APPENDIX 16-A

Wildlife Baseline Report

Coffee Gold Mine:
Wildlife Baseline Report
Version 1.2

Prepared For
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REVISION SUMMARY

Version No.	Date	Revision Notes	Revision Authors
1.0	July 8, 2016	Draft Version	L. Pigage and others
1.1	Sept 27, 2016	Final Version	K. Russell, A. MacLeod
1.2	Mar 14, 2017	Addition of 2016 field data and Fortymile caribou RSF model results	B. Smith, K. Beckmann, T. Mahon, A. MacLeod

EXECUTIVE SUMMARY

Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Kaminak; the Proponent) is proposing to develop the Coffee Gold Mine (Coffee Project; the Project) located 130 km south of Dawson, Yukon. The Project is located at a green field site that has not been previously mined, but has had ongoing exploration activities since discovery in 2010. Baseline environmental studies began in 2010 and were expanded in the following years in anticipation of future regulatory requirements. Kaminak retained Environmental Dynamics Inc. (EDI) to complete the terrestrial baseline studies.

To receive authorization for the Project to proceed, it must be evaluated under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA), obtain a Quartz Mining License, a Type A Water Licence, and other associated authorizations. During the environmental assessment process, potential Project effects on valued environmental and socio-economic components are determined and mitigation is developed to reduce or eliminate potential adverse effects. In support of that assessment, this wildlife baseline report was developed to summarize information on current and historical wildlife presence, distribution, and habitat use in the Project area using the best available information including published and unpublished scientific data, Traditional Knowledge, local knowledge, and baseline survey data.

Species of potential conservation concern listed under the federal *Species at Risk Act* (SARA), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and/or the Canadian Endangered Species Conservation Council (CESCC) that occur, or have the potential to occur in the Project area include woodland caribou (northern mountain population), grizzly bear, wolverine, cougar, collared pika, and little brown myotis.

Three caribou herds have the potential to inhabit the area including the Fortymile, Klaza, and Nelchina caribou herds. The Fortymile and Nelchina herds are both barren-ground caribou, while the Klaza herd is part of the northern mountain population of woodland caribou.

Fortymile Caribou Herd

The Fortymile caribou herd is a migratory ecotype of caribou that occupies east-central Alaska and west-central Yukon. The core of the herd's range is centred on the Yukon-Tanana Upland (i.e., Tanana Hills) in Alaska. The herd has experienced large fluctuations in population size ranging from an estimated 260,000 to 500,000 animals in the 1920s to approximately 5,740 to 8,610 animals in 1974. Currently, the Fortymile caribou herd is estimated at approximately 52,000 individuals.

The Fortymile caribou herd displays long-distance movements between relatively distinct seasonal ranges. The herd calves and summers in the higher elevation habitat of the Yukon-Tanana Upland (the Tanana Hills) in east-central Alaska and has only recently been using its historic winter range in Yukon (since 2002) and the Project Regional Study Area (RSA; since 2013). Use of the RSA by Fortymile caribou is seasonal and occurs between October and April. Based on both satellite collar data and aerial survey data, large numbers of Fortymile caribou were observed in the RSA during the winters of 2013/2014 and 2015/2016, with very few caribou found in the RSA during the winter of 2014/2015.

Migratory caribou herds exhibit unpredictable use of their winter range, so accurately predicting annual distribution and movement in future years is not possible as there are too many variables that influence caribou behaviour. However, based on the current use of the RSA, and assuming a stable or increasing population, the Fortymile caribou herd has the potential to occur within the RSA seasonally during any year.

Klaza Caribou Herd

The Klaza caribou herd is part of the northern mountain population of woodland caribou. The herd's annual range includes part of the Dawson Range Mountains in central Yukon, with Klaza caribou often concentrating in higher elevation habitats, including Klaza, Apex, Prospector, and Nansen mountains (Hegel and O'Donoghue 2015). The most recent population estimate for the Klaza caribou (2012) estimated the herd at 1,179 animals (Hegel 2013).

The annual range of the Klaza caribou herd overlaps only the southern portions of the RSA, south of the Yukon River. However, the RSA does not overlap with the Klaza winter range (Hegel and O'Donoghue 2015). Consequently, the Project is only expected to interact with Klaza caribou during the spring, summer, and/or fall months. Caribou were observed incidentally within the RSA between May and September during baseline studies. Based on these observations and the location of the Project at the northern extent of the range, Klaza caribou are not expected to use the RSA in any considerable numbers.

Nelchina Caribou Herd

The Nelchina caribou herd is a relatively large barren-ground herd in the interior of Alaska. Similar to the Fortymile caribou herd, Nelchina caribou calve in the western portion of their range and disperse east toward the Alaska-Yukon border during winter. The herd occupies winter range on the periphery of the RSA. The winter range of the Nelchina caribou herd is primarily located in Alaska (Collins *et al.* 2011; Joly *et al.* 2003); however, a portion of the herd winters near the Yukon-Alaska border and some collared caribou have spent a part of the winter in Yukon, though not in significant numbers (Schwanke 2011). A small number of caribou from the Nelchina herd may enter the RSA during winter, but the number of caribou and time spent in the RSA is expected to be very low.

Moose

Moose occur throughout the entire Yukon and are considered to be Secure (CESCC 2011). Within the RSA, moose densities are close to the Yukon average (150 to 249 moose/1000 km^2; Yukon Fish and Wildlife Management Board 1996), with some of the northern sections possibly higher than average. In coordination with the 2015 Dawson Goldfields moose census, a population estimate was developed for the area within a 10 km buffer of the proposed Northern Access Route (NAR), an aerial extent of 3,298 km^2. An estimated 814 moose (90% CI of 723-917) are expected to occur within this area at a density of 247 moose/1,000 km^2.

Moose were observed many times throughout the year during wildlife baseline surveys and are widely distributed across the RSA (EDI 2017a). During the early winter season, moose congregate in subalpine shrub communities. Key areas where moose are abundant during the early winter include the King Solomon Dome area and the Henderson Dome area. In the late winter, moose are more restricted in their habitat use

than in other seasons, although regional surveys have indicated that snow depths may not be as restrictive here as in other parts of Yukon, and that during the late-winter season moose may be distributed over a wider range of elevations as compared to other areas (O'Donoghue *et al.* 2013b; EDI 2017a, 2016b). A Habitat Suitability Index (HSI) model developed for moose late winter habitat found that the RSA contains abundant and widespread high quality late winter moose habitat. During the late winter, higher concentrations of moose were observed in the southwestern sections of the RSA along the White river, the upper sections of the Henderson Creek and Black Hills Creek drainages, and just north of the Indian River.

Moose are the primary harvest species within the RSA and are a highly valued species for both First Nations people and licensed hunters. Between 2006 and 2015, 480 moose were harvested by licensed hunters within the RSA (Government of Yukon 2016a). With a total mean annual harvest of 48 moose, between 5 and 10% of the total Yukon annual moose harvest occurs within the RSA. The Dawson Goldfields Game Management Subzones (GMSs) in particular are some of the most intensely harvested areas of Yukon as a result of having above average moose density (Cooley *et al.* 2012) and above average access.

Thinhorn Sheep

Thinhorn sheep are distributed throughout Yukon. Most Yukon thinhorn sheep populations occur in alpine/subalpine habitat with available food sources that are in close proximity to escape terrain. Within the RSA, the only known thinhorn sheep populations occur along the Yukon River on the steep, south-facing bluffs. Three occurrence areas are known along the Yukon River: the Minto occurrence area to the east of the RSA, the White River occurrence area located at the confluence of the Yukon and White Rivers, and the Ballarat Creek occurrence area along the north bank of the Yukon River near Ballarat Creek. The proposed NAR passes through the Ballarat Creek occurrence area. Based on the low numbers of sheep at each of these three occurrence areas, it is thought that sheep migrate along the Yukon River. The maximum number of sheep documented within the Ballarat Creek occurrence area is eight sheep. Several wildlife surveys were completed to document sheep use of this area, and an HSI model was developed to better understand the distribution of suitable sheep habitat along the Yukon River cooridor.

Mule deer

Mule deer occur in the RSA, but at low numbers. Mule deer have been expanding their range into the Yukon since the 1940s. The current working estimate for the Yukon mule deer population is thought to be around 1,000 animals (S. Czetwertynski, pers. comm, 2016). Based on observations of mule deer during baseline studies, and by Project personnel, the mule deer population is likely limited to a small number of individuals concentrated along the south-facing slopes of the Yukon, Stewart, and potentially Indian River valleys, and along the Klondike Highway. According to trapping concession holders whose traplines overlap the RSA, mule deer have been present in the Coffee Creek/Yukon River area for at least 30 years and the population has been increasing (Interview 14, pers. comm., 2016).

Grizzly Bear

Yukon's grizzly bear population is estimated to be between 6,000 and 7,000 individuals, making up about 25% of the total grizzly bear population in Canada (COSEWIC 2012). There is limited available information

on grizzly bear abundance and distribution within the RSA but according to the Environment Yukon carnivore biologist, grizzly bear density in the area is considered to be low (R. Maraj, pers. comm., 2016). The working density estimate for the Klondike Plateau ecoregion is 11 bears/1,000 km^2 and the Yukon Plateau-Central ecoregion is 15 bears/1,000 km^2. Grizzly bear observations have been recorded throughout the RSA on wildlife cameras, during baseline studies, and by Project personnel. Based on observations and harvest records, it can be assumed that grizzly bears use the entire RSA but occur at relatively low densities. Given their large ranges and diverse habitat requirements grizzly bears have the potential to interact with all aspects of the proposed Project footprint.

To assess the availability and quality of grizzly bear habitat in the RSA, four GIS-based models were produced, which are described in the Coffee Gold Mine: Grizzly Bear Habitat Model Report (EDI 2016c). Each model aims to predict an aspect of grizzly bear habitat requirements, including habitat effectiveness, security zones, linkage zones, and denning habitat suitability.

Grizzly bear denning surveys were completed within a 2 km buffer of the proposed NAR alignment and within a 5 km buffer of the proposed mine site in spring 2016 (March 21–May 6). No grizzly bears or grizzly bear dens were located despite considerable survey effort by trained biologists (EDI 2017a). The first grizzly bears were noted on the paired site wildlife cameras on April 14 and April 26, indicating that den emergence occurred during the survey period.

Black Bear

Detailed information on black bear distribution and abundance within the RSA is not available; however, local knowledge indicates that there are 'lots of black bears in the area' (Interview 15, pers. comm. 2016), which is consistent with Project observations. Black bears have commonly been observed in the RSA during the non-denning period (October to May; Government of Yukon 2015b) and were recorded throughout baseline studies during wildlife surveys, as incidental observations recorded by Kaminak staff, on the remote wildlife cameras. During grizzly bear den surveys conducted in 2016, several black bears and suspected black bear den sites were located on south-facing slopes with fresh greenery (EDI 2017a). As a result of their diverse seasonal habitat needs, black bears have the potential to interact with the proposed Project across the entire extent of the Project footprint.

Wolverine

Wolverines occur in the RSA and have been observed on a number of occasions during wildlife baseline surveys. During the 2015 snow track survey of the Java Road (access road between the Yukon River and the deposit area) fresh tracks of one wolverine were incidentally recorded. The 2016 snow track survey of the NAR and Java Road detected 14 occurrences of fresh wolverine tracks and eight old tracks. Wolverines were generally detected at higher elevations along Sulphur Creek, Eureka Ridge, Maisy May Creek, Barker Creek, Thistle Mountain, and Java Road. Wildlife cameras have been installed since May 2015 within the LSA, with three observations of wolverine captured on the Sulphur and Eureka wildlife cameras thus far. One wolverine was observed during the 2016 late winter ungulate survey (EDI 2017a).

A denning habitat model was created for the RSA using remotely sensed snow cover estimates (EDI 2016d). Based on the model, less than one percent (%) of the RSA is classified as high quality denning habitat, with high value habitats occurring primarily along high elevation ridges.

Given the large size of wolverine home ranges there is potential for wolverines to interact with the Project at low densities across the entire extent of the Project footprint.

Wolves

The wolf population in the RSA is unknown; however, local knowledge indicates that wolf populations within the region are healthy and relatively abundant, with 'lots of wolves in the area' (Interview 14 & 15, pers. comm. 2016). During Project baseline surveys, wolves were observed throughout the RSA incidentally during aerial ungulate surveys, by remote trail cameras, during the snow track surveys conducted in 2015 and 2016, and by Project personnel (EDI 2017a). Wolf tracks were observed during both the 2015 snow tracking survey along the Java Road and the 2016 snow tracking survey along the proposed NAR. The majority of tracks were observed in low elevation areas.

A paired-site wildlife road use camera study was conducted and wolves were captured on at least one of two paired cameras at each of the six locations. During the winter of 2015/2016, wolves passed cameras on the NAR 76 times with pack size ranging from one to ten animals. A total of 199 wolves were counted passing the cameras. Wolves are assumed to occur throughout the RSA, wherever available prey exists.

Other furbearers

In addition to wolverine and wolf, several other high-value furbearing species are present in the RSA including Canada lynx, American marten, red fox, coyote, red squirrel, American mink, common muskrat, northern river otter, ermine, least weasel, and American beaver. Historical trapping records also indicated Arctic fox occurred in this area; however, it is believed this is an exceptional occurrence. Project baseline surveys documented many of these species throughout the RSA during snow track surveys and incidentally on various other surveys.

According to Yukon Conservation Services, the RSA overlaps a very active trapping area (K. Meister, pers. comm. 2016). Based on current trapping records, Canada lynx and American marten are key harvest species in the region; however, various other species are also important to local trappers including red fox, coyote, red squirrel, mink, otter, weasels and beaver. Based on Traditional Knowledge, many of the species currently harvested in the RSA have a long history of harvest in the region (e.g., Pearse and Weinstein 1988; Mishler and Simeone 2004; InterGroup Consultants Ltd 2009; Tr'ondëk Hwëch'in 2012a, 2012b; Bates and DeRoy 2014; Dobrowolsky 2014), and local First Nations specifically report having harvested beaver, muskrat, mink, marten, snowshoe hare, gopher, fox, lynx, and wolverine in the Coffee Creek area (Tr'ondëk Hwëch'in 2012a; Bates and DeRoy 2014; Dobrowolsky 2014).

Collared pika

Collared pika have been assessed by COSEWIC as a species of Special Concern and are known to occur in the Project region. Project baseline studies included targeted surveys for collared pika; however, no pika

were detected within close proximity to proposed Project infrastructure. Pika were observed in many of the talus patches located in the southeastern sections of the RSA.

Little brown myotis

In August 2014, acoustic bat surveys were conducted near the Coffee exploration camp in the Yukon River Valley and at the Latte deposit. Little brown myotis was detected at the Camp Location but not at the Latte Deposit. Based on the Project observations and previous documentation of little brown myotis near Dawson (Slough and Jung 2008), the species is expected to be present, in low numbers, in suitable, low-elevation (i.e., below 1,000 m) habitats throughout the RSA. A habitat model of potential roosting habitat for little brown myotis was developed to assess the availability of roosting habitat within the RSA.

Other small mammals

Other small mammals that have the potential to occur in the Project area include red squirrel, Arctic ground squirrel, northern flying squirrel, snowshoe hare, and several species of species of mice, voles and shrews. While none of these small mammal species are a conservation concern federally or territorially, they remain ecologically important as prey species of larger carnivores and furbearers.

Amphibians

Wood frog is the only species of amphibian expected to occur in the RSA. Wood frogs were observed incidentally by Project staff on several occasions in lowland habitats within the Yukon River valley. Observations included both adult and juvenile individuals. Wood frog is assumed to occur throughout the Project area in appropriate wetland habitats and will interact with Project infrastructure and activities in these areas.

Mineral licks

Mineral licks are important to ungulate species as they provide a means to obtain essential mineral nutrients which otherwise may be lacking in an ungulate diet (Rea *et al.* 2004). Several mineral licks were reported to EDI and the Company in the Coffee Creek area, Barker Creek area, and the Maisy May Creek area. These areas were investigated by qualified biologists. To date, no active mineral licks have been identified in the RSA; however, follow-up surveys are planned.

ACKNOWLEDGEMENTS

The information summarized in this Wildlife Baseline Report reflects the hard work of a number of people and organizations, without whom, this report would not have been possible.

The Government of Yukon, Department of Environment (Environment Yukon) funded and staffed many of the regional studies summarized in this report. The assistance of a number of Environment Yukon biologists who supplied background data on surveys, collared wildlife, wildlife mortalities and local knowledge, as well as valuable input and guidance for this baseline report is greatly appreciated. Thanks to Mike Suitor (North Yukon Regional Biologist), Martin Kienzler (Fish and Wildlife Technician), Mark O'Donoghue (Northern Regional Biologist), Ramona Maraj (Carnivore Biologist), Troy Hegel (Ungulate Biologist, Caribou/Sheep/Goat), Sophie Czetwertynski (Ungulate Biologist, Moose/Elk/Deer), Kyle Russell (Program Technician, Caribou/Sheep/Goat), Tom Jung (Senior Wildlife Biologist, Biodiversity), Bruce McLean (Senior Habitat Protection Biologist), Kirby Meister (Conservation Office Services, Manager, Field Operations North), Richard Cherepak (Environmental Assessment Analyst), and Julia Ahlgren (Environmental Assessment Analyst) among others.

As a component of the engagement and consultation process undertaken for the Coffee Gold Mine, various groups and individuals shared their knowledge of the Project area and the local wildlife. Several of these individuals asked to remain anonymous, but their contributions greatly increased our understanding of wildlife populations in this region. The time and input from all involved in the engagement and consultation process is much appreciated. Special thanks to the members of the Tr'ondëk Hwëch'in Technical Working Group for their advice on the environmental baseline program and the information that they shared about the Project area.

Wildlife baseline field surveys for the Coffee Gold Mine were conducted by Access Consulting Group (2011–2013) and EDI Environmental Dynamics Inc. (2014–2016). Thanks to the Kaminak Environmental Monitors (Robert Farr, Derek Scheffen, Andrew Taylor and Evan Warren), members of the Tr'ondëk Hwëch'in Natural Resources Department (George MacLeod and James Roberts) and other local residents (Geoff Ranson, Spencer Wallace, Becky Partridge, and David Curtis) who assisted in various wildlife surveys and baseline programs conducted for this Project.

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ACRONYMS AND ABBREVIATIONS

CESCC ..... Canadian Endangered Species Conservation Council

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

Coffee Project, the Project ..... Coffee Gold Mine

EDI ..... Environmental Dynamics Inc.

FCSA ..... Fortymile Caribou Study Area

FNNND ..... First Nation of Na-cho Nyäk Dun

GIS ..... Geographic Information System

GMA ..... Game Management Area

GMS ..... Game Management Subzone

GMZ ..... Game Management Zone

HSI ..... Habitat Suitability Index

IUCN ..... International Union for the Conservation of Nature

Kaminak ..... Kaminak Gold Corporation

KCH ..... Klaza Caribou Herd

km ..... Kilometres

km^2 ..... Kilometres squared

LSA ..... Local Study Area

NAR ..... Northern Access Route

RSA ..... Regional Study Area

RTC ..... Registered Trapping Concession

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

SFN ..... Selkirk First Nation

THFN ..... Tr'ondëk Hwëch'in First Nation

VCs ..... Valued Components

VHF ..... Very High Frequency

WKA ..... Wildlife Key Area

WRFN ..... White River First Nation

YESAA ..... *Yukon Environmental and Socio-economic Assessment Act*

YESAB ..... Yukon Environmental and Socio-economic Assessment Board

YFWMB ..... Yukon Fish and Wildlife Management Board

Yukon CDC ..... Yukon Conservation Data Centre

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1 INTRODUCTION

1.1 PROJECT DETAILS

Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Kaminak; the Proponent) is proposing to develop a gold mine, known as the Coffee Gold Mine (Coffee Project; the Project) in west-central Yukon, located approximately 130 kilometers south of Dawson (Figure 1-1). The Project (including the proposed access corridor) is located on Crown Land and overlaps the asserted area or established traditional territories of Tr'ondëk Hwëch'in (TH), Selkirk First Nation (SFN), First Nation of Na-cho Nyäk Dun (FNNND) and White River First Nation (WRFN).

The proposed Project will consist of an open pit gold mine using a cyanide heap leach process to extract gold from the ore. The Project will include four open pits (Latte, Double Double, Supremo, and Kona) developed using standard drill and blast methods and mined using conventional shovel and truck methods. Other Project infrastructure will include waste rock storage facilities, a conventional heap leach facility, a processing plant, a camp site, an airstrip and other support infrastructure. A 214 km all-weather access road with river barge crossings, referred to as the Northern Access Route (NAR), will provide access between Dawson and the mine site. The majority of the NAR is located along existing roads through the Dawson Goldfields which will be upgraded; approximately 37 km of new road will be constructed, along with the construction or upgrade of barge landings at the river crossings. During the open water period barges will be utilized to cross the Stewart River and Yukon River, and during the winter months, ice crossings will be constructed to allow transport trucks to drive across the rivers.

Kaminak retained EDI Environmental Dynamics Inc. (EDI) to perform the terrestrial wildlife baseline investigation in support of the Project Proposal to be submitted to the Yukon Environment and Socio-economic Assessment Board (YESAB) Executive Committee for screening under the *Yukon Environment and Socio-economic Assessment Act* (YESAA), and applications to be submitted for a Quartz Mining License and a Type A Water License from the Yukon Water Board, among other permits and licenses.

Wildlife baseline surveys for the Coffee Project were completed for most of the focal species between 2011 and present and are described in detail in the Wildlife Field Programs Report (EDI 2017a). Habitat models were developed for moose (late winter; EDI 2016a), thinhorn sheep (EDI 2016b), grizzly bear (EDI 2016c) and wolverine (denning; EDI 2016d), to quantify available habitat in the Project area, which are described in their respective reports. This report summarizes the current knowledge and baseline conditions of terrestrial mammals and amphibians in the Project area, including results from the wildlife surveys and habitat modelling, and relies on a number of data sources described further in Section 1.4. This report, as well as the accompanying reports, is in support of the Project Proposal submission to YESAB, the Water License Application, and the Quartz Mining License Application, among other licenses and permits required. Reports accompanying this wildlife baseline report include:

- Coffee Gold Mine: Wildlife Field Program Report (EDI 2017a)

- A Resource Selection Function Model for the Fortymile Caribou Herd (Muhly 2017)
- Coffee Gold Mine: Moose Late Winter Habitat Suitability (EDI 2016a)
- Coffee Gold Mine: Thinhorn Sheep Habitat Suitability (EDI 2016b)
- Coffee Gold Mine: Grizzly Bear Habitat Model (EDI 2016c)
- Coffee Gold Mine: Wolverine Denning Habitat Model (EDI 2016d)
- Coffee Gold Mine: Bird Baseline Report (EDI 2017b).

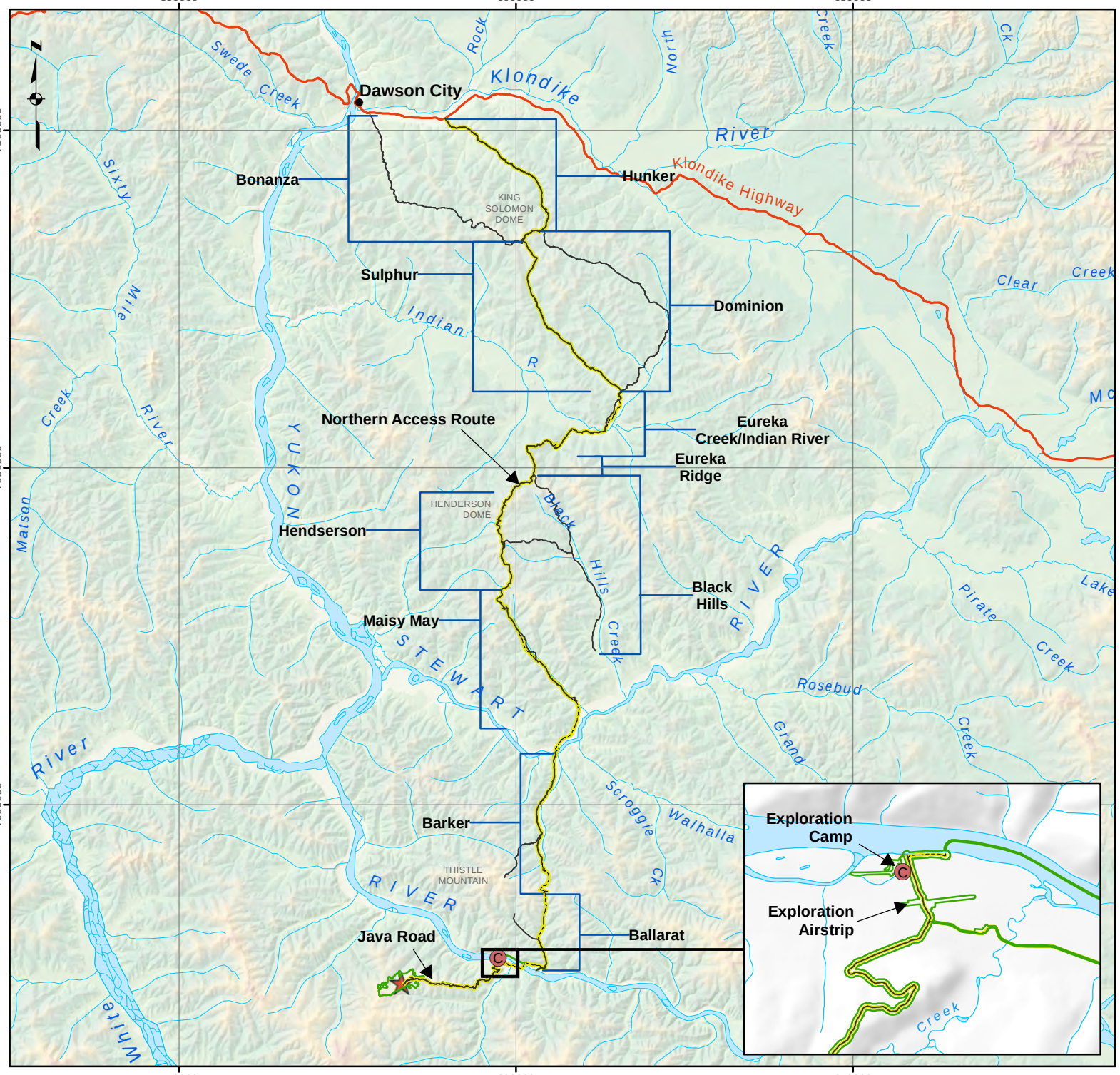

FIGURE: 1-1

Overview of the Coffee Project

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Project data displayed is site specific.

Disclaimer
This document is not an official land survey and the spatial data presented is subject to change.

0 10 20 30
KM

Map Reference Scale: 1:800,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

Drawn: MP	Checked: AM/LP	Date: 3/14/2017

KAMINAK GOLD CORPORATION EDI

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1.2 OBJECTIVES

To receive authorization for the Project to proceed, it must be evaluated under YESAA, as well as obtain a Quartz Mining License, and Type A Water License. During the environmental assessment process, potential Project effects on valued environmental and socio-economic components (VCs) are determined and mitigation is developed to reduce or eliminate potential adverse effects.

To assess potential Project effects on wildlife, an understanding of wildlife baseline conditions is required. Therefore, the overall objective of this wildlife baseline report is to summarize information on current and historical wildlife presence, distribution and habitat use in the Project area using the best available information including published and unpublished scientific data, Traditional Knowledge, local knowledge, and baseline survey data. The content of this report addresses the objectives identified in YESAB's *Proponents Guide to Information Requirements for Executive Committee Project Proposal Submissions* (2005):

- Describe abundance and distribution characteristics of major wildlife species within the project area and vicinity. Include information on mammals, amphibians, birds, and reptiles (including rare/endangered species);
- Describe the habitat classifications used in the Project area, and any implications concerning the distribution and abundance of habitat types that may influence the Project;
- Provide a map showing the spatial arrangement of habitats of special interest, if applicable;
- Identify and describe transportation corridors and critical, key, and sensitive habitats. Include periods of habitat use in the Project area and vicinity;
- Identify any species listed on the COSEWIC (Committee on the Status of Endangered Wildlife in Canada) and Species at Risk lists;
- Describe any special management requirements due to vulnerability, threatened, or endangered status; and
- Identify and describe any ongoing studies in the Project area.

The wildlife baseline report also includes information requirements, to the extent possible, discussed in the Government of Yukon, Department of Environment (Environment Yukon) document *Kaminak Gold Corporation at Coffee Creek – Dawson Goldfields Access Considerations, Wildlife Baseline Data Recommendations* (Suitor 2015). These recommendations were developed to provide general guidance to the proponent and its consultant, EDI, on information needed to assess potential effects of the development and use of the NAR.

1.3 SPATIAL BOUNDARIES

The **Regional Study Area** (RSA) was established to assess the abundance and distribution of most large wildlife species in the Project area, including caribou, moose, thinhorn sheep, mule deer, grizzly and black bears, wolf, wolverine, and other furbearers. Game Management Areas are legal boundaries used to manage Yukon wildlife species and are made up of Game Management Zones (GMZ or Zones) that are further divided into Game Management Subzones (GMS or Subzones). In Yukon, there are eleven Zones divided

into 443 Subzones. The RSA was delineated to include any GMS that intersects, or is in close proximity to the Project footprint, including the NAR (Figure 1-2). The size of the RSA is 13,661 km^2.

To assess the abundance and distribution of wildlife that have smaller, or more localized, habitat requirements, a **Local Study Area** (LSA) was established. The wildlife LSA is approximately 473 km^2 and includes the proposed mine site area, the road between the existing Coffee Camp and the deposit (i.e., the Java Road), the current airstrip, Coffee Camp, and the proposed NAR to the junction with the Klondike Highway. Around the mine site, the LSA is delineated based on the height of land while encompassing a minimum buffer of 1 km around the proposed development. Along the NAR, the LSA includes a 1 km buffer on either side of the road.

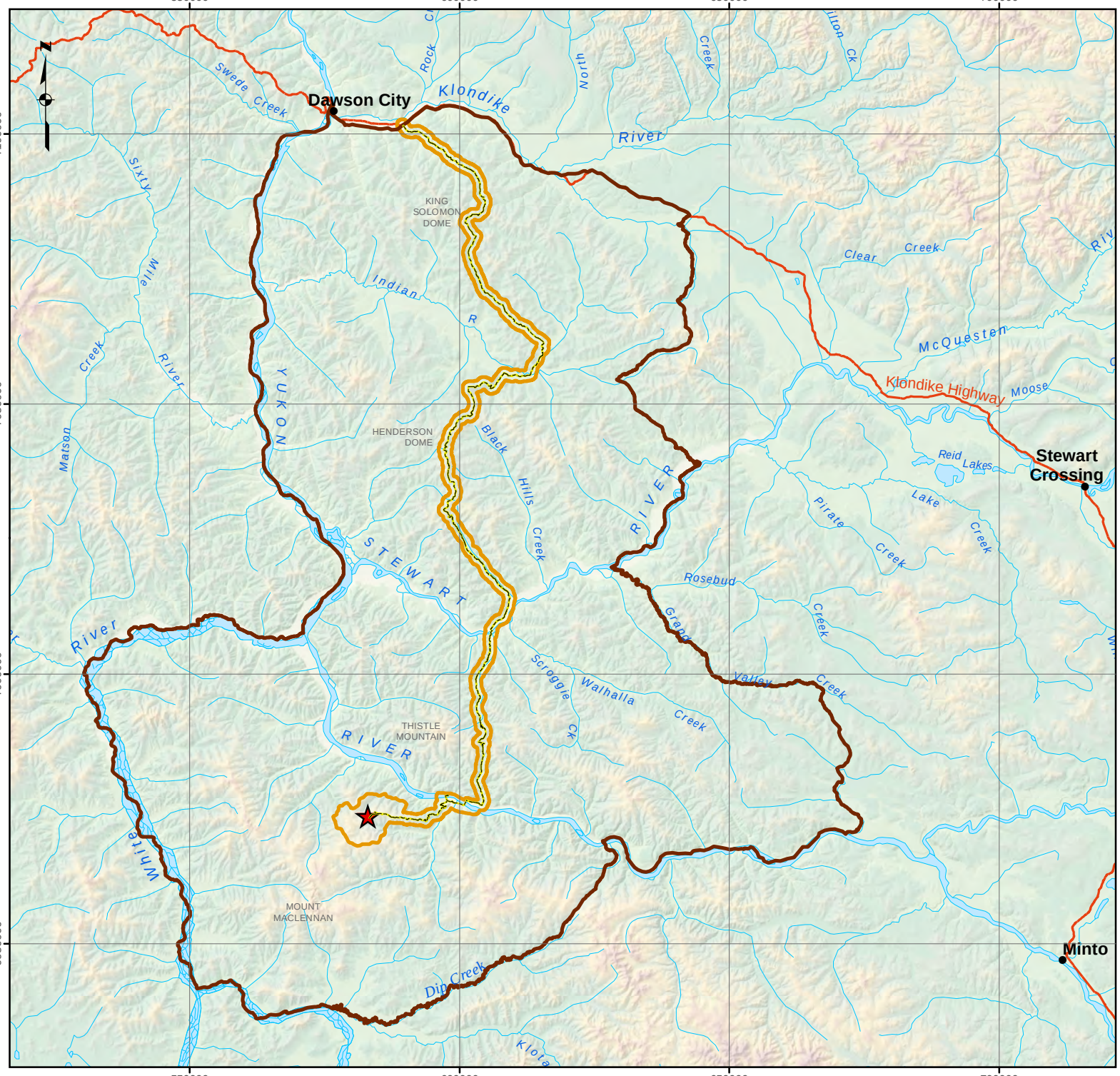
The **Project footprint** is the area that encompasses all Project infrastructure, including new and existing sections of the NAR. Figure 1-2 displays the boundaries of the RSA, LSA and Project footprint. Figure 1-3 and Figure 1-4 show the GMSs and trapping concessions, respectively, that interact with the Project.

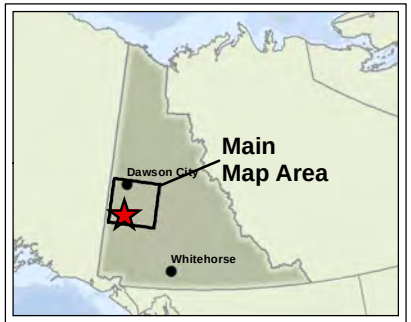
The majority of the baseline field studies and analysis for the wildlife baseline were located within the RSA. However, field surveys did not always extend to the full boundaries of the RSA. For those surveys, discussion of survey results references the **survey extent**. In some cases, the survey extents have shifted several times since the initiation of wildlife surveys for the Coffee Project, to accommodate changes related to Project access. For more discussion on the specific survey extents for wildlife baseline studies, refer to the Coffee Gold Mine: Wildlife Field Program Report (EDI 2017a).

1.4 DATA SOURCES

This report summarizes the wildlife baseline conditions for the Project area, which were compiled from a number of sources that are referenced in the relevant sections. These sources include:

- Wildlife baseline surveys conducted for the Coffee Project (Access Consulting Group 2011, 2013a, 2013b, 2014; EDI 2017a);
- Wildlife habitat modelling completed for the Coffee Project (EDI 2016a, 2016b, 2016c, 2016d; Muhly 2017);
- Regional wildlife survey data, population estimates, and harvest data collected by Environment Yukon (various);
- Collar data for the Fortymile Caribou Herd collected by Environment Yukon, Alaska Department of Fish and Game, and Alaska Bureau of Land Management;
- Traditional Knowledge (various);
- Information collected during Project consultation; and
- Available scientific literature including both published and unpublished sources.





Legend

- Coffee Project
- Highway
- Proposed Route
- Local Study Area
- Regional Study Area

FIGURE: 1-2

Wildlife study areas for the Coffee Project

Data Sources
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Project data displayed is site specific.

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Map Reference Scale: 1:1,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

Drawn: MP	Checked: LP/AM	Date: 3/10/2017

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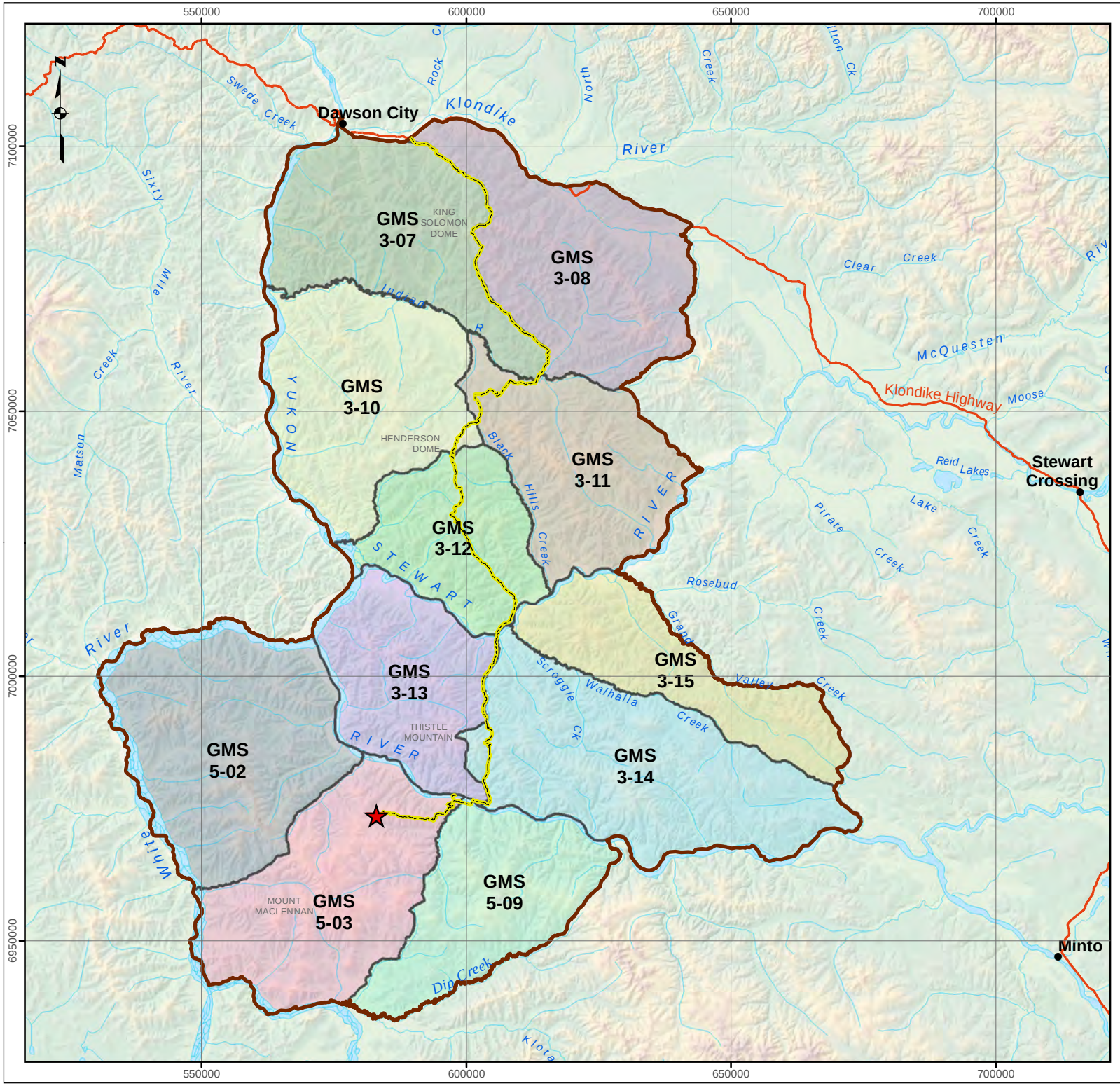

FIGURE 1-3

Game management subzones

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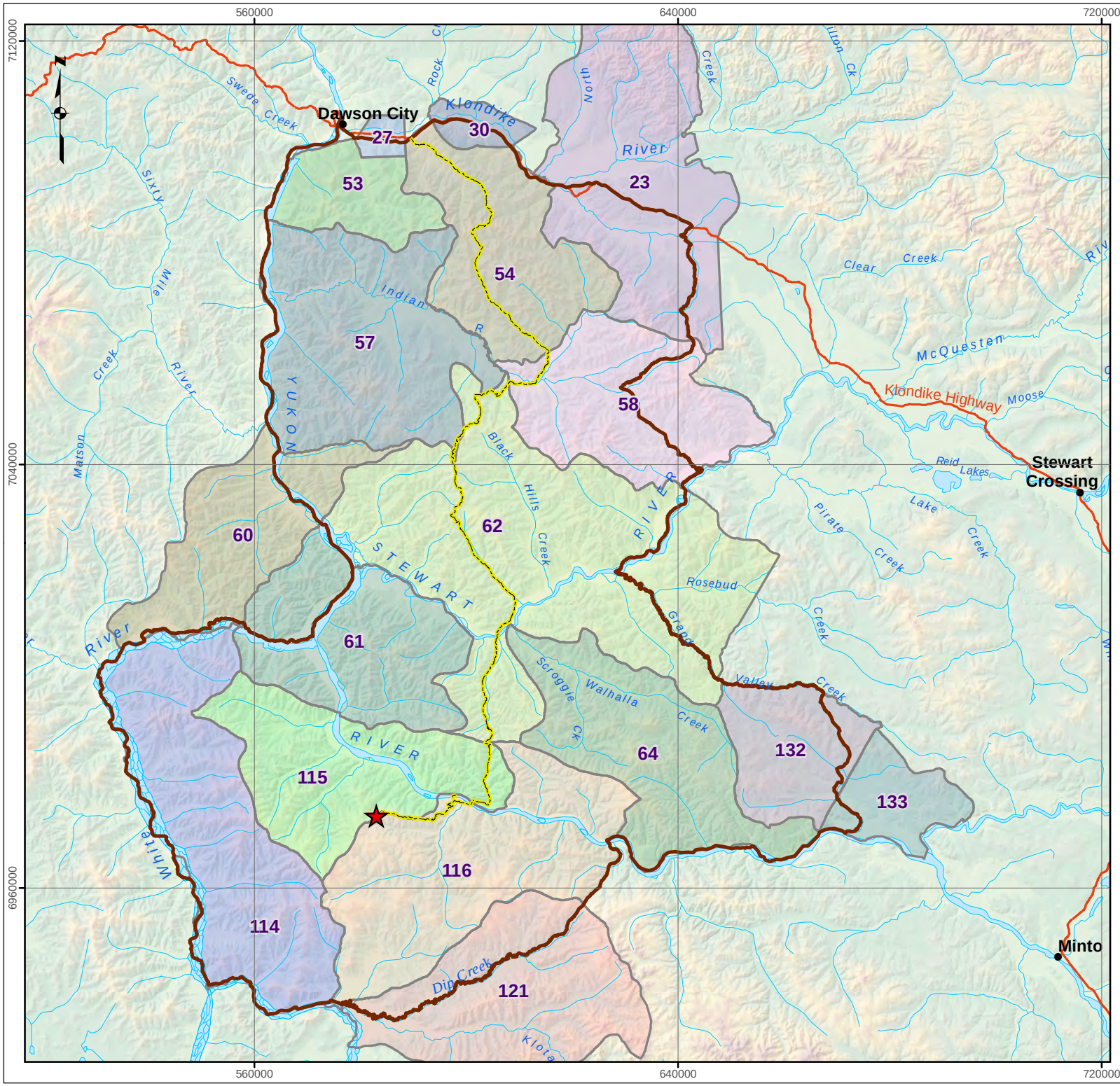

FIGURE: 1-4

Trapping concessions

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Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Project data displayed is site specific. Survey data collected by EDI Environmental Dynamics Inc. (2015).

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Map Reference Scale: 1:1,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

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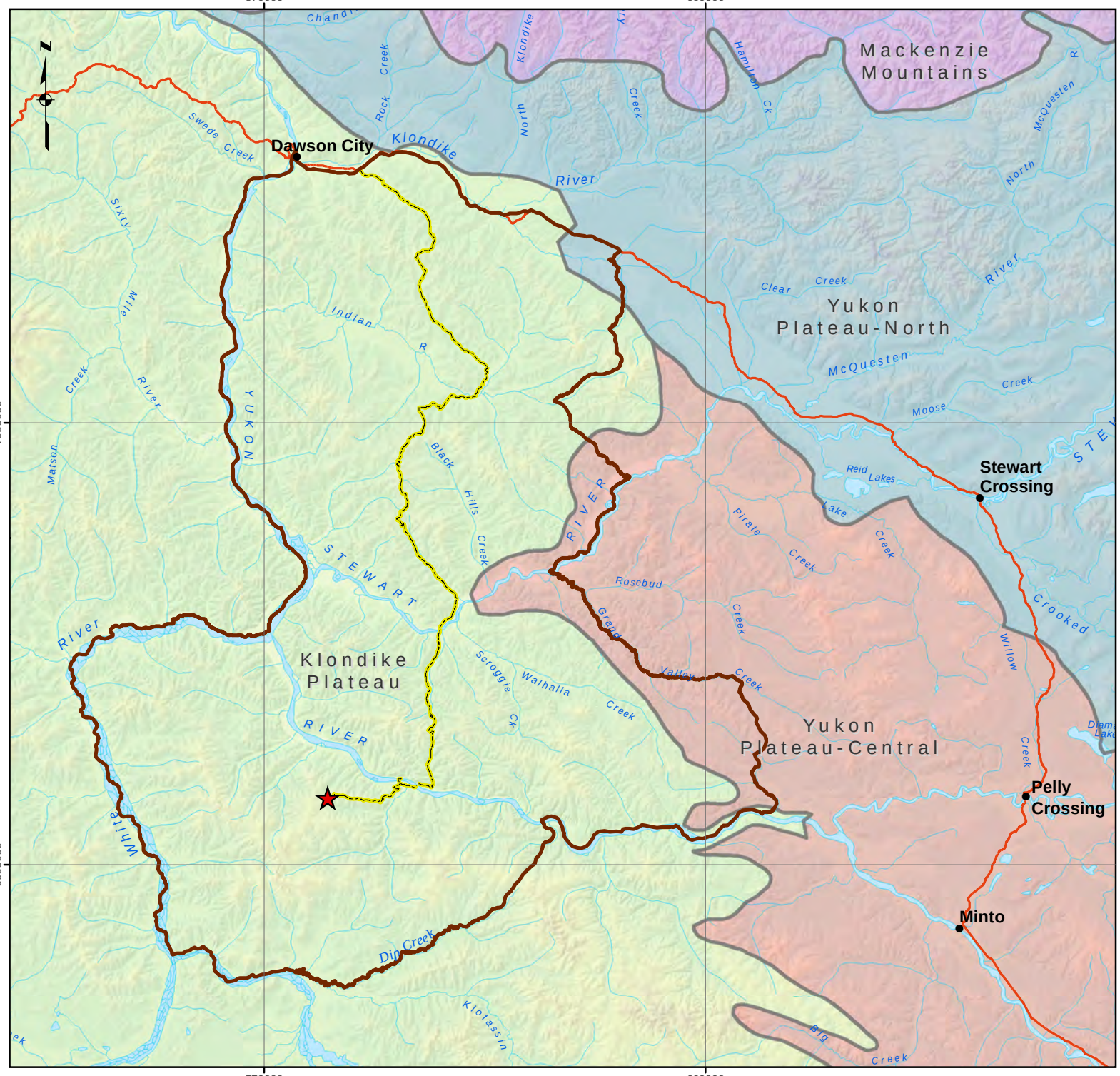
1.5 REGIONAL OVERVIEW

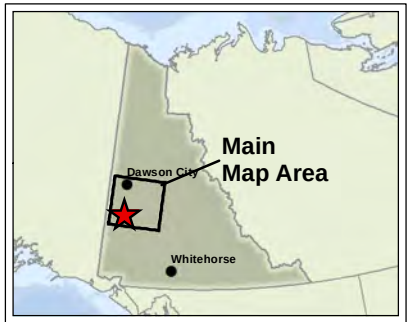
1.5.1 ECOLOGICAL DESCRIPTION

The Project is located in west-central Yukon, within the Boreal Cordillera Ecozone, and within that, the Klondike Plateau Ecoregion (Figure 1-5; Smith *et al.* 2004). The area is a part of easternmost Beringia, and as such, has been exposed to long periods of weathering. The colluvial surface deposits have been deeply incised, forming steep-sided V-shaped valleys containing small streams. These features are characteristic of the ecoregion and are defining features which distinguish the area from adjacent ecoregions (Smith *et al.* 2004). Alpine and subalpine ridges within the area also show characteristic rock outcroppings (tors) which are bedrock remnants that remain after long periods of weathering. One of the most notable physical features in the ecoregion is the Yukon River which flows in an east-west direction through the south portion of the Project area. Elevations in the RSA range from less than 400 m along the Yukon River to over 1,700 m. Lakes are absent from the study area and open-water wetlands and ponds are mainly limited to small bodies of water along the river floodplains and ponds resulting from placer mining activities in the Dawson Goldfields region. The southern portion of the Project area overlaps the northwestern extent of the Dawson Range.

The Project area includes predominantly boreal forest and subalpine habitats. Alpine habitat is also present but is limited in overall extent and is confined to small patches in the southwest and southeast portions of the RSA. Boreal forest habitats are generally dominated by white spruce (*Picea glauca*) and/or black spruce (*Picea mariana*) forests, with mixed forests and stands of aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), and/or birch (*Betula neoalaskana*) on warmer aspects, well-drained slopes, and valley bottoms. This region has an extensive fire history, therefore young, deciduous-dominated, and mixedwood stands are more common than mature conifer-dominated stands. The hillsides which flank the north side of Coffee Creek and the Yukon, Stewart, and Indian rivers are dominated by deciduous vegetation including aspen and birch. Understory vegetation varies across aspects and slope position with nutrient-rich sites supporting willows (*Salix* spp.), alders (*Alnus* spp.), and a variety of other shrubs, grasses, horsetails (*Equisetum* spp.), and forbs, while poorly drained depressions and upland sites include sphagnum mosses (*Sphagnum* spp.), tussock grass, sedges, shrubs, and lichens. Subalpine areas represent the transitional zone from boreal forest to alpine and are characterized by dense scrub birch (*Betula glandulosa*) and willow with dwarf shrubs becoming more common with an increase in elevation. Alpine habitats are characterised by primarily unvegetated areas and sparsely vegetated tundra; tors and felsenmeer are also found on the high elevation ridges.

The northern portion of the NAR passes through the Dawson Goldfields. This area has a long history of placer mining activity with a number of active mine sites and extensive areas of disturbed ground. This disturbance is limited primarily to the valley bottoms with relatively intact and unmined vegetated areas on the hillsides. The disturbed areas include a wide range of reclaimed sites ranging from those in a very early successional state, dominated by bare ground and grasses to areas in a more advanced successional state where dense stands of young aspen, balsam poplar, and willow dominate.





Legend

- Coffee Project
- Proposed Route
- Regional Study Area

Ecoregions overlapping the Project Area

- Klondike Plateau Ecoregion
- Mackenzie Mountains Ecoregion
- Yukon Plateau-Central Ecoregion
- Yukon Plateau-North Ecoregion

FIGURE: 1-5

Ecoregions in the Project area

Data Sources
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Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

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Map Reference Scale: 1:1,100,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

Drawn: MP	Checked: AM/LP	Date: 3/14/2017

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1.5.2 WILDLIFE OVERVIEW

The entire LSA and a large portion of the RSA fall within the Dawson Regional Planning area and numerous wildlife species have the potential to occur in the region, as listed in Table 1-1. Ungulates that are common throughout the area include caribou (*Rangifer tarandus*) and moose (*Alces alces*). Thinhorn sheep (*Ovis dallii*) and mule deer (*Odocoileus hemionus*) are present but have been observed in lesser numbers. Wood bison (*Bison bison athabascae*) and elk (*Cervus canadensis*) have not been documented in the area. Predators include grizzly (*Ursus arctos*) and black bear (*Ursus americanus*), wolf (*Canus lupus*), coyote (*Canus latrans*), and red fox (*Vulpes vulpes*). Other furbearers that have been documented in the Project area include North American beaver (*Castor canadensis*), Canada lynx (*Lynx canadensis*), wolverine (*Gulo gulo*), American marten (*Martes americana*), American mink (*Neovison vison*), North American river otter (*Lontra canadensis*), and a variety of weasels. A number of small mammal species can also be found in the RSA including snowshoe hare (*Lepus americanus*), collared pika (*Ochotona collaris*), common muskrat (*Ondatra zibethicus*), squirrels, mice, voles, shrews (*Sorex* sp.) and bats (*Myotis* sp.). The only amphibian expected to occur in the Project region is the wood frog (*Lithobates sylvaticus*).

Table 1-1. Mammal species that have the potential to occur in the Project area.

Common name	Latin name	Presence documented in the RSA[1]
UNGULATES		
Caribou	*Rangifer tarandus caribou and Rangifer tarandus granti*	Yes
Moose	*Alces alces*	Yes
Thinhorn sheep	*Ovis dalli*	Yes
Mule deer	*Odocoileus hemionus*	Yes
CARNIVORES		
Grizzly bear	*Ursus arctos*	Yes
Black bear	*Ursus americanus*	Yes
Wolverine	*Gulo gulo*	Yes
Grey wolf	*Canis lupus*	Yes
Coyote	*Canis latrans*	Yes
Red fox	*Vulpes vulpes*	Yes
Arctic fox	*Vulpes lagopus*	Yes[2]
Cougar	*Puma concolour*	Possible[3]
Canada lynx	*Lynx canadensis*	Yes
American marten	*Martes americana*	Yes
Least weasel	*Mustela nivalis*	Yes
Ermine	*Mustela ermine*	Yes
American mink	*Neovison vison*	Yes
Northern river otter	*Lontra canadensis*	Yes
HARE AND PIKAs		
Snowshoe hare	*Lepus americanus*	Yes
Collared pika	*Ochotona collaris*	Yes
RODENTS		
Red squirrel	*Tamiascurus hudsonicus*	Yes
Least chipmunk	*Tamias minimus*	No
Woodchuck	*Marmota monax*	No
Hoary marmot	*Marmota caligata*	Yes
Arctic ground squirrel	*Spermophilus parryii*	Yes
Northern flying squirrel	*Glaucomys sabrinus*	Yes
American beaver	*Castor canadensis*	Yes
Bushy-tailed woodrat	*Neotoma cinerea*	No
Deer mice	*Peromyscus maniculatus*	Yes
Northern red-backed vole	*Myodes rutilus*	Yes
Meadow vole	*Microtus pennsylvanicus*	No
Tundra vole	*Microtus oeconomus*	No
Singing vole	*Microtus miurus*	No

Table 1-1. Mammal species that have the potential to occur in the Project area.

Common name	Latin name	Presence documented in the RSA[1]
Common muskrat	*Ondatra zibethicus*	Yes
Northern bog lemming	*Synaptomys borealis*	Yes
Meadow jumping mouse	*Zapus hudsonius*	No
North American Porcupine	*Erethizon dorsatum*	Yes
BATS		
Little brown bat	*Myotis lucifugus*	Yes
Northern long-eared myotis	*Myotis septentrionalis*	No
SHREWS		
Dusky shrew	*Sorex monticolus*	No
American water shrew	*Sorex palustris*	No
Pygmy shrew	*Sorex hoyi*	No
Tundra shrew	*Sorex tundrensis*	No

[1] Species presence confirmed by observation made during environmental baseline studies, as incidental observations by mine staff, or through harvest records provided by Environment Yukon (Government of Yukon 2016a).

[2] Historical trapping records have documented Arctic fox in the RSA; however, it is believed this is an exceptional occurrence. Baseline studies have not observed the species and the RSA is south of the documented range for Arctic fox in Yukon (Government of Yukon 2016b).

[3] During the Project engagement and consultation process, anecdotal reports of cougar sightings in the region were received by the Project team. The Camp Wildlife Log also included a report of a cougar in the Project area in 2011; however, no photo or other documentation was available to provide confirmation of this reported sighting. The species was not detected during other baseline studies and, to our knowledge, there are no confirmed records of cougar in the RSA.

1.5.3 SPECIES AT RISK

A number of the wildlife species occurring in the RSA are considered to be of conservation concern — either federally or territorially in Yukon (Table 1-2). The list includes species assessed by COSEWIC and identified in SARA. It also includes species identified in the *Yukon Wildlife Act* and by the Yukon Conservation Data Centre (Yukon CDC).

Table 1-2. Mammals with conservation status that occur, or have the potential to occur, in the RSA.

Common Name	Latin Name	SARA[1]	COSEWIC[2]	Yukon	Observed in the RSA[5]
Woodland Caribou, Northern Mountain Population	*Rangifer tarandus caribou*	Special Concern (Schedule 1)	Special Concern (2014)	-	Yes
Mule deer	*Odocoileus hemionus*	No status	Not at Risk	Vulnerable[3]	Yes
Grizzly Bear	*Ursus arctos*	No Status	Special Concern (2012)	-	Yes
Wolverine	*Gulo gulo*	No Status	Special Concern (2014)	-	Yes
Cougar	*Puma concolour*	Not at Risk	Not at Risk	Specially Protected[4]	Possible
Collared Pika	*Ochonona collaris*	No Status	Special Concern (2011)	-	Yes
Little Brown Myotis	*Myotis lucifugus*	Endangered (Schedule 1)	Endangered (2013)	-	Yes

[1]*Species at Risk Act* (SARA) Designation.
[2]COSEWIC Designation with year last assessed.
[3]Yukon CDC status.
[4]*Yukon Wildlife Act* Designation.
[5]Observed in the RSA during wildlife baseline studies.

1.5.4 FOCAL SPECIES

The wildlife baseline program, including both the field surveys outlined in the Wildlife Field Programs Report (EDI 2017a), and the discussion of baseline conditions in this Wildlife Baseline Report includes a broad review of the species and habitats present, as well as more detailed focus on specific species. Focal species selected for field surveys and baseline reporting include both species of conservation concern and species with social, cultural, or economic value. They reflect recommendations received during Project consultation with Environment Canada, Environment Yukon, local First Nations, and other stakeholders, as well as a review of relevant Traditional Knowledge. Consideration for the selection of focal species or species groups included:

- Species of conservation concern including both federal (COSEWIC and SARA) and territorial listings (Table 1-2);
- Species harvested by First Nations or other local harvesters in the RSA;
- Species selected as focal species for previous environmental assessments in Yukon;
- Species raised as a concern during Project consultation;
- Species with the potential to interact with the proposed Project.

Discussion of focal species in this Wildlife Baseline Report includes both species that were a primary focus and species that were a secondary focus. Those species identified as a primary focus for the Wildlife Baseline

Report are generally discussed in greater detail; in most cases, targeted field surveys and habitat modelling were completed for these species. Those species identified as a secondary focus for the Wildlife Baseline Report are described in lesser detail; however, in some cases targeted field surveys were conducted for these species. Table 1-3 identifies the focal species for the Wildlife Baseline Report and the rationale for their selection.

Table 1-3. Focal species or species groups selected for the Wildlife Baseline Report

Species/Species Group	Primary or Secondary Focus	Rationale for Selection as a Focal Species
Caribou	Primary	Fortymile Caribou Herd raised as a key concern by Environment Yukon (Suitor 2015) and TH (N. Becker, pers. comm. 2016), during Project consultation effects to Fortymile caribou were one of the most commonly raised concerns regarding wildlife[1]. Klaza Caribou Herd listed on Schedule 1 of the SARA and assessed as Special Concern by COSEWIC.
Moose	Primary	Primary big game harvest species present in the RSA; raised as a concern by Environment Yukon (Suitor 2015); identified as a key concern by TH (N. Becker, pers. comm. 2016); during Project consultation effects to moose were one of the most commonly raised concerns regarding wildlife[1].
Thinhorn Sheep	Primary	Raised as a concern by Environment Yukon (Suitor 2015) due to low densities and sensitivity of sheep to disturbance.
Mule Deer	Secondary	Not raised as a particular concern in relation to Project effects; however, Environment Yukon requested that baseline observations be documented and reported (Suitor 2015).
Grizzly Bear	Primary	Raised as a concern by Environment Yukon (Suitor 2015; R. Maraj, pers. comm., 2016); assessed as Special Concern by COSEWIC.
Black Bear	Secondary	Raised as a concern by Environment Yukon (R. Maraj, pers. comm., 2016) due to potential mortality risks associated with the Project.
Wolverine	Primary	Raised as a concern by Environment Yukon (Suitor 2015; R. Maraj, pers. comm., 2016); assessed as Special Concern by COSEWIC.
Grey Wolf	Secondary	Raised as a concern, primarily in relation to the potential effects of facilitated predation on ungulate species (Suitor 2015; TH TWG, pers. comm., 2016).
Other Furbearers	Secondary	Raised as a concern by TH (TH TWG, pers. comm., 2016); Wildlife Baseline Report focusses on American marten and lynx, the two most frequently trapped species in the RSA.
Collared Pika	Secondary	Raised as a concern by Environment Canada (Environment Canada, pers. comm., 2015) and assessed as Special Concern by COSEWIC. Initially considered as a Primary focus; however, field surveys did not locate any pika within 10 km of the proposed Project footprint.
Bats	Primary	Listed on Schedule 1 of the SARA and assessed as Endangered by COSEWIC.

[1] During Project consultation, a wide range of concerns regarding wildlife and specific wildlife species were related to the Project team; however, concerns regards effects to the Fortymile Caribou Herd and moose were the most common and were raised by Project regulators, First Nations and other Yukon residents.

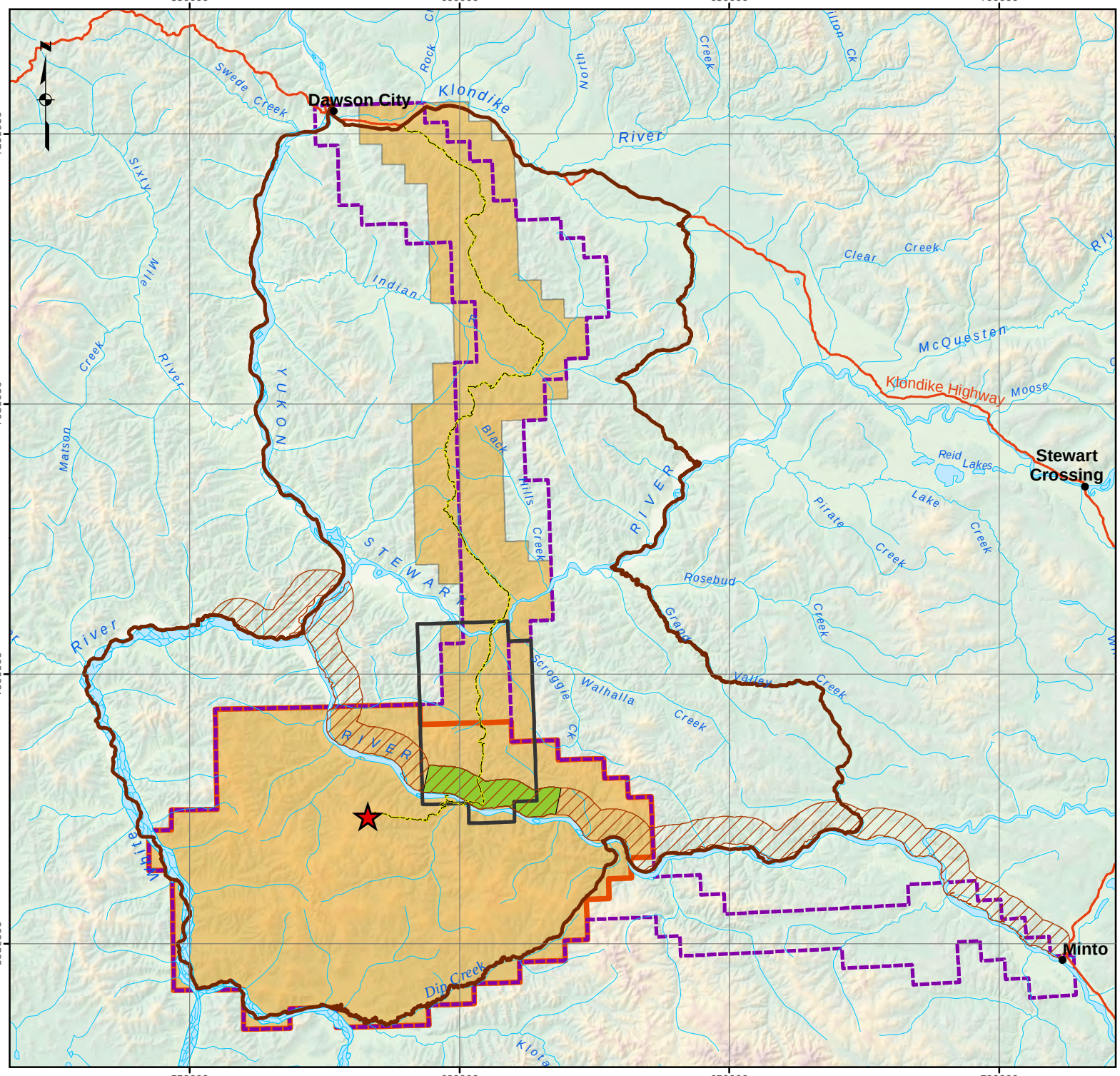
2 UNGULATES

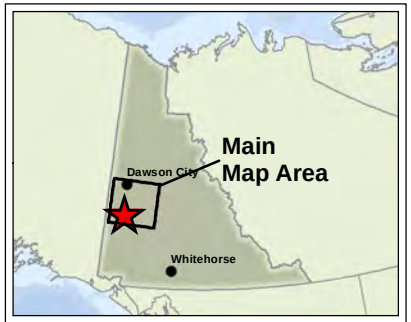
Ungulates, particularly caribou, moose, and thinhorn sheep are important and highly valued species in Yukon. A number of surveys were completed as part of the Project's Wildlife Field Program that focused on assessing ungulate habitat use and distribution (Table 2-1). The methods and results of these surveys are described in the Wildlife Field Program Report (EDI 2017a). The spatial boundaries for the aerial ungulate surveys completed by EDI are shown in Figure 2-1.

Table 2-1. Summary of ungulate surveys conducted for the Coffee Project (2014–2016).

Survey Type	Target Species	Dates Conducted
Aerial Early Winter Moose Surveys [1]	Moose	November 13–16, 20–22, 2015
Aerial Late Winter Ungulate Surveys	Moose and Caribou	February 28–March 5, 2014 March 10–14, 2015 March 7–10, 2016
Aerial Thinhorn Sheep Surveys	Thinhorn sheep	November 22, 2015 (early winter) February 29, 2016 (late winter) May 25, 2016 (lambing) June 13, 2016 (summer) October 24, 2016 (early winter)
Ground-based Sheep Investigations	Thinhorn sheep	May 27–August 28, 2015 June 14–17, 2016 October 25–26, 2016
Snow Tracking Surveys	Caribou, Moose, Wolves, Wolverine, and other Furbearers	February 11–15, 2015 February 22–25, 2016
Remote Camera Studies	Caribou, Moose, Thinhorn sheep, and Wolves	May 2015-Ongoing
Mineral Lick Investigation	Ungulates	August 2–5, 2015 August 26–30, 2015 April 25 and 26, 2016 June 15, 2016
Pellet Removal Plots	Caribou	Summers of 2014, 2015, 2016
Caribou Pellet Collection and Dietary Analysis	Caribou	Summer of 2014

[1] Conducted in conjunction with Environment Yukon.





Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area
- Focal Sheep Survey Area
- Regional Sheep Survey Area
- 2014 Late Winter Survey Extent
- 2015 Late Winter Survey Extent
- 2015 Early Winter Survey Extent
- 2016 Late Winter Survey Extent

FIGURE: 2-1

Extent of ungulate surveys for the Coffee Project

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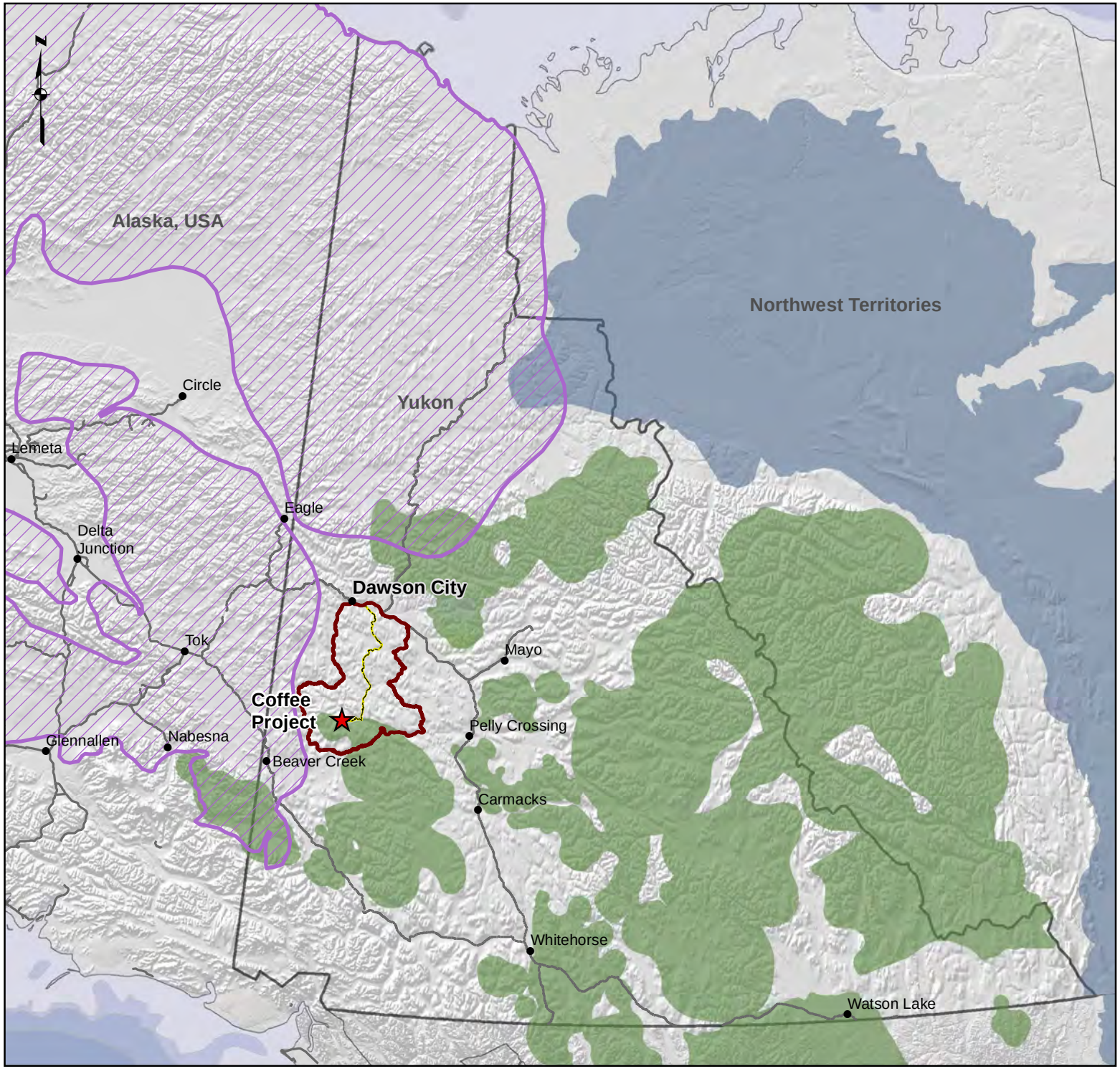
2.1 CARIBOU

Caribou occupy most of the northern hemisphere's higher latitude terrestrial environments (CARMA 2016), and are commonly the most abundant large mammal throughout their range. In North America, caribou are classified by subspecies or ecotype based on geographic distribution, physical attributes, behaviour, and management authority; however, there is currently no agreed taxonomic classification (Festa-Bianchet *et al.* 2011). In this report we have used COSEWIC's classification of caribou as 'designatable units' (COSEWIC 2011a).

Yukon is occupied by caribou that are part of the northern mountain, barren-ground, and boreal designatable units — of these, northern mountain and barren-ground caribou are found in the RSA (Figure 2-2). Northern mountain caribou are a sedentary ecotype of caribou that occur throughout most of Yukon and parts of northern British Columbia and western Northwest Territories. The total population of Northern Mountain caribou is approximately 45,000 individuals in 36 geographically distinct herds, though some herd ranges overlap (Environment Canada 2012). Northern Mountain caribou are listed as a species of Special Concern on Schedule 1 of the Canadian *Species at Risk Act* (SARA; Government of Canada 2016) and are considered Vulnerable within Yukon (Government of Yukon 2015a). The Yukon population of northern mountain caribou is estimated at 25,000 (Government of Yukon 2015a). Barren-ground caribou are a migratory ecotype of caribou that occupy most of northern Canada and Alaska. The total population of barren-ground caribou likely exceeds 2,000,000 (CARMA 2016; data from herds in central Alaska and much of Nunavut are missing). The Yukon population is estimated at approximately 220,000 animals (Government of Yukon 2015b).

Within the RSA, three herds of caribou may occur seasonally: the Klaza caribou herd (classified as northern mountain caribou), and the Fortymile and Nelchina caribou herds (barren-ground caribou). In Canada, the Fortymile and Nelchina caribou herds are recognized as part of the barren-ground caribou; however, in Alaska and much of the published literature, the herd's taxonomic classification is Grant's caribou, similar to the Porcupine caribou herd in northern Yukon. The distribution of Grant's caribou includes most of Alaska and parts of northern and western Yukon. The current annual range of the Fortymile and Klaza caribou herds overlaps with the RSA, while the Nelchina caribou herd range is on the periphery of the RSA.



Legend

- Coffee Project
- Proposed Route
- Regional Study Area

Migratory Caribou Range

- Barren-ground Caribou

Sedentary Caribou Range

- Boreal Caribou
- Northern Mountain Caribou

FIGURE: 2-2

Distribution of caribou in Yukon

Data Sources
Topographic Spatial Data courtesy of Esri. All Rights Reserved.

Barren Ground caribou herd range - Alaska Department of Fish and Game.

Northern mountain caribou ranges - Yukon Government Environment Yukon.

Boreal caribou range - Government of Northwest Territories, 2015.

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KM

Map Reference Scale: 1:6,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 CSRS Yukon Albers

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2.1.1 FORTYMILE CARIBOU

The Fortymile caribou herd is a migratory ecotype of caribou and part of the barren-ground designatable unit. The Fortymile caribou herd occupies east-central Alaska and west-central Yukon. The core of the herd's range is centred on the Yukon-Tanana Upland (i.e., Tanana Hills) in Alaska. Historically, the Fortymile caribou herd was one of the largest caribou herds in North America and the herd ranged widely across both Yukon and Alaska, including the entire Project RSA. Following a population crash in the early to mid-1900s, the herd abandoned most of its Yukon range, including the RSA. The Fortymile caribou have only recently returned to the Project area with an eruptive movement in the fall of 2013, corresponding with the continued growth of the herd.

2.1.1.1 Population and Herd Recovery

The Fortymile caribou herd was once one of the largest caribou herds in North America. In the 1920s, the herd was estimated to have reached a population peak of between 260,000 and 569,000 animals (Murie 1935; Boertje et al. 2012). At the herd's peak, they ranged across large areas of Alaska and Yukon. The Yukon range included much of central Yukon and extended as far south and east as Whitehorse, with parts of Yukon used during all seasons (McDonald and Cooley 2004). During the early part of the 20th century, there were reports of large groups of caribou migrating throughout the central Yukon (McDonald and Cooley 2004); all are assumed to be Fortymile caribou. The 1995 Fortymile Caribou Herd Management Plan (Alaska Department of Fish and Game 1995) and McDonald and Cooley (2004) provide the estimated historical extent of their range, which approximately corresponds with Murie (1935; Figure 2-5).

The Fortymile caribou herd experienced a population decline during the 1930s (McDonald and Cooley 2004) followed by further declines until it reached its smallest recorded size in 1973 of between 5,740 and 8,610 caribou (Valkenburg et al. 1994). As the population decreased, the herd disappeared from large portions (>75%) of its historic range (Gronquist et al. 2006) including nearly all of its range in Yukon. The herd was not observed in Yukon during some winters starting in 1960, and not at all between 1976 and 1984 (McDonald and Cooley 2004).

The Fortymile caribou herd began increasing in size through the mid-1970s and 1980s as a result of reduced harvest, favorable environmental conditions, and low wolf numbers (Valkenburg et al. 1994), until population growth stagnated at approximately 22,000 caribou in the early 1990s (Gronquist et al. 2006). During this period, very few caribou crossed into Yukon, although starting in 1985, small numbers were infrequently found in Yukon (McDonald and Cooley 2004; M. Suitor, pers. comm. 2014-2016).

In 1993, concerned about the low numbers of Fortymile caribou returning to Yukon, the Tr'ondëk Hwëch'in (TH) initiated discussions with Alaskan Fish and Game Advisory Committees and expressed interest in recovering the herd to its former ranges. This led to the creation of an international recovery team with representatives from governments, First Nations, user groups, and committees/boards from both Alaska and Yukon. In 1995, the team produced a comprehensive five-year recovery plan for the herd aimed at promoting herd growth through reduced harvest, habitat management, predator management, and public outreach (Gronquist et al. 2006; M. Suitor, pers. comm. 2014-2016). Through the recovery efforts, the

Fortymile caribou herd increased by 78% over the life of the plan, and by 2001 the herd had increased to 40,204 animals (Gronquist et al. 2006). In the fall of 2002, the herd began its first major movement into Yukon since the 1960s with tens of thousands of caribou returning to Yukon and extending the herd's winter range into areas west of Dawson, in the vicinity of the Yukon, Forty Mile, Sixty Mile, and Ladue Rivers (Barker and Hegel 2012; Kienzler and Suitor 2015).

In 2010, the Alaska Department of Fish and Game estimated that the herd size had increased to 51,675 caribou (Alaska Department of Fish & Game 2014); however, the herd range in Yukon was still largely restricted to habitats along the north shore of the Yukon River downstream of Dawson and along the Top of the World Highway, Sixty Mile River, and Ladue River. In the fall of 2013, the Fortymile caribou herd made another eruptive movement east into Yukon, reoccupying large areas of their historic range (including parts of the Project RSA) last used during previous population peaks in the 1960s, and in some cases decades earlier (Kienzler and Suitor 2015). The Fortymile caribou herd is currently estimated at approximately 52,000 animals based on the 2010 population estimate. A population survey was attempted in Alaska in 2015 and 2016, the results of which are not yet available; however, the herd is believed to be stable or increasing in size (M. Suitor, pers. comm. 2014-2016). Table 2-2 provides a summary of the Fortymile caribou population estimates between 1920 and 2010.

Large caribou herds naturally cycle through periods of scarcity and abundance. In the case of the Fortymile caribou herd, the causes of the decline may have been a combination of weather (Post and Forchhammer 2004), overgrazing of winter forage (Collins et al. 2011), and predation (Valkenburg et al. 1994); however, early in the recovery effort, people believed that the near extirpation of the Fortymile herd was mostly due to harvest. Long-term monitoring of caribou populations and Traditional Knowledge suggest that large migratory caribou herds naturally cycle between periods of population highs and lows, with corresponding range expansions and contractions (Gunn et al. 2011). The decline of the Fortymile herd likely followed this pattern, but the additional adverse anthropogenic effects related to increased hunting pressure during Klondike gold rush may have exacerbated the decline and/or delayed their recovery (Valkenburg et al. 1994).

Table 2-2. Summary of the Fortymile caribou population estimates (1920–2010)

Year	Estimate	Reference
1920	200,000–568,000	Valkenburg *et al.* 1994; Murie 1935
1950	6,500	“”
1950	20,000	“”
1953	46,000	“”
1956	45,000	“”
1958	40,000	“”
1960	50,000	“”
1962	50,000	“”
1963	50,000	“”
1969	20,000	“”
1970	15,000	“”
1971	11,000	“”
1972	15,000	“”
1973	5,312	“”
1974	4,041	“”
1975	3,982	“”
1975	7,175	“”
1981	10,093	“”
1983	12,350	“”
1984	13,402	“”
1986	15,303	“”
1988	19,975	“”
1990	22,766	“”
2003	43,375	Harvest Management Coalition 2012
2010	51,675	“”

2.1.1.2 Distribution and Movement

The Fortymile caribou herd is a migratory ecotype that displays the characteristic long-distance movements between relatively distinct seasonal ranges and gregarious behaviour on calving grounds. Migratory behaviour provides access to seasonally available habitat and helps avoid predators. Winter range is generally the largest of the seasonal ranges and often overlaps with the winter range(s) of other migratory and non-migratory caribou herds. Winter range distribution and movement is somewhat unpredictable as caribou are inconsistent in their range use.

The Fortymile herd calves and summers in the higher elevation habitat of the Yukon-Tanana Upland (Tanana Hills) in east-central Alaska. This portion of the herd’s range has remained its core range during the population lows and caribou occupy this area during all seasons (Figure 2-5; Boertje *et al.* 2012). The herd has primarily occupied the Alaska portion of their range since the population low in the 1970s. As the herd

recovered, their range expanded, reoccupying parts of their historic range west of the Steese Highway and east into Yukon, often in eruptive movements (see section 2.1.1.1). The size of the herd's range shows a direct relationship with herd size (Boertje *et al.* 2012).

Currently, Fortymile caribou are present seasonally in Yukon. Although historically Fortymile caribou may have been found in Yukon year-round (McDonald and Cooley 2004), recent satellite collared caribou locations show they are generally using habitat in Yukon and the Project RSA only during the early and late winter seasons, and the corresponding migration periods, between October and April (Figure 2-6 and Figure 2-7). This is consistent with data from the various remote camera monitoring programs which, to date, have photographed caribou in the RSA from late October through late-April (EDI 2017a).

Since 2013, the winter range of the Fortymile herd has included large portions of the Project RSA; however, winter distribution has varied between years. Both the satellite collar data and Project survey data show that caribou heavily used the RSA during the winter of 2013/2014 and again in 2015/2016, while very few caribou were in the RSA during the winter of 2014/2015 (Figure 2-6, Figure 2-7, Figure 2-8). During the winters of 2013/2014 and 2015/2016 satellite collared caribou locations show that a considerable portion of the herd was in Yukon, including parts of the RSA. However during the winter of 2014/2015, the herd only used the very western edge of Yukon and no collared animals used the RSA. Collar data indicates that the caribou did not cross the White or Yukon rivers during the fall of 2014, and observations by survey crews indicated that the White River remained unfrozen, providing a possible hypothesis for the Fortymile herd not using the area. Collar data and survey data for the winter of 2016/2017 were not available at the time of reporting; however, according to Environment Yukon biologists the majority of the herd is wintering in Alaska and did not cross into the Yukon (M. Suitor, pers. comm., 2016).

Baseline ungulate surveys for the Coffee Project began in 2011 (Access Consulting Group 2011, 2013a, 2013b); however, Fortymile caribou were not detected in the Project area until the winter of 2013/2014 (consistent with satellite collar data). The late winter survey in March 2014 recorded 1,146 Fortymile caribou occupying areas within the southern portion of the RSA, south of the Yukon River (the 2014 survey did not yet include the northern portion of the RSA). During the winter of 2014/2015, very few caribou were observed, with only 21 caribou documented during the 2015 late winter survey (EDI 2017a). Caribou were again observed in large numbers in the 2015/2016 winter surveys — 4,752 caribou were observed incidentally during the 2015 early winter moose survey of the Dawson Goldfields in the northern portion of the RSA (north of the Stewart River; report pending, preliminary data provided by M. Suitor, pers. comm., 2016), with another 625 caribou documented in incidental sightings in an associated late winter survey along the NAR between the Yukon and Stewart Rivers (EDI 2017a). During the March 2016 late winter survey, 290 caribou were observed within the survey extent and surveyors noted an abundance of tracks (both old and new) in various locations through the area (EDI 2017a). The majority of caribou observed during the Project surveys were using alpine and subalpine areas within the survey extent, with concentrations on the alpine and subalpine ridges to the north of the Yukon River from Thistle Mountain east to Selwyn Dome. Caribou were observed in a range of habitat types from low elevation forests to alpine. Across the various surveys, caribou were observed in groups ranging in size from 1–130 animals (EDI 2017a).

Migratory caribou herds exhibit unpredictable use of their winter range, so accurately predicting annual distribution and movement in future years is not possible as there are too many variables that influence caribou behaviour. Future range use and movements of the Fortymile caribou herd in Yukon likely depends on stable or continued population growth; however, based on the herd's current distribution, Fortymile caribou have the potential to occur seasonally within the RSA during any year. Use of the RSA in any given year could range from no caribou, to small numbers of caribou in isolated areas of the RSA, to thousands of caribou spread across large portions of the RSA.

Residency in RSA

Fortymile caribou outfitted with satellite collars started occupying areas near the Project in September 2013. Two caribou location datasets were provided by Environment Yukon that document caribou distribution. The datasets were specific to the type of collar used to record caribou locations: Argos and Iridium. The Iridium collar dataset generally provided one location per caribou per day; however, some intervals between locations were longer because caribou left Yukon, collars may have temporarily malfunctioned, or collar data was screened out prior to distributing. The Argos collar dataset recorded multiple locations per day but did not include a time stamp in the dataset, therefore to make the data comparable to the Iridium dataset, locations were averaged for each day. Averaging location reduces precision and accuracy; however, the data is suitable at the scale of this analysis.

Both collar datasets were restricted to a polygon provided by Environment Yukon (M. Suitor, pers. comm., 2015; Figure 2-8) that outlines the area which the Fortymile herd can reasonably be expected to use within the coming decade. It is based on the historic distribution of the herd, the 2013–2014 distribution, and what Environment Yukon considers to be expansion habitat adjacent to those locations. This area, referred to as the Fortymile Caribou Study Area (FCSA) in this report, encompasses all areas that the herd has used since returning to Yukon (2002 to spring 2016), as well as additional habitats to the west which may be used should the herd continue to expand its range. Compared to the historic range (e.g., McDonald and Cooley 2004), this study area does not go as far south and east, but does include area to the north (Tombstone-Ogilvie) based on the 2013 Fortymile herd movement.

The collar data provided the opportunity to characterize residency time in the Project footprint, the wildlife RSA and the FCSA. Residency is based on the three season-years (October 1 to April 30; 2013/2014, 2014/2015, 2015/2016) of satellite collar data collected for the herd. Consecutive point locations were connected to create step segments and a polyline database. The lines were then split at each node to create individual step segments. Steps that intersect the FCSA, RSA or Project footprint were selected and split at the intersection. The proportion of each step that was within each study area multiplied by the number of days the step represented (usually one day) was used to estimate the residency time of each caribou. The method was repeated for each year. The average residency time was calculated using all three years of collar data and the maximum and minimum amount of time any one individual caribou spent in the FCSA, RSA or Project footprint from the three years of data were used as the maximum and minimum residency times.

The average residency time in the Project footprint for all collared caribou over the three years of data collection was only 0.01 days (range 0–0.19 days) whereas the average residency time in the RSA was 15.97

days (range 0–162.26 days) and the average residency time in the entire FCSA was 74.77 days (range 1.00–183.00 days; Table 2-3). These estimates assume that the collars are representative of the caribou that occurred in Yukon during this period and that step lengths accurately represent caribou movements. Based on this information, collared Fortymile caribou have spent a relatively small amount of time during the winter season in the Project footprint area relative to the time spent in the remainder of the RSA and FCSA, suggesting that while the area could be used, to date, use has been relatively brief.

Table 2-3. Residency estimates of collared Fortymile caribou within Fortymile Caribou Study Area, Regional Study Area and Project footprint

Study Area	Residency Measure (days)	2013/2014	2014/2015	2015/2016	Total
Fortymile Caribou Study Area (Area = 77,5532 km²)	*Total satellite collared caribou*	*28*	*20*	*55*	*103*
	Average residency	113.50	17.50	75.88	74.77
	Maximum residency	183.00	74.00	148.84	183.00
	Minimum residency	10.00	1.00	18.00	1.00
Wildlife RSA (Area = 13, 661 km²)	*Total satellite collared caribou*	*5*	*0*	*20*	*25*
	Average residency	11.93	0	23.83	15.97
	Maximum residency	162.26	0	115.76	162.26
	Minimum residency	0	0	0	0
Project footprint (Area = 33 km²)	*Total satellite collared caribou*	*0*	*0*	*9*	*9*
	Average residency	0	0	0.01	0.01
	Maximum residency	0.00	0.00	0.19	0.19
	Minimum residency	0.00	0.00	0.00	0.00

Long-distance movement patterns

The Fortymile caribou move extensively within their annual range. Long-distance directional movements consistent with migratory behaviour are exhibited in the satellite collar data. To identify areas of long-distance movement consistent with migratory behaviour, we calculated the distance between consecutive points within the FCSA. For the purposes of this baseline report, two time periods were used in the analysis which are based on when caribou are expected to occur in the RSA (caribou encounter period: October 1 to April 30), and when they are not expected to occur in the RSA (May 1 to September 31). The lines were sorted by length and the top 0.5 % of the longest lines was excluded from the dataset to account for errors in the location dataset. The 75th percentile was used as the criteria for identification of change in caribou movement behaviour (i.e., foraging vs. migratory movement).

Based on the collar data, long-distance movements tend to be more concentrated in specific areas, such as higher elevation terrain and adjacent to the Yukon River. Caribou crossed the major rivers most frequently on the White River upstream of the Yukon River confluence (winter 2013/2014), and on the Yukon River just north of the confluence of the White and Yukon rivers and north of the Yukon and Stewart River confluence (winter of 2015/2016; Figure 2-9). During the winter of 2013/2014, long-distance caribou movement within the RSA was most concentrated south of the Yukon River in the Dawson Range (Figure 2-9). In the winter of 2015/2016, caribou travel paths in the RSA were concentrated in the higher

elevation areas connecting Mt. Stewart, Thistle Mountain, Selwyn Dome, and the higher elevation areas connecting Ruby Mountain, Reindeer Mountain, and Henderson Dome (Figure 2-9).

The analysis of long-distance movement based on satellite collar data is generally consistent with other reports of Fortymile caribou migration through this region. Anecdotal reports received by Environment Yukon during the winter of 2013/2014 also support the premise that during migration, Fortymile caribou tend to use higher elevation terrain. Reports indicate that during the fall of 2013, caribou moved into the Dawson Goldfields using ridge systems in the area. Once on top of a ridge system, caribou travelled east in large numbers (i.e. hundreds) with small groups breaking off and travelling down different ridge systems to access new areas (Kienzler and Suitor 2015). The collar and survey data are also consistent with Traditional Knowledge that confirms Fortymile caribou historically used and moved through the RSA (Tr'ondëk Hwëch'in 2012b), although one local trapping concession holder reported that Fortymile caribou were moving through the area differently, using different migration routes, than they had observed when the Fortymile had last been seen in Yukon (Interview 14, pers. comm., 2016). In the past, Coffee Creek was known as one of many points where caribou crossed the Yukon River (Dobrowolsky 2014; Tr'ondëk Hwëch'in 2012a) and the subalpine and alpine ridges in the Coffee Creek area are known to provide winter habitat for the Fortymile herd (Tr'ondëk Hwëch'in 2012a).

2.1.1.3 Winter Habitat Use and Diet

An early winter season habitat model was developed to quantify habitat selection by Fortymile caribou within the Canadian portion of their range (Muhly 2017). This model and the accompanying report (Muhly 2017) provides the most current baseline information describing Fortymile caribou early winter habitat use. The early winter season, December 1 to February 26, was chosen because that was the period when the herd appeared to be relatively 'settled' on their winter range (i.e. not exhibiting long distance directional movement associated with migration; M. Suitor, pers. comm., 2015). The study area used in the modelling exercise was the FCSA, which encompasses all areas that the herd has used since returning to Yukon, as well as additional areas to the south and east which may be used should the herd continue to expand its range (M. Suitor, pers. comm., 2015).

The model followed a resource selection function (RSF) approach (Boyce and McDonald 1999; Manly et al. 2007), which indicates the relative probability of wildlife selection of habitat types (Johnson et al. 2006). An RSF is a data-driven model that quantifies and contrasts the statistical relationships between used animal locations and available habitat, and the results can be used to predict habitat quality across an area of inference. Data on caribou use was obtained from 60 caribou affixed with GPS telemetry collars that were monitored between 2012 and 2016 as part of a joint study by the Alaska Department of Fish and Game and Bureau of Land Management in the United States of America, and by Environment Yukon in Canada. The RSF used a second-order design that examined selection of home ranges within a population range (Johnson 1980). Habitat variables used in the analysis consisted of spatial data available in a GIS and included EOSD Land Cover Classes, normalized difference vegetation index (NDVI) values, slope, aspect, distance to water, and road density. The predictive performance of the top-selected RSF model, as determined using Akaike Information Criterion (AIC), was evaluated using a k-fold cross validation approach (Johnson et al. 2006).

Results of the RSF analysis indicated that:

- Caribou selected home ranges farther from large rivers.
- Caribou selected areas that were burned 41 to 60 years ago, but avoided areas burned 11 to 40 years and 61 to 70 years ago, or that were not burned, relative to recently burned areas (less than 10 years ago).
- Caribou selected all vegetation cover types relative to barren cover, except for dense conifer forest. Bryoids were the strongest selected vegetation cover type, followed by sparse mixedwood forest, water, shrubland, and dense broadleaf forest.
- Caribou selected east and west aspects relative to north aspects, and avoided flat aspects.
- Caribou avoided areas with high-use road densities greater than 0.05 km/km^2 and areas with low-use road densities greater than 0.10 km/km^2.
- Caribou selected areas with intermediate NDVI values.
- Caribou selected slopes between 20 to 30 degrees.

Model validation statistics calculated using k-fold cross validation on 28 caribou indicated that the RSF model had good predictive power of caribou locations (Muhly 2017). Based on the model results, habitat selection probabilities were predicted across the study area (Figure 2-10). Descriptive rating classes were applied to the RSF scores based on the frequency of actual caribou use (i.e., telemetry locations) relative to random locations across the range of RSF predictions. This was done by determining the RSF value at which point the ratio of used to random points switched from negative to positive (0.76) and defining Moderate and High categories to equal bins above 0.76 and Low and Very Low to equal bins below 0.76. The distribution of habitat availability and caribou telemetry locations within the FCSA are summarized in Table 2-4.

Table 2-4. Availability of early winter habitat within the Fortymile caribou herd study area.

Habitat class	RSF Values	Area (km^2)	Area (%)	Caribou Observations	Used:Random Ratio
High	0.88 - 1	5,148	6.6	182 (15.7%)	+0.93
Moderate	0.76 - 0.88	14,232	18.4	562 (45.1%)	+0.77
Low	0.38 - 0.76	45,049	58.1	452 (38.7%)	-0.35
Very Low	0 - 0.38	13,072	16.9	6 (0.5%)	-0.93

Although the early winter period was identified as the key season of interest for this project, there is also value in determining how well the model predicted caribou use in the rut (October 1 – November 30) and late winter (February 27 – March 31) periods. Performance of the early winter RSF for the rut and late winter periods was assessed by evaluating the distribution of predicted RSF scores associated with caribou locations from those two periods and comparing them to the pattern of RSF scores associated with used and available (i.e. random) locations during early winter (Figure 2-3). This shows that the distribution of predicted RSF scores for caribou locations is similar among seasons. Overall, for all three seasons, use was higher than random for RSF scores in the three highest bins and lower than random in the seven lowest bins. This provides support that the early winter model is also representative of selection during rut and late winter. However, smaller differences between used and random locations during rut and late winter, than

for early winter, suggests that the model does not perform as well for rut and late winter as it does for early winter.

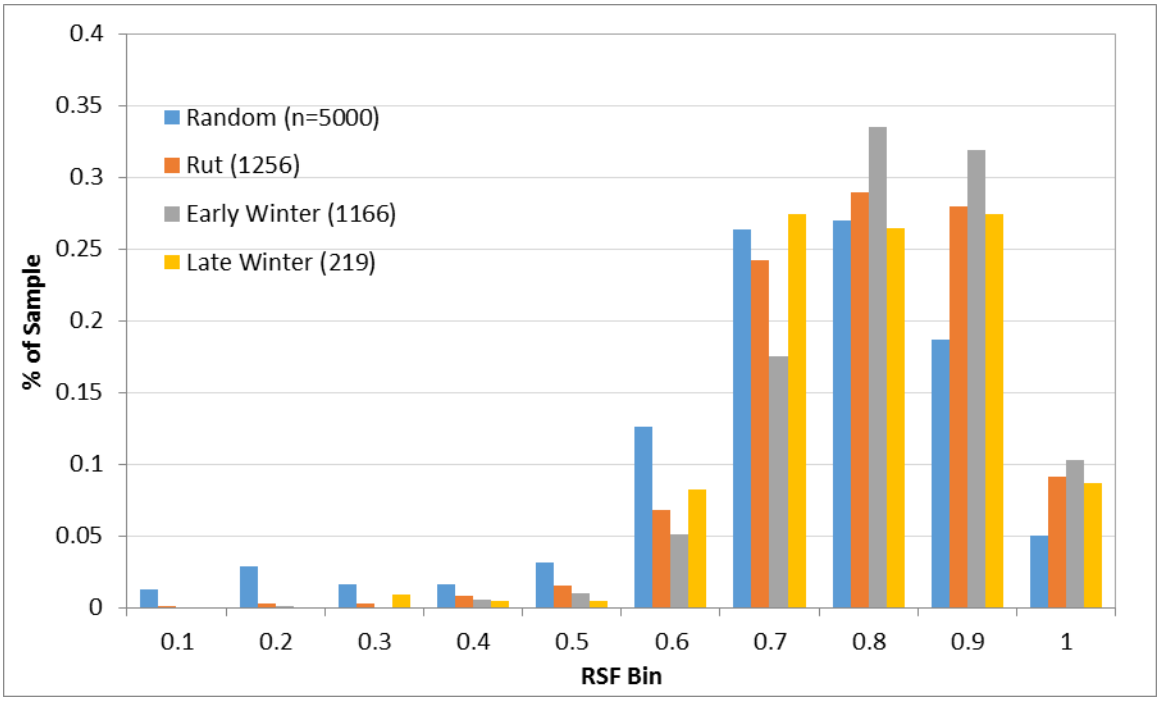


Figure 2-3. Comparison of predicted RSF scores for caribou locations across seasons.

Winter habitat selection by caribou herds in Yukon has previously been statistically modeled using a combination of fire history, vegetation cover, terrain, and human disturbance variables (Florkiewicz *et al.* 2004, 2007; Collins *et al.* 2011) including for the Fortymile caribou herd using aerial survey data from 2008–2010 (Barker and Hegel 2012). Although the significance of, and coefficient values for, covariates vary among studies, results tend to consistently support two primary mechanisms driving selection – avoidance of predation risk and selection of foraging habitat. In other studies, selection of mid-upper elevation habitats is likely a result of avoidance of predation and greater snow depth in valley bottoms, and poor forage availability and climatic conditions at high elevations (James *et al.* 2004; Gustine *et al.* 2006; Barker and Hegel 2012).

For the smaller study area examined by Barker and Hegel (2012) (in the northwestern portion of the FCSA), Fortymile caribou selected winter range that was mid-elevation (peak selection at 786 m), contained high lichen abundance, and was far from old burns. Although Muhly (2017) did not include elevation as a covariate in his model, concentrations of predicted high quality habitat occurred in subalpine and low alpine areas at 700–1000 m.

Lichens, the primary winter forage for caribou, appear to be a primary driver of Fortymile caribou habitat selection (Barker and Hegel 2012). During winter, caribou consume approximately 1.3–4.9 kg of lichen per day (Holleman *et al.* 1979), accounting for more than half of forage intake. In Yukon, lichen abundance is largely determined by wildfire history. Lichens are slow-growing and typically take between 40 and 60 years post-burn for enough suitable lichen biomass to accumulate before the area is considered good winter

foraging habitat (Klein 1982; Schaeffer and Pruitt 1991; Thomas *et al.* 1996; Joly *et al.* 2003, 2007, 2010; Collins *et al.* 2011); however, in Environment Canada's (2008) *Scientific review for the identification of critical habitat for woodland caribou (Rangifer tarandus caribou), boreal population, in Canada*, 50 years post-burn is considered to be 'recently disturbed'. The abundance of lichens is also often influenced by forest community type (e.g., dry, mature coniferous forests), soil characteristics, topography, grazing, and the time since disturbance (i.e., from land clearing or forest fire; Joly et al. 2010).

Within the Fortymile caribou herd range, wildland fires, followed by land clearing, are likely the greatest influence on lichen abundance; however, large caribou herds can also overgraze winter range causing reduced lichen availability (Collins *et al.* 2011; Joly *et al.* 2015). Snow depth may also be an important influence on winter habitat selection (Russell *et al.* 1993; Johnson *et al.* 2002; Tyler 2010), with deep snow restricting movement and hindering the accessibility and detection of lichen (Johnson *et al.* 2000).

Fortymile caribou diet analysis

Caribou fecal pellets were collected near the proposed mine site during summer 2014 and analyzed for winter diet composition (Figure 2-4). The pellets are most likely from the Fortymile caribou that were present in the RSA during the winter of 2013/14; however, given the time of the collection it is possible that some of the pellets were from outside of the winter season. Analysis of the diet composition from the pellets indicate that the Fortymile caribou in Yukon seem to be consuming less lichen and greater moss than was reported from other herds in Alaska (Table 2-5). Lower lichen content in caribou winter diets is hypothesized to be associated with reduced adult overwinter survival and potentially recruitment of young through reduced body condition at birth (Joly *et al.* 2015). The results are consistent with an area where the preferred winter forage is limited, as moss is only consumed incidentally when caribou consume lichens closer to the moss layer that has limited nutritional value (Ihl and Barboza 2007). The proportion of lichen in the diet is less informative because differences in content of lichens in caribou diets have been documented as a function of sex, reproductive status (pregnant vs. not pregnant), caribou herds, and seasonal differences (early vs. late winter) (Joly *et al.* 2015). The date of deposition, sex, and age of the caribou that dropped the pellets are unknown.

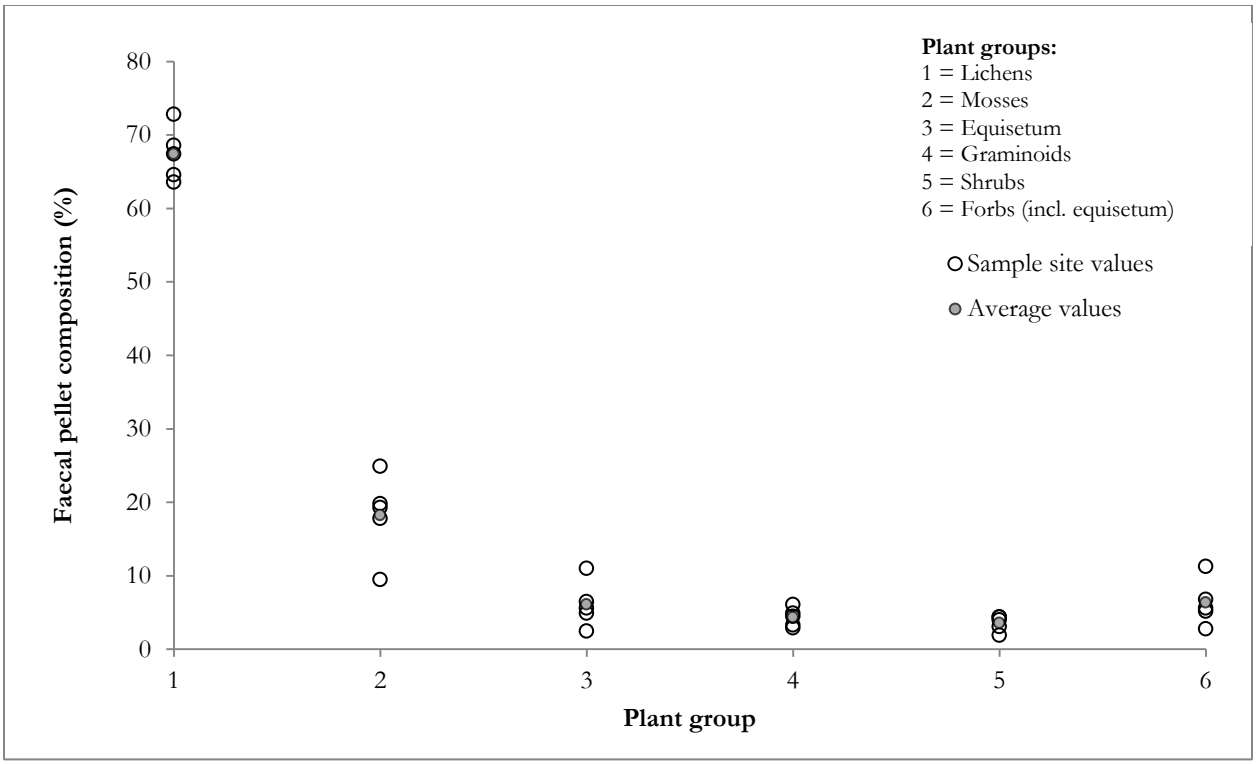


Figure 2-4. Faecal pellet composition (%) of caribou samples collected within the RSA. Averages are derived from the five sample sites.

Table 2-5. Faecal pellet composition (%) of caribou samples collected within the RSA compared to Fortymile caribou, Arctic caribou, and Galena Mountain caribou winter faecal samples.

	Arctic (2012)[1]	Galena (2012)[1]	Fortymile (1992)[2]	Fortymile (1993)[2]	Fortymile (1994)[2]	Fortymile (1995)[2]	Fortymile (1996)[2]	Fortymile (2014)
Lichens	72.8	88.8	72	81	80	84	86	67.4
Mosses	11.9	4.7	9	7	4	1	1	18.4
Equisetum	n/a	n/a	7	3	6	8	6	6.1
Graminoids	5.9	1.6	1	1	4	2	2	4.3
Shrubs	7.6	4.2	10	8	5	4	5	3.6
Forbs (incl. equisetum)	1.7	0.4	3	0	0	0	0	6.3
Sample size	**74**	**18**	**6**	**7**	**1**	**6**	**4**	**5**

[1] Data from Joly et al. 2015, [2]Data from Boertje and Gardner 1998.

2.1.1.4 Harvest and Mortality

First Nations people in Yukon and Alaska have relied on the Fortymile herd as a source of food and materials for centuries. According to information collected by McDonald and Cooley (2004), Han people have hunted Fortymile caribou since at least the mid-1850s, using the hides for clothing and freezing or drying the meat. The herd was commercially harvested during the Klondike gold rush until the 1930s

(Valkenburg *et al.* 1994) and was an important source of income for First Nations during that time (Tr'ondëk Hwëch'in. n.d.). Prior to and during the Klondike gold rush, most of the Fortymile caribou harvest likely occurred along the major rivers that bisect the herd's range because those were the primary transportation routes. The distribution of caribou harvest changed considerably with the construction of the Steese Highway in the 1920s and the Taylor and Top of the World highways in the 1950s. The majority of Fortymile harvest now occurs along these transportation routes.

Harvest management is complicated by the fact that the herd's range crosses the Alaska-Yukon border. In Alaska, the state Department of Fish and Game and the federal Bureau of Land Management and Eastern Interior Regional Subsistence Advisory Council work together with local advisory committees. In Yukon, Environment Yukon, TH, and the Yukon Fish and Wildlife Management Board (YFWMB) are responsible for aspects of harvest management (M. Suitor, pers. comm. 2014-2016). Transboundary harvest management for any species is difficult due to different users and priorities on each side of the border; however, Alaska and Yukon organizations cooperatively manage harvest through participation in the Fortymile Caribou Harvest Coalition.

Currently, by agreement of the Coalition parties and Yukon, Alaskan hunters are allocated 65% of the annual allowable harvest (AAH) and Yukon hunters 35%. The AAH varies by herd size: total AAH is set at 3% when the herd is below 70,000 caribou and increases to 4% when the herd exceeds 70,000 caribou (Harvest Management Coalition 2012). However, as a part of the Fortymile Caribou Herd Management Plan (1996–2001, see Section 2.1.1.1), the Yukon Government closed resident harvest of Fortymile caribou in Yukon and the TH began a voluntary no-harvest program. Since then, the Yukon Government and TH have chosen to maintain the closure so that the Yukon portion of the harvest allocation can be put towards population growth.

Harvest estimates for the Fortymile caribou herd are available from 1951, although the quality of harvest data has improved since then (Valkenburg *et al.* 1994). Annual harvest estimates of Fortymile caribou between 1951 and 2010 range from 30 to 2,325 caribou (Valkenburg *et al.* 1994, Harvest Management Coalition 2012), and the number approximately tracks the herd numbers. Harvest of the Fortymile herd is now more strictly regulated. Alaska hunters harvest approximately 1,000 caribou per year and the Yukon harvest is currently limited to a very small First Nations' harvest (Dawson Regional Planning Commission 2013; M. Suitor, pers. comm. 2014-2016; K. Meister, pers. comm. 2016; N. Ayoub, pers. comm. 2016).

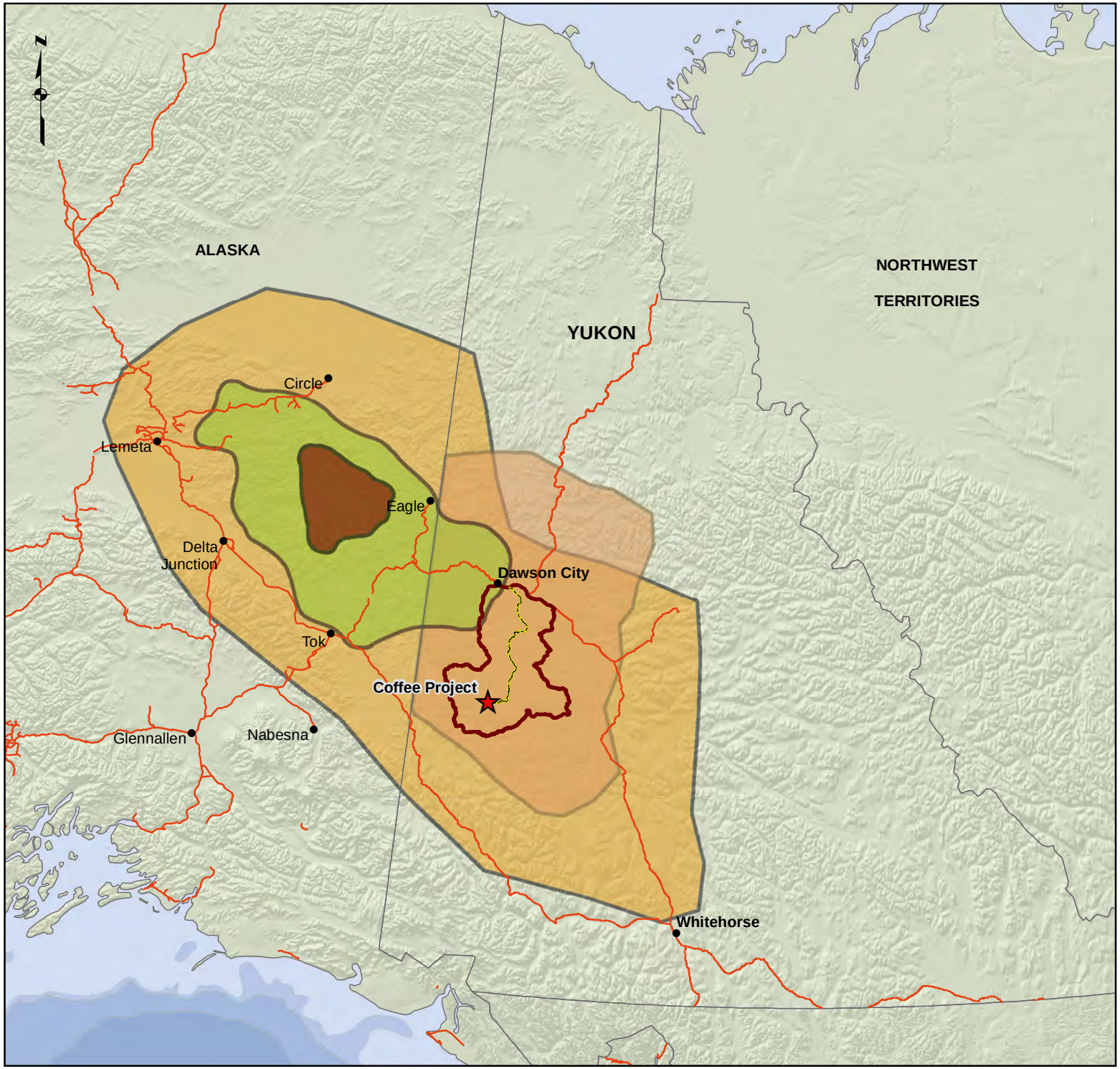
With the expanding herd range and increasing herd size, Yukon and TH governments are considering re-opening the Yukon harvest for Fortymile caribou in the near future (M. Suitor, pers. comm. 2014-2016; K. Meister, pers. comm. 2016). As detailed in the Fortymile Caribou Herd Harvest Plan 2012–2018, Yukon and TH governments negotiated an allocation of 35% of the AAH, corresponding to a harvest of more than 500 caribou per year in Yukon (Table 2-6).

Predator control has played an important role in the recovery of the Fortymile caribou herd (Harvest Management Coalition 2012). Active predator control within the Fortymile caribou range has been implemented to some degree in Alaska since about 1950 (Valkenburg *et al.* 1994). Wolf predation has been suggested as the dominant factor determining the herd's population growth (Boertje *et al.* 2012). Wolves

followed by grizzly bears are the greatest cause of Fortymile caribou mortality. Boertje and Gardner (1998) estimate that wolves consumed 2,000–3,000 calves and 1,200–1,900 adult caribou annually from 1992 to 1997.

Table 2-6. Fortymile caribou harvest targets (Harvest Management Coalition 2012)

Herd size	Harvest rate (%)	Yukon allocation (35%)	Alaska allocation (65%)
50,000	3%	525	975
55,000	3%	578	1,073
60,000	3%	630	1,170
65,000	3%	683	1,268
70,000	4%	980	1,820
75,000	4%	1,050	1,950
80,000	4%	1,120	2,080
85,000	4%	1,190	2,210
90,000	4%	1,260	2,340
100,000	4%	1,400	2,600



Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area
- Fortymile Caribou Herd Study Area
- Fortymile Caribou Herd Core Range
- Fortymile Caribou 2008 Range
- Fortymile Caribou Herd Historic Range

FIGURE: 2-5

Fortymile caribou herd range

Data Sources
Topographic Spatial Data courtesy of Esri. All Rights Reserved.

Fortymile caribou herd core range and 2008 range - Boertje et al., 2012.

Fortymile caribou herd historic range - McDonald and Cooley, 2004.

Disclaimer
This document is not an official land survey and the spatial data presented is subject to change.

0 100 200
KM

Map Reference Scale: 1:6,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 CSRS Yukon Albers

Drawn: MP	Checked: AM/LP	Date: 3/14/2017

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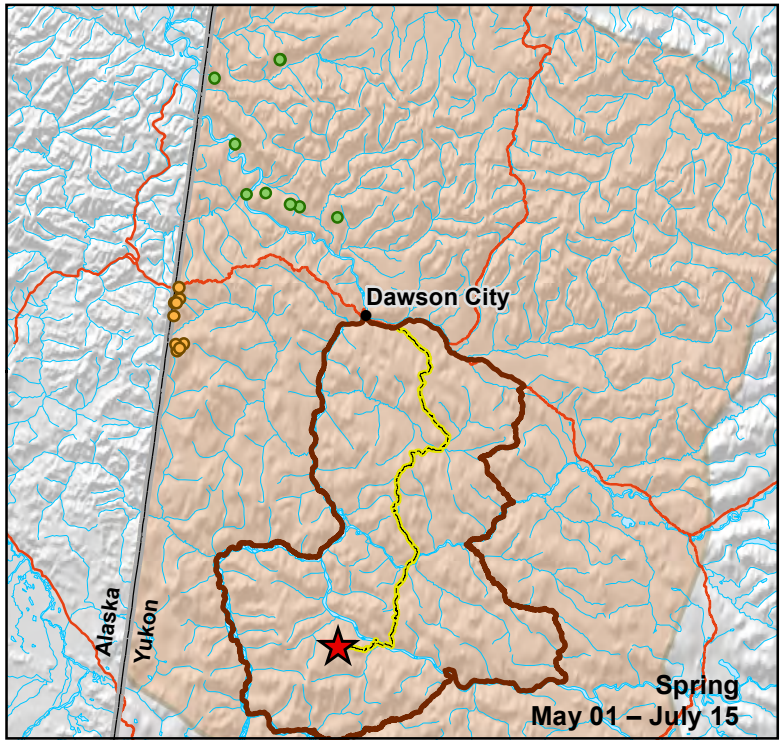

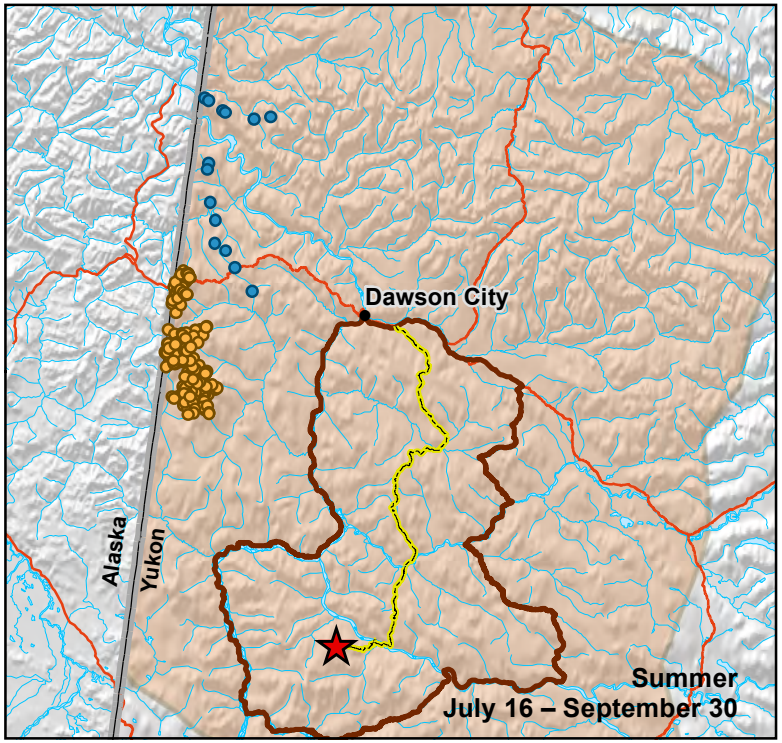

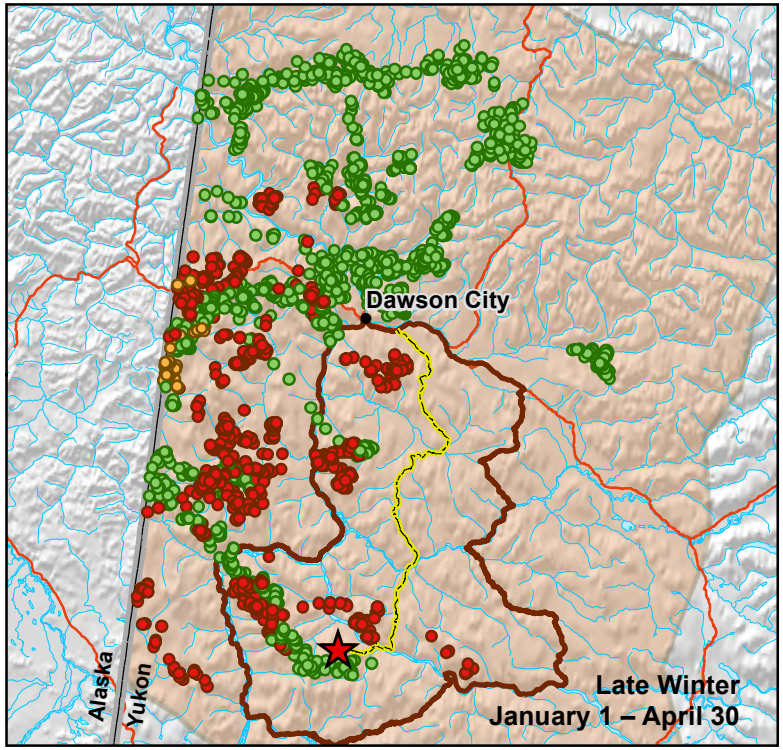

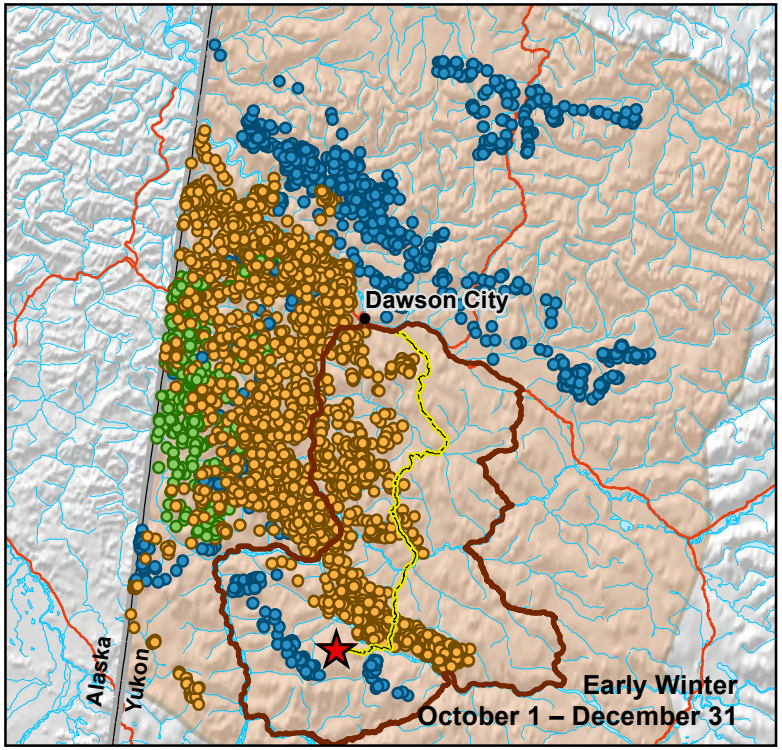

Legend

- Coffee Project
- Proposed Route
- Yukon/Alaska Border
- Fortymile Caribou Study Area
- Regional Study Area

Fortymile Caribou Herd Satellite Collar Locations (by year)

- 2013
- 2014
- 2015
- 2016

FIGURE: 2-6

Fortymile caribou satellite collar locations in Yukon (Sept. 2013 – Feb. 2016)

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Collar data provided by Environment Yukon - Yukon Government, Alaska Department of Fish and Game, and Alaska Bureau of Land Management.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

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KM

Map Reference Scale: 1:3,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 CSRS Yukon Albers

Drawn: MP	Checked: AM/LP	Date: 3/14/2017

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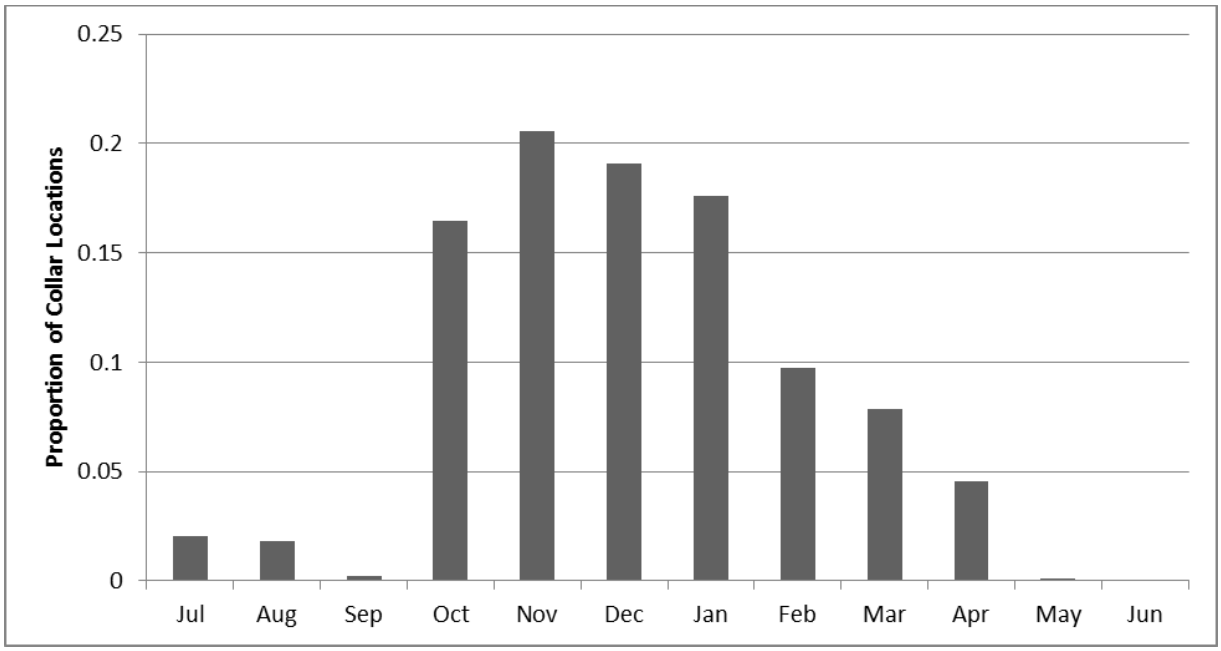
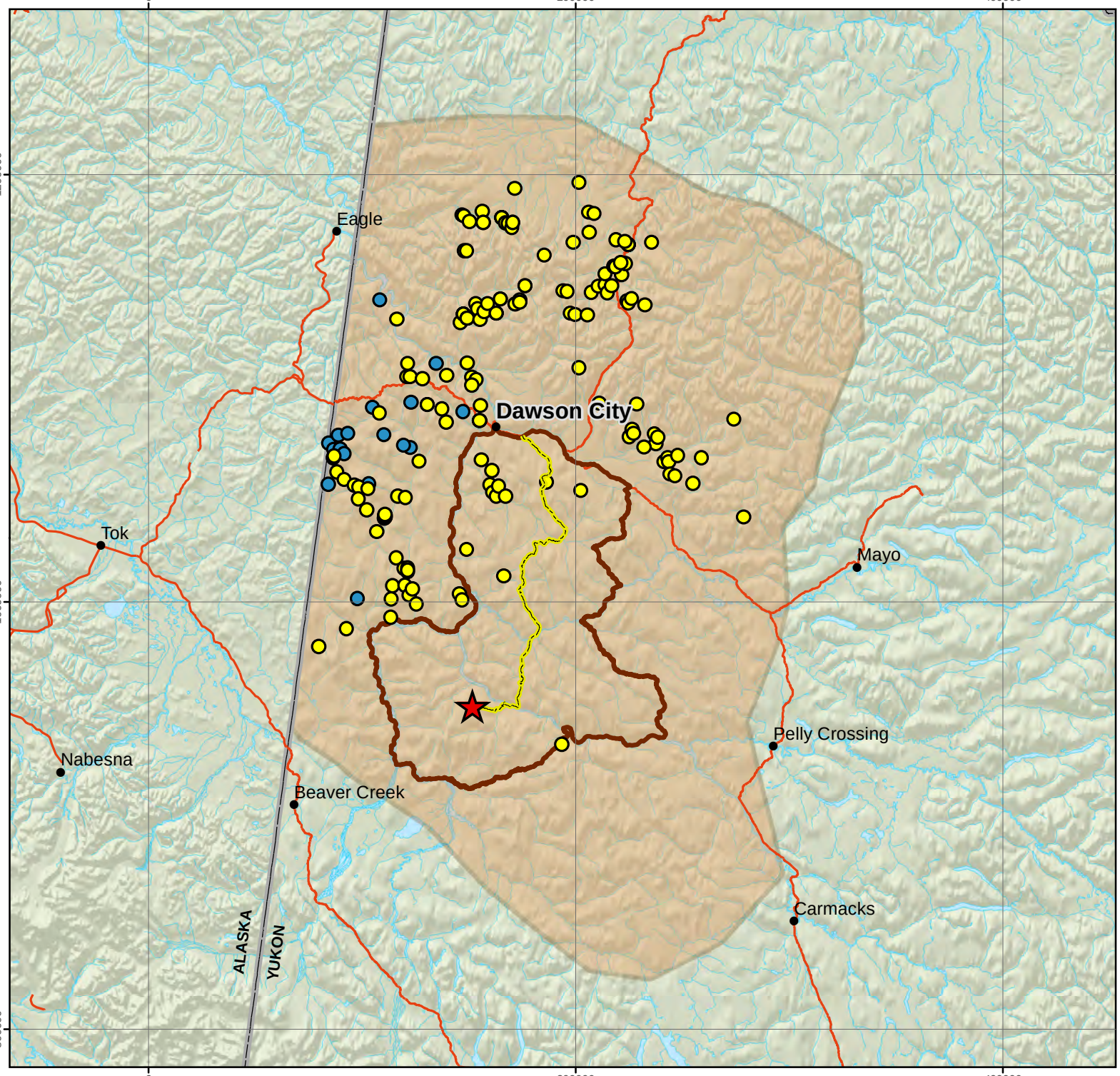
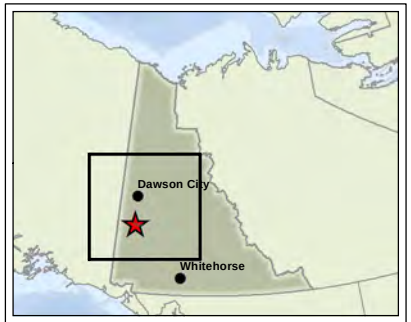


Figure 2-7. Proportion of available caribou satellite collar locations by month within Yukon between September 27, 2013 and February 2, 2016.





Legend

- Coffee Project
- Fortymile Caribou Locations (2003 - 2013)
- Fortymile Caribou Locations (2013 - 2015)
- Proposed Route
- Yukon/Alaska Border
- Regional Study Area
- Fortymile Caribou Study Area

FIGURE: 2-8

Fortymile VHF collared caribou locations (pre and post 2013)

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Collar data provided by Environment Yukon - Yukon Government, Alaska Department of Fish and Game, and Alaska Bureau of Land Management.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

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KM

Map Reference Scale: 1:3,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 CSRS Yukon Albers

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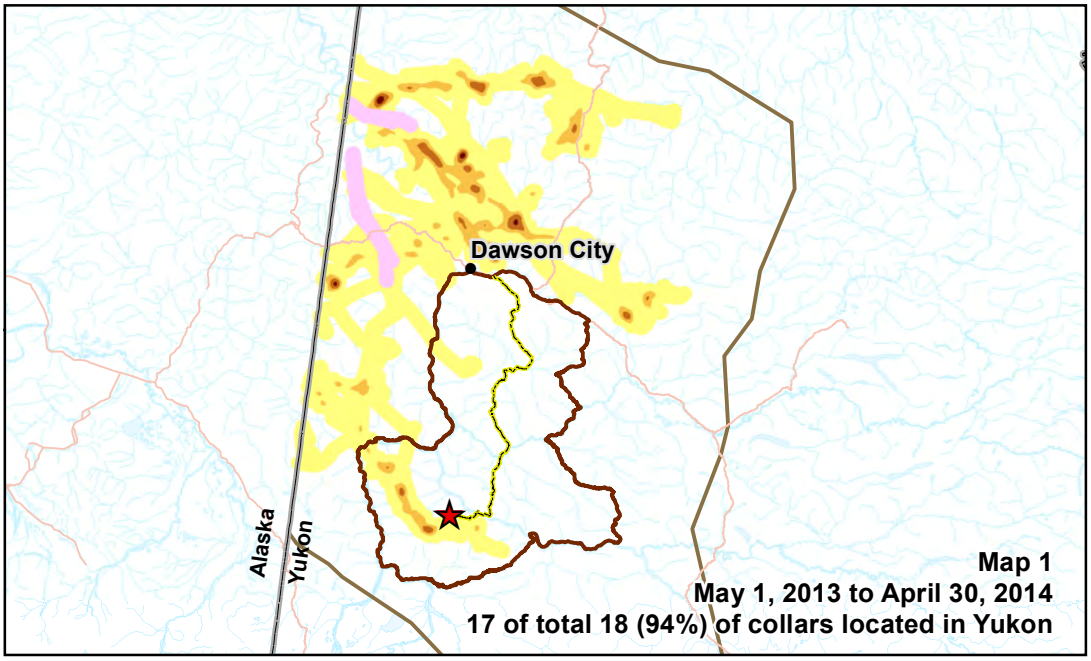

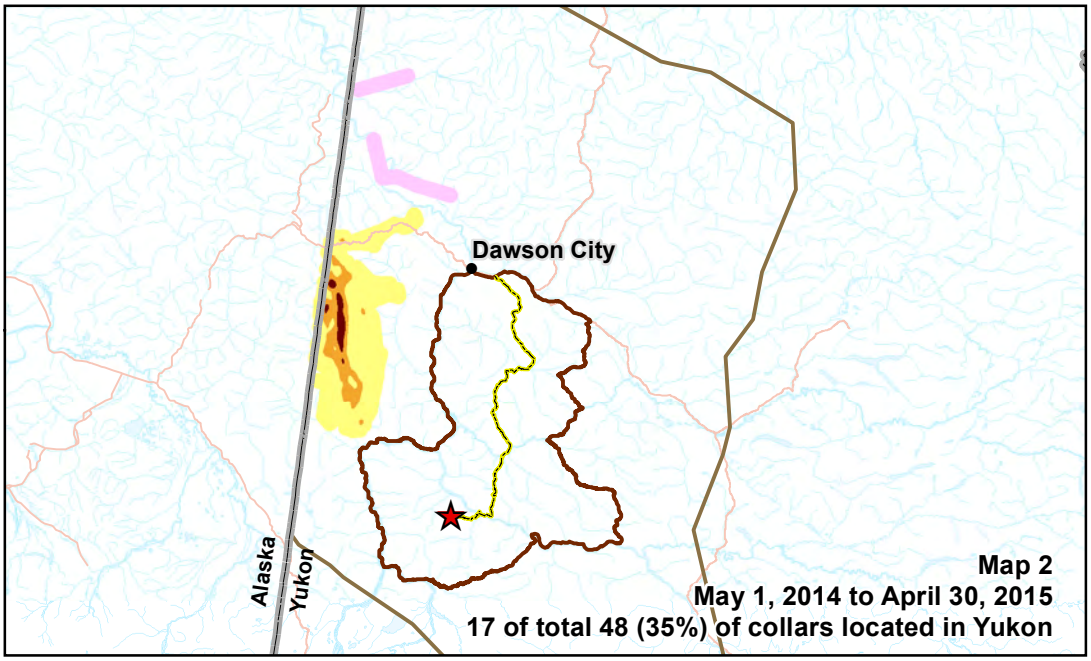

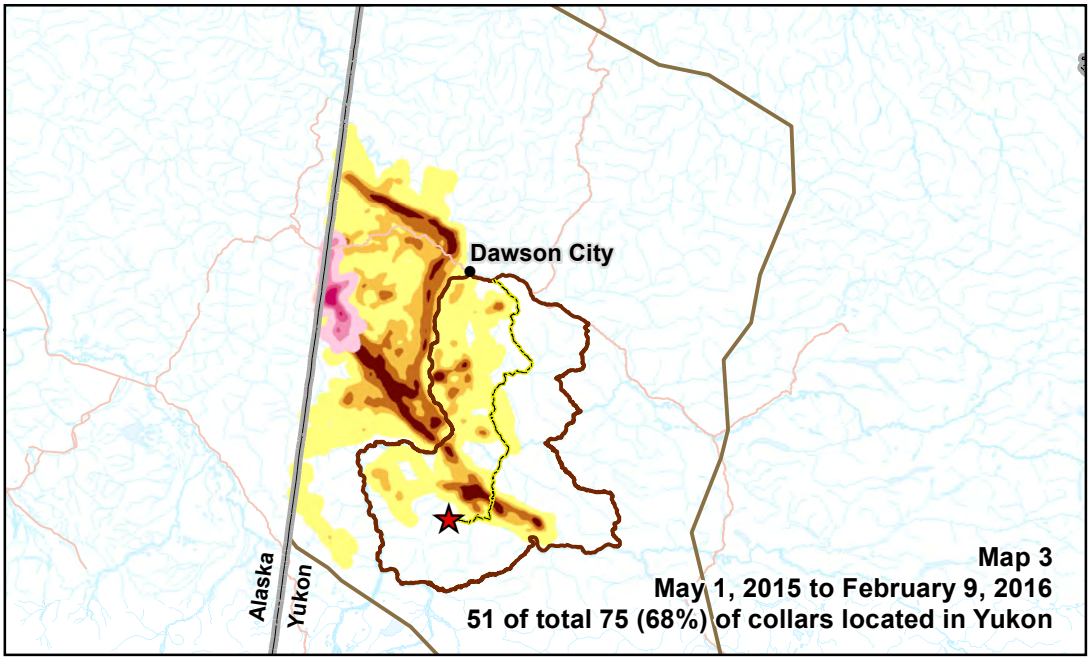

Legend

- Coffee Project
- Proposed Route
- Yukon/Alaska Border
- Fortymile Caribou Study Area
- Regional Study Area

Density of long-distance caribou movements (path segments/km^2)

May 1 – September 30	October 1 – April 30
<1	<1
1 - 2	1 - 2
2 - 3.5	2 - 3.5
>3.5	>3.5

FIGURE: 2-9

Long-distance movements of Fortymile caribou in Yukon

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Collar data provided by Environment Yukon - Yukon Government, Alaska Department of Fish and Game, and Alaska Bureau of Land Management.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

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0 25 50 75 100 125 150
KM

Map Reference Scale: 1:0 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 CSRS Yukon Albers

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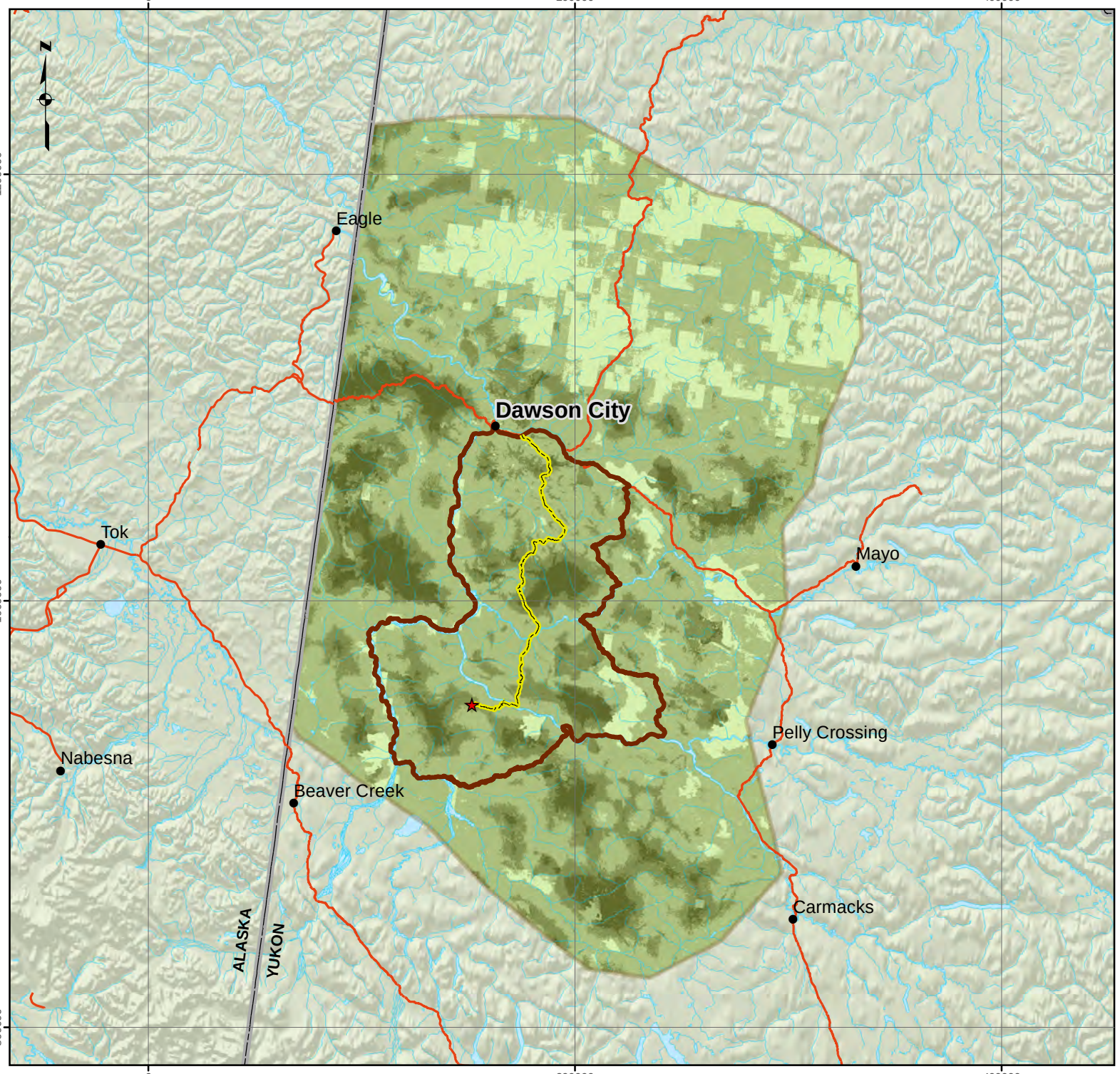

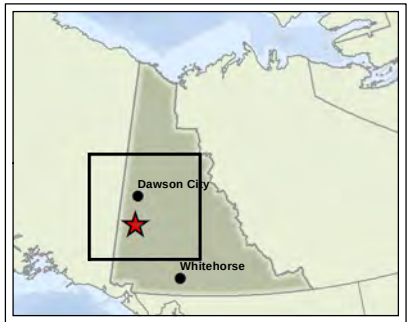

Legend

- Coffee Project
- Proposed Route
- Yukon/Alaska Border
- Regional Study Area
- Fortymile Caribou Study Area

Fortymile Caribou Herd Habitat Suitability (Early Winter)

- Very Low
- Low
- Moderate
- High

FIGURE: 2-10

Early winter habitat suitability for the Fortymile caribou herd

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Resource Selection Function Probability Model provided by Tyler Muhly in conjunction with EDI Environmental Dynamics Inc. (2016).

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KM

Map Reference Scale: 1:3,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 CSRS Yukon Albers

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2.1.2 OTHER CARIBOU HERDS

2.1.2.1 Klaza Caribou Herd

The Klaza caribou herd (Klaza) is part of the northern mountain population of woodland caribou. The first documentation of the Klaza caribou herd was by Hoefs and Lortie (1975) who conducted a large mammal inventory within Game Management Zone 5. Increased interest in mineral exploration in the Dawson Range, and the start of construction of the Freegold Road in the mid-1980s precipitated the first detailed herd study from 1987 to 1991. Based on this work, the first inventory of the Klaza herd in 1989 estimated a total of 441 caribou (Farnell *et al.* 1991). In 2000, a fall composition survey documented 651 caribou (Hegel 2013). Following the mineral exploration "rush" in 2010, Yukon Government prioritized an update to the information available on herd demographics and completed a detailed habitat use study. The most recent population study for the Klaza herd was in 2012, resulting in an estimated 1,179 caribou (95% CI=952–1461; Hegel 2013).

The Klaza caribou herd annual range is located in the Dawson Range in central Yukon and overlaps the southern portion of the Project RSA, south of the Yukon River (Figure 2-11). Throughout their range, Klaza caribou are typically concentrated in higher elevation habitats including Klaza, Apex, Prospector, and Nansen mountains (Hegel and O'Donoghue 2015). The herd occupies primarily high elevation habitats near and above treeline within its range, making seasonal altitudinal changes in habitat use.

During the calving season, individuals are dispersed throughout their range. Cows usually give birth alone or in small groups to reduce predation risk as predators are less likely to detect isolated or small groups of caribou. In the summer, caribou typically use higher elevation habitat to escape insects and reduce predation risk (Farnell *et al.* 1991). Klaza caribou remain in higher elevation habitat through the fall until snow accumulation and condition reduces access to winter forage. Caribou move to lower elevations during winter where ground lichens are more abundant and available. Late winter is the most limiting seasonal habitat for woodland caribou (Environment Canada 2008). Given the importance of winter habitat, Hegel and O'Donoghue (2015) modeled late winter habitat selection by Klaza caribou. The Klaza winter range is located entirely outside the RSA and does not interact with the Project (Figure 2-11).

Klaza caribou have been occasionally observed within the RSA since the initiation of exploration activities on the Coffee Property in 2010 (Table 2-6). Project observations of suspected Klaza caribou were limited to the spring, summer, and early fall months and were typically single caribou or small groups of caribou, as would be expected on the periphery of the range. Based on observations to date, the Project is expected to interact with the Klaza caribou herd during the spring, summer, and/or fall months but caribou are not expected to be found near the Project in any considerable numbers.

Predation is the primary source of mortality for the Klaza caribou herd. Harvest is strictly managed through a lottery permit hunt. Fewer than ten caribou are harvested from the Klaza caribou herd annually (EDI 2014).

Table 2-7. Project observations of suspected Klaza caribou in the Project RSA

Date	Number of Caribou	Description	Location	Source[1]
8 Sept 2010	2	Female caribou with calf seen near the south Kona zone	Near Kona deposit	Camp wildlife log
20 Sept 2010	17	Group of 17 caribou near the "B52 Saddle"	Headwaters of Halfway Creek; between Latte and Kona deposits	Camp wildlife log
11 Sept 2011	5	Group of caribou resting on west side of Supremo hill — 3 adults, possibly 2 sub-adults.	Near Supremo deposit	Camp wildlife log
Late summer 2012	Unknown	Helicopter pilot reported that he saw caribou in small groups on the ridges during the later summer of 2012, when flying for exploration purposes.	Coffee Property	Access 2014
4 Aug 2013	1	Caribou at km 13 on Java Road. Possibly a yearling.	Km 13 on Java Road[2]	Camp wildlife log
18 May 2014	1	Caribou at km 9.5 on Java Road. Possibly a yearling.	Km 9.5 on Java Road[2]	Camp wildlife log
22-24 June 2014	12	Group of 4 bulls, 6 cows and 2 calves observed in alpine area along alternate road alignment between Coffee and Casino	In southeast section of Coffee Property (approximately 20 km southeast of proposed mine site)	Incidental observation: breeding bird surveys
28 July 2014	2	2 adult male caribou between km 9 and km 12 on Java Road.	Km 9 and km 12 on Java Road[2]	Camp wildlife log
7 July 2015	2	2 caribou crossed the road near exploration laydown area.	Laydown area near Supremo deposit	Camp wildlife log
8 July 2015	1	Caribou at km 17 on Java Road	Km 17 on Java Road[2]	Camp wildlife log
20 July 2015	1	Caribou along road between Latte and Supremo	Road between Latte and Supremo deposits	Camp wildlife log
11 Aug 2015	1	1 male caribou along Java Road at km 16.5.	Km 16.5 on Java Road[2]	Camp wildlife log
13 Aug 2015	1	1 male caribou along Java Road at km 17.4	Km 17.4 on Java Road[2]	Camp wildlife log
12 May 2016	1	Caribou observed along Java Road at km 16	Km 16 on Java Road[2]	Camp wildlife log
13 May 2016	1	Caribou observed along Java Road at km 17, possibly a yearling.	Km 17 on Java Road[2]	Camp wildlife log
8 June 2016	1	Caribou at Latte deposit	Near Latte deposit	Camp wildlife log
18 June 2016	3	Caribou observed along Java Road at km 17.9	Km 17.9 on Java Road[2]	Camp wildlife log
6 July 2016	1	Caribou observed along Java Road at km 13.5.	Km 13.5 on Java Road[2]	Camp wildlife log
19 July 2016	1	Caribou observed along Java Road at km 12.	Km 12 on Java Road[2]	Camp wildlife log
28 July 2016	1	Caribou at Supremo Hill	Near Supremo deposit	Camp wildlife log

Date	Number of Caribou	Description	Location	Source[1]
7 Aug 2016	2	Caribou observed near core farm gravel pit.	Coffee Property – near exploration airstrip	Camp wildlife log
28 Aug 2016	15	Caribou at Kona deposit.	Near Kona deposit.	Camp wildlife log
27 Sept 2016	2	Caribou seen at WB15-05	Headwaters of Latte Creek, south of proposed Heap Leach Facility	Camp wildlife log

[1] At the time of reporting, camp wildlife log for 2012 was not available.

[2] Java Road refers to the access road between the Yukon River barge landing and the Supremo and Latte deposit areas.

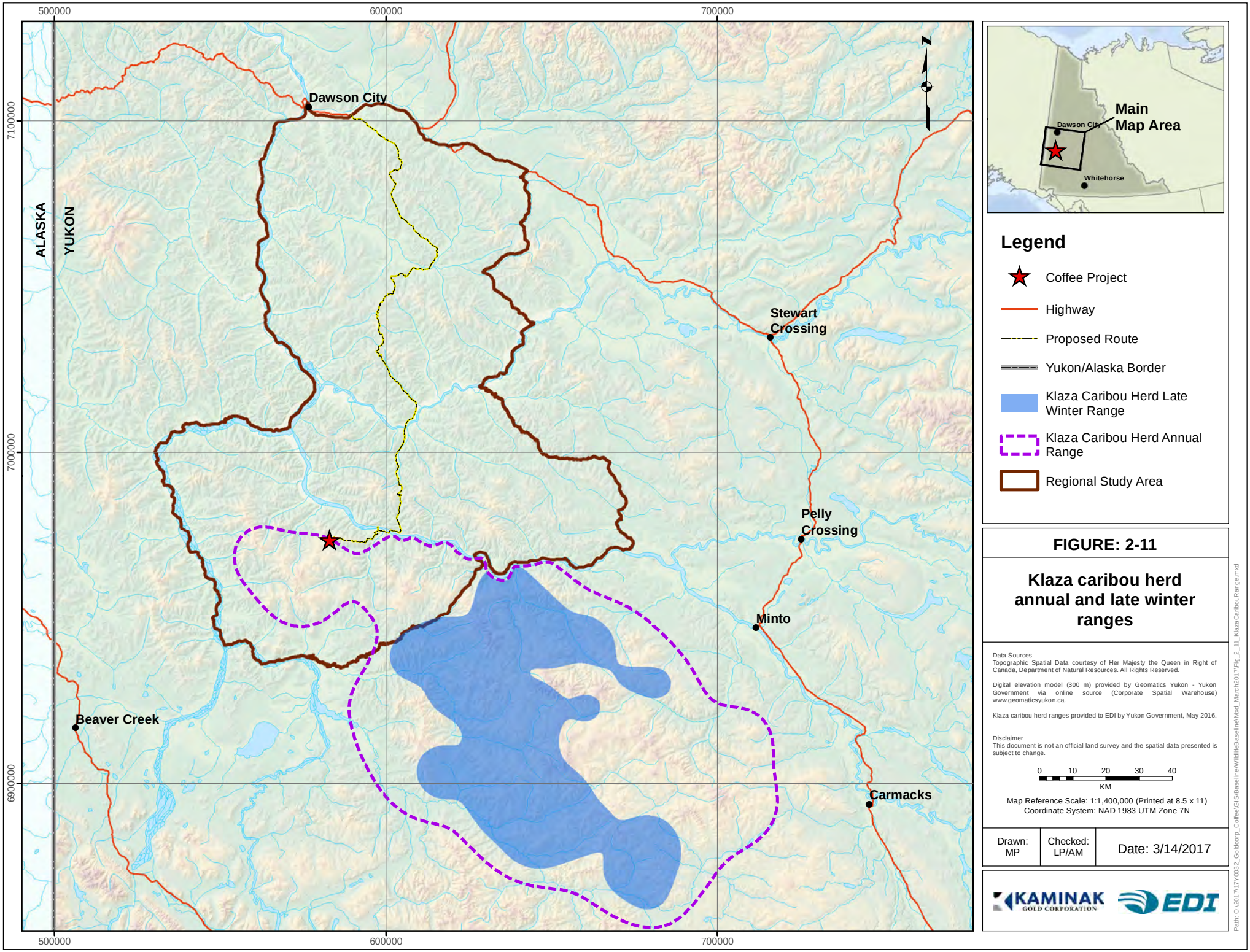

FIGURE: 2-11

Klaza caribou herd annual and late winter ranges

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital elevation model (300 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Klaza caribou herd ranges provided to EDI by Yukon Government, May 2016.

Disclaimer
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0 10 20 30 40
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Map Reference Scale: 1:1,400,000 (Printed at 8.5 x 11)
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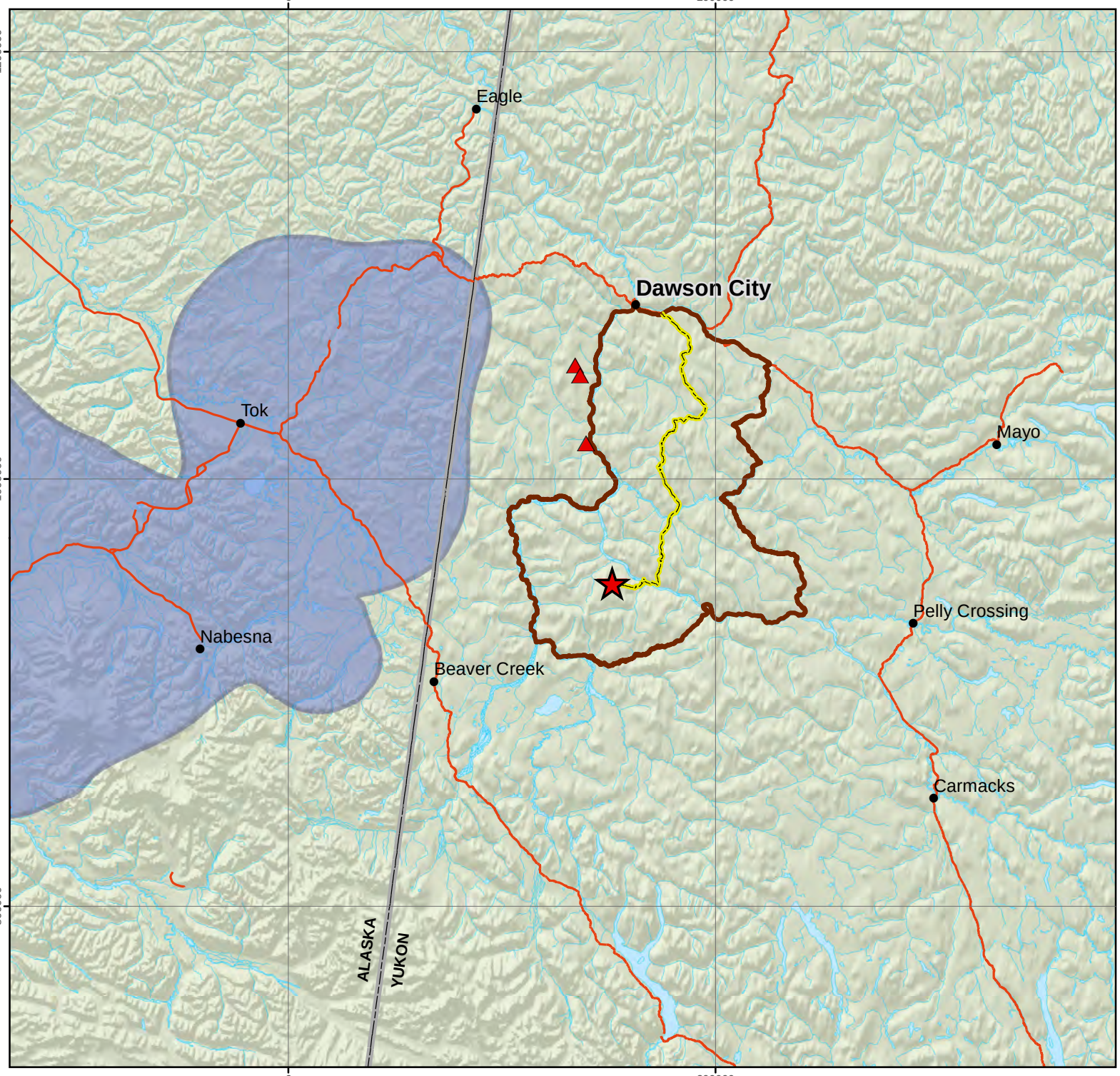
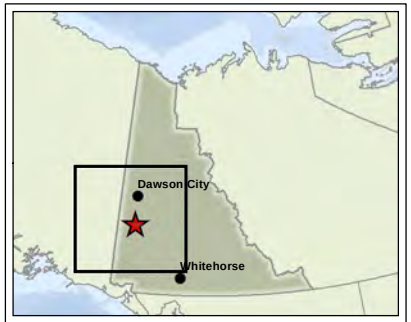
2.1.2.2 Nelchina Caribou Herd

The Nelchina caribou herd is a relatively large barren-ground herd in the interior of Alaska. Similar to the Fortymile caribou herd, Nelchina caribou calve in the western portion of their range and disperse east toward the Alaska-Yukon border during winter. Also similar to the Fortymile, the Nelchina caribou herd has undergone considerable changes in population size over the last decade. The last population low occurred in the early 1970s, when the herd dropped to <10,000 animals (Van Ballenberghe 1985 *in* Eberhardt and Pitcher 1992). Since then, the herd has increased and as of 2011, was estimated at 46,500 caribou (Alaska Department of Fish & Game 2016). During population lows, the area occupied by the Nelchina herd contracted towards their calving area (Hemming 1975). As the herd grew in the 1980s, it expanded its winter range to the Tanana Uplands near the Yukon-Alaska border (Roffler *et al.* 2012). The use of the winter range near the Alaska-Yukon border is a relatively new change in winter distribution. Prior to the early 1990s the Nelchina herd's winter range was the Nelchina River basin south of the Alaska Range of mountains and north of Valdez, Alaska. Recently, part of the Nelchina herd occupied winter range in an area northeast of Tok, Alaska and adjacent to the Taylor Highway and the Alaska-Yukon border. There is some evidence that the shift was due to a change in lichen biomass from overgrazing and forest fires within the historic winter range (Collins *et al.* 2011).

The Nelchina caribou herd occupies winter range in an area west of the RSA, primarily in Alaska (Collins *et al.* 2011, Joly *et al.* 2003). A portion of the herd winters near the Yukon-Alaska border and some collared caribou have spent a part of the winter in Yukon, though not in significant numbers (Schwanke 2011). Available collar data shows that three Nelchina very high frequency (VHF) collar locations were documented on the northwestern border of the RSA (Figure 2-12). The Fortymile and Nelchina herds can mix during the fall and winter (Roffler *et al.* 2012). Males tend to show greater overlap with other herds and do not exhibit as much range fidelity as females (Roffler *et al.* 2012); however, the sex of the Nelchina caribou near the RSA is unknown. Based on the collar data and discussions with Environment Yukon (M. Suitor, pers. comm., 2014-2016), a small number of caribou from the Nelchina herd may enter the RSA during winters, although the RSA is outside of the current mapped herd range and the number of caribou and time spent in the RSA is likely to be very low. Winter habitat use by Nelchina caribou is expected to be similar to habitat use by the Fortymile caribou herd (T. Hegel and M. Suitor, pers. comm., 2015) and driven by the selection for high lichen abundance and avoidance of recently burned areas (Joly *et al.* 2003; Collins *et al.* 2011).





Legend

- Coffee Project
- Nelchina Caribou Locations (2015)
- Proposed Route
- Yukon/Alaska Border
- Regional Study Area
- Nelchina Caribou Herd Range (partially shown)

FIGURE: 2-12

Nelchina caribou herd range and VHF collared caribou locations (2015)

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Collar data provided by Environment Yukon - Yukon Government, Alaska Department of Fish and Game, and Alaska Bureau of Land Management.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

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2.2 MOOSE

Moose are a large herbivore and the largest member of the deer family. Moose are widespread across Canada, occurring in every province and territory with the exception of Prince Edward Island. Due to their large global range and population, and their apparent global population growth, moose have been assessed as Least Concern by the International Union for the Conservation of Nature (IUCN; Geist *et al.* 2008). Moose have not been assessed by COSEWIC but are widespread across Canada and are not a conservation concern in the broader Canadian context. Moose are considered Secure in Yukon (CESCC 2011).

Yukon is uniquely situated as a transition zone between two subspecies of moose: Alaska moose (*Alces alces gigas*) and western moose (*Alces alces andersoni*). These two subspecies formed as a result of geographical separation during the last glacial maximum. Alaska moose persisted in the Beringian refugia while western moose persisted south of the Laurentide and Cordilleran ice sheets. Currently, ranges of both subspecies have expanded, with a region of hybridization occurring in the central Yukon (Hundertmark *et al.* 2003).

2.2.1 POPULATION

The total Yukon moose population is approximately 70,000. This population estimate is based on ongoing aerial surveys conducted by Environment Yukon to support moose management in the territory (Government of Yukon 2016c). The moose population within the RSA, particularly the region north of the Stewart River in Game Management Zone 3, has been well studied. Recent early winter census surveys in 2012 and 2015 provide up to date population and density estimates for nearly all of the RSA. Overall, moose densities in the RSA are close to the Yukon average, which generally ranges between 150 to 249 moose/1000 km^2 (Yukon Fish and Wildlife Management Board 1996), with some of the northern regions possibly higher than average. According to the Dawson Planning Region Resource Assessment Report, the area "supports a stable moose population at relatively high densities" (Dawson Regional Planning Commission 2013).

In the southern half of the RSA, an early winter moose census was conducted in November 2012 for the Lower Stewart White Gold region. GMSs surveyed included the entirety of GMS 313, 314, 502, 503, and 509. The total survey area was about 6,751 km^2. Based on survey results an estimated 1,147 moose (90% CI of 960-1,333) are expected in the survey area, at a density of 170 moose per 1,000 km^2 (O'Donoghue *et al.* 2013a). The 2012 census data indicates that calf survival was fairly low, while yearling and bull ratios were healthy (Table 2-8).

The northern regions of the RSA were most recently surveyed in the 2015 Dawson Goldfields moose census. This survey included the entirety of GMS 307, 308, 310, 311 and 312. Based on survey results, an estimated 1,639 moose (90% CI of 1,501-1,801) are expected in the survey area, at a density of 277 moose/1000 km^2 (report pending, preliminary survey results provided by M. Suitor). Following the completion of the 2015 Dawson Goldfields survey, Kaminak, in collaboration with Environment Yukon, extended the survey to include the area along the proposed NAR between the Yukon and Stewart rivers (including portions of GMS 313 and 314). Based on the combined survey results, Environment Yukon

developed a population estimate for the NAR, including the area within a 10 km buffer of the proposed alignment from the junction with the Klondike Highway to the Yukon River, an aerial extent of 3,298 km². An estimated 814 moose (90% CI of 723-917) are expected to occur within this area at a density of 247 moose/1,000 km².

Table 2-8. Survey estimates from the 2012 early winter moose census (O'Donoghue *et al.* 2013a).

	Number of calves per 100 adult cows	Yearling and bull ratio per 100 adults	Yearling and bull ratio per 100 cows
Survey Results	21	12	64
YFWMB Recommendations (1996)	25	8-15	30

2.2.2 DISTRIBUTION

Moose are distributed across the territory in all boreal forest regions, but are more densely populated in southern Yukon (Government of Yukon 2016c). Moose tend to have a clumped distribution, selecting habitats based on the availability of forage, distance to cover, ease of travel, and avoidance of predators (Hamilton *et al.* 1980; Dussault *et al.* 2005). They prefer mosaic forest communities with some combination of mature forest for cover and shrub or wetland areas for forage (Geist *et al.* 2008). In Yukon, moose are often found in riparian areas, wetlands, regenerating burns, and near treeline in subalpine shrub habitat with abundant willows (Tr'ondëk Hwëch'in 2012b; Government of Yukon 2016c).

In west-central Yukon, moose often show seasonal elevation migration patterns, although some moose likely have small home-ranges that are inhabited year round (Hundertmark 1997; Dawson Regional Planning Commission 2013). In the spring and summer, moose can be found in a wide variety of habitats ranging from subalpine to valley bottom. Wetlands and aquatic habitats can be important feeding areas for moose at this time of year (Government of Yukon 2016c).

In the late fall and early winter months, moose tend to congregate in the extensive shrub communities of the subalpine. Early winter census surveys in the Lower Stewart White Gold area found that moose were widely distributed in a variety of habitats but were more likely to be seen in subalpine willow flats and creek draws compared to forested areas, burned areas, and lower elevation slopes (O'Donoghue *et al.* 2013a). Based on the results of the early winter moose surveys, high densities of moose can be expected in several higher elevation areas of the RSA during the early winter; those with the potential to interact with the proposed NAR include the King Solomon Dome area, and the Henderson Dome area. Figure 2-13 shows the early winter moose densities along the NAR based on the 2015 early winter surveys. Based on the 2012 early winter moose survey in the southern sections of the RSA (O'Donoghue *et al.* 2013a), high densities of moose are not expected in the mine site area during the early winter.

When snow loads are low, moose may stay in the high elevation early winter habitats year round; however with deeper snow, moose are forced down into lower elevation areas during the late winter (Government of Yukon 2016c). In parts of Yukon, late winter moose habitat is limited to low elevation areas along stream and river valleys; key winter ranges for moose are generally low elevation forested valleys where tree canopy

cover intercepts snow, resulting in shallower snow conditions, lower energy costs, greater forage availability, and cover from predators (Government of Yukon 2016c). However, within the RSA, late winter ungulate surveys have indicated that snow depths may not be as restrictive as in other parts of Yukon, and that during the late-winter season moose may be distributed over a wider range of elevations as compared to other areas (O'Donoghue *et al.* 2013b; EDI 2017a, 2016b). Late winter aerial surveys have documented moose throughout the RSA (O'Donoghue *et al.* 2013b; EDI 2017a). Based on the results of the Project late winter ungulate surveys (2014–2016), several parts of the survey extent show higher concentrations of moose during the late winter including the southwestern sections of the RSA along the White River, the upper sections of the Henderson Creek and Black Hills Creek drainages, and just north of the Indian River (Figure 2-14). Moose in the RSA were frequently observed on higher elevation slopes (i.e. upper boreal high and subalpine) than would be expected in regions with more snowfall.

2.2.3 HABITAT USE AND DIET

Moose use a wide range of habitats throughout the RSA, selecting for several habitat variables at varying spatial and temporal scales. Moose are herbivorous, feeding on a variety of woody shrubs, leaves, and aquatic plants (Government of Yukon 2016c). Mineral licks play an important role in moose diet as a source of sodium (Tankersley and Gasaway 1983). Throughout the snow-free portion of the year, habitat availability is likely not a limiting factor for moose in the RSA.

Moose habitat is most limited during the late winter periods when primary productivity is lowest, energetic demands are highest, and snow conditions reduce habitat availability by increasing the energetic costs of travel. Moose late winter habitat selection involves trade-offs between predator avoidance, snow depth, and forage availability (Dussault *et al.* 2005). While predation often occurs in the spring and summer, winter predation by wolves remains a source of mortality (Hayes *et al.* 2003) and moose avoid habitat types that increase the likelihood of detection by wolves (Dussault *et al.* 2005). Taller and denser vegetation types provide more shelter from predators and reduced snow cover, while more open areas have a greater abundance of willow shrub, the preferred winter food source of moose (Risenhoover 1989).

Moose were commonly observed browsing on willows during the late winter Coffee Project baseline surveys. Willow is an early successional species and is most abundant in open and disturbed areas such as subalpine treeline, stream riparian, placer mines, exploration camps, and burns between 10 and 30 years old (Maier *et al.* 2005). Moose are likely to use habitat characterized by a mosaic of forest and shrub areas as these areas provide both shelter and forage. With the exception of high elevation areas, snow depth is unlikely to limit moose movement during winter as much of the RSA often receives less than 70 cm of snow, recognized as a limiting depth for habitat use by moose (Peek 1997). The February 2016 snow tracking survey along the NAR found an average snow depth of 45 cm within the survey extent (range 14–96 cm; EDI 2017a).

Two important factors influencing the availability of moose habitat in the RSA are forest fires and human disturbance. Fire is the driving factor in central Yukon forest succession. Areas burned 10 to 30 years ago provide excellent moose habitat due to their early successional state with an abundance of woody shrubs for

browse (Maier *et al.* 2005). Recently burned areas and areas that have not been burned in over 40 years provide lower forage availability.

Other disturbed areas such as roads, trails, and placer disturbed creeks and valleys, can also provide high quality moose browse. Disturbances create an opening in the forest canopy and clear ground, leaving prime conditions for early successional species such as willow to establish. Willows thrive along the edges and within disturbed areas creating excellent foraging opportunities for moose. Roads and trails also provide movement corridors allowing for rapid and efficient movement between habitat areas.

To determine the availability and suitability of late winter habitat in the RSA, a Habitat Suitability Index (HSI) model was developed (EDI 2016a). The HSI model used land cover, fire history, and digital elevation model data to estimate habitat suitability based on knowledge of moose from studies in other areas. The HSI model was validated with late winter survey data from 2008 (Environment Yukon 2010), 2012 (O'Donoghue *et al.* 2013b), 2014, and 2015 (EDI 2017a), and showed good agreement in most of the RSA. The model indicates that the RSA contains abundant high quality late winter moose habitat (Table 2-9). High quality late winter habitat is also widely distributed within the RSA (Figure 2-15). A particularly large patch of late winter habitat occurs between the White and Yukon rivers in the southwest portion of the RSA. This modelled area repeatedly had high concentrations of moose during late winter aerial surveys. Another large patch of modelled suitable late-winter habitat occurs in the Indian River drainage; however, there were few observations of moose in this area. Few observations in the modelled high-value habitat is likely because the area was burned in 2004 and surveyed in late winter 2008, only three growing seasons later. Current conditions, 12 years since the burn, are expected to offer much higher suitability and use by moose due to forage development over the intervening period.

Table 2-9. Availability of late winter moose habitat within the RSA.

Habitat class	Area (km²)	% RSA	Moose Observations	Selection Index
High	3,585	26.2%	607 (55.1%)	+1.10
Moderate	2,245	17.4%	192 (17.4%)	+0.05
Low	1,964	14.4%	132 (12.0%)	-0.17
Very Low	5,867	42.9%	171 (15.5%)	-0.64

2.2.4 HARVEST AND MORTALITY

Moose are the primary harvest species within the RSA and are a highly valued species for both First Nations people and licensed hunters. The Coffee Creek area has been traditionally used by local First Nations and families would return to the area each fall to harvest moose (Tr'ondëk Hwëch'in 2012a).

Much of the RSA, particularly the Dawson Goldfields region, is very accessible to hunters due to an abundance of roads and trails. These areas experience relatively high levels of harvest pressure. Licensed harvest in Yukon is managed by Environment Yukon. Environment Yukon's moose management guidelines allow for Annual Allowable Harvest rates of 2 to 5%, with rates of 3 to 4% for relatively stable, average

density populations (Yukon Renewable Resources 1996). Harvest data from licenced hunter kill reports is collected and compared to GMS population estimates to ensure that harvest rates are sustainable.

All GMSs in the RSA are open to licenced hunters for bull moose with an annual bag limit of one. Harvest records were provided by Environment Yukon from the previous ten years of moose harvest data (2006–2015) and reported by GMS (Table 2-10; Government of Yukon 2016a). Between 2006 and 2015, 480 moose were harvested by licensed hunters within the RSA. Mean annual harvest rates vary by subzone, from 1.4 moose/year to 8.2 moose/year (Government of Yukon 2016a). In general, harvest numbers appear related to accessibility of areas with the higher harvest generally occurring closer to Dawson and in areas accessible from existing Dawson Goldfields access roads (GMS 307, 308, 310-312). Relatively high harvest also occurred in GMSs accessible from the Yukon River and remote placer access roads (GMS 502, 313 and 314). The remaining GMSs (315, 503 and 509) had relatively low harvest numbers, likely due to their relative inaccessibility to hunters. Subsistence harvest by First Nations is assumed to be at similar levels to licenced harvest (N. Ayoub pers. comm., 2016).

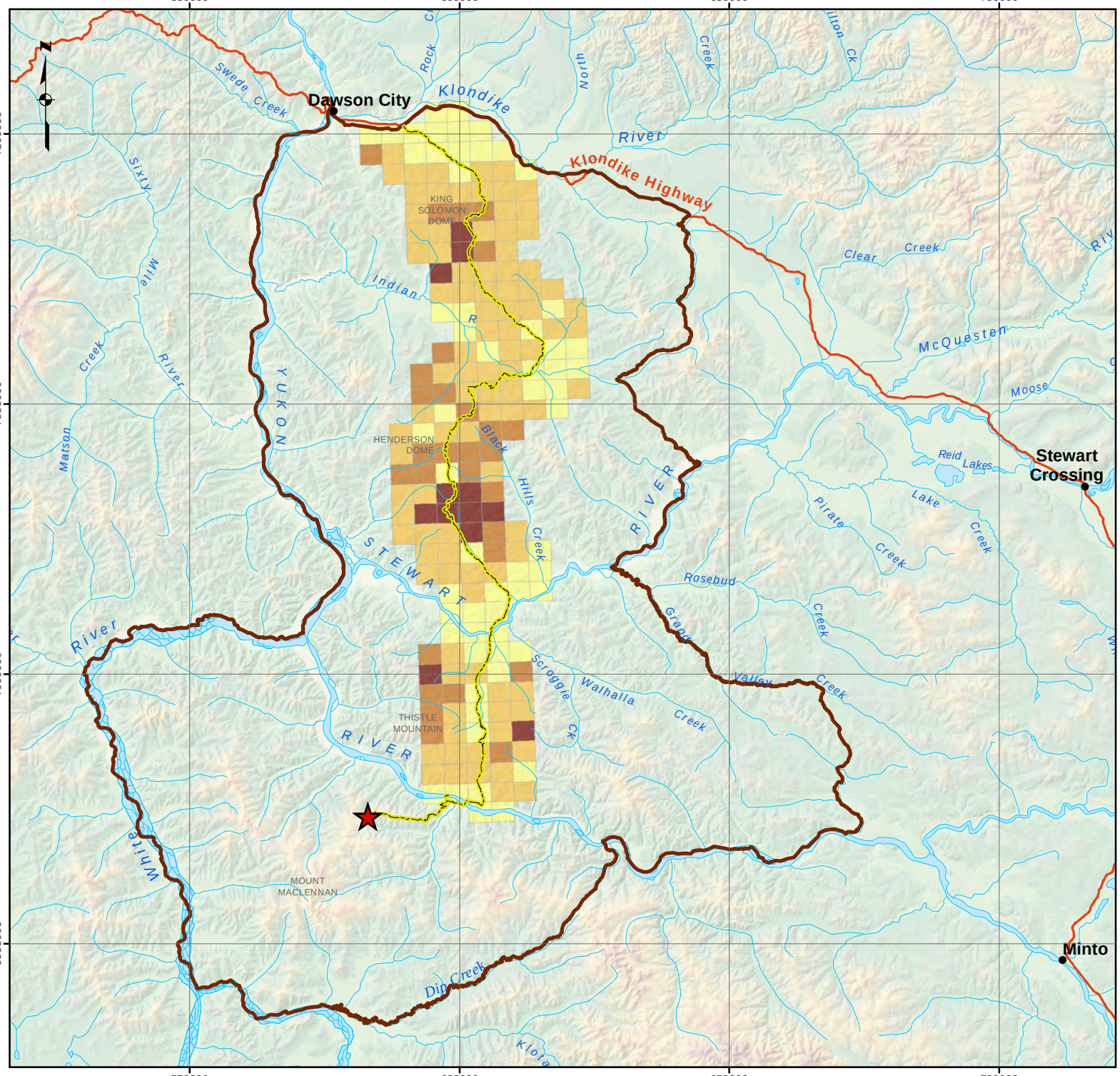
A cumulative effects assessment for wildlife in the White Gold area states that new access into previously inaccessible areas could result in increased moose harvest (EDI 2013). This assessment modelled total moose harvest, road/trail density, and length of major rivers within each GMS to look at the relationship between human access and harvest. The study found that the number of moose harvested in a GMS is independent of moose density and river access, but moose harvest increased by 3.12 moose for every additional 1 km of road/trail per 1 km^2, indicating that there is a positive correlation between density of roads/trails and number of moose harvested.

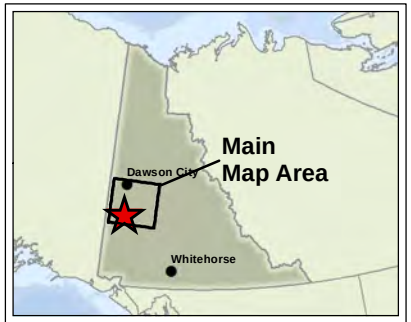
With a total mean annual harvest of 48 moose (Government of Yukon 2016a), between 5 and 10% of the total Yukon annual moose harvest occurs within the RSA. The Dawson Goldfield GMSs in particular are some of the most intensely harvested areas of Yukon as a result of having above average moose density (Cooley *et al.* 2012) and above average access. Non-harvest moose mortality also occurs occasionally within the RSA. Between 2006 and 2015 a total of 20 moose were killed as a result of non-harvest activities such as vehicle collisions (Government of Yukon 2016a). Non-harvest moose mortality occurs more frequently in regions with higher human activity levels. Out of 20 non-harvest mortalities reported, 18 occurred in GMSs 307 and 308; the two GMSs within the RSA that border the Klondike Highway.

Predation, particularly of moose calves, by grizzly bears, black bears, and wolves, is likely one of the leading causes of moose mortality (Larsen *et al.* 1989). Studies from southeast Yukon found that grizzly bears and wolves accounted for 50% and 26% of all moose mortalities, respectively (Larsen *et al.* 1989). Many cows give birth to calves in the subalpine zone in May and June to provide abundant browse at that time of year. Grizzly bears spend much of the spring in the subalpine zone and may kill as many as 50% of each year's moose calves (Government of Yukon 2016b). In eastern interior Alaska, Bertram and Vivion (2002a) found that predation was responsible for 92% of calf mortality, driving a very low overall calf survival rate of 20% and limiting population growth in the area. Predation levels in the RSA are unknown but it is likely that predation limits moose populations.

Table 2-10. Moose harvest statistics from 2006 to 2015 in the game management subzones that interact with the RSA (Government of Yukon 2016a).

GMS	Harvest Regulations (2015-2016 season)	Total Harvest	Mean Annual Harvest
307	Open; Bag limit 1	72	7.2
308	Open; Bag limit 1	51	5.1
310	Open; Bag limit 1	53	5.3
311	Open; Bag limit 1	44	4.4
312	Open; Bag limit 1	65	6.5
313	Open; Bag limit 1	82	8.2
314	Open; Bag limit 1	31	3.1
315	Open; Bag limit 1	16	1.6
502	Open; Bag limit 1	37	3.7
503	Open; Bag limit 1	15	1.5
509	Open; Bag limit 1	14	1.4
Total		**480**	**48**





Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area

Early Winter Moose Density

- Low
- Moderate
- Moderate/High
- High

FIGURE: 2-13

Early winter moose density estimate

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Project data displayed is site specific. Survey data collected by EDI Environmental Dynamics Inc. (2014-2016).

Disclaimer
This document is not an official land survey and the spatial data presented is subject to change.

0 10 20 30 40
KM

Map Reference Scale: 1:1,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

Drawn: MP	Checked: AM/LP	Date: 3/10/2017

KAMINAK GOLD CORPORATION EDI

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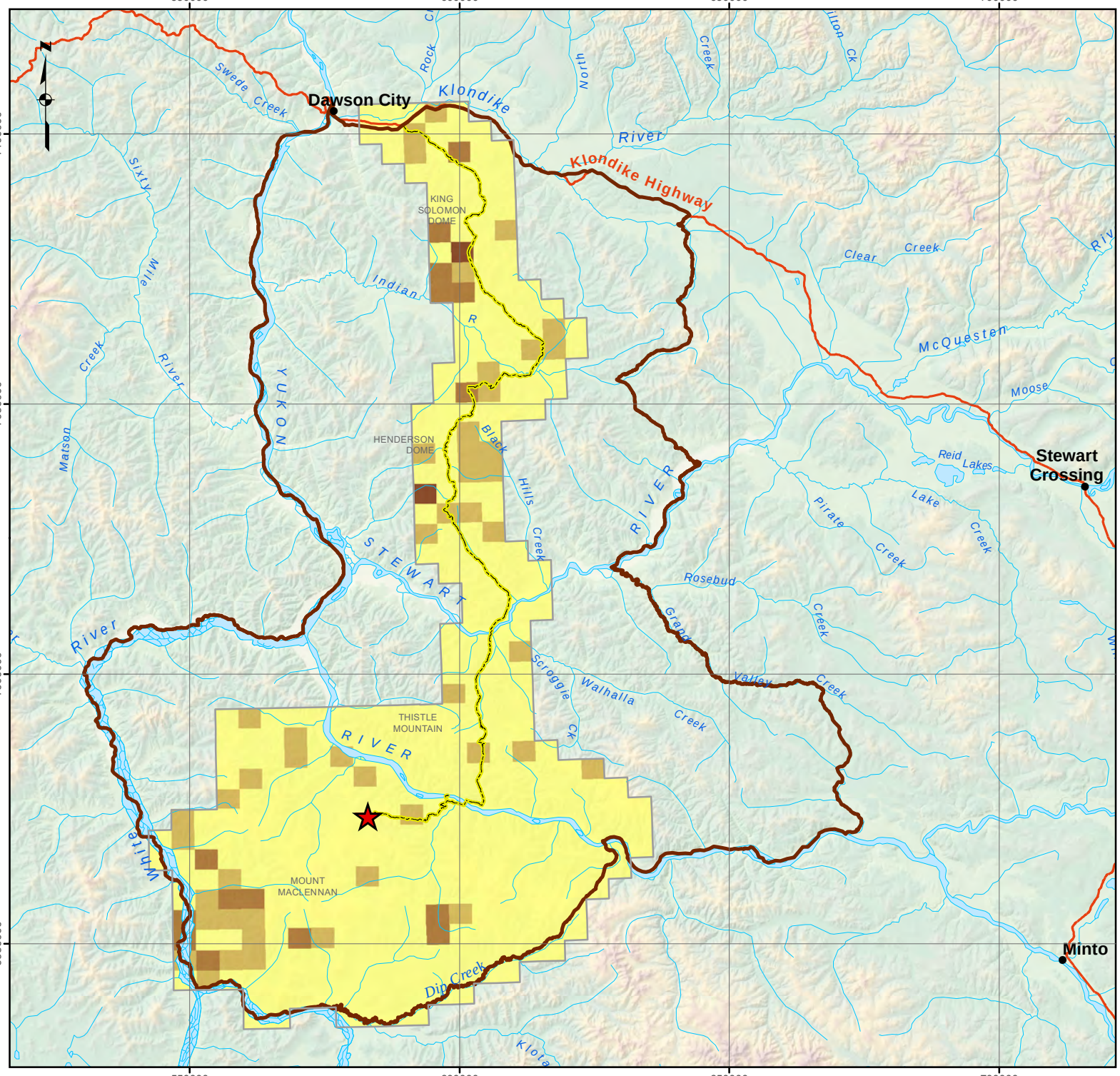

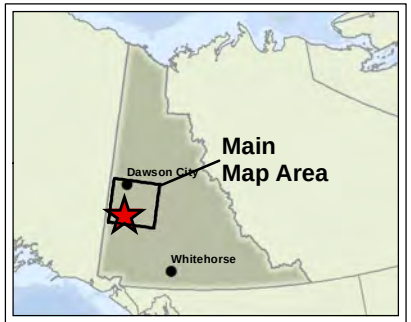

Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area
- Survey Extent

NewDensity

- 0 – 1 Moose
- >1 – 3 Moose
- >3 – 5 Moose
- >5 Moose

FIGURE: 2-14

Late winter moose density estimate

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Project data displayed is site specific. Survey data collected by EDI Environmental Dynamics Inc. (2014-2016).

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Map Reference Scale: 1:1,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

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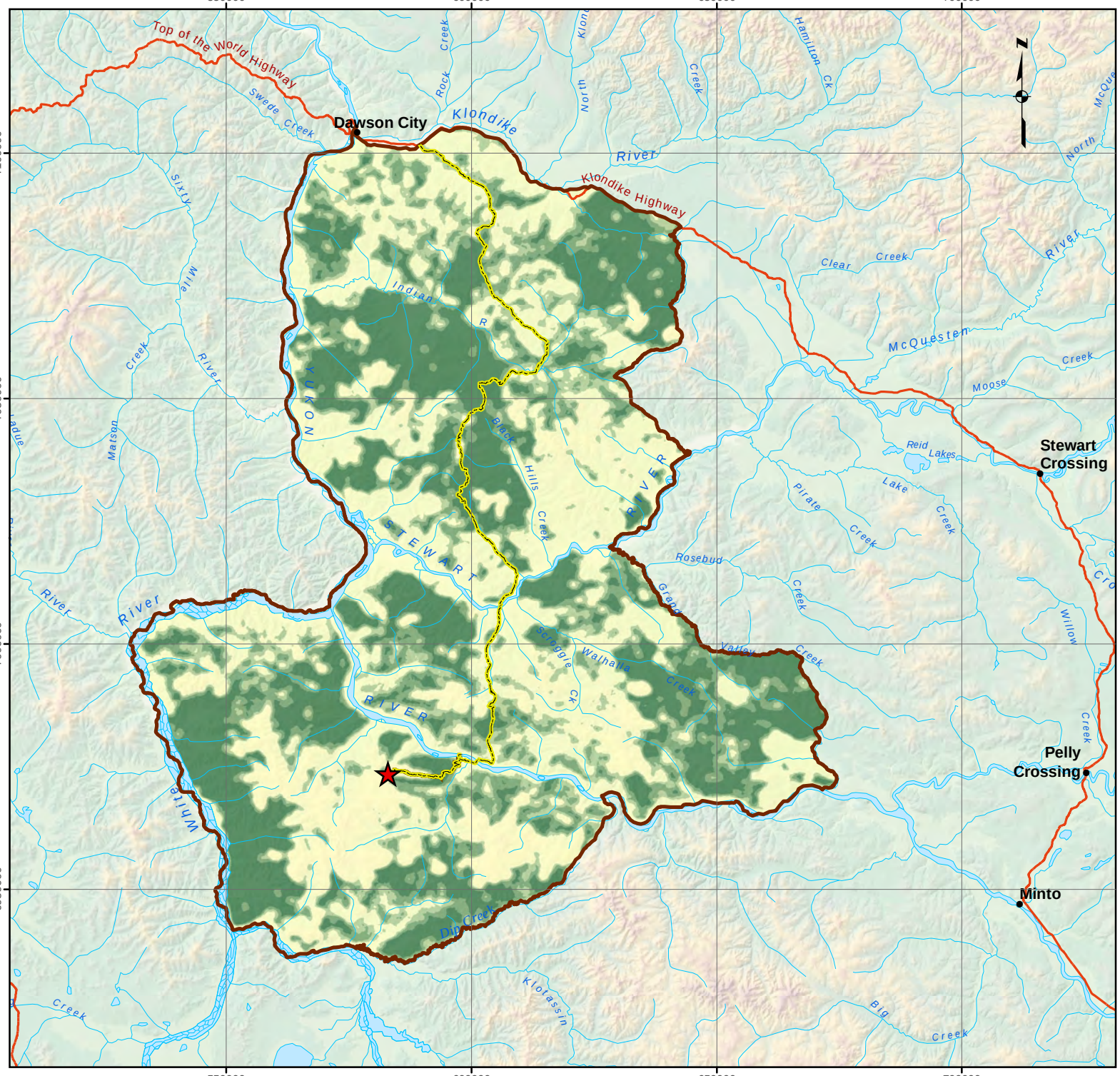

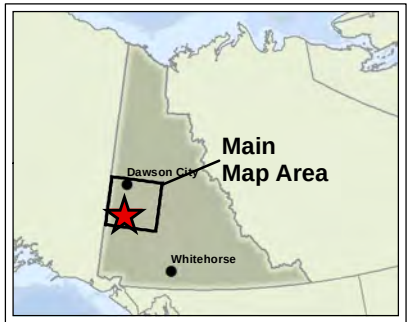

Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area

Moose Late Winter Habitat Suitability

- 0 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1

FIGURE: 2-15

Late-winter habitat suitability for moose

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Moose late winter suitability model produced by EDI (2016).

Project data displayed is site specific. Habitat suitability model created by EDI Environmental Dynamics Inc. (2016).

Disclaimer
This document is not an official land survey and the spatial data presented is subject to change.

0 10 20 30 40
KM

Map Reference Scale: 1:1,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

Drawn: MP	Checked: AM/LP	Date: 3/10/2017

KAMINAK GOLD CORPORATION EDI

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2.3 THINHORN SHEEP

Thinhorn sheep are native to northwestern North America, inhabiting portions of Yukon, British Columbia, Northwest Territories, and Alaska (Festa-Bianchet 2008). There are two subspecies, Dall's sheep (*Ovis dalli dalli*) and Stone's sheep (*Ovis dalli stonei*). A colour morph known as Fannin sheep also occurs and is thought to be the result of cross-breeding between Dall's and Stone's sheep (Worley *et al.* 2004; Government of Yukon 2015c). Dall's sheep are more abundant than Stone's sheep in Yukon and are the only subspecies that occur in the RSA. For the purposes of this baseline report, sheep using the area are referred to as thinhorn sheep.

Thinhorn sheep have not been assessed by COSEWIC but appear to have stable populations and ranges, and are designated Least Concern by the IUCN (Festa-Bianchet 2008) and Secure in Yukon (CESCC 2011).

2.3.1 POPULATION

An estimated 20,000 thinhorn sheep live in Yukon, ranging from the southern border to the North Slope (Barichello *et al.* 1989a; Government of Yukon 2015c). Within the RSA, there are records of thinhorn sheep from two general areas: Mount Maclennan, located approximately 14 km south of the proposed mine site, and the steep south-facing bluffs along the Yukon River (Figure 2-16).

The Yukon Wildlife Key Area (WKA) database has records of sheep on Mount Maclennan based on Traditional Knowledge. The area was noted as having a historic population of 12–15 sheep that 'may have been hunted out'; no sheep have been recorded there since 1990 (Government of Yukon 2016d). A survey of the Mount Maclennan area in July 2010 by Environment Yukon did not locate any sheep (Government of Yukon 2011a).

The other area of the RSA with known use by thinhorn sheep is the steep, south-facing hillslopes with rock bluff complexes, located along the north side of the Yukon River. The first official survey of this area for thinhorn sheep was in July 2010 (Government of Yukon 2011a); however there are anecdotal reports dating back to the Yukon gold rush of sheep using this area (Russell pers. comm. 2015). Local trapping concession holders also report seeing small numbers of thinhorn sheep on the cliffs above the Yukon River year-round, and observations have included both adult sheep and ewes with lambs (Interview 14, pers. comm., 2016). Several Project baseline surveys for sheep were conducted along the Yukon River corridor to augment existing data on thinhorn sheep in the RSA (EDI 2017a). A WKA for sheep has been delineated along the Yukon River bluffs west of Ballarat Creek (Government of Yukon 2016d); however, Project surveys observed sheep within a broader area both east and west of Ballarat Creek, referred to in this report as the Ballarat Creek occurrence area (Figure 2-17). A maximum of eight sheep have been observed at the Ballarat Creek occurrence area during any single survey; during Project baseline surveys, a maximum of four sheep were observed (Table 2-11).

Outside of the Project RSA, thinhorn sheep populations also occur on the steep slopes near the confluence of the White and Yukon rivers (referred to as White River occurrence area) and on the north slope of the

Yukon River between Minto and Fort Selkirk (referred to as the Minto occurrence area). Fifteen years of sheep surveys in the Minto occurrence area show a stable or slightly increasing sheep population of approximately 120 animals, and lamb to nursery sheep ratios suitable for maintaining a healthy population (Government of Yukon 2014a). Within the White River occurrence area, approximately 15–20 sheep have been present since 2003 (Government of Yukon 2011a). These populations may act as a source for immigrants into the Ballarat Creek area.

The distances between the three areas are farther than sheep normally move on an annual basis (45 km from the White River occurrence area to Ballarat and 85 km from Ballarat to the Minto occurrence area); however, individual animals or small groups have been observed making occasional dispersal movements over those distances (Geist 1971). In other parts of North America several sheep populations have been described as having metapopulation structures (Bleich et al. 1996; Epps et al. 2005; Akçakaya et al. 2007), that are characterized by isolated subpopulations, in discreet occurrence areas separated by unsuitable habitat, that exhibit a pattern of extirpation and recolonization of individual areas over a period of many years. If a metapopulation dynamic is occurring along the Yukon River, the Ballarat occurrence area might be considered a 'satellite' subpopulation (Hanski and Gyllenberg 1993) that is likely to experience more frequent extirpations, and longer vacancies, due to its small geographic size and small subpopulation number. The Minto occurrence area might be a 'core' subpopulation that is rarely extirpated and which is a regular source of emigrating animals to recolonize or supplement satellite areas like Ballarat. Without immigration to supplement or recolonize the Ballarat occurrence area, long term persistence of sheep is uncertain. Berger (1990) predicted that populations with less than 50 sheep will go extinct, on average, within 50 years. Empirical observations of small sheep populations have observed both extinctions and persistence over periods of several decades, and the factors that affected those outcomes varied widely among populations (Krausman 1997).

Table 2-11. Thinhorn Sheep observations within the Ballarat Creek occurrence area 2010-2016

Date	Survey	Thinhorn Sheep Observations[1]	Source
June 2010	Environment Yukon Sheep Survey	6 sheep (4 nursery, 1 lamb, 1 ram)	Government of Yukon 2011a
February 2011	Environment Yukon Sheep Survey	8 sheep (6 nursery, 2 rams)	Government of Yukon 2011a
June 2014	Cliff-nesting Raptor Survey	4 sheep (nursery – no lambs)	EDI 2017a
April 2015	Cliff-nesting Raptor Survey	0	EDI 2017a
June 2015	Cliff-nesting Raptor Survey	0	EDI 2017a
June 2015	Incidental Observation	3 sheep (unclassified)	EDI 2017a
August 2015	Incidental Observation	1 sheep (unclassified)	EDI 2017a
November 2015	Sheep Survey – Early Winter	4 sheep (3 ewes, 1 unclassified)	EDI 2017a
February 2016	Sheep Survey – Late Winter	0	EDI 2017a
May 2016	Sheep Survey – Lambing	4 sheep (unclassified – no lambs)	EDI 2017a
June 2016	Sheep/Raptor Survey – Summer	0	EDI 2017a
June 2016	Incidental Observation – Ground Based Sheep Surveys	4 sheep (3 ewes, 1 possible yearling)	EDI 2017a
October 2016	Sheep Survey – Early Winter	4 sheep (nursery – no lambs)	EDI 2017a

[1] Outside of the Ballarat Creek occurrence area, one additional observation of thinhorn sheep was made in the RSA during Project baseline studies. The Camp Wildlife Log includes a record of three sheep observed walking along the slopes near the Kona deposit in June 2016. There are no cliffs or other steep slopes that could provide escape terrain for thinhorn sheep in the vicinity of the Kona deposit, and subsequent searches for sheep in this area conducted by the Kaminak Environmental Monitors did not locate the animals.

2.3.2 DISTRIBUTION AND MOVEMENT

Thinhorn sheep generally have a clustered distribution, staying in relatively close proximity to essential habitat features including escape terrain, mineral licks, and foraging habitat. They are not migratory but may move to different seasonal ranges (Government of Yukon 2015c). In contrast to the vast majority of Yukon sheep, the population known in the RSA inhabits non-alpine, low elevation riparian areas.

The Ballarat Creek occurrence area consists of several steep, south-facing bluff complexes separated by forested valleys, including bluffs both east and west of Ballarat Creek. Survey observations and local knowledge (Interview 14, pers. comm., 2016) indicate that sheep may be found within the Ballarat Creek occurrence area year-round (Table 2-11). Although sample size is low, there is some indication of differences in seasonal distribution within the occurrence area to suggest that sheep may exhibit seasonal movements between areas of suitable habitat within the occurrence area, at least periodically crossing the Ballarat Creek valley (Figure 2-17).

To gain additional information on sheep distribution and movement through the Ballarat Creek area, remote cameras were installed in several locations along established wildlife trails within the Ballarat Creek valley and the lower valley slopes in 2015 (EDI 2017a). Sheep trail investigations were also conducted in 2015 and 2016, and in October 2016 remote cameras were deployed along ridgetop trails in the Ballarat area to gain a

better understanding of sheep use and movements. To date, no sheep have been captured on the remote cameras in the Ballarat Creek valley or lower valley slopes (EDI 2017a; data from the ridgetop cameras was not available at the time of reporting). The 2015 and 2016 trail investigations identified a number of wildlife trails with varying level of use. Well-used trails are located along the valley bottom; however, most of these parallel Ballarat Creek and based on camera results are mostly used by other species. Lightly used trails were located along the ridgelines on both the east and west side of the creek and evidence of sheep use was found along ridgeline trails. Areas showing evidence of concentrated use by sheep including numerous pellet groups, bed sites, and disturbed ground leading into escape terrain and forage habitat were also found during the sheep trail investigations; however, these were generally located along the mid- to upper-sections of the slopes. The proposed NAR alignment parallels then crosses Ballarat Creek and travels west below the Yukon River bluffs to where it crosses the Yukon River. The 2016 sheep trail investigations included a survey at the toe of the slope west of Ballarat Creek where the proposed NAR alignment intersects the currently delineated thinhorn sheep WKA. No evidence of use by thinhorn sheep was found in this area.

As discussed in Section 2.3.1, if there is a metapopulation dynamic occurring along the Yukon River, occasional movements between the three Yukon River occurrence areas may occur. If thinhorn sheep do travel among the three known occurrence areas, the most likely movement corridor is along a series of steep hillslopes and ridges that occur on the north side of the Yukon River. Based on survey observations, these hillslopes offer good foraging habitat but limited escape terrain. A more detailed review of sheep habitat availability and distribution can be found in the Thinhorn Sheep Habitat Suitability Report (EDI 2016b) which was developed to map the distribution and quantify sheep habitat along the Yukon River corridor (Figure 2-18).

2.3.3 HABITAT USE AND DIET

Within the RSA and along the Yukon River corridor, thinhorn sheep occur in low densities at sporadic, isolated locations. The primary limiting factor for sheep in this region appears to be the amount of suitable habitat, especially escape terrain (Hayes 2015).

Thinhorn sheep have very specific habitat requirements. Foremost is the need for steep, rugged rock cliffs that they use as 'escape terrain' to avoid predators (Geist 1971). They also require seasonal foraging areas and secluded lambing areas in association with escape terrain. Foraging areas are predominantly grass and forb dominated habitats (Seip and Bunnell 1985), such as alpine tundra, south aspect hillslopes, and, occasionally, low elevation meadows where sheep primarily feed on grasses, sedges and forbs although they will also browse on shrubs (Hoefs and Cowan 1979). Mineral licks can also be important habitat features for many sheep populations (Simmons 1982; Government of Yukon 2015c). Mineral licks are used during the spring and summer, but use is typically highest in June and July. Sheep may travel several kilometers away from escape terrain and through forested areas to access mineral licks (Simmons 1982).

Most sheep in the Yukon make annual movements or migrations among seasonal habitat types (Sheep Management Team 1996). Winter range is typically used from early September to May, and consists of foraging habitat, in association with escape terrain, with characteristics that reduce snow accumulation.

These characteristics can include lower elevation, south aspect, and wind prone slopes, often in combination. In May, sheep typically begin moving away from their winter range, following the progression of new plant growth to higher elevations. Pregnant ewes normally seek steep, secluded areas away from other sheep in May and June to birth and rear their lambs before regrouping with other sheep in the summer. Summer range tends to be the most widespread of seasonal sheep habitats and includes a variety of foraging types in association with escape terrain. Summer range often is at the highest elevations, but can include a range of elevations and can overlap with winter range. During the rut and pre-rut periods (October to December) rams may travel great distances in search of mating opportunities, often with a diminished regard for proximity to escape terrain.

Most sheep in Yukon occur in mountain alpine zones, where grass and forb dominated meadows, occur in association with mountain cliffs and ridges that provide escape terrain (Sheep Management Team 1996; Hayes 2015). Thinhorn sheep habitat use in the RSA is markedly different — pasture tends to be low elevation, south-facing parkland slopes rather than the more typical alpine meadow and subalpine shrub communities. Escape terrain is believed to be the rocky riparian outcrops that characterize much of the north bank of the Yukon River.

To determine the availability and distribution of thinhorn sheep habitat along the Yukon River corridor, an HSI model was developed (EDI 2016b). The HSI model used terrain steepness, aspect, distance from escape terrain, land cover, and distance from the Yukon River to estimate habitat suitability within and between the White River, Ballarat Creek, and Minto occurrence areas. Generally, the model results corresponded well with information about habitat use by thinhorn sheep in the area. The amount and distribution of modeled sheep habitat is quite limited with High and Moderate rated habitats accounting for only 1% of the total modelling area (Table 2-12). Suitable habitats were identified in relatively small extents, concentrated on steep, non-forested, south aspect hillslopes, with rocky bluff complexes, along the north side of the Yukon River. The model predictions corresponded well with the three known sheep occurrence areas in the region and identified several other potential habitat areas between them (Figure 2-18).

Table 2-12. Availability of thinhorn sheep habitat within the modelling extent.

Habitat class	Area (km²)	% Area
High	3,585	26.2%
Moderate	2,245	17.4%
Low	1,964	14.4%
Very Low	5,867	42.9%

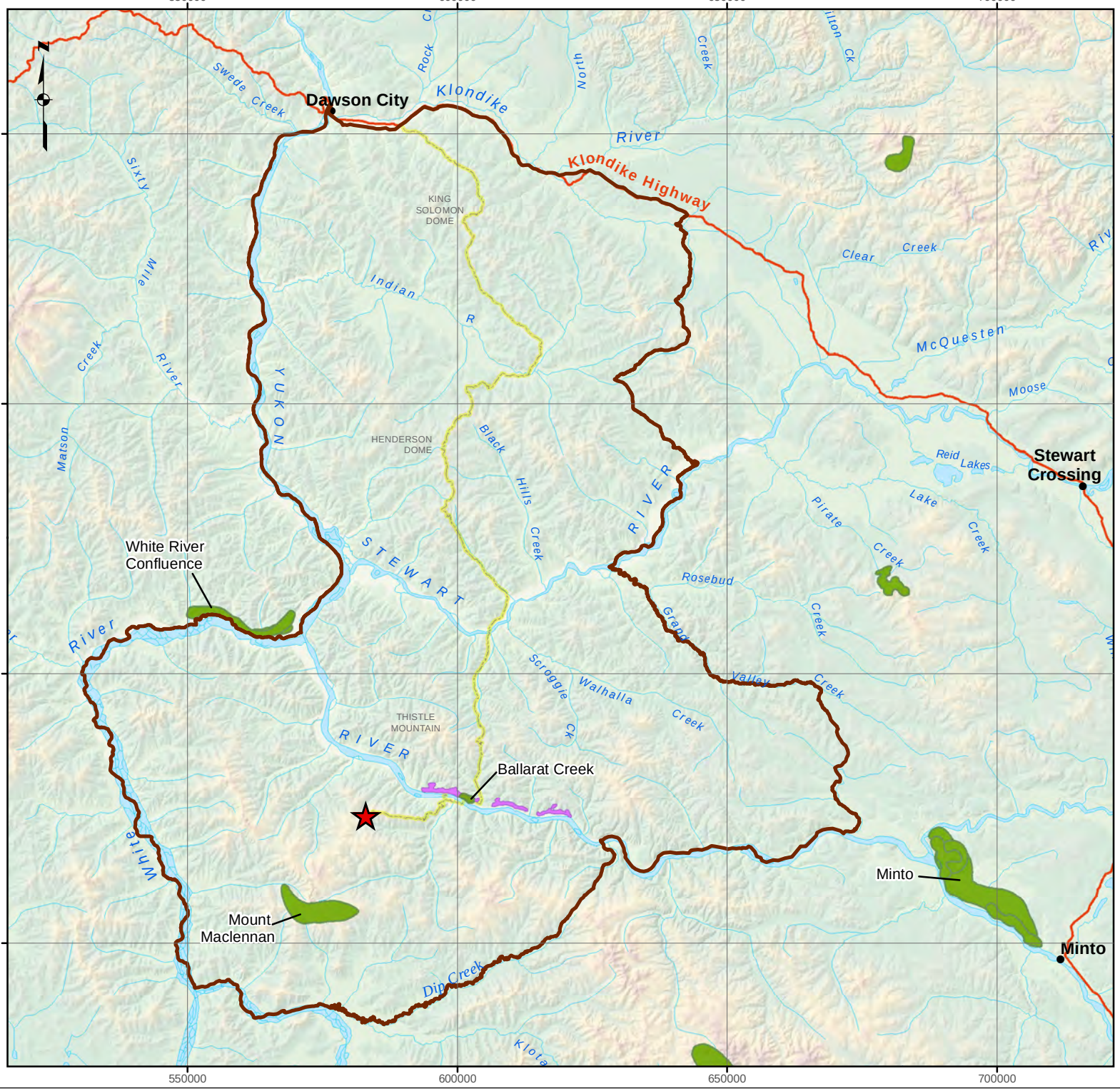
2.3.4 HARVEST AND MORTALITY

Thinhorn sheep are highly valued in Yukon, both for their appeal to sport-hunters and for their importance as a traditional harvest species for some Yukon First Nations. Licensed hunting of thinhorn sheep is managed by Environment Yukon while Yukon First Nations have subsistence harvest rights for sheep protected under the Umbrella Final Agreement, and Yukon First Nation Final Agreements.

Thinhorn sheep are known to be a traditional seasonal food source for all four First Nation groups with asserted or established traditional territories that overlap the Project (Bates and DeRoy 2014; InterGroup Consultants Ltd. 2009; Dawson Indian Band 1988; McClellan 1987; Mishler and Simeone 2004; Pearse and Weinstein 1988); however, the areas where sheep hunting traditionally occurs are well outside the RSA. There is no documented Traditional Knowledge of sheep being targeted where they occur along the Yukon River and sheep are not known to be harvested within the RSA at the current time. Sheep harvest is permitted by licensed hunters in GMS 502, 503, and 509 (Figure 1-3) but there have been no sheep harvested by licensed hunters in the last 10 years. All Zone 3 GMSs, which includes the Ballarat Creek occurrence area, are closed to sheep hunting. There is little information available on unlicensed or subsistence harvest; however, local trapline concession holders have indicated that they are not aware of any subsistence harvest of sheep in the area (Interview 14, pers. comm., 2016).

The main cause of natural mortality for thinhorn sheep within the RSA is likely predation, although mortality rates are unknown. Predators of sheep include wolves, wolverine, coyotes, golden eagles, lynx, and grizzly bear (Hoefs and Cowan 1979; Stephenson *et al.* 1991; Arthur 2003). No predators in the region are suspected to be sheep specialists as there is likely not enough sheep biomass available. Generally, wolves are not believed to have a strong effect on sheep populations (Barichello *et al.* 1989b); however, in the RSA there may be a risk of predation by wolves since the Ballarat Creek sheep live in sympatry with moose, caribou, and mule deer and the density of wolves is likely higher than in alpine sheep habitat which may increase opportunistic predation.

Severe weather during late winter and spring can limit sheep forage access, affecting already precarious energy balances in ewes and lambs and ultimately influencing recruitment (Geist 1971). Sheep are also known to be susceptible to diseases such as pneumonia and parasites (Jenkins *et al.* 2007). Due to their naturally fragmented range and isolated small group size, Yukon River sheep may be at a greater risk of extirpation from stochastic events such as extreme weather and disease.



Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area
- Ballarat Creek Occurrence Area
- Dall's Sheep Wildlife Key Areas

FIGURE: 2-16

Thinhorn sheep wildlife key areas in vicinity of the Coffee Project RSA

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Dawson Range Sheep Distribution and Wildlife Key Areas provided by Environment Yukon - Yukon Government.

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Map Reference Scale: 1:1,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

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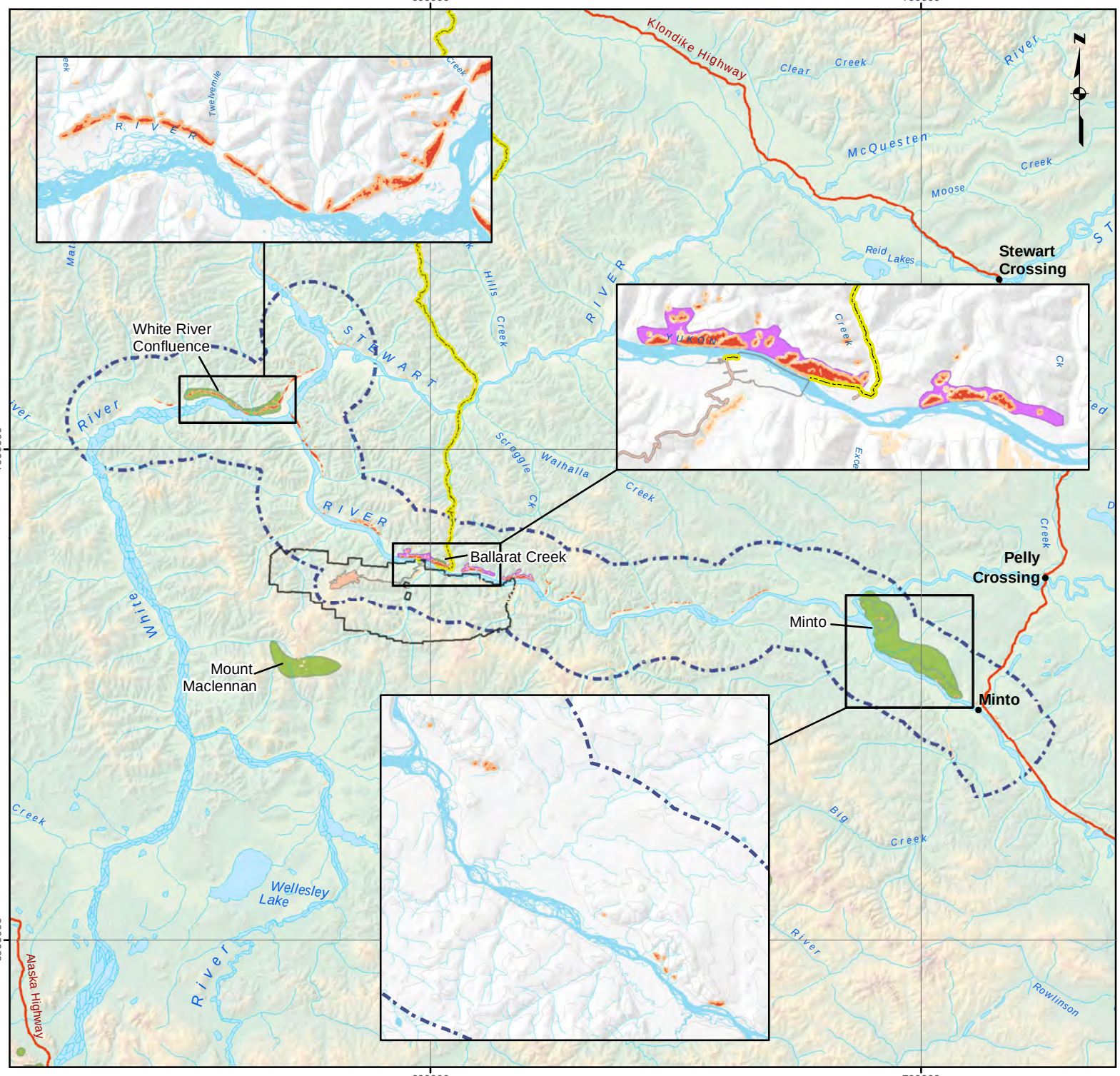
Figure 2-17. Thinhorn sheep observations within the Ballarat Creek occurrence area

Figure 2-17: Thinhorn Sheep Observations within the Ballarat Creek Occurrence Area is not provided in the publically available version of the Coffee Gold Mine: Wildlife Baseline Report due to the sensitive nature of the data.



Legend

- Highway
- Proposed Route
- Project Footprint
- Thinhorn Sheep Wildlife Key Areas
- Ballarat Creek Occurrence
- Thinhorn Sheep Habitat Modeling Extent

Habitat Suitability Index

- Nil
- Low
- Moderate
- High

FIGURE: 2-18

Thinhorn sheep habitat suitability

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Thinhorn sheep habitat suitability model produced by EDI (2016).

Project data displayed is site specific.

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Map Reference Scale: 1:1,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

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2.4 MULE DEER

Mule deer are ubiquitous in western North America, inhabiting a wide variety of habitats from Alaska, Western Canada and United States, and into Northern Mexico. Due to their adaptability to a wide range of habitats and a large stable global population, mule deer are considered to be Least Concern by the IUCN (Sanchez Rojas and Gallina Tassaro 2008). Mule deer have not been assessed by COSEWIC.

Mule deer only reached Yukon in the last 70–80 years, with the first reported sightings from Southern Yukon in the 1940s (Hoefs 2001). Mule deer are now known to occupy much of Yukon, south of Dawson, particularly along the highway corridors which provide preferred early successional vegetation (Government of Yukon 2015d). Dawson appears to be the northern limit of mule deer range in Yukon with the exception of one sighting on the Dempster Highway (Hoefs 2001). In Yukon, mule deer are considered Vulnerable (CESCC 2011) due to their small population size and the location of the Yukon population on the margins of the Canadian range.

Northward range expansion into Yukon is likely a result of recolonization following the last glacial maximum (Hoefs 2001). Other factors such as climate change and the northward spread of agriculture may be accelerating this range expansion.

2.4.1 POPULATION

Mule deer population in Yukon is small and not well studied. In 2001, Hoefs estimated that there were likely between 500 and 800 individuals. This number now is likely higher as the population appears to have been increasing steadily in Yukon since record keeping began in the 1950s (Hoefs 2001). The current working estimate for the Yukon mule deer population is thought to be around 1,000 animals (S. Czetwertynski, pers. comm., 2016). The number of mule deer in the RSA is unknown; however, based on mule deer observations during wildlife surveys in the RSA, it is likely limited to a small number of individuals concentrated along the south-facing slopes of the Yukon, Stewart, and potentially Indian rivers valleys, and along the Klondike Highway. According to trapping concession holders whose traplines overlap the RSA, mule deer have been present in the Coffee Creek/Yukon River area for at least 30 years and the mule deer population has been increasing in the area (Interview 14, pers. comm., 2016).

2.4.2 DISTRIBUTION

Mule deer are known to inhabit the RSA, although their regional distribution is not well-understood. All mule deer and mule deer sign observed during Project baseline surveys were located along the Yukon River near Ballarat Creek and the slopes above Coffee Creek (EDI 2017a). According to the local Conservation Officer Services, small numbers of deer are also occasionally observed along the lower Stewart River and along the local highways (K. Meister, pers. comm., 2016).

In other northern forest regions, mule deer migrate seasonally, inhabiting high elevation areas during summer and fall and moving to lower elevation areas with lower snow accumulation in the winter and

spring (Hayden *et al.* 2008). Mule deer ranges can be variable in size and are dependent on seasonal migration and dispersal. Reports exist of migrations of more than 160 km (Wallmo 1981); however, some deer maintain the same home range during all seasons, making dispersal, movement, and population densities difficult to predict with sparse data. Open and semi-open grass dominated south-facing slopes throughout the RSA likely provide ideal year-round habitat for mule deer due to the availability of forage and low snow accumulation during winter as a result of wind and sun exposure.

Project baseline surveys documented mule deer or mule deer sign on several occasions. Remote wildlife cameras in the Ballarat Creek valley photographed mule deer during eight separate events in 2015 and 2016, including observations in both the summer and winter seasons (in April, May, August, November, and December). In November 2015, during an early winter ungulate survey, four deer were observed west of Ballarat Creek, mid-slope on a sparsely forested, south-facing slope above the Yukon River. The Camp Wildlife Log also documented mule deer south of the Yukon River, along the lower sections of the Java Road, on two occasions in August 2016. Other than the one observation of four deer during the early winter ungulate survey, mule deer were observed individually or in groups of two.

2.4.3 HABITAT USE AND DIET

Mule deer habitat in Yukon consists of grass-dominated areas, either semi-arid south facing slopes or early successional vegetation areas such as burns, agricultural fields, and road right-of-ways (Government of Yukon 2015d). Deer are not well adapted to deep snow and require winter range with limited snow cover. Winter habitat exists on south-facing slopes where wind and sun exposure reduce snow cover, providing forage throughout the winter. South-facing slopes are also the first free of snow in the spring and have the first green-up making them ideal for spring grazing. Mule deer diet throughout the year consists of grasses, forbs, foliage, and shrubs (Government of Yukon 2015d).

2.4.4 HARVEST AND MORTALITY

Mule deer harvest in Yukon is managed by Environment Yukon and controlled through the Permit Hunt Authorization lottery system. Only ten permits are issued each year and only male mule deer may be harvested. No mule deer have been harvested by licenced hunters within the RSA in the last 10 years.

Natural predators of mule deer include bears, wolves, cougars, and coyotes (Government of Yukon 2015d). Mortality rates of mule deer within the RSA remain unknown. Weather, human land use, and disease are other factors controlling mule deer population dynamics in Yukon. Cold winters may be particularly limiting in the RSA as this region represents the most northerly mule deer habitat in the world (Sanchez Rojas and Gallina Tassaro 2008).

3 CARNIVORES

Large carnivores including grizzly bear, black bear, grey wolf, wolverine, and smaller furbearing species such as American marten, lynx, and red fox are known to be present in the RSA. These species are economically, ecologically, and culturally valuable to First Nations people, licensed hunters, and the fur harvest industry. A number of surveys were completed as part of the Project's Wildlife Field Program that focused on assessing carnivore and furbearer habitat use and distribution (Table 3-1). The methods and results of these surveys are summarized in the Wildlife Field Program Report (EDI 2017a).

Table 3-1. Summary of carnivore and furbearer surveys conducted for the Coffee Project (2014–2016).

Survey Type	Target Species	Dates Conducted
Grizzly Bear Den Surveys	Grizzly Bear, Black Bear	March 21, 2016 March 31, 2016 April 22, 2016 May 6, 2016
Snow Track Surveys - Coffee Property	All wildlife species	February 11-15, 2015
Snow Track Surveys - NAR	All wildlife Species	February 22-26, 2016
Paired Site Wildlife Road Use Study	Wolf and others	November 2015-Ongoing
Remote Camera studies	All wildlife Species	May 2015-Ongoing

3.1 GRIZZLY BEAR

Grizzly bear are a large omnivore found across western and northern Canada (COSEWIC 2012) and are recognized for their social, cultural, and economic value. Grizzly bears were assessed by COSEWIC in 2012 and are listed as a species of Special Concern (COSEWIC 2012). COSEWIC has identified the largest threats to Canadian grizzly bear population as 1) human caused mortality (including illegal and legal hunting, defense of life or property, and accidental killings) and 2) habitat loss and fragmentation (COSEWIC 2012). In Yukon, grizzly bears are listed as Sensitive (CESCC 2011).

3.1.1 POPULATION

Yukon's grizzly bear population is estimated to be between 6,000 and 7,000 individuals, making up about 25% of the total grizzly bear population in Canada (COSEWIC 2012). There is limited available information on grizzly bear abundance and distribution within the RSA but according to the Environment Yukon carnivore biologist, grizzly bear density in the area is considered to be low (R. Maraj, pers. comm., 2016). The working density estimate for the Klondike Plateau ecoregion is 11 bears/1,000 km^2 and the Yukon Plateau-Central is 15 bears/1,000 km^2. Based on observations and harvest records, it can be assumed that grizzly bears use the entire RSA but occur at relatively low densities. Additionally, based on local knowledge, there is some indication that grizzly bear densities might be slightly higher in the southern portions of the RSA than the northern sections — reports from local biologists and trapline concession holders suggest that while present, grizzly bears are uncommon along the northern portions of the proposed NAR (M. Suitor,

pers. comm. 2014-2016; Interview 15, pers. comm. 2016), but may be present in slightly higher numbers to the south (Interview 14, pers. comm. 2016).

3.1.2 DISTRIBUTION

Grizzly bears occur throughout Yukon, ranging from the B.C./Yukon border to the Arctic coast. Grizzly bears have large home ranges that are determined by food availability, cover, and possibly competition avoidance (Rigg 2005). The average home range size in Canada is 700 km² for females and 1,800 km² for males (COSEWIC 2012). The weighted average multi-annual home range size for females in Kluane was 305 km² (Maraj 2007) while in the Mackenzie Mountains, the average home range size for six females was estimated at 265 km² (Miller *et al.* 1982).

Grizzly bear observations have been recorded throughout the RSA on wildlife cameras, during baseline studies in the area, and by Project personnel. Grizzly bears were documented on 13 separate occasions on remote cameras, and incidentally by EDI biologists during baseline surveys on 5 occasions. Grizzly bears were also reported on the Camp Wildlife Log on 15 occasions between 2010 and 2016 (EDI 2017a). Grizzly bear observations were made throughout the RSA including observations in the Dominion Creek valley, Eureka Ridge, Maisy May Creek valley, Barker Creek valley, Ballarat Creek valley, and along the Java Road (see Figure 1-1 for Project area references). Observations were recorded seasonally between April 13 and October 24. Most observations were of individual bears; however, observations of females accompanied by a cub or yearling were made on multiple occasions. Given their large ranges and diverse habitat requirements grizzly bears have the potential to interact with all aspects of the proposed Project footprint including the NAR and mine site.

3.1.3 HABITAT USE AND DIET

Yukon grizzly bears use a variety of habitats, including boreal forest, alpine and subalpine, and arctic tundra (Government of Yukon 2015e). Grizzly bears are opportunistic omnivores and vary their diets based on seasonal food availability. The primary food source for grizzly bears is vegetation, but they will also prey on animals opportunistically. The other main food sources in the spring include overwintered berries, roots and winter-killed carcasses (Popadynec 2009; Government of Yukon 2015e). Within Yukon, grizzly bears are the primary predator of moose calves in the spring (Larsen *et al.* 1989). Throughout the summer and fall, grizzly bears feed largely on grasses and horsetail, and berries when they become available (Government of Yukon 2015e). Traditional Knowledge of bear habitat and diet indicates that low-lying river valleys and floodplains (such as the White River) provide good grizzly bear habitat due to the seasonal abundance of high-bush cranberries (Campbell 2012).

To assess the availability and quality of grizzly bear habitat in the RSA, four geographical information systems (GIS) based models were produced, which are described in the Coffee Gold Mine: Grizzly Bear Habitat Model Report (EDI 2016c). Each model aims to predict an aspect of grizzly bear habitat requirements. The models include:

- Habitat effectiveness
- Security zones
- Linkage zones
- Denning habitat suitability

The habitat effectiveness model evaluates habitat quality as a relationship of topographic features, vegetative features, and proximity to human infrastructure and activities to estimate grizzly bear habitat effectiveness. At baseline, the habitat effectiveness model indicated that overall habitat in the RSA is 93.1% effective during green-up (peak greenness in July) and 92.7% effective during green down (senescence in September).

The security zones model estimates if available habitat is secure, where grizzly bears can forage for 24–48 hours without interacting with humans. The security areas model identified that at baseline 93.9% of the RSA is 'secure' for grizzly bears (Figure 3-1).

The linkage zones model identifies areas of potential movement for bears between habitat patches based on landscape factors and proximity to human infrastructure and activities. The linkage zone model identified that 92.5% of the RSA was modelled to be in the minimal danger category (Figure 3-2).

A denning habitat suitability model was created to identify and quantify areas suitable for grizzly bear denning. The grizzly bear denning habitat model estimates that 0.5% and 9.2% of areas within the RSA have high and moderately-high suitable habitat for denning, respectively (Figure 3-3). More information on the models is provided in EDI 2016c. Grizzly bear denning surveys were also completed within a 2 km buffer of the proposed NAR alignment and within a 5 km buffer of the proposed mine site in spring 2016 (March 21–May 6). No grizzly bears or grizzly bear dens were located despite considerable survey effort by trained biologists (EDI 2017a). The first grizzly bears were noted on wildlife cameras in the Ballarat Creek drainage on April 14, 2016 (adult bear) and on April 26, 2016 in the Barker Creek drainage (sow and cub), indicating that den emergence occurred during the survey period. During other Project baseline surveys in the RSA, two potential grizzly bear dens were observed on a steep south-facing slope above the Yukon River.

3.1.4 HARVEST AND MORTALITY

Grizzly bears are managed as a big game species in Yukon, and harvest of grizzly bears is restricted in some GMS. The bag limit is one bear every three years in open subzones (Government of Yukon 2015f). It is compulsory for all hunters to report all bear kills (Government of Yukon 2015f). From 2006–2015, grizzly bears were harvested in game management subzones 307, 308, 313, 314, and 509 within the RSA (Government of Yukon 2016a). Grizzly bears were not harvested in the other GMSs found in the RSA (310, 311, 312, 315, 502, and 503). According to conservation officer services, most of the grizzly bear harvest in this region occurs along the Yukon and Stewart rivers rather than local roads (K. Meister, pers. comm. 2016). One other mortality was recorded in GMS 311. Table 3-1 summarizes harvest data for the subzones where harvesting occurred.

Table 3-1. Grizzly bear harvest statistics from 2006 to 2015 in the game management subzones that interact with the RSA (Government of Yukon 2016a).

GMS	Harvest Regulations (2015-2016 season)	Total Harvest	Mean Annual Harvest
307	Open; Bag limit 1 every 3 years	1	0.1
308	Open; Bag limit 1 every 3 years	1	0.1
313	Open; Bag limit 1 every 3 years	1	0.1
314	Open; Bag limit 1 every 3 years	1	0.1
509	Open; Bag limit 1 every 3 years	2	0.2
Total		**6**	**0.6**

Other sources of mortality include conflict kills, collisions with vehicles, and predation from other bears or large carnivores, such as wolves. While conflict kills are required to be reported to Conservation Officer Services, it is suspected that not all incidents are accurately reported.

Collisions with vehicles that result in mortality do occur but these collisions in Yukon are rare. EDI (2015) reported that 15 grizzly bear mortalities resulted from collisions with vehicles between 2003 and 2014 on all Yukon Highways. The majority of these collisions occurred on the Alaska Highway (60%) where there is the majority of traffic volume travelling at high speeds. The most comparable road to the NAR is the Nahanni Range Road where only one grizzly bear was killed in the 12 year period. Although the Nahanni Range Road is comparable, traffic volumes and speed limits are higher and road conditions are better than the NAR will be.

Predation on grizzly bears, particularly predation on bear cubs by other bears does occur but predation rates for Yukon are unknown.

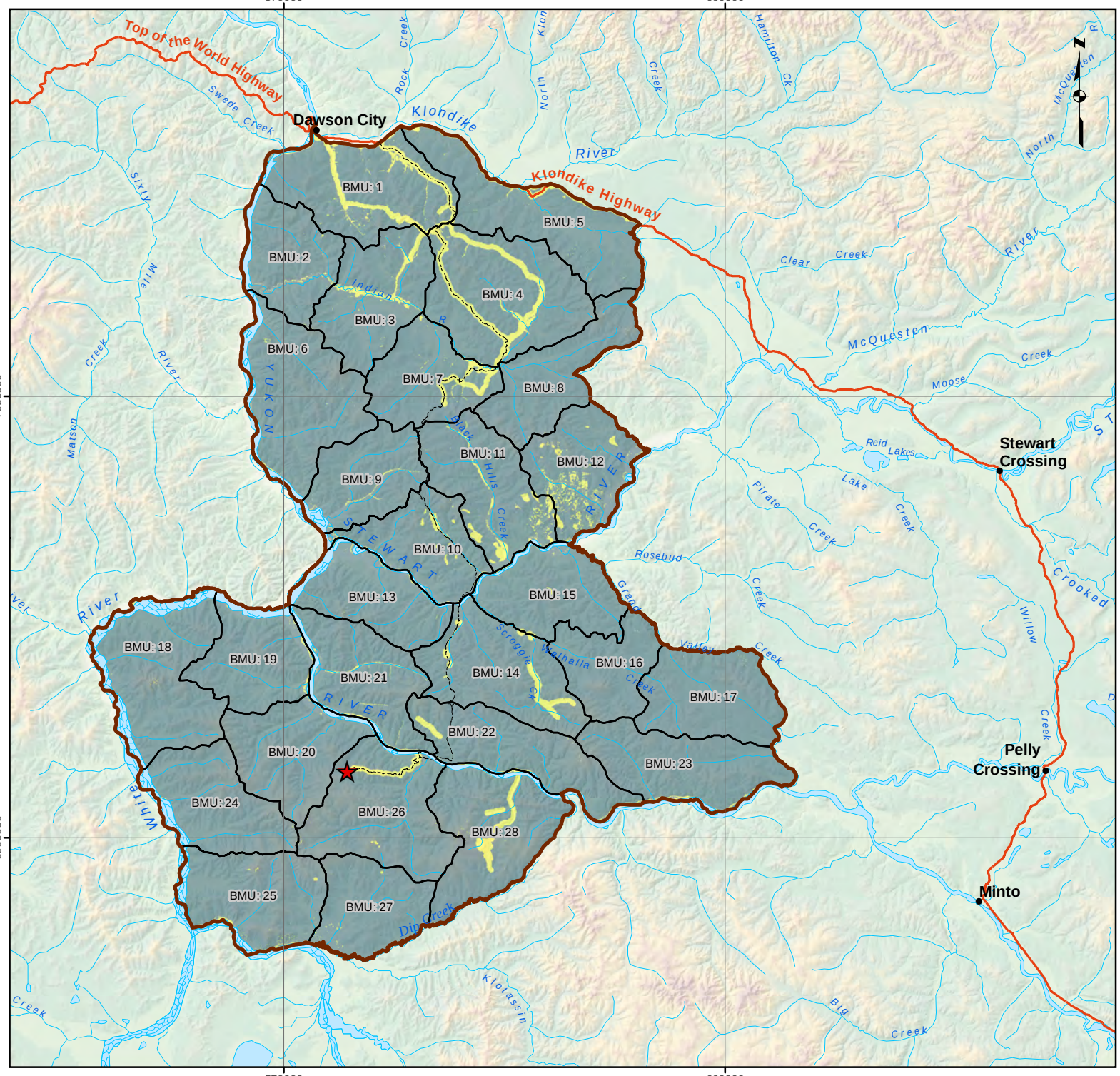

FIGURE: 3-1

Grizzly bear security areas

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Project data displayed is site specific. Grizzly bear security areas created by EDI Environmental Dynamics Inc. (2016).

Disclaimer
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Map Reference Scale: 1:1,000,000 (Printed at 8.5 x 11)
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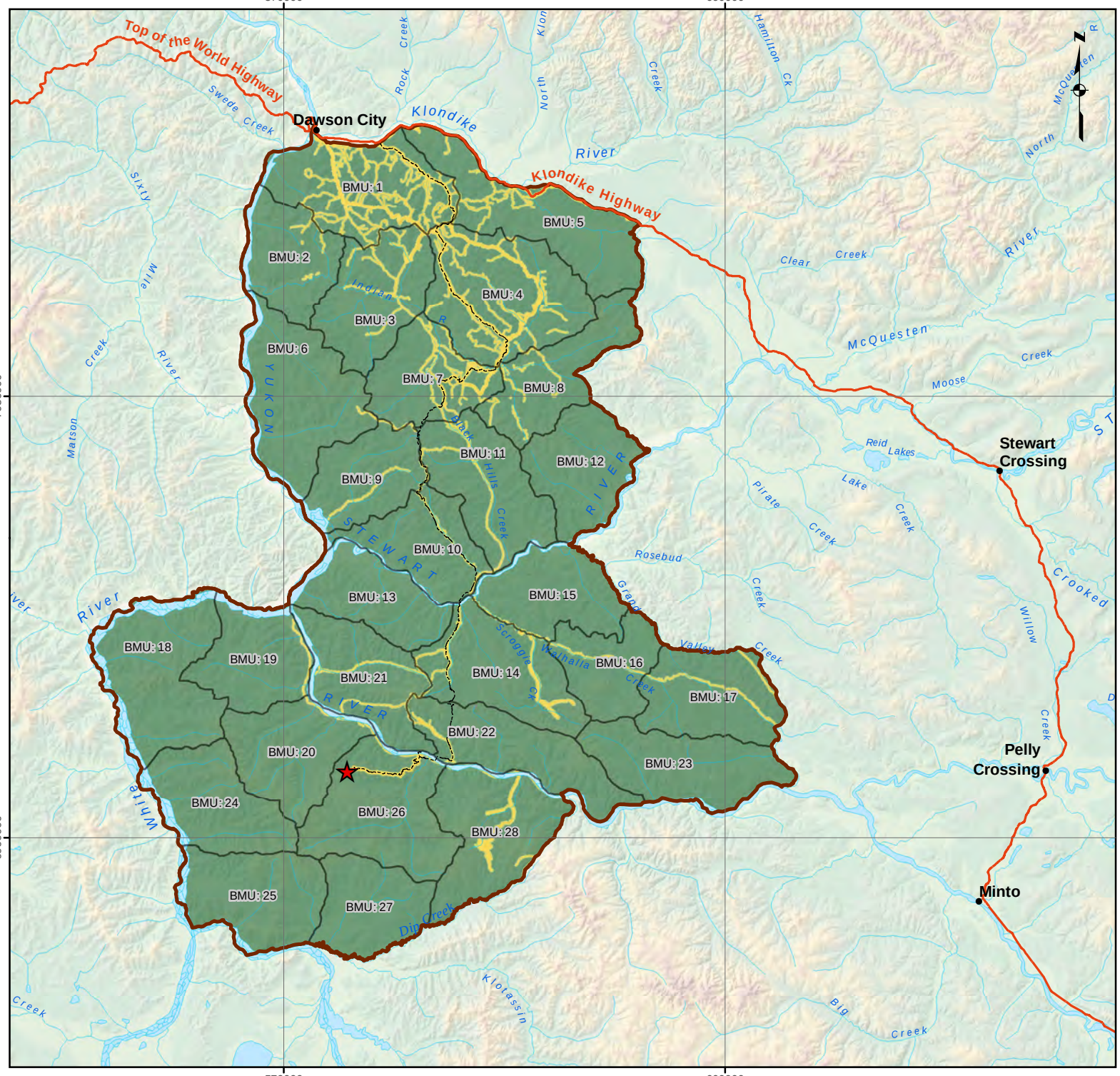

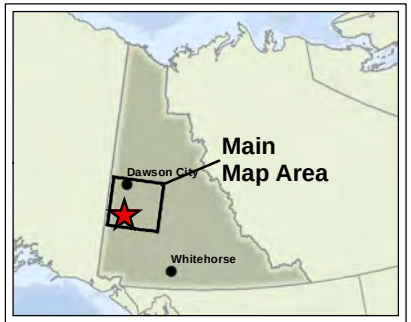

Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area
- Bear Management Unit

Grizzly Bear Linkage Zone Class

- Minimal Danger
- Low Danger
- Moderate Danger
- High Danger

FIGURE: 3-2

Grizzly bear linkage zones

Data Sources
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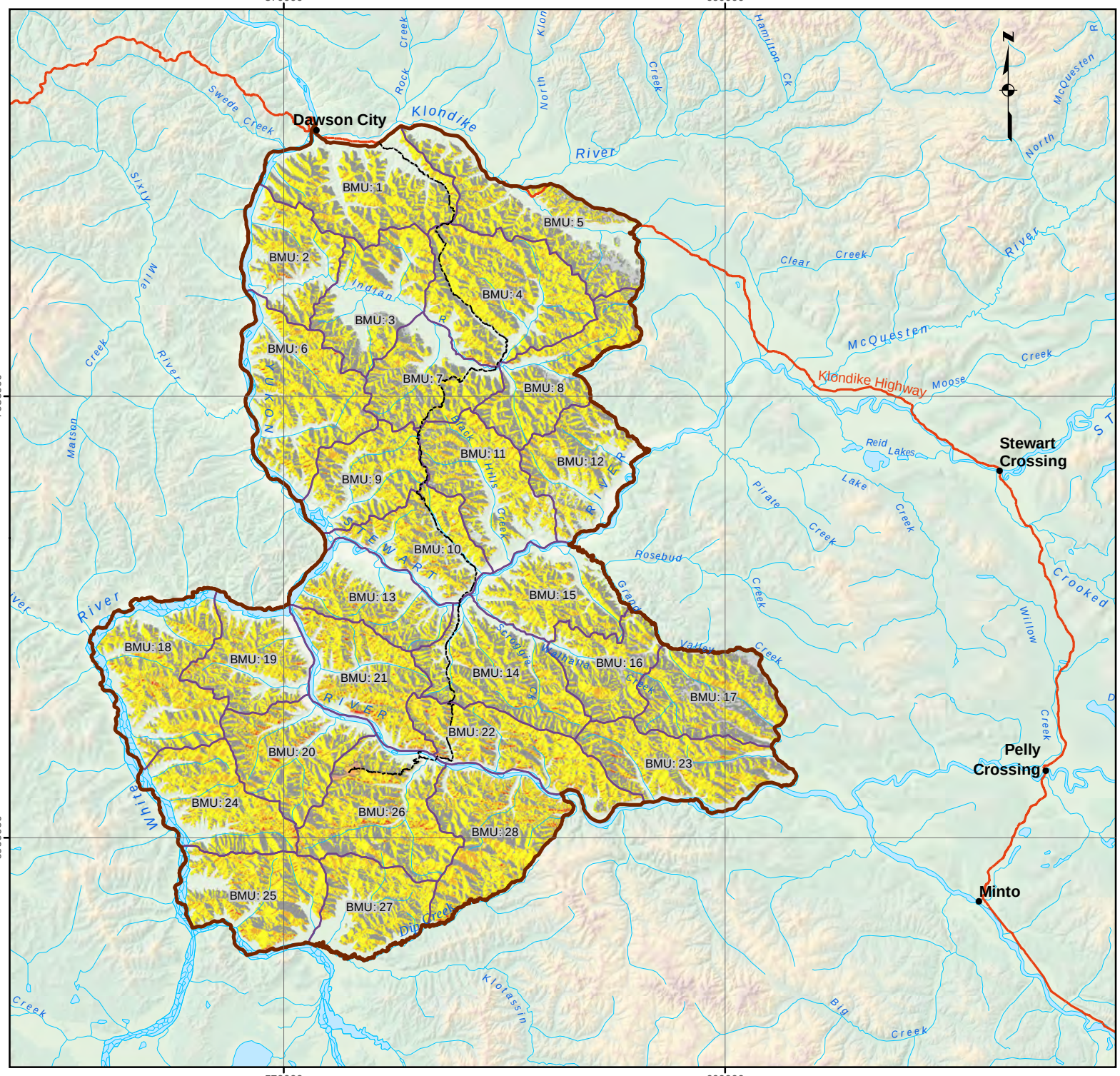

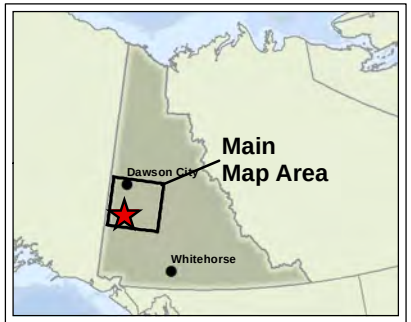

Legend

- Highway
- Proposed Route
- Regional Study Area
- Mine Site
- Bear Management Unit

Grizzly Bear Denning Suitability

- Nil
- Low
- Low/Moderate
- Moderate
- Moderate/High
- High

FIGURE: 3-3

Grizzly bear denning suitability

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

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3.2 BLACK BEAR

There are an estimated 10,000 black bears in Yukon (Government of Yukon 2015g). They range from the British Columbia/Yukon border to northern Yukon near Old Crow, with the highest population densities in the southern portion of their range (Government of Yukon 2015g). Black bears are designated Not at Risk in Canada (COSEWIC 2002).

Black bears are omnivores, with a diet that varies widely depending on location and season (Government of Yukon 2015g). Plants and berries make up the majority of their diet, which is supplemented by insects and meat (MacHutchon 1989). Black bears use a wide variety of forested and non-forested habitats for foraging. Local knowledge (e.g. M. Suitor, pers. comm. 2014-2016; Interview 15, pers. comm. 2016) and incidental Project observations indicate that grassy, south-facing slopes within the RSA are heavily used by black bears, particularly in the spring. Other important foraging habitats include floodplains along rivers and creeks, and berry-rich habitats (Government of Yukon 2015g). Denning usually occurs in well-drained forested areas on level terrain under root clumps (Bertram and Vivion 2002b). Males are the first to emerge from their dens in early spring, while females and cubs remain in the den a month longer (Government of Yukon 2015g).

Detailed information on black bear distribution and abundance within the RSA is not available; however, local knowledge indicates that there are 'lots of black bears in the area' (Interview 15, pers. comm. 2016), which is consistent with Project observations. Black bears have commonly been observed in the RSA during the non-denning period (May to October; Government of Yukon 2015g). Although no specific surveys were conducted for black bears, they were recorded throughout baseline studies during wildlife surveys, as incidental observations, on the remote wildlife cameras, and in recorded harvest statistics. Black bears were the most commonly recorded species in the Camp Wildlife Log and were the most frequently observed species on remote cameras during the non-denning period — 196 black bears were recorded in the Camp Wildlife Log between 2010 and 2016, and 214 bears photographed on remote cameras, although in both cases some of these observations could have been of the same individual (EDI 2017a). Collectively baseline observations of black bear occurred from April 18–September 30 (with the exception of one observation in Feb 2015). Black bear sows with one or two cubs were observed in all years. During grizzly bear denning surveys in spring 2016, several black bears and suspected black bear den sites were located on south aspect slopes with fresh greenery (EDI 2017a). As a result of their diverse seasonal habitat needs, black bears have the potential to interact with the proposed Project across the entire extent of the Project footprint including the NAR, mine site, and camp infrastructure.

Black bears are managed as a big game species in Yukon and are harvested by First Nations and licensed hunters. The bag limit for licensed hunters is two black bears per year and harvest can occur from spring through fall in all Yukon game management subzones (Government of Yukon 2015f). It is compulsory for licensed hunters to report all black bear kills (Government of Yukon 2015f). Within the RSA, black bears have been harvested in game management subzones 307, 308, 310-314, 502, and 509 (Government of Yukon 2016a). Black bears were not harvested in GMS 315 and 503. Table 3-2 summarizes harvest data between 2006 and 2015 for these subzones.

Other sources of black bear mortality include conflict kills, collisions with vehicles, and predation from other bears or large carnivores. While conflict kills are required to be reported to Conservation Officer Services, it is suspected that not all incidents are accurately reported. Current levels of conflict kills within the RSA are believed to be relatively high, particularly in the northern sections of the RSA (K. Meister, pers. comm. 2016; R. Maraj, pers. comm. 2016).

Table 3-2. Black bear harvest statistics between 2006 and 2015 in the game management subzones that interact with the RSA (Government of Yukon 2016a).

GMS	Harvest Regulations (2015-2016 season)	Total Harvest	Mean Annual Harvest
307	Open; Bag limit 1	14	1.4
308	Open; Bag limit 1	5	0.5
310	Open; Bag limit 1	4	0.4
311	Open; Bag limit 1	4	0.4
312	Open; Bag limit 1	10	1.0
313	Open; Bag limit 1	6	0.6
314	Open; Bag limit 1	14	1.4
502	Open; Bag limit 1	1	0.1
509	Open; Bag limit 1	2	0.2
Total		**60**	**6.0**

3.3 WOLVERINE

Wolverine has a circumpolar distribution and is the largest mustelid in North America. The species is widely distributed across Canada and Alaska. Wolverines occur at low densities throughout their range because of their territorial behaviour and large home ranges. The conservation status of wolverines in Canada was assessed as Special Concern by COSEWIC in 2014. The assessment identifies the primary reasons for the designation as human caused effects on the southern portion of the species range, risks associated with climate changes, and a lack of available information (COSEWIC 2014).

3.3.1 POPULATION

Densities of wolverine are generally low compared to other terrestrial mammal species. The low density is thought to be linked to food availability. The estimated population of wolverine in Canada is unknown but assumed to be greater than 10,000 individuals (COSEWIC 2014). In Yukon, the wolverine population is estimated to be 3,500–4,000 animals (COSEWIC 2014). Wolverine densities in Yukon are some of the highest reported in North America, estimated at approximately ten wolverine per 1,000 km² (Banci and Harestad 1990, Golden *et al.* 2007).

3.3.2 DISTRIBUTION

Wolverines are widely distributed across North America and assumed to occupy all of Yukon. Wolverines are territorial and move extensively within their home ranges. Home ranges are generally discrete, though male and female home ranges overlap (Persson *et al.* 2010). Home ranges of wolverines have been documented exceeding 1,000 km² (Persson *et al.* 2010), but in Yukon are reported at 139–526 km² (Banci 1987). Wolverines are a polygynous species where male home ranges are larger and overlap multiple female home ranges to increase mating opportunities.

Wolverines were observed in the RSA on a number of occasions. The 2015 snow track survey of the Java Road did not detect wolverine on transects, but fresh tracks of one wolverine were incidentally recorded travelling the length of the airstrip during the survey (i.e. off transect). The 2016 snow track survey of the NAR and Java Road detected 14 occurrences of fresh wolverine tracks and eight old tracks (Table 3-3). Wolverine were generally detected at higher elevations along Sulphur Creek, Eureka Ridge, Maisy May, Barker Creek, Thistle Mountain, and Java Road (Figure 3-4). Wildlife cameras have been installed within the LSA since May 2015, with two observations of wolverine captured in the Sulphur Creek valley and one captured in the Eureka Ridge area. One wolverine was observed during the 2016 late winter ungulate survey (EDI 2017a).

Given the large size of wolverine home ranges there is potential for wolverines to interact with the Project at low densities across the entire extent of the Project footprint including the NAR, mine site, and camp infrastructure.

Table 3-3. Wolverine tracks (fresh and old) observed during the 2016 snow track surveys.

Road Segment[1]	Total Number of Track Observations	Number of Observed Old Tracks	Number of Observed New Tracks
Sulphur	2	1	1
Indian River	0	0	0
Eureka	2	1	1
Henderson Dome	0	0	0
Maisy May	4	2	2
Stewart River	0	0	0
Barker	4	0	4
Thistle	5	2	3
Thistle to NAR	1	1	0
Ballarat	0	0	0
Yukon River	0	0	0
Kona/Java	6	3	3
Total	26	8	14

[1] Road segments are shown on Figure 1-1

3.3.3 HABITAT USE AND DIET

Wolverine are generally not known to have specific habitat requirements and are assumed to occur where prey is available. Wolverine are thought to avoid areas where anthropogenic activity occurs. Although the wolverine collar data in Scrafford and Boyce's study (2015) shows that wolverine in Northwestern Alberta do use habitat in close proximity to industrial activity, human presence associated with this activity is relatively low.

Denning habitat is often thought to be a limiting habitat feature for wolverine since they require snow deep enough to dig dens into. Wolverines use two types of dens: natal and maternal (Magoun and Copeland 1998). Natal dens are used early February to mid-March for parturition (i.e., birthing) and immediately post-partum (Copeland *et al.* 2010). Female wolverines move kits to maternal dens when natal den conditions become unsuitable. Maternal dens can be several kilometres from natal dens and a female wolverine may use multiple maternal dens within a single year (Magoun and Copeland 1998). Snow cover through the wolverine denning period has been shown to predict wolverine den locations, and is described as a critical habitat component (Copeland *et al.* 2010).

A denning habitat model created for the RSA using remotely sensed snow cover estimates between 2006 and 2015 found that the area likely contains limited high quality denning habitats (Figure 3-5; EDI 2016d). The RSA contains few areas of regular late spring snow cover, assumed to be a proxy for deep snow and indicative of potential wolverine denning habitat. The number of years that an area was snow covered was binned into four classes that describe the relative quality of an area for wolverine denning. The habitat quality classes represent the top three, middle four, and bottom three years with late snow cover; in addition to a habitat class that represents potentially unsuitable habitat. The lowest habitat quality class, very low,

represents areas that were never snow covered through the entire 10 year study period and are likely unsuitable denning habitat. Low quality habitats are those that were irregularly snow covered; moderate quality habitat are areas that were commonly snow covered; and high quality habitat are areas that were regularly snow covered through the denning season.

Less than 1% of the RSA was classified as high quality denning habitat during the study period (Table 3-4). The denning habitat model suggests that there is little suitable denning habitat within the RSA; consequently, the wolverine population in the region may be limited by the availability of denning habitat. Areas where wolverines are most likely to den within the RSA are concentrated in higher elevation terrain such as the high elevation ridges south and west of the Yukon River (Figure 3-5).

Wolverines are carnivores that acquire food through predation and scavenging. Foraging strategy depends on the availability of prey and the presence of other predators. They are known to opportunistically prey on large and small animals, and consume carrion when available. Wolverines have been described as facultative scavengers (Van Dijk *et al.* 2008) and facultative predators (Andrén *et al.* 2011), as they scavenge when prey is unavailable and hunt for prey when carrion is unavailable. As predators they consume a broad number of species (e.g., mammals of various sizes and birds), but as a scavenger they consume the species targeted by the dominant predator in the region (Van Dijk *et al.* 2008). Prey species includes moose, beaver, snowshoe hare, other ungulates, black bear, marten, red squirrel, and grouse (Scrafford and Boyce 2015). The primary prey species in Yukon seems to be snowshoe hares (Jung and Kukka 2013, Van Dijk *et al.* 2008).

Wolverines in the RSA are unlikely to be limited by food availability given the abundance of ungulates and prey species in this region, particularly since they will have increasing access to food with the Fortymile caribou herd now reoccupying the area. Migratory caribou herds can be an important source of food for wolverine (Dalerum *et al.* 2009) and reductions in caribou numbers in Canada may be one of the causes for the reduced wolverine numbers (COSEWIC 2014). The seasonal presence of the Fortymile caribou herd in the RSA would provide abundant food for wolverine during the winter, potentially increasing the wolverine density in the region. During summers when Fortymile caribou migrate back to Alaska, wolverine may shift their diet to other species that are common in the region (Dalerum *et al.* 2009) such as moose or snowshoe hare.

Table 3-4. Availability of wolverine denning habitat classes within the RSA.

Habitat class	Years with late snow	Area (km²)	%
High	8 to 10	27	0.2
Moderate	4 to 7	1,451	9.1
Low	1 to 3	11,468	72.1
Very Low	0	2,959	18.6

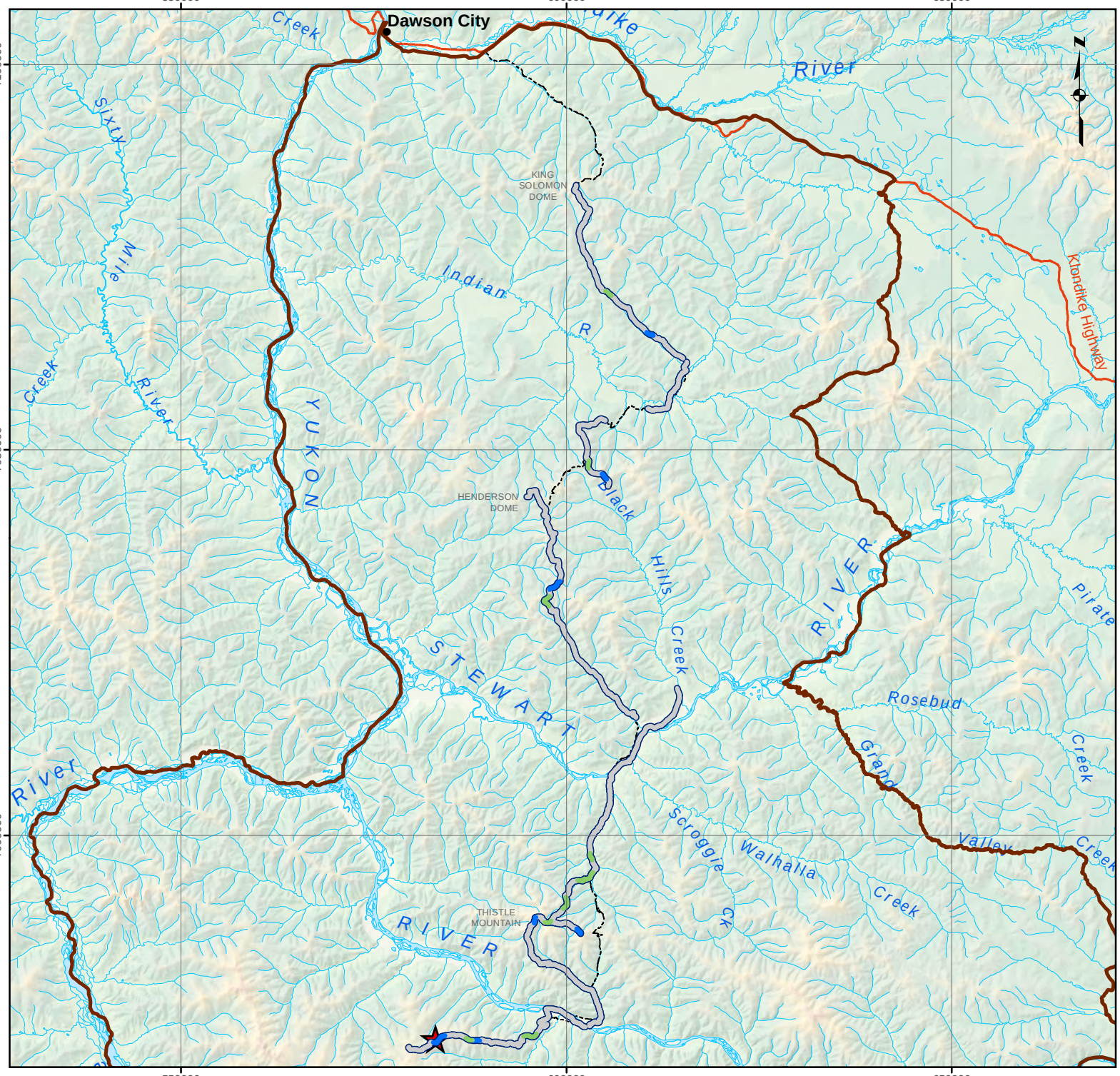
3.3.4 HARVEST AND MORTALITY

Wolverines are exposed to natural mortality risks from predation and starvation. The predators of wolverines are large carnivores, such as wolves, grizzly bear, cougars, and other wolverine, as well as golden eagles (Cardinal 2004). The extent of predation on wolverines is unknown.

Wolverines are a commonly trapped furbearer in Yukon and a valuable species for First Nations and non-First Nations trappers. One study found that human-caused mortality (trapping and road-kill) accounted for 46% of deaths in a review of 12 studies using radio-collared animals (Krebs *et al.* 2004). Yukon's trapping rules restrict the timing of harvest in order to target male wolverine and a study of harvested carcasses indicated that the rules are generally working to minimize female mortality (Jung and Kukka 2013). The number of wolverine trapped in Yukon varies among years. Average annual wolverine harvest in Yukon between 1990 and 2010 was approximately 120 wolverines (Jung and Kukka 2013). Within trapping concessions that intersect the RSA, between 2004 and 2013 the average wolverine harvest was 10 wolverine per year (Table 3-6). Trapping by licensed fur harvesters has been reported as the primary cause of adult wolverine mortality in Montana (Squires *et al.* 2007). The effect of trapping on Yukon's wolverine population is unknown.

Wolverines are also recognized as a big game species in Yukon's hunting regulations. Wolverines are harvestable by Yukon residents with a valid hunting license. Resident hunters are permitted to harvest one wolverine per year and are charged a nominal sealing fee when the pelt is submitted for inspection. Guided non-residents are permitted to harvest one wolverine per year and are charged the sealing fee in addition to the $75 non-resident harvest fee. No wolverine kills were reported in the RSA by hunters between 2006 and 2015 (Government of Yukon 2016a).

Other sources of wolverine mortality may include collisions with vehicles and predation by other carnivores. A recent study on large mammal-vehicle collisions on major roads and highways in Yukon did not report any wolverine kills as a result of a motor vehicle collision between 2003 and 2014 (EDI 2015). Natural predation rates on wolverine in Yukon are unknown.



Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area

Wolverine Tracks Observed

- No Tracks
- Few
- Some
- Many
- Very Many
- Old Tracks

FIGURE 3-4

2016 Late winter snow tracking survey: wolverine

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Project data displayed is site specific. Data collected by EDI (2016) was obtained using Garmin GPS technology.

Disclaimer
This document is not an official land survey and the spatial data presented is subject to change.

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Map Reference Scale: 1:700,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

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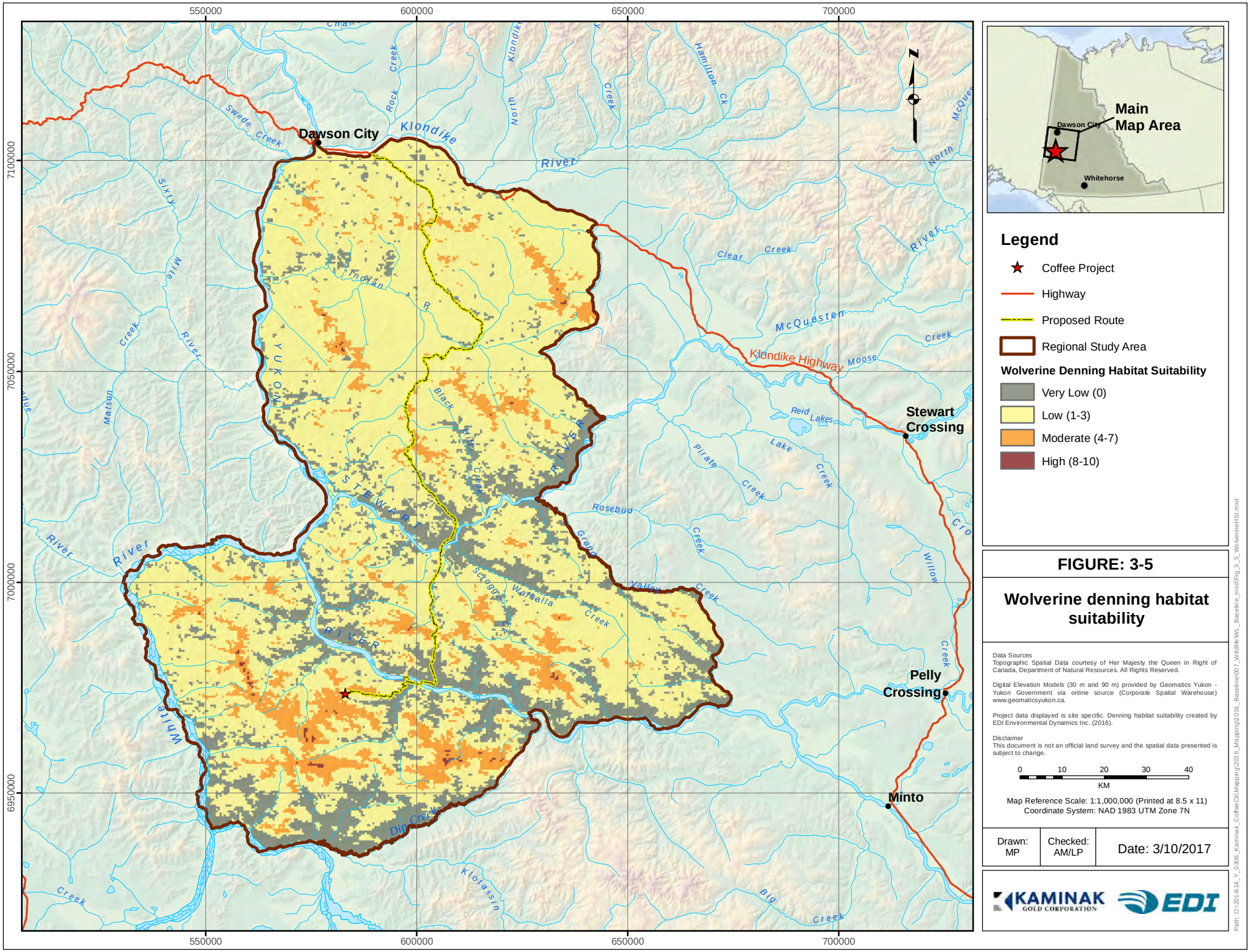
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Swede Creek
Rock Creek
North Klondike
Hamilton Ck
McQuesten River
Sixty Mile River
Indian R
Clear Creek
McQuesten
Klondike Highway
Moose Creek
Stewart Crossing
Reid Lakes
Pirate Lake Creek
Matson Creek
YUKON
STEWART
RIVER
Black Hills Creek
Rosebud Creek
Grand Valley Creek
Scroggie Ck
Wareham Creek
Willow Creek
Pelly Crossing
Minto
White River
Dip Creek
Klotassin
Big Creek
Main Map Area
Dawson City
Whitehorse
Legend
Coffee Project
Highway
Proposed Route
Regional Study Area
Wolverine Denning Habitat Suitability
Very Low (0)
Low (1-3)
Moderate (4-7)
High (8-10)
FIGURE: 3-5
Wolverine denning habitat suitability
Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
Project data displayed is site specific. Denning habitat suitability created by EDI Environmental Dynamics Inc. (2016).
Disclaimer
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3.4 GREY WOLF

Grey wolves are widely distributed around the globe although range contraction has occurred in many regions due to habitat loss and fragmentation (Mech and Boitani 2010). Wolves are abundant in Yukon and are not a conservation concern federally or territorially (Government of Yukon 2012). The wolf population in Yukon is believed to fluctuate but is considered relatively stable with a total population of approximately 4,500 to 5,000 (Government of Yukon 2012).

Wolf populations have been shown to be correlated to the abundance of their ungulate prey species, primarily moose and caribou (Messier 1994). Total wolf population and wolf densities are an important factor in determining population dynamics of ungulates (Messier 1994). Wolves hunt in packs of varying sizes, with differing rates of hunting success depending on pack size (Hayes *et al.* 2000).

Wolves are widely distributed across the landscape, moving over large ranges and inhabiting any areas where prey species are available. In the spring, females give birth to pups which are raised in a den. Litter size is typically five or six pups (Mech and Boitani 2010). Wolf dens may be multi-generational, being used and developed over many years. Dens are sensitive to human disturbance and may be abandoned if human activity occurs nearby (Frame *et al.* 2007). No wolf dens have been identified in the RSA to date.

The wolf population in the RSA is unknown; however, local knowledge indicates that wolf populations within the region are healthy and relatively abundant, with 'lots of wolves in the area' (Interview 14 & 15, pers. comm. 2016). During Project baseline surveys, wolves were observed throughout the RSA incidentally during aerial ungulate surveys (Table 3-5), during the snow track surveys conducted in 2015 and 2016 (Figure 3-6), by remote trail cameras, and by Project personnel (EDI 2017a).

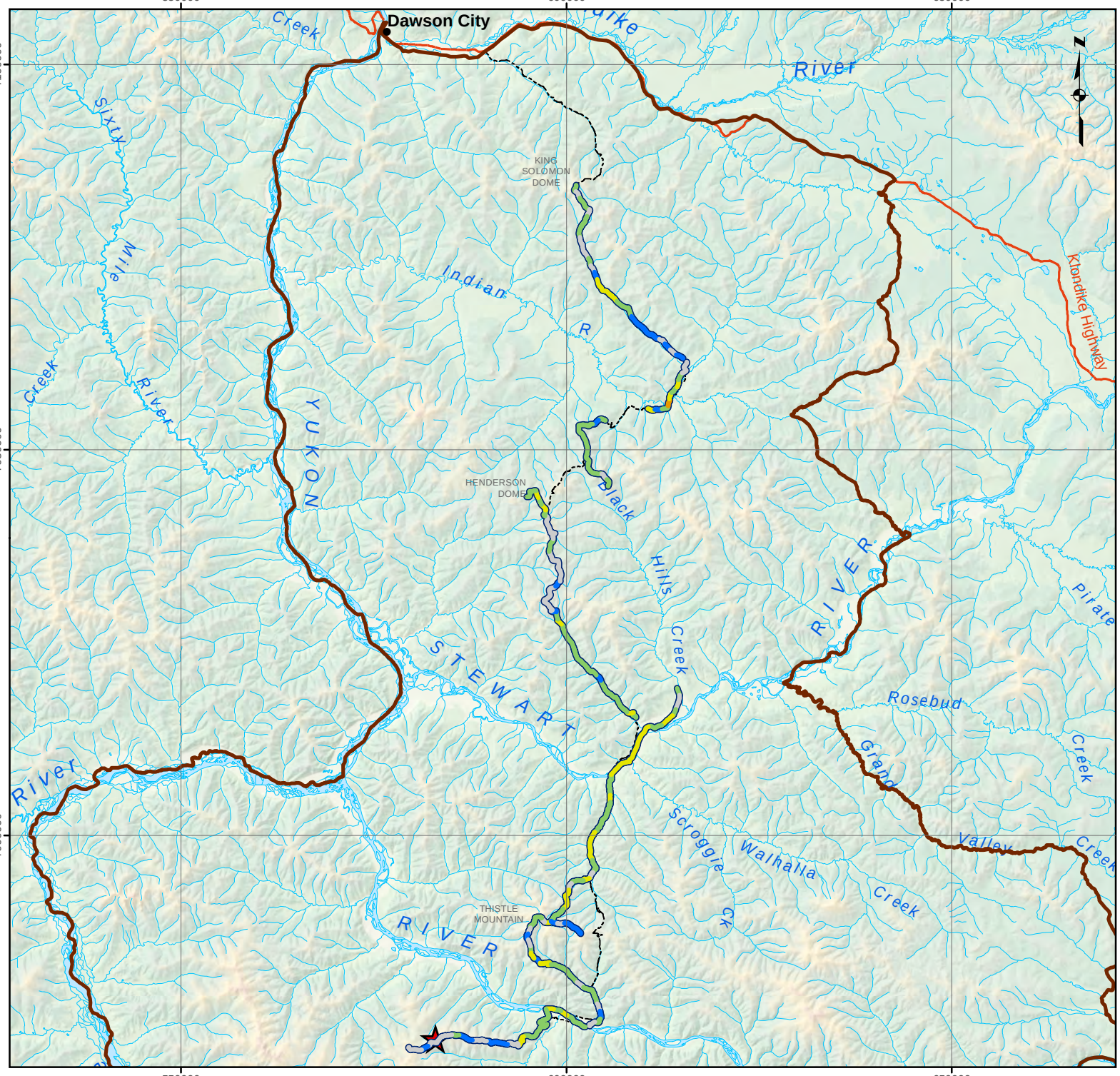
Table 3-5. Incidental observations of grey wolves during regional ungulate surveys in the RSA.

Survey	Location	Survey Area	Wolf Observations	Source
2012 Late Winter Moose Survey: Lower Stewart River — White Gold Area	Southern sections of Coffee RSA & surrounding areas	11,490 km^2	Four groups of wolves totalling 14 individuals	O'Donoghue *et al.* 2013b
2012 Early Winter Moose Survey: Lower Stewart River West — White Gold Area	Southern sections of Coffee RSA	6,751 km^2	One pack of 8 wolves and 3 individual wolves	O'Donoghue *et al.* 2013a
2014 Coffee Project Late Winter Survey	Southern sections of RSA	3,500 km^2	Two wolves	EDI 2017a
2015 Coffee Project Late Winter Survey	Southern sections of RSA & NAR corridor	7,300 km^2	Wolf tracks were noted in several locations but no wolves observed	EDI 2017a
2015 Early Winter Moose Survey: Dawson Goldfields	Northern sections of RSA	N/A	Three wolf packs with 12-13 wolves in each pack and 2 individual wolves	M. Suitor, pers. comm., 2016 (report pending)
2016 Coffee Project Late Winter Survey	Southern sections of RSA & NAR corridor	6,350 km^2	One pack of 4 wolves	EDI 2017a

Wolf tracks were observed during snow track surveys conducted in both February 2015 along the Java Road and February 2016 along the NAR. During the Java Road snow track surveys, wolf tracks were observed on six of the 31 transects, five of which were located in the boreal high and one in the subalpine bioclimate zone. Most of these observations were located on transects along Coffee Creek, the Yukon River, and the lower elevations of the Java Road (EDI 2017a). During the 2016 snow tracking surveys along the NAR, wolf tracks were observed in 132 of the 204 1-km segments and were more commonly observed in the lower elevation areas (average elevation of observations was 674 m), but were observed throughout the entire elevational range of the survey route (Figure 3-6). Wolf tracks were observed more in the following areas (from north to south): Sulphur Creek, Eureka Creek, Henderson Dome, along the Stewart River, Barker Creek, and near and along the Yukon River (refer to Figure 1-1 for road segments).

During Project consultation, concerns were raised regarding the potential for Project activities to result in increased wolf use along the NAR during the winter, thereby potentially leading to increased predation rates. In response to these concerns, a paired site remote camera study was initiated in November 2015 to document current use of roads in the RSA. During the winter of 2015/2016, wolves were captured on at least one of two paired cameras at each of the six locations. Wolves passed cameras on the NAR 76 times with pack size ranging from one to ten animals. A total of 199 wolves were counted passing paired cameras along the NAR; however, the same individuals may have been captured on multiple occasions. The majority of wolf observations along the proposed NAR were along the Indian River, Stewart River/lower Barker Creek, and Ballarat Creek valleys. With the exception of Ballarat Creek (Site A), it appears that wolves currently use the existing roads along the NAR alignment more than they use the off-route roads (EDI 2017a).

Wolves are managed as a big game species and as a furbearer, being both hunted and trapped across Yukon. Wolf pelts are an important source of revenue for First Nation and non-First Nation trappers within the RSA (InterGroup 2009). On average 155 wolves are trapped and 60 are harvested by hunters in Yukon every year (Government of Yukon 2012). In the GMSs and RTCs that overlap with the RSA, a mean annual harvest of 16 wolves per year was reported between 2004 and 2013 (Table 3-6; Government of Yukon 2016a). Due to their ability for rapid, widespread dispersal and rapid breeding, wolf populations are resilient to population decline from harvest mortality. There is currently no threat of unsustainable harvest or loss of genetic diversity in Yukon wolf populations (Government of Yukon 2012).



Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area

Wolf Tracks Observed

- No Tracks
- Few
- Some
- Many
- Old Tracks

FIGURE 3-6

2016 Late winter snow tracking survey: wolf

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

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3.5 OTHER FURBEARERS

In addition to wolverine and wolf, several other high-value furbearing species are present in the RSA including Canada lynx, American marten, red fox, coyote, red squirrel, American mink, common muskrat, northern river otter, ermine, least weasel, and American beaver. Project baseline surveys documented many of these species throughout the RSA during snow track surveys and incidentally on various other surveys. American marten, Canada lynx, and red squirrel were the most common furbearers documented during snow track surveys. Coyote was documented in the RSA during baseline studies, but based on Project observations and local knowledge (Interview 15, pers. comm. 2016) appears to present in only small numbers. Likewise, while Arctic fox is reported as being harvested in the RSA, this is believed to be an extralimital occurrence; baseline studies did not detect this species and the RSA is well outside the documented range for Arctic fox in Yukon (Government of Yukon 2016b).

Management of furbearers and trapping is the responsibility of Environment Yukon. Trapping harvest statistics are recorded for each registered trapline concession (RTC). Harvest statistics for individual RTCs are considered private and therefore trapline data provided by Environment Yukon represents a coarse view of furbearer harvest in the RSA. Twenty RTCs intersect with the RSA and harvest statistics are reported from two blocks (Figure 3-7):

- North Block — North of the Stewart River (RTCs 23, 27, 30, 53, 54, 57, 58, 60, and 62)
- South Block — South of the Stewart River (RTCs 61, 64, 114, 115, 116, 121, 122, 132, and 133)

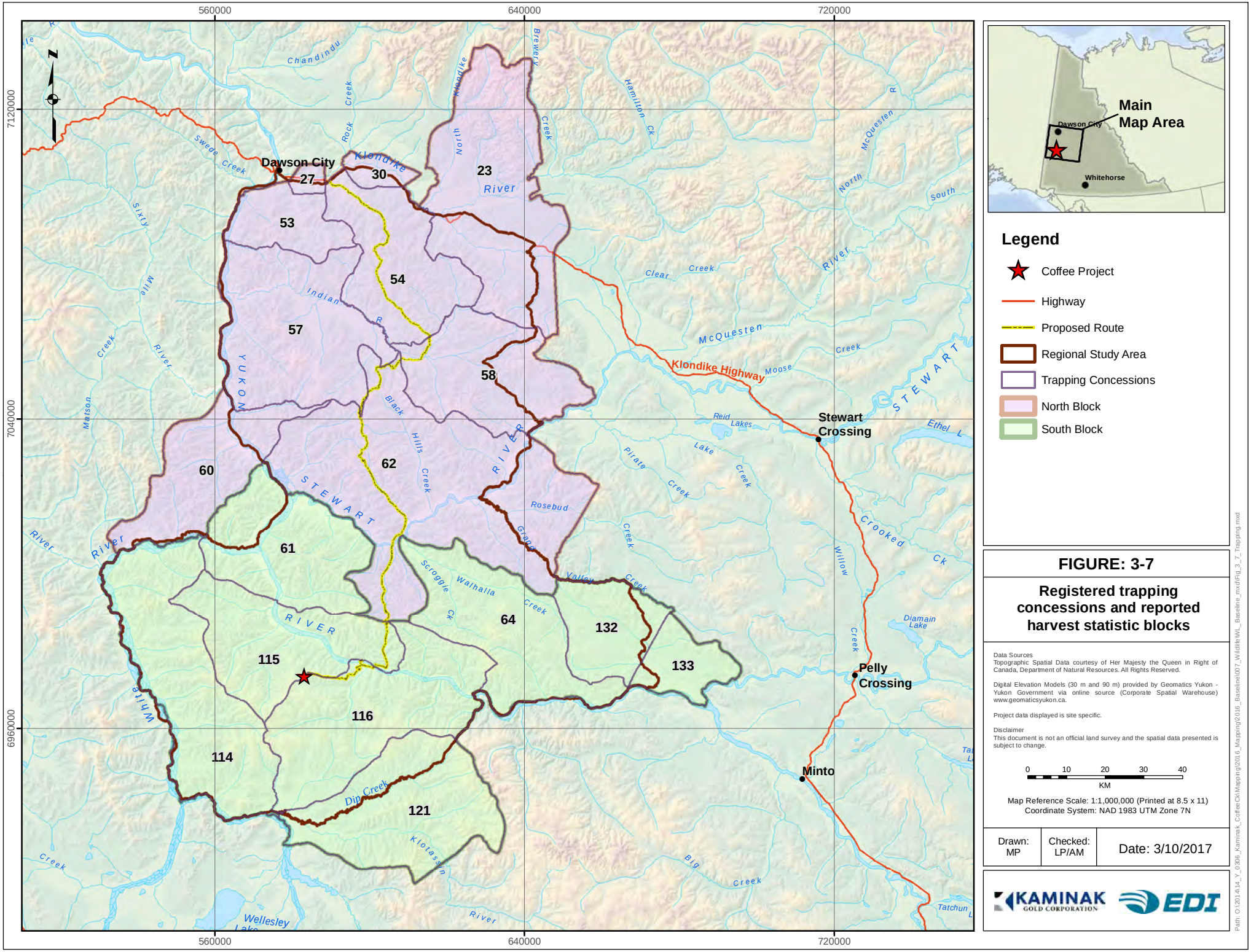
According to Yukon Conservation Services, the RSA, particularly the northern sections of the RSA overlapping game management zone 3, is a very active trapping area (K. Meister, pers. comm. 2016). Based on current trapping records (Table 3-6) and discussions with local trapping concession holders (e.g. Interview 14 & 15, pers. comm. 2016), Canada lynx and American marten are key harvest species in the region; however, various other species are also important to local trappers. Table 3-6 lists the mean annual, minimum annual, maximum annual and total harvest for each furbearing species harvested within the North and South Blocks from 2004 to 2013.

Table 3-6. Furbearer harvest statistics from registered trapline concessions that interact with the RSA north and south of the Stewart River.

Animal	Mean annual harvest (2004-2013)		Minimum annual harvest (2004–2013)		Maximum annual harvest (2004–2013)		Total Harvest (2004–2013)	
	North	South	North	South	North	South	North	South
Beaver	19.3	9.8	0	0	45	55	193	98
Coyote	0.5	2.3	0	0	2	7	5	23
Arctic fox	0.4	0	0	0	3	0	4	0
Red fox	9.3	2.8	0	0	23	5	93	28
Lynx	78.1	22.5	18	5	157	64	781	225
American marten	182.4	75.6	77	4	440	170	1,824	756
Mink	3.5	1.5	0	0	14	4	35	15
Otter	0.3	0.2	0	0	2	2	3	2
Red squirrel	14.1	10.6	0	0	52	86	141	106
Weasel	12.7	1.2	3	0	40	5	127	12
Wolf	10.1	5.7	1	3	24	8	101	57
Wolverine	6.3	3.9	2	0	12	8	63	39

According to Traditional Knowledge, many of the species currently harvested in the RSA have a long history of harvest in the region (e.g., Pearse and Weinstein 1988; Mishler and Simeone 2004; InterGroup Consultants Ltd 2009; Tr'ondëk Hwëch'in 2012a, 2012b; Bates and DeRoy 2014; Dobrowolsky 2014), and local First Nations specifically report having harvested beaver, muskrat, mink, marten, snowshoe hare, gopher, fox, lynx, and wolverine in the Coffee Creek area (Tr'ondëk Hwëch'in 2012a; Bates and DeRoy 2014; Dobrowolsky 2014). The trapping of furbearers for their furs and meat was, and continues to be, an important way of life for local First Nations (Pearse and Weinstein 1988; InterGroup Consultants Ltd. 2009; Calliou Group 2012; Tr'ondëk Hwëch'in 2012b; Bates and DeRoy 2014).

Due to the relative abundance of American marten and Canada lynx within the RSA, and their importance to First Nations and the fur harvest industry, these species are described further in the following sections.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Moose
Stewart Crossing
Reid Lakes
Pirate Creek
Lake Creek
Ethel L
Crooked Ck
Willow Creek
Diamain Lake
Pelly Crossing
Minto
Tatchun L
Big Creek
Tatchun River
Wellesley Lake
Dip Creek
Klotassin
Scroggie Ck
Walhalla Creek
Valley Creek
Rosebud Creek
Black Hills Creek
Indian R
Sixty Mile Creek
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64
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116
114
121
132
133
YUKON
STEWART
RIVER
Legend
Coffee Project
Highway
Proposed Route
Regional Study Area
Trapping Concessions
North Block
South Block
FIGURE: 3-7
Registered trapping concessions and reported harvest statistic blocks
Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
Project data displayed is site specific.
Disclaimer
This document is not an official land survey and the spatial data presented is subject to change.
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Map Reference Scale: 1:1,000,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N
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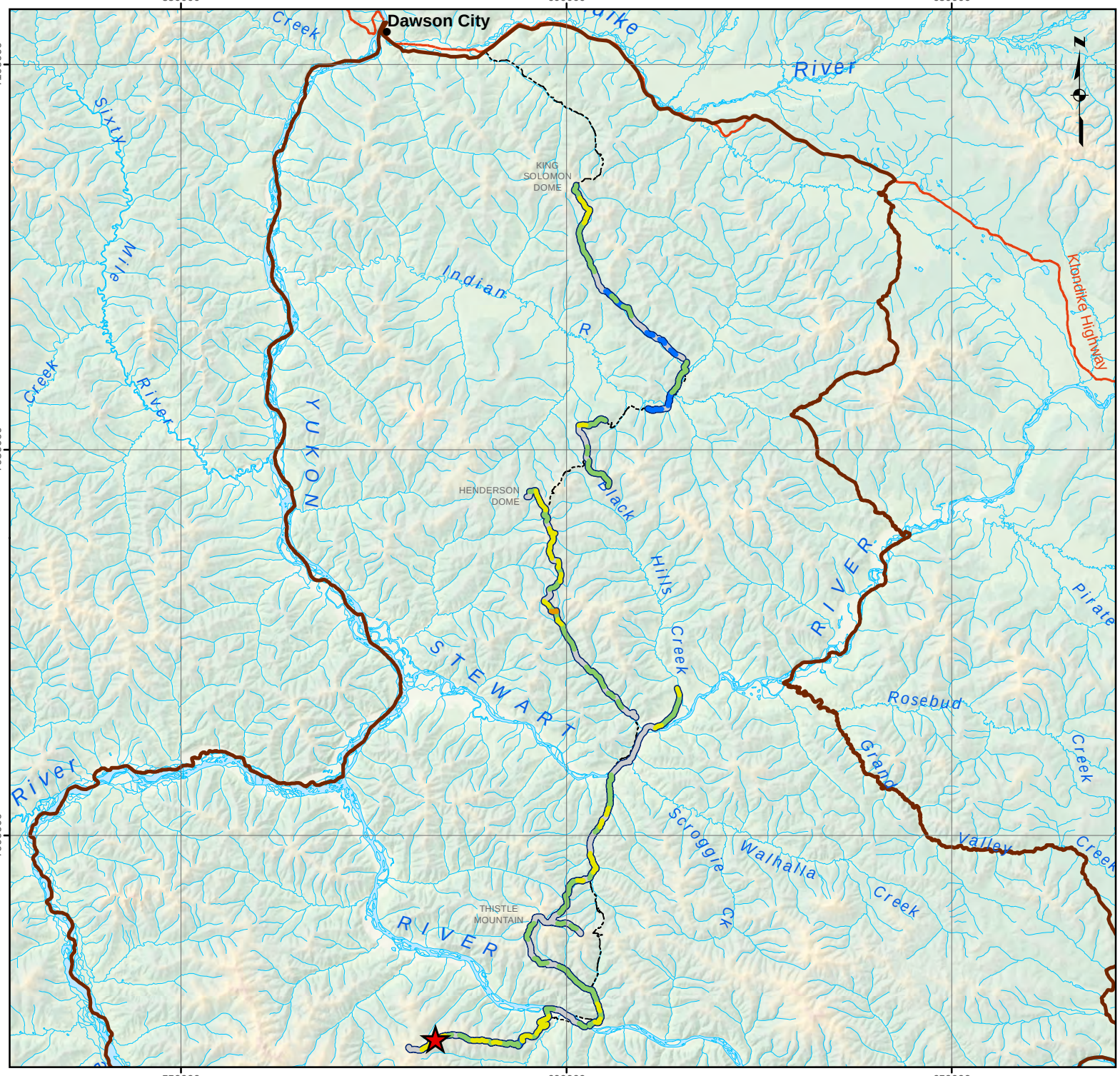
3.5.1 AMERICAN MARTEN

American marten are widely distributed across Canada and some of the northern United States (Reid and Helgen 2008). Marten occur in forested areas throughout Yukon. While no population estimates exist and trend data is primarily based on trapping harvest reports, marten are considered Secure in Yukon (CESCC 2011) and have not been assessed by COSEWIC with the exception of the Newfoundland sub-species (*Martes americana atrata*) which was assessed as Threatened (COSEWIC 2007).

Marten primarily inhabit mature coniferous forests with closed canopies and abundant standing and downed woody debris (Buskirk and Powell 1994). In Yukon, they have also been known to use early successional forest and disturbed forest areas although older coniferous forests are certainly their preferred habitat (Slough 1989). Dens are located in enclosed features such as downed trees, tree cavities, burrows, rock piles, or brush piles (Hatler *et al.* 2008). Marten primarily feed on small mammals such as voles and mice but have also been observed forging opportunistically on berries, birds, and snowshoe hare (Slough *et al.* 1989).

Marten are a commonly trapped species in Yukon. Marten were the most frequently harvested furbearer in the RSA between 2004 and 2013 with an annual average of 182 and 75 being harvested from North and South Blocks, respectively (Table 3-6). In the RSA, annual marten harvest ranged from ~80 (2009) to over 600 (2006) animals. Local trapline concession holders report that marten are abundant in the region and populations are generally healthy (Interview 14 & 15, pers. comm. 2016) although density and distribution can fluctuate, particularly in response to forest fires (Interview 15, pers. comm. 2016). Marten are widespread, but are particularly abundant in forested habitats and in the 'high country' (Interview 14 & 15, pers. comm. 2016). One of the interviewees reported that in the northern sections of the RSA, marten populations did not seem to be affected by the placer mines and associated roads (Interview 15, pers. comm. 2016).

Marten have been observed incidentally on multiple occasions within the LSA by Project personnel and on the wildlife cameras (EDI 2017a). Marten were also one of the most commonly documented species during snow track surveys where they were found in a wide range of habitat types including boreal forest, subalpine shrub, and burns throughout the survey area (Figure 3-8). The spatial distribution and frequency of marten observations throughout the LSA indicate that marten are likely to interact with the Project, wherever suitable habitat exists.



Legend

- Coffee Project
- Highway
- Proposed Route
- Regional Study Area

American Marten Tracks Observed

- No Tracks
- Few
- Some
- Many
- Very Many
- Old Tracks

FIGURE 3-8

2016 Late winter snow tracking survey: American marten

Data Sources
Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Project data displayed is site specific. Data collected by EDI (2016) was obtained using Garmin GPS technology.

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Map Reference Scale: 1:700,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

Drawn: LG	Checked: AM/LP	Date: 3/10/2017

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3.5.2 LYNX

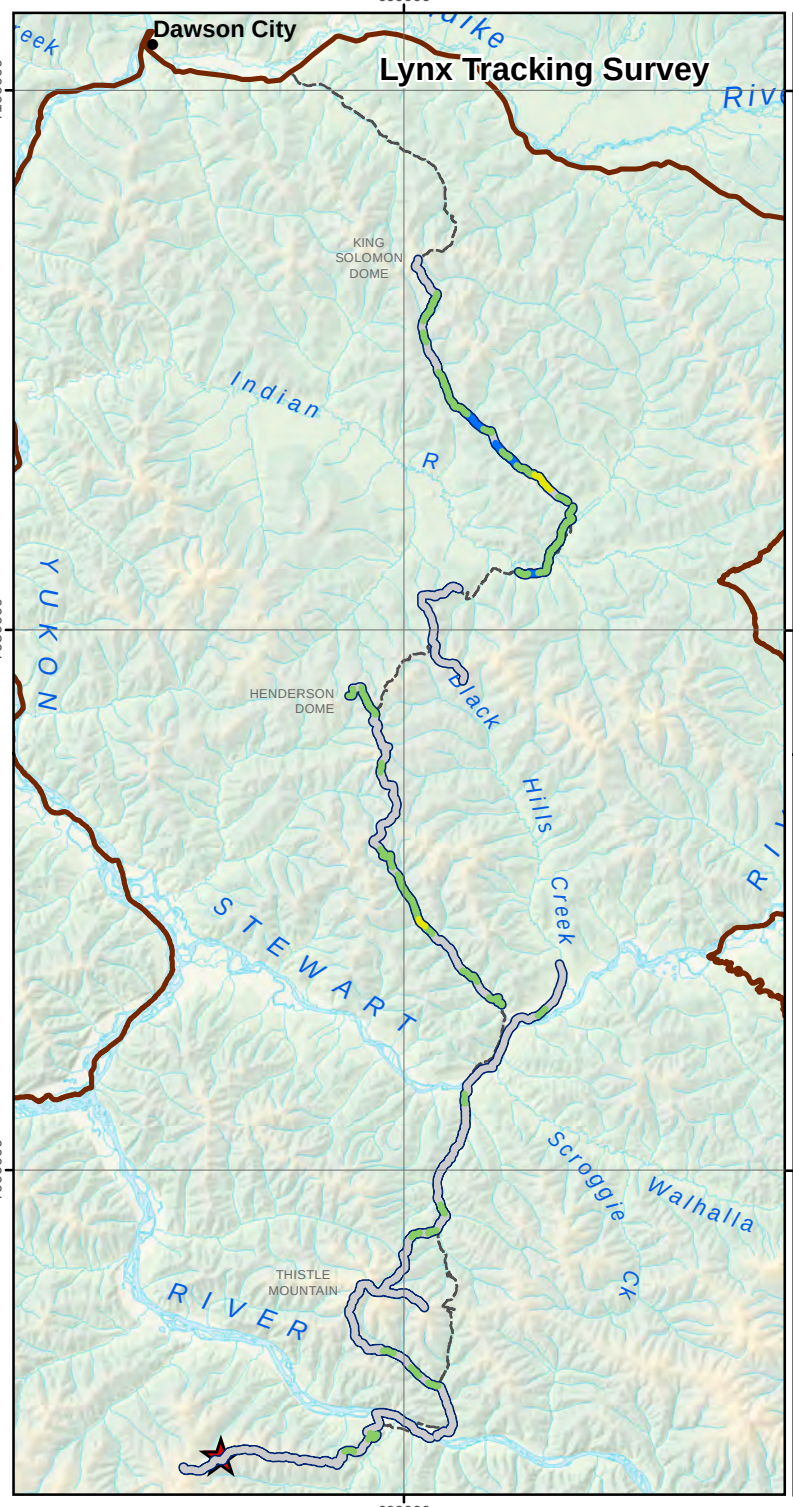
Canada lynx are distributed across the forested regions of Canada and parts of the northern United States. Their Yukon range includes the entire territory with the exception of the Arctic coastal plain which is not forested. Lynx populations fluctuate broadly every 9 to 11 years, depending on the cyclical abundance of snowshoe hare, their primary prey species (Stenseth *et al.* 1997). There are no estimates of Yukon lynx population size available.

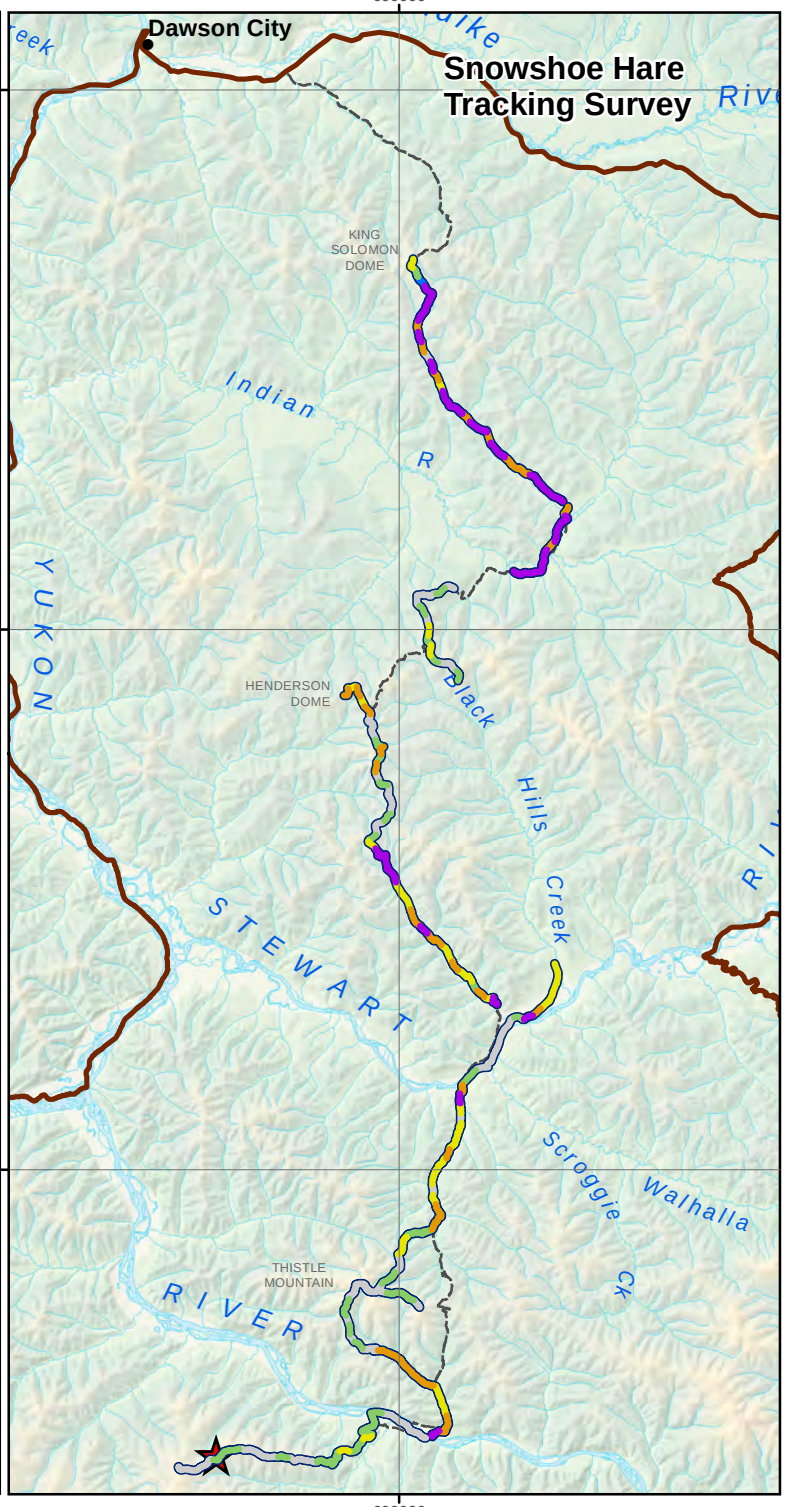
Lynx have high potential for population growth as demonstrated by their rapid increase in numbers during periods of high prey abundance. They also have been found to migrate vast distances during times of low prey abundance, increasing their resilience to local disturbances. No evidence has been found to suggest recent overall declines in lynx numbers or distribution. Lynx were assessed as Not at Risk by COSEWIC (Poole 2001) and are considered Stable territorially (CESCC 2011).

Lynx dens are often located in areas with thick vegetation growth or blowdown debris which offer some form of overhead protection (Slough 1999). Dens are not re-used year to year but they remain an important habitat feature for lynx recruitment. No lynx dens have been identified in the RSA to date, although targeted surveys for lynx dens were not conducted. Remote cameras did capture family groups of lynx on multiple occasions and lynx are assumed to den in the RSA.

Lynx are the second most frequently trapped animal in the RSA with an average of 78 and 22 lynx harvested annually in the North and South Blocks, respectively (based on 2004–2013 harvest data; Table 3-6). Trapping harvest of lynx typically follows lynx population cycles. Within the RSA lynx harvest increased between 2004 and 2007. A maximum of 157 and 64 lynx were harvested annually in the North and South Blocks, respectively. From 2008 to 2013 lynx harvest numbers generally decreased with the lowest reported harvest of lynx occurring in 2013, the last year of available trapping data.

Lynx have been observed incidentally within the LSA on many occasions by Project personnel, by remote cameras deployed for wildlife field programs and during the 2016 late winter ungulate survey (EDI 2017a). In particular, remote cameras photographed 270 lynx during 2015 and 2016 (although some of these observations were likely of the same individual). Lynx tracks were observed many times during 2015 and 2016 snow tracking surveys (Figure 3-9). Lynx presence generally occurred in lower elevation, unburned boreal forest areas. Lynx presence also correlated with the presence of snowshoe hare, their main prey (Figure 3-9). During snow tracking surveys, lynx were only observed in areas where snowshoe hare tracks were also observed. The proposed Project is most likely to interact with lynx and lynx habitat in the lower elevation boreal forest regions along the NAR.





Legend

- Settlement/Community
- Coffee Project
- Highway
- Proposed Route
- Regional Study Area

Lynx & Snowshoe Hare Tracks Observed

- No Tracks
- Few
- Some
- Many
- Very Many
- Old Tracks

FIGURE 3-9

2016 Late winter snow tracking survey: lynx and snowshoe hare

Project data displayed is site specific. Data collected by EDI (2016) was obtained using Garmin GPS technology.

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KM

Map Reference Scale: 1:700,000 (Printed at 8.5 x 11)
Coordinate System: NAD 1983 UTM Zone 7N

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4 SMALL MAMMALS

Several species of small mammals were studied during the Coffee Project wildlife baseline program in 2014 and 2015 (EDI 2017a). Table 4-1 provides a summary of small mammal studies conducted for the Project.

Table 4-1. Summary of small mammal studies and surveys.

Date	Target Species	Objectives	Methods
August 1–11, 2014	Bats	Document species composition	Remote acoustic monitoring at Coffee camp and Latte deposit
August 25–27, 2014	Collared Pika	Document distribution	Point Count surveys on talus patches within 5 km of proposed Project infrastructure
August 3, 2015 August 28–30, 2015	Collared Pika	Document distribution	Point Count surveys on talus patches within 5 km of proposed Project infrastructure
August 26–31, 2015	Mice, Voles	Document species composition, collect samples for trace metal analysis	Snap trapping along 3 traplines set up in different habitat types

4.1 COLLARED PIKA

Collared pika are a species of small lagomorph (rabbit family) found in alpine regions throughout the Beringian areas of Yukon, British Columbia, Northwest Territories and Alaska. Collared pika were assessed as a species of Special Concern by COSEWIC in 2011 primarily due to their predicted sensitivity to climate change and poor dispersal abilities.

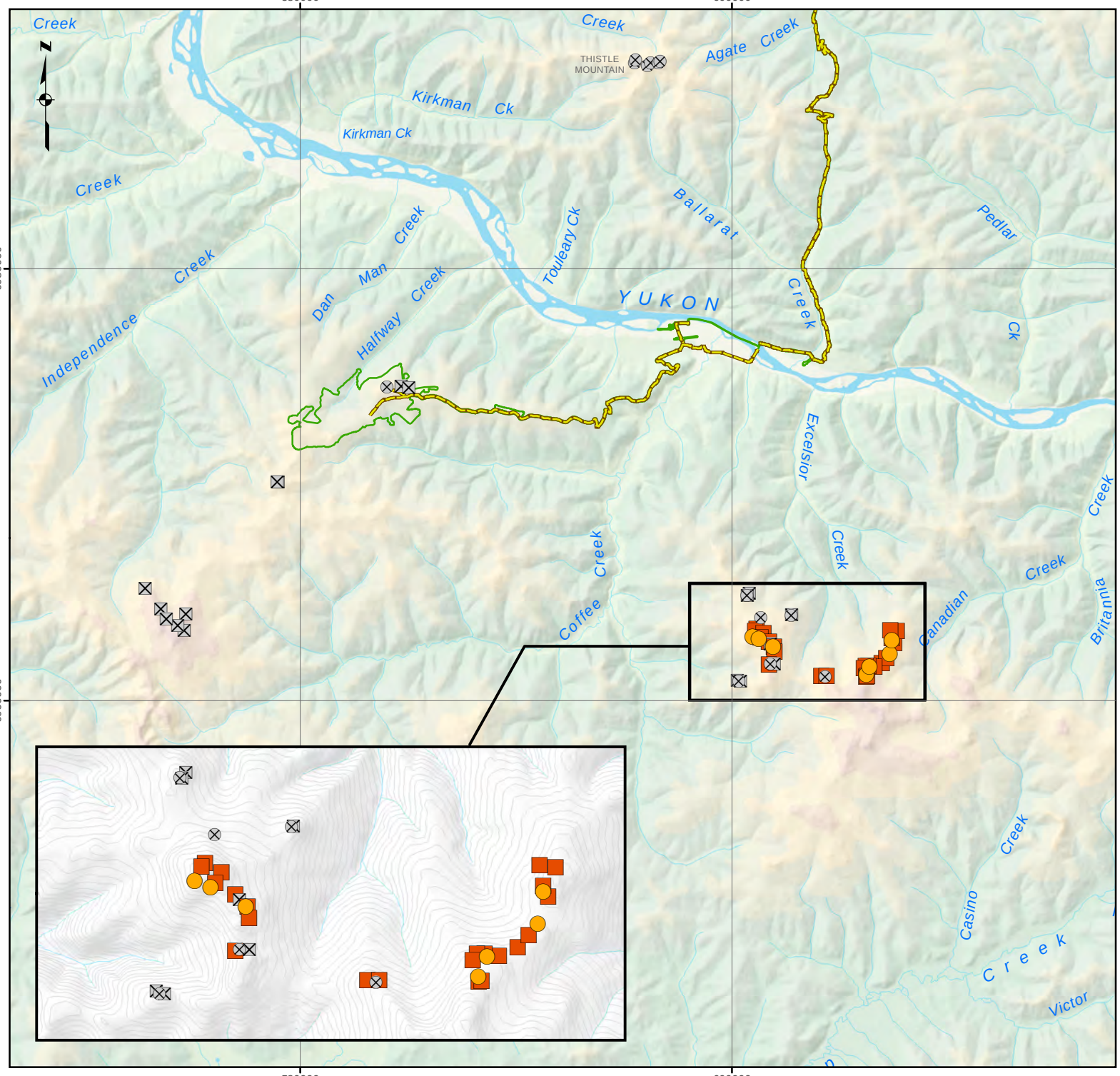
The habitat requirements for pika consist of alpine boulder fields (talus) in close proximity to alpine meadows. Pika rely on talus areas, using the interstitial spaces between boulders for shelter, predator avoidance, and food storage. They also rely on meadows close to these talus patches to provide forage opportunities. During summer, pika will collect and store forage materials, primarily graminoids, leafy shrubs, and forbs (Hudson *et al.* 2008) in food caches called haypiles which allow them to survive during the winter months. Pika are highly territorial and actively defend their haypiles and foraging grounds. Due to their specific habitat requirements, pika habitat is naturally fragmented across their range.

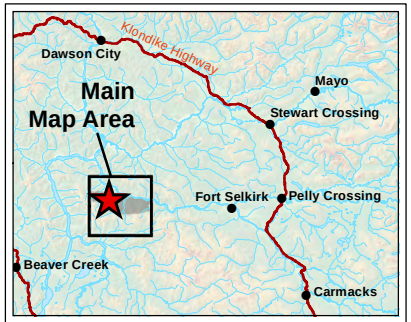
Little is known regarding the total population size or average colony size of collared pika as they are not well-studied and often inhabit remote alpine habitats. Almost all available information on collared pika comes from one location in the Ruby Ranges of southwestern Yukon where long-term studies have been conducted (Franken and Hik 2004; Morrison and Hik 2007; Hudson *et al.* 2008). Pika exhibit metapopulation characteristics with many distinct sub-populations interconnected by occasional dispersal and migration events (Franken and Hik 2004). Dispersal and migration are not well understood for pika. Franken and Hik (2004) found that post-weaning juveniles disperse typically less than 500 m from their birthplace. Long-distance dispersal between mountain ranges has not been documented and is thought to very rarely occur.

No studies have been conducted to date to determine the frequency and rates of collared pika mortality from different sources. Studies in the Ruby Ranges have found correlations between annual pika mortality and climate conditions suggesting that cold exposure in low snow years and starvation in late snowmelt years may be important factors in determining annual mortality rates (Morrison and Hik 2007). Little is known about pika predation but it is likely that predators include weasels, red fox, and raptors (COSEWIC 2011b).

In the western United States studies on American pika (*Ochotona princeps*), a closely related species, have found a link between climate warming and upslope retreat of populations (Beever *et al.* 2003; Rodhouse *et al.* 2010). As lower elevation habitats become less suitable due to changing temperature and moisture conditions, pika populations may become more fragmented and isolated, increasing the risk of local extirpations due to stochastic environmental conditions (Beever *et al.* 2003). Studies conducted on collared pika suggest that habitat fragmentation, which may be exacerbated by climate warming, is a concern for this species as well (Franken and Hik 2004). Climate change may also increase the variability of temperature, precipitation, and extreme weather events which can directly and indirectly affect pika survival (Morrison and Hik 2007; COSEWIC 2011b).

Baseline studies for the Coffee Project included two years of pika surveys in suitable habitats within 5 km of Project infrastructure. During these surveys, pika were only located in the southeastern corner of the Coffee Property (Figure 4-1; EDI 2017a). The two years of baseline surveys confirmed occupancy in many talus patches within this area; however, pika were not found to occupy any other talus patches within the survey extent. Pika were not found within the Project LSA and the surveys indicated that potential habitat within the LSA was extremely limited and marginal in quality. Pika are not likely to interact with the Project due to the large distance between proposed infrastructure and the documented pika colonies and their poor ability to disperse.





Legend

- Proposed Route
- Project Footprint

2014 Pika Survey Results

- Pika Detected/Observed
- No Pika Detected/Observed

2015 Pika Survey Results

- Pika Detected/Observed
- No Pika Detected/Observed

FIGURE: 4-1

Pika survey effort & observations for the Coffee Gold Project

Data Sources
1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2014 & 2015).

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Map Reference Scale: 1:250,000 (Printed at 8.5 x 11)
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4.2 BATS

Information on bat distribution, seasonal activity patterns, and roosting habitats for Yukon is not well studied; however, five species of bats are known to occur in the territory. Little brown myotis (little brown bat) is the most wide-spread bat species within the territory and can be found from Dawson south to the British Colombia border (Slough and Jung 2008; Government of Yukon 2011b; Slough et al. 2014), typically below 1,000 m in elevation (Slough and Jung 2008). Other Yukon bat species include northern long-eared myotis, big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*) and long-legged myotis (*Myotis volans*) found in the south-eastern and south-central parts of Yukon (Slough and Jung 2008; Slough et al. 2014).

The northern long-eared myotis and the little brown myotis species have been emergency listed under the federal SARA as the result of drastic population declines from white-nose syndrome in eastern Canada. The little brown myotis and the northern long-eared myotis are both listed as endangered territorially (Government of Yukon 2014b). Little brown myotis is common across much of Canada and it is believed that the total population was likely greater than one million and relatively stable prior to the discovery of white-nose syndrome in 2006 (COSEWIC 2013). Ongoing studies of little brown myotis in Yukon aim to increase knowledge of this species and establish a long-term data set to assess population trends territorially (Jung and Kukka 2014). Several recent studies of bat colonies infected with white-nose syndrome in eastern Canada and the United States show a decline of greater than 90% population within three years of infection (Mainguy and Derosiers 2011; Turner et al. 2011; COSEWIC 2013). White-nose syndrome remains the primary concern for conservation of this species although white-nose syndrome is not believed to have expanded into Yukon bat populations yet (COSEWIC 2013).

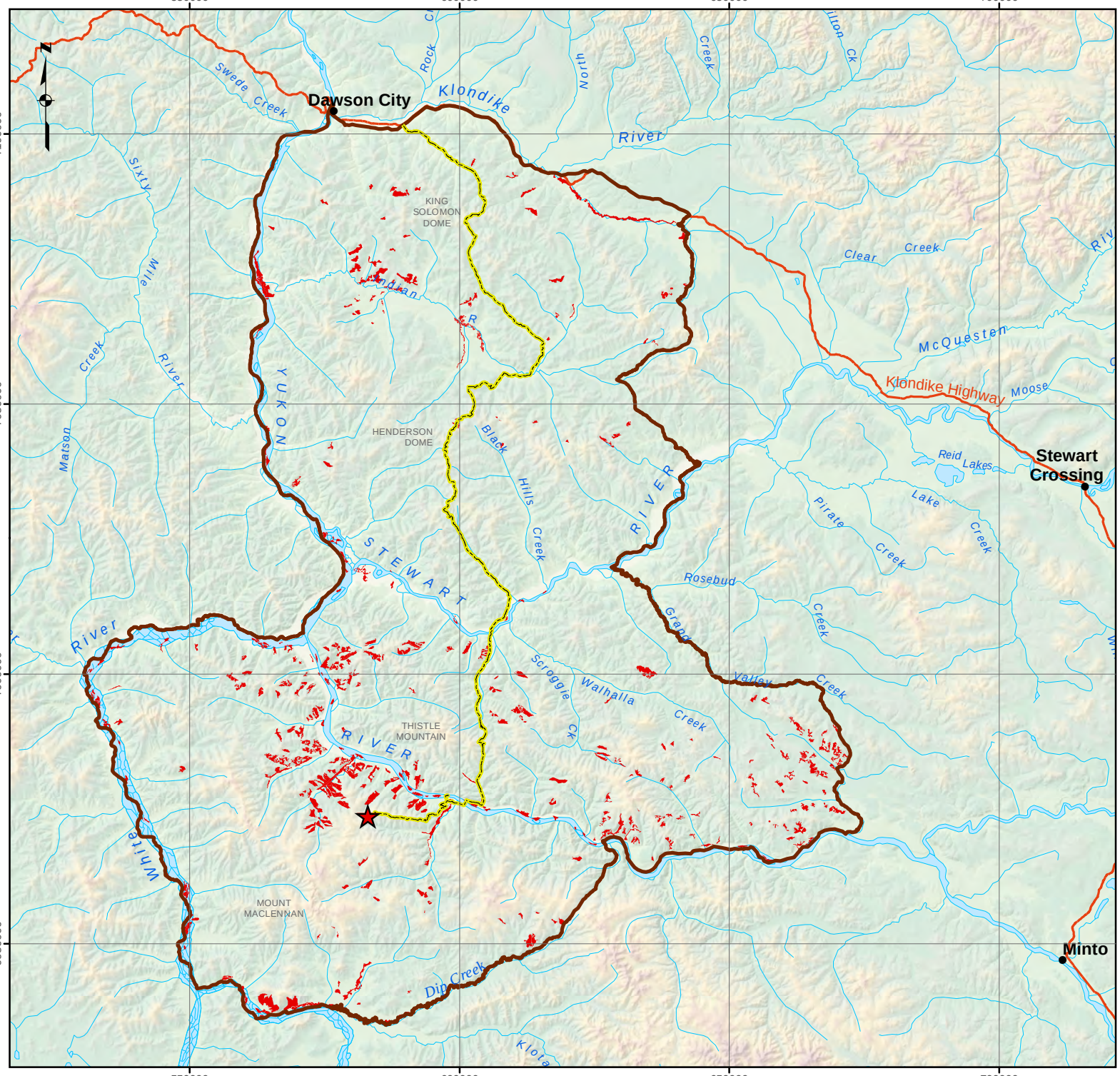
Acoustic surveys for bats within the Project LSA were conducted in August 2014 in two locations: the first at a wetland in the Yukon River floodplain near the current Coffee camp (430 m elevation), and the second near the proposed mine site in the Latte deposit area (1105 m elevation). Little brown myotis was detected on all four survey nights at the Coffee camp location, but was not detected in the Latte area, which was surveyed for six nights (EDI 2017a). Previous studies in Yukon have found that little brown myotis is generally found below 1,000 m in elevation (Slough and Jung 2008), which is consistent with the lack of detections in the Latte area. No other bat species were detected during the investigations and based on existing knowledge no other species are expected within the Project area.

Little brown myotis can usually be found in Yukon between mid- to late April and late September/early October. Females typically begin to occupy maternity colony roosts in Yukon during the last two weeks of April, with pups typically born from late June through mid-July. Maternity colonies began to disband in early August with only a few bats, mainly juveniles, remaining by September (Slough and Jung 2008) or early October (Government of Yukon 2011b). Nagorsen and Brigham (1993) reported no bat hibernacula north of 52°N in British Columbia. Hibernating bats have not been found in the Yukon and it is believed that bats likely migrate to winter hibernacula outside of Yukon (Slough and Jung 2008).

In the summer, little brown myotis forage for insects, typically over water, during the night (Jung et al. 1999). Foraging habitats are generally found within 500 m of water and include riparian, lacustrine, shoreline, and, to a lesser degree, forested habitats (Slough and Jung 2008). Studies in B.C. have also found

little brown myotis foraging over bluffs and forest openings (Nagorsen and Brogham 1993). During the day little brown myotis roost in tree cavities, on cliffs, and on artificial structures. Female bats also establish summer maternity roosts to give birth to and raise pups (Fenton and Barclay 1980). Most known maternity roosts in Yukon are located in buildings; however a few natural roosts are known in rock crevices and trees (Slough and Jung 2008). Bats typically emerge at sunset to forage and return to their day roost by sunrise. They may travel long distances in a night between their foraging and roosting areas. One-way commuting distances from roost to foraging areas can range from less than 1 km to as far as 20 km (Pierson 1998).

Based on the detection of little brown myotis at the Coffee camp survey location, and previous records of little brown myotis near Dawson (Slough and Jung 2008), the species is expected to be present, in low numbers, in suitable, low-elevation (i.e., below 1,000 m) habitats throughout the RSA. Little brown myotis are most likely to interact with Project infrastructure and activities during the summer months in areas with potential for roost sites or foraging habitat. Roosting habitat is expected to be the most limiting factor within the RSA; to characterise the availability of roosting habitat a basic habitat suitability model was conducted. Because specific roosting features such as tree cavities, rock crevices, caves and under the bark of trees, are difficult to identify at a broad-scale, old forest (i.e. > 130 years) below 1,000 m in elevation was used as a surrogate for potential roosting habitat (Figure 4-2). This habitat type often contains roosting features like tree cavities and thick tree bark that bats can climb under. The model identified a total of 307.9 km^2 of potential roosting habitat within the RSA; however, only a small fraction of this area is likely to contain the site-specific features required for roosting.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7050000
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Dawson City
Klondike River
Swede Creek
Rock Creek
North Creek
Hilton Ck
Sixty Mile River
KING SOLOMON DOME
Clear Creek
McQuesten
Klondike Highway
Moose
Creek
YUKON RIVER
HENDERSON DOME
Black Hills Creek
Stewart Crossing
Reid Lakes
Pirate Creek
Lake Creek
Matson
STEWART RIVER
Rosebud Creek
Grand Valley Creek
Scroggie Ck
Walhalla Creek
THISTLE MOUNTAIN
White River
MOUNT MACLENNAN
Dip Creek
Minto
Legend
Coffee Project
Highway
Proposed Route
Regional Study Area
Little Brown Myotis Roosting Habitat
Main Map Area
Dawson City
Whitehorse
FIGURE 4-2
Little brown myotis roosting habitat suitability mapping
Data Sources
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Digital Elevation Models (30 m and 90 m) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
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4.3 OTHER SMALL MAMMALS

Other small mammals that have the potential to occur in the LSA include red squirrel, Arctic ground squirrel, northern flying squirrel, snowshoe hare, and several species of species of mice, voles and shrews. While none of the small mammals known to the area are a conservation concern federally or territorially, they remain ecologically important as prey species of larger carnivores and furbearers. Additionally, some small mammal species, in particular Arctic ground squirrel and snowshoe hare, have been used by First Nations people in the area (Pearse and Weinstein 1988). All small mammals present within the LSA are likely to interact with some portion of the proposed Project footprint.

During wildlife baseline studies, northern red-backed voles and deer mice were captured during a small mammal trapping program conducted in August 2015. Red-backed voles were captured in both mature boreal low forest and subalpine shrub habitats. Deer mice were captured less frequently than red-backed voles and only in mature boreal low forest (EDI 2017a). It is expected that these species are both widespread in the Project RSA. It is likely that other species of vole, mouse, or shrew inhabit the LSA; however, none have been detected to date. Trace metals analysis on red-backed voles was also conducted to assess baseline concentrations of trace metals in small mammals (EDI 2017a).

Snowshoe hare were observed incidentally by Project staff and remote cameras on multiple occasions. Snowshoe hare tracks were present throughout the LSA and in many habitat types during snow tracking surveys (Figure 3-9; EDI 2017a). Hare tracks were typically found in lower elevation areas, but were also sometimes detected in subalpine areas. Lynx tracks were often detected in areas where hare tracks were abundant.

5 AMPHIBIANS

Four species of amphibians are known to occur in Yukon: wood frog, western toad (*Anaxyrus boreas*), Columbia spotted frog (*Rana luteiventris*), and boreal chorus frog (*Pseudacris maculate*). Wood frog is the only species expected to occur in the RSA as the other three species are only known to occur in south central and southeast Yukon, near the British Columbia border (Government of Yukon 2013a). The wood frog is common across Yukon and is not a conservation concern territorially, with its Yukon range extending from the British Columbia border north to the Old Crow Flats. It is estimated that there are more than 10,000 mature individuals in Yukon (Government of Yukon 2013b).

The wood frog inhabits a variety of habitats, but is typically found in or near wetlands. Breeding occurs from late April through June in clear shallow ponds (Government of Yukon 2013a). Wood frogs are distinctive for their ability to survive sub-zero winter temperatures. Where most amphibians would freeze and die, wood frogs produce a sugar which acts as antifreeze, preventing their cells from freezing. Their heart stops beating, intercellular liquid freezes and the sediment and water around them freezes but in the spring they thaw out and emerge (Government of Yukon 2013a).

No amphibian surveys were conducted as part of the Project's wildlife field program; however wood frogs were observed incidentally by Project staff on several occasions in lowland habitats within the Yukon River valley. Observations included both adult and juvenile individuals. Wood frog is assumed to occur throughout the Project area in appropriate wetland habitats and will interact with Project infrastructure and activities in these areas.

6 MINERAL LICKS

Mineral licks are important to ungulate species as they provide essential mineral nutrients which otherwise may be lacking in an ungulate diet (Rea *et al.* 2004). Mineral licks can be characterized as 'wet' or 'dry' depending on their location and characteristics. Wet licks are found in moist, muddy areas and are typically used by moose. They are often characterized by a concentration of trails and tracks leading to a wet, muddy spring (Rea *et al.* 2004). Sheep and goats more commonly use dry licks which can be areas of exposed mineral soils on a hillside or cut bank.

During the Project baseline data collection program, several known/suspected mineral licks were reported to the Project team by Environment Yukon and local First Nations. Several field surveys were conducted to locate the reported mineral licks; however, to date no mineral licks have been confirmed in the LSA despite substantial survey effort (EDI 2017a).

A mineral lick was reported in the Barker Creek valley as part of a WKA identified by Environment Yukon (EDI 2017a). EDI biologists conducted a thorough search of the location provided by Environment Yukon and walked the entire length of the proposed NAR that passes through the WKA in August 2015. No evidence of a mineral lick was found. Biologists also noted a lack of other wildlife sign that might indicate a mineral lick in the vicinity (e.g., wildlife trails, extensive ungulate sign).

Reports of a mineral lick in the Coffee Creek area were provided to EDI by both Environment Yukon and TH, although neither could provide a specific location (i.e., geographic coordinates) and descriptions of the site varied. During the summer of 2015, EDI biologists and Kaminak environmental monitors searched several areas within the Coffee Creek valley which matched the descriptions provided, but no mineral licks were located. However, biologists did note an abundance of moose sign throughout the Coffee Creek valley and the surveys did locate several wildlife trails.

During Project consultation for the Coffee Project in late 2015/early 2016, two additional mineral licks in the Maisy May valley and the Black Hills area were reported to the Project team by TH members. A description of each mineral lick and their location was provided by Tr'ondëk Hwëch'in Fish and Wildlife Branch (N. Ayoub, pers. comm. 2016). The reported location of the mineral lick in the Black Hills area is more than 3 km from the proposed NAR, therefore, no interaction with the proposed Project is expected and follow-up surveys will not be conducted in this area. The reported lick in the Maisy May valley is in closer proximity to the proposed NAR; however, a field verification survey and remote camera monitoring conducted in summer 2016 did not identify an active lick in this area. Follow-up discussion and/or field surveys with the TH to confirm the exact location and status of the reported lick are planned.

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