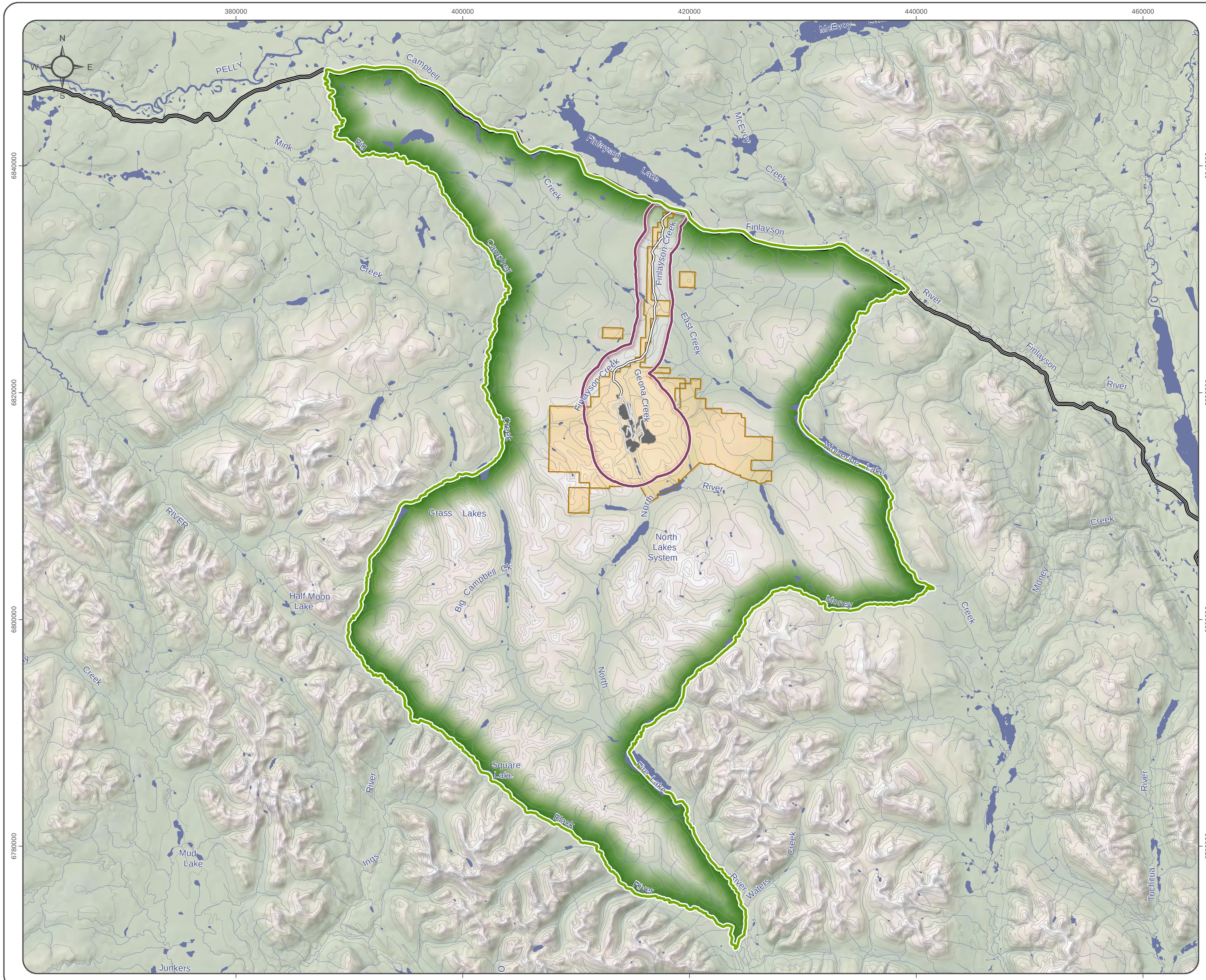


KUDZ ZE KAYAH PROJECT
MOOSE HABITAT SUITABILITY

## FIGURE 2-2
## MOOSE LOCAL AND REGIONAL STUDY AREAS FOR KUDZ ZE KAYAH PROJECT

NOVEMBER 2016

- Local Study Area
- Regional Study Area (Game Management Subzone 10-07)
- Location of Proposed Mine Infrastructure
- BMC Minerals (No.1) Ltd. Mineral Claim Areas
- Tote Road/Proposed Access Road
- Proposed Mine Road
- Highway
- Watercourse
- Waterbody

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



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# 3 HABITAT SELECTION

Moose have different habitat requirements depending on time of year. Throughout all seasons their overarching requirements are access to food and cover. Generally, areas with a mosaic of habitat types are best for moose, including openings for browse and forested cover that provide security and snow interception in winter (Dussault et al., 2005). Feeding habitats and thermal cover requirements can vary significantly from season to season (Turney and Blume, 2002). Potentially limiting habitats are late winter and calving ranges (DFMPT, 2013). The moose surveys for the KZK baseline study took place in the late fall, considered post rut (November, 2015 and December, 2016) and late winter (March, 2015 and 2016) to assess and monitor moose activity in general and during late winter periods for the Project (AEG, 2016). Calving surveys are generally not conducted since moose hide in the shrubs and forest near wetlands and rivers during calving; therefore, surveys would be difficult and disruptive. It is the late fall and late winter habitats that have been modelled and classified in this report, so a brief description of moose habitat requirements during these two periods is provided below.

Moose return to shrubby, open upland areas (such as large stands of shrubs and saplings) in fall and early winter during the rut, and prior to migration to wintering areas (Peek et al., 1982). Moose most commonly select open-canopy communities during late fall and early winter, where food (mainly shrubs) are plentiful. Open canopy can be open forests, shrub lands, burns, clearings, and logged areas. Moose usually stay close to the edges of denser forest stands while browsing in proximity to escape cover.

In mountainous regions, snow depths are often less at low elevations, moose move from high elevations in early winter to low elevations in late winter (Peek, 2007). In late winter, moose will seek out denser forest canopies when snow is deep or crusty. In some regions, snow depth is lower at wind-blown, high-elevation sites than at low-elevation sites; in which case the reverse pattern is exhibited (Peek, 2007). Moose tend to avoid steep slopes and sites without vegetation cover (Gilliham and Parker, 2008).

Except during the rut, moose habitat use typically differs among males and females during much of the year. Spatial segregation apparently occurs because adult males select habitat with greater forage abundance, while females (especially cows with calves) select habitats with greater cover (Bowyer et al., 2001; Miquelle et al., 1992). Miquelle et al. (1992) found that segregation was greatest in winter and with large bulls, the speculation being that, because of their larger body size and post rut energy deficit large bulls were more prone to malnutrition in winter than other age or gender classes, causing them to move to areas with high forage biomass but deep snow, whereas other age and gender classes foraged in areas with low forage availability but shallow snow.

Moose habitat use varies between years, reflecting differences in weather (Peek et al., 1982).

# 4 METHODS

The methods used to generate the moose HSI were developed based on the data which covered the RSA which is delineated by Game Management Subzone 10-07. The HSI models were developed using four environmental variables and were evaluated with an existing record of moose aerial survey observation locations. The general methodology is consistent with Environment Yukon's *Knowledge-Based Habitat Suitability Modelling Guidelines* (Clarke, 2012). The following sections list and describe the data and approach used to produce an HSI for moose post rut and late winter seasons.

## 4.1 DATA SOURCE

Data inputs for the model included spatial data and expert knowledge obtained from multiple agencies including Environment Yukon, Geomatics Yukon, Alexco Environmental Group (AEG), and Makonis Consulting and Associates. Spatial data used to create and evaluate the model are listed below in Table 4-1.

**Table 4-1: Habitat Suitability Index Data Sources**

| Dataset | Description | Source |
|---|---|---|
| Digital Elevation Model (DEM) | Elevation raster dataset; resampled to 25 m | Geomatics Yukon, Yukon Government |
| Slope | Slope raster data measuring degrees of slope generated from the DEM (25 m cell size) | Created by AEG based from Geomatics Yukon, Yukon Government data |
| Aspect | Aspect raster data measuring aspect in degrees generated from the DEM (25 m cell size) | Created by AEG based from Geomatics Yukon, Yukon Government data |
| Vegetation Cover | Main vegetation cover derived from Ross River Dene Council Predictive Ecosystem Mapping Project (25 m cell size) (Grods et al., 2013) | Makonis Consulting and Associates, Provided by Environment Yukon, Yukon Government |
| Moose Aerial Survey Points (AEG) | Aerial Survey locations of moose from 2015 and 2016 | AEG (Project acquired data) |

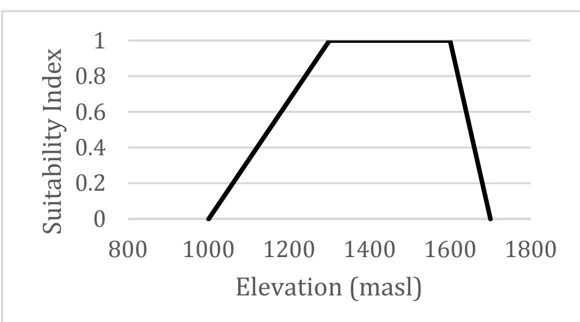
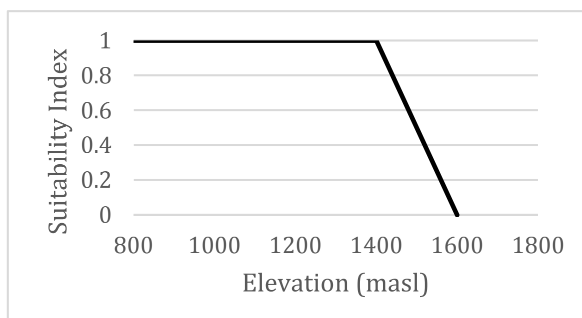
## 4.2 VARIABLES

The four variables: elevation, slope, aspect, and vegetation cover were selected as model parameters to develop the moose HSI for the post rut (early winter) and late winter seasons. For each season, the respective variables were divided into six classes ranging from 0 to 1, with 0 representing not suitable habitat (nil) and 1 representing highly suitable habitat (high). The classes within the variable were ranked based on their significance for moose during the specific season. Significance of each class was determined using existing site-specific observations, expert opinion, and previously conducted moose HSI models.

## 4.3 ELEVATION

Elevation data were extrapolated from the 25 m DEM and was computed as a continuous variable for the purpose of the HSI. A linear fuzzy membership function was applied to determine the suitability ranking between suitable and not suitable habitat. Break values for post rut were developed based on a +/- 150 m buffer applied to the average treeline elevation of 1,450 masl. The elevation break value for the late winter model was developed using a decreasing linear relationship with elevation above the treeline > 1,600 masl. Suitable habitat for moose during late winter season was segregated, as the majority of the individuals prefer lower elevation with less snow and more vegetation; however, some of the larger bulls will reside in upper elevation mountain draws. The equation and function used for post rut and late winter seasons are shown in Table 4-2.

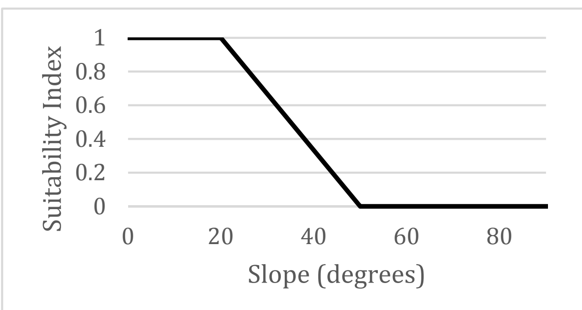
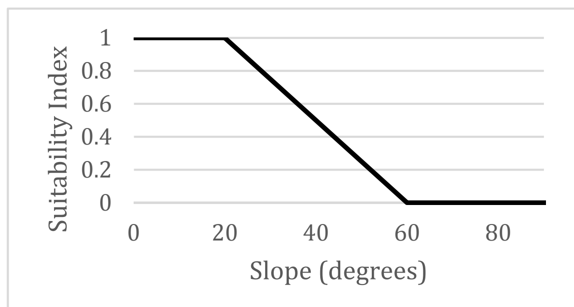
**Table 4-2: Fuzzy Membership Function and Class Ranking for Elevation Suitability**

| Moose Post Rut Season | Moose Late Winter Season |
|---|---|
| Lower elevation linear function<br>$f(x) = \begin{cases} 0, & x \leq 1000 \\ \left(\frac{x-1000}{1300-1000}\right) & 1000 < x < 1300 \quad x \in \mathrm{X} \\ 1, & 1300 \leq x \leq 1600 \end{cases}$<br>Upper elevation linear function<br>$f(x) = \begin{cases} 0, & x \geq 1700 \\ \left(\frac{x-1600}{1700-1600}\right) & 1600 < x < 1700 \quad x \in \mathrm{X} \\ 1, & 1300 \leq x \leq 1600 \end{cases}$ | Elevation linear function<br>$f(x) = \begin{cases} 0, & x \geq 1600 \\ \left(\frac{x-1400}{1600-1400}\right) & 1400 < x < 1600 \quad x \in \mathrm{X} \\ 1, & x \leq 1400 \end{cases}$ |
|  |  |

## 4.4 SLOPE

Slope or terrain steepness was derived from the 25 m DEM using ArcGIS 10.4 and was modelled in degrees of slope between neighbouring raster cells. Slope was treated as a continuous variable for the purpose of the HSI model using a linear fuzzy membership function to derive the values between suitable and not suitable habitat. Functions of slope suitability were derived from expert opinion and knowledge of moose behaviour within the RSA (Table 4-3).

**Table 4-3: Fuzzy Membership Function and Class Ranking for Slope Suitability**

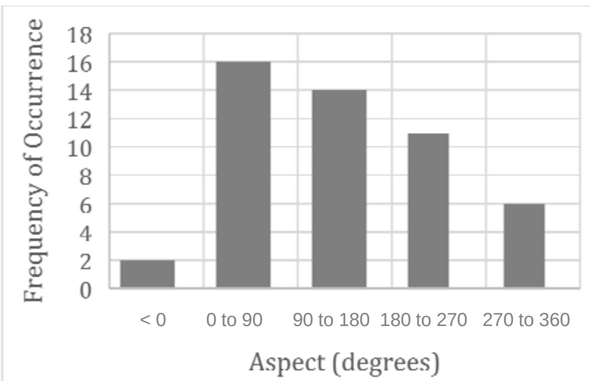
| Moose Post Rut Season | Moose Late Winter Season |
|---|---|
| Slope linear function<br>$f(x) = \begin{cases} & 0,\ x \geq 50 \\ \left(\frac{x-20}{50-20}\right) & 20 < x < 50\ \ x \in X \\ & 1, x \leq 20 \end{cases}$ | Slope linear function<br>$f(x) = \begin{cases} & 0,\ x \geq 60 \\ \left(\frac{x-20}{60-20}\right) & 20 < x < 60\ \ x \in X \\ & 1, x \leq 20 \end{cases}$ |
|  |  |

## 4.5 Aspect

Aspect was derived from the 25 m DEM using the aspect tool in ArcGIS. Aspect was classified into four quadrants of cardinal direction and treated as a discrete variable for the HSI. Aspect was informed from previously collected aerial data along with expert opinion as shown in Table 4-4. Aspect did not show as strong of a variance between class values and as a result received a lower variable weighting in comparison to the other variables.

**Table 4-4: Distribution and Class Ranking for Aspect Suitability**

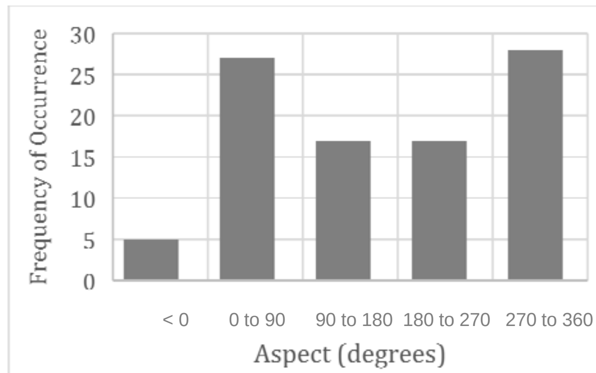
**Moose Post Rut Season**




* x-axis represents range of values within a bin width of 90 degrees

| Variable Class | Suitability Index Ranking |
|---|---|
| 0-90 | 0.8 |
| 90-180 | 0.8 |
| 180-270 | 0.4 |
| 270-360 | 0.4 |
| <0 | 0.4 |

**Moose Late Winter Season**




* x-axis represents range of values within a bin width of 90 degrees

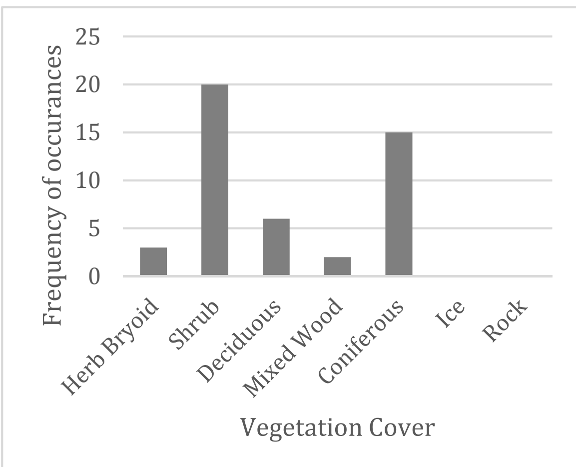
| Variable Class | Suitability Index Ranking |
|---|---|
| 0-90 | 0.8 |
| 90-180 | 0.2 |
| 180-270 | 0.3 |
| 270-360 | 0.8 |
| <0 | 0.8 |

## 4.6 Vegetation Cover

Vegetation cover type was classified based on the Regional Ecosystems of East-Central Yukon *Predictive Ecosystem Map* (PEM) that was completed in 2013 by Makonis Consulting Ltd. (Grods et al., 2013). The PEM spatial data and methodology was received from Environment Yukon. The PEM product was developed using land cover, surficial material, and base features (i.e., watercourses, water bodies, and elevation) as a means to predict the broad ecosystem units in the defined study area. The final product was then evaluated by ground-truthing, with ecosystem plots, and review of aerial imagery. The aerial imagery was collected in 2016 and was obtained by BMC for the Project. The PEM is recommended to be used at a scale of 1:100,000 or smaller (Grods et al., 2013). For the purpose of the model, the PEM was classified into the dominate vegetation cover, not utilizing the landscape classification, as these aspects were already addressed in the model (i.e. x). Aerial survey data were intersected with the PEM and the suitability index rating was developed based on the data distribution and expert knowledge as shown in Table 4-5.

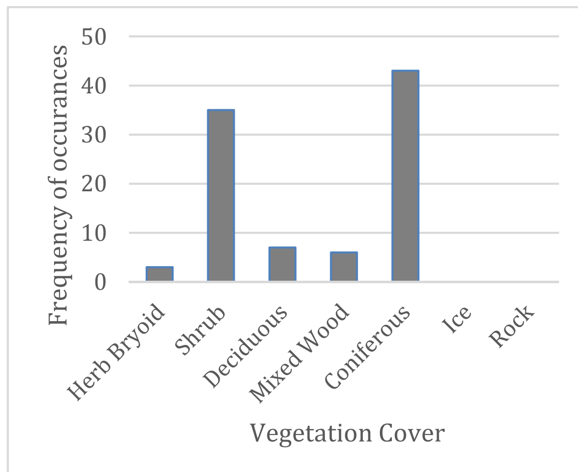
**Table 4-5: Distribution and Class Ranking for Vegetation Cover Suitability**

**Moose Post Rut Season**




| Variable Class | Suitability Index Ranking |
|---|---|
| Herb Bryoid | 0.1 |
| Shrub | 1.0 |
| Deciduous | 0.1 |
| Mixed Wood | 0.2 |
| Coniferous | 0.6 |
| Ice | 0.0 |
| Rock | 0.0 |

**Moose Late Winter Season**




| Variable Class | Suitability Index Ranking |
|---|---|
| Herb Bryoid | 0.1 |
| Shrub | 1.0 |
| Deciduous | 0.0 |
| Mixed Wood | 0.2 |
| Coniferous | 0.6 |
| Ice | 0.0 |
| Rock | 0.0 |

## 4.7 MODEL DEVELOPMENT

The moose HSI models were developed by combining the different environmental variables to predict the habitat suitability for the post rut and late winter seasons. The result of the model is two raster datasets, one for each season, at a 25 m cell size resolution for the entire RSA. The final layers are represented by six habitat index rankings, from nil to high suitability, based on the British Columbia Wildlife Habitat Rating

Standards (RIC, 1999). The model development and flowchart are described below and are visually represented in Figure 4-1.

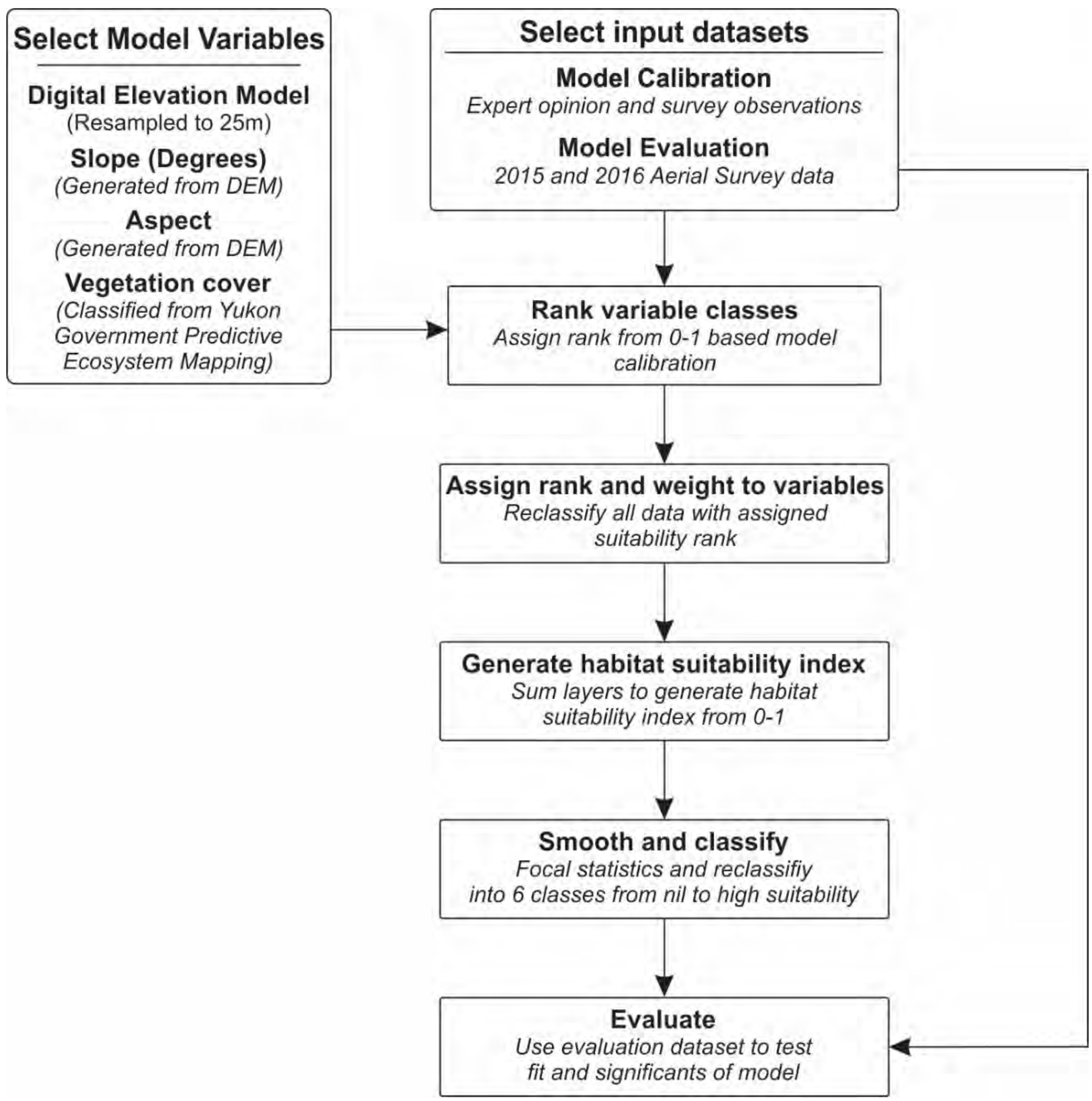
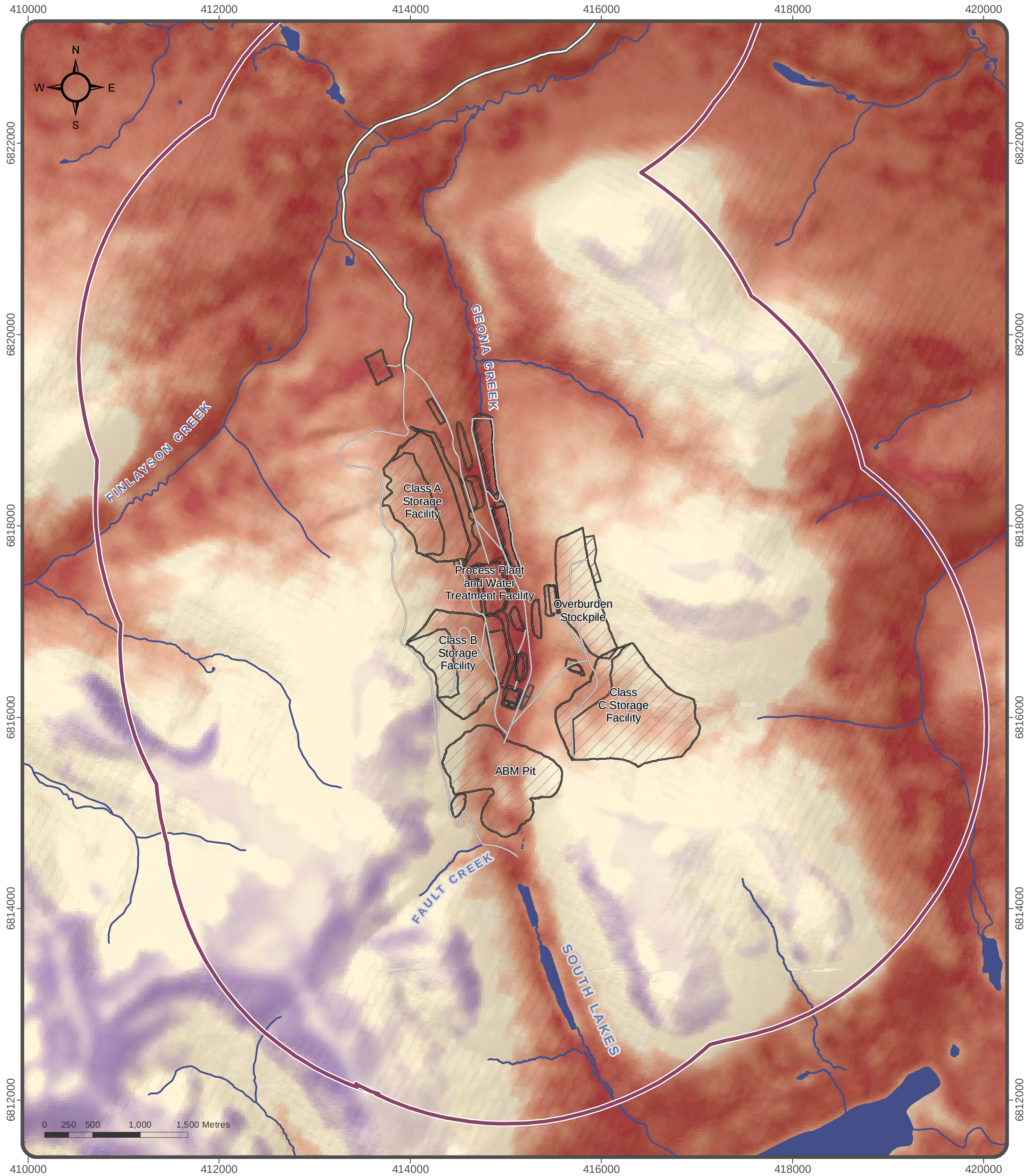



**Figure 4-1: Habitat Suitability Index Process Workflow**

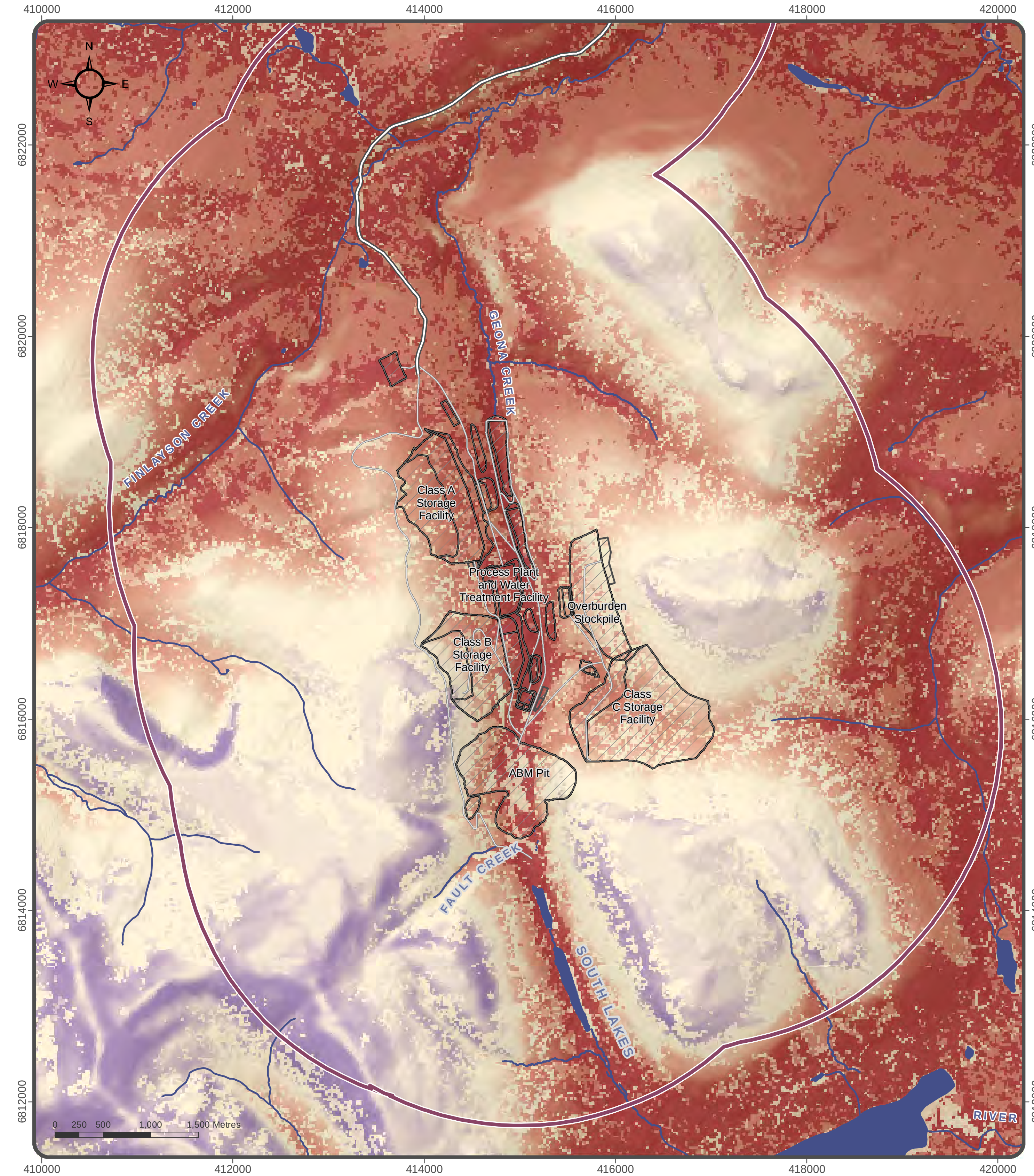
The input model variables were converted into raster datasets with equal cell size of 25 m so the corresponding variable values would align spatially with each other for the purpose of analysis. Existing observations from two years of baseline data collection in conjunction with expert knowledge were used to classify the four variables from 0 to 1, with 0 being not suitable and 1 being the most suitable habitat. Elevation and slope variables were treated as continuous variables, with the values between 0 and 1, and were calculated using a linear fuzzy membership equation. The variables aspect and vegetation cover are discrete in nature and were treated as such in the model. These variables were divided into classes and assigned a value between 0 to 1 based on frequency of occurrence validated by expert opinion.

After each variable was reclassified, they were assigned a weight based on their importance as a factor influencing suitability of habitat. Each classified layer was multiplied by its weight and then added together to achieve a final suitability rating from 0 to 1. Focal statistics with a 100 m (4 cell) radius were run on the output HSI to smooth small groupings of isolated cells that were artifacts of the data. This created an even and continuous raster of the landscape (Figure 4-2:). The final HSI rasters were then divided into six equal classes ranging from 0 to 1, and were evaluated against the aerial survey point data to test the correlation and significance of the models.

## HABITAT SUITABILITY INDEX WITH FOCAL STATISTICS




## HABITAT SUITABILITY INDEX WITHOUT FOCAL STATISTICS




Datum: NAD 83; Map Projection: UTM Zone 9N



AEG

- Tote/Proposed Access Road
- Proposed Site Road
- Watercourse
- Waterbodies
- Local Study Area
- Location of Proposed Mine Infrastructure

**Late Winter Habitat Suitability**

- High Suitability
- Low Suitabilty

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KUDZ ZE KAYAH PROJECT
MOOSE HABITAT SUITABILITY

**FIGURE 4-2**
**COMPARISON OF LATE WINTER HABITAT SUITABILITY INDEX USING FOCAL STATISTICS**

NOVEMBER 2016

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## 4.8 EVALUATION

Model evaluation was carried out using the non-parametric Kendall tau test to determine whether the final suitability ranking (divided into 6 rank classes) and observation density were correlated. A non-parametric test was used since data did not follow a normal distribution and the Kendall tau test for rank correlation was chosen rather than the Spearman's test because the Kendall tau is less sensitive to error and is more accurate with smaller data sets (Statistics Solutions, 2016). Observation density was obtained from the evaluation dataset (aerial survey data). The p-value was used to determine whether the correlation was significant or not at a 95% confidence level ($\alpha = 0.05$), and the Kendall tau coefficient was used to determine the strength of the correlation. The tau coefficients obtained for various iterations of the model were compared and the model with the highest value (strongest correlation) was selected as the final habitat suitability model. All statistics were generating using R, a statistical computing software program (R Core Team, 2014).

# 5 RESULTS

Evaluation of the HSI models indicate that there is a strong correlation between the suitability classes of the model and the number of occurrences of moose within each class. The post rut HSI (p-value = 0.00833) suggests a significant (e.g., significant if $p < 0.05$) correlation between rated habitat suitability and number of occurrences within each class while the strength of the correlation is strong (tau correlation coefficient = 0.8667). The late winter HSI (p-value = 0.02778) suggests a significant correlation between related habitat suitability and occurrence within each class while the strength of the correlation is strong (tau correlation coefficient = 0.7333). The model calculated the habitat suitability for the extent of the RSA (GMS 10-07). The values listed in Table 5-1 represent the total area of the six habitat suitability classes for the post rut and late winter seasons.

**Table 5-1: Habitat Suitability Results**

| | Moose Post Rut Season | | | Moose Late Winter Season | | |
|---|---|---|---|---|---|---|
| **Habitat Suitability Index** | **Area (Ha)** | **Percent of total area (%)** | **Occurrences per class** | **Area (Ha)** | **Percent of total area (%)** | **Occurrences per class** |
| Nil | 5,975 | 3 | 0 | 12,865 | 7 | 0 |
| Very low | 9,833 | 5 | 1 | 18,156 | 10 | 2 |
| Low | 43,498 | 23 | 1 | 12,630 | 7 | 3 |
| Moderate | 41,025 | 22 | 10 | 14,705 | 8 | 9 |
| Moderately High | 51,925 | 28 | 19 | 3,7045 | 20 | 17 |
| High | 35,648 | 19 | 16 | 92,504 | 49 | 55 |
| **Total** | **187,904** | **100** | **47** | **187,904** | **100** | **86** |

Of the total area (Table 5-2 and Table 5-3) shows how much of each HSI class each season will be directly affected by the proposed Mine footprint and how much will be indirectly affected in the area of influence or local study area.

## Table 5-2: Distribution of Suitable Post Rut Habitat Within Moose RSA

| Moose Habitat Suitability Index Regional Study Area (GMS 10-07) | | | |
|---|---|---|---|
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of RSA (%)** |
| Nil | 95594 | 5975 | 3% |
| Very Low | 157320 | 9833 | 5% |
| Low | 695972 | 43498 | 23% |
| Moderate | 656402 | 41025 | 22% |
| Moderately High | 830800 | 51925 | 28% |
| High | 570373 | 35648 | 19% |
| | | | |
| **Suitable Moose Habitat in LSA** | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of RSA (HSI)** |
| Nil | 1680 | 105 | 2% |
| Very Low | 3822 | 239 | 2% |
| Low | 43437 | 2715 | 6% |
| Moderate | 30952 | 1935 | 5% |
| Moderately High | 39389 | 2462 | 5% |
| High | 61846 | 3865 | 11% |
| | | | |
| **Directly Affected Suitable Moose Habitat from Project Feature footprint**** | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of RSA (HSI)** |
| Very Low | 174 | 11 | 0% |
| Low | 586 | 37 | 0% |
| Moderate | 206 | 13 | 0% |
| Moderately High | 2168 | 136 | 0% |
| High | 12799 | 800 | 2% |

** Cell size 25 m x 25 m (625 $m^2$)*

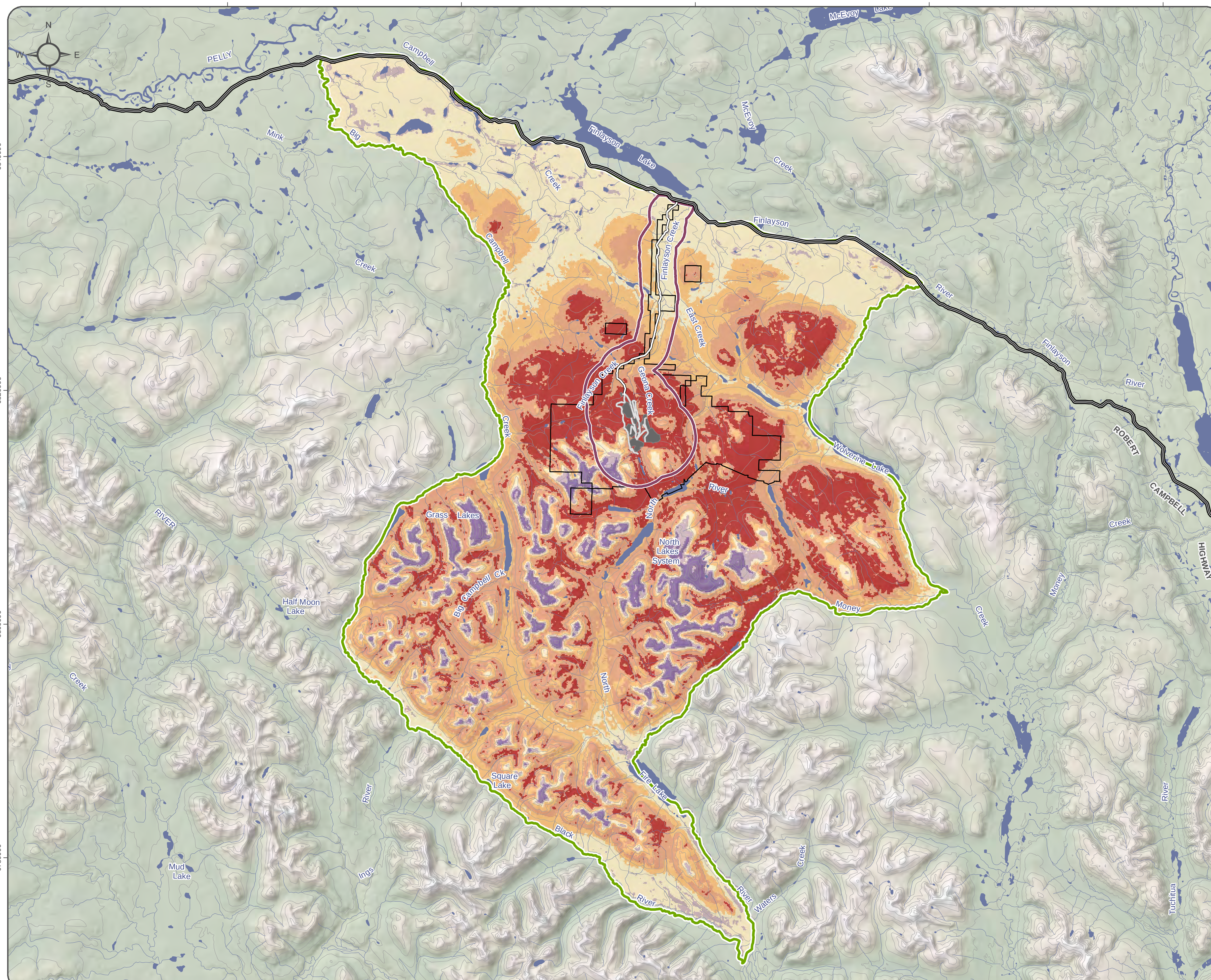
*** Project footprint for HSI is considered to be the area bound by the project diversion ditches and the tote road*

## Table 5-3: Distribution of Suitable Late Winter Habitat Within Moose RSA

| Moose Habitat Suitability Index Regional Study Area (GMS 10-07) | | | |
|---|---|---|---|
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of RSA (%)** |
| Nil | 205832 | 12865 | 7% |
| Very Low | 290488 | 18156 | 10% |
| Low | 202072 | 12630 | 7% |
| Moderate | 235275 | 14705 | 8% |
| Moderately High | 592723 | 37045 | 20% |
| High | 1480071 | 92504 | 49% |
| | | | |
| **Suitable Moose Habitat in LSA** | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of** RSA (HSI) |
| Nil | 1176 | 74 | 1% |
| Very Low | 15124 | 945 | 5% |
| Low | 14958 | 935 | 7% |
| Moderate | 17042 | 1065 | 7% |
| Moderately High | 27540 | 1721 | 5% |
| High | 105286 | 6580 | 7% |
| | | | |
| **Directly Affected Suitable Moose Habitat from Project Feature footprint** | | | |
| **Habitat Suitability Index** | **Number of Cells** | **Area (ha)** | **Percent of RSA (HSI)** |
| Nil | 4 | 0.25 | 0% |
| Very Low | 76 | 4.75 | 0% |
| Low | 335 | 20.94 | 0% |
| Moderate | 2133 | 133.31 | 1% |
| Moderately High | 6846 | 427.88 | 1% |
| High | 6539 | 408.69 | 0% |

** Cell size 25 m x 25 m (625 m$^2$)*

Figure 5-1 and Figure 5-2 show the extent of the study areas and areas of influence for the post rut and late winter seasons.




MINERALS

KUDZ ZE KAYAH PROJECT
MOOSE HABITAT SUITABILITY

**FIGURE 5-1**
**POST RUT HABITAT SUITABILITY**

NOVEMBER 2016

**HABITAT SUITABILITY INDEX**

Nil
Moderate
Very Low
Moderately High
Low
High

Local Study Area
Regional Study Area (Game Management Subzone 10-07)
Location of Proposed Mine Infrastructure
BMC Minerals (No.1) Ltd. Mineral Claim Areas
Tote Road/Proposed Access Road
Proposed Mine Road
Highway
Watercourse
Waterbody

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



1:325,000 when printed on 11 x 17 inch paper

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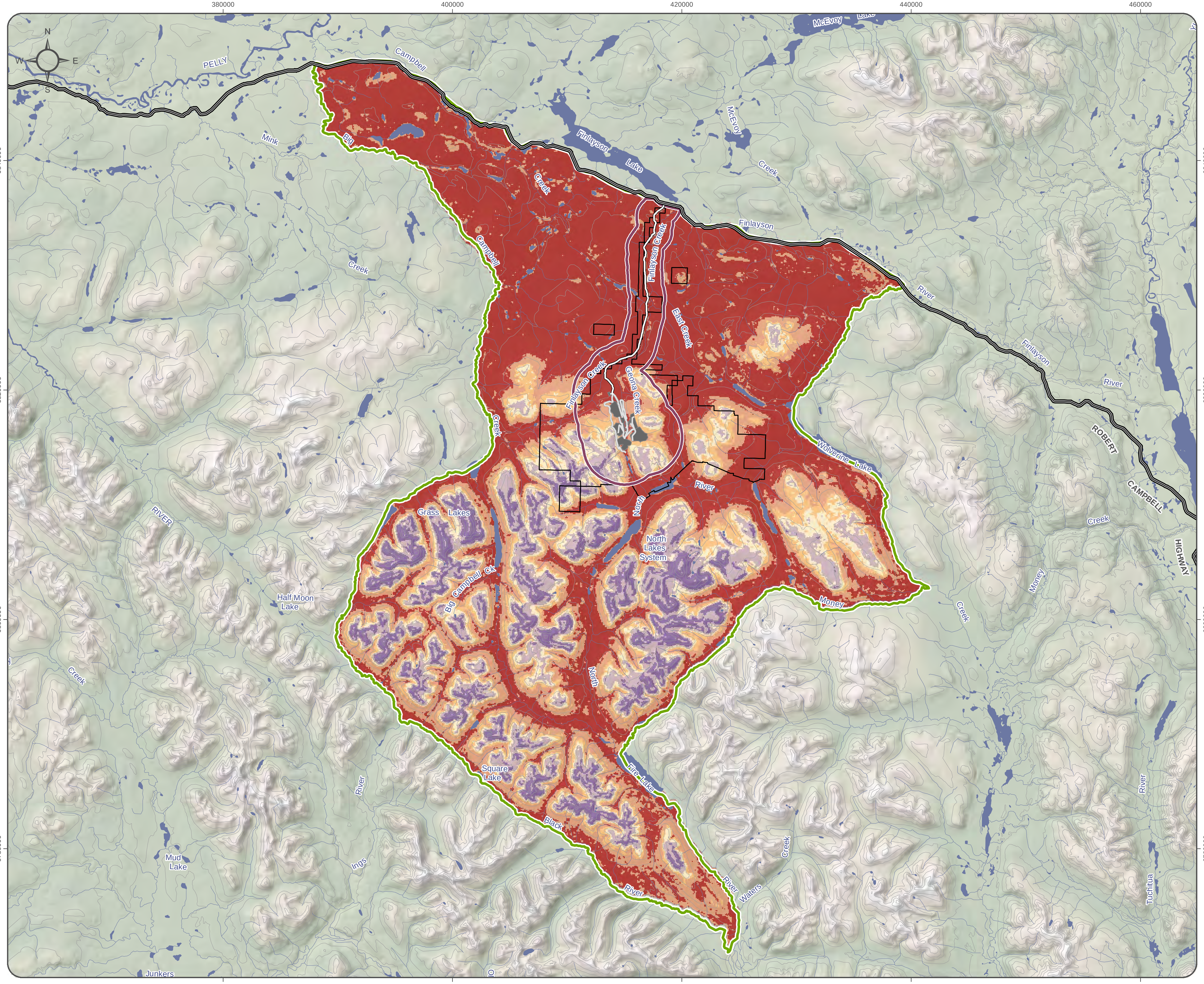


BMC MINERALS

KUDZ ZE KAYAH PROJECT
MOOSE HABITAT SUITABILITY

## FIGURE 5-2
## MOOSE LATE WINTER HABITAT SUITABILITY

NOVEMBER 2016

### HABITAT SUITABILITY INDEX

- Nil
- Very Low
- Low
- Moderate
- Moderately High
- High

- Local Study Area
- Regional Study Area (Game Management Subzone 10-07)
- Location of Proposed Mine Infrastructure
- BMC Minerals (No.1) Ltd. Mineral Claim Areas
- Tote Road/Proposed Access Road
- Proposed Mine Road
- Highway
- Watercourse
- Waterbody

ALEXCO ENVIRONMENTAL GROUP

Digital elevation model created by the Yukon Department of the Environment interpolated from the digital 1:50,000 Canadian National Topographic Database (NTDB Edition 2) contour and watercourse layers. Obtained from Geomatics Yukon.



Datum: NAD 83; Projection UTM Zone 9N



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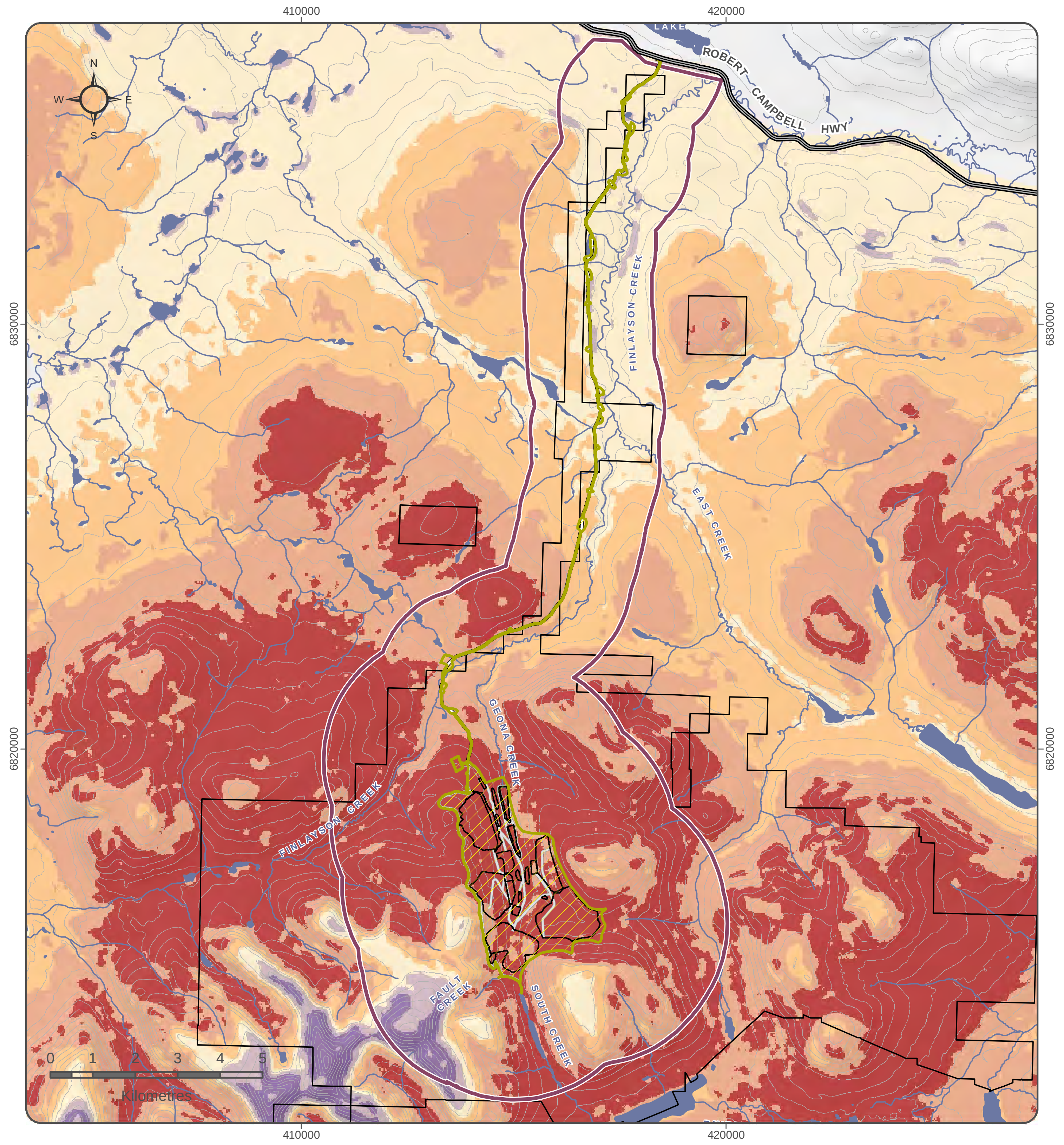
# 6 DISCUSSION

The model shows that within the RSA there is ample moderately high and high quality post rut habitat for moose. Approximately 42% (87,573 ha) of the RSA is moderately high to high suitability post rut habitat; and 63% (129,549 ha) of the RSA is moderately high to high suitability late winter habitat for moose. The actual percentage of high quality habitat is likely to be lower due to the influence of predators and subtler habitat selection factors not included in the HSI model such as snow loading on lee sides of ridges in late winter or the juxtaposition of different preferable vegetation communities within the two seasonal habitats. Modeling of predation rates by wolves on moose in the Finlayson area by Hayes and Harestad (2000) indicate that moose densities are reduced from the potential habitat capacity by wolf prey rates.

Habitat availability can be affected through direct loss within the Project development area and indirect loss from Project activities or infrastructure that create sensory disturbances and temporarily reduce the effectiveness of the habitat. Within the RSA, approximately 0.6% (840 ha) of moderately high to high quality late winter moose habitat will be directly affected by the Project footprint; and approximately 6.4% (8,301 ha) of moderately high to high quality habitat late winter habitat could be indirectly affected by Project activity (Figure 6-1 and Figure 6-2).

Future refinements of the model could use snow depth, and distance to riparian systems as part of the model; however, the four parameters used in the model provide an acceptable level of accuracy for the level of assessment required. Additionally, differences in habitat selection by cows with calves compared to bulls can help explain some variability in habitat use. There are also indications that moose continue to use the same areas for post rut and late winter based on the 2015 and 2016 observations. These factors may help explain unexpected variability when interpreting future monitoring data over the life of the Project.




**HABITAT SUITABILITY INDEX**

- Nil
- Very Low
- Low
- Moderate
- Moderately High
- High

- Local Study Area
- Location of Proposed Mine Infrastructure
- Direct Disturbance Area
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas
- Tote Road/Proposed Access Road
- Proposed Mine Road


Datum: NAD 83; Projection: UTM Zone 9N

AEG



BMC MINERALS

**KUDZ ZE KAYAH PROJECT**
**MOOSE HABITAT SUITABILITY**

**FIGURE 6-1**

**POST RUT HABITAT SUITABILITY WITHIN LOCAL STUDY AREA AND PROPOSED PROJECT FOOTPRINT**

NOVEMBER 2016

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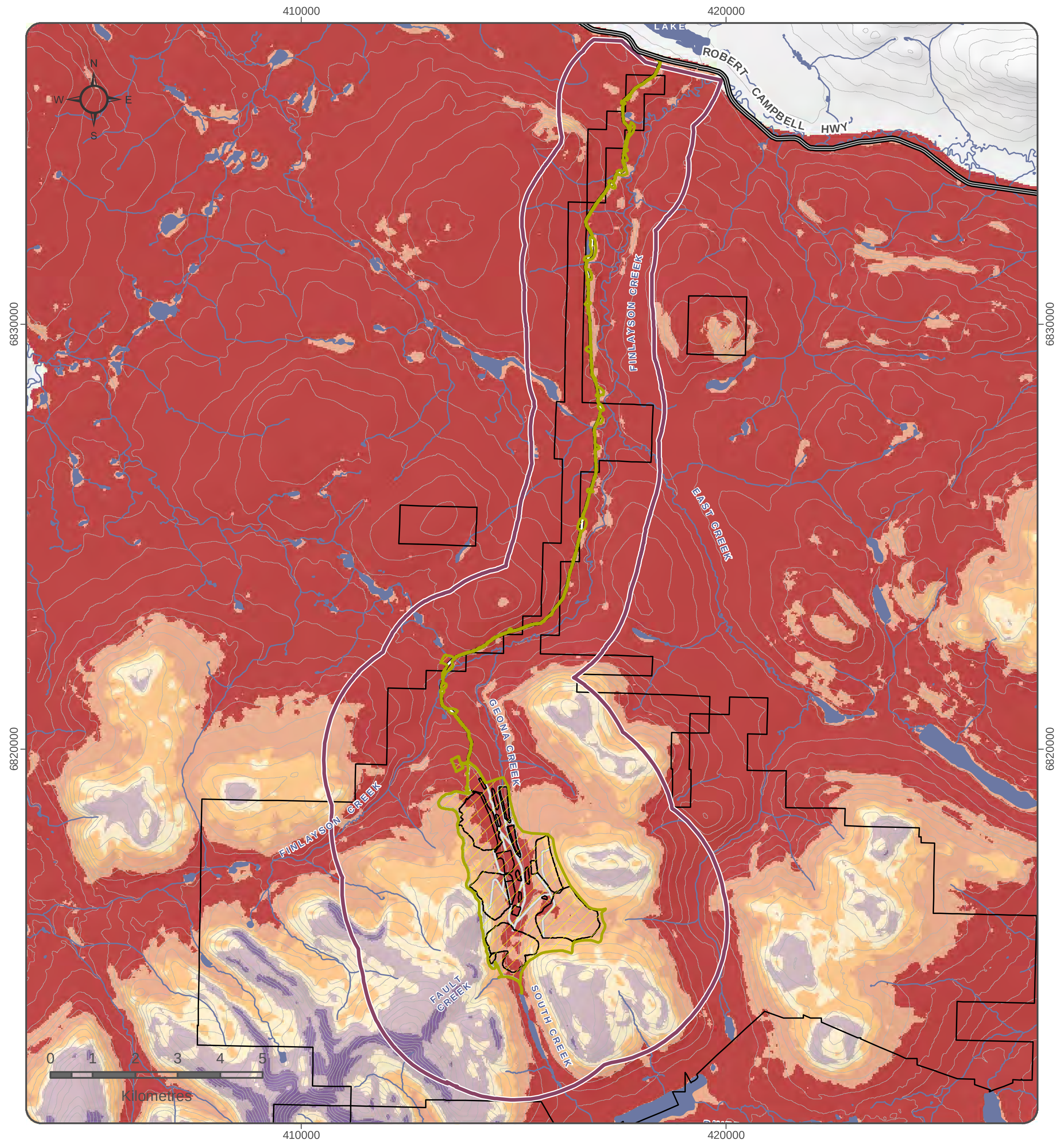


## HABITAT SUITABILITY INDEX

- Nil
- Very Low
- Low
- Moderate
- Moderately High
- High

- Local Study Area
- Location of Proposed Mine Infrastructure
- Direct Disturbance Area
- BMC Minerals (No. 1) Ltd. Mineral Claim Areas
- Tote Road/Proposed Access Road
- Proposed Mine Road

# KUDZ ZE KAYAH PROJECT
# MOOSE HABITAT SUITABILITY

## FIGURE 6-2

## LATE WINTER HABITAT SUITABILITY WITHIN LOCAL STUDY AREA AND PROPOSED PROJECT FOOTPRINT

NOVEMBER 2016


Datum: NAD 83; Projection: UTM Zone 9N

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# 7 Limitations

Data on moose distribution during the post rut and late winter was collected in November/December and March from 2015 to 2016, providing two sets of data for post rut and two sets of data for late winter events. Therefore, the data do not fully reflect variations in weather and snow conditions that occur over several years nor long term climate changes. Nonetheless, the data provided suitable verification for the model and the model can be refined as more data are collected over time.

HSI models are a predictive tool that aim to produce a continuum of preferred habitat for a selected species using available data. The following is a list of limitation associated with the HSI for moose post rut and late winter seasons:

- Physical observation data used to evaluate the model was limited in sample size to 47 post rut locations and 86 late winter locations;
- The HSI is a knowledge-based model that incorporates quantitative data with expert opinion. The model reflects some biases related to expert opinion; and
- The model was constructed using data for animal presence while not taking into consideration absence of animal data.

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# APPENDIX D

## KUDZ ZE KAYAH PROJECT LATE WINTER UNGULATE SURVEY 2015 BY EDI

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# Kudz Ze Kayah Project
# Late WInter Ungulate Survey
# 2015

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15Y0078
April 2015

ENVIRONMENTAL DYNAMICS INC.

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## EXECUTIVE SUMMARY

An aerial survey was completed March 25–27, 2015 to document the late winter distribution of caribou and moose relative to the proposed Kudz Ze Kayah mine project. We observed 31 moose and 19 caribou within the survey area. All ungulate observations were recorded north of the proposed mine site. Moose and caribou were largely detected (observations or tracks) using lower elevation habitats. The survey area includes some higher elevations terrain that has deeper snow and is likely less suitable for moose and caribou during winters. Two wolf packs (6 and 7 wolves/pack) were observed within the survey area. The project's main interaction with caribou and moose during the late winter will be along the access road.

## ACKNOWLEDGEMENTS

The survey was completed with the assistance of Nicole Etzel and Traci Morgan (YG). Their vigilance and patience during the survey was greatly appreciated.

## AUTHORSHIP

This report was prepared by EDI Environmental Dynamics Inc. Staff who contributed to this project include:

Graeme Pelchat, M.Sc., P.Biol ........ Author

Matt Power, AScT. ........ Mapping

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# 1 BACKGROUND

EDI Environmental Dynamics Inc. (EDI) was contracted by BMC Mineral Ltd. (BMC) to conduct a late winter survey for moose and caribou in relation to the proposed Kudz Ze Kayah mining project. The proposed Kudz Ze Kayah mine site is in the Pelly Mountains, approximately 110 km southeast of Ross River (Figure 1). The project site is accessed from a 20 km road that joins the Robert Campbell Highway at the eastern end of Finlayson Lake.

BMC is currently advancing environmental baseline data collection in preparation of a project proposal submission to YESAB. The objective of the late winter survey was to document the spatial distribution of moose and caribou relative to the Kudz Ze Kayah project. The information will be used to inform the project proposal through baseline winter habitat analyses and to further understand the potential project interactions with moose and caribou during the most habitat limited season.

Monitoring the distribution of wildlife, particularly the Finlayson Caribou Herd, near the project area during the late winter will be important as BMC prepares a project proposal submission to YESAB and as the project moves into the development phase. This survey is the first attempt to document moose and caribou distribution at a regional scale in the project area. The 2015 survey is suitable as the initial survey of an ongoing monitoring program. The results can be used to refine future late winter ungulate distribution survey methods.

## 1.1 Study Area

The Kudz Ze Kayah project area includes wildlife species common to the region and the Yukon. Caribou are the highest profile species in the area. The Yukon Government determined that the local herd, the Finlayson Caribou Herd, was threatened by overharvest and predation in the 1980s. Consequently, the government initiated a recovery program that included harvest closure and predator (wolf) control to recover the caribou herd. The program was successful at growing the caribou population in the short-term, but today the herd seems to be returning to the pre-treatment size. The Finlayson Caribou Herd concentrates in a relatively small and accessible area during the winter which increases their vulnerability to unmanaged overharvest. The herd is dispersed throughout high elevation terrain during the non-winter seasons. The Finlayson Caribou Herd is part of the northern mountain population of woodland caribou, which is listed as 'special concern' on schedule 1 of the *Species at Risk Act*. Moose are the most valued subsistence harvest species in central and southern Yukon, and are ubiquitous throughout the region. Thinhorn sheep are the most sought after trophy species in Yukon. Stone sheep, a subspecies of thinhorn sheep, occur in the region. Five wildlife key areas (WKA) for sheep are identified in the area (Figure 1).

# 2 METHODS

## 2.1 Survey Area

The survey area is defined by the Yukon Government's Game Management Area (GMA) 1007. The GMA is appropriate for defining the study area as it represents the scale of wildlife population management in Yukon. Furthermore, moose population estimates/densities are currently available by GMAs providing context for assessing project and cumulative effects on the local and regional moose population. Baseline data on the distribution of moose at the scale of the GMA will be compatible with other available information.

This survey area is a suitable size for describing wildlife that could interact with the project and provide a more regional perspective on wildlife distribution. The survey area provides a reasonable effects monitoring area because all potential direct and indirect project effects will be contained within the area, and it provides a representative sample of regional habitats.

The survey area was gridded into survey blocks with a dimension of 5 minutes longitude by 2 minutes latitude (approximately 4×4 km at the survey latitude) for consistency with Yukon Government late winter survey methods. The survey blocks do not match the GMA boundaries so blocks were included in the survey area if the majority of a block was within the GMA. An additional three blocks were included to reduce edginess of the survey area. The 2015 survey area is 2,063 km² (Figure 2).

## 2.2 Survey Details

The late winter ungulate distribution survey was completed on March 25-27, 2015. The survey was conducted using a Cessna 206 flown at 120–150 km/hr and an elevation of 200–300 m above ground. The aircraft was based out of the Faro airport and six drums of aviation fuel were stored at the Ross River airport for refuelling each day. Refueling in Ross River reduced aircraft ferry time increasing survey efficiency. Surveyors included Martin Hebert (pilot/observer), Nicole Etzel (observer), Traci Morgan (observer), and Graeme Pelchat (navigator/observer).

Survey blocks are used to guide survey intensity, while providing flexibility to fly according to terrain. Each block was sampled four times at 1 km interval if the entire block contained potential ungulate habitat. High elevation terrain was not flown because ungulates in the area do not use these habitats during the late winter (compare Photo 1 and Photo 2).

A total of 14.2 hours was required to survey the area (Table 1), corresponding to an overall survey intensity of 0.41 minutes/km². The real survey intensity through suitable late winter habitat for ungulates is higher than 0.41 minutes/km² as alpine habitats in the southern portion of the study area were not surveyed.

Wildlife observations and tracks, and the flight route were recorded using a handheld GPS. Observation records include the species, number of animals in the group, and when possible age class (adult/calf) and sex of the animals. The distance and direction of animals from the GPS marked waypoint were estimated to correct the spatial location. Only fresh tracks that crossed directly under the flight path were recorded during the survey, tracks observed outside of the flight path were not recorded. The track recording protocol is consistent with methods developed by Environment Yukon for collecting moose track data (Environment Yukon 2011). Track records include species and an estimate of the number of animals in the group; the track categories are one (1), few (2), some (3–5), or many (>5) animals. Furthermore, the habitat types and aspect where recorded for each observation and tracks record.

Incidental wildlife observations were recorded during flights between Ross River and the survey area, and of non-target species during the survey.

**Table 1. Daily summary of survey time required to complete the Kudz Ze Kayah late winter ungulate survey**

| Date | Total survey time (hours) |
|---|---|
| 25 March 2015 | 5.5 |
| 26 March 2015 | 6.2 |
| 27 March 2015 | 2.4 |
| **Total** | **14.2** |

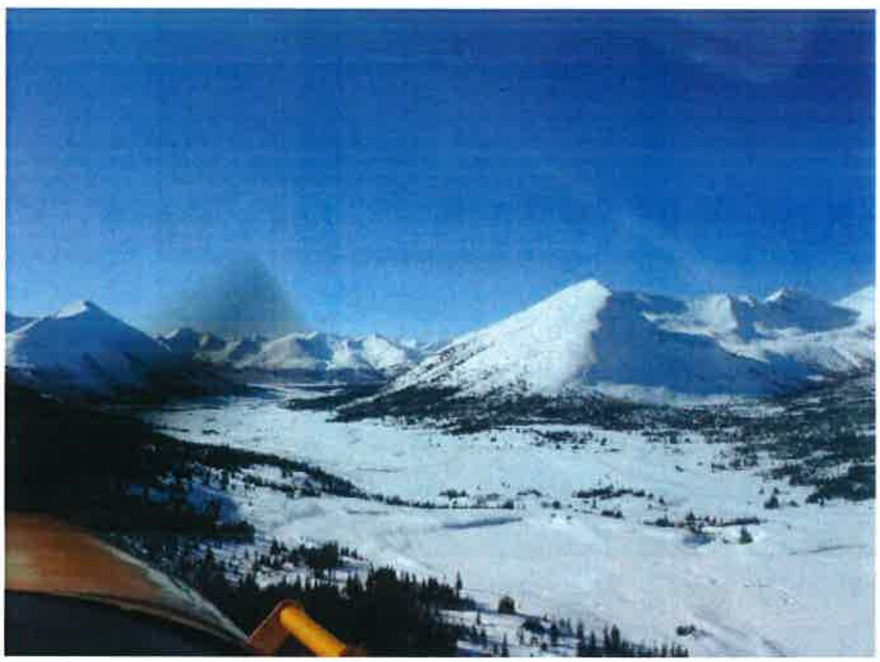


Photo 1. Example of high elevation mountain blocks in the southern portion of the survey area

**Photo 2. Example of low elevation terrain in the northern portion of the survey area**

## 2.3 Survey Conditions

Weather conditions were generally very good during the survey. Visibility and weather was exceptional the first day of the survey so we flew the high elevation terrain to the south of the survey area in case weather deteriorated. Weather deteriorated the following two days as patches of clouds moved in and some wind restricted the flight route at times.

The area received some minor snowfall the 3 days before the start of the survey, which is ideal for identifying fresh tracks. However, warm weather and moderate wind made identifying fresh tracks difficult as tracks were melting and quickly looked old.

# 3 RESULTS AND DISCUSSION

## 3.1 Observations

Moose and caribou were largely detected (observations and tracks) in lower elevation habitats within the survey area; primarily north of the mine site (Figure 3).

All moose observations were north of the project site, though fresh tracks were recorded sparsely scattered throughout the survey area at lower elevations. In total 31 moose were observed during the survey, 5 of the observations were cow/calf pairs. Moose were primarily observed using flat or gently slope terrain close to streams and habitat that contained shrub understory. While all moose observations and most fresh moose tracks were recorded north of the proposed mine site, older tracks were observed throughout lower elevation habitats within survey area indicating that moose use much of the survey area at some point during the winter. Two wolf packs were observed during the survey. Wolf presence can drive other animals out of areas as they attempt to minimize predation risk. The distribution of wolves could explain the presence of older moose tracks but lack of observations south of the proposed mine site.

Caribou observations and tracks were almost exclusively observed in the low elevation habitats north and west of the project site. In total 19 caribou were observed within the survey area. Extensive caribou tracks were observed on lakes and meadows in the northwest portion of the survey area and during transit to Ross River—where about two-thirds of the Finlayson Caribou Herd usually winters (Photo 1; Adamczewski et al. 2010). Fresh caribou tracks from a group of less than 10 animals were observed in the southern extent of the survey area along the Black River. These caribou could be part of the Wolf Lake Herd or are a group of Finlayson caribou isolated from the main part of the herd. These caribou tracks were observed in an open pine stand valley bottom west of a large burn.

Sheep were not observed during the survey. This survey method is not appropriate for finding sheep, so the lack of observations is expected. One old set of tracks that looked like it could be sheep was observed near Fire Lake; however, these could be caribou tracks from early winter.

## 3.2 Incidental observations

Incidental wildlife observations during the late winter survey include:

- Four moose were observed during transit flights between Ross River and the survey area.
- Fourteen caribou were observed during transit flights between Ross River and the survey area.
- At least 4 hunter killed caribou were observed on a lake near Ross River.
- Two wolf packs were observed during the survey (Figure 3). The pack observed March 25 included seven black wolves and was about 10 km west of the proposed mine site (Photo 2).

The pack observed March 26 included 5 black and 1 gray wolves, and was observed about 20 km southeast of the proposed mine site.

- One recent wolf killed moose was observed in the southern portion of the survey area (Figure 3).
- One falcon, presumably a gyrfalcon, was briefly observed in the northwest portion of the survey area.
- A porcupine or wolverine excavation was found. We briefly spotted a medium sized dark animal's hind end as it disappeared under the snow. The hole was near treeline on a south facing slope. There was only one trail to the hole and the tracks seemed more consistent with porcupine tracks (tracks were dragging through the snow); however, a wolverine using the same path multiple times might make a similar track.

**Photo 1. Example of extensive caribou use of lakes northwest of the survey area**

Photo 2. Wolf pack observed 25 March 2015

# 4 SUMMARY AND RECOMMENDATIONS

## 4.1 Summary

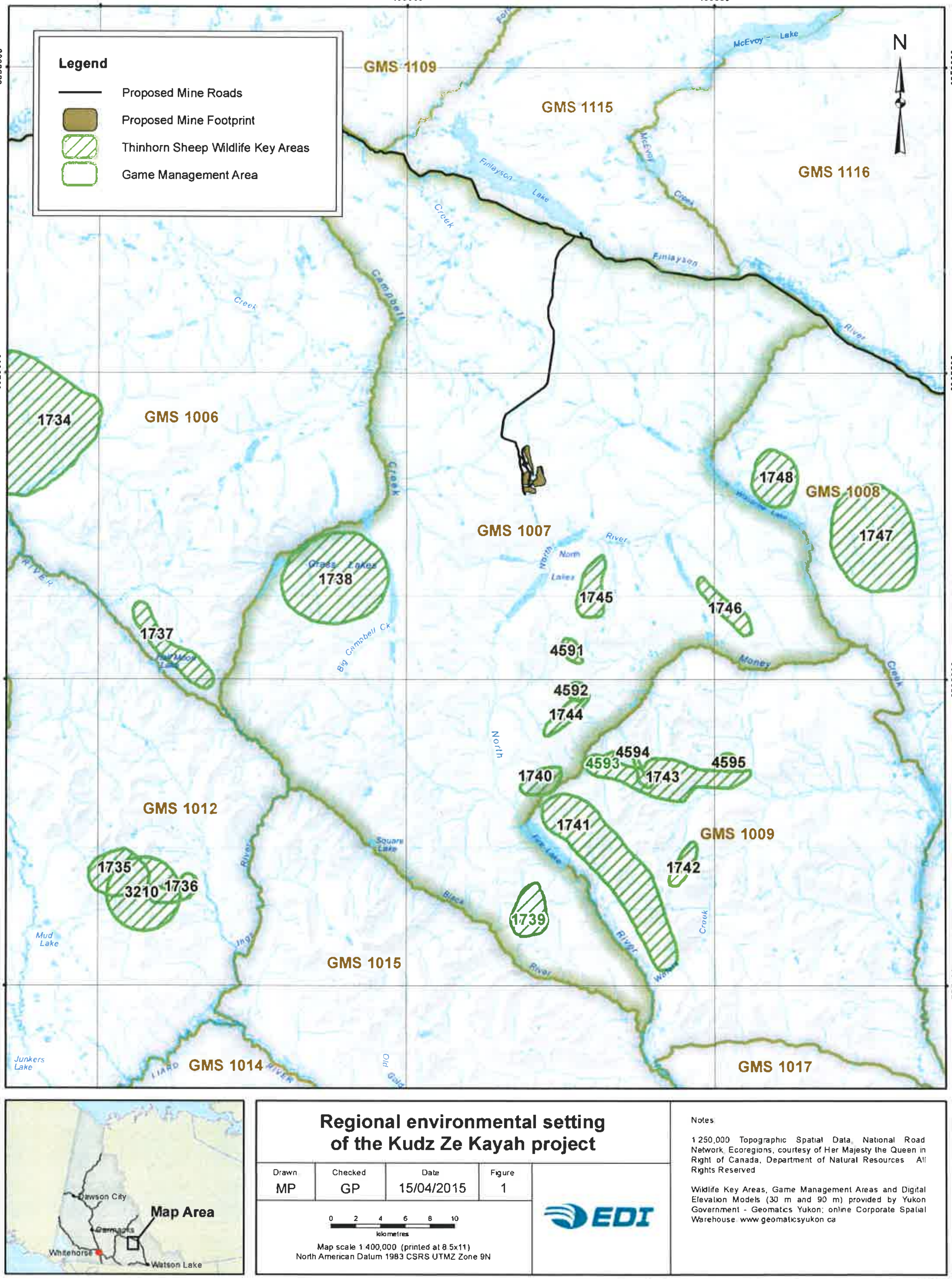
The results of this survey show a clear pattern of moose and caribou late winter distribution in relation to the proposed Kudz Ze Kayah project. The project's main interaction with caribou and moose during the late winter will be along the access road. While there were few fresh tracks at higher elevations (e.g. proposed mine site elevation), older tracks were observed indicating that the project has the potential to interact with ungulates, in particular moose, at the mine site during the late winter.

Snow conditions drive ungulate distribution. While the general perception is that snow depth this year is much less than normal, the 2015 snow conditions in the area are normal according to long-term snow monitoring data (Yukon Government Snow Survey Bulletin 2015). Years with more snowfall will push ungulates away from the proposed mine site into lower elevation habitats.

## 4.2 Recommendations

Options for increasing survey efficiency if BMC chooses to conduct a repeat survey include:

- Base out of Yukon Zinc's Wolverine camp if it is open. This would save up to 6 hours of aircraft time ferrying to refuel.
- Use the Finlayson Lake airstrip for refuelling if it is plowed. This would also cut down on ferry time from Ross River.
- The survey as it was completed in 2015 required 7 drums of aviation fuel—one more than was purchased.




## Regional environmental setting of the Kudz Ze Kayah project

| Drawn | Checked | Date | Figure |
|---|---|---|---|
| MP | GP | 15/04/2015 | 1 |

0 2 4 6 8 10 kilometres

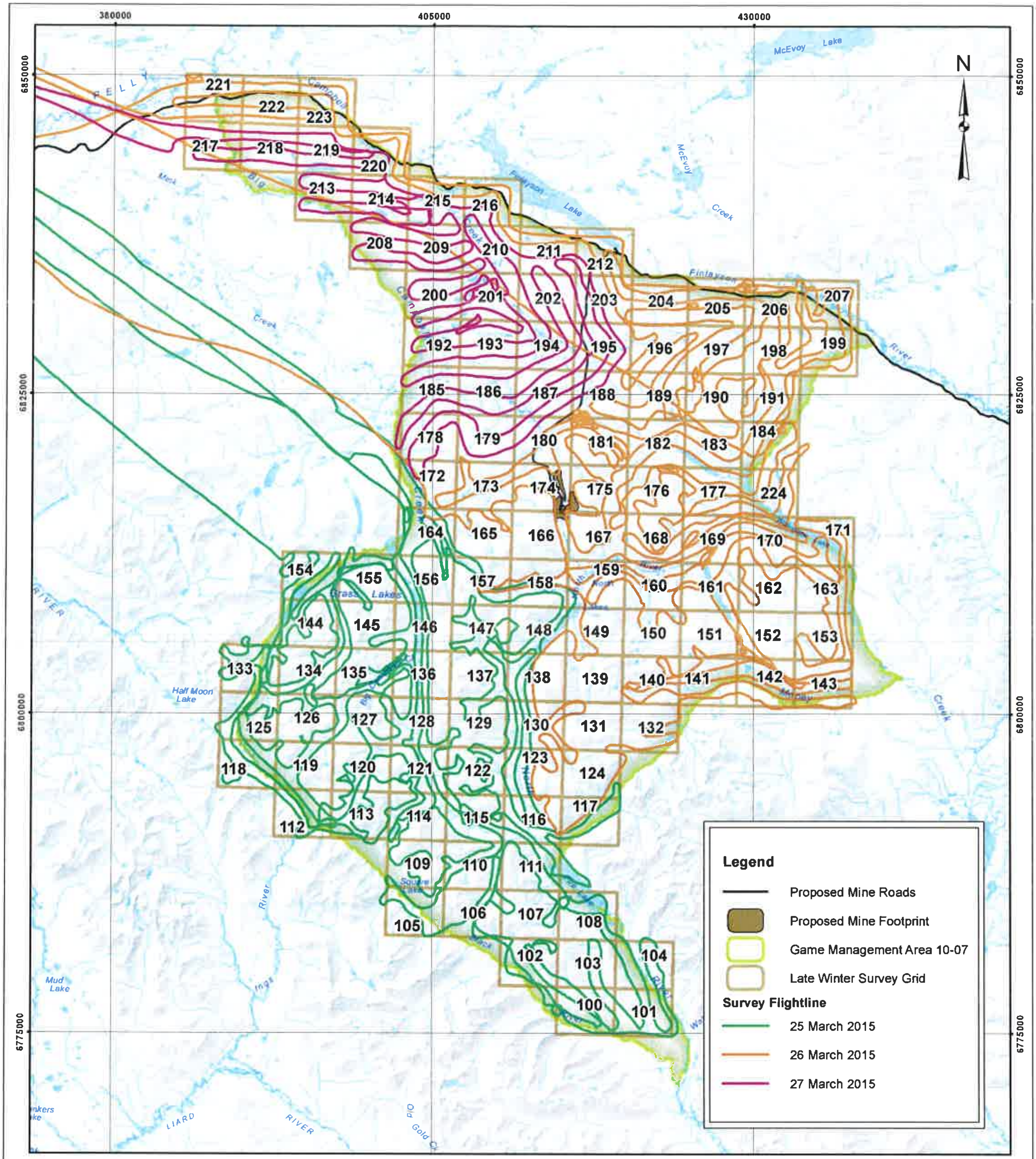
Map scale 1:400,000 (printed at 8.5x11)
North American Datum 1983 CSRS UTMZ Zone 9N

EDI

Notes:

1:250,000 Topographic Spatial Data, National Road Network, Ecoregions, courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved

Wildlife Key Areas, Game Management Areas and Digital Elevation Models (30 m and 90 m) provided by Yukon Government - Geomatics Yukon; online Corporate Spatial Warehouse: www.geomaticsyukon.ca





## Late winter survey area and flightlines

| Drawn | Checked | Date | Figure: |
|---|---|---|---|
| MP | GP | 15/04/2015 | 2 |

0 2 4 6 8 10
Kilometres

Map scale 1:400,000 (printed at 8.5x11)
North American Datum 1983 CSRS UTMZ Zone 9N

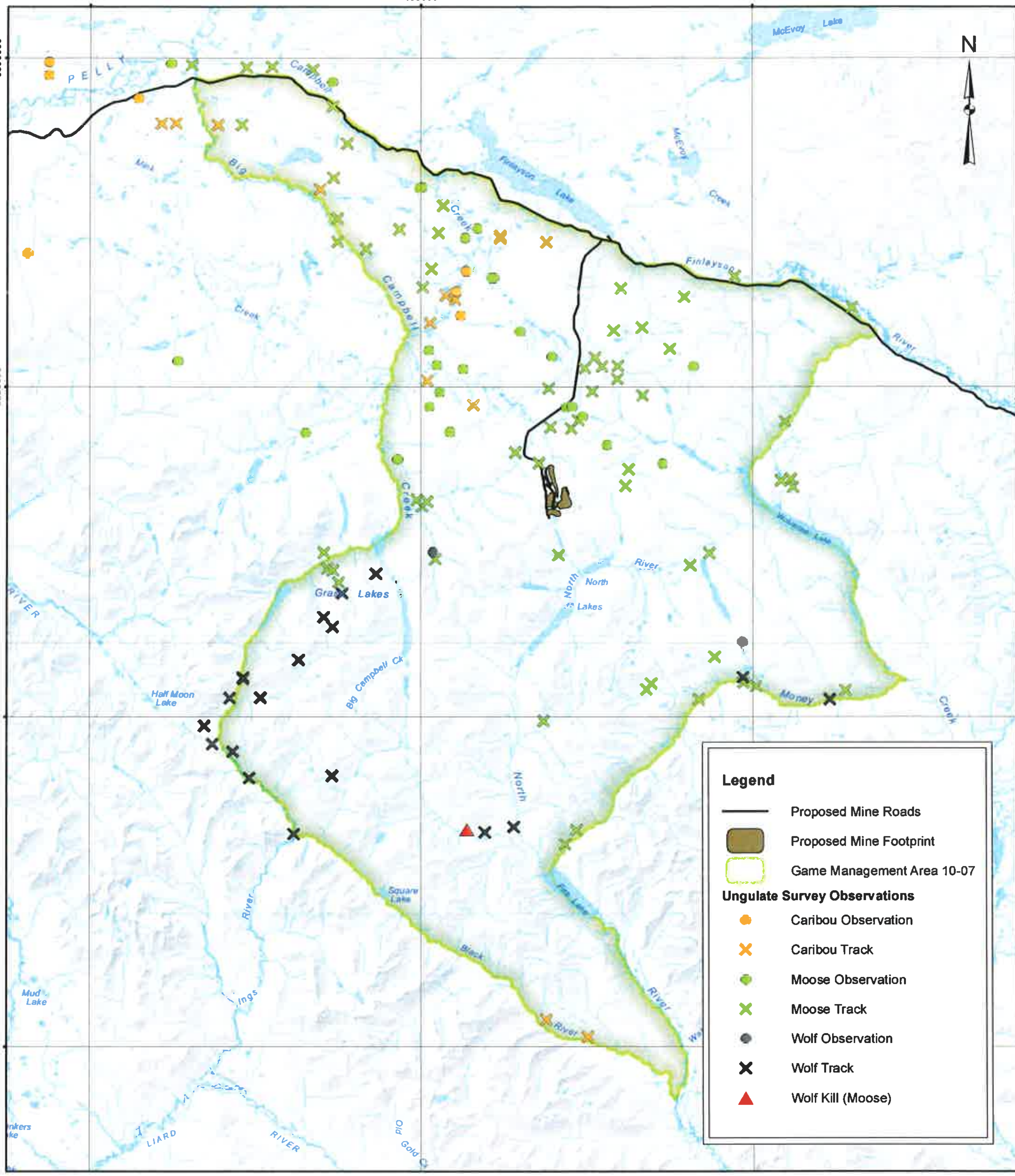
EDI

Notes:

1:250,000 Topographic Spatial Data, National Road Network, Ecoregions; courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved

Project survey data was collected by EDI Environmental Dynamics Inc. (March, 2015)

Digital Elevation Models (30 m and 90 m) provided by Yukon Government - Geomatics Yukon; online Corporate Spatial Warehouse www.geomaticsyukon.ca





## Late winter survey wildlife observations

| Drawn | Checked | Date: | Figure: |
|---|---|---|---|
| MP | GP | 15/04/2015 | 3 |

0 2 4 6 8 10
Kilometres

Map scale 1:400,000 (printed at 8.5x11)
North American Datum 1983 CSRS UTMZ Zone 9N

EDI

Notes

1:250,000 Topographic Spatial Data, National Road Network, Ecoregions; courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved

Project survey data was collected by EDI Environmental Dynamics Inc (March, 2015)

Digital Elevation Models (30 m and 90 m) provided by Yukon Government - Geomatics Yukon; online Corporate Spatial Warehouse www.geomaticsyukon.ca

Path: J:\Yukon\Projects 2015\15Y0078_BMC_UngulateSurvey\Mapping\Final_Mapping\Fig3_SurveyObs_15Apr2015_MP.mxd

# 5 REFERENCES

Adamczewski, J., R. Florkiewicz, R. Farnell, C. Foster, and K. Egli. 2010. Finlayson caribou herd late-winter population survey, 2007. Yukon Fish and Wildlife Branch Report SR-10-01. Whitehorse, Yukon, Canada.

Environment Yukon. 2011. Collecting track data during early and late winter moose surveys. Government of Yukon, Fish and Wildlife Branch. 2 pp.

Environment Yukon. 2015. Yukon Snow Survey Bulletin and Water Supply Forecast, 1 March 2015. Government of Yukon, Water Resources Branch. 28 pp.

# APPENDIX E

## BIRDER'S CHECKLIST FOR FARO AND ROSS RIVER REGION

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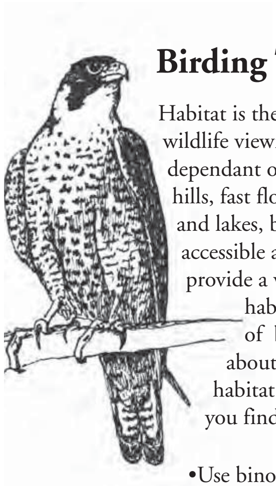
## Birding Tips



Habitat is the key to successful wildlife viewing. Wildlife is dependant on habitat. The rolling hills, fast flowing creeks, wetlands and lakes, broad river bottom, accessible alpine areas and cliffs provide a wide range of natural habitats for a great variety of birds. Learning more about the species' habits and habitat requirements will help you find them.

- Use binoculars, spotting scopes and telephoto lenses. By doing so you will get a more detailed look or a better photo without disturbing the birds.
- You may find what appears to be an 'orphaned' bird; leave young birds where you find them. The parents are most certainly nearby, waiting for you to move away before returning for their offspring.
- A bird that displays odd behaviour or calls and flies over your head is likely a parent requesting that you move on, carefully. Many birds nest on the ground and are vulnerable to trampling. Remember, a closer look could alert nest predators to the nest's location. Please do not break or remove vegetation for a better photo.

*This checklist was produced with assistance from the* Canadian Wildlife Service Birds of Yukon database *and the* Yukon Bird Club.

A Birder's Checklist of the Faro & Ross River Region
ISBN 1-55362-139-5

YUKON WILD

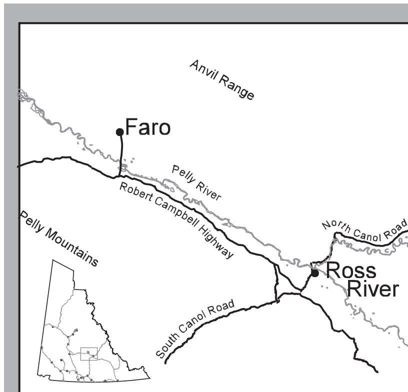
# A Birder's Checklist

of the

FARO & ROSS RIVER REGION

Yukon
Environment

2003




The Campbell Region lies in south central Yukon and contains the Village of Ross River and the Town of Faro. Bisected by the Tintina Trench, North America's largest fault, the area is one of the best locations to observe bird migration in Yukon. This long valley acts as a giant flyway, funnelling birds between southern and northern regions.

## How You Can Help

In order to improve and revise this checklist we need the help of people like you! This checklist is a first attempt to summarize the expected species in the area. Of the territory's 279 know bird species (60 of which are casual or accidental) 160 have been found or are expected to be found in the area. If you find any birds described as rare, casual, or not recorded on this checklist, please report them along with complete field observation notes to:

**Wildlife Viewing Program**
Department of Environment
P.O. Box 2703
Whitehorse, Yukon, Y1A 2C6
(867) 667-8291

**Pass this list along to someone else!**

## The Seasons

Yukon bird migrations do not necessarily correspond with our calendar. Their seasons are described as:

**SP**RING (March 1 - May 31)
**SU**MMER (June 1 - July 31)
**AU**TUMN (August 1 - November 30)
**W**INTER (December 1 - February 28)

## The Symbols

**C** - ***Common*** - usually present and expected in suitable habitat
**U** - ***Uncommon*** - often present in suitable habitat but not regularly observed
**R** - ***Rare*** - observed annually, but infrequently encountered
**X** - ***Casual/Accidental*** - not observed annually; species beyond its normal range
***** - ***Confirmed Breeder***

Lower case symbols are expected species without confirmed sightings.

## Dedicated to Con Carlson

Much of the knowledge of birds of the region is due to careful observations by the late Con Carlson.

Con was, at first glance, an unlikely birder. A bearded, burly man, he worked for many years in Faro at the mine assay lab, as a mechanic and finally for the Yukon Government operating equipment. He was never without his well-worn binoculars, and documented the reliability of the Sandhill Crane migration dates along the Tintina Trench.

With his dog Quint, he enjoyed the fall hunt both for upland game birds and waterfowl. One day he was amazed to have a Gray Jay swoop into his cabin pursued closely by a goshawk. He managed to get the hawk out of the cabin and it made for a lively story as only he could tell.

*Mary Whitley*

| SPECIES | SEASONS | | | |
|---|---|---|---|---|
| | SP | SU | A | W |
| Red-throated Loon | r | | r | |
| Pacific Loon* | C | C | C | |
| Common Loon* | U | C | u | |
| Horned Grebe* | C | C | C | |
| Red-necked Grebe* | u | C | u | |
| Tundra Swan | C | | c | |
| Trumpeter Swan | C | r | c | |
| Greater White-fronted Goose | u | | U | |
| Snow Goose | r | | r | |
| Canada Goose | C | C | C | |
| American Wigeon* | C | C | C | |
| Mallard* | C | C | C | |
| Blue-winged Teal | R | R | | |
| Northern Shoveler* | C | C | c | |
| Northern Pintail | C | C | c | |
| Green-winged Teal | C | C | c | |
| Canvasback | U | R | r | |
| Redhead | U | r | r | |
| Ring-necked Duck* | U | C | u | |
| Greater Scaup | u | U | u | |
| Lesser Scaup* | C | C | C | |
| Harlequin Duck* | R | R | R | |
| Surf Scoter | U | U | u | |
| White-winged Scoter | U | C | U | |
| Oldsquaw | U | R | u | |
| Bufflehead* | C | C | C | |
| Common Goldeneye | U | U | u | |
| Barrow's Goldeneye* | C | C | C | |
| Hooded Merganser | X | | | |
| Red-breasted Merganser* | U | u | U | |
| Common Merganser | U | U | U | |
| Ruddy Duck | r | R | r | |
| Osprey* | r | U | u | |
| Bald Eagle* | C | C | U | |
| Northern Harrier | U | u | u | |
| Sharp-shinned Hawk | R | R | r | |
| Northern Goshawk | U | U | U | r |
| Red-tailed Hawk | U | U | U | |
| Rough-legged Hawk | r | | r | |
| Golden Eagle | U | U | U | |
| American Kestrel | U | U | U | |
| Merlin | r | R | R | |

| SPECIES | SEASONS | | | |
|---|---|---|---|---|
| | SP | SU | A | W |
| Peregrine Falcon | R | r | R | |
| Gyrfalcon | R | r | R | r |
| Ruffed Grouse | C | c | c | c |
| Spruce Grouse* | C | C | C | c |
| Blue Grouse | u | U | u | u |
| Willow Ptarmigan | r | r | R | R |
| Rock Ptarmigan | U | U | u | u |
| White-tailed Ptarmigan | r | r | R | r |
| Sharp-tailed Grouse | R | r | r | r |
| Sora | U | U | r | |
| American Coot* | u | U | r | |
| Sandhill Crane | C | | C | |
| Black-bellied Plover | r | | r | |
| American Golden Plover | R | r | r | |
| Semipalmated Plover* | u | U | u | |
| Killdeer | u | u | u | |
| Lesser Yellowlegs* | C | C | c | |
| Solitary Sandpiper | c | U | u | |
| Wandering Tattler | R | r | r | |
| Spotted Sandpiper* | C | C | c | |
| Upland Sandpiper | r | | | |
| Whimbrel | R | | | |
| Hudsonian Godwit | r | | | |
| Sanderling | r | | | |
| Semipalmated Sandpiper | u | X | r | |
| Western Sandpiper | r | | | |
| Least Sandpiper | u | U | u | |
| Baird's Sandpiper | R | | R | |
| Pectoral Sandpiper | U | | r | |
| Long-billed Dowitcher | r | X | r | |
| Common Snipe | C | C | C | |
| Red-necked Phalarope | U | U | u | |
| Red Phalarope | r | | | |
| Bonaparte's Gull* | U | C | u | |
| Mew Gull | C | C | c | |
| Herring Gull | C | C | c | |
| Glaucous Gull | X | | | |
| Arctic Tern | C | C | u | |
| Rock Dove | X | | | X |
| Mourning Dove | | X | | |

| SPECIES | SEASONS | | | |
|---|---|---|---|---|
| | SP | SU | A | W |
| Common Nighthawk | r | C | u | |
| Rufous Hummingbird | | X | | |
| Belted Kingfisher | U | C | u | |
| Great Horned Owl | u | U | U | u |
| Snowy Owl | X | | X | |
| Northern Hawk- Owl | r | | r | r |
| Great Gray Owl | R | r | r | r |
| Short-eared Owl | r | | R | |
| Boreal Owl | U | u | r | r |
| Downy Woodpecker | R | r | R | r |
| Hairy Woodpecker | u | U | u | r |
| Three-toed Woodpecker* | U | U | U | U |
| Black-backed Woodpecker | X | | | |
| Northern Flicker* | C | C | c | |
| Pileated Woodpecker | | X | | |
| Olive-sided Flycatcher | u | C | u | |
| Western Wood-Pewee | U | C | u | |
| Alder Flycatcher | c | C | u | |
| Least Flycatcher | r | U | r | |
| Hammond's Flycatcher | r | R | r | |
| Say's Phoebe | U | U | u | |
| Northern Strike | U | U | U | |
| Warbling Vireo | | X | | |
| Gray Jay | U | C | C | C |
| Black-billed Magpie | X | | | X |
| Common Raven* | C | C | C | C |
| Horned Lark | U | U | u | |
| Tree Swallow | C | C | r | |
| Violet-green Swallow* | C | C | U | |
| Bank Swallow* | C | C | U | |
| Cliff Swallow* | C | C | U | |
| Barn Swallow | u | U | r | |
| Black-capped Chickadee | C | C | C | C |
| Boreal Chickadee | C | C | C | C |
| Red-breasted Nuthatch | R | r | R | r |
| American Dipper | U | u | u | U |
| Ruby-crowned Kinglet | C | C | C | |

| SPECIES | SEASONS | | | |
|---|---|---|---|---|
| | SP | SU | A | W |
| Mountain Bluebird | U | U | R | |
| Townsend's Solitaire* | U | U | u | |
| Gray-cheeked Thrush | u | U | r | |
| Swainson's Thrush | C | C | u | |
| Hermit Thrush | C | C | u | |
| American Robin | C | C | c | |
| Varied Thrush | U | U | u | |
| American Pipit | C | U | C | |
| Bohemian Waxwing | U | C | u | r |
| Tennessee Warbler | r | R | r | |
| Orange-crowned Warbler* | U | C | U | |
| Yellow Warbler* | C | C | c | |
| Yellow-rumped Warbler | C | C | C | |
| Townsend's Warbler | | R | | |
| Blackpoll Warbler | U | U | u | |
| Northern Waterthrush | U | U | r | |
| Common Yellowthroat* | u | C | u | |
| Wilson's Warbler | C | C | c | |
| Western Tanager | | X | | |
| American Tree Sparrow | U | R | U | |
| Chipping Sparrow* | U | C | r | |
| Savannah Sparrow | C | C | u | |
| Fox Sparrow | U | U | u | |
| Lincoln's Sparrow | c | C | c | |
| White-crowned Sparrow | C | C | c | |
| Golden-crowned Sparrow | U | U | u | |
| Dark-eyed Junco* | C | C | C | r |
| Lapland Longspur | C | R | u | |
| Snow Bunting | U | | U | |
| Red-winged Blackbird* | U | C | u | |
| Rusty Blackbird* | C | C | C | |
| Brown-headed Cowbird | R | R | R | |
| Gray-crowned Rosy Finch | U | U | U | X |
| Pine Grosbeak | u | U | U | u |
| Purple Finch | X | | | |
| Red Crossbill | u | u | u | r |
| White-winged Crossbill | c | C | C | u |
| Common Redpoll | C | r | C | C |
| Hoary Redpoll | r | | r | r |
| Pine Siskin | u | C | c | |
| Evening Grosbeak | | X | | |

# APPENDIX F

## LIST OF BIRDS OBSERVED DURING BREEDING BIRD SURVEY 2015 AND 2016

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Bird Survey Results June 2015 Kudz Ze Kayah Site

| **Wpt** | 188 | 189 | 190 | 191 | BB-7 | Riparian TOTAL Ind | 192 | 193 | 195 | 196 | 198 | 199 | BB-8 | BB-5 | Mixed open Sub-alpine forest TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Site name** | BB_1 | BB_2 | BB_14 | BB_4 | BB-7 | | BB_15 | BB_6 | BB_16 | BB_9 | BB_12 | BB_13 | BB-8 | BB-5 | |
| **Habitat** | Riparian | Riparian | Riparian | Riparian | Riparian | | Sub-alpine f. | Sub-alpine f. | Sub-alpine f. | Sub-alpine f. | Sub-alpine f. | Sub-alpine f. | Sub-alpine f. | Sub-alpine f. | |
| **Elevation** | 1320m | 1330m | 1360m | 1360m | 1360m | | 1420m | 1450m | 1400m | 1400m | 1390m | 1410m | 1490m | 1530m | |
| **Date** | 23-Jun-15 | 23-Jun-15 | 23-Jun-15 | 23-Jun-15 | 23-Jun-15 | | 23-Jun-15 | 23-Jun-15 | 23-Jun-15 | 23-Jun-15 | 23-Jun-15 | 23-Jun-15 | 23-Jun-15 | 23-Jun-15 | |
| **Time** | 6:20 AM | 6:56 AM | 7:25 AM | 7:43 AM | 9:46 AM | | 8:20 AM | 9:00 AM | 9:32 AM | 9:37 AM | 9:53 AM | 9:55 AM | 7:53 AM | 6:51 AM | |
| Scaup sp. | | | | | | 0 | | | | | | | | | 0 |
| Barrow's Goldeneye | | | | | | 0 | | | | | | | | | 0 |
| Goldeneye sp. | | | 1 | | | 1 | | | | | | | | | 0 |
| Trumpeter Swan | | | | | | 0 | | | | | | | | | 0 |
| Spruce Grouse | | | | | | 0 | 1 | | | | | | | | 1 |
| Willow Ptarmigan | | | | | | 0 | | | | 1 | | | | | 1 |
| Common Loon | | | | | | 0 | | | | | | | | | 0 |
| Northern Harrier | | 1 | | | | 1 | | | | | | | | | 0 |
| Solitary Sandpiper | | | | 1 | | 1 | | | | | | | | | 0 |
| Spotted Sandpiper | | | | | | 0 | | | | | | | | | 0 |
| Semi-palmated plover | | | | | (1)* | (1)* | | | | | | | | | 0 |
| Red-necked Phalarope | | | | | | 0 | | | | | | | | | 0 |
| Lesser Yellowlegs | | | | | | 0 | | | | | 1 | | | | 1 |
| Mew Gull | | | | | | 0 | | | | | | | | | 0 |
| Olive-sided Flycatcher | 1 | | | 1 | | 2 | | | | | | | | 1 | 1 |
| Alder Flycatcher | | 1 | 1 | 1 | | 3 | | | | | 2 | 1 | 1 | | 4 |
| Say's Phoebe | | | | | | 0 | | | | | | | | | 0 |
| Northern Shrike | | 1 | | | | 1 | | | | 1 | 1 | | | | 2 |
| Gray Jay | | | | | | 0 | | | | | 1 | | 1 | | 2 |
| Horned Lark | | | | | | 0 | | | | | | | | | 0 |
| Violet-green Swallow | | | | | | 0 | | | | | | | | | 0 |
| Black-capped Chickadee | | | | | | 0 | | | | | | | 1 | 1 | 2 |
| Ruby-crowned Kinglet | | | | | | 0 | 1 | 1 | | | | | 1 | 1 | 4 |
| American Robin | | 1 | 1 | | | 2 | | 1 | | | | 2 | | 1 | 4 |
| Gray-cheeked Thrush | | | | | | 0 | 1 | 1 | | | 1 | 1 | | 1 | 5 |
| Northern Watertrush | 1 | 1 | | | | 2 | | | | | | | | | 0 |
| Yellow Warbler | | 1 | 1 | | | 2 | | | 1 | | 2 | 2 | | 1 | 6 |
| Yellow-rumped Warbler | | | | | 2 | 2 | 1 | | 1 | | | | | | 2 |
| Blackpoll Warbler | | | | 2 | | 2 | | 1 | 1 | | | 1 | | | 3 |
| Common Yellowthroat | 1 | | | | | 1 | | | | | | | | | 0 |
| Wilson's Warbler | 2 | 1 | 1 | 1 | | 5 | 2 | | 2 | | 2 | 1 | 1 | 1 | 9 |
| Tennessee Warbler | | 1 | | | | 1 | | | | | | | | | 0 |
| American tree Sparrow | 3 | 1 | 1 | 2 | 1 | 8 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 7 |
| Chipping Sparrow | | | | | | 0 | 1 | | | | | | | | 1 |
| Savannah Sparrow | | | | | | 0 | | | | | | | 1 | | 1 |
| Fox Sparrow | | | | | | 0 | | | 1 | | 1 | | | | 2 |
| Lincoln's Sparrow | | | 1 | 1 | 1 | 3 | | | | | 1 | | | | 1 |
| White-crowned Sparrow | 3 | 3 | 2 | 3 | 2 | 13 | 2 | | 2 | | 2 | 3 | 2 | 2 | 13 |
| Golden-crown Sparrow | | | | | | 0 | | 1 | 1 | | | 1 | | | 3 |
| Slate-colour Junco | 1 | 1 | | | | 2 | 1 | 1 | | | 1 | | | 1 | 4 |
| Red-winged Balckbird | | | | | | 0 | | | | | | | | | 0 |
| Rusty Blackbird | | | | | | 0 | | | | | | | | | 0 |
| Common Redpoll | | | | 1 | | 1 | 2 | | | | | | | | 2 |
| **TOTAL SPECIES** | 7 | 11 | 8 | 9 | 4 | 19 (+1)* | 10 | 7 | 8 | 2 | 12 | 9 | 8 | 10 | 24 |

* 1 semipalmated plover seen near BB7, not at exact site.

Species in red are of conservation concern.

Bird Survey Results June 2015 Kudz Ze Kayah Site

| Wpt | BB-3 | BB-10 | BB-11 | | | ABR-1 | 202 | ABR-3 | 203 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Site name** | BB-3 | BB-10 | BB-11 | | | ABR-1 | ABR-4 | ABR-3 | ABR-2 | | |
| **Habitat** | Alpine | Alpine | Alpine Wet | | | Wetland | Wetland/ Riparian | Wetland/ Riparian | Wetland/ Riparian | | |
| **Elevation** | 1550 | 1520 | 1510 | | | - | | | | | |
| **Date** | 24-Jun-15 | 23-Jun-15 | 23-Jun-15 | | | 23-Jun-15 | 24-Jun-15 | 24-Jun-15 | 24-Jun-15 | | |
| **Time** | 6:56 AM | 10:41 AM | 8:55 AM | Alpine TOTAL Ind | Footprint TOTAL Ind | 10:31 AM | 5:56 AM | 6:10 AM | 6:33 AM | Wetland TOTAL Ind | Footprint + Wetland TOTAL Ind |
| Scaup sp. | | | | 0 | 0 | 2 | | | 33 | 35 | 35 |
| Barrow's Goldeneye | | | | 0 | 0 | | | | | 0 | 0 |
| Goldeneye sp. | | | | 0 | 1 | | | | | 0 | 1 |
| Trumpeter Swan | | | | 0 | 0 | | | | | 0 | 0 |
| Spruce Grouse | | | | 0 | 1 | | | | | 0 | 1 |
| Willow Ptarmigan | 1 | | | 1 | 2 | 1 | | | | 1 | 3 |
| Common Loon | | | | 0 | 0 | | 3 | | | 3 | 3 |
| Northern Harrier | | | | 0 | 1 | | | | | 0 | 1 |
| Solitary Sandpiper | | | | 0 | 1 | | | | | 0 | 1 |
| Spotted Sandpiper | | | | 0 | 0 | 2 | | 1 | | 3 | 3 |
| Semi-palmated plover | | | | 0 | (1)* | | | | | 0 | (1)* |
| Red-necked Phalarope | | | | 0 | 0 | | | | | 0 | 0 |
| Lesser Yellowlegs | | | | 0 | 1 | | | 1 | 1 | 2 | 3 |
| Mew Gull | | | | 0 | 0 | | | 1 | | 1 | 1 |
| Olive-sided Flycatcher | | | | 0 | 3 | 1 | | 1 | | 2 | 5 |
| Alder Flycatcher | | | 1 | 1 | 8 | | | | 1 | 1 | 9 |
| Say's Phoebe | | | | 0 | 0 | | | | | 0 | 0 |
| Northern Shrike | | | | 0 | 3 | | | | | 0 | 3 |
| Gray Jay | | | | 0 | 2 | | | | | 0 | 2 |
| Horned Lark | 1 | | | 1 | 1 | | | | | 0 | 1 |
| Violet-green Swallow | | | | 0 | 0 | | | | | 0 | 0 |
| Black-capped Chickadee | | | | 0 | 2 | | | | | 0 | 2 |
| Ruby-crowned Kinglet | | | | 0 | 4 | | | | | 0 | 4 |
| American Robin | 1 | | | 1 | 7 | | | | | 0 | 7 |
| Gray-cheeked Thrush | | | | 0 | 5 | | | | | 0 | 5 |
| Northern Watertrush | | | | 0 | 2 | | | | | 0 | 2 |
| Yellow Warbler | | | | 0 | 8 | 1 | 2 | 1 | 2 | 6 | 14 |
| Yellow-rumped Warbler | | | | 0 | 4 | | | | | 0 | 4 |
| Blackpoll Warbler | | | | 0 | 5 | | | | | 0 | 5 |
| Common Yellowthroat | | | | 0 | 1 | | 1 | 1 | 1 | 3 | 4 |
| Wilson’s Warbler | | 1 | 2 | 3 | 17 | 1 | 2 | 1 | 2 | 6 | 23 |
| Tennessee Warbler | | | | 0 | 1 | | | | | 0 | 1 |
| American tree Sparrow | 1 | 1 | | 2 | 17 | 2 | 1 | 4 | 2 | 9 | 26 |
| Chipping Sparrow | | | | 0 | 1 | | | | | 0 | 1 |
| Savannah Sparrow | 1 | 1 | 1 | 3 | 4 | | | | | 0 | 4 |
| Fox Sparrow | | | | 0 | 2 | | | 1 | | 1 | 3 |
| Lincoln’s Sparrow | | 1 | 1 | 2 | 6 | 1 | 1 | 1 | 1 | 4 | 10 |
| White-crowned Sparrow | | | 2 | 2 | 28 | | 3 | 1 | | 4 | 32 |
| Golden-crown Sparrow | 2 | 2 | | 4 | 7 | | | | 1 | 1 | 8 |
| Slate-colour Junco | | | | 0 | 6 | | | | 1 | 1 | 7 |
| Red-winged Balckbird | | | | 0 | 0 | | | | | 0 | 0 |
| Rusty Blackbird | | | | 0 | 0 | | | | | 0 | 0 |
| Common Redpoll | | | | 0 | 3 | | | | | 0 | 3 |
| **TOTAL SPECIES** | 6 | 5 | 5 | 10 | 31 (+1)* | 8 | 7 | 11 | 10 | 17 | 35 (+1)* |

* 1 semipalmated plover seen near BB7, not at exact site.

Species in red are of conservation concern.

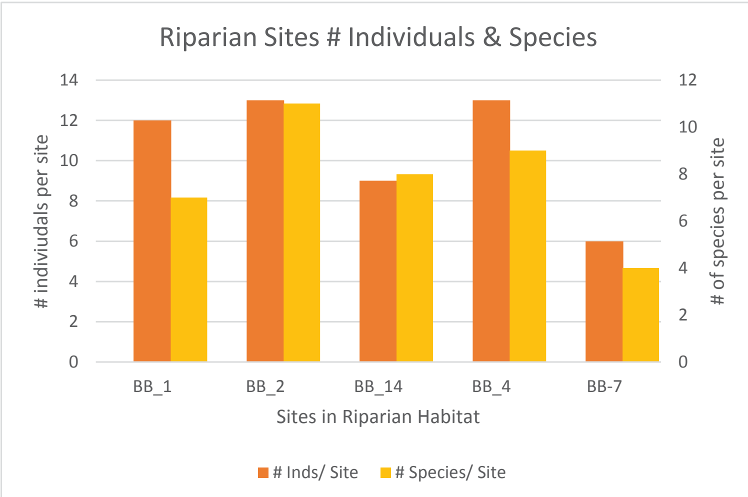
Bird Survey Results June 2015 Kudz Ze Kayah Site

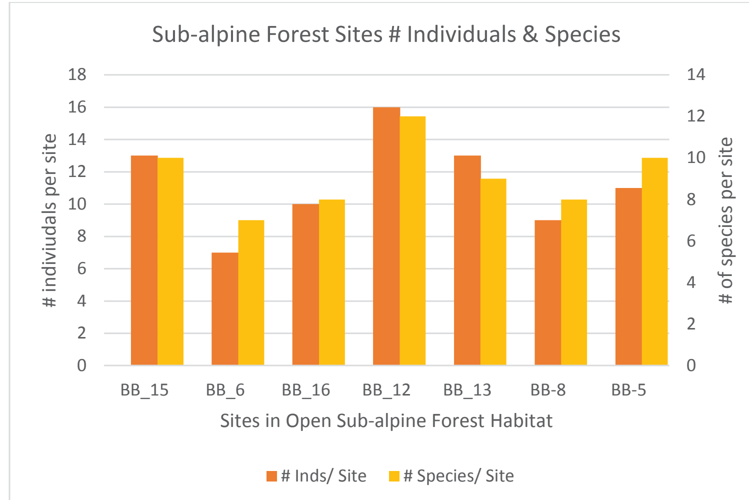
| Wpt | 200 | 206 | RS-4 | RS-1 | 208 | 209 | 210 | Road Sites TOTAL Ind | Footprint + Wetland + Road Sites TOTAL Ind | REF6 | 205 | Reference Site TOTAL Ind | ALL SITES TOTAL Ind |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Site name** | RS-3 | RS-5 | RS-4 | RS-1 | RS-6 | RS-7 | RS-2 | | | REF 1 | REF 2 | | |
| **Habitat** | Lowland forest | Riparian/ Lowland f | Riparian/ Lowland f | Wetland approx | Wetland/ creek | Wetland/ creek | Lowland forest | | | Wetland/ | Wetland/ | | |
| **Elevation** | 1120m | 1280m | 1260m | 30m from road | approx. 1ha | flooding road | | | | Riparian | Riparian | | |
| **Date** | 23-Jun-15 | 24-Jun-15 | 24-Jun-15 | 24-Jun-15 | 24-Jun-15 | 24-Jun-15 | 24-Jun-15 | | | 24-Jun-15 | 24-Jun-15 | | |
| **Time** | 12:05 PM | 9:10 AM | 9:30 AM | 10:20 AM | 10:37 AM | 10:34 AM | 10:39 AM | | | 5:30 AM | 7:10 AM | | |
| Scaup sp. | | | | | | | | 0 | 35 | 2 | 13 | 15 | 50 |
| Barrow's Goldeneye | | | | 1 | | | 2 | 3 | 3 | | | 0 | 3 |
| Goldeneye sp. | | | | | | | | 0 | 1 | | | 0 | 1 |
| Trumpeter Swan | | | | | | | | 0 | 0 | | 4 | 4 | 4 |
| Spruce Grouse | | | | | | | | 0 | 1 | | | 0 | 1 |
| Willow Ptarmigan | | | | | | | | 0 | 3 | | | 0 | 3 |
| Common Loon | | | | | | | | 0 | 3 | | | 0 | 3 |
| Northern Harrier | | | | | | | | 0 | 1 | | | 0 | 1 |
| Solitary Sandpiper | | | | | | | | 0 | 1 | | | 0 | 1 |
| Spotted Sandpiper | | | | | | | 1 | 1 | 4 | | | 0 | 4 |
| Semi-palmated plover | | | | | | | | 0 | (1)* | | | 0 | (1)* |
| Red-necked Phalarope | | | | | | | | 0 | 0 | | 4 | 4 | 4 |
| Lesser Yellowlegs | | | | | | | | 0 | 3 | | 4 | 4 | 7 |
| Mew Gull | | | | | | | | 0 | 1 | | | 0 | 1 |
| Olive-sided Flycatcher | | | | | | | | 0 | 5 | | | 0 | 5 |
| Alder Flycatcher | | | | | | | | 0 | 9 | | | 0 | 9 |
| Say's Phoebe | | | 2 | | | | | 2 | 2 | | | 0 | 2 |
| Northern Shrike | | | | | | | | 0 | 3 | | | 0 | 3 |
| Gray Jay | | | 1 | | | | | 1 | 3 | | | 0 | 3 |
| Horned Lark | | | | | | | | 0 | 1 | | | 0 | 1 |
| Violet-green Swallow | | | | | | | 4 | 4 | 4 | | | 0 | 4 |
| Black-capped Chickadee | | | | | | | | 0 | 2 | 1 | | 1 | 3 |
| Ruby-crowned Kinglet | 1 | | | | 1 | | 1 | 3 | 7 | | | 0 | 7 |
| American Robin | 1 | | | | | | 1 | 2 | 9 | | | 0 | 9 |
| Gray-cheeked Thrush | 1 | | | | | | | 1 | 6 | | | 0 | 6 |
| Northern Watertrush | | | | | | | | 0 | 2 | | | 0 | 2 |
| Yellow Warbler | | | | | | | | 0 | 14 | 2 | 2 | 4 | 18 |
| Yellow-rumped Warbler | | | | | | | | 0 | 4 | | | 0 | 4 |
| Blackpoll Warbler | 1 | | | | | | | 1 | 6 | | | 0 | 6 |
| Common Yellowthroat | | | | | | | | 0 | 4 | | 1 | 1 | 5 |
| Wilson's Warbler | | | | | | | | 0 | 23 | 2 | 1 | 3 | 26 |
| Tennessee Warbler | | | | | | | | 0 | 1 | | | 0 | 1 |
| American tree Sparrow | | | | | | | 1 | 1 | 27 | 2 | 3 | 5 | 32 |
| Chipping Sparrow | 1 | | | | | | | 1 | 2 | | | 0 | 2 |
| Savannah Sparrow | 1 | | | | | | | 1 | 5 | 1 | 1 | 2 | 7 |
| Fox Sparrow | | | | | | | | 0 | 3 | | | 0 | 3 |
| Lincoln's Sparrow | | | | | | | | 0 | 10 | | 1 | 1 | 11 |
| White-crowned Sparrow | 1 | | | | | | | 1 | 33 | 2 | 3 | 5 | 38 |
| Golden-crown Sparrow | | | | | | | | 0 | 8 | 1 | | 1 | 9 |
| Slate-colour Junco | | | | | | | 2 | 2 | 9 | | | 0 | 9 |
| Red-winged Balckbird | | | | | | | | 0 | 0 | | 1 | 1 | 1 |
| Rusty Blackbird | | | | | | | | 0 | 0 | | 2 | 2 | 2 |
| Common Redpoll | | | | | | | | 0 | 3 | 1 | | 1 | 4 |
| **TOTAL SPECIES** | 7 | 0 | 2 | 1 | 1 | 0 | 7 | 14 | 38 (+1) | 9 | 13 | 16 | 42 (+1)* |

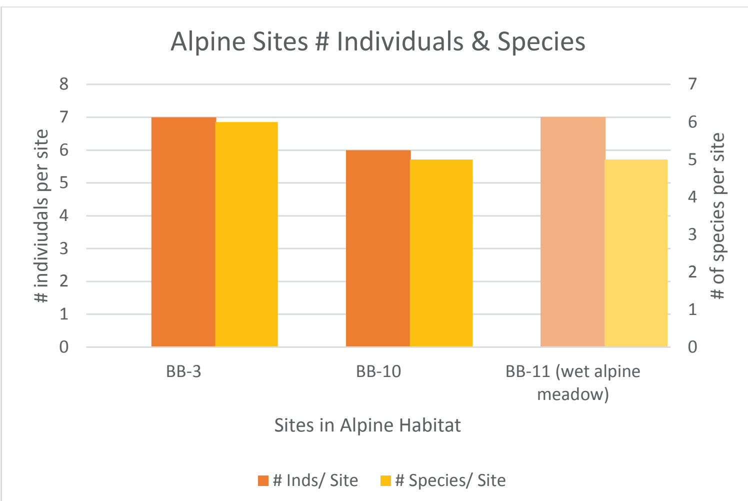
* 1 semipalmated plover seen near BB7, not at exact site.

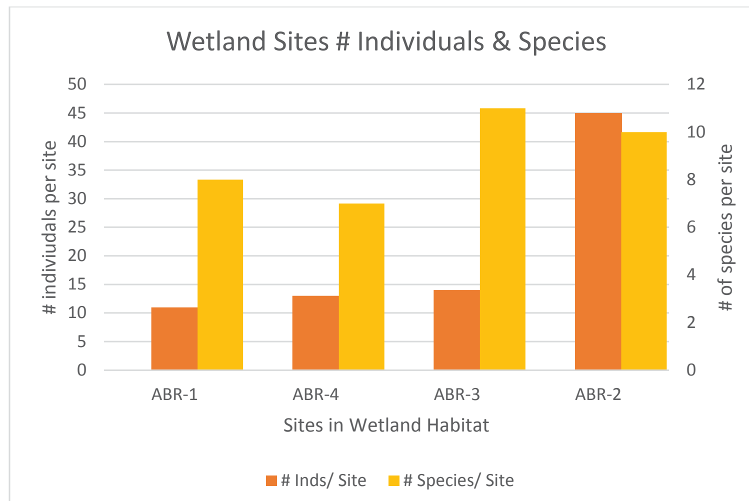
Species in red are of conservation concern.

Bird Survey Results June 2015 Kudz Ze Kayah Site

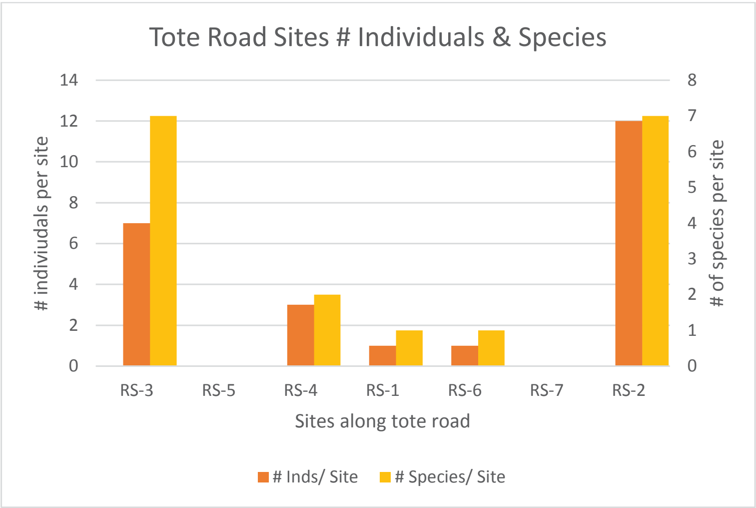


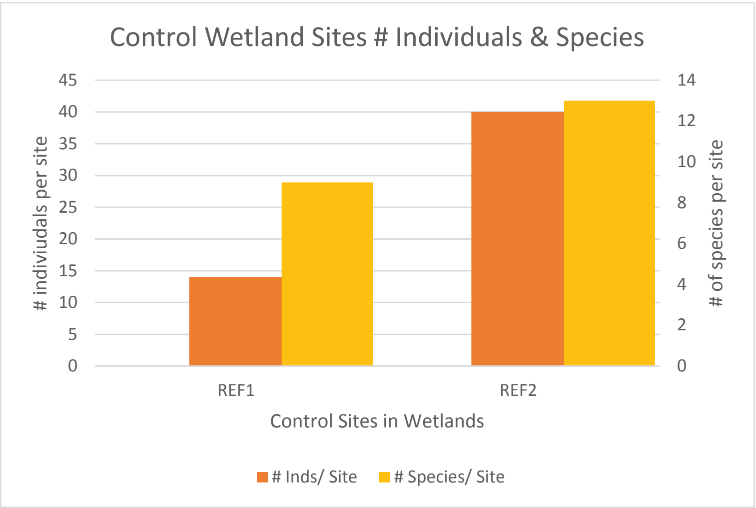



Bird Survey Results June 2015 Kudz Ze Kayah Site



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# APPENDIX G

## 2015 AND 2016 KUDZ ZE KAYAH CAMP WILDLIFE LOGS

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## WILDLIFE LOG

The following is the Wildlife Log for the Kudz Ze Kayah Project for the 2015 exploration field season. It summarizes the wildlife observations from the Wildlife Observation Cards which were completed by project personnel and contractors.

| DATE | TIME | OBS | WEATHER[1] | | | SPECIES | NO. ANIMALS[2] | | | | | LOCATION[3] | WILDLIFE ACTIVITY[4] | HABITAT[5] | OTHER COMMENTS[6] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TEMP (0C) | PRECIP | WIND | | TOTAL | F | M | UNC | JUV | | | | |
| July 23 2015 | 13:00 | Trent Newirk | | Sunny | | Ducks | 12-Oct | | | | | GD4F | "Schithering" | | |
| July 23 2015 | 13:00 | Trent Newkirk | | | | Grouse | 1 | 1 | | | | | Flushed | Marsh | |
| July 23 2015 | 10:15 | Sean Suttie | 15C | Partially Sunny | | Brown Bear | 1 | | | 1 | | | Grazing | Valley | Seen from helicopter; bear turned south. |
| July 24 2015 | 10:30 | Nathan Conroy | 10C | LR | | Moose | 1 | | | 1 | | 6816023, 416246 | | | |
| July 24 2015 | 8:00 | Darcy Baker | 12C | Cloudy | | Brown Bear | 2 | | | | 2 | Km 21 Tote Rd. | Wandering | Slope | Looked to be 2 yrs old, expected to see mother but was not visible. |
| July 24 2015 | 16:06 | Trent Newkirk | | Sunny | | Brown Bear | 2 | | | 2 | | 6815762, 414802 | Roaming, Inquisitive | Buck Brush | 2 bears were separated at first and then they met up; likely were looking for sow. |
| July 24 2015 | 17:00 | Trent Newkirk | | M | | Ptarmigan | 4 | 1 | | | 3 | 6817664, 414260 | Flushed | Buck Brush | |
| July 26 2015 | | Trent Newkirk | | Sunny | | Ptarmigin | 4 | 4 | 1 | | 3 | 6816711, 414579 | Flushed | East facing slope | |
| July 27 2015 | 18:00 | Chris Hughes | | | | Porcupine | 1 | | | 1 | | 23 Km Tote Road | Eating food along road | | |
| July 29 2015 | 21:10 | Kevin Duff | | | | Moose | 2 | 1 | | | 1 | Km 23 Tote Rd. | | On Road | |
| July 29 2015 | 20:20 | Kevin Duff | | | | Caribou | 1 | | 1 | | | Repeater | Laying down | | |
| July 29 2015 | | Robert Dick | | | | Moose | 1 | 1 | | | | C18 | Feeding, fritting | | |
| July 30 2015 | 20:45 | Miles Jecawsky | 17C | | | Porcupine | 1 | | | 1 | | Km 21 Tote Rd. | Walking on Road | | |
| July 31 2015 | 16:20 | Kevin Duff | | | | Bald Eagle | 1 | | | 1 | | Over camp | "Cruising SE" | | |
| July 31 2015 | 13:00 | Liam Leslie | | | | Brown Bear | 2 | | | 2 | | Km 23 left Mtn. ridge | Up on rige, in and out of sight for a few hrs. | Mountain Slope | |
| July 31 2015 | 8:00 | Liam Leslie | | | | Fox | 1 | | | 1 | | Day Fuel Area | Foraging | | |
| July 31 2015 | 12:10 | Kevin Duff | | | | Caribou | 2 | 1 | | | 1 | 4 miles east of camp | Sleeping | | |
| July 31 2015 | 12:15 | Kevin Duff | | | | Moose | 1 | 1 | | | | 1.5 miles east of camp | Feeding | | |
| August 1 2015 | 9:30 | Kevin Duff | | | | Moose | 2 | 1 | | | 1 | 1.5 Mile East of Camp | | | |
| August 1 2015 | 10:10 | Kevin Duff | | | | Moose | 1 | 1 | | | | 1 Mile North of Camp | Feeding on aquatic plants | Pond | |
| August 1 2015 | 11:00 | John Usselman | 10C | | | Ptarmigan | 4 | 1 | | | 3 | Km 23 Tote Road | Flew away as ATV approached | Road shoulder | |
| August 2 2015 | 8:30 | Kevin Duff | | | | Caribou | 5 | 2 | 2 | | 1 | 1 Mile SW of Camp | Laying Down | Side of hill | |
| August 2 2015 | 8:25 | Kevin Duff | | | | Golden Eagle | 1 | | | 1 | | 3 Miles SW of Camp | Flying SW | | |
| August 2 2015 | 9:20 | Kevin Duff | | | | Caribou | 3 | 1 | | | 2 | 1.25 Miles SW of Camp | Feeding | | |
| August 4 2015 | 13:30 | Kevin Duff | 20C | | | Brown bear | 1 | | 1 | | | 5 Miles East of Camp | Cruising | Alpine | |
| August 4 2015 | 13:35 | Kevin Duff | 20C | | | Brown Bear | 1 | | 1 | | | 6.1 Miles SE of Camp | Cruising | Sub Alpine | |
| August 4 2015 | 15:00 | Sean Suttie | | | | Black Bear | 3 | 1 | | | 2 | Km 12 Tote Road | | | |
| August 4 2015 | 7:00 | Mike Holt | | | | Black Bear | 1 | | | 1 | | Km 21 Tote Road | Ran into bush as ATV approached | | |
| August 4 2015 | 9:20 | Cole Godfrey | | | | Ptarmigan | 1 | | | 1 | | | Flying | | |
| August 5 2015 | 9:20 | Kevin Duff | | | | Hoary Marmot | 1 | | | 1 | | 3 Miles South of Camp | | Rock pile | Den (3) holes. |
| August 5 2015 | 11:30 | Kevin Duff | | | | Hoary Marmot | 2 | | | 2 | | 5 Miles South of Camp | | Below rock wall 5500 ft | 2 visible, several heard. |
| August 5 2015 | 10:35 | Kevin Duff | | | | Caribou | 1 | 1 | | | | North Lake | Walking | Brushy Shoreline | |
| August 5 2015 | 8:40 | Kevin Duff | | | | Caribou | 1 | | 1 | | | 2.5 Miles South of Camp | Cruising | Alpine | |
| August 5 2015 | 16:00 | John Usselman | 22C | Dry | | Pine Martin | 1 | | | 1 | | Km 5 Tote rd | Up a tree | Sparse forest | Interested in crew. "fake lunging" |
| August 8 2015 | 14:00 | Sean Suttie | | Partly cloudy | | Ermine | 1 | | | 1 | | 6819663, 413747 | Running away | Rocks and boulders | |
| August 8 2015 | | Robert Dick | | | | Caribou | 1 | | | 1 | | On Road | Running | | |
| August 10 2015 | 15:00 | Keifer Sterriah | | Overcast | | Caribou | 8 | 2 | 6 | | | East of Km 25 (Tote Rd.) | | Alpine, ridge. | |
| August 10 2015 | 3:00 | Andrei Lelel(?) | | | | Caribou | "a few" | | | | | On ridge across the way | | | |

## WILDLIFE LOG

The following is the Wildlife Log for the Kudz Ze Kayah Project for the 2015 exploration field season. It summarizes the wildlife observations from the Wildlife Observation Cards which were completed by project personnel and contractors.

| DATE | TIME | OBS | WEATHER[1] | | | SPECIES | NO. ANIMALS[2] | | | | | LOCATION[3] | WILDLIFE ACTIVITY[4] | HABITAT[5] | OTHER COMMENTS[6] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TEMP (0C) | PRECIP | WIND | | TOTAL | F | M | UNC | JUV | | | | |
| August 11 2015 | 13:30 | James Mooney | | Overcast | | Porcupine | 1 | | | 1 | | Between Camp and Geona Creek | "Scrub birch" | | |
| August 11 2015 | 4:30 | Eliane Roy | | Overcast | | Fox | 1 | | | 1 | | Km 24 Tote Rd. | Running | | |
| August 11 2015 | 10:30 | DH | | | | Moose | 1 | | | 1 | | Km 21 Tote Rd. | Running from truck | | Was at night |
| August 12 2015 | 12:45 | Keifer Sterriah | | | | Caribou | 1 | | | 1 | | 6815000, 413500 | | | |
| August 12 2015 | 8:30 | Keifer Sterriah | | Overcast | | Moose | 1 | 1 | | | | Between Genoa Ck. And KZ14 | | | Calf was likely nearby |
| August 13 2015 | 8:40 | Kevin Duff | Cold | Wet | | Moose | 2 | 1 | | | 1 | 200m West of 15-06 | Standing | Brushy slope | |
| August 13 2015 | 10:30 | Kevin Duff | | | | Caribou | 2 | 1 | | | 1 | Top of GP4F | Walking | Side slope | 5000 FT |
| August 15 2015 | 8:20 | Kevin Duff | | | | Caribou | 2 | | 2 | | | 4 Miles SE of Camp | | 5000 ft | |
| August 15 2015 | 17:20 | Trevor Rabb | | | | Caribou | 3 | | 3 | | | 61.4595, -130.53234 | Roaming | | |
| August 15 2015 | 11:30 | Trent Newkirk | | | | Porcupine | 3 | | | | | Faro --> Ross River | Walking | | |
| August 16 2015 | 13:35 | Kevin Duff | | | | Caribou | 1 | | 1 | | | 3.5 Miles SE of Camp | Walking | | |
| August 16 2015 | 13:00 | Kelli Bergh | | | | Ptarigan | 1 | | | 1 | | Along Tote Rd | | | |
| August 16 2015 | | Kelli Bergh | Sunny | | | Groundhog | Several | | | X | | Flycamp (25 Km) | Curious, cute | Flat area by core | |
| August 16 2015 | 18:30 | Kelli Bergh | | | | Caribou | 2 | | 2 | | | Hillside between GP4F and A13M | Running | Slopes | |
| August 16 2015 | 9:00 | Kevin Duff | | | | Caribou | 3 | | 2 | | 1 | 4.1 SE of Camp | Resting | | |
| August 16 2015 | 11:30 | Cooper Campbell | 15C | | | Hawk | 1 | | | 1 | | Km 5 Tote Rd | Landed in tree top | | |
| August 16 2015 | 12:00 | Cole Godfrey | | | | Ptarmigan | 10-Aug | | | | | Between drill and camp | | | |
| August 16 2015 | 15:30 | Dave Nuttall | | | | Ptarmigan | 4 | | | 4 | | Km 25.22 Tote Road | | | |
| August 17 2015 | 7:45 | Kevin Duff | | | | Caribou | 2 | | 2 | | 2 | 3.2. Miles SE of Camp | Feeding | | |
| August 17 2015 | | Kevin Duff | | | | Gyr Falcon | 1 | | 1 | | | N612416.55, W1303102.5 | Soaring | Cliff Face 6500 ft. | 6.5 Miles S of Camp |
| August 17 2015 | 8:14 | Trevor Rabb | | | | Fox | 1 | | | 1 | | Fly Camp | Eating gophers | | |
| August 18 2015 | 17:30 | Kevin Duff | | R | | Caribou | 1 | | | | 1 | 2.1 Miles SE of camp | Running | | |
| August 19 2015 | 20:20 | Kevin Duff | | R | | Moose | 1 | 1 | | | | East end of north lake | Feeding | In lake | |
| August 19 2015 | 10:05 | Kevin Duff | | R | | Moose | 1 | 1 | | | | 1.3 miles east of camp | Standing | Brushy sideslope | |
| August 19 2015 | 14:00 | Kevin Duff | | | | Moose | 1 | 1 | | | | 1.3 miles east of camp | Feeding | | |
| August 20 2015 | 23:20 | Kevin Duff | | | | Caribou | 3 | | 1 | | 2 | 3.5 Miles SE of camp | | Alpine | |
| August 20 2015 | 17:00 | Kevin Duff | | | | Moose | 1 | 1 | | | | North lake | Feeding | In water | |
| August 20 2015 | 19:05 | Kevin Duff | | sunny | | Moose | 1 | | 1 | | | 5.1 miles E of camp | standing | brushy slope | |
| August 21 2015 | 8:10 | Kevin Duff | | nice | | Fox | 1 | | | | | diesel tank | walking | | |
| August 21 2015 | 11:00 | Morgan | | LR | | Sharp shinned halk | 1 | | | 1 | | GP4F | | | May have been migrating |
| August 21 2015 | 9:40 | Kevin Duff | | cold | | Caribou | 4 | | 3 | 1 | | 1.6 miles SW of Camp | feeding | alpine | |
| August 22 2015 | 11:00 | Monty Oatman | 8 | | | Moose | 1 | | 1 | | | Near Gatehouse | | On road | |
| August 22 2015 | 9:30 | Kevin Duff | | | | Caribou | 4 | 3 | | | 1 | 1.6 miles SW of camp | feeding | | |
| August 23 2015 | 17:35 | Monty Oatman | 8 | LR | | Moose | 2 | 1 | | | 1 | 1.2 Miles from camp | | | |
| August 23 2015 | 11:00 | Laura McIntyre | 20 | | | Sandhill Crane | 15 | | | 15 | | Sky over camp | Migrating | | |
| August 24 2015 | 18:45 | Trent Newkizk | | N | | Brown Bear | 1 | | | 1 | | Km. 9.7 Tote Rd. | Running away from vehicle | Western Rd. Slope | |
| August 24 2015 | Am | Nicole Etzel | | | | Caribou | 5 | M | | | | 60 m SW of weather Station | Curious | | |
| August 24 2015 | | Nicole Etzel | | | | Sandhill Crane | 8 | | | | | | Fleeing the cold | | |
| August 24 2015 | 9:00 | Heiko M | | | | Caribou | 9 | 5 | 2 | 2 | | | Feeding | | |
| August 24 2015 | 11:15 | Heikeo M | | | | Collared Pika | 2 | | | 2 | | | | | |
| August 24 2015 | 17:00 | Monty Oatman | 10 | | | Moose | 2 | 1 | | | 1 | | | | |
| August 24 2015 | 17:04 | Monty Oatman | 10 | | | caribou | 3 | | | 3 | | 4 miles south of camp | | | |
| August 25 2015 | | Nicole Etzel | | | | Caribou | 3 | | | | | North of weather station | | | |
| August 25 2015 | 4:00 PM | Nicole Etzel | | | | Black bear | 1 | | | | | North of weather station | | | |

## WILDLIFE LOG

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| DATE | TIME | OBS | WEATHER[1] | | | SPECIES | NO. ANIMALS[2] | | | | | LOCATION[3] | WILDLIFE ACTIVITY[4] | HABITAT[5] | OTHER COMMENTS[6] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TEMP (0C) | PRECIP | WIND | | TOTAL | F | M | UNC | JUV | | | | |
| August 26 2015 | 11:50 | Laura McIntyre | 17 | | | Northern Hawk Owl | 1 | | | 1 | | Km 22 tote road | Flying from low tree | | |
| August 26 2015 | 3:00 PM | Andre | | | | Falcon | 1 | | | | | | | | |
| August 26 2015 | 9:00 AM | Darryl Epp | | | | Ptarmigan | 30 | | | | | Hill of GP4F | | | |
| August 26 2015 | | Darryl Epp | | | | Caribou | Several malesand females | | | | | Hill of GP4F | | | |
| August 26 2015 | 8:06 | Monty Oatman | | | | Caribou | 4 | | | 4 | | 4 miles SW of Camp | Grazing | | |
| August 26 2015 | 10:00 | Catherine | | | | Caribou | | | | | | Met stn | | | |
| August 26 2015 | 13:00 | Robin Black | | | | Caribou | 4 | 3 | 1 | | | | watching | | They were in very good behaviour |
| August 26 2015 | 11:40 | Trent Newkirk | | | | Caribou | 2 | | 2 | | | 4212437, 6814982 | feeding | alpine | |
| August 26 2015 | 16:00 | Heiko M | | | | Caribou | 1 | | 1 | | | | Wandering/ | | |
| August 26 2015 | 11:30 | Heiko M | | LR | | Caribou | 1 | 1 | | | | Rhyolite mtn uplands | Feeding/ passing through | | |
| August 27 2015 | 12:00 | Greg Keating | | LR | | Caribou | 4 | 2 | 2 | | | On hill next to camp | eating | | |
| August 27 2015 | 8:24 | Monty Oatman | 4 | rain | | Caribou | | | | | | ½ mile SW of camp | grazing | | |
| August 27 2015 | 16:45 | David Rissanen | | | | caribou | 2 | | 2 | | | | feeding | | |
| August 27 2015 | 12:00 | Grace Johnny | | raining | | caribou | 4 | | 4 | | | camp | feeding | mountain | |
| August 28 2015 | 8:50 PM | Cooper Campbell | 5 | Light rain | | | 15 - 20 | | | | | 50 m west of core shack – subalpine | Flying north | | |
| August 28 2015 | 8:50 | Cooper Campbell | 5 | | | Sandhill cranes | 15-20 | | | | | 50 m west of core shack | | | |
| August  29 2015 | 14:00 | Chuck Sheasman | | | | Caribou | 1 | 1 | | | | Km 22 tote rd | | | |
| August 29 2015 | 15 | Murray Joney | 10 | | | caribou | 1 | | 1 | | | Lake south of new culvert | Moving across valley | | |
| August 30 2015 | 7:45 PM | Cooper Campbell | 5 | Overcast | | Sanhill Crane | 20 | | | | | Directly above core shack | Flying in V heading south | Sub-alpine | |
| August 30 2015 | 6:20 PM | Cooper Campbell | 5 | raining | | Sanhill Crane | 3 Flocks | | | | | Directly above core shack | Flying in V heading south | Directly above core shack | |
| August 30 2015 | 9:15 AM | Andre | | | | Caribou | 6 | | | | | | | | |
| August 30 2015 | 3:00 PM | Andre | | | | Caribou | 8 | | | | | | | | |
| August 31 2015 | 11:15 | Mike Leidel | | Snowing and foggy | | Sanhill Crane | Flock | | | | | | Flying south | | |
| August 31 2015 | 4:30 PM | Cooper Campbell | 1 | Flurries | | Sandhill Crane | 40 | | | | | Directly above camp | Flying in V heading south east | | |
| August 31 2015 | 11:55 AM | Cooper Campbell | 0 | Flurries | | Sandhill Crane | 20 | | | | | 200 m east of core shack | Flying in a V heading south east | | |
| Sept 1 2015 | 2:00 PM | Andre Leled | | | | Caribou | 3 | | | | | GP4F on slope | | | |
| Sept 2 2015 | 16:00 | Andre Lebel | | | | Golden Eagle | | | | | | | cruising | | |
| Sept 3 2015 | 11:30 AM | Kelli Bergh | 11 | sunny | | Ptarmigan | 2 | | | | | Km 23 | On side of road | | |
| Sept 3 2015 | 14:00 | Kristen | 10 | | | muskrat | 1 | | | 1 | | ABM | swimming | Lake shore | |
| Sept 5 2015 | 11:00 AM | Nicole Etzel | Chilly | | | Geese | | | | | | | Flying | | |
| Sept 5 2015 | 6:30 PM | Cooper Campbell | 7 | Rain | | Sandhill Crane | Aprox 20 | | | | | Directly over camp | Flying low | | |
| Sept 5 2015 | 7:00 PM | Brian Hegarty | | Rain | | Rabit/hare | 1 | | | | | In brush by camp | running | | |
| Sept 5 2015 | 7:00 | Brian Hegarty | 1 | rain | | Hare | 1 | | | 1 | | Beside camp | | | |

**WILDLIFE LOG**

The following is the Wildlife Log for the Kudz Ze Kayah Project for the 2015 exploration field season. It summarizes the wildlife observations from the Wildlife Observation Cards which were completed by project personnel and contractors.

| DATE | TIME | OBS | WEATHER[1] | | | SPECIES | NO. ANIMALS[2] | | | | | LOCATION[3] | WILDLIFE ACTIVITY[4] | HABITAT[5] | OTHER COMMENTS[6] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TEMP (0C) | PRECIP | WIND | | TOTAL | F | M | UNC | JUV | | | | |
| Sept 5 2015 | 9:00 | Andre Lebel | | | | Caribou | 7 | 4 | 3 | | | | standing around | | |
| Sept 6 2015 | 2:30 PM | Keifer Sterriah | | | | Falcon | 2 | | | | | Old core shack – km 25 | | | |
| Sept 6 2015 | 14:30 | Keifer Sterriah | | | | Falcon | 2 | | | 2 | | Core shack | | | |
| Sept 7 2015 | 17:10 | Kevin Duff | 7 | | | Caribou | 10 | 8 | 2 | | | 3.4 Miles SE of camp | feeding | alpine | |
| Sept 7 2015 | 16:50 | Kevin Duff | 7 | | | Moose | 1 | 1 | | | | 1.4 miles south of camp | feeding | Valley bottom | |
| Sept 8 2015 | 14:00 | Andre Lelod | | | | Caribou | 3 | | | 3 | | GP4F | | | |
| Sept 8 2015 | 7:00 | Kevin Duff | 4 | | | Moose | 2 | 1 | | | 1 | GP4F | Walking past drill | | |
| Sept 8 2015 | 11:00 | Andre Lebel | | | | Caribou | 7 | 6 | | | | | | | |
| Sept 8 2015 | 9:05 | Kevin Duff | 10 | | | Caribou | 1 | 1 | | | | GP4F | standing | Brushy slope | Red antlers, velvet shed |
| Sept 9 2015 | 18:15 | Kevin Duff | | | | Moose | 1 | | 1 | | | 2.6 Miles SE of camp | Walking | Brushy Slope | |
| Sept 9 2015 | 18:20 | Kevin Duff | 10 | | | Moose | 1 | 1 | | | | 0.8 Miles East of Camp | Feeding | Brushy Knob | |
| Sept 9 2015 | 17:40 | Kevin duff | | | | Moose | 1 | 1 | | | | GP4F | standing | Brushy slope | |
| Sept 9 2015 | 12:00 | Nathan Conroy | 10C | LR | | Caribou | 1 | | | 1 | | 6814500, 416582 | | | |
| Sept 10 2015 | 8:10 | Kevin Duff | | | | Moose | 1 | 1 | | | | 1.8 Miles SE of Camp | Feeding | Brushy Slope | |
| Sept 10 2015 | 18:40 | Kevin Duff | | | | Moose | 3 | 1 | | | 2 | 1.6 miles W of camp | resting | Brushy slope | Last years calves |
| Sept 10 2015 | 14:00 | Sean Suttie | 3 | | | Fox | 1 | | 1 | | | coreland | urinating | marsh | |
| Sept 11 2015 | 12:00 | Anthony Bier | 10 | | | Porcupine | 1 | | | 1 | | 50-100m west of south creek | Running away | Sub alpine | |
| Sept 11 2015 | 8:15 | Kevin Duff | | | | Caribou | 5 | 4 | 1 | | | 3.6 Miles south of camp | Resting | Alpine | |
| Sept 11 2015 | 10:20 | Kevin Duff | | | windy | Caribou | 8 | | | 8 | | Repeater | Resting | Snow pack | |
| Sept 11 2015 | 13:30 | Kevin Duff | | | windy | Moose | 2 | 1 | | | 1 | 1 mile SE of Km 25 | feeding | In water | |
| Sept 11 2015 | 8:05 | Kevin Duff | | | | Moose | 1 | 1 | | | | 2 Miles S of camp | feeding | Brushy slope | |
| Sept 11 2015 | 7:00 | Kevin Duff | | | windy | Moose | 2 | 1 | | | 1 | 4 Miles SE of camp | feeding | Top of tree line | This years calf |
| Sept 11 2015 | 18:45 | Kevin Duff | | | | Moose | 1 | 1 | | | | 1.4 miles East of camp | feeding | Brushy slope | |
| Sept 12 2015 | 7:40 | Kevin Duff | 2 | | | Sandhill cranes | 26 | | | 26 | | 6 miles north of camp | Flying SE | | |
| Sept 13 2015 | 7:55 | Kevin Duff | 1 | | | Moose | 2 | 2 | | | | 6 miles south of camp | Feeding | Brushy slope | |
| Sept 13 2015 | 7:40 | Kevin Duff | 2 | | | Moose | 1 | | 1 | | | 1.6 miles east of camp | walking | Top of tree line | |
| Sept 13 2015 | 8:30 | Kevin Duff | 2 | | | Brown bear | 1 | | | 1 | | 1.5 miles SW of camp | Walking | alpine | |
| Sept 13 2015 | 9:10 | Kevin Duff | 2 | snowing | | Moose | 1 | | 1 | | | 3 miles SE of camp | walking | Top of tree line | |
| Sept 13 2015 | 17:40 | Kevin Duff | 4 | | | Caribou | 8 | 5 | 3 | | | 3.4 miles south of camp | resting | alpine | |
| Sept 14 2015 | 18:45 | Kevin Duff | 7 | | | Moose | 1 | | 1 | | | 0.5 miles east of camp | cruising | Brushy slope | |
| Sept 14 2015 | 16:45 | Kevin Duff | 2 | | | Moose | 2 | 1 | 1 | | | 3.4 miles SE of camp | courting | Top of tree line | |
| Sept 14 2015 | | Kevin Duff | | | | Moose | 3 | 2 | 1 | | | 3.1 miles SE camp | courting | Brushy slope | |
| Sept 14 2015 | 7:10 | Kevin Duff | 0 | | | Moose | 3 | 2 | 1 | | | 4 miles SE of camp | resting | Top of tree line | |
| Sept 14 2015 | 9:30 | Kevin Duff | 0 | | | Caribou | 7 | 1 | 7 | | | 3.6 miles SW of camp | resting | Sideslope alpine | |
| Sept 15 2015 | 15:00 | Chrissy Vandentillaart | 3 | | | Fox | 1 | | | 1 | | Pump shack | running | | |
| Sept 15 2015 | 19:10 | Kevin Duff | 4 | | | Moose | 4 | 1 | 1 | | 2 | 4 miles south of camp | courting | Valley bottom | |
| Sept 15 2015 | 8:00 | Kevin Duff | 1 | | | Caribou | 2 | 1 | 1 | | | 2.2km east of rd | courting | Valley bottom | |
| Sept 15 2015 | 7:40 | Kevin Duff | 1 | | | Moose | 1 | 1 | | | | 1 miles east of camp | feeding | Brushy slope | |
| Sept 15 2015 | 7:30 | Kevin Duff | 1 | | | Moose | 1 | 1 | | | | North lake | feeding | In water | |
| Sept 16 2015 | 7:45 | Kevin Duff | 1 | | | Moose | 3 | 2 | 1 | | | 3.1 miles SE of camp | feeding | | |
| Sept 17 2015 | 7:35 | Kevin Duff | 1 | | | Moose | 1 | 1 | | | | 2.8 miles south of camp | feeding | Brushy slope | |
| Sept 17 2015 | 18:50 | Kevin Duff | 3 | LR | | Moose | 2 | 1 | | | 1 | 3.2 miles SE of camp | feeding | Brushy slope | |
| Sept 18 2015 | 14:00 | Andre Lebel | | | | Ptarmigan | | | | | | GP4F | annoying | | A “squabble” |

## WILDLIFE LOG

The following is the Wildlife Log for the Kudz Ze Kayah Project for the 2015 exploration field season. It summarizes the wildlife observations from the Wildlife Observation Cards which were completed by project personnel and contractors.

| DATE | TIME | OBS | WEATHER[1] | | | SPECIES | NO. ANIMALS[2] | | | | | LOCATION[3] | WILDLIFE ACTIVITY[4] | HABITAT[5] | OTHER COMMENTS[6] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TEMP (0C) | PRECIP | WIND | | TOTAL | F | M | UNC | JUV | | | | |
| Sept 18 2015 | 7:40 | Kevin Duff | 0 | | | Moose | 2 | 1 | 1 | | | 3.3 miles SE of camp | standing | Top of tree line | |
| Sept 18 2015 | 7:40 | Kevin Duff | 0 | mist | | Moose | 4 | 2 | 1 | | 1 | 3.5 miles SE of camp | feeding | Brushy saddle | |
| Sept 19 2015 | 7:20 | Kevin Duff | -2 | snowing | | Moose | 2 | | 2 | | | 3.5 miles SE of camp | sparring | Top of tree line | |
| Sept 19 2015 | 8:10 | Kevin Duff | -2 | | | Moose | 1 | 1 | | | | 1 miles south of camp | walking | Valley bottom | |
| Sept 19 2015 | 7:30 | Kevin Duff | -2 | | | Moose | 2 | 1 | | | 1 | 3.8 miles SE of camp | resting | Brushy slope | |
| Sept 20 2015 | 7:20 | Kevin Duff | 2 | | | Caribou | 2 | 2 | | | | 3.4 miles south of camp | feeding | alpine | |
| Sept 21 2015 | 10:35 | Kevin Duff | 0 | | | Moose | 2 | 1 | | | 1 | 1 mile south of camp | feeding | In water | |
| Sept 21 2015 | 10:20 | Kevin Duff | 0 | | | Caribou | 5 | 1 | 4 | | | 2.7 miles SE of camp | feeding | alpine | |
| Sept 21 2015 | 10:30 | Kevin Duff | 0 | | | Moose | 2 | 1 | 1 | | | Weather station | feeding | Brushy slope | |
| Sept 21 2015 | 7:20 | Kevin Duff | | | | Moose | 6 | 4 | 2 | | | 3.1 miles SE of camp | resting | Brushy saddle | |
| Sept 21 2015 | 20:00 | Andre Lebel | | | | Caribou | 9 | 3 | 6 | | | GP4F West | | | |
| Sept 21 2015 | | Andre Lebel | | | | Golden eagle | | | | | | | crowing | | |
| Sept 22 2015 | 7:10 | Kevin Duff | 0 | Snow | | Moose | 7 | 4 | 1 | | 2 | 3.6 miles SE of camp | resting | Top of tree | |
| Sept 22 2015 | 9:20 | Kevin Duff | 0 | snow | | Moose | | | | | | 23 km | feeding | Valley bottom | |
| Sept 22 2015 | 13:10 | Kevin Duff | 4 | | | caribou | 5 | 1 | 4 | | | 2 miles SE of camp | running | saddle | |
| Sept 22 2015 | 9:00 | Darrel Epn | | | | Ptarmigan | | | | | | Hill of GP4F | feeding | | ignored crew |
| Sept 22 2015 | 6:45 | Darrel Epn | -2 | Light snow | | Moose | 1 | | | | | Km 22 tote rd | | | |
| Sept 22 2015 | 7:20 | Darrel Epn | | | | moose | 2 | | | | | 23 km tote rd | | | |
| Sept 22 2015 | 7:20 | Darrel Epn | | | | caribou | 1 | | | | | 21 km tote rd | | | |
| Sept 23 2015 | 15:30 | Kevin Duff | 0 | | | Sandhill cranes | | | | | | weather station | standing | | |
| Sept 23 2015 | 7:40 | Kevin Duff | -2 | snowing | | sandhill cranes | | | | | | 2 miles SW of camp | | | |
| Sept 24 2015 | 7:00 | Kevin Duff | -2 | | | Moose | 3 | 1 | 1 | | 1 | 1.1miles S of camp | rutting | trees | |
| Sept 24 2015 | 8:10 | Kevin Duff | -2 | | | Caribou | 2 | 1 | 1 | | | 1.2 miles south of camp | rutting | trees | |
| Sept 24 2015 | 7:20 | Kevin Duff | 0 | | | Moose | 7 | 4 | 3 | | | 2.9 miles SE of camp | rutting | Brushy slope | |
| Sept 24 2015 | 8:45 | Kevin Duff | 0 | | | Moose | 2 | | 2 | | | 1 mile south of camp | fighting | trees | |
| Sept 24 2015 | 9:40 | Kevin Duff | 0 | snowing | | Moose | 4 | 2 | 2 | | | 3.5 miles east of camp | feeding | Brushy slope | |
| Sept 24 2015 | 13:00 | Kevin Duff | 4 | | | Moose | 1 | | 1 | | | 0.5 miles south of camp | resting | trees | |
| Sept 24 2015 | 10:00 | Sean Suttie | | overcast, light snow | | Moose | | | | | | km 23.5 tote road | standing still | | |
| Sept 24 2015 | 10:00 | Sean Suttie | | LS | | Moose | 1 | | 1 | | | 23.5 km tote rd | Standing still | | |
| Sept 25 2015 | 17:50 | Kevin Duff | 0 | sunny | | Caribou | 14 | 3 | 11 | | | 2.4 miles east of camp | feeding | alpine | |
| Sept 25 2015 | 17:55 | Kevin Duff | -1 | sunny | | Caribou | 20 | 4 | 16 (cows/calfs) | | | 4.6miles east of camp | feeding | alpine | |
| Sept 25 2015 | 18:55 | Kevin Duff | -1 | sunny | | Moose | 1 | 1 | | | | GP4F | resting | treeline | |
| Sept 26 2015 | 9:20 | Cooper Campbell | -5 | clear | | Moose | 1 | 1 | | | | km 22.75 tote road | walking on road | | |
| Sept 27 2015 | 9:00 | Chad Bustin | | snow | | Moose | | | | | | Fly camp | | | Only tracks |
| Sept 29 2015 | 11:00 | Dave Nuttall | | cloudy/dry | | Moose | 1 | | | | | km 22 side of road | standing | | |
| Sept 29 2015 | 11:00 | Cole Godfrey | | cloudy | | Moose | 1 | | | | | | ran away | | |
| Sept 29 2015 | 8:15 | Kevin Duff | 6 | overcast | | bald eagle | 1 | | | 1 | | km 25 | sitting on east hill overlooking drills | hilltop | |
| Sept 29 2015 | 13:30 | Kevin Duff | 7 | windy | | caribou | 1 | 1 | | | | 3.6 miles SE of camp | looking for cows | alpine | |
| Sept 30 2015 | 16:05 | Kevin Duff | 6 | windy | | caribou | 8 | 2 | 6 (cows/calfs) | | | 2.4 miles east of camp | feeding | alpine | |
| Oct 3 2015 | 6:15 | Cooper Campbell | -5 | | | rabbit | 1 | | | | | km 21.25 tote road | running | forest | |
| Oct 1 2015 | 10:00 | Andre Lebel | 0 | | | Raven | 2 | | | x | | Above Core land | | | |
| Oct 1 2015 | 17:00 | Cooper Campbell | -5 | | | Rabbit | 1 | | | 1 | | Km 21.25 tote rd | running | | |

**WILDLIFE LOG**

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| DATE | TIME | OBS | WEATHER[1] | | | SPECIES | NO. ANIMALS[2] | | | | | LOCATION[3] | WILDLIFE ACTIVITY[4] | HABITAT[5] | OTHER COMMENTS[6] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TEMP (0C) | PRECIP | WIND | | TOTAL | F | M | UNC | JUV | | | | |
| Oct 2 2015 | 15:00 | Andre Lebel | | | | Raven | | | | x | | | Flying around | | |
| Oct 2 2015 | 8:40 | Kevin Duff | -6 | | | Lynx | 1 | | | 1 | | ½ mile W of camp | running | Brushy knob | |
| Oct 4 2015 | 8:00 | Andre Lebel | | | | Bunny Rabbit | | | | | | | Hopping by | | |
| Oct 5 2015 | 13:20 | Kevin Duff | | | | caribou | 9 | 6 | 1 | | 2 | 2.4 miles SE of camp | feeding | Sub-alpine | |
| Oct 6 2015 | 8:00 | Kevin Duff | -5 | | | caribou | 1 | | 1 | | | 3.9 miles S of camp | walking | alpine | |
| Oct 6 2015 | 14:20 | Kevin Duff | 0 | | | caribou | 12 | 7 | 1 | | 4 | 3.4 miles S of camp | feeding | alpine | |
| Oct 6 2015 | 16:40 | Kevin Duff | 0 | | | moose | 3 | 1 | 1 | | 1 | 2 miles SE of camp | | Brushy slope | |
| Oct 6 2015 | 8:00 | Andre Lebel | | | | Caribou | | | | | | GP4F | Standing around | | |
| Oct 6 2015 | 11:00 | Andre Lebel | | | | Raven | | | | | | GP4F | Flying by | | |
| Oct 7 2015 | 13:16 | Rene | | snow | | moose | 5 | 2 | 3 | | | 3 km south of camp | | | |
| Oct 8 2015 | 7:20 | Kevin Duff | -1 | | | Moose | 6 | 2 | 1 | | 3 | 1 mile E of camp | | | Bull courting cow. Immature bulls sparring |
| Oct 10 2015 | 16:20 | Kevin Duff | 3 | | | caribou | 1 | | 1 | | | 2.4 miles SE of camp | searching for cows | | Nose to ground |
| Oct 10 2015 | 16:35 | Kevin Duff | 3 | | | moose | 3 | 2 | 1 | | | 2.5 miles S of camp | feeding | Brushy saddle | |
| Oct 11 2015 | 7:40 | Kevin Duff | 2 | | | Moose | 3 | 2 | | | | 2.7 miles SE of camp | | Top of tree line | |
| Oct 11 2015 | 8:10 | Kevin Duff | 1 | | | Caribou | 1 | | 1 | | | 2.3 Miles E of camp | feeding | alpine | |
| Oct 12 2015 | 10:15 | Kevin Duff | 1 | | | Caribou | 3 | 1 | 1 | | 1 | 3.4 miles SE of camp | Feeding | Tree line | |
| Oct 12 2015 | 18:00 | Mike Leidl | | | | Wolf | | | | x | | Core Land Pond | | | "putting holes in our rink" |
| Oct 13 2015 | 9:10 | Kevin Duff | 1 | | | Moose | 3 | 2 | 1 | | | 3.3 miles SE of camp | | | |
| Oct 13 2015 | 9:30 | Kevin Duff | 1 | | | Caribou | 60 | | | x | | 4.6 miles E of camp | feeding | alpine | |
| Oct 14 2015 | 13:20 | Kevin Duff | 4 | | | Moose | 3 | 1 | 1 | | 1 | 2.6 miles E of camp | Bull chasing cow | | |
| Oct 14 2015 | 13:20 | Kevin Duff | 3 | | | Caribou | 8 | 5 | 1 | | 2 | 3 miles S of camp | | alpine | |
| Oct 14 2015 | 17:15 | Kevin Duff | 1 | | | Red Tail Hawk | 1 | | | 1 | | | Chasing birds | Brushy saddle | |
| Oct 14 2015 | 17:30 | Kevin Duff | 1 | | | Caribou | 2 | | 2 | | | GP4F lake | Walking | Valley bottom | |
| Oct 17 2015 | 14:35 | Kevin Duff | 6 | | | Mud Swallows | | | | x | | 413508, 6821813 | | River Bank | Approx. 25-30 burrows |
| Oct 17 2015 | 14:55 | Kevin Duff | 6 | | | Caribou | 17 | | | 17 | | 1.4 miles SW of camp | feeding | | |
| Oct 18 2015 | 8:20 | Kevin Duff | | | | Moose | 2 | 1 | | | 1 | ¼ mile E of camp | feeding | | |
| Oct 18 2015 | 15:30 | Chrissy Vandentillaart | 4 | | | Caribou | | | | x | | Weather station | | | |
| Oct 19 2015 | 10:45 | Trent Newkirk | 2 | snow | | Wolf | 1 | | 1 | | | Camp/ Gen shed | | | |
| Oct 24 2015 | 11:30 | Trent Newkirk | | | | Ptarmigan | 1 | | | 1 | | Km 23 tote road | | | |
| Oct 24 2015 | 12:00 | Trent Newkirk | | | | Wolf | | | | | | | | | Just Tracks were sighted |
| Nov 9 2015 | 8:00 | Roger Hubstein | | light snow | | Ptarmigan | aprox 25 | | | | | Tote Road | | | |
| Nov 10 2015 | 13:30 | Tom Michaluck | -10 | clear windy | | Caribou | 40 (groups of 4 to 10 within 200-300 m of each other) | | | | | summit of mountain | docile | alpine | |
| Nov 15 2015 | 16:45 | Kelli Bergh | -19 | | | Ptarmigan | | | | | | km 6 Tote Road | flying | | |
| Nov 16 2015 | 11:30 | Jason Smith | | cold | | moose | 2 | 2 | | | | km 22 tote road | | | |
| Nov 16 2015 | 16:00 | Rene | | clear windy | | Ptarmigan | 1 | | | | | repeater | feeding | slopes | |
| Nov 16 2015 | 16:30 | Kelli Bergh | -15 | over cast | | Caribou | 3 | | | | | aprox 300 m north west of core land | | slope | |

## 2016 WILDLIFE LOG

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| DATE | OBSERVER | SPECIES | # | LOCATION | BEHAVIOUR | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| 26-Apr-16 | R.Vourdouw | American Robin | 1 | Fly Camp. | flying and singing | Tree | |
| 2-May-16 | Crystal Beaudry | American Robin | 1 | 20km | | | |
| 30-May-16 | Robert Andrew | American Robin | 1 | km 24 | | slope | |
| 7-May-16 | Jody Inkster | American Robin | 2 | ABM Deposit, near drill | feeding & flying | wetland | |
| 10-May-16 | Jody Inkster | American Robin | 2 | ABM Deposit, near drill | hopping on ground | | |
| 14-May-16 | Jody Inkster | Arctic Tern | 2 | near MW15-16 | | marsh | |
| 5-Apr-16 | Sean Suttie | Bald Eagle | 1 | Camp - Core shack | Flying | | |
| 5-Apr-16 | Rene Darveau | Bald Eagle | 1 | Camp site | | | |
| 8-Jun-16 | | Barn Swallows | 15 | camp site | flying | | present since early June |
| 10-Jun-16 | Robert Andrew | Barn Swallows | | km 24 | | | |
| 11-Jun-16 | Crystal Beaudry | Barn Swallows | 2 | driller staging | | | |
| 12-Jun-16 | Jody Inkster | Barn Swallows | 2 | camp site | flying, building a nest | sub-alpine | |
| 12-Jun-16 | Crystal Beaudry | Barn Swallows | 2 | camp | | | |
| 20-Jun-16 | Scot MacNeil | Bear | | tote road | | | |
| 29-Apr-16 | Lucian McMillan | Beaver | 1 | 16km | Foraging on side of road | | |
| 19-May-16 | Kelli Bergh | bird of prey | 1 | up high towards the snow capped hill west of ABM | circling | alpine | likely eagle given the size |
| 17-May-16 | Jacob Acklack | Black Bear | 1 | km 1 tote road | running across road | | |
| 1-Jun-16 | Doris John | Black Bear | 1 | km 5 tote road | | on road | |
| 3-Jun-16 | Derrick Mohr | Black Bear | 1 | km 22.5 | walking | | cleared off road |
| 28-Jul-16 | Catherine Henry | Black Bear | 1 | KM 1 | walking | tote road | |
| 23-May-16 | Dillon Hume | Bumblebee | 1 | Camp, Coreland | | | |
| 8-May-16 | Trevor Boyko | Canada Goose | 1 | Edge of lake | feeding | | |
| 11-May-16 | Jody Inkster | Canada Goose | 150 | above mountain near camp | flying north west | | |
| 4-Jun-16 | Robert Neg | Canada Goose | | directly above camp | flying in a v-formation | | above camp 200m flying north |
| 28-Aug-16 | Trent Newkirk | Canada Goose | 8 | north of ABM pond | feeding | | |
| 17-May-16 | Dorothy Dick | Canada Lynx | 1 | km 14 tote road | standing on road and went into bush | | |
| 31-May-16 | Tyler Porter | Canada Lynx | 1 | km 15 tote road | walking | tote road | uninterested in us |
| 6-Jul-16 | Oscar Neilson | Canada Lynx | 1 | km 21 | light jog | roadside | |
| 20-Jul-16 | Rene Darveau | Canada Lynx | 1 | km 14.8 | hunting | road | |
| 26-Jul-16 | Catherine Henry | Canada Lynx | 1 | KM15 | crossing road | tote road | |
| 7-Sep-16 | Neil Martin | Canada Lynx | 1 | Hwy 8 km east of gate house | running | forest | |
| 1-Jul-16 | Kevin Duff | Caribou | 2 | 3.2 mi SE of camp | resting on snow | snow patch | |
| 2-Jul-16 | Kevin Duff | Caribou | 1 | 3.4mi SE of camp | resting | tree line | |
| 2-Jul-16 | Rafe Etzel | Caribou | 1 | GP4F | laying down | | |
| 2-Jul-16 | Dennis Menacho | Caribou | 1 | GP4F | laying down | | |
| 2-Jul-16 | Kevin Duff | Caribou | 1 | 2.6 mi SE of camp | walking | saddle | immature bull |
| 3-Jul-16 | Kevin Duff | Caribou | 1 | 3.3 mi SE of camp | resting | snow patch | mature bull |
| 4-Jul-16 | Ron Voordouw | Caribou | 1 | near GP4F | lying in snow | alpine slope | |
| 4-Jul-16 | Kevin Duff | Caribou | 1 | 3.5 mi SE of camp | laying down | snow patch | mature bull |
| 4-Jul-16 | Rafe Etzel | Caribou | 1 | | laying in snow | hillside | |
| 4-Jul-16 | Dennis Menacho | Caribou | 1 | | laying in snow | hillside | |
| 9-Jul-16 | Kevin Duff | Caribou | 3 | 4.1 km S of Camp | Grazing | Alpine | |
| 9-Jul-16 | Kevin Duff | Caribou | 1 | 2.8 m E of camp | Feeding | Alpine | |
| 9-Jul-16 | Kevin Duff | Caribou | 2 | 3.6m S of Camp | Breeding | Saddle | |
| 10-Jul-16 | Rafe Etzel | Caribou | 1 | Above the deposit | Feeding | hillside | |
| 11-Jul-16 | Kevin Duff | Caribou | 1 | 3 miles S of Camp | Feeding | Alpine | |
| 11-Jul-16 | Kevin Duff | Caribou | 2 | 1 mi S of camp | Feeding | Bushy Slope | |
| 13-Jul-16 | Rafe Etzel | Caribou | 1 | East of Genoa Creek | Feeding | mountain slope | |
| 14-Jul-16 | Dennis Menacho | Caribou | 1 | East of Genoa Creek | Resting | hillside | |
| 15-Jul-16 | Kevin Duff | Caribou | 1 | 2.5 mil S of Camp | Resting | Alpine | |
| 15-Jul-16 | Rory Goebel | Caribou | 1 | Km 21 | | Road | |
| 15-Jul-16 | Trent Newkirk | Caribou | 1 | Upper East Bam | Feeding | buck brush | |
| 17-Jul-16 | Oscar Neilson | Caribou | 1 | Road | Walking | | |

## 2016 WILDLIFE LOG

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|---|---|---|---|---|---|---|---|
| 18-Jul-16 | Terry Ollie | Caribou | 1 | Fault Creek | drinking water | | |
| 27-Jul-16 | Jason Smith | Caribou | 1 | camp | feeding | hill slope | |
| 27-Jul-16 | Daniel Menacho | Caribou | | | | | |
| 27-Jul-16 | Doris John | Caribou | 1 | Coreland | feeding | ridge | |
| 28-Jul-16 | Jody Inkster | Caribou | 1 | south of camp | grazing | alpine ridge | bull |
| 31-Jul-16 | Glen Wadsworth | Caribou | 1 | N61 27.705,W130 32.957 | walking | alpine | |
| 30-Jul-16 | Glen Wadsworth | Caribou | 1 | N61 27.393, W130 32.494 | walking | hill top | |
| 27-Jul-16 | Kevin Duff | Caribou | 1 | KM 20 | resting | | |
| 30-Jul-16 | Rafe Etzel | Caribou | 2 | Rhyolite Peak | feeding | slopes | |
| 26-Jul-16 | Rafe Etzel | Caribou | 1 | 500m south of camp | resting | brush | |
| 27-Jul-16 | Tara Ollie | Caribou | 1 | Core land | feeding | brushy | |
| 1-Aug-16 | Russ Geist | Caribou | 1 | km 23.75 | running | | |
| 2-Aug-16 | Kellin Friesen | Caribou | 1 | Weather station | | | |
| 2-Aug-16 | Oscar Neilson | Caribou | 1 | ridge S of camp | resting | alpine | |
| 3-Aug-16 | Glen Wadsworth | Caribou | 1 | 61 26'49.2,130 31'43.2" | walking | high slopes | |
| 4-Aug-16 | Jody Inkster | Caribou | 1 | ridge S of camp | feeding | alpine | |
| 5-Aug-16 | Abraham Tutcho | Caribou | 1 | km 21 | | | bull |
| 6-Aug-16 | Jody Inkster | Caribou | 1 | km 21 | running/feeding | shrubs | crossing road, bull |
| 7-Aug-16 | Jody Inkster | Caribou | 1 | km 20.7 | walking on road | subalpine | |
| 13-Aug-16 | Rene Darveau | Caribou | 1 | pond | feeding | shore of pond | |
| 13-Aug-16 | Rene Darveau | Caribou | 1 | drill pad DHK | running | slope | |
| 14-Aug-16 | Rene Darveau | Caribou | 2 | west of deposit | feeding | | |
| 14-Aug-16 | Kevin Duff | Caribou | 2 | Rhyolite peak | walking | alpine | |
| 15-Aug-16 | Kevin Duff | Caribou | 12 | back of Rhyolite Peak | feeding | alpine | |
| 16-Aug-16 | Kevin Duff | Caribou | 5 | above ABM east | feeding | alpine | |
| 17-Aug-16 | Kevin Duff | Caribou | 1 | 3.4mi S of camp | feeding | alpine | 1 immature bull |
| 18-Aug-16 | Kevin Duff | Caribou | 1 | 22km | walking | brushy slope | mature bull |
| 18-Aug-16 | Kevin Duff | Caribou | 1 | Rhyolite peak | walking | alpine | mature bull |
| 19-Aug-16 | Kevin Duff | Caribou | 1 | Rhyolite Peak | feeding | alpine | immature bull |
| 19-Aug-16 | Kevin Duff | Caribou | 4 | 3.6mi S of camp | feeding | alpine | mature bulls |
| 19-Aug-16 | Kevin Duff | Caribou | 3 | 3.2mi S of camp | feeding | alpine | 2 cows and a calf |
| 19-Aug-16 | Kevin Duff | Caribou | 1 | | resting | alpine | immature bull |
| 19-Aug-16 | Rene Darveau | Caribou | 2 | Rhyolite Peak | watching | slope | |
| 20-Aug-16 | Kevin Duff | Caribou | 1 | 3.4mi SE of camp | resting | alpine | bull |
| 20-Aug-16 | Kevin Duff | Caribou | 4 | 3.1mi SE of camp | feeding | | mature bull, immature bull, cow and calf |
| 20-Aug-16 | Jody Inkster | Caribou | 13 | 2km SW of weather Station | feeding and resting | alpine | |
| 21-Aug-16 | Kevin Duff | Caribou | 1 | Rhyolite peak | feeding | alpine | immature bull |
| 21-Aug-16 | Kevin Duff | Caribou | 1 | Weather station | feeding | subalpine | mature bull |
| 22-Aug-16 | Kevin Duff | Caribou | 11 | Rhyolite peak | feeding | alpine | ɔull, immature bull, 4 cows, 2 calves |
| 22-Aug-16 | Kevin Duff | Caribou | 1 | Rhyolite peak | feeding | valley bottom | mature bull |
| 27-Aug-16 | Kevin Duff | Caribou | 2 | above ABM east | feeding | alpine | mature and immature |
| 27-Aug-16 | Kevin Duff | Caribou | 13 | Rhyolite peak | resting | | |
| 27-Aug-16 | Harold John | Caribou | 14 | Rhyolite Peak | | | |
| 28-Aug-16 | Harold John | Caribou | 17 | Rhyolite peak | | | |
| 29-Aug-16 | Kevin Duff | Caribou | 4 | Rhyolite peak | feeding | alpine | immature bulls |
| 29-Aug-16 | Jody Inkster | Caribou | 13 | 5km SW of camp | resting | alpine | |
| 29-Aug-16 | Jody Inkster | Caribou | 4 | 4 km SW of camp | resting | | |
| 31-Aug-16 | Jody Inkster | Caribou | 11 | south of Fault Cr | feeding/resting | slope | |
| 2-Sep-16 | Kevin Duff | Caribou | 12 | Rhyolite peak | feeding | alpine | cows and calves |
| 2-Sep-16 | Kevin Duff | Caribou | 20 | SE end of property | feeding | alpine | 10 bulls, 10 cows/calves |
| 3-Sep-16 | Kevin Duff | Caribou | 3 | 3.4mi SE of camp | feeding | alpine | 2 cows and a calf |
| 5-Sep-16 | Kevin Duff | Caribou | 22 | Rhyolite peak | feeding | alpine | |
| 11-Sep-16 | Kevin Duff | Caribou | 18 | Rhyolite peak | resting | alpine | |
| 9-Sep-16 | scott mac | Caribou | 1 | center road on drill pad km 21 | resting | Reclaimed drill pad | resting bull |
| 9-Sep-16 | Kevin Duff | Caribou | 30 | Rhyolite peak | feeding | alpine | |
| 8-Sep-16 | Kevin Duff | Caribou | 12 | Rhyolite peak | feeding | alpine | |

## 2016 WILDLIFE LOG

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| DATE | OBSERVER | SPECIES | # | LOCATION | BEHAVIOUR | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| 14-Sep-16 | Kevin Duff | Caribou | 1 | 1 km sw 25 km | feeding | alpine | |
| 11-Sep-16 | Rene Darveau | Caribou | 18 | Rhyolite Peak | feeding | alpine | herd |
| 11-Sep-16 | Jamie McLennan | Caribou | 1 | RC higway finlaysin crossing | walking | Taiga | |
| 12-Sep-16 | Rene Darveau | Caribou | 4 | Rhyolite Peak S. | feeding | alpine | |
| 12-Sep-16 | Sheila Johnny | Caribou | 5 | mountain | walking | alpine | |
| 11-Sep-16 | Rene Darveau | Caribou | 18 | Ryolite Peak | Feeding | Slope | |
| 12-Sep-16 | Sheila Johnny | Caribou | 5 | mountain | Walking | Alpine | |
| 12-Sep-16 | Rene Darveau | Caribou | 4 | South of Ryolite Peak | Feeding | Slope | |
| 28-Apr-16 | Terry Ollie | Caribou | 6 | 22km slope | Feeding | | |
| 2-May-16 | Jerome de Pasquale | Caribou | 4 | Ridge West of Krakatoa | | | |
| 11-May-16 | Rudi Kern | Caribou | 1 | km 20.5 tote road | feeding | | |
| | Richard Andrew | Caribou | 1 | KM 21 | walking, grazing | shrubs | |
| 11-May-16 | William Davis | Caribou | 1 | km 20.5 tote road | seemed shocked | in the willows | was travelling west |
| 11-May-16 | Jody Inkster | Caribou | 1 | south of camp | walking | mountain slope | |
| 12-May-16 | Abraham Tutcho | Caribou | 1 | km 5 tote road | running on side of road | | |
| 15-May-16 | Terry Ollie | Caribou | 1 | seen from camp | running | | |
| 17-May-16 | Terry Ollie | Caribou | 2 | | Walking | | |
| 4-Jun-16 | Doris John | Caribou | 1 | skyline above camp | | | |
| 4-Jun-16 | Sheila Johnny | Caribou | 1 | | | | |
| 4-Jun-16 | Grace Johnny | Caribou | 1 | | feeding | | |
| 8-Jun-16 | Jody Inkster | Caribou | 11 | weather station | chilling out | alpine | about 1.5 kms SE from station |
| 8-Jun-16 | Doris John | Caribou | 4 | mountain slope above camp | | sub-alpine | |
| 8-Jun-16 | Kellin Friesen | Caribou | 6 | above camp on skyline | | | |
| 8-Jun-16 | Sheila Johnny | Caribou | | | feeding | | |
| 8-Jun-16 | Roger H | Caribou | 6 | ridge SE of camp | feeding | | |
| 23-Jun-16 | tim bennett | Caribou | 1 | ice above ABM | feeding | | |
| 9-Jul-16 | Rene Darveau | Collard Pika | 1 | Km 23 | Feeding | Slope | |
| 15-Jul-16 | Rene Darveau | Collard Pika | 1 | Km 21 | | Slope | |
| 27-Aug-16 | Harold John | Collared Pika | | Rhyolite Peak | | | |
| 3-Sep-16 | Kevin Duff | Common Nighthawk | 1 | flying over camp | flying | camp | |
| 28-Jul-16 | Dave Nuttall | Common Raven | 1 | north of Coreland | perched, calling | | |
| 10-May-16 | Crystal Beaudry | Common Raven | 1 | km 24.5 tote road | eating apple stolen from drillers lunch | | |
| 11-May-16 | Jody Inkster | Common Raven | 2 | shore of ponds at ABM | perching on tree | | |
| 30-May-16 | Robert Andrew | Crow | 1 | km 24 | | | |
| 8-May-16 | Crystal Beaudry | Ducks - 2 spp | ~20 | Ponds north of culvert | | | |
| 7-May-16 | Trevor Boyko | Eagle | 1 | | flying around | hillside | |
| 15-May-16 | Dillon Hume | Eagle | 1 | ABM | flying | Sky | |
| 10-Jun-16 | Robert Andrew | Eagle | 1 | drill site | | | |
| 30-Jul-16 | Glen Wadsworth | Eagle | 1 | N61 27.833,W130 36.376 | flying | | |
| 2-Aug-16 | Glen Wadsworth | Eagle | 1 | east of deposit | sitting on nest | bluffs | |
| 4-Aug-16 | Glen Wadsworth | Eagle | 1 | N61 26'47",W130 37'03" | sitting | bluffs | |
| 7-Jun-16 | Doris John | Ermine | 1 | parking lot | | | could be a male by its size |
| 7-Jun-16 | Will Shawcross | Ermine | 1 | km 20 | | | |
| | Kellin Friesen | Falcon | 1 | KM 24 | flying | | |
| 3-Aug-16 | Glen Wadsworth | Falcon | 1 | 61 37'52.9",130 32'53.1" | flying | high slopes | |
| 2-Aug-16 | Glen Wadsworth | Falcon | 1 | N61 27 30", W130 33 06" | flying | high slopes | |
| 10-Sep-16 | Kevin Duff | Fischer | 1 | 1km west of Rhyolite Peak | walking | alpine | crossing mountain top |
| 3-Apr-16 | Dorothy Dick | Golden Eagle | 1 | East of fault creek | Flying above hill | | |

## 2016 WILDLIFE LOG

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| DATE | OBSERVER | SPECIES | # | LOCATION | BEHAVIOUR | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| 30-Jul-16 | Glen Wadsworth | Golden Eagle | 1 | N61 27.883, W130 36.376 | flying | alpine | |
| 6-Aug-16 | Glen Wadsworth | Golden Eagle | 2 | N61 27' 36", W130 35' 13" | sitting on nest | bluffs | 2 youngsters |
| 10-Sep-16 | Doris John | Golden Eagle | 1 | camp | circling | | |
| 10-Sep-16 | shirley ladue | Golden Eagle | 1 | camp | circling | | |
| 10-Sep-16 | Sheila Johnny | Golden Eagle | 1 | camp | circling | | |
| 3-Sep-16 | Jody Inkster | Golden Eagle | 1 | east of deposit | flying | alpine | |
| 3-Jun-16 | Jody Inkster | Golden Eagle | 2 | above drills | flying | | |
| 1-Jul-16 | Jody Inkster | Golden Eagle | 2 | above W mountain | flying/looking for food | sky | |
| 2-Jun-16 | | Gray Jay | 2 | camp | searching for food | trees | |
| 19-Apr-16 | | Grizzly Bear | 2 | ~3.5km SW of camp | | Rocks & shrubs | Part of aerial bear den survey |
| 10-May-16 | Robert Andrew | Grizzly Bear | 1 | highway 232km | | | |
| 12-May-16 | Crystal Beaudry | Grizzly Bear | 1 | km 22.8 tote road | running east off road towards valley | | |
| 13-May-16 | Jody Inkster | Grizzly Bear | 1 | 300 m from km 21 tote road | running | | |
| 20-Jun-16 | Scott Mac | Grizzly Bear | 1 | km 13 | walking | | |
| 5-Jul-16 | Jody Inkster | Grizzly Bear | 1 | west of deposit | feeding/running | alpine | 2-3 year old |
| 14-Jul-16 | Terry Ollie | Grizzly Bear | 1 | Km 25 | Feeding | | |
| 28-Jul-16 | Jody Inkster | Grizzly Bear | 1 | east of Fault Cr | feeding | alpine, slope | |
| 16-Aug-16 | Kevin Duff | Grizzly Bear | 1 | 1 mi N or North Lake | feeding | brushy slope | |
| 16-Aug-16 | Annette Giesbrecht | Grizzly Bear | 1 | km 4 | running | road | |
| 16-Aug-16 | Jody Inkster | Grizzly Bear | 1 | km 4 | running | road | running across road |
| 17-Aug-16 | Kevin Duff | Grizzly Bear | 1 | 2.8 mi SE of camp | eating berries | treeline | boar |
| 19-Aug-16 | Kevin Duff | Grizzly Bear | 1 | 3.2mi SE of camp | feeding | treeline | adult |
| 19-Aug-16 | Rene Darveau | Grizzly Bear | 1 | GP4F | feeding | slope | |
| 27-Aug-16 | Nick Degraff | Grizzly Bear | 1 | 10.5km on tote road | | | |
| 2-Sep-16 | Kevin Duff | Grizzly Bear | 2 | 0.5mi E of ABM | eating berries | alpine | sow and cub (last year) |
| 3-Sep-16 | Kevin Duff | Grizzly Bear | 2 | above skid drill | feeding | alpine | sow and cub (last year) |
| 10-May-16 | Madeline Peace | Grizzly Bear | 1 | Fault Creek near gauging station | walking | | |
| 8-Jun-16 | Heiko | Grizzly Bear | 1 | weather station | | alpine | 2km from weather station |
| 5-Jul-16 | Paul Donnessey | Grizzly Bear | 1 | west of deposit | feeding | slopes | |
| 2-May-16 | Crystal Beaudry | Ground Squirrel | 1 | 24.5km | Playing in culvert | | |
| 8-May-16 | Crystal Beaudry | Ground Squirrel | 1 | 23km | | | |
| 9-May-16 | Jody Inkster | Ground Squirrel | 1 | Near weather access | running along the road | Subalpine | |
| 9-May-16 | Jody Inkster | Ground Squirrel | 1 | near ABM culvert | watching me | creek bank | |
| 9-May-16 | Abraham Tutcho | Ground Squirrel | 1 | KM 22 | | side of road | |
| 1-Jun-16 | Jerome de Pasquale | Ground Squirrel | 2 | km 22.5 | running across the road | | |
| 7-Jun-16 | Jerome de Pasquale | Ground Squirrel | 1 | camp site | | | |
| 8-Jun-16 | Rene Darveau | Ground Squirrel | 1 | km 23 | | | near incinerator |
| 9-Jun-16 | Crystal Beaudry | Ground Squirrel | 10 | km 20 - 23 | | | |
| 21-Jul-16 | Rene Darveau | Ground Squirrel | 1 | km 24 | running | | |
| 24-Jul-16 | Rene Darveau | Ground Squirrel | 1 | km 25 | running | | |
| 24-Jul-16 | Rene Darveau | Ground Squirrel | | km 24 | | | |
| 26-Jul-16 | Annette Giesbrecht | Ground Squirrel | 1 | camp | walking | | |
| 30-Jul-16 | Dillon Hume | Ground Squirrel | 1 | camp | running | Camp | |
| 13-Aug-16 | Doreen Ladue | Ground Squirrel | 1 | camp | running | | |
| 14-Aug-16 | Sheila Johnny | Ground Squirrel | 1 | camp | running | | |
| 17-Aug-16 | Sheila Johnny | Ground Squirrel | 1 | camp | running | | |
| 17-Aug-16 | Annette Giesbrecht | Ground Squirrel | 1 | kitchen | | | |
| 19-Aug-16 | Sheila Johnny | Ground Squirrel | 1 | camp | running | bushes | |
| 19-Aug-16 | Doreen Ladue | Ground Squirrel | 1 | camp | running | | |
| 19-Aug-16 | Sheila Johnny | Ground Squirrel | 1 | kitchen | running | | |
| 10-May-16 | Rudi Kern | Ground Squirrel | 2 | km 24 tote road | running | | |
| 2-Jun-16 | | Ground Squirrel | 2 | ABM km 24 | scurrying along | roadside | |

### 2016 WILDLIFE LOG

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| DATE | OBSERVER | SPECIES | # | LOCATION | BEHAVIOUR | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| 16-Aug-16 | Sheila Johnny | Grouse | 1 | km 15 | | | |
| 17-Aug-16 | Doreen Ladue | Grouse | 1 | 1.5km | flying | on road | |
| 17-Aug-16 | Doreen Ladue | Grouse | 3 | on tote road | running | | |
| 26-Aug-16 | Doreen Ladue | Grouse | 1 | km 3 | flying | | |
| 3-Jun-16 | Jody Inkster | Gull | 1 | near lake at deposit | flying | wetland | |
| 27-Jul-16 | Jody Inkster | Gyrfalcon | 1 | near GW station 6 | flying, calling | subalpine | |
| 27-Jul-16 | Catherine Henry | Gyrfalcon | 2 | ST KZ6 | protecting nest | valley | |
| 4-May-16 | Abraham Tutcho | Hawk | 1 | 22km | Flying | Slopes | |
| 4-May-16 | Roger & Jerome | Hawk | 1 | 22km | Hunting | | Following road as a hunting corridor |
| 17-Jun-16 | Will Shawcross | Hawk | 1 | km 22.5 | soaring | | |
| 29-May-16 | Will Shawcross | Hoary Marmot | 1 | Km 22.5 | Eating Grass | | |
| 11-Jun-16 | Robert Andrew | Hoary Marmot | 1 | km 24 | | | staging |
| 22-May-16 | Paul Donnessey | Hoary Marmot | 1 | Km 22.5 | | | |
| 11-Jun-16 | Will Shawcross | Hoary Marmot | 1 | km 22.5 | | tote road | |
| 12-Jun-16 | Crystal Beaudry | Hoary Marmot | 1 | km 22 | | | |
| 12-Jun-16 | Rory Goebel | Hoary Marmot | 2 | km 23 | | roadside | |
| 12-Jun-16 | Rory Goebel | Hoary Marmot | 2 | Km 23 | | | |
| 13-Jun-16 | Crystal Beaudry | Hoary Marmot | 2 | km 22 | | | |
| 13-Jun-16 | Scott MacNeil | Hoary Marmot | 2 | | | | |
| 14-Jun-16 | Crystal Beaudry | Hoary Marmot | 2 | km 22 | | | |
| 14-Jun-16 | Scott Mac | Hoary Marmot | 1 | km 23 | | | |
| 15-Jun-16 | Crystal Beaudry | Hoary Marmot | 2 | km 22 | | | |
| 16-Jun-16 | Crystal Beaudry | Hoary Marmot | 1 | driller staging | | | |
| 21-Jun-16 | Scott Mac | Hoary Marmot | 2 | Km 23 | | | |
| 23-Jun-16 | Scott MacNeil | Hoary Marmot | 2 | km 23 | | | |
| 23-Jun-16 | tim bennett | Hoary Marmot | 1 | driller staging | | | |
| 8-Jun-16 | Rene Darveau | Hoary Marmot | 1 | km 22.5 | watching | rock pile | |
| 8-Jun-16 | Ron Voordouw | Hoary Marmot | 2 | km 23 | running for cover | boulders | looks like they live there |
| 30-Jun-16 | Rafe Etzel | Hoary Marmot | 2 | km 23 | running | side of road | |
| 30-Jun-16 | Rafe Etzel | Hoary Marmot | 1 | km 23 | running | side of road | |
| 8-Jul-16 | Rene Darveau | Hoary Marmot | 1 | km 22.7 | running | bank | |
| 10-Jun-16 | Crystal Beaudry | Least Chipmunk | 1 | km 20 | running | tote road | |
| 3-Jul-16 | Jody Inkster | Least Chipmunk | 3 | km 17.5-17 | feeding | roadside | |
| 21-Jun-16 | tim bennett | Marten | 1 | tote road | walking | | |
| 18-May-16 | Martin | Marten | 1 | km 22.9 tote road | running across road | | |
| 1-Jun-16 | Ron Voordouw | Mew Gull | 2 | Deposit on lake | flying and sitting | | |
| 4-Jun-16 | Ron Voordouw | Mew Gull | 1 | drill area | flying | lake | |
| 12-Apr-16 | Dorothy Dick | Moose | 2 | Km 14 Access Road | | | Standing on road. |
| 19-Apr-16 | | Moose | 1 | 2km E of camp | Bedded | Shrub | Part of aerial bear den survey |
| 30-Apr-16 | Robert | Moose | 1 | 23km | | | |
| 3-May-16 | Dorothy Dick | Moose | 1 | Below fuel tank site | Standing on side of road and ran away | | |
| 8-May-16 | Richard Andrew | Moose | 1 | KM 22 | | | |
| 10-May-16 | Robert Andrew | Moose | 1 | highway 303km | | | |
| 12-May-16 | Brian Hegarty | Moose | 1 | km 4 tote road | running | | |
| 26-May-16 | Robert Andrew | Moose | 1 | km 22 | | | |
| 13-Jun-16 | Gary McLaughlin | Moose | 1 | gate house | wondering | | |
| 15-Jun-16 | Rob Duncan | Moose | 1 | camp site | | | |
| 16-Jun-16 | Shayne Booke | Moose | 2 | km 22 | | | cow and a calf |
| 20-Jun-16 | Taylor Roldyh | Moose | 1 | drill site | | | |
| 20-Jun-16 | Taylor Roldyh | Moose | 1 | K16-370 | | | |
| 30-Jun-16 | Oscar Neilson | Moose | 1 | km 22.5 | resting | | |
| 1-Jul-16 | Kevin Duff | Moose | 1 | 0.5 mi N of N lake | feeding | brushy plateau | |
| 2-Jul-16 | Dennis Menacho | Moose | | GP4F | laying down | | |
| 2-Jul-16 | Rafe Etzel | Moose | 1 | GP4F | laying down | | |
| 2-Jul-16 | Darrin Dawson | Moose | 2 | km 22 | running across road | Subalpine | |
| 2-Jul-16 | Kevin Duff | Moose | 2 | 3.5 mi SE of camp | resting | tree line | 1 bull, 1 cow |
| 3-Jul-16 | Kevin Duff | Moose | 1 | 3.6 mi SE of camp | walking | treeline | mature bull |
| 4-Jul-16 | Kevin Duff | Moose | 1 | 2.0 mi SE of camp | feeding | brushy slope | cow |
| 7-Jul-16 | Kevin Duff | Moose | 3 | camp | walking | brush | 1 cow, 2 calves |
| 8-Jul-16 | Kevin Duff | Moose | 1 | 1 mi S of camp | standing | brush | |

## 2016 WILDLIFE LOG

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| DATE | OBSERVER | SPECIES | # | LOCATION | BEHAVIOUR | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| 8-Jul-16 | Rafe Etzel | Moose | 2 | Genoa Creek | Resting | Brush | 1 cow, 1calf |
| 9-Jul-16 | Derrick Mohr | Moose | 2 | 21.5Km | | | Did not see Mother |
| 9-Jul-16 | Abraham Tutcho | Moose | 3 | 21Km | | | |
| 12-Jul-16 | Will Shawcross | Moose | 2 | Km 20 | Running | | |
| 16-Jul-16 | Doreen Ladue | Moose | 2 | Behind Kitchen | Feeding | Camp | |
| 16-Jul-16 | Sheila Johnny | Moose | 2 | Behind Kitchen | Feeding | Camp | |
| 16-Jul-16 | Doris John | Moose | 2 | Behind Kitchen | Feeding | Camp | |
| 16-Jul-16 | Will Shawcross | Moose | 2 | Behind Kitchen | Feeding | Camp | |
| 19-Jul-16 | Rory Goebel | Moose | 3 | Km 18 | Walking | Buck brush | |
| 20-Jul-16 | Rafe Etzel | Moose | 1 | Km 23 | Walking | buck brush | |
| 24-Jul-16 | Kevin Duff | Moose | 1 | 0.5 mi E of camp | feeding | creek bank | |
| 25-Jul-16 | Kevin Duff | Moose | 2 | ABM | walking | riparian | cow and a calf |
| 26-Jul-16 | Daniel Menacho | Moose | | | | | |
| 28-Jul-16 | Glen Wadsworth | Moose | 1 | N61 28.430 W130 34.018 | feeding | slopes | |
| 30-Jul-16 | Glen Wadsworth | Moose | 1 | N61 26.766, W130 34.630 | laying down | slopes | |
| 28-Jul-16 | Glen Wadsworth | Moose | 1 | N61 28.430 W130 34.018 | feeding | slopes | |
| 30-Jul-16 | Glen Wadsworth | Moose | 1 | N61 26.766, W130 34.630 | laying down | slopes | |
| 27-Jul-16 | Kevin Duff | Moose | 1 | 1.8 km SE of camp | resting | hill slope | |
| 27-Jul-16 | Jerome de Pasquale | Moose | 2 | pond at ABM | swimming | pond | |
| 25-Jul-16 | Whitney Wood | Moose | 1 | km 20.5 tote road | crossing road | | |
| 26-Jul-16 | Rafe Etzel | Moose | 1 | SEB 006 | walking | alpine | |
| 2-Aug-16 | Glen Wadsworth | Moose | 2 | 61 26'34.1", 130 34'53.8" | feeding | lake | cow and a calf |
| 2-Aug-16 | Glen Wadsworth | Moose | 1 | 61 26'35.3",130 34'55.0" | feeding | lake | |
| 5-Aug-16 | Glen Wadsworth | Moose | 1 | 61 29'55", 130 36'34" | feeding | lower slope | |
| 5-Aug-16 | Glen Wadsworth | Moose | 3 | 100m SE of camp | | slope | cow & 2 calves |
| 15-Aug-16 | Kevin Duff | Moose | 2 | 1 mi SE of 25km | feeding | in a lake | 1 cow 1 calf |
| 16-Aug-16 | Kevin Duff | Moose | 1 | GP4F | walking | brushy slope | cow |
| 16-Aug-16 | Kevin Duff | Moose | 2 | 1mi W of GP4F | resting | swamp area | 1 cow 1 calf |
| 17-Aug-16 | Kevin Duff | Moose | 1 | 22 km | walking | brush | 1 cow |
| 17-Aug-16 | Kevin Duff | Moose | 2 | 23km | walking | brush | 1 cow 1 calf |
| 17-Aug-16 | Abraham Tutcho | Moose | 1 | 21km | | | |
| 19-Aug-16 | Kevin Duff | Moose | 2 | Upper East Bam | resting | tree line | cow and a calf |
| 19-Aug-16 | Kevin Duff | Moose | 3 | .25 mi SE of camp | feeding | brush | cow and two calves |
| 19-Aug-16 | Kevin Duff | Moose | 1 | 2.1mi SE of camp | resting | brushy slope | bull |
| 19-Aug-16 | Rene Darveau | Moose | 3 | 20km | walking | slope | sow and 2 cubs |
| 19-Aug-16 | Rene Darveau | Moose | 1 | GP4F | sleeping | slope | |
| 19-Aug-16 | Rene Darveau | Moose | 1 | GP4F | running | slope | |
| 21-Aug-16 | Kevin Duff | Moose | 1 | 2.4 mi SE of camp | standing | brushy slope | mature bull |
| 21-Aug-16 | Kevin Duff | Moose | 2 | 1.6 mi SE of camp | feeding | brushy slope | cow and calf |
| 25-Aug-16 | Kevin Duff | Moose | 1 | Geona Creek valley | feeding | wetland | |
| 10-Sep-16 | Kevin Duff | Moose | 1 | 1/2 km south of 25km | raking antlers | treeline | |
| 10-Sep-16 | Kevin Duff | Moose | 2 | 1 km south of 25km | raking antlers | treeline | cow and calf walking |
| 10-Sep-16 | Kevin Duff | Moose | 3 | 1/2km west of Rhyolite Peak | resting | alpine | 3 mature bulls |
| 11-Sep-16 | Kevin Duff | Moose | 3 | 1 km SW Rhyolite peak | feeding | alpine | 3 mature bulls |
| 8-Sep-16 | scott mac | Moose | 2 | Genoa Creek 1 km north ABM | resting | scrub | 2 mature bulls |
| 6-Sep-16 | Kevin Duff | Moose | 2 | 1 km south of 25km | feeding | Lake | cow and calf |
| 6-Sep-16 | Kevin Duff | Moose | 3 | 1 km west of North Lake | walking | valley bottom | 2 bull following a cow |
| 7-Sep-16 | Kevin Duff | Moose | 2 | 0.5 km s of km 25 | feeding | lake | cow and calf |
| 7-Sep-16 | Kevin Duff | Moose | 2 | 1 km sw 25 km | ruttting | treeline | bull and cow ruttung |
| 14-Sep-16 | Kevin Duff | Moose | 1 | 0.5 km s of km 25 | feeding | lake | cow |
| 13-Sep-16 | Kevin Duff | Moose | 1 | 1 km sw 25 km | feeding | Lake | |
| 13-Sep-16 | Kevin Duff | Moose | 1 | 1 km s of km 25 | feeding | lake | cow |
| 13-Sep-16 | Kevin Duff | Moose | 2 | 1.5 km sw 25 km | ruttting | Lake | cow and calf |

## 2016 WILDLIFE LOG

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| DATE | OBSERVER | SPECIES | # | LOCATION | BEHAVIOUR | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| 12-Sep-16 | Kathleen Suza | Moose | 2 | Genoa Creek 1 km north ABM | walking | valley bottom | cow and bull |
| 12-Sep-16 | Rene Darveau | Moose | 1 | Rhyolite Peak S. | walking | forest | |
| 12-Sep-16 | Sheila Johnny | Moose | 2 | valley | feeding | forest | |
| 14-Sep-16 | Kevin Duff | Moose | 3 | 1.5 mi SE of camp | rutting | forest | |
| 14-Sep-16 | Kevin Duff | Moose | 2 | 1.5 mi SE of camp | feeding | forest | |
| 12-Sep-16 | Rene Darveau | Moose | 1 | South of Ryolite Peak | Walking | forest | |
| 12-Sep-16 | Sheila Johnny | Moose | 2 | Valley | Feeding | | |
| 20-Sep-16 | Mat Brickendin | Moose | 3 | UTM 417086/6816460 | | | Moose followed mat up into the alpine |
| 21-Sep-16 | Rory Goebel | Moose | 1 | 18-17Km | Feeding | Road | |
| 29-Sep-16 | Mat Brickendin | Moose | 2 | UTM 0418078/6815608 | Feeding | | |
| 24-Jul-16 | Kevin Duff | Mose | 2 | 1.8 mi S of camp | walking | brushy slope | cow and a calf |
| 23-May-16 | Jerome de Pasquale | Muskrat | 1 | Drill Site | swimming | | |
| 28-Apr-16 | R.Vourdouw | Northern Harrier | 1 | Fly Canp. | Hunting | Marsh | |
| 6-Aug-16 | Shawn Scott | Northern Shrike | 1 | km 23 | perched | in trees | |
| 28-Jun-16 | Morgan H. | Olive-sided Flycatcher | 1 | 9V 414820E, 6814400N | feeding | coniferous dominated | calling |
| 3-May-16 | Jody Inkster | Peregrine Falcon | 1 | Robert Campbell Hwy | Flying into trees | | |
| 27-Aug-16 | Will Shawcross | Porcupine | 1 | 22.5km | eating | side of road | |
| 2-Sep-16 | Will Shawcross | Porcupine | 1 | km 22 | eating grass | road | |
| 2-Sep-16 | Jody Inkster | Porcupine | 1 | 22.8km | running | road | |
| 10-Sep-16 | Kelli Bergh | Porcupine | 1 | km 22 tote road | walking | road | |
| 9-Sep-16 | Kelli Bergh | Porcupine | 1 | KM 13 tote road | running | | |
| 10-Sep-16 | Dale Gibson | Porcupine | 1 | | | | |
| 9-Sep-16 | shirley ladue | Porcupine | 1 | km 23 tote road | walking | | |
| 10-Sep-16 | Sheila Johnny | Porcupine | 1 | camp | feeding | camp | |
| 11-Sep-16 | Jamie McLennan | Porcupine | 1 | Tote road Km 7 | walking | Taiga | |
| 18-Sep-16 | Jamie McLennan | Porcupine | 1 | tote road km 22 | walking | forest | |
| 2-May-16 | Abraham Tutcho | Porcupine | 1 | Access road | Running | | |
| 3-May-16 | Gary McLaughlin | Porcupine | 1 | 15km | Walking across road | | |
| 4-May-16 | Anthony Bier | Porcupine | 1 | 16km | walking along road | | moving away slowly |
| 5-May-16 | Jody Inkster | Porcupine | 1 | Near KZ-2 (25km) | eating and sleeping | Willow tree | Climbed a tree, ate and rested |
| 16-May-16 | Kelli Bergh | Porcupine | 1 | km 11 tote road | running on side of road | | |
| 11-May-16 | Trevor Boyko | Porcupine | 1 | km 21 tote road | | | |
| 12-May-16 | Rafe Etzel | Porcupine | 1 | km 14 tote road | walking | | |
| 12-May-16 | Abraham Tutcho | Porcupine | | | | | |
| 13-May-16 | Gary McLaughlin | Porcupine | 2 | km 15 tote road | eating along side of road | | |
| 14-May-16 | Crystal Beaudry | Porcupine | 1 | km 14 tote road | walking across road | | |
| 24-May-16 | Terry Ollie | Porcupine | 1 | Km 22 | | | |
| 25-May-16 | Dale Gibson | Porcupine | 1 | | | | |
| 1-Jun-16 | Tyler Porter | Porcupine | 1 | historic Coreland | running away | swamp area | |
| 3-Jun-16 | Jerome de Pasquale | Porcupine | 1 | under incinerator | | | |
| 3-Jun-16 | Dillon Hume | Porcupine | 1 | Coreland | chewing core boxes | | |
| 4-Jun-16 | Ron Voordouw | Porcupine | 1 | km 22 | running | slopes | |
| 7-Jun-16 | Crystal Beaudry | Porcupine | 1 | km 12 | eating | road side | |
| 11-Jun-16 | Robert Andrew | Porcupine | 1 | km 22 | | | |
| 13-Jun-16 | Tyler Porter | Porcupine | 1 | km 13 | crossing road | | |
| 27-Jun-16 | Steve Bultitude | Porcupine | 1 | km 17 | running | forest | |
| 1-Jul-16 | Tyler Porter | Porcupine | 1 | tote road | crossing the road | | in a hurry |
| 2-Jul-16 | Jamie McLennan | Porcupine | | km 18 | | | |
| 6-Jul-16 | Oscar Neilson | Porcupine | 1 | km 20 | | buck brush | |
| 8-Jul-16 | Jody Inkster | Porcupine | 1 | km 23.5 | running | roadside | |
| 9-Jul-16 | Paul Donnessey | Porcupine | 1 | Pad 6 | | | |
| 15-Jul-16 | Oscar Neilson | Porcupine | 1 | Weather station | | hills | |
| 15-Jul-16 | Rory Goebel | Porcupine | 1 | Km 21 | | Road | |
| 21-Jul-16 | Will Shawcross | Porcupine | 1 | Km 21 | crossing road | | |
| | Mitch Heynen | Porcupine | 1 | km 15-12 | | roadside | |
| | Russ Geist | Porcupine | 1 | | | | |
| 2-Aug-16 | Kelli Bergh | Porcupine | 1 | km 18 | running | roadside | ran down road and up tree |

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| DATE | OBSERVER | SPECIES | # | LOCATION | BEHAVIOUR | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| 9-Aug-16 | Rene Darveau | Porcupine | 1 | km 17.3 | walking | road | |
| 13-Aug-16 | Rene Darveau | Porcupine | 1 | km 21.5 | walking | road | |
| 17-Aug-16 | Jody Inkster | Porcupine | 1 | km 22 | walking | subalpine | walking across road |
| 5-Apr-16 | Annette Giesbrecht | Ptarmigan | 1 | Outhouses | Feeding | | |
| 5-Apr-16 | Rene Darveau | Ptarmigan | 2 | Camp site | Feeding | | |
| 5-Apr-16 | Sean Suttie | Ptarmigan | 2 | Camp - Outhouses | Feeding | Flats | All white with red mark above eyes. |
| 18-Apr-16 | Sean Suttie | Ptarmigan | 1 | Km 22 | Running for its life | Tote road | |
| 18-May-16 | Kelli Bergh | Ptarmigan | 30 | on east valley of ABM | | | |
| 19-May-16 | Kelli Bergh | Ptarmigan | 10 | on west valley of ABM | | | |
| 20-May-16 | Rene Darveau | Ptarmigan | 1 | Camp Site | | | |
| 25-May-16 | Rene Darveau | Ptarmigan | 1 | Road | | | |
| 26-May-16 | Alicia Vainio | Ptarmigan | 2 | Km 21.3 | Roosting | | |
| 6-Jun-16 | Rene Darveau | Ptarmigan | 1 | weather station | feeding | buck brush | |
| 7-Jun-16 | Rene Darveau | Ptarmigan | 1 | km 21 | | road side | |
| 7-Jun-16 | Rene Darveau | Ptarmigan | 1 | km 22 | flying | road side | |
| 9-Jun-16 | Tyler Porter | Ptarmigan | 1 | near drills | walking/exploring | | |
| 9-Jun-16 | Tyler Porter | Ptarmigan | 1 | km 25 | took really long to cross road!!! | tote road | |
| 9-Jun-16 | Rene Darveau | Ptarmigan | 1 | km 21 | | | |
| 12-Jun-16 | Rory Goebel | Ptarmigan | 1 | km 21 | running | roadside | |
| 12-Jun-16 | Rory Goebel | Ptarmigan | 1 | Km 21 | | | |
| 13-Jun-16 | Doreen L | Ptarmigan | 1 | tote road | on road | | |
| 6-Jul-16 | Rene Darveau | Ptarmigan | 1 | feeding | km 14.5 | | |
| 9-Jul-16 | Rene Darveau | Ptarmigan | 9 | Road 22.7 | Family walk | road | |
| 10-Jul-16 | Rene Darveau | Ptarmigan | 4 | 22.8km | Running | Road | |
| 11-Jul-16 | Rene Darveau | Ptarmigan | 9 | 22.6Km | Feeding | Road | |
| 17-Jul-16 | Rene Darveau | Ptarmigan | 3 | Drill Pad 1616 | Resting | | |
| 18-Jul-16 | Jessica Galavan | Ptarmigan | 3 | Staging | Sitting in RTV | Staging | |
| 26-Jul-16 | Kellin Friesen | Ptarmigan | 7 | KM 23 | walking | side of road | |
| | Tyler Porter | Ptarmigan | 3 | KM 25 | walk | side of road | |
| 1-Aug-16 | Dave Nuttall | Ptarmigan | 2 | ABM east hill | fluttering, walking | | |
| 9-Aug-16 | Rene Darveau | Ptarmigan | 3 | km 18 | | | |
| 11-Aug-16 | Rene Darveau | Ptarmigan | 4 | km 21.2 | flying | road | |
| 13-Aug-16 | Rene Darveau | Ptarmigan | 4 | km 22 | running | road | |
| 13-Aug-16 | Rene Darveau | Ptarmigan | 4 | pad 1616 | flying | slope | |
| 3-Apr-16 | Gary McLaughlin | Ptarmigan | 2 | Fault creek | Running around | | |
| 3-Apr-16 | Jim Newton | Ptarmigan | 1 | Km 23.5 on road | Flying | Buck brush | |
| 6-Jun-16 | Crystal Beaudry | Red Fox | 1 | km 24 | eating a ground squirrel | | |
| 17-Jun-16 | Will Shawcross | Red Fox | 1 | km 22.5 | eating a muskrat | | |
| 19-Jun-16 | Abraham Tutcho | Red Fox | 1 | KM 22.5 | Ptarmigan in mouth | | |
| 20-Jun-16 | Scott Mac | Red Fox | 1 | km 21 | carrying a juvenile marmot | | |
| 21-Jun-16 | Scott Mac | Red Fox | 1 | km 21 | carrying a ground squirrel | | |
| 22-Jul-16 | Will Shawcross | Red Fox | 1 | km 22.5 tote road | carrying ground squirrel | | |
| 7-Apr-16 | Rene Darveau | Red Fox | 1 | Camp site | | | Huge bicolor |
| 3-May-16 | Mike Campbell | Red Fox | 1 | ABM Deposit | running | Clearing | ran at me outside drill |
| 5-May-16 | Mike Campbell | Red Fox | 1 | ABM Deposit | walking | | Approached drill |
| 6-May-16 | Chris | Red Fox | 1 | ABM Deposit | scavenging | | In drill shack |
| 11-May-16 | Rafe Etzel | Red Fox | 1 | km 25 tote road | passing through | bush | |
| 18-May-16 | Terry Ollie | Red Fox | 1 | Drill Lay down | Walking around | | |
| 19-May-16 | | Red Fox | 1 | Camp Dry area | | | |
| 25-May-16 | Rene Darveau | Red Fox | 1 | Road | Running | | |
| 26-May-16 | Rene Darveau | Red Fox | 1 | Road | Running | | |
| 27-May-16 | Rory Goebel | Red Fox | 1 | camp, Kitchen | Investigating | | Very calm round people. |
| 27-May-16 | Trent Newkirk | Red Fox | 1 | camp, Kitchen | Looking for food | | |
| 27-May-16 | Rene Darveau | Red Fox | 1 | Campsite | Feeding | | |
| 28-May-16 | Will Shawcross | Red Fox | 1 | Incinerator | Walking | | |
| 28-May-16 | Trent Newkirk | Red Fox | 1 | Roadside | Scavenging | | |
| 29-May-16 | Taylor Roldyh | Red Fox | 1 | Drill area | | Slope | |

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| DATE | OBSERVER | SPECIES | # | LOCATION | BEHAVIOUR | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| 29-May-16 | Robert Andrew | Red Fox | 1 | km 24 | | | |
| 3-Jun-16 | Ron Voordouw | Red Fox | 1 | tote road | running | | came up to window |
| 4-Jun-16 | Crystal Beaudry | Red Fox | 1 | km 23 | | | |
| 5-Jun-16 | Oscar Neilson | Red Fox | 1 | km 22 | eating a dead rabbit | along the brush | loving life |
| 9-Jun-16 | Tyler Porter | Red Fox | 1 | km 21.5 | had ground squirrel in mouth | tote road | |
| 9-Jun-16 | Shayne Booke | Red Fox | 1 | drill site | | | |
| 10-Jun-16 | Robert Andrew | Red Fox | 1 | km 23 | | | tame, came close |
| 10-Jun-16 | Trevor Boyko | Red Fox | 1 | km 23 | | | coming to see what we're doing |
| 16-Jun-16 | Doug Walker | Red Fox | 1 | staging | | | |
| 20-Jun-16 | Scott MacNeil | Red Fox | 1 | km 20 | carrying a squirrel | | |
| 22-Jun-16 | Dale Gibson | Red Fox | 1 | km 23 | feeding | | groundhog in mouth |
| 27-Jun-16 | Steve Bultitude | Red Fox | 1 | drill site | hunting | by the pond | |
| 30-Jun-16 | Tyler Porter | Red Fox | 1 | tote road | feeding | | squirrel in mouth |
| 30-Jun-16 | Rafe Etzel | Red Fox | 1 | km 22.5 | walking | road | |
| 2-Jul-16 | Ron Voordouw | Red Fox | 1 | | running | | |
| 2-Jul-16 | Ross Polutnik | Red Fox | 1 | K16-372 | curiously looking | | seemed friendly |
| 2-Jul-16 | Oscar Neilson | Red Fox | 1 | k16-377 | walking | slopes | |
| 5-Jul-16 | Grace Johnny | Red Fox | 1 | camp site/kitchen | running | | |
| 5-Jul-16 | Grace Johnny | Red Fox | 1 | camp/kitchen | | | |
| 5-Jul-16 | Dan Rohn | Red Fox | 2 | km 22 & k16-381 | trotting | | stole lunch |
| 5-Jul-16 | Martine | Red Fox | 1 | campsite | passing through | | back of kitchen |
| 6-Jul-16 | Rene Darveau | Red Fox | 1 | campsite | running | | |
| 9-Jul-16 | Rene Darveau | Red Fox | 1 | Km 22 | Feeding | Road | |
| 15-Jul-16 | Sheila Johnny | Red Fox | 1 | Camp | Walking | | |
| 15-Jul-16 | Doris John | Red Fox | 1 | Camp | Walking | | |
| 15-Jul-16 | Doreen Ladue | Red Fox | 1 | Camp/Bathroom | Investigating | Camp | |
| 15-Jul-16 | Rene Darveau | Red Fox | 1 | Camp site | Looking for food | Camp | |
| 15-Jul-16 | Oscar Neilson | Red Fox | 1 | Camp/Tent 6 | Investigating | Camp | |
| 18-Jul-16 | Jessica Galavan | Red Fox | 1 | Km 22 | Running | | |
| 19-Jul-16 | Paul Donnessey | Red Fox | 1 | km 22 | Feeding | Road | Caught gophers |
| 24-Jul-16 | Daniel Menacho | Red Fox | | | | | |
| 26-Jul-16 | Annette Giesbrecht | Red Fox | 1 | camp | | | |
| 27-Jul-16 | Dillon Hume | Red Fox | 1 | Coreland | defecating on core | | |
| 27-Jul-16 | Jody Inkster | Red Fox | 1 | km 22.5 | walking | roadside | had squirrel in mouth |
| 31-Jul-16 | Shawn Scott | Red Fox | 1 | km 23 | feeding | | eating baby rabbit |
| 2-Aug-16 | Kellin Friesen | Red Fox | 1 | camp | snooping | | friendly |
| 2-Aug-16 | Dillon Hume | Red Fox | 1 | Coreland | running | | stole food |
| 13-Aug-16 | Rene Darveau | Red Fox | 1 | staging | feeding | | |
| 20-Aug-16 | Jody Inkster | Red Fox | 1 | Weather station | carrying ptarmigan | subalpine | |
| 28-Aug-16 | Will Shawcross | Red Fox | 1 | 22km | eating | | eating a squirrel |
| 18-Sep-16 | Shirley Ladue | Red Fox | 1 | camp | | | |
| 18-Sep-16 | shirley ladue | Red Fox | 1 | | | | |
| 30-Sep-16 | Doris John | Red Fox | 1 | Kitchen Tent | Investigating | Camp | Followed Doris to her tent |
| 1-Oct-16 | shirley ladue | Red Fox | 2 | Road km 19-20 | Playing | Camp | |
| 15-Jul-16 | Paul Donnessey | Red Fox | 1 | Km 21.5 | Walking | Road | Caught a rabbit |
| 21-Sep-16 | Rory Goebel | Red Fox | 1 | Bottom hill of km 19 | Running | Road | Running around seemed to be following Rory |
| 22-Sep-16 | Rory Goebel | Red Fox | 1 | Camp | Investigating | Camp | |
| 2-Jul-16 | Jamie McLennan | Red Squirrel | | km 16 tote road | carrying a cone | | |
| 3-Jul-16 | Jody Inkster | Red Squirrel | 1 | km 14 | running | roadside | |
| 12-May-16 | Jody Inkster | Red Squirrel | 2 | km 22 tote road | running across road | | |
| 15-Jul-16 | Trent Newkirk | Red-necked Phalarope | 1 | Pond Below SEB-001 | Feeding | Pond | |
| 1-Jul-16 | Kevin Duff | Red-tail Hawk | 1 | 3.4mi NE of camp | circling mtn | | |
| 26-Apr-16 | Jerome de Pasquale | Sandhill Crane | ~80 | Above camp | flying | | |
| 26-Apr-16 | Jerome de Pasquale | Sandhill Crane | ~400 | Above camp | flying | | |
| 26-Apr-16 | R.Vourdouw | Sandhill Crane | ~1000 | Above camp | flying north | | |
| 28-Apr-16 | Doris | Sandhill Crane | 2 | Above camp | flying/circling | | |
| 28-Apr-16 | Doreen | Sandhill Crane | many | Above camp | flying/circling | | |
| 28-Apr-16 | Jennifer Tom | Sandhill Crane | many | Above camp | flying/circling | | |
| 3-May-16 | Jody Inkster | Sandhill Crane | ~30 | Robert Campbell Hwy | Flying | | |
| 11-Sep-16 | Jamie McLennan | Sandhill Crane | 30 | West of camp | Flying | | |

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|---|---|---|---|---|---|---|---|
| 12-Sep-16 | Jamie McLennan | Sandhill Crane | 70 | over camp | Flying | | |
| 13-Sep-16 | Jamie McLennan | Sandhill Crane | 125 | Gatehouse | Flying | | |
| 14-Sep-16 | Jamie McLennan | Sandhill Crane | 40 | 5km s. of camp | Flying | | |
| 14-Sep-16 | Jamie McLennan | Sandhill Crane | 100 | 3 km E of camp | Flying | | |
| 17-Sep-16 | Jamie McLennan | Sandhill Crane | 225 | deposit | Flying | | |
| 18-Sep-16 | Jamie McLennan | Sandhill Crane | 30 | 2 km e of camp | Flying | | |
| 18-Sep-16 | Jamie McLennan | Sandhill Crane | 50 | over camp | Flying | | |
| 18-Sep-16 | Jamie McLennan | Sandhill Crane | 70 | over camp | Flying | | |
| 18-Sep-16 | Shirley Ladue | Sandhill Crane | | over camp | Flying | | |
| 18-Sep-16 | Shiela Johnny | Sandhill Crane | | over camp | Flying | | |
| 19-Sep-16 | Jamie McLennan | Sandhill Crane | 40 | over camp | Flying | | |
| 20-Sep-16 | Jamie McLennan | Sandhill Crane | 30 | over camp | Flying | | |
| | shirley ladue | Sandhill Crane | | sky | Flying | | |
| 20-Aug-16 | Annette Giesbrecht | Sandhill Crane | | above camp | flying south | | |
| 20-Aug-16 | Sheila Johnny | Sandhill Crane | | above camp | flying south | | |
| 20-Aug-16 | Jody Inkster | Sandhill Crane | 100 | above camp | flying SE | | |
| 27-Aug-16 | Jody Inkster | Sandhill Crane | 150 | above camp | flying | | |
| 27-Aug-16 | Doris John | Sandhill Crane | many | over camp | flying | | |
| 27-Aug-16 | Doris John | Sandhill Crane | | over camp | flying | | |
| 29-Aug-16 | Trent Newkirk | Sandhill Crane | 30 | Geona/Fylinson Confulence | Flying | | |
| 29-Aug-16 | Doreen Ladue | Sandhill Crane | a bunch | above camp | Flying | sky | |
| 29-Aug-16 | Doreen Ladue | Sandhill Crane | lots | above camp | Flying | | u shape formation |
| 29-Aug-16 | Doris John | Sandhill Crane | | above camp | Flying | | circling |
| 29-Aug-16 | Doreen Ladue | Sandhill Crane | lots | above camp | Flying | | |
| 30-Aug-16 | Doreen Ladue | Sandhill Crane | lots | above camp | flying | sky | |
| 30-Aug-16 | Doreen Ladue | Sandhill Crane | lots | above camp | flying | | circling |
| 30-Aug-16 | Jody Inkster | Sandhill Crane | 50 | 300m south of camp | flying/circling | slopes | |
| 30-Aug-16 | Kevin Duff | Sandhill Crane | 300 | Weather station | standing | subalpine | |
| 31-Aug-16 | Jody Inkster | Sandhill Crane | 50 | 1 km SW of camp | flying | subalpine | |
| 31-Aug-16 | Doreen Ladue | Sandhill Crane | bunches | above camp | flying | | |
| 31-Aug-16 | Doreen Ladue | Sandhill Crane | 38 | above camp | flying | sky | |
| 31-Aug-16 | Doreen Ladue | Sandhill Crane | lots | above camp | ready to land | slopes | |
| 31-Aug-16 | Kevin Duff | Sandhill Crane | 200 | Weather station | standing | subalpine | |
| 31-Jul-16 | Shawn Scott | Semi-palmated Plover | 2 | km 25 | | creek side | with young |
| 9-May-16 | Jody Inkster | Snowshoe Hare | 1 | camp parking lot | eating | | |
| 17-May-16 | Dillon Hume | Snowshoe Hare | 1 | Camp | Sitting | | |
| 19-May-16 | Alicia Vainio | Snowshoe Hare | 1 | Geo Office | | | |
| 20-May-16 | Rene Darveau | Snowshoe Hare | 1 | Camp Site | | | |
| 25-May-16 | Rene Darveau | Snowshoe Hare | 1 | Road | Running | | |
| 26-May-16 | Alicia Vainio | Snowshoe Hare | 1 | | Hopping | Forrest | |
| 3-Jun-16 | Crystal Beaudry | Snowshoe Hare | 3 | km 15 tote road | | | |
| 5-Jun-16 | Oscar Neilson | Snowshoe Hare | 1 | Geo office | kicking it old school | buck brush | seemed rad |
| 5-Jun-16 | Oscar Neilson | Snowshoe Hare | 1 | km 22 | being eaten by a fox | a fox's mouth | unhappy |
| 11-Jun-16 | Crystal Beaudry | Snowshoe Hare | 1 | km 21 | running | tote road | |
| 31-Jul-16 | Dave Nuttall | Snowshoe Hare | 1 | camp | feeding | | |
| 27-Jul-16 | Glen Wadsworth | Snowshoe Hare | 2 | 14km tote rd | resting | tote road | |
| | Rene Darveau | Snowshoe Hare | 6 | KM 13-15 | resting | side of road | |
| 25-May-16 | Rene Darveau | Snowshoe Hare | 1 | Road | Running | | |
| 23-May-16 | Dillon Hume | Snowshoe Hare | 3 | Tote Road | | | |
| 30-Jul-16 | Mitch Heynen | Snowshoe Hare | 5 | km 15-12 | | roadside | |
| 4-May-16 | Maurice | Snowshoe Hare | 1 | Parking lot | Just chilling | | |
| 4-May-16 | Jody Inkster | Snowshoe Hare | 1 | 13.5km | Running | | |
| 9-May-16 | Rafe Etzel | Snowshoe Hare | 1 | KM 17 | running | | |
| 14-May-16 | Jody Inkster | Snowshoe Hare | 2 | km 23.5 tote road | | | |
| 27-May-16 | Rene Darveau | Snowshoe Hare | 1 | km 22 | running | Road | |
| 27-May-16 | Rene Darveau | Snowshoe Hare | Several | km 15 tote road | running | Road | Big bunch |
| 27-May-16 | Rene Darveau | Snowshoe Hare | 1 | Campsite | Running | | |
| 31-May-16 | Jody Inkster | Snowshoe Hare | 1 | km 15 tote road | running | roadside | |
| 31-May-16 | O.Nielsen | Snowshoe Hare | 1 | | buck brush | | |
| 2-Jun-16 | Jody Inkster | Snowshoe Hare | 1 | km 21.5 | running | roadside | |
| 7-Jun-16 | Jody Inkster | Snowshoe Hare | 1 | km 22 | running | road side | |

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|---|---|---|---|---|---|---|---|
| 8-Jun-16 | Grace Johnny | Snowshoe Hare | 1 | camp site | feeding | | |
| 9-Jun-16 | Rene Darveau | Snowshoe Hare | 2 | camp site | playing | | parking lot |
| 13-Jun-16 | Doreen Ladue | Snowshoe Hare | 1 | tote road | hopping across road | | |
| 14-Jun-16 | Rory Goebel | Snowshoe Hare | 1 | campsite | feeding | camp | |
| 27-Jun-16 | Dillon Hume | Snowshoe Hare | 1 | core shack | running | | |
| 1-Jul-16 | Grace Johnny | Snowshoe Hare | 1 | camp | | | |
| 1-Jul-16 | Rene Darveau | Snowshoe Hare | group | km 14-16 | running | tote road | |
| 2-Jul-16 | Jody Inkster | Snowshoe Hare | 1 | km 21 | crossing road | sub-alpine | |
| 2-Jul-16 | Rene Darveau | Snowshoe Hare | | km 14-16 | running | | a group |
| 2-Jul-16 | Rene Darveau | Snowshoe Hare | group | km 14-16 | | tote road | |
| 4-Jul-16 | Rene Darveau | Snowshoe Hare | 1 | camp site | running | tote road | |
| 8-Jul-16 | Rene Darveau | Snowshoe Hare | 2 | campsite | running | | |
| 13-Jul-16 | Doreen Ladue | Snowshoe Hare | 1 | Camp | hopping across road | Bush | |
| 15-Jul-16 | Rene Darveau | Snowshoe Hare | 1 | Camp site | Hopping | Camp | |
| 18-Jul-16 | Doreen Ladue | Snowshoe Hare | 1 | Outside Office #3 | Feeding | Camp | |
| 24-Jul-16 | Rene Darveau | Snowshoe Hare | 1 | km 20.2 | | | |
| 26-Jul-16 | Jason Smith | Snowshoe Hare | 2 | camp | | | |
| 26-Jul-16 | Dave Nuttall | Snowshoe Hare | 2 | km 14 | hanging out | | |
| 30-Jul-16 | Kelli Bergh | Snowshoe Hare | 1 | km 12 | crossing road | running | |
| | Kelli Bergh | Snowshoe Hare | 1 | km 10 | | | |
| 1-Aug-16 | Dave Nuttall | Snowshoe Hare | 1 | Coreland | hopping around | | |
| 2-Aug-16 | Kelli Bergh | Snowshoe Hare | 2 | km 8 & 8.2 | running across road | | |
| 5-Aug-16 | Dillon Hume | Snowshoe Hare | | camp | | | |
| 17-Aug-16 | Doreen Ladue | Snowshoe Hare | 4 | camp | running | on road | |
| 17-Aug-16 | Doreen Ladue | Snowshoe Hare | 1 | on tote road | hopping | | |
| 27-Aug-16 | Jason Smith | Snowshoe Hare | 1 | coreland | | | |
| 17-May-16 | Kelli Bergh | Snowshoe Hare | 1 | km 21 tote road | hopping away | | |
| 17-May-16 | Kelli Bergh | Snowshoe Hare | 1 | km 23 tote road | watching truck | | |
| 12-May-16 | Jody Inkster | Snowshoe Hare | 2 | km 16 tote road | running | | |
| 19-May-16 | Kelli Bergh | Snowshoe Hare | 1 | km 20 tote road | hopping away | | |
| 16-Jun-16 | Doris John | Snowshoe Hare | 1 | campsite | sitting | | kitchen |
| 1-Aug-16 | Kelli Bergh | Snowshoe Hare | 3 | km 10, 5, 3 | running | | |
| 27-May-16 | Robert Andrew | Snowshoe Hare | | km 24 | | | |
| 9-Jun-16 | Trevor Boyko | Snowshoe Hare | 2 | tote road | feeding | | |
| 10-Jun-16 | Robert Andrew | Snowshoe Hare | 1 | | | | |
| 4-Jul-16 | Jody Inkster | Snowshoe Hare | 2 | km 16-13 | running | roadside | |
| 16-Aug-16 | Sheila Johnny | Snowshoe Hare | 3 | km 15 | hopping | | |
| 2-May-16 | Jerome de Pasquale | Snowshoe Hare | 1 | Camp near parkade | | | grey colour |
| 9-May-16 | Jody Inkster | Snowshoe Hare | 1 | Parking lot in camp | Eating | | |
| 12-May-16 | Crystal Beaudry | Snowshoe Hare | 1 | km 19 tote road | hopping off road | | |
| 16-May-16 | Jody Inkster | Snowshoe Hare | 1 | fuel station at camp | running | | |
| 23-May-16 | Jerome de Pasquale | Snowshoe Hare | 1 | On the road | Sitting | | |
| 2-Jun-16 | Jerome de Pasquale | Snowshoe Hare | 1 | behind outhouses | | in camp | |
| 7-Jun-16 | Crystal Beaudry | Snowshoe Hare | 4 | km 12-16 | | road side | |
| 7-Jun-16 | Jerome de Pasquale | Snowshoe Hare | | | | | |
| 12-Jun-16 | Jody Inkster | Snowshoe Hare | 3 | camp site | feeding | sub-alpine | kitchen and parking lot |
| 13-Jun-16 | Doreen L | Snowshoe Hare | 2 | tote road | crossing road | | |
| 16-Jun-16 | Sheila Johnny | Snowshoe Hare | 1 | kitchen | | | |
| 16-Jun-16 | Doreen L | Snowshoe Hare | 1 | kitchen | feeding | | |
| 20-Jun-16 | Kellin Friesen | Snowshoe Hare | 1 | main office | | | |
| 11-Jul-16 | Rene Darveau | Snowshoe Hare | 1 | Camp | | | |
| 14-Jul-16 | Doreen Ladue | Snowshoe Hare | 1 | Camp | Feeding | bushes | |
| 15-Jul-16 | Doreen Ladue | Snowshoe Hare | 1 | Parking Area | Hopping | Road | |
| 16-Jul-16 | Rene Darveau | Snowshoe Hare | 1 | Camp | Feeding | Camp | |
| 2-Sep-16 | Jody Inkster | Snowshoe Hare | 1 | km 21 | running | road | |
| 2-Sep-16 | Jody Inkster | Snowshoe Hare | 1 | camp, parking lot | running | camp | |
| 9-Sep-16 | Kelli Bergh | Snowshoe Hare | 1 | KM 13.5 tote road | running | | |
| 2-Aug-16 | Shawn Scott | Spotted Sandpiper | | km 25 | | | |
| 3-May-16 | Gary McLaughlin | Spruce Grouse | 1 | 15km | Flying | | On ground & flew away |
| 3-Jul-16 | Jody Inkster | Spruce Grouse | 1 | km 14 | running | tote road | |

## 2016 WILDLIFE LOG

The following is the Wildlife Log for the Kudz Ze Kayah Project for the 2016 exploration field season. It summarizes the wildlife observations from the Wildlife Observation Cards which were completed by project personnel and contractors.

| DATE | OBSERVER | SPECIES | # | LOCATION | BEHAVIOUR | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| 30-Jul-16 | Jerome de Pasquale | Spruce Grouse | 1 | SEB 003 | feeding | brush | |
| | Mitch Heynen | Spruce Grouse | 3 | km 15-12 | | roadside | |
| 23-May-16 | Rory Goebel | Weasel | 1 | Km 23,24 | Walking | | |
| 30-Apr-16 | Jody Inkster | Willow Ptarmigan | 2 | 23km | Running | Tote road | |
| 1-Jul-16 | Rene Darveau | Willow Ptarmigan | 2 | km 9 | | road | |
| 4-Jul-16 | Jody Inkster | Willow Ptarmigan | 7 | km 23 | running/flying | roadside | family |
| 18-Apr-16 | Terry Ollie | Wolf | 2 | Km 24.5 | Running | On road | |
| 12-Jul-16 | Russ Geist | Wolf | 1 | 20.5km | | | |
| 12-Jul-16 | Will Shawcross | Wolf | 1 | 22Km | Running | | |
| 29-Jul-16 | Jay Sather | Wolf | 1 | 14.5km | running | road | |
| 29-Aug-16 | Kevin Duff | Wolf | 1 | KP 16-12, lower road | running | valley bottom | |
| 21-May-16 | Rudi Kern | Wolf | 1 | Km 22 | Running | | |
| 19-Jun-16 | Dale Gibson | Wolf | 1 | km 23 | running | | |
| 20-May-16 | Rudi Kern | Wolf | 2 | Drill Site | Investigating | Buck brush/Swamp | |

# APPENDIX H

## FINLAYSON LAKE BREEDING BIRD SURVEY SUMMARY 1992-2014

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| Species - Finlayson Lake BBS | 1992 | 1993 | 1994 | 1995 | 1997 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2013 | 2014 | Total | Average per year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Swainson's Thrush | 47 | 36 | 73 | 36 | 28 | 79 | 59 | 50 | 71 | 76 | 90 | 64 | 97 | 68 | 44 | 79 | 106 | 75 | 78 | 1256 | 66.11 |
| White-winged Crossbill | 31 | 24 | 27 | 128 | 163 | 25 | 15 | 23 | 13 | 75 | 96 | 11 | 8 | 20 | 1 | 70 | 12 | 7 | 11 | 760 | 40.00 |
| Yellow-rumped Warbler | 35 | 10 | 52 | 43 | 50 | 45 | 30 | 31 | 32 | 41 | 25 | 39 | 43 | 40 | 45 | 56 | 52 | 46 | 35 | 750 | 39.47 |
| Dark-eyed Junco | 36 | 22 | 49 | 34 | 39 | 38 | 33 | 24 | 39 | 53 | 16 | 57 | 36 | 29 | 13 | 32 | 46 | 42 | 29 | 667 | 35.11 |
| White-crowned Sparrow | 58 | 43 | 49 | 58 | 80 | 25 | 19 | 14 | 32 | 30 | 24 | 32 | 22 | 22 | 33 | 21 | 36 | 13 | 25 | 636 | 33.47 |
| Ruby-crowned Kinglet | 12 | 15 | 39 | 31 | 26 | 16 | 21 | 6 | 25 | 20 | 38 | 42 | 21 | 15 | 12 | 25 | 28 | 24 | 31 | 447 | 23.53 |
| Alder Flycatcher | 21 | 7 | 14 | 14 | 17 | 13 | 19 | 14 | 18 | 30 | 23 | 29 | 25 | 26 | 26 | 21 | 22 | 24 | 22 | 385 | 20.26 |
| Gray Jay | 21 | 33 | 46 | 40 | 23 | 15 | 9 | 17 | 13 | 15 | 4 | 14 | 13 | 19 | 18 | 18 | 19 | 26 | 18 | 381 | 20.05 |
| Blackpoll Warbler | 13 | 14 | 13 | 15 | 11 | 27 | 19 | 19 | 18 | 23 | 23 | 20 | 22 | 28 | 24 | 24 | 26 | 14 | 10 | 363 | 19.11 |
| Fox Sparrow | 10 | 9 | 16 | 17 | 13 | 12 | 13 | 15 | 12 | 22 | 18 | 26 | 25 | 25 | 33 | 21 | 29 | 28 | 19 | 363 | 19.11 |
| Wilson's Warbler | 4 | 7 | 16 | 13 | 9 | 9 | 16 | 21 | 18 | 21 | 17 | 20 | 22 | 20 | 28 | 32 | 16 | 12 | 18 | 319 | 16.79 |
| Northern Waterthrush | 9 | 4 | 9 | 13 | 14 | 16 | 13 | 14 | 13 | 21 | 19 | 17 | 18 | 11 | 11 | 13 | 16 | 9 | 6 | 246 | 12.95 |
| American Robin | 17 | 5 | 9 | 16 | 6 | 16 | 10 | 23 | 18 | 23 | 17 | 9 | 12 | 9 | 7 | 11 | 15 | 11 | 6 | 240 | 12.63 |
| Lincoln's Sparrow | 11 | 3 | 11 | 22 | 11 | 0 | 7 | 8 | 11 | 21 | 11 | 16 | 19 | 20 | 14 | 16 | 11 | 8 | 8 | 228 | 12.00 |
| Orange-crowned Warbler | 9 | 0 | 5 | 10 | 13 | 5 | 0 | 4 | 5 | 16 | 15 | 26 | 17 | 25 | 22 | 15 | 16 | 8 | 6 | 217 | 11.42 |
| Chipping Sparrow | 15 | 24 | 18 | 13 | 9 | 5 | 9 | 7 | 5 | 6 | 23 | 4 | 3 | 9 | 5 | 15 | 9 | 6 | 14 | 199 | 10.47 |
| Olive-sided Flycatcher | 8 | 10 | 5 | 7 | 3 | 6 | 6 | 8 | 14 | 9 | 10 | 14 | 10 | 6 | 6 | 8 | 13 | 4 | 4 | 151 | 7.95 |
| Gray-cheeked Thrush | 5 | 12 | 9 | 7 | 3 | 8 | 9 | 5 | 9 | 3 | 11 | 13 | 5 | 14 | 7 | 9 | 10 | 3 | 3 | 145 | 7.63 |
| Tennessee Warbler | 2 | 0 | 6 | 5 | 5 | 1 | 0 | 1 | 5 | 2 | 8 | 15 | 10 | 10 | 7 | 9 | 22 | 13 | 21 | 142 | 7.47 |
| Common Yellowthroat | 3 | 3 | 4 | 3 | 2 | 3 | 4 | 1 | 5 | 3 | 3 | 3 | 8 | 5 | 17 | 4 | 5 | 5 | 8 | 89 | 4.68 |
| Wilson's Snipe | 8 | 10 | 8 | 18 | 7 | 5 | 1 | 3 | 8 | 2 | 1 | 3 | 2 | 2 | 0 | 3 | 1 | 1 | 4 | 87 | 4.58 |
| Lesser Yellowlegs | 5 | 8 | 9 | 9 | 11 | 2 | 5 | 4 | 4 | 2 | 0 | 5 | 4 | 4 | 0 | 2 | 6 | 1 | 2 | 83 | 4.37 |
| Pine Grosbeak | 5 | 8 | 12 | 1 | 6 | 8 | 3 | 3 | 5 | 7 | 1 | 1 | 1 | 0 | 2 | 10 | 2 | 1 | 2 | 78 | 4.11 |
| Bohemian Waxwing | 17 | 6 | 8 | 7 | 10 | 0 | 6 | 4 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 0 | 3 | 0 | 2 | 68 | 3.58 |
| Bank Swallow | 4 | 0 | 0 | 1 | 0 | 6 | 2 | 3 | 14 | 0 | 20 | 0 | 2 | 0 | 0 | 0 | 5 | 0 | 0 | 57 | 3.00 |
| Pine Siskin | 32 | 0 | 1 | 0 | 9 | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 52 | 2.74 |
| Boreal Chickadee | 3 | 7 | 4 | 4 | 2 | 3 | 2 | 1 | 2 | 0 | 1 | 1 | 1 | 0 | 7 | 4 | 4 | 0 | 1 | 47 | 2.47 |
| Rusty Blackbird | 3 | 2 | 5 | 3 | 4 | 0 | 2 | 0 | 4 | 5 | 0 | 1 | 1 | 0 | 1 | 2 | 2 | 2 | 2 | 39 | 2.05 |
| Yellow Warbler | 0 | 1 | 2 | 0 | 0 | 6 | 0 | 1 | 1 | 3 | 2 | 4 | 3 | 3 | 0 | 1 | 3 | 3 | 0 | 33 | 1.74 |
| Solitary Sandpiper | 4 | 2 | 4 | 5 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 26 | 1.37 |
| Western Wood-Pewee | 2 | 0 | 4 | 5 | 2 | 3 | 2 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 25 | 1.32 |
| Least Flycatcher | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 3 | 1 | 5 | 0 | 0 | 2 | 4 | 3 | 0 | 0 | 0 | 0 | 23 | 1.21 |
| Common Raven | 0 | 0 | 5 | 0 | 4 | 3 | 0 | 1 | 0 | 2 | 0 | 0 | 2 | 1 | 1 | 0 | 2 | 1 | 1 | 23 | 1.21 |
| Northern Flicker | 3 | 1 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 2 | 0 | 4 | 0 | 0 | 21 | 1.11 |
| Yellow-bellied Flycatcher | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 3 | 3 | 18 | 0.95 |
| Common Loon | 0 | 1 | 4 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 2 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 17 | 0.89 |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Tree Sparrow | 6 | 0 | 1 | 0 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 17 | 0.89 |
| Savannah Sparrow | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 1 | 4 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 1 | 16 | 0.84 |
| Common Redpoll | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 5 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 16 | 0.84 |
| Spotted Sandpiper | 0 | 5 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 12 | 0.63 |
| Varied Thrush | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 1 | 12 | 0.63 |
| American Three-toed Woodpecker | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 3 | 2 | 11 | 0.58 |
| Purple Finch | 0 | 0 | 0 | 2 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0.47 |
| Canada Goose | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 8 | 0.42 |
| Herring Gull | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0.37 |
| Tree Swallow | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 7 | 0.37 |
| White-throated Sparrow | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 2 | 0 | 0 | 7 | 0.37 |
| Swamp Sparrow | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0.32 |
| Red-tailed Hawk | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.26 |
| Sora | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.26 |
| Semipalmated Plover | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.26 |
| Common Merganser | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 4 | 0.21 |
| Say's Phoebe | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0.21 |
| Townsend's Solitaire | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0.21 |
| Mallard | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 3 | 0.16 |
| Arctic Tern | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 0.16 |
| Belted Kingfisher | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.16 |
| Clay-colored Sparrow | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0.16 |
| Green-winged Teal | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.11 |
| Bufflehead | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.11 |
| Spruce Grouse | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0.11 |
| Sharp-shinned Hawk | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0.11 |
| Killdeer | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.11 |
| unid. Woodpecker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0.11 |
| Warbling Vireo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 0.11 |
| Barn Swallow | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.11 |
| Bald Eagle | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.05 |
| Northern Hawk Owl | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.05 |
| Hairy Woodpecker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0.05 |
| American Kestrel | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.05 |
| Northern Shrike | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.05 |
| **Total Species** | **33** | **35** | **43** | **40** | **37** | **37** | **36** | **35** | **35** | **39** | **32** | **32** | **37** | **33** | **34** | **36** | **37** | **32** | **36** | | |
| **Total individuals** | **460** | **340** | **554** | **595** | **595** | **419** | **360** | **337** | **424** | **552** | **534** | **501** | **465** | **447** | **399** | **536** | **554** | **398** | **399** | | |