Appendix 18-A

Brucejack Gold Mine Project: Wildlife Characterization Baseline Report

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Pretium Resources Inc.

BRUCEJACK GOLD MINE PROJECT
Wildlife Characterization Baseline Report

PRETIVM





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BRUCEJACK GOLD MINE PROJECT

WILDLIFE CHARACTERIZATION BASELINE REPORT

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Pretium Resources Inc.

Prepared by:

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Vancouver, British Columbia

Executive Summary

Engineers and Scientists

Executive Summary

This report presents the baseline wildlife studies undertaken for the proposed Brucejack Project of Pretium Resources Inc. The Brucejack property is situated within the Sulphurets District in the Iskut River region, approximately 20 kilometres northwest of Bowser Lake and 65 kilometres north-northwest of the town of Stewart, British Columbia (BC). This study provides the final year of baseline reporting for the characterization of wildlife and wildlife habitat within the Project area undertaken from 2010 to 2013.

The wildlife baseline studies included a literature review of management plans specific to the region, identification of species at risk or of interest potentially occurring within the area, and field surveys conducted with a Regional Study Area (RSA). Field surveys were conducted from 2010 to 2013 and focused on mammal, avian, and amphibian communities. Surveys for mammals included moose (*Alces alces*), mountain ungulates (in particular mountain goat [*Oreamnos americanus*]), bats, hoary marmot (*Marmota caligata*), fur-bearing species, wolverine (*Gulo gulo),* and grizzly bear (*Ursus arctos)*. Surveys conducted for birds included raptors, waterbirds, and upland breeding birds. Surveys for amphibians focused on the western toad (*Anaxyrus boreas)*. Incidental observations of wildlife recorded during field surveys are also presented.

Aerial surveys were conducted for moose in the winter, which focused on lower elevation habitats in the study area. Winter survey units (SUs) were delineated for interior and coastal influenced areas. The moose survey results were compared to regional moose habitat use and distribution. Once adjusted for sightability, the 2011 Brucejack population estimates were 160 (± 17 at 90% CI) in the interior and 14 (± two at 90% CI) in the coastal areas. Moose density estimates were 0.42 moose per km^2 in the interior and 0.24 moose per km^2 in the coastal areas. Capable moose habitat within the interior was associated with the Bell Irving River and Bowser Lake. The Bowser River drainage also supports a substantial number of moose. The coastal survey area, on the other hand, had very little capable habitat, resulting in fewer moose observations. The population estimates for moose suggest a substantial decline in the number of moose since regional surveys were conducted two years previous. There have been concerns raised about overharvest of moose in the area and so the decrease in moose density may be a result of increased pressure from harvest, predation or other factors. Productivity estimates, however, were relatively similar to those recorded during regional surveys.

Aerial surveys for mountain ungulates (mountain goat, Stone's sheep, and northern caribou) were flown during the summers of 2010 and 2012, and winters of 2011 and 2013. Mountain goats were the only mountain ungulate observed during the ungulate surveys, however, a small Stone's sheep herd was incidentally detected. The study area included a total of 35 Survey Units within the RSA and focused on areas along the proposed power line route.

The RSA supports a substantial population of mountain goats. The resident mountain goat population contains at least 265 individuals in undeveloped areas and 21 individuals in areas associated with the power line route. The density of goats along the power line route was found to be lower than other areas surveyed in the RSA, in part likely due to historical access and development. Juvenile mortality rate between summer 2010 and winter 2011 was approximately 27% and in more pristine areas of the RSA the kidding ratio was found to be 26 kids to 100 adults, which is similar to previous regional estimates.

Forty-four percent of mountain goats observed during the winter surveys were within provincial goat Ungulate Winter Ranges (UWRs). The UWRs have provincial designation with associated set-backs during sensitive periods of the year. Valuable low elevation goat winter range habitat along the Bowser River and

Bowser Lake was identified (SU11 and SU2), with notable goat activity. These areas would be exposed to proposed Project activities. An additional four SUs, identified as occupied within the Local Study Area (LSA), overlapped some aspect of the proposed development (SU5, SU7, SU22 and SU23). A mineral lick was also identified within the RSA but was a substantial distance from proposed development.

A bat inventory was conducted in the summer of 2012 using an electronic bat detector at six survey locations within the LSA. Bat echolocation calls were recorded at five sites. Low elevation areas within the LSA were found to have suitable bat habitat. A large proportion of bat detections occurred within these areas, including at a lake between Wildfire Creek and McInnes Creek watersheds and in riparian habitat along the Scott Creek and Bowser River confluence.

Bat echolocation sonogram analysis suggested that as many as seven species of bats occur within the LSA. There was high confidence that the western long-eared myotis (*Myotis evotis*) and the little brown myotis (*M. lucifugus*) were detected. The little brown myotis is federally designated as Endangered by COSEWIC (COSEWIC 2012). The northern long-eared myotis (*M. septentrionalis*), silver-haired bat (*Lasionycteris noctivagans*), long-legged myotis (*M. volans)*, and California myotis (*M. californicus)* were also potentially present but sonogram data were not conclusive. The northern long-eared myotis is provincially blue listed (BC CDC 2013b). Suitable conditions exist for winter hibernacula within the LSA; however, none were identified during these studies.

Aerial and ground survey inventories were conducted to locate hoary marmot colonies within the LSA during the summer of 2012. Hoary marmots were found to be abundant but not evenly distributed. A total of 173 hoary marmot colonies were located within seven SUs and approximately 67% of the colonies were expected to be occupied. Survey Unit four and SU seven contained the most colonies. Areas around Brucejack Lake and the deposit also support many active colonies (SU1a, SU2, and SU3). Average marmot colony density was 1.4 (± 0.8 SD) per km^2 for habitat between 1,100 m and 1,600 m (anticipated to support vegetation), and 0.9 (± 0.6 SD) for habitat above 1,100 m due to a decrease in forage habitat quality at higher elevations. These density estimates are similar to regional data.

Habitat information was collected during ground surveys at 18 colonies. Survey Units with extensive, connected habitat tended to have larger colonies. Most colonies were found on west to southeast facing aspects with slopes between 20 and 40 percent. Soils at marmot colonies were typically well-drained and loamy with significant herb and heather-heath vegetation components.

The RSA supports an abundant and diverse group of furbearing species. They were assessed as present/not detected using incidental information, the provincial Fur Harvest Database, and socio-economic studies. Nine fur-bearer species were confirmed to be present in the RSA from incidental observations: wolverine (*Gulo gulo)*, fisher (*Martes pennant)*, American marten (*Martes Americana)*, red squirrel (*Tamiasciurus hudsonicus)*, grey wolf (*Canis lupus)*, black bear (*Ursus americanus)*, red fox (*Vulpes vulpes)*, mink (*Neovision vison)*, and beaver (*Castor canadensis)*. The provincially blue-listed fisher was observed in low elevation habitat along the Bell Irving River and Treaty Creek. Marten accounted for the majority of the reported trapper harvest, followed by beaver, squirrel, and ermine. The most productive trapline was within the north-eastern portion of the RSA, and it included Bowser Lake, Bell Irving River, Treaty Creek, and a large section of Highway 37. Lynx (*Lynx canadensis)* and ermine (*Mustela ermine)* were not detected during baseline studies and were reported as rarely harvested in the Fur Harvest Database, suggesting low abundance relative to other fur-bearing species. In addition, the RSA had minimal suitable muskrat habitat.

In the winter of 2012, wolverine hair sampling stations were set-up with remote cameras at 10 sites in late-winter moose habitat. Genetic analysis and ventral pelage markings were used to identify individual wolverines. Five different wolverines were identified from DNA analysis (represented by a female to male gender ratio of 60 to 40), and seven from remote photo images. Wolverines were detected at eight of the 10 sample sites with few re-detections, therefore the actual population is likely larger than seven. The minimum wolverine population estimate determined by the 2012 inventory represents 5% of the wolverine population unit for that area, signifying that the study area is regionally important for sustaining wolverine.

Incidental images of red fox, marten, red squirrel, fisher, and grey wolf were also captured by the cameras. Marten images were recorded at all sites, and accounted for the vast majority of fur-bearer species images, particularly within low elevation forests. Marten population estimates may be useful as an index of low elevation habitat integrity, and as a basis for monitoring environmental effects of the proposed project.

The status of the grizzly bear population in the Brucejack study area was assessed during 2011 and 2012 using a DNA-based mark-recapture study. Hair samples were non-invasively collected from barb wire stations set up in suitable grizzly bear habitat within a 7 km x 7 km cell. The study grid (49 km^2), was representative of home range size of female grizzly bears within this region and was recommended by BC regional wildlife staff in the Skeena Region. In 2011, grizzly bear hair samples were collected during the summer from 42 grid cells, covering an area of 2,058 km^2. Sampling was predominantly conducted at high elevation alpine sites. In 2012, grizzly bear hair samples were collected during the spring and early summer from 36 grid cells, covering an area of 1,764 km^2. Sampling was conducted at different locations from those in 2011 to reflect differences in plant phenology and habitat suitability earlier in the year. Samples were collected every two weeks for three sessions. Hair sampling of grizzly bears was also conducted to assess the use of rivers and creeks by grizzly bears feeding on spawning salmon. During the fall, non-baited trail snags were set along riparian trails and water crossings at 16 sites in 2011 and 21 sites in 2012.

In 2011, a total of 25 grizzly bears were detected: 22 individual grizzly bears in the summer and 3 in the fall (12 males and 13 females). No grizzly bears were detected in both seasons. In 2012, a total of 14 grizzly bears were detected: 12 individual grizzly bears were detected in the summer and 4 in the fall (8 males and 6 females), with two detected during both seasons sampled. In total, 37 individual grizzly bears were identified during the two years of baseline studies in the Brucejack study area and included 7 grizzly bears that were detected during the 2008 and 2009 KSM baseline studies. Sixty-one different bears have been identified from the Brucejack and KSM RSAs. Population estimates were not possible for the Brucejack data sets due to lack of recaptures; however, the KSM population estimate was 58 bears (22 - 93 with a 95% CI) for a similar number of total detections.

Remote cameras were placed at 10 of the grizzly bear DNA sampling sites during 2012 to evaluate study design effectiveness and collect additional detection information. The grizzly bear sampling sites were found to be effective from the remote camera images collected in 2012. Grizzly bears appeared to be attracted to the baited hair stations, and wire height and distance from the baited brush pile appeared suitable for collecting bear hair samples.

Raptor stand-watch surveys and goshawk call play-back surveys were conducted in 2010 and 2012 within the RSA. Six raptor species were detected during those studies and during incidental observations: northern goshawk (*Accipiter gentiles*), bald eagle (*Haliaeetus leucocephalis*), golden eagle (*Aquila chrysaetos*), northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), and short-eared owl (*Asio flammeus*). The short eared owl is a provincially blue-listed species (BC CDC 2013b) and federally designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC 2008b). Suitable short-eared owl nesting habitat was identified in a relatively small area near the mouth of the Bowser River. Bald eagles were observed most frequently, followed by golden eagles and red-tailed hawks.

Northern goshawks were not detected in either year of call playback surveys but were incidentally observed in 2012. Areas of suitable habitat were identified during previous studies within the LSA; however, the existing fragmented landscape and riparian corridors limit the actual contiguous stands of mature forest that goshawks prefer. The negative results of the call playback surveys are a reflection of the lack of high quality nesting habitat within the LSA.

In 2012, four aerial surveys were conducted for waterbirds during the breeding and migration periods for waterbirds in northern BC. A total of 28 species were identified, three of which were identified as species of provincial or regional concern: harlequin duck, great-blue heron, and trumpeter swan. The most commonly observed species were ring-necked duck, mallard, Canada goose, American green-winged teal, and Barrow's goldeneye. The largest abundances of birds were observed during staging or spring pair surveys compared to the brood survey, suggesting that the available habitat in the Brucejack Project area may be more important for staging than for breeding.

Large concentrations of waterbirds were observed within the LSA along Bowser River, Knipple Lake, and at the confluence of Bowser River and Bowser Lake during spring staging. The majority of fall staging waterbirds were found outside the LSA near Border Lake, along the upper Bell Irving River, and Snowbank Creek. Large concentrations of broods were detected along Treaty Creek, at the northern end of the Bell Irving River, and in small lakes along Wildfire Ridge. Overall, lake, pond, marsh, backchannel, and some river habitat were the most frequently utilized habitats by staging and breeding waterbirds.

Variable radius point count surveys were conducted in June 2010 and 2012 within the LSA. A total of 1,155 individuals of 1,119 breeding territories representing 55 upland bird species were detected during baseline point count surveys in the Brucejack LSA. The ten most commonly detected species were Swainson's thrush, varied thrush, dark-eyed junco, ruby-crowned kinglet, Wilson's warbler, yellow-rumped warbler, yellow warbler, pine siskin, Townsend's warbler, and hermit thrush. On average, more upland bird species and breeding territories were observed in roadside habitats compared to non-roadside habitat during VRPC surveys. Fewer breeding pairs and fewer species of upland birds were detected in the high elevation alpine Coastal Mountain-heather Alpine (CMA) and Boreal Altai Fescue Alpine (BAFA) Biogeoclimatic Ecosystem Classification (BEC) Zones, in which the main deposit and project infrastructure occur. However, despite low abundance and species richness, the alpine bird community is unique with certain species detected only in these areas. In general, areas with the highest average bird abundance and highest species richness were in the eastern half of the LSA, including Scott Creek near Todedada Lake, the upper Bowser River, and areas within 2 km of Highway 37.

Four species of conservation concern were observed within the LSA and RSA including the olive-sided flycatcher, rusty blackbird, barn swallow, and sooty grouse. The olive-side flycatcher (Threatened) and rusty blackbird (Special Concern) are both listed on Schedule 1 of the *Species at Risk Act* (*SARA*) and are provincially blue listed. The barn swallow has been assessed by COSEWIC as Threatened and is provincially blue listed, and the sooty grouse is provincially listed as Threatened and on the BC blue list.

Aerial and ground-based surveys were conducted in the summer of 2012 to identify western toad breeding areas within the LSA. The western toad is provincially blue-listed and federally designated as a species of Special Concern by COSEWIC (COSEWIC 2002), on Schedule 1 of the *SARA* and is globally designated as near threatened by the International Union for Conservation of Nature (Wind and Dupuis 2002; IUCN 2004). Western toad breeding habitat was identified at seven sites during amphibian surveys and at two sites incidentally, and most sites were in the Interior Cedar Hemlock (ICH) BEC zone. Western toad breeding sites were located within 5 km of the proposed Brucejack Project access road, and five were less than 2 km away. Columbia spotted frogs were also observed at 14 sites. Disease screening analysis determined a sample of western toad tissue was negative for chytrid fungus, an amphibian fungal skin disease.

Acknowledgements

Engineers and Scientists

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BRUCEJACK GOLD MINE PROJECT
WILDLIFE CHARACTERIZATION BASELINE REPORT

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Glossary and Abbreviations

Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

Accidental	Species occurring infrequently and unpredictably, outside their usual range. Accidental species are excluded from the Red, Blue, and Yellow list.
Alleles	An allele is an alternative form of a gene (one member of a pair) that is located at a specific position on a specific chromosome. These DNA codings determine distinct traits that can be passed on from parents to offspring.
Alpine	High-elevation land above the tree-line: alpine vegetation on zonal sites is dominated by low shrubs, herbs, bryophytes and lichens. Although treeless by definition, patches of stunted (krummholz) trees may occur. Much of the alpine is covered by rock and ice rather than vegetation.
Avian	Of, relating to, or characteristic of birds.
BAFA	Boreal Altai Fescue Alpine BEC zone
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre - collects and disseminates information on plants, animals and ecosystems (ecological communities) at risk at the provincial level, and is tied to Nature Serve, an international, non-profit organization of cooperating Conservation Data Centres and Natural Heritage Programs all using the same methodology to gather and exchange information on the threatened elements of biodiversity.
BC ILMB	British Columbia Integrated Land Management Bureau
BC MOE	British Columbia Ministry of Environment
BC MFLNRO	Ministry of Forest Lands and Natural Resource Operations
BC *Wildlife Act* (1996)	The main provincial law for protecting wildlife, endangered species, and wildlife habitat. The Act has a number of provisions for protecting, managing, and purchasing habitat areas as well as protecting endangered and threatened species. The Act is administered by the Ministry of Environment.
BEC	Biogeoclimatic Ecosystem Classification: a standard, hierarchical classification system for mapping terrestrial ecosystems in British Columbia.
Biogeoclimatic subzone	A level of the biogeoclimatic classification system that defines the climate of an area, as characterized by the plant association occurring on zonal sites, e.g., Engelmann Spruce – Subalpine Fir Zone - Very Cold Subzone (ESSFwv; (BC Ministry of Forests and Range 2007).
Biogeoclimatic units	A general term referring to any level of Biogeoclimatic zones, subzones, variants or phases. Biogeoclimatic units are inferred from a system of ecological classification based on a floristic hierarchy of plant associations. The recognized units are a synthesis of climate, vegetation, and soil data (Pojar, Klinka, and Meidinger 1987).

Biogeoclimatic variant	A further subdivision of biogeoclimatic subzone reflecting further differences in regional climate. Variants are described as warmer, colder, drier, wetter, or snowier than the 'typical' subzone, e.g., Mountain Hemlock-Leeward Moist Maritime variant (MHmm2), where leeward (2) is the particular variant.
Biogeoclimatic zone	Geographical areas having similar patterns of energy flow, vegetation and soils as a result of a broadly homogeneous macroclimate. Biogeoclimatic zones are comprised of biogeoclimatic subzones with similar zonal climax ecosystems (BC Ministry of Forests and Range 2007).
Blue List	A list of ecological communities, and indigenous species and subspecies of special concern in British Columbia, maintained by the BC Ministry of Environment.
Census Area	The total census area included area within 250 m of the outer flight lines associated with the survey helicopter route.
CI	Confidence Interval
Blue-list	A list of ecological communities, and indigenous species and subspecies of special concern in British Columbia.
CMA	Coastal Mountain-heather Alpine BEC zone
COSEWIC	Committee on the Status of Endangered Wildlife in Canada: a federal committee of experts that assesses and designates the level of threat to wildlife and vegetation species in Canada.
CPS	Call Playback Survey: a survey method for detecting inconspicuous, scarce or nocturnal species known to respond to calls during the breeding season. Pre-recorded calls or call playbacks simulate the presence of an "intruder" into an already claimed territory and often elicit a response in the target species. The response of the bird allows the observer to record the presence of the species.
CWH	Coastal Western Hemlock BEC zone
DEM	Digital Elevation Model: a digital array of elevations for a number of ground positions at regularly spaced intervals.
DNA	Deoxyribonucleic acid is a nucleic acid — usually in the form of a double helix — that contains the genetic instructions monitoring the biological development of all cellular forms of life.
EcoCat	Ecological Reports Catalogue
Ecosystem (terrestrial)	A volume of earth-space that is composed of non-living parts (climate, geologic materials, groundwater, and soils) and living or biotic parts, which are all constantly in a state of motion, transformation, and development. No size or scale is inferred.
EIC	Environmental Impact Certificate
ESSF	Engelmann Spruce – Subalpine Fir BEC zone
Exotic	Species that have been moved beyond their natural range as a result of human activity. Exotic species are also known as alien species, foreign species, introduced species, non-indigenous species and non-native species. Exotic species are excluded from the Red, Blue and Yellow lists.

Forb	Non-grassy herbaceous plant.
GMD	General Management Direction
GPS	Global Positioning System
Habitat	Land and water surface used by wildlife, which may include biotic and abiotic aspects such as vegetation, exposed bedrock, water and topography.
Hectare	Ha: 10,000 m^2 or 0.01 km^2 or 2.47 acres
Herb	A plant, either annual, biennial or perennial, with stems that die back to the ground at the end of the growing season. Herbaceous species include forbs, graminoids (sedge, grasses, and rushes), ferns, and fern allies (e.g., horsetails).
HSR	Habitat suitability rating
ICH	Interior Cedar Hemlock BEC Zone
ILM	Integrated Land Management Board
IWMS	Identified Wildlife Management Strategy: an initiative of the Ministry of Environment in partnership with the Ministry of Forests and Range. The IWMS provides direction, policy, procedures and guidelines for managing Identified Wildlife. The goals of the Strategy are to minimize the effects of forest and range practices on Identified Wildlife situated on Crown land and to maintain their limiting habitats throughout their current ranges and, where appropriate, their historic ranges.
km	Kilometer
LSA	Local Study Area, 55,187 ha in size
LRMP	Land and Resource Management Plan
MCP	Minimum Convex Polygon: completely enclose all data points by connecting the outer locations in such a way as to create a convex polygon, which can represent a minimum home range area.
Mesic	Water removed somewhat slowly in relation to supply; soil may remain moist for a significant, but sometimes short period of the year. Available soil moisture reflects climatic inputs (BC Ministry of Environment Lands and Parks and BC Ministry of Forests Research Branch 1998).
MH	Mountain Hemlock BEC zone
Microsatellite	Long repetitious strings of noncoding DNA. Their length and the fact that they are not influenced by selection make them good genetic landmarks for DNA comparisons.
Migration	The regular seasonal or daily movement of animal populations to and from different areas, often considerable distances apart. Migration often occurs in corridors between preferred habitat types.
***Migratory Birds Convention Act* (1994c)**	A federal government commitment established in 1917 to protect most migrating birds found in Canada. The Act fulfilled the terms of the Migratory Birds Convention of 1916 between Canada and the U.S.A. The Canadian government has the authority to pass and enforce regulations to protect those species of migratory birds which are included in the Convention.

Moisture regime Indicates, on a relative scale, the available moisture for plant growth in terms of the soil's ability to hold, lose, or receive water. Described as moisture classes from Very Xeric (0) to Hydric (8; (BC Ministry of Environment Lands and Parks and BC Ministry of Forests Research Branch 1998).

Model An idealized representation of reality developed to describe, analyze or understand the behaviour of some aspect of it a mathematical representation of the relationship under study.

NatureServe NatureServe represents an international network of biological inventories known as natural heritage programs or conservation data centers operating in all 50 U.S. states, Canada, Latin America and the Caribbean. NatureServe is a non-profit conservation organization whose mission is to provide the scientific basis for effective conservation action.

NWA Nass Wildlife Area, as defined in the Nisga'a Final Agreement (NFA).

Nutrient regime Indicates the available nutrient supply for plant growth on a site, relative to the supply on all surrounding sites. Nutrient regime is based on a number of environmental and biotic factors, and is described as classes from very poor (A) to very rich (E) and saline (F; (BC Ministry of Environment Lands and Parks and BC Ministry of Forests Research Branch 1998).

Parkland Subalpine area characterized by forest clumps interspersed with open subalpine meadows and shrub thickets. Vegetation cover may vary in the proportion of treed patches, meadows, and shrub thickets. The term parkland can also be used for lower elevation forest that are open due to restricted moisture availability, such as occurs in the Ponderosa Pine zone.

PEM Predictive Ecosystem Mapping - a modelled approach to ecosystem mapping using various spatial datasets as input. Mapping follows provincial standards and a pre-defined classification system.

Red-list List of ecological communities, and indigenous species and subspecies that are extirpated, endangered or threatened in British Columbia. Red listed species and sub-species have- or are candidates for- official Extirpated, Endangered or Threatened Status in B.C. Not all Red-listed taxa will necessarily become formally designated. Placing taxa on these lists flags them as being at risk and requiring investigation.

RDKS Regional District of Kitimat-Stikine

RIC Resource Inventory Committee: a body of the BC government that develops survey standards for BC wildlife and ecosystems.

RISC Resource Information Standards Committee, formerly the Resource Inventory Committee.

RSA Regional Study Area - 3744 km^2 in size

SARA *Species at Risk Act* (2002) - A Canadian federal statute which is designed to meet one of Canada's commitments under the International Convention on Biological Diversity. The goal of the Act is to protect endangered or threatened organisms and their habitats. It also manages species which are not yet threatened, but whose existence or habitat is in jeopardy.

Shannon's Diversity and Equitability	Shannon's Diversity Index is a mathematical measure of species diversity in a community. Diversity indices provide more information about community composition than species richness as they also take the relative abundance of different species into account, along with the number of species (Magurran 1988; Rosenzweig 1995). Shannon's Equitability reports how proportionate the number of individuals are within a community as a measure of the evenness.
Site series	Describes all land areas capable of producing the same late seral or climax plant community within a biogeoclimatic subzone or variant (Banner et al. 1993). Site series can usually be related to a specified range of soil moisture and nutrient regimes within a subzone or variant, but other factors, such as aspect or disturbance history may influence it as well. Site series form the basis of ecosystem units. Definition is taken directly from the RISC standards for Terrestrial Ecosystem Mapping.
SIWE	Species Inventory Web Explorer
SRMP	Sustainable Resource Management Plan
Stand Watch Survey	A survey method for detecting species and any associated breeding activity by predicting where the species is most likely to occur and then observing the species at the selected location.
Standard Error	A statistical measure of the spread or variability of a set of data.
Structural Stage	Describes the structural characteristics, and often the age, of vegetated ecosystems (RIC 1998g).
SU	Survey Unit, delineated polygon for the purposes of wildlife surveys.
TEM	Terrestrial Ecosystem Mapping: delineation and attribution of ecosystem units based on air photo interpretation. Mapping follows provincial standards and a pre-defined classification system.
Topography	The configuration of a surface, including its relief and the position of its natural and man-made features
tpd	Tonne per day
TSA	Timber Supply Area
UTM	Universal Transverse Mercator
UWR	Ungulate Winter Range: an area identified by the BC Ministry of Environment as "an area that contains habitat that is necessary to meet the winter habitat requirements of an ungulate species".
VEC	Valued Ecosystem Component
VRPC	Variable Radius Point Count: a survey method used for identifying species and estimating relative abundances of species in an area. An observer stands at fixed locations within the study area and records any birds detected and estimates horizontal distance to species detected.
Wetland	Sites dominated by hydrophytic vegetation where soils are water-saturated for a sufficient length of time such that excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development (MacKenzie and Moran 2004).

WHA	Wildlife Habitat Area: mapped areas that are necessary to meet the habitat requirements of an Identified Wildlife species under the Identified Wildlife Management Strategy. WHAs designate habitats in which activities are managed to minimize their effect on the Identified Wildlife for which the area was established.
WMU	Wildlife Management Unit: the BC government divides the province into regions (i.e., WMU) for purposes of managing wildlife harvest
WSI	Wildlife Species Inventory
Yellow List	List of ecological communities and indigenous species that are not at risk in British Columbia.

1. Introduction

1. Introduction

1.1 WILDLIFE BASELINE STUDIES OVERVIEW

This report presents the results of wildlife baseline studies conducted between 2010 and 2013 for the proposed Brucejack Gold Mine Project (the Project). The purpose of baseline studies was to collect information that will be used to plan the Project, prepare a description of the environmental setting, and assess potential environmental effects of the Project. Baseline data collection for resource development projects provides current information about the wildlife species and habitat conditions that can be found within a proposed project area.

This report provides a summary of provincial and federal wildlife legislation that will influence resource planning, a review of wildlife literature pertinent to the area, and the results of wildlife field studies that are likely to require consideration in the environmental assessment certificate (EAC) application. Field studies focused on the mammal community (moose, mountain ungulates, bats, hoary marmots, furbearer species, wolverine, and grizzly bear), avian community (raptors, waterbirds, and breeding birds), and amphibian community (western toads) within study areas defined for the Project. Baseline data collection was supplemented with available wildlife literature and the results of regional studies.

1.2 OBJECTIVES

The overall goal of conducting wildlife baseline inventories was to characterize the wildlife community in preparation for the environmental assessment which will assess and mitigate the potential effects of the proposed Project on wildlife species and habitat in the area. The specific objectives of the wildlife baseline studies were to:

- identify and examine current wildlife land use management objectives and existing wildlife inventories associated with the location of the proposed Project area;
- identify wildlife species of conservation concern and focal species and/or groups in the study area; and,
- characterize the mammal, avian, and amphibian communities and collect baseline information on focal species' presence, distribution, and habitat quality and/or use in the study area.

2. Project Description

2. Project Description

Pretium Resources Inc. (Pretivm) proposes to develop the Project as a 2,700 tonne per day (tpd) underground gold and silver mine. The Brucejack property is located at 56°28′20″ N latitude by 130°11′31″ W longitude, which is approximately 950 km northwest of Vancouver, 65 km north-northwest of Stewart, and 21 km south-southeast of the closed Eskay Creek Mine (Figure 2-1). The Project is located within the Kitimat-Stikine Regional District. Several First Nation and Treaty Nations have traditional territory within the general region of the Project including the Skii km Lax Ha, the Nisga'a Nation, the Tahltan Nation, the Gitxan First Nation, and the Gitanyow First Nation.

The mine site area will be located near Brucejack Lake. Vehicle access to the mine site will be via an existing exploration access road from Highway 37 that may require upgrades to facilitate traffic during mine operations. A transmission line will connect the mine site to the provincial power grid near Stewart or along Highway 37; two options are currently under consideration.

The Project is located within the boundary range of the Coast Mountain Physiographic Belt, along the western margin of the Intermontane Tectonic Belt. The local terrain ranges from generally steep in the western portion of the Project area in the high alpine with substantial glacier cover to relatively subdued topography in the eastern portion of the Project area towards the Bell-Irving River. The Brucejack mine site will be located above the tree line in a mountainous area at an elevation of approximately 1,400 masl; surrounding peaks measure 2,200 m in elevation. The access and transmission corridors will span a range of elevations and ecosystems reaching a minimum elevation near the Bell Irving River of 500 masl. Sparse fir, spruce, and alder grow along the valley bottoms, with only scrub alpine spruce, juniper, alpine grass, moss, and heather covering the steep valley walls.

The general area of the Brucejack Property has been the target of mineral exploration since the 1960s. In the 1980s Newhawk Gold Mines Ltd. conducted advanced exploration activities at the current site of the proposed Brucejack mine site that included 5 km of underground development, construction of an access road along the Bowser River and Knipple Glacier, and resulted in the deposition of 60,000 m^3 of waste rock within Brucejack Lake.

Environmental baseline data was collected from Brucejack Lake and the surround vicinity in the 1980s to support a Stage I Impact Assessment for the Sulphurets Project proposed by Newhawk Gold Mines Ltd. Silver Standard Resources Inc. commenced recent environmental baseline studies specific to the currently proposed Project in 2009 which have been continued by Pretivm, following its acquisition of the Project in 2010. The scope and scale of the recent environmental baseline programs have varied over the period from 2009 to the present as the development plan for the Project has evolved.

PROJECT # 1042-008-01 GIS # BJP-15-001 March 05 2013

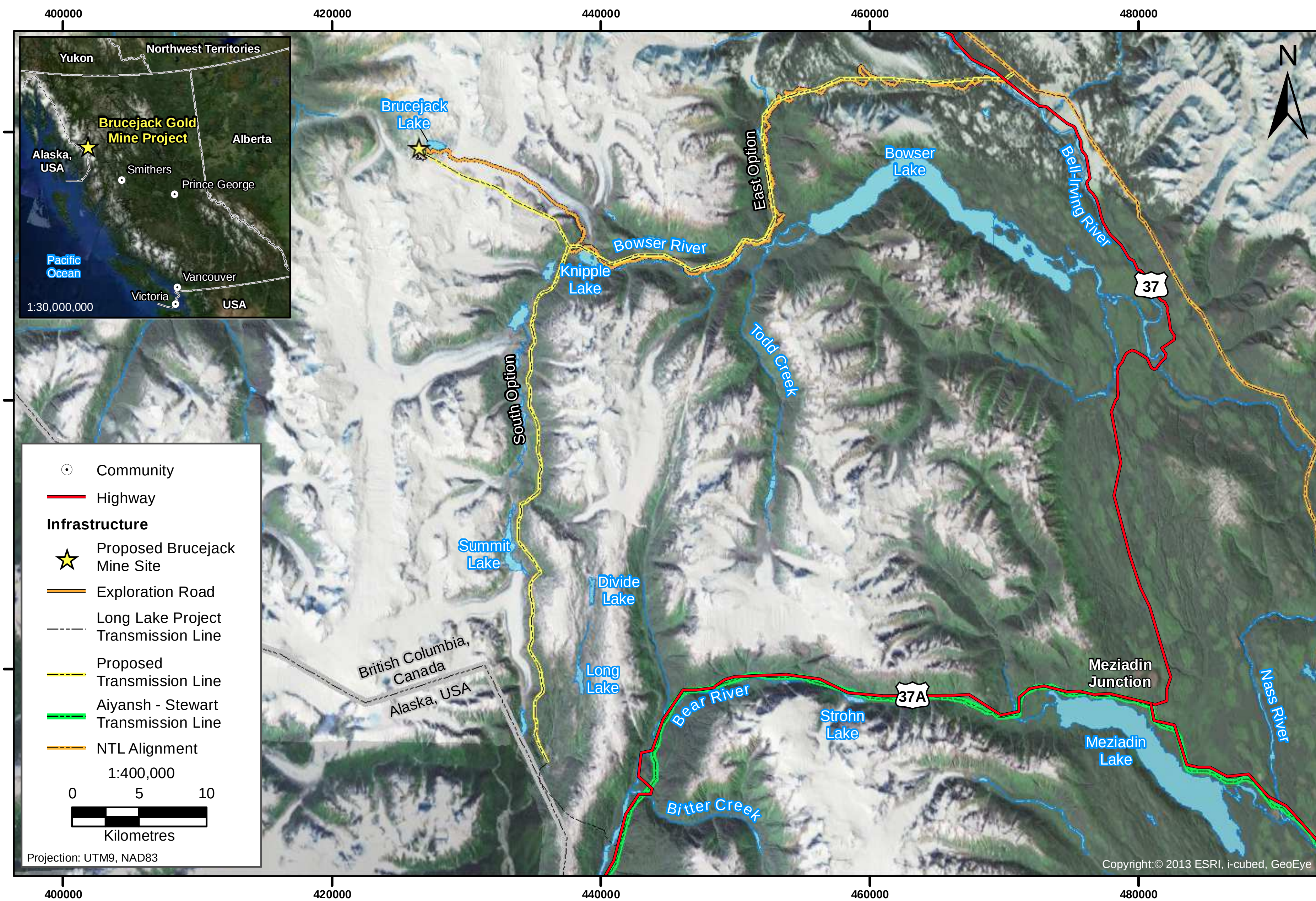

Figure 2-1

PRETIVM

Figure 2-1

Brucejack Gold Mine Project Overview

Rescan Engineers & Scientists

3. Study Areas

3. Study Areas

Wildlife species were characterized for two study areas: a Regional Study Area (RSA) and a Local Study Area (LSA; Figure 3-1). The RSA, 374,433 ha in size, was delineated to reflect the area anticipated to provide habitat for wildlife species that may come in contact with proposed Project infrastructure during the course of a season or lifetime and considered ecological factors such as height of land and watershed boundaries when delineating boundaries (Rescan 2013a). Species groups that were assessed at the RSA scale were ungulates, waterbirds, raptors, breeding birds and bats and large carnivore mammals, due to their distributions and extent of regional movement. Species information, including home range sizes, habitat use, and seasonal movement patterns, were considered when selecting the RSA boundary. The LSA, 31,847 ha in size, was defined by a buffer extending at least to the height of land or 1.0 km buffer around the outer limits of the proposed infrastructure and linear developments which included: the exploration access road, the proposed mine site and the proposed south option transmission line. All of the selected wildlife species were studied within the LSA but some were limited to the LSA because of their relatively limited mobility or by the habitat information that was available for them such as hoary marmots (*Marmota caligata*), and amphibians.

The RSA is located in the Meziadin Mountains and Southern Boundary Ranges ecosections within the Nass Ranges and Boundary Ranges ecoregions and the Coast and Mountains ecoprovince. Ecologically, the RSA is divided into two distinct climatic regions. The western and southern portion is in moist coastal ecosystems represented by the biogeoclimatic ecosystem classification (BEC) units of Coastal Western Hemlock -Wet Maritime (CWHwm), Mountain Hemlock - Leeward Moist Maritime (MHmm2), and Coastal Mountain-heather Alpine - Undifferentiated Parkland (CMAunp). The eastern portion of the study area encompasses a transitional zone from coastal to interior ecosystems that includes the BEC units of Engelmann Spruce – Subalpine Fir - Wet Very Cold (ESSFwv), Boreal Altai Fescue Alpine - Undifferentiated Parkland (BAFA), and Interior Cedar Hemlock - Very Wet Cold (ICHvc). Elevations in the RSA range from about 240 m at the confluence of Sulphurets Creek and the Unuk River, to over 2,300 m at the peak of the Unuk Finger. Habitat types are diverse with mature forests and wetlands at lower elevations, and shrubs/stunted trees and drier sparsely-vegetated subalpine and alpine habitat at higher elevations.

There are three provincial parks in, or within close proximity to, the proposed Project wildlife RSA: Nigunsaw Provincial Park, Border Lake Provincial Park, and Lava Forks Provincial Park.

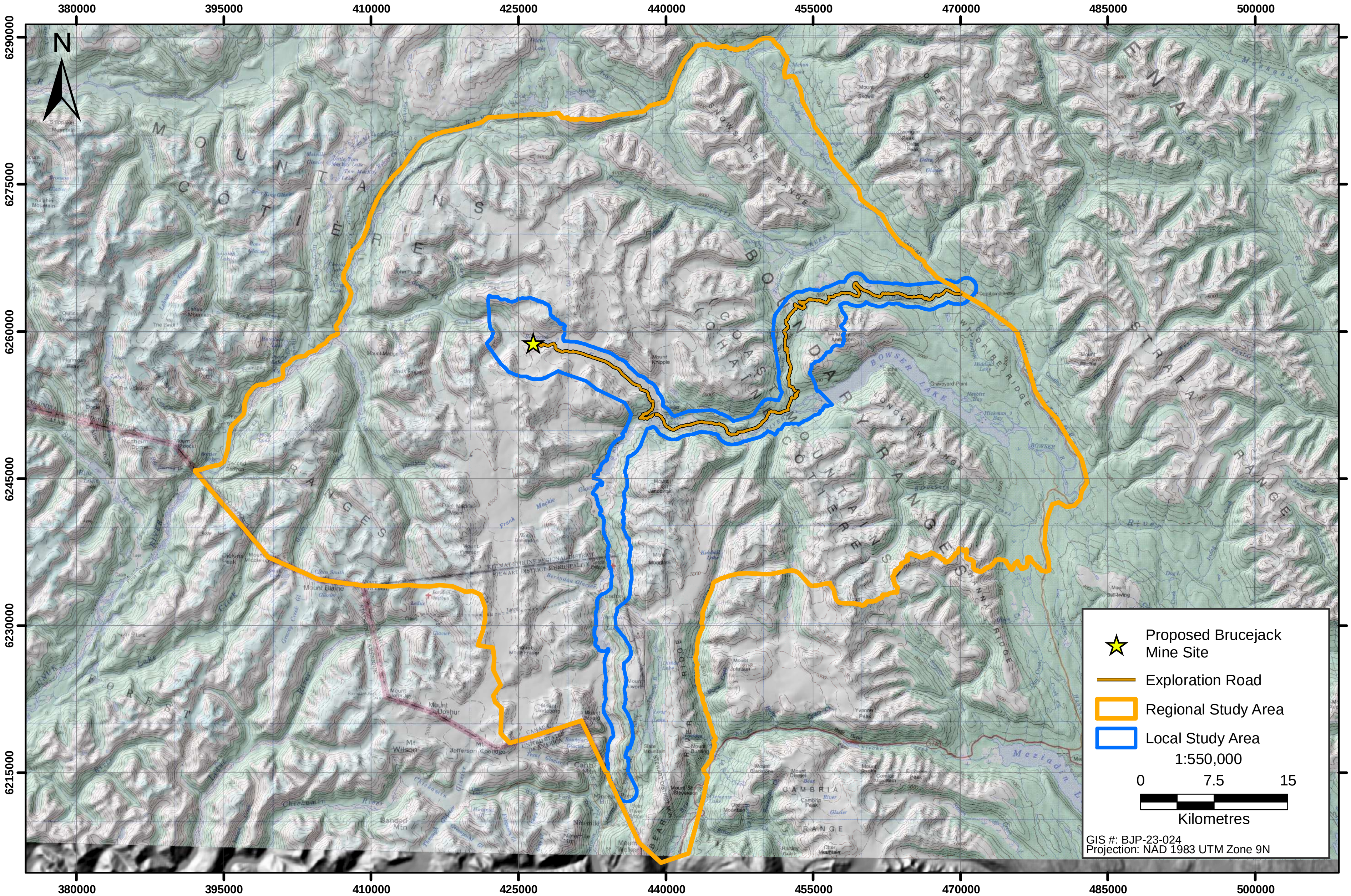

Figure 3-1

PRETIVM

Wildlife Regional Study Area and Local Study Area

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4. Background Information

4. Background Information

4.1 APPLICABLE LEGISLATION (FEDERAL AND PROVINCIAL)

Applicable legislation for wildlife has been summarized in Table 4.1-1. Land use as it pertains to wildlife is guided in two ways through: 1) Wildlife Legislation, which includes the relevant statute laws, such as Acts and associated regulations developed by provincial and federal administration, as well as best management practices; and 2) Land Management Plans, which are guidelines developed by user groups and stakeholders to identify and integrate local resource values with development.

Table 4.1-1. Summary of Relevant Acts or Regulations for Wildlife and Wildlife Habitat

Act or Regulation	Implications for Management
BC *Wildlife Act* (1996)	• Protects most vertebrate animals from direct harm or harassment except as allowed by regulation (e.g., hunting or trapping). Legal designation provides additional protection for selected red- and blue-listed species and their residences. • Section 34 of the Act specifically protects birds and their eggs from possession, molestation, injury, or destruction; the nests of eagles, peregrine falcons, gyrfalcons, ospreys, herons, and burrowing owls year-round; and the nests of all other birds when the bird or their eggs are in the nest. • Section 9 of the Act specifically protects a beaver or muskrat house, den, or dam from disturbance, molestation, or destruction, except in the case of trappers licensed under the Act. • Alteration or removal of a beaver dam is permitted under the *Wildlife Act* "to provide irrigation or drainage under lawful authority for the protection of property" and for drainage purposes with specific restrictions. To remove a beaver dam or muskrat house, the Ministry must be notified at least 45 days in advance of the removal project.
Canada *Migratory Birds Convention Act* (1994a)	• Prohibits the taking or killing of migratory birds, their nests, and eggs, and the deposition of harmful substances in areas frequented by migratory birds. • Species protected include waterfowl, cranes, rails and coots, shorebirds including gulls and terns, pigeons and doves, insectivorous songbirds (excluding blackbirds), seabirds, loons, grebes, herons, egrets, and bitterns.
Canada *Species at Risk Act* (2002)	• Protects wildlife present on the Schedule 1 "List of Wildlife Species at Risk" on federal lands as well as the critical habitat of those species. • Section 137 amends the *Canadian Environmental Assessment Act* (CEAA) to clarify, for greater certainty, that EAs must always consider effects to listed wildlife species, their critical habitat, or the residences of individuals of that species. • Section 79(2) states "the person must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans."
BC *Forest and Range Practices Act* (2004a)	• Section 149.1 of the Act authorizes the minister responsible for the *Wildlife Act* to establish one or more of the following: o An area as an ungulate winter range and objectives for the ungulate winter range; o An area as a wildlife habitat area and objectives for the wildlife habitat area; o A general wildlife measure (i.e., wildlife habitat feature); o Categories of wildlife for the purposes of subparagraphs above; • Section 150.5 of the Act authorizes the establishment of riparian reserve zones, riparian management zones, and riparian management areas for different classes of streams, wetlands, and lakes.

(continued)

Table 4.1-1. Summary of Relevant Acts or Regulations for Wildlife and Wildlife Habitat (completed)

Act or Regulation	Implications for Management
BC *Water Act* (1988)	• Any proposed works in or about a stream must protect fish and wildlife habitat. • The Act applies to the quantity and quality of water on which fish or wildlife depend directly or indirectly to carry out their life processes, and spawning grounds and the nursery, rearing, food supply, and migration areas. • Under Part 7 of the BC *Water Act Regulation*, works must meet the standards under Section 42 (1) and (2), regardless of the type of work, including: o the timing window or the period(s) of time in the year during which the change can proceed without causing harm to fish, wildlife, or habitat; o the minimum instream flow or the minimum flow of water that must remain in the stream while the change is made; o the removal of material from the stream or stream channel in connection with the change; o the addition of substance, sediment, debris, or material to the stream or stream channel in connection with the change; o the salvage or protection of fish or wildlife during or after the change is made; o the protection of natural materials and vegetation that contribute to habitat or stream channel stability; o the restoration of the worksite after the change has been made; o the requirement to obtain an approval from the federal Department of Fisheries and Oceans in connection with the change.
BC Order – Ungulate Winter Range (mountain goat) #U-6-002	• Provincially designated mountain goat winter range polygons and associated management regulations that are described in detail and polygons provided in Schedule A (#U-6-002) and include time restrictions set back distances for development activities (BC MOE 2004).

Wildlife and wildlife habitat are protected under federal and provincial legislation, such as the BC *Wildlife Act* (1996), the Canada *Migratory Birds Convention Act* (1994a), the Canada *Species at Risk Act* (2002), the BC *Forest and Range Practices Act* (2004a), the BC *Water Act* (1988). Provincial and federal legislation and regulations, along with best management practice guidelines and standards, help to ensure that developments are designed and carried out in an environmentally responsible manner.

Provincial forests within the RSA are administered by the Ministry of Forests, Land, and Natural Resource Operations (MFLNRO). The Project is located in the Skeena-Stikine and Kalum forest districts, and the Cassiar and Nass Timber Supply Areas (TSAs). Wildlife is managed provincially by the MFLNRO Region 6 (Skeena), and the federal agency responsible for wildlife and species at risk in the area is the Pacific/Yukon division of Environment Canada. The Project overlaps with three Wildlife Management Units (WMU) within Skeena Region 6: WMUs 6-16, 6-21, and minor portions of 6-17. A provincially designated mountain goat winter range order (#U-6-002) contains habitat polygons that overlap many areas of the RSA (BC MOE 2004). Preliminary Provincial Wildlife Habitat Areas (WHA's) for grizzly and Ungulate Winter Range (UWR) for moose have also been developed within the RSA and were included with grizzly bear and moose assessments.

In general, standards and good practices are guiding statements that allow development to occur in a way that will avoid, limit, or mitigate effects on aquatic and riparian habitats, water quality and quantity, fish and wildlife species, and public safety and property. Following definitions in the *Standards and Best Practices for Instream Works* (BC MWLAP 2004c), "standard" is a regulatory requirement that must be followed or achieved in the design and completion of developments. "Best practice" is a recommended method or technique that should be followed to ensure the standards are met and effects are mitigated. Best management practices and guidelines relevant to the Project include the following:

- Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia (BC MWLAP 2004a).
- Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia (BC MOE 2005).
- Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia (BC MOE 2006a).
- Wildlife Guidelines for Backcountry Tourism/Commercial Recreation (BC MOE 2006b).
- Management Plan for the Mountain Goat in British Columbia (MOE 2010).
- Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006 (APLIC 2006).
- Standards and Best Practices for Instream Works (BC MWLAP 2004c).
- Wetlands Environmental Assessment Guideline (Milko 1998).
- Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia (WSP 2009).
- BC Resource Information Standards Committee (RISC) standards for conducting wildlife inventory protocol (RISC 2013).

4.2 LAND MANAGEMENT PLANS

Land Management Plans include Land Resource Management Plans (LRMPs) and Sustainable Resource Management Plans (SRMPs). These plans are developed by a stakeholder-based process that attempts to integrate the various environmental, social, and economic values of the area while providing guidelines for regional resource development. The Project is within the Regional District of Kitimat-Stikine (RDKS), and contains extensive areas of Crown land and areas subject to the Cassiar Iskut-Stikine LRMP (BC ILMB 2000) in the northwest of the RSA, and Nass South SRMP (BC ILMB 2012) in the southwest of the RSA. A substantial area within the eastern portion of the RSA is without a strategic land management plan.

LRMPs are sub-regional, integrated resource plans that establish the framework for land use and resource management objectives and strategies that provide a basis for detailed management planning. Regional plans or LRMPs (sub-regional plans) often result in broad land/coastal use zones delineated on a map; resource management objectives for land/coastal use zones; broad strategies for integrating resource use; socio-economic analysis; and plan monitoring, implementation, and interpretation mechanisms.

SRMPs focus on similar issues and values as regional plans and LRMPs but at a more detailed level. For example, SRMPs are used to identify Old Growth Management Areas (OGMAs) - a priority component of biodiversity planning, to address specific economic development issues such as agriculture or tourism developments, and to manage values such as spiritual and cultural resources as identified by First Nations.

The northwestern portion of the RSA falls within the General Management Direction (GMD) of the Cassiar Iskut-Stikine LRMP. Objectives and strategies of the GMD apply throughout the LRMP area, outside of Protected Areas. In addition to the GMD, there are objectives and strategies for area-specific Resource Management Zones (RMZs). One RMZ occurs within the RSA, the Unuk River RMZ. A small part of the of southeast portion of the RSA is within the Nass South SRMP and the divide between Unuk River and

Treaty Creek drainages (BC ILMB 2009). The RSA also lies partially within the Nass Area as defined in the *Nisga'a Final Agreement*.

The southwestern portion of the RSA falls within the Nass South SRMP. Wildlife-related management objectives for the Unuk River RMZ of the Cassiar Iskut-Stikine LRMP, and the Nass South SRMP are described in Table 4.2-1.

Table 4.2-1. Wildlife Objectives of the Cassiar Iskut-Stikine LRMP and Nass South SRMP

Management Direction	Wildlife-Related Resource	Wildlife-Related Management Objectives
Cassiar Iskut-Stikine LRMP (BC ILMB 2000)		
General Management Direction – Access Management	Access Management	• Minimize impacts on wildlife habitat and sensitive ecosystems during road construction and use. • Manage game populations by controlling hunting and fishing access, where required. • Provide access for long-term resource management and economic development needs while minimizing impacts on environmental social, cultural heritage, and wildlife habitat values and commercial activities. • Minimize disturbance to wildlife due to aircraft use, particularly during sensitive periods.
General Management Direction – Biodiversity/ Ecosystem Health	Aquatic Ecosystems and Riparian Habitat	• Conserve riparian habitat by minimizing disturbance to the structural and functional features of riparian habitat, including critical habitat features.
	Endangered Plants and Animals	• Maintain habitats of rare, threatened, and endangered animals, plants, and plant communities as described in the BC Conservation Data Centre lists. • Maintain habitat of fisher where populations are known to exist. • Maintain nesting and foraging habitat for nest sites of raptors, particularly rare and endangered species, including northern goshawk, short-eared owl, gyrfalcon, peregrine falcon. • Minimize disturbance of critical habitat areas for trumpeter swans (e.g., nesting and over-wintering areas, including early spring migration stops).
	Special Landforms: Plateaus	• Minimize impacts of motorized activities on plateaus and their habitats. • Maintain connectivity for wildlife between plateaus and adjacent plateaus and mountain ranges.
	Wildlife: General	• Maintain habitat to support healthy wildlife populations. • Manage development and access to conserved important habitat features and wildlife.
	Wildlife: Moose	• Maintain functional integrity of moose winter range by maintaining critical habitat features (i.e., thermal and snow interception cover, winter forage, and visual screening), and by managing harvesting activities to minimize the impact on winter habitat.
	Wildlife: Caribou	• Maintain large areas of high value caribou habitat including spring, summer, and winter habitat by maintaining the integrity of important habitat characteristics such as forests with lichen, areas of contiguous mature and old forest, and wetland complexes. • Maintain the functional integrity of mapped caribou winter range, with particular reference to the Three Sisters, Kehlechoa River, and the Stikine. Also address the range north and east of Spatsizi Park by maintaining winter forage opportunities and snow interception cover, and managing access and harvesting activities to minimize effects on winter habitat.

Table 4.2-1. Wildlife Objectives of the Cassiar Iskut-Stikine LRMP and Nass South SRMP (continued)

Management Direction	Wildlife-Related Resource	Wildlife-Related Management Objectives
Cassiar Iskut-Stikine LRMP (BC ILMB 2000) (cont'd)		
General Management Direction – Biodiversity/ Ecosystem Health cont'd	Wildlife: Mountain Goat and Stone's Sheep	• Maintain large areas of high value Stone's sheep and mountain goat habitat and avoid disturbing animals during kidding and lambing. • Maintain functional integrity of mapped winter range for mountain ungulates by maintaining critical habitat features (i.e., thermal and snow interception cover and winter forage), and by managing access to minimize impact to winter habitat.
	Wildlife: Grizzly Bear	• Maintain large areas of high value habitat by maintaining areas of well-distributed, seasonally important habitats for grizzly bear across the landscape and through time. • Reduce human-bear interactions. • Manage hunting and other activities to limit bear mortality from all human causes to less than 4% of the estimated population so harvest of females does not exceed 30% of annual allowable harvest and the total kill is not area-concentrated. • Minimize bear/human conflicts and disruption of bear habitat use. • Monitor overall effectiveness of habitat management for grizzly bear.
	Wildlife: Marten	• Maintain large areas of high value marten habitat by maintaining important habitat characteristics (i.e., forest structural attributes and mature and old forest providing interior forest conditions).
Area-Specific Resource Management Zone – Unuk River Zone	General	• Maintain high quality and quantity of grizzly bear habitat while allowing commercial timber harvesting and mineral exploration and development to occur.
Nass South SRMP (BC ILMB 2012)		
Water Resources	Water	• Maintain ecological functioning of streams, rivers, wetland complexes and lakes, including those that do not support fish populations. • Maintain the functional integrity of floodplains and alluvial fans.
Biodiversity Resources	Biodiversity	• Maintain or recruit structural attributes of old forests to support stand-level biodiversity.
Wildlife	Moose	• Maintain, enhance, or restore moose winter range habitats. • Through access management, minimize mortality and disturbance to moose within and adjacent to the moose winter ranges identified.
	Mountain Goat	• Minimize adverse disturbance to goats within identified mountain goat winter range. • Minimize the number of roads within 500 m of winter range and 1000 m of canyon-dwelling goat winter range. • Minimize adverse disturbance to mountain goat winter range from helicopter logging activities.
	Grizzly Bear	• Preserved the highest value grizzly bear habitat. • Maintain the quality and effectiveness of grizzly bear foraging habitat. • Minimize human-bear conflicts. • Minimize long-term displacement of grizzly bears from industrial access development.

(continued)

Table 4.2-1. Wildlife Objectives of the Cassiar Iskut-Stikine LRMP and Nass South SRMP (completed)

Management Direction	Wildlife-Related Resource	Wildlife-Related Management Objectives
Nass South SRMP (BC ILMB 2012) (cont'd)		
Wildlife cont'd	Water	• Maintain ecological functioning of streams, rivers, wetland complexes and lakes, including those that do not support fish populations. • Maintain the functional integrity of floodplains and alluvial fans.
	Furbearers	• Minimize impact to known high value fisher and wolverine habitat.
	Northern Goshawk	• Maintain nesting and post-fledgling habitat at known goshawk nest areas, to support continued use and reproduction in those areas. • Maintain foraging habitat around known goshawk nest and post-fledgling areas.
	General Wildlife	• Maintain effectiveness of riparian habitats adjacent to wetlands.

4.3 LITERATURE REVIEW

A literature review was conducted to identify current best practices for wildlife inventory and existing species information. Species specific information applicable to each study that was conducted has been included within the associated section describing that baseline work.

4.4 PAST ENVIRONMENTAL STUDIES IN THE PROJECT AREA

An initial review was undertaken to assess the available sources of information that would be useful for supplementing baseline inventory results and to aid in determining the wildlife species that could potentially occur within the study area.

Specifically, the objectives of this review were to:

- identify any historical or current research conducted on wildlife in the study area;
- identify reports and databases that may provide information on the wildlife and habitat within the study area;
- identify areas that may have legislative protection within the wildlife study area under the *Forest and Range Practices Act* (2004a) and BC *Wildlife Act* (1996), such as Ungulate Winter Ranges (UWRs) or Wildlife Habitat Areas (WHAs); and
- document the wildlife species that may be present in the study area with specific emphasis on species of conservation concern.

The scope of the review was restricted to available online scientific journals, online provincial databases, and information provided directly by regional wildlife inventory specialists. The following information sources were consulted:

- BC Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO) / Ministry of Environment (MOE) Ecosystem Branch website: publishes various reports on wildlife and identified wildlife under the Identified Wildlife Management Strategy (IWMS);
- BC MFLNRO / MOE Fish and Wildlife Branch: harvest data from provincial Wildlife Management Units (WMUs);
- BC MFLNRO: manages and provides LRMPs, and geographic information;

- iMapBC: a spatial information tool than can be used to assess the presence and locations of wildlife in an area through occurrence reports and telemetry locations; it also helps identify important wildlife habitat, such as UWRs and WHAs;
- Ecological Reports Catalogue (EcoCat): provides access to a database of published wildlife research reports from across the province;
- Wildlife Species Inventory (WSI): maintains a database for submitting information from wildlife inventory studies in BC, in the form of reports and datasets. Completed datasets and reports are available to the public using the Species Inventory Web Explorer (SIWE);
- BC Conservation Data Centre (BC CDC) database: an online database that collects and disseminates information on plants, animals, and ecosystems (ecological communities) at risk in British Columbia. This information provides a centralized and scientific source of information on the status, locations, and level of protection of these organisms and ecosystems (BC CDC 2013b);
- BC Species and Ecosystems Explorer: an online source for authoritative conservation information on approximately 6,000 plants and animals and almost 600 ecological communities (ecosystems) in BC; and
- Web of Science: university library catalogue with peer-reviewed literature.

Table 4.4-1 presents existing data on wildlife inventory and studies that have been conducted in the area, along with their main objectives. Details relevant to the species groups inventoried during this study are discussed under each species specific section of the baseline report.

Table 4.4-1. Summary of Wildlife Inventories within or near the Project Study Area

Wildlife Inventory	Location	Wildlife Resource	Objectives and Outcomes
Stage I Environmental and Socioeconomic Impact Assessment for the Sulphurets Property, Section 7.4.3 (Rescan 1989)	Brucejack Mine Site previously the Sulphurets property owned by Newhawk Gold Mines Ltd. (NPL) and Granduc Mines Limited	Mountain Goat, Moose, Furbearers, Birds, Grizzly Bears and Black Bears	• Information was gathered from resource mapping and the provincial government • Brief aerial and ground surveys were conducted • Ungulate habitat capability and wildlife observations were mapped • Section 9.8 of the document described the environmental impact assessment which identified habitat loss and hunting associated with the exploration access road and infrastructure footprint
KSM Wildlife Characterization Report (Rescan 2010b)	Unuk, Bowser, and Bell-Irving River watersheds.	Moose, Mountain Goat, Birds, Small Mammals, Grizzly Bear, Bats, Groundhog, and Herptile	• Inventoried and characterised the wildlife resource within the KSM RSA • Estimated moose, goat, and grizzly bear populations • Identified distribution of hoary marmot • Characterised bird and small mammal species composition, and identified presence of bats
KSM Wildlife Habitat Suitability Baseline Report (Rescan 2010c)	Unuk, Bowser, and Bell-Irving River watersheds	Moose, Mountain Goat, Grizzly Bear, American Marten, Hoary Marmot	• Modelled and inventoried suitable habitat for grizzly bear, moose, mountain goat, American marten, and hoary marmot

(continued)

Table 4.4-1. Summary of Wildlife Inventories within or near the Project Study Area (completed)

Wildlife Inventory	Location	Wildlife Resource	Objectives and Outcomes
Nass South SRMP (BC ILMB 2012)	Nass South SRMP area	Moose, Mountain Goat, Grizzly Bear, Northern Goshawk	• Identified moose winter range as Ungulate Winter Range under the *Forest and Range Practices Act* • Identified mountain goat winter range as Ungulate Winter Range under the *Forest and Range Practices Act* • Identified high value grizzly bear habitat through the Wildlife Habitat Area (WHA) process under the *Forest and Range Practices Act* • Identified high value northern goshawk habitat by Habitat Suitability modelling
Cassiar Iskut-Stikine LRMP (BC ILMB 2000)	Cassiar Iskut-Stikine LRMP area	Moose, Mountain Goat, Grizzly Bear, Marten	• Identified high value moose habitat • Identified high value mountain goat habitat and kidding areas • Identified high value grizzly bear habitat • Identified high value marten habitat
Galore Creek Project (RTEC 2006e, 2006f, 2006g, 2006b, 2006c, 2006d, 2006a, 2007a, 2008a).	Area near Bob Quinn/ Stikine River	Moose, mountain goat, grizzly bear, waterfowl, raptors, forest birds, bats, small mammals, herptiles	• Identified moose, goat, grizzly bear, and marten habitat • Inventoried moose, goat, and grizzly bear populations • Identified bat, small mammal, and herptiles that occurred • Characterised the bird community associated with available ecosystems
Northwest Transmission Line Project (Rescan 2009b, 2009a)	Linear area from Terrace to Bob Quinn	Moose, mountain goat, grizzly bear, bats, waterfowl, raptors, forest birds, herptiles	• Identified moose, mountain goat, grizzly bear, black bear, fisher, American marten seasonal habitats • Inventoried mountain goat and moose populations • Characterised bird, waterfowl, and herptile population
Red Chris Porphyry Copper-Gold Project (Roberts and Turney 2004)	Tattoga area	Moose, Stone's sheep, mountain goat, grizzly bear	• Habitat suitability mapping for sheep, goat, moose, and grizzly bear
Keim (2004)	Taku River drainage	Mountain Goats	• Determined mountain goat winter movements, winter habitat selection, and core winter habitat using GPS collared mountain goats in the Taku River drainage
BC MOE (2008)	Nass TSA and Upper Portion of Ningunsaw and Unuk watersheds	Mountain Goats	• Identified Ungulate Winter Range (#U-6-002).
McElhanney (2007a)	Northern Nass TSA	Grizzly Bears	• Conducted grizzly bear habitat suitability to support the designation of grizzly bear Wildlife Habitat Areas (WHA)
McElhanney (2007b)	Northern Nass TSA	Moose	• Conducted moose winter habitat suitability to support the designation of moose UWR in the northern Nass TSA

5. Species of Conservation Concern

Engineers and Scientists

5. Species of Conservation Concern

The likelihood of occurrence was evaluated for a complete suite of species that could potentially be encountered in the RSA (Appendix 5-1). The likelihood of occurrence was placed into three categories (Table 5-1), which are based on residency status and/or seasonal habitat requirements (Table 5-2). Known and presumed distributions and habitat requirements were gathered from multiple sources (V. Stevens 1995; Sibley 2000; Stebbins 2003; Alderfer 2006; Reid 2006; CARCNET 2009; BC CDC 2010a; NatureServe 2010).

Table 5-1. Criteria for Assessing the Likelihood of Occurrence in the Regional Study Area

Category	Definition and Criteria for Assessment[1]
Likely (L)	Species that are likely to occur. Species that have overlapping seasonal ranges within the study areas, species that are known to occur within the BEC zones associated with the study areas, and species whose seasonal habitat requirements are met within the study areas.
Possible (P)	Species that possibly occur. Species in this category may or may not have overlapping seasonal ranges within the study areas, seasonal habitat requirements may or may not be met within the study areas, but species have been detected in BEC zones associated with the study areas. Many migratory bird species can be placed in this category as species are expected to pass over or near the study areas during spring and fall migrations, and as such, their presence would be possible but infrequent.
Unlikely (U)	Species that are unlikely to occur. Species in this category have seasonal ranges near the study areas (within 100 km) and may or may not have been detected in BEC zones associated with the study areas. However, seasonal habitat requirements are not met within the study areas. Species with low population sizes are also placed in this category.

[1] Likelihood of that species occurrence was based upon range maps and ecological information according to various sources (V. Stevens 1995; Sibley 2000; Stebbins 2003; Alderfer 2006; Reid 2006; CARCNET 2009; BC CDC 2010a; NatureServe 2010).

Table 5-2. Criteria for Assessing the Presence of Species

Category	Definition and Criteria for Assessment
Resident	Species is present and active year-round and species seasonal range overlaps with the study areas.
Resident hibernator	Species is present year-round but hibernates during the winter months (e.g., marmot and bat species). Species seasonal range overlaps with the study areas.
Resident migrant	Species is present during most of the year but migrates south for the winter (e.g., bat species). Species seasonal range overlaps with the study areas.
Breeder	Species is present during the spring, summer, and fall (i.e., breeding) season. Species seasonal range overlaps with the study areas.
Migrant	Species is present only during spring and/or fall migrations. Species seasonal range overlaps with the study areas.
Winter	Species is present only during the winter. Species seasonal range overlaps with the study areas.
Migratory Bird Species Specific Category	
Offshore	Identifies marine species, i.e., species that use offshore ocean-associated habitats during the year (e.g., estuaries, open water)
(none)	Identifies all other species, i.e., species that use onshore terrestrial and aquatic habitats during the year (e.g., forests, alpine, lakes, rivers)

The provincial, federal, and international conservation status was determined for those species that potentially occur in the RSA (Appendix 5-2). BC provincial rankings are categorized as either red, blue, or yellow, while the categories used in the federal listing under the *Species at Risk Act* (*SARA*) are based on assessments conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). For the purposes of this report, species of conservation concern include:

1. species or populations on the provincial red and blue lists and/or provincially ranked as critically imperiled, imperiled, and vulnerable;
2. species classified by COSEWIC as endangered, threatened, or special concern;
3. species listed on Schedule 1 of *SARA*;
4. species globally ranked as imperiled or vulnerable by NatureServe and/or IUCN. Appendix 5-2 provides a list of conservation status definitions.

A total of 283 wildlife species potentially occur within the study areas: six amphibians, one reptile, 222 birds, and 54 mammals (Appendix 5-1). Overall, 33 species of conservation concern were considered as likely occurring (L) or possibly occurring (P) within the RSA, including 1 amphibian, 25 bird species, and 8 mammals (Table 5-3).

Based on the complete list of species potentially occurring within the RSA, a second list was developed for species or wildlife groups of potential interest (Table 5-4). Species or wildlife groups of interest are not necessarily of conservation concern, but are identified as regionally important for biological, economic, social, or cultural reasons. Regionally important species or groups have been identified by biologists, Aboriginal peoples, local community members, and from information included in LRMPs and SRMPs. The groups identified were: waterfowl, songbirds and raptors. The species identified were moose, mountain goat, marten, wolverine, grizzly bear, silver-haired bat and northern goshawk.

Table 5-3. Potentially Occurring Vertebrate Species of Conservation Concern

Common Name	Scientific Name	Likelihood of Occurrence[1]	Conservation Status[2]					
			BC Rank	BC List	Identified Wildlife[3]	COSEWIC	SARA	Global Rank
Amphibians								
Western toad	*Anaxyrus boreas*	L	S3S4	Blue		SC	1-SC	G4
Birds								
Sooty Grouse	*Dendragapus fuliginosus*	L	S3S4	Blue				G5
Olive-sided flycatcher	*Contopus cooperi*	L	S3S4B	Blue		T	1-T	G4
Barn swallow	*Hirundo rustica*	L	S3S4B	Blue	Y	T		G5
Rusty blackbird	*Euphagus carolinus*	L	S3S4B	Blue		SC	1-SC	G4
Yellow-billed loon	*Gavia adamsii*	P	S2S3N	Blue		NAR		G4
American bittern	*Botaurus lentiginosus*	P	S3B	Blue				G4
Tundra swan	*Cygnus columbianus*	P	S3N	Blue				G5
Brant	*Branta bernicla*	U	S3M	Blue				G5
Surf scoter	*Melanitta perspicillata*	P	S3B,S4N	Blue				G5
Rough-legged hawk	*Buteo lagopus*	P	S2S3N	Blue		NAR		G5
Peregrine Falcon, *pealei* ssp	*Falco peregrinus pealei*	P	S3B	Blue		SC	1-SC	G4T3
Gyrfalcon	*Falco rusticolus*	P	S3S4B	Blue		NAR		G5
American golden-plover	*Pluvialis dominica*	P	S3S4B	Blue				G5
Wandering tattler	*Tringa incana*	P	S3S4B	Blue				G5
Red-necked phalarope	*Phalaropus lobatus*	P	S3S4B	Blue				G4G5
Snowy owl	*Bubo scandiacus*	P	S3N	Blue		NAR		G5
Short-eared owl	*Asio flammeus*	P	S3B,S2N	Blue	Y	SC	1-SC	G5
Great blue heron	*Ardea herodias fannini*	P	S2S3B,S4N	Blue		SC	1-SC	G5T4
Western screech-owl	*Megascops kennicottii kennicottii*	P	S3	Blue		T	1-SC	G5T4
Western grebe	*Aechmophorus occidentalis*	P	S1B,S2N	Red		C		G5
Northern goshawk, *laingi* ssp	*Accipiter gentilis laingi*	P	S2B	Red	Y	T	1-T	G5T2

(continued)

Table 5-3. Potentially Occurring Vertebrate Species of Conservation Concern (completed)

			Conservation Status[2]					
Common Name	**Scientific Name**	**Likelihood of Occurrence[1]**	**BC Rank**	**BC List**	**Identified Wildlife[3]**	**COSE WIC**	**SARA**	**Global Rank**
Birds (cont'd)								
Peregrine Falcon, *anatum* ssp	*Falco peregrinus anatum*	P	S2?B	Red		SC	1-T	G4T4
Swainson's Hawk	*Buteo swainsoni*	P	S2B	Red				G5
Upland sandpiper	*Bartramia longicauda*	P	S1S2B	Red				G5
Common nighthawk	*Chordeiles minor*	L	S4B	Yellow		T	1-T	G5
Horned grebe	*Podiceps auritus*	P	S4B	Yellow		SC		G5
Mammals								
Fisher	*Martes pennant*	L	S2S3	Blue	Y			G5
Grizzly bear	*Ursus arctos*	L	S3	Blue	Y	SC		G4
Least weasel	*Mustela nivalis*	L	S4	Yellow				G5
Wolverine, *luscus* spp	*Gulo gulo luscus*	L	S3	Blue	Y	SC		G4T4
Northern myotis	*Myotis septentrionalis*	P	S2S3	Blue		E		G4
Northern Caribou (population 15)	*Rangifer tarandus* pop. 15	P	S3	Blue	Y	T/SC	1-SC	G5T5
Keen's myotis	*Myotis keenii*	P	S1S3	Red	Y	DD	3	G2G3
Little brown myotis	*Myotis lucifugus*	L	S5	Yellow		E		G5

[1] *P = potentially occurring, L = likely*
[2] *Conservation Status rankings are provided in Appendix 5-2.*
[3] *Identfied Wildlife =species that have been acknowledged as important to regional stakeholder groups such as First Nations, regulators and other regional community members.*

Table 5-4. Species or Groups of Interest within the Project RSA

Species Name (*scientific name*)	Reason of Interest	Likelihood of Occurrence
Moose (*Alces americanus*)	Identified as culturally significant and hunted by Aboriginal peoples. Economically important species to local hunters and guide outfitters. Ungulate winter ranges (UWR) for moose identified in the RSA. Identified as an important species requiring increased management consideration by the Nass South SRMP (BC ILMB 2012) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).	Confirmed
Mountain goat (*Oreamnos americanus*)	Identified as culturally significant and hunted species by Aboriginal peoples. UWR for goat identified within the RSA. Identified as an important species requiring increased management consideration by the Nass South SRMP (BC ILMB 2012) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).	Confirmed
Waterfowl	Individuals, eggs, and active nests protected under *Migratory Birds Convention Act* (1994a) and BC *Wildlife Act* (1996).	Confirmed (Several species)
Marten (*Martes americana*)	Identified as a culturally significant species and trapped by Aboriginal peoples. Economically important furbearer to local trappers. Identified as an important species requiring increased management consideration by land management plans including the Nass South SRMP (BC ILMB 2012) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000). Biologically important as an indicator species.	Confirmed
Wolverine *(Gulo gulo)*	Identified as a species at risk with little knowledge of its behavior or habitat use in the Skeena Region. Increasing emphasis from regulators to include inventory of this species to attain a better understanding locally for assessment of future developments.	Confirmed
Grizzly bear (*Ursus arctos horribills*)	A species at risk and a species of provincially high profile with continued emphasis on its conservation. It has received prominent consideration in the applicable LRMP and SRMP for the RSA and will continue to be emphasized as a species warranting enhanced consideration to integrate its conservation with development.	Confirmed
Silver-haired bat (*Lasionyceteris noctivagans*)	Identified by BC MOE/MNRO as regionally important in the Skeena region because of concerns with maintaining maternal roosts in tree cavities.	Likely
Northern goshawk (*Accipiter gentilis*)	Component of biodiversity, reduced conservation concern down listed to yellow, identified in the Nass South SRMP (BC ILMB 2009, 2012) as requiring additional consideration. Identified as culturally significant species by Aboriginal peoples.	Likely
Songbirds	Component of biodiversity, individuals, eggs, and active nests protected under *Migratory Birds Convention Act* (1994a) and BC *Wildlife Act* (1996).	Expected (several species)
Raptors	Nests and certain raptor species are protected under BC Wildlife Act. The group includes culturally significant raptors identified by Aboriginal peoples. Identified as an important species requiring increased management consideration by land management plans including the Nass South SRMP (BC ILMB 2012) Cassiar Iskut-Stikine LRMP (BC ILMB 2000).	Expected (several species)

6. Mammal Community

Engineers and Scientists

6. Mammal Community

6.1 OVERVIEW

Identifying mammalian species in the proposed Project area is a necessary step in meeting the obligations of federal and provincial regulations for species protection. Baseline studies were conducted from 2010 to 2012 and included desk-based and field research.

The following sections summarize mammalian studies conducted from 2010 to 2012. This inventory focused on mammal species or groups of species considered to occur in the Project study areas that were identified as a species or group of provincial or federal conservation concern or of social, economic or biological importance within the province according to various sources such as the Cassiar Iskut-Stikine LRMP (BC ILMB 2000), Nass South SRMP (BC ILMB 2012) , and regional management plans developed by provincial agencies. Mammal baseline studies focused on moose, mountain ungulate, bats, hoary marmots, fur-bearing species, wolverine, and grizzly bear. Studies were designed to establish baseline information on species presence, distribution, and habitat use in the area, identify the characteristics of occupied habitats as a basis for Habitat Suitability Modelling, and identify species of conservation concern in the study areas.

6.2 MOOSE

6.2.1 Introduction

Moose occur commonly throughout the forested areas of BC. The provincial population estimate for moose in 2000 was approximately 170,000 animals, with over 70% in northern BC (D. A. Blood 2000). Moose populations in BC are generally rated as apparently secure and not susceptible to extirpation or extinction under present conditions (BC CDC 2010b). Moose were selected as a focal species for baseline surveys because of their social, economic, and biological importance to the region.

Moose are protected by the provincial *Wildlife Act* (1996), whereby harvesting activities by non-Aboriginals is permitted under hunting licences. There are three categories of hunters in BC: resident, non-resident, and Aboriginal hunters. The proposed development and associated RSA overlaps with three Wildlife Management Units (WMUs) within Skeena Region 6: 6-21, 6-16, and minor portions of 6-17. The Fish and Wildlife Branch of the BC MFLNRO collects and aggregates raw harvest data for resident and non-resident hunters for each WMU. Moose, particularly bulls, form a large portion of the resident and non-resident hunters' harvest within these WMUs: 96% of the 1,778 moose harvested from 1976 to 2005 were males. Aboriginal hunting rights are associated with either a treaty or an asserted traditional territory. Harvest data from Aboriginal hunting is not collected uniformly by the BC MFLNRO and are therefore not included in harvest estimates or hunting levels. Local conservation initiatives for moose are integrated into regional resource management plans. The Cassiar Iskut-Stikine LRMP (BC ILMB 2000) provides specific guidelines for managing moose. Management objectives are to protect the functional integrity of moose winter range by maintaining critical habitat features, managing harvesting activities, and minimizing road construction in moose winter range.

Individual moose may migrate seasonally, the timing of which is dependent on weather events such as snowfall. Approximately 71% of the moose population in the nearby Nass Wildlife Area (NWA) was identified as migratory individuals, with bulls and cows moving considerable distances between seasonal ranges within the NWA (Demarchi 2000). Migratory moose have a mean multiannual home range of 218 km^2, while non-migratory moose have a mean multiannual home range of 42 km^2 (Demarchi 2003). Migratory behaviour in moose is apparently learned, as young individuals follow the movement patterns of their mothers, both in terms of seasonal home ranges and migration routes (Sweanor and Sandegren 1989). As a result, migratory movements often follow traditional routes, using the same migration corridor every year, but patterns of migration may vary from year to year, depending on extent and duration of snowfall (Bowyer, Ballenberghe, and Kie 2003). Moose are browsers, foraging on stems and twigs of woody plants in winter and the leaves of succulent shoots of shrubs and trees during the rest of the year (Bowyer, Ballenberghe, and Kie 2003). Availability of seasonal forage strongly influences moose habitat use.

Moose data recently collected in the region included surveys conducted for Seabridge Gold's the KSM project over five days during late February and early March, 2009 (Rescan 2010b). The KSM study area includes substantial overlap with the RSA for the Brucejack Gold Mine Project. During this period, 21 SUs were surveyed within coastal and interior environmentally influenced areas of the KSM study (Appendices 6.2-1, 6.2-2 and 6.2-3). During the survey, 4.4 hours were directed at 426 km^2 of habitat (total area within SUs) in the coastal survey area, and 12.7 hours of survey time was directed at 644 km^2 of habitat (total area) in the interior survey area. Following adjustments made for sightability, a total of 33 moose (± 6 at 90% CI) were estimated for the coastal KSM survey area and 198 moose (± 28 at 90% CI) for the interior KSM survey area. The adjusted numbers of bulls, cows, and calves are presented in Appendix 6.2-3.

The baseline KSM data also include gender information. The sex ratio of observed moose in the coastal survey area once adjusted for sightability, was 155 bulls (± 51 at 90% CI) per 100 cows, and productivity from observed coastal moose data was 20 calves per 100 cows (± 11 at 90% CI) once adjusted. In the interior survey area, the sex ratio of observed moose was 47 bulls per 100 cows (± 12 at 90% CI) once adjusted for sightability, while productivity for the interior survey area was 43 calves per 100 cows (± 9 at 90% CI) once adjusted. Observed density in the coastal survey area was 0.16 moose per km^2 of capable habitat and 0.08 moose per km^2 of total area. Observed density in the interior survey area was 0.44 moose per km^2 in capable habitat and 0.3 moose per km^2 of total area.

6.2.2 Objective

The specific objective of the baseline moose study was to assess the late winter abundance and distribution of moose within the RSA. Aerial surveys during the late winter are recommended to assess population size and calf recruitment (RIC 2002). Winter surveys are preferred because moose visibility is high against snow cover. In addition, the availability of winter habitat is also considered to be a limiting factor for moose and surveys at this time permit the identification of important winter habitat for moose.

6.2.3 Methods

Methods used to conduct moose inventory adhered to provincial standards (RIC 2002). The inventory included delineation of the study area into Survey Units (SUs) and helicopter-based aerial surveys of these SUs in winter. Data collected on moose observations included the GPS location, the number of moose, and gender and age classification. The program AERIAL SURVEY (Unsworth et al. 1998) with detection probabilities determined using sightability data from a British Columbia moose model (Quayle, MacHutchon, and Jury 2001) was used to determine population demographics and density estimates. The sightability estimates permit development of confidence intervals around the population estimates. Density estimates were calculated in moose per square kilometre for total area, the area surveyed (census area), and area of locally defined capable habitat based on observations from nearby inventories conducted in the past.

6.2.3.1 Field Surveys

Prior to initiating the field surveys the RSA was sub-divided into 22 SUs, covering approx. 893 km^2 of the RSA (Figure 6.2-1). Twenty-one of these SUs were previously delineated for the KSM Project. SUs were classified as coastal or interior-influenced habitat, because physical (e.g., snow accumulation, elevation, topography) and vegetation characteristics vary between these two regions. Coastal and interior habitat was identified using provincial Biogeoclimatic Ecosystem Classification (BEC) zones. Eight SUs (SU 1 to 8) fall within two coastal BEC zones: Coastal Western Hemlock (CWH) and Mountain Hemlock (MH). Collectively, SUs 1 through 8 are referred to as the coastal survey area for the purposes of this report. Survey Units 9 to 23 fall within the Interior Cedar Hemlock (ICH) and Engelmann Spruce Subalpine Fir (ESSF) BECs, which are representative of drier transitional interior habitat. Collectively, SUs 9 through 23 are referred to as the interior survey area.

Moose were surveyed following RIC standards (RIC 2002) and were consistent with the BC MFLNRO wildlife permit SM11-66841. A Bell 206 helicopter with two observers, a pilot, and navigator was used, maintaining a flying height between 50 and 100 m above ground level and a flying speed between 20 and 60 km/hr. This rate changed with conditions: it was faster over open areas where sightability was greater and slower over closed forest. Surveys were conducted when daytime high temperatures were below freezing and snow cover was complete. Surveys were conducted within SUs from valley bottoms up to an elevation of approximately 1,000 m. Surveys were not conducted in areas where moose occupancy was limited including elevations above 1,000 m, as well as areas of steep topography or deep snowpack. Helicopter flight paths within each SU were recorded using a hand-held Garmin 76 GPS with an external antenna adapted for helicopter use.

Moose observations were recorded and individuals were identified as calves or adults (including yearlings). Adults were classified by sex (bulls or cows). Cows were distinguished from bulls based on the presence of a vulva patch—a white patch of hair seen on the rump. The percent vegetative cover was estimated within a 9 to 10 m radius around the first animal seen in each group to determine the sightability correction factor for developing more accurate population estimates (Anderson and Lindzey 1996; Unsworth et al. 1998; Quayle, MacHutchon, and Jury 2001). A habitat suitability rating (HSR) was made based on the presence of topographic and vegetative features. This HSR is used for evaluating habitat suitability modeling.

6.2.3.2 Data Analysis

<u>Aerial Survey Effort</u>

The total area, area surveyed (referred to as the census area), and the total capable moose habitat in each SU were calculated. The total area for each SU included the whole area within the boundaries of the SU. Census area included the area covered by helicopter flight lines, with a maximum extent of 250 m on either side of the helicopter flight line on the ground. Helicopter flight lines were downloaded and analyzed with ArcView©, Version 9.1 (Environmental Systems Research Institute). Capable habitat is defined by RIC (1999a) as "the ability of the habitat, under the optimal natural (seral) conditions for a species to provide its life requisites, irrespective of the current condition of the habitat." For moose during this survey, the definition was modified to the habitat type that was most able to provide for winter life requisites because of the limiting nature of winter habitat and its relative importance to moose. Capable habitat was defined using professional judgement gathered from previous surveys in the area and included areas below 700 m on slopes of less than 60%. Survey effort was determined by the ratio of survey time to total area within each SU, the ratio of survey time to the census area within each SU, and the ratio of survey time to the amount of capable habitat within each SU. Results include a summary of survey effort of census areas expressed as a rate in minutes per km^2.

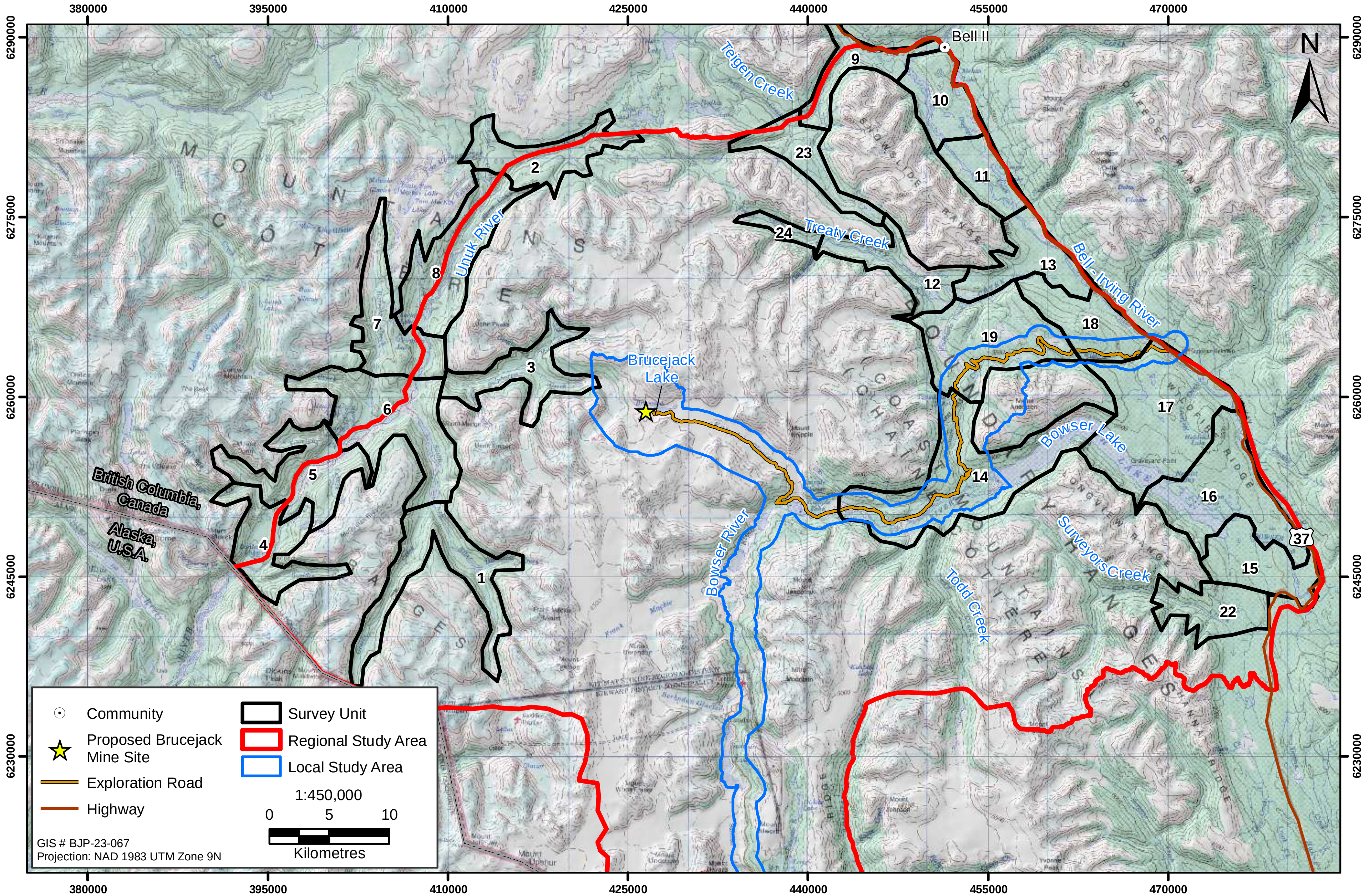


Figure 6.2-1

Moose Survey Units

Moose Observations

The total number of moose observed during the aerial surveys and the composition of each group (i.e., bull, cow, calf) was calculated. Sightability correction was applied to each moose group observation using the program AERIAL SURVEY (Unsworth et al. 1998). Detection probabilities were determined using sightability data from a British Columbia moose model (Quayle, MacHutchon, and Jury 2001).

Population Characteristics

Population demographics and density were analyzed for moose with associated error estimates. Analyses were run separately on moose observed in coastal and interior survey areas. Population sex ratio (number of males per females) and productivity (number of calves per female) metrics were calculated for moose observations that were adjusted for sightability. Density estimates, based on both observed and adjusted data, were also calculated for the total area, census area, and area of capable habitat. Moose location and habitat use has been illustrated with maps and plates.

6.2.4 Results

This inventory indicated that there is a substantial population of moose in the interior ecosystems of 160 ± 17 moose with 55 bulls per 100 cows and 50 calves per 100 cows. The moose population in the coastal area was smaller, with 14 ± 2 moose and a sex ratio of 212 bulls per 100 cows, and productivity of 25 calves per 100 cows. Density of moose within the census area in the interior was 0.42 moose per km^2 and coastal area had 0.24 moose per km^2 observed. The results of the inventory are presented separately for the interior and coastal-influenced ecology of the RSA.

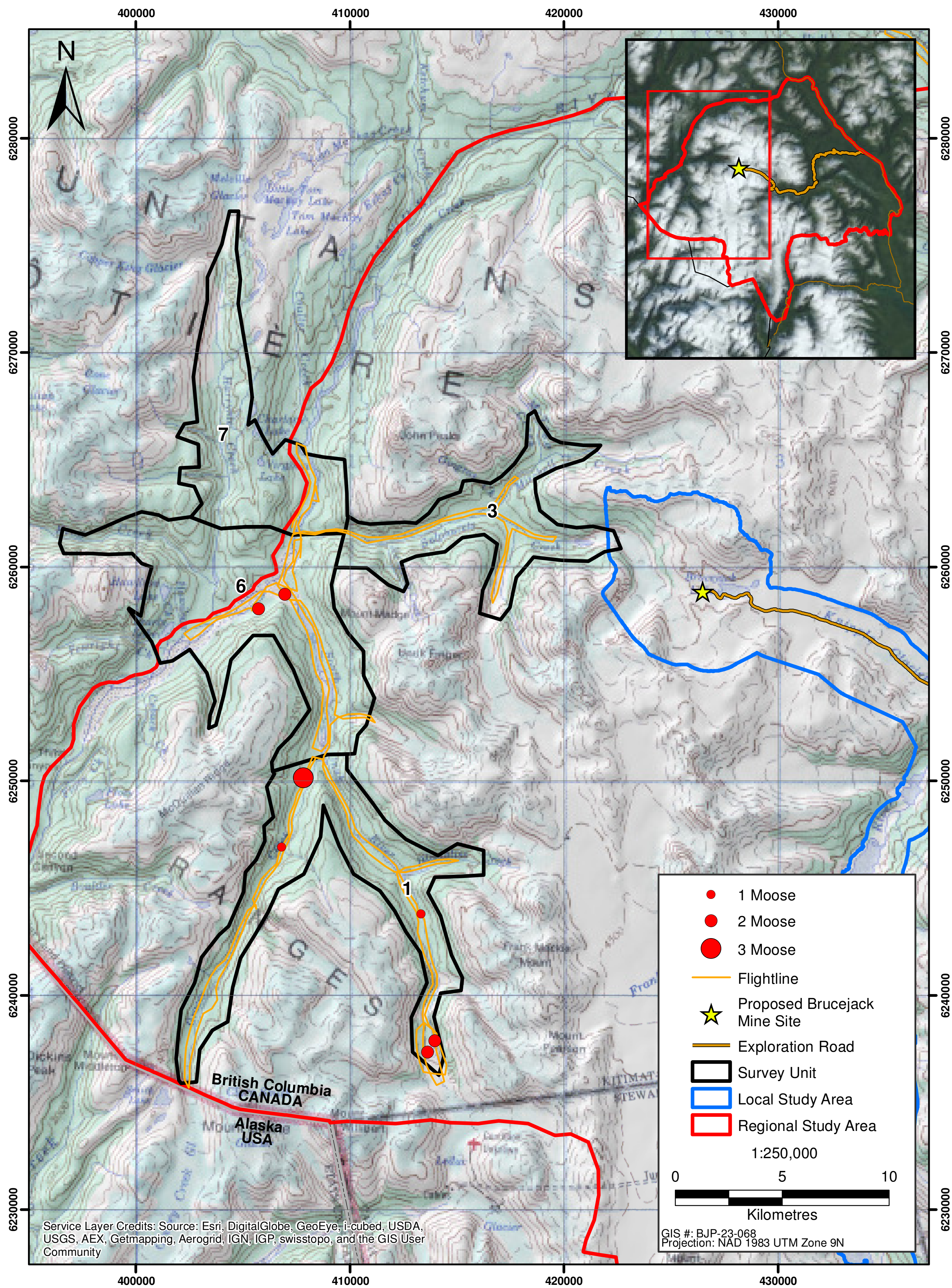
6.2.4.1 Aerial Survey Effort

Moose surveys were conducted over four days during mid-February, 2011. Over 16.4 hours of helicopter survey time were flown for the aerial moose surveys on February 15, 16, 19 and 20, 2011. Weather conditions were good for the aerial surveys with temperatures ranging between -8°C and -19°C, 100% snow cover in the RSA, and generally flat lighting. During this period, 17 SUs were surveyed for 15 to 157 minutes each, based on their size, for a total of 16.4 hours of survey time (Appendix 6.2-4). SUs 2, 4, 5 and 8 in the coastal influenced area were outside of the RSA and not surveyed while SU 24 had excessively deep snow (> 2 m), and so was also not surveyed.

During the survey, 1.7 hrs were directed at 59 km^2 of habitat (the census area) in the coastal survey area. Within the interior survey area, 14.7 hrs of survey time was directed at 383 km^2 of habitat (total census area). Survey effort was summarized by total area, census area, and capable habitat (Table 6.2-1). Survey flight lines are displayed in Figure 6.2-2 and Figure 6.2-3 for coastal and interior surveys respectively.

Table 6.2-1. Summary of Survey Effort, 2011

		Survey Effort (min/km^2 ± Standard Deviation)	
Survey Area	Stat	Coastal Survey Area	Interior Survey Area
Total Area	Range within SUs	0.15 to 0.82	0.43 to 2.60
	Average	0.44 ± 0.14	1.40 ± 0.20
Census Area	Range within SUs	1.55 to 1.89	1.63 to 3.09
	Average	1.69 ± 0.07	2.30 ± 0.14
Capable Habitat	Range within SUs	0.35 to 1.86	0.63 to 8.56
	Average	0.98 ± 0.33	2.45 ± 0.54



PRETIVM

Moose Winter Observations in Coastal Survey Area, 2011

Figure 6.2-2

Rescan Engineers & Scientists

PROJECT # 0194150-0004 GIS # BJP-23-069 April 19, 2013

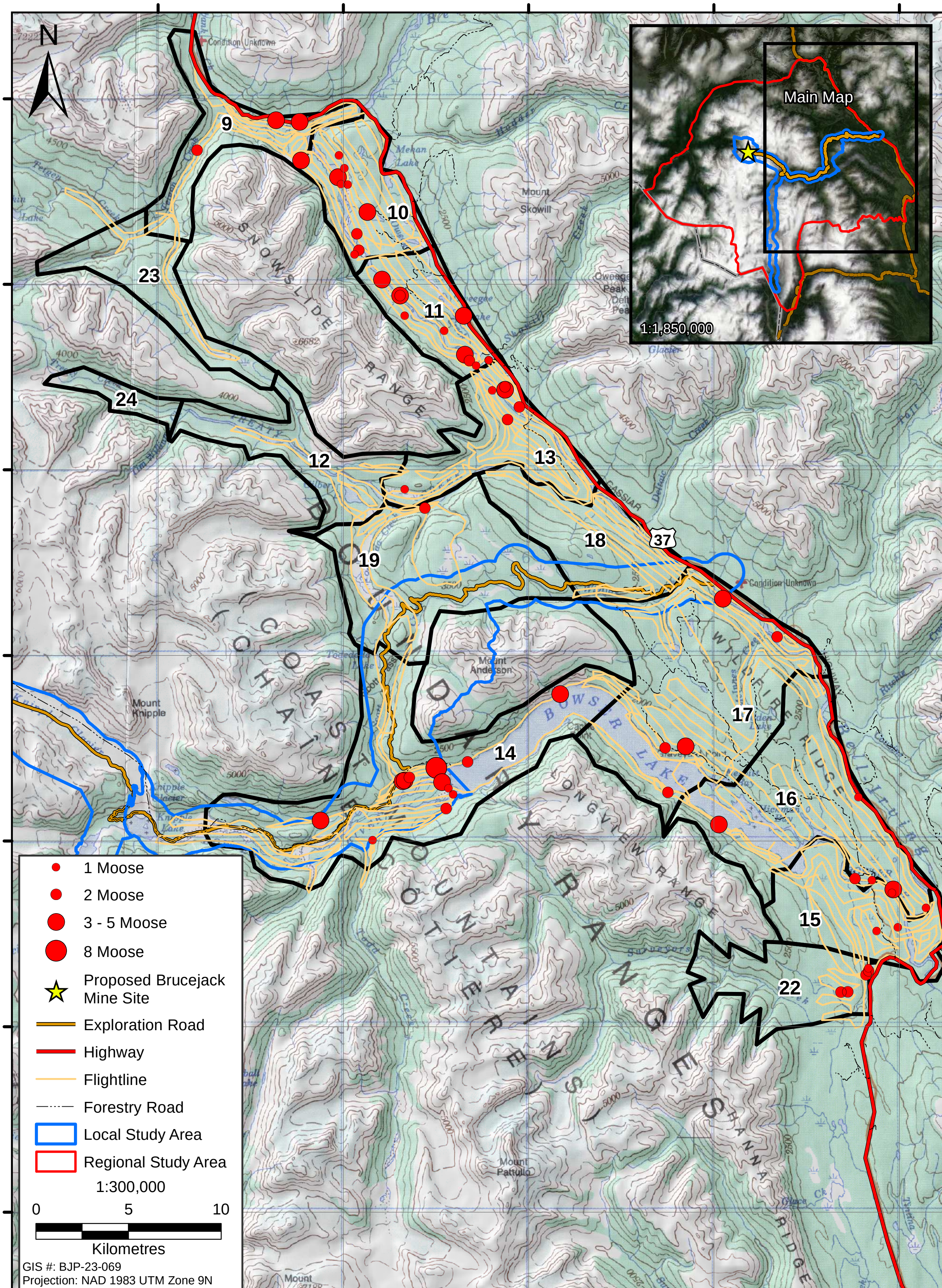


Figure 6.2-3

Moose Winter Observations in Interior Survey Area, 2011

PRETIVM

Rescan Engineers & Scientists

6.2.4.2 Moose Observations

Within the coastal survey area, 13 moose were observed in 7 groups in 2 of the 4 SUs (Figure 6.2-2; Table 6.2-2; Appendix 6.2-5). Bulls were most frequently seen (62% of observations), followed by cows (31%), and calves (7%); no moose were unclassified (Table 6.2-2). Within the interior survey area, 135 moose were observed in 62 groups across 10 of the 13 SUs (Figure 6.2-3; Table 6.2-2; Appendix 6.2-5). Cows accounted for the majority (46%) of moose observed, followed by bulls (26%), calves (23%), and unclassified moose (5%). Details of observations are included in Appendix 6.2-5.

Table 6.2-2. Summary of Winter Moose Observations in Coastal and Interior Survey Areas, 2011

	Coastal Survey Area			Interior Survey Area		
Parameter	**Observed Number**	**Adjusted Number[a]**	**90% Confidence Interval[b]**	**Observed Number**	**Adjusted Number[a]**	**90% Confidence Interval[b]**
Bulls	8	8	± 2	35	41	± 6
Cows	4	4	± 0	64	74	± 8
Calves	1	1	± 0	30	37	± 6
Unclassified	0	0	± 0	6	8	± 4
Total	**13**	**14**	**± 2**	**135**	**160**	**± 17**

[a] *Adjustments for sightability and estimates of variance were derived using the program Aerial Survey (Unsworth et al. 1998) with the BC moose model (Quayle, MacHutchon, and Jury 2001).*
[b] *90% confidence intervals = 1.65*(variance)$^{0.5}$.*

Following adjustments made for sightability, a total of 14 moose (± 2 at 90% CI) were estimated for the coastal survey area and 160 moose (± 17 at 90% CI) for the interior survey area of the Brucejack Project (Table 6.2-2). The adjusted numbers of bulls, cows, and calves are presented in Table 6.2-2.

6.2.4.3 Population Characteristics

The sex ratio of moose in the coastal survey area was 200 bulls per 100 cows. The sex ratio was 212 bulls (± 69 at 90% CI) per 100 cows after a sightability adjustment. Productivity from observed coastal moose data was 25 calves per 100 cows, and 27 calves per 100 cows (± 12 at 90% CI) once adjusted for sightability. In the interior survey area, the sex ratio of observed moose was 55 bulls per 100 cows which remained the same once adjusted for sightability. Productivity for the interior survey area was 47 calves per 100 cows, and 50 calves per 100 cows (± 10 at 90% CI) once adjusted for sightability.

In general, the density of moose was more than twice as high in the interior survey area than in the coastal survey area (Table 6.2-3; Appendix 6.2-6). In the coastal survey area, the highest observed density was observed in SU 1 at the headwaters of the South Unuk River (0.33 moose/km^2 of capable habitat; Appendix 6.2-6). The highest density in the interior survey area was observed along the Bell Irving River in SU 11 north of Skowill Creek (0.82 moose/km^2 of capable habitat), followed by SU 10 at the Bell Irving and Snowbank Creek confluence (0.59 moose/km^2 of capable habitat), SU 13 (0.44 moose/km^2 capable habitat) just downstream of SU 11, and SU 14 (0.45 moose/km^2), which included the Bowser watershed above Bowser Lake (Appendix 6.2-6). Plates 6.2-1 and 6.2-2 illustrate good quality winter moose habitat and Plate 6.2-3 identifies a moose calf predated by wolves in SU 18.

Table 6.2-3. Summary of Winter Moose Density in Coastal and Interior Survey Areas, 2011

	Coastal Survey Area			Interior Survey Area		
Survey Area	**Observed Density (moose/km^2)**	**Adjusted Density (moose/km^2)**	**90% Confidence Interval**	**Observed Density (moose/km^2)**	**Adjusted Density (moose/km^2)**	**90% Confidence Interval**
Total Area	0.058	0.062	± 0.009	0.202	0.240	± 0.015
Census Area	0.221	0.238	± 0.034	0.353	0.418	± 0.026
Capable Habitat	0.120	0.130	± 0.019	0.290	0.344	± 0.021

Plate 6.2-1. Moose observed at west end of Bowser Lake in interior SU 14.

Plate 6.2-2. Moose in coastal SU 1.

Plate 6.2-3. Wolf on remainder of moose calf in SU 18.

6.2.5 Discussion

The 2011 baseline moose inventory provided information on moose winter spatial distribution across the RSA and demographic indices for evaluating productivity and population fitness. The moose population inventory and analysis provided Survey effort and density estimates can allow for comparison of the results between years and with other projects in the region. Moose observations were compared to regional moose habitat use and distribution. Conditions for the moose survey were excellent and the survey covered all available winter habitat in the RSA. Snow depths were deep during the survey and much of the area above 700 m supported depths greater than 2 m. Snow depths exceeding 2 m would preclude moose winter use of an area. Therefore, an upper elevation limit of 700 m was used.

The survey area, particularly capable habitat associated with the Bell Irving River and Bowser Lake and River drainage, support a substantial number of moose. Most observations of moose were outside the LSA, within the RSA and tended to be in areas more isolated from roads. Notable areas were above the Bowser Lake which supported 35 of the 135 moose observed (26%), and SUs 11 and 10, which supported 39 moose (29% of observations) and included habitat near the upper Bell Irving River. The coastal area of the RSA included very little capable habitat, resulting in few moose observations.

Within the LSA a substantial number of moose were observed wintering in highly suitable habitat associated with the flood plain above the Bowser Lake (SU 14). This area supports abundant browse and is at relatively low elevation compared to habitat within the other two LSA SUs (SU 18 and SU 19), which had deep snow precluding moose use during the survey. The area above Bowser Lake is currently isolated and less exposed to human disturbance or harvest then similar highly suitable habitat associated with the Bell Irving River, as access is only accommodated by snowmobile along the Bowser Lake during winter (or by boat or float plane when the lake is not covered in ice). This isolation has likely resulted in the concentration of moose observed.

Moose observations were associated with low elevation habitats which support more winter browse. Use of riparian areas, lakes, and river shorelines were noted, which is typical of habitat selection by moose in the region. Moose were observed lying on open snow on Bowser Lake well off the shore, which is a typical predator avoidance strategy associated with the deep and powdery snow pack conditions in this area.

Table 6.2-4 displays the results from this survey to baseline results from other projects conducted in the same region. Demographic metrics such as sex ratio and calf productivity are within the range of observations noted in the region. However moose density in capable habitat was lower than areas of comparable ecology, particularly more isolated study areas such as the habitat associated with the Iskut/Stikine and Schaft/Mess Creeks (RTEC 2006c, 2007c).

Table 6.2-4. Winter Moose Population Characteristics within North Western British Columbia

Adjusted Population Characteristics	Brucejack Interior Survey Area	Brucejack Coastal Survey Area	Schaft/ Mess Creek[a]	Stikine/ Iskut River[b]	More Creek/ Bob Quinn[b]	Nass Wildlife Area[c]	Bell Irving/ Ningansaw (North SA)[d]
Number	160	14	314	481	148	-	414
Productivity Ratio (calves/100 cows)	50	27	31	64	46	47	57
Sex Ratio (bulls/100 cows)	55	212	93	74	93	38	110
Capable Habitat Density (moose/km^2)	0.34	0.13	0.67	0.42	0.67	-	0.48 (calculated weighted average for density classes)

[a] *RTEC (2007c).*
[b] *RTEC (2006c).*
[c] *Demarchi (2000), taken from population surveys in 1997.*
[d] *Rescan (2009b).*

Substantially fewer moose groups were observed during this survey at SUs 17, 16 and 9 compared to surveys in similar habitats in the region. The higher rated winter habitat within those SUs is primarily along highway 37 so moose may have higher harvest rates due to good road access and a lack of protected winter range areas (Rescan 2013c). Large groups of moose were observed in SUs 13, 11, 10 and 9, which are also bounded by Highway 37 on the east side, however, highly suitable winter habitat was identified in areas that were not near the highway 37 (Rescan 2013c). Other factors such as predation by wolf, (as observed in SU 18) and bears, impacts of more severe winter (such as in 2009), and other factors may also contribute to the lower than expected numbers in these SUs.

For SUs surveyed and counts adjusted for sightability, in 2009 for the KSM Project estimates were 33 moose in the coast and 198 in the interior (Appendix 6.2-3), versus 2011 Brucejack estimates of 14 (± 2 at 90% CI) in the coast and 160 (± 17 at 90% CI) in the interior (Table 6.2-4). These data suggest a substantial decline (21%) in the number of moose between the two survey years. Within the interior SUs where surveys were conducted for both projects, productivity estimates were 50 calves per 100 cows (± 10 at 90% CI) and a sex ratio of 55 bulls per 100 cows (± 10 at 90% CI). The productivity for the interior survey area during the KSM inventory was 43 calves per 100 cows (± 9 at 90% CI) and the sex ratio of observed moose was 47 bulls per 100 cows (± 12 at 90% CI) once adjusted for sightability. These demographics were not significantly different between surveys. Annual population variability is dependent on population variables such as gender and age demographics and influencing environmental pressures such as climate, predators and forage availability so it will change from year to year and between regional areas.

There have been concerns raised about overharvest of moose in the area. Numbers provided by BC MFLNRO wildlife biologists in Smithers suggest that First Nation harvest in areas associated with the Bell Irving River is high, and the extent of harvest directly to the north of the Nass Wildlife area is unknown (RTEC 2007c; Demarchi 2011). The observed low moose density in 2011 compared to 2009 may be a result of increased pressure from harvest, predation or other factors.

The information collected to describe moose baseline population and distribution identified key areas of winter use and has suggested that population parameters observed are within the range of regional observations. A possible decline in population or shift in distribution from anecdotal observations and comparison of survey results was noted, and this information will be important to address in the development of a monitoring plan. The description of moose provided by the inventory will contribute to assessing possible impacts to this species from the project.

6.3 MOUNTAIN UNGULATES

6.3.1 Introduction

There are four mountain ungulate species in northwestern BC: mountain goat (*Oreamnos americanus*), northern caribou (*Rangifer tarandus*), Stone's sheep (*Ovis dalli stonei*), and smaller numbers of Dall's sheep (*O. d. dalli*). Mountain ungulates receive particular conservation attention from the BC government because they are important economic and social resources for traditional harvest by Aboriginal peoples and recreational harvest for resident and non-resident hunters.

The Cassiar Iskut-Stikine LRMP (BC ILMB 2000) provides guidelines for the management of habitat for mountain ungulates. Management objectives for each species includes maintaining large areas of high value habitat and the functional integrity of winter range, as well as minimizing disturbance to animals during kidding (goats) and lambing (sheep) periods.

The total number of mountain goats in BC has been estimated at approximately 50,000 individuals (D.A. Blood 2000; Côté and Festa-Bianchet 2003), of which approximately 16,000 to 35,000 occur within the Skeena Region (BC ILMB 2009). Mountain goats are widely distributed throughout the province and can be found in most major mountain ranges, except those on coastal islands (e.g., Vancouver and Queen Charlotte Islands; (D.A. Blood 2000). While suitable habitat for mountain goats is found throughout the province, mountain goats are most numerous in northern BC. The southern Rocky Mountain and Coast Mountain ranges also support substantial populations (D.A. Blood 2000; Demarchi, Johnson, and Searing 2000). Mountain goats are yellow-listed in the province because they are widespread and abundant (BC CDC 2013b). However, mountain goats are protected under the provincial *Wildlife Act* (1996) whereby harvesting activities by non-aboriginals are only permitted under a hunting license.

Winter is an important season for mountain goats because of the limited availability of habitats that can provide a combination of escape terrain, forage, and cover during this critical period. Escape terrain includes steep cliffs, rocky outcrops, and talus slopes where goats can escape from predators. The MFLNRO has identified some ungulate winter ranges (UWRs). These areas are considered to be necessary components for the survival of ungulates. UWRs and their management objectives are mandated under the authority of Sections 9(2) and 12(1) of the *Government Actions Regulation* (BC Reg. 582/ 2004b) and *Forest and Range Practices Act* (Section 149.1; 2004a). Within the RSA there is an approved mountain goat UWR within the Nass TSA (UWR u-6-002; BC MOE 2008).

Habitat requirements for thinhorn sheep broadly overlap those of mountain goat, because sheep are also reliant on escape terrain for cover and predator avoidance. Northern caribou typically select more rolling terrain throughout the year than do mountain goat. The RSA, however, is just beyond the known continuous regional distribution of both sheep and caribou (Shackleton 1999), possibly due to lower overall habitat suitability or climactic factors such as snowpack depth and persistence. Therefore, local populations of sheep and caribou are not expected to occupy habitat year round within the RSA, though occasional occurrences of dispersing or wandering sheep and caribou or small isolated populations may occur.

Mountain ungulate aerial surveys were conducted for the neighbouring KSM Project during summer 2008 and winter 2009 (Appendices 6.3-1 and 6.3-2). The KSM study was conducted in 28 SUs to more accurately quantify mountain ungulate distribution (Appendices 6.3-3 and 6.3-4). Only mountain goats were observed. A total of 230 goats were counted within 20 SUs during the summer survey (78% adults and 22% kids), and 178 goats were counted in 11 SUs during the winter survey (79% adults and 21% kids). The kidding ratio was 28 kids per 100 adults during summer, and 26 kids to 100 adults during winter. The group size of mountain goats ranged from 1 to 28 individuals (mean 3.7 ± 0.6 SD) in the summer, compared to 1 to 16 (mean 2.6 ± 0.3 SD) in the winter.

6.3.2 Objectives

The goal of this study was to collect baseline information on mountain ungulate distributions within the study areas. The specific objectives of this study were to establish baseline estimates for the summer and winter population sizes, herd composition, and distribution of mountain goats within the study areas and determine whether Stone's sheep, and northern caribou also reside in the study areas.

6.3.3 Methods

The Brucejack RSA was initially surveyed for mountain ungulates during the summer of 2010 and winter of 2011 in a relatively undeveloped area. Additional surveys were conducted during the summer of 2012 and late winter of 2013, focusing on the proposed south option transmission route along the Granduc Access Road. The latter surveys included areas that had been developed for the Granduc Mine and the existing Long Lake hydro-electric Project. The area continues to be influenced by industrial and tourist activity. Subsequent analyses were kept separate to better reflect anticipated differences in the sub-populations associated with these two survey areas.

6.3.3.1 Aerial Surveys

Aerial surveys for mountain ungulates were flown during the summers of 2010 and 2012, and winters of 2011 and 2013 (Figure 6.3-1). Surveys were not conducted in areas where mountain ungulate habitat was not present such as along the northern side of the LSA near the Bell Irving River. The study area included 28 survey units (SUs) originally delineated for the KSM project (Appendices 6.3-3 and 6.3-4), and an additional five SUs added to correspond to the Brucejack Gold Mine project RSA, which overlaps significantly with the KSM study area. The combined KSM and Brucejack study area contains 33 Survey Units (SUs) representing undisturbed areas, and an additional two SUs to facilitate inventory of the proposed power line route (Figure 6.3-1), for a total of 35 SUs.

A total of 29 of the 35 SUs were selected as the primary survey area for baseline aerial surveys for mountain ungulates in the RSA. Those SU's were considered a high priority due to their habitat capability and relative distance to proposed infrastructure so ungulates in those areas are more likely to be affected. Some of the SUs not considered priority areas, however, were surveyed opportunistically as time and weather permitted for use as potential control areas during future monitoring. This included SUs 3, 4, and 19 in the north of the study area and SUs 13, 14, 15, and 16 in the southwest. Weather presented additional challenges, and some SUs that had been surveyed in summer 2010 could not be safely flown during the following winter.

Aerial survey methods for mountain ungulates adhered to Provincial Resource Information Standards Committee (RISC) protocols (RIC 2002), including the division of the study area into SUs and the use of a helicopter. The 27 SUs that were surveyed in 2010 and 2011 covered approximately 2,730 km^2 of the RSA (Figure 6.3-1), and the additional two SUs surveyed in 2012 and 2013 that encompassed the proposed south option transmission line route, covered 382 km^2. Survey units contained suitable mountainous terrain and habitat that could be used by mountain ungulates during the summer and winter. SU boundaries were determined based on topographic features that could limit movements of mountain ungulates between adjacent units such as low elevation valleys because they are vulnerable to predation in the absence of escape terrain. Delineating survey units minimizes inter-unit movement during the survey period, thereby increasing the independence of each unit and the accuracy of population estimates.

The aerial surveys were conducted by two observers and a navigator. Surveys focused predominately on areas above the tree line due to difficulties detecting mountain ungulates under closed canopy forest. During winter, suitable barren escape terrain below tree line was included because these areas may be compatible with winter use. The helicopter maintained an average speed of approximately 100 km per hour and was adjusted for visibility; faster over open areas where visibility was good and slower over areas where visibility was obscured by vegetation cover (Rice CG, Jenkins KJ, and WY 2009). Flight lines followed topographic contours or identifiable features, spaced at approximately 500 m intervals. Flight paths were recorded using a hand-held Garmin GPS 76 unit with an external antenna.

The locations of goat groups were recorded using GPS, and the number of goats divided as either kids or adults were noted consistent with RISC survey classification level one, which is the simplest level, so as to reduce disturbance on goats while surveying during the sensitive time of year (RIC 2002). Animals that could not be classified by age with confidence were recorded as unidentified. At each location, the dominant vegetation cover type and habitat suitability rating (HSR) was estimated based on topographic and vegetative features used for habitat suitability modelling in the region. A HSR of one represented the most suitable habitat based on local benchmarks, while a HSR of six represented habitat devoid of habitat features that could be used by mountain ungulates. This information will be used in the evaluation of habitat maps developed for the Project.

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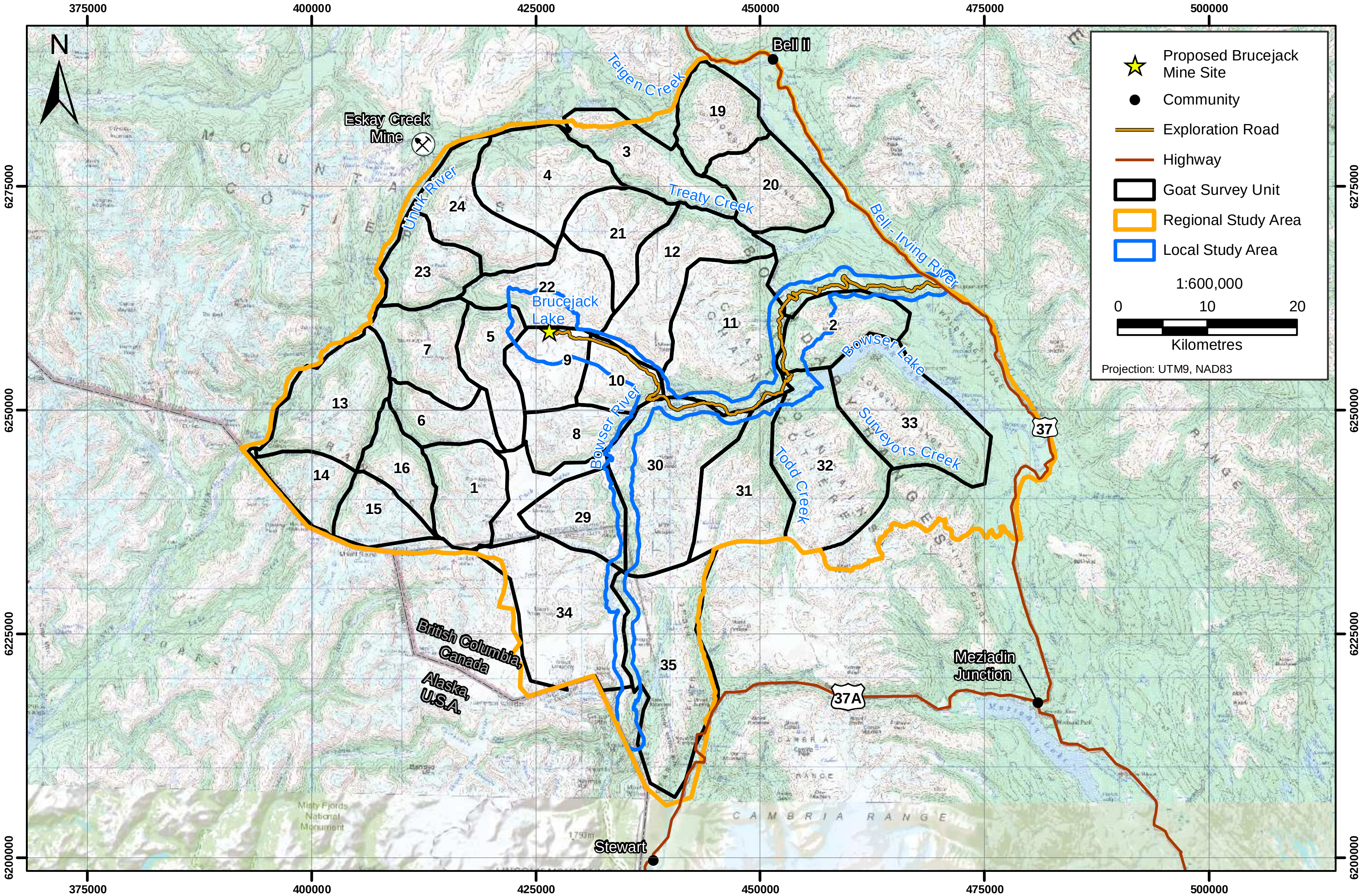

Figure 6.3-1

PRETIVM

Mountain Ungulate Survey Units in the Regional Study Area

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6.3.3.2 Data Analysis

Survey Effort

The total area and the census area were calculated for each SU. The total area equals the entire area within the boundary of the survey unit. The census area boundary extended out 250 m from the outer flight line, representing the area most likely capable of supporting mountain ungulates, particularly goats. Survey effort was determined as the ratios of survey time to total area and survey time to census area.

Population Characteristics

Group sizes and composition, kidding rates, and densities were calculated for each SU. The number of young (e.g., kids) per 100 adults was calculated for both the summer (natality ratio) and winter (recruitment ratio) periods consistent with survey intensity level one definitions (RIC 2002). A density was calculated for both the total area and the census area by dividing the number of ungulates by the respective areas. Survey estimates were not adjusted for sightability because suitable models are not available for establishing sightability corrections for mountain ungulates in BC (RIC 2002; Ayotte 2005). Incidental observations of other mountain ungulates (sheep), were totaled and discussed separately from those of mountain goats.

Winter observations were determined to be within or outside UWRs for each surveyed SU. Provincially-designated goat UWRs were identified throughout the RSA, and their collective areas were estimated to derive densities by UWR for comparison with total and census area densities.

6.3.4 Results

6.3.4.1 Survey Effort

Summer surveys were completed in 20 SUs from August 10 to 16, 2010 (30.5 hours of helicopter time) covering a total area of approximately 2,110 km^2 (1,073 km^2 of census area), and on September 5, 2012 (4.8 hours) in three SUs (34, 35, 29) and an additional area of 463 km^2 (Table 6.3-1 and Appendix 6.3-5). The average summer survey effort was slightly greater in the summer of 2010 (0.88 min/km^2), than in 2012 (0.58 min/km^2) (Table 6.3-2).

Table 6.3-1. Survey Units flown in Summer 2010, 2012 and Winter 2011, 2013

Survey Unit	Summer	Winter	Survey Unit	Summer	Winter
1	2010	ns	15	ns [a]	ns [a]
2	2010	2011	16	ns [a]	ns [a]
3	ns [a]	2011	19	ns	ns
4	ns [a]	ns	20	2010	2011
5	2010	2011	21	2010	ns
6	2010	ns	22	2010	2011
7	2010	2011	23	2010	2011
8	2010	2011	24	2010	2011
9	2010	2011	29	2010/2012	2013
10	2010	2011	30	2010	2011
11	2010	2011	31	2010	2011
12	2010	2011	32	2010	2011
13	ns [a]	ns [a]	33	2010	2011
14	ns [a]	ns [a]	34	2012	2013
			35	2012	2013

[a] *ns: not surveyed.*

Table 6.3-2. Summary of Survey Effort by Total Area and Census Area, 2010 and 2011

	Survey Effort (min/km^2 ± SD)			
	Summer 2010	**Winter 2011**	**Summer 2012**	**Winter 2013**
Total Area				
Range within SUs	0.34 to 1.33	0.43 to 2.06	0.41 to 0.71	0.28 to 0.67
Average	0.88 ± 0.24	0.88 ± 0.42	0.58 ± 0.16	0.46 ± 0.20
Surveyed (census) Area				
Range within SUs	1.09 to 2.44	1.24 to 2.78	0.65 to 1.06	0.51 to 0.83
Average	1.69 ± 0.35	1.82 ± 0.47	0.82 ± 0.21	0.63 ± 0.18

Winter surveys were conducted in 17 SUs from February 17 to 22, 2011 (26.2 hours), covering a total area of approximately 1,898 km^2 and a census area of 865 km^2 (Table 6.3-1 and Appendix 6.3-6). In 2013 from March 4 to March 5 (3.6 hours), covered a total area of approximately 464 km^2 and a census area of 324 km^2 (Table 6.3-1, Appendix 6.3-6). The average winter survey effort was 0.88 min/km^2 in 2011 and 0.46 min/km^2 in 2013 (Table 6.3-2).

Nineteen SUs were surveyed during both summer and winter flights (Table 6.3-1). Six SUs were not surveyed at any time due to logistical or weather related factors.

6.3.4.2 Population Characteristics

Northern caribou or Stone's sheep were not observed during the summer or winter surveys. The remainder of this report focuses on results for mountain goats.

<u>Summer</u>

A total of 265 mountain goats were observed in 110 groups during summer aerial surveys in 2010 (Plate 6.3-1; Figure 6.3-2 and Table 6.3-3). Goats were not observed in SUs 6 and 8. Overall group composition was 79.2% adults and 20.8% kids, with a kidding ratio of 26 kids per 100 adults. Group sizes ranged from one to 19 individuals (mean 2.4 ± 3.0 SD). Most observations were of a single individual (56.9%). On average, 0.15 (± 0.09 SD) goats were observed per minute of survey time.

Plate 6.3-1. Goats on high elevation summer escape terrain in the RSA, 2010.

PROJECT #1042-006-04 GIS # BJP-23-016 March 15 2013

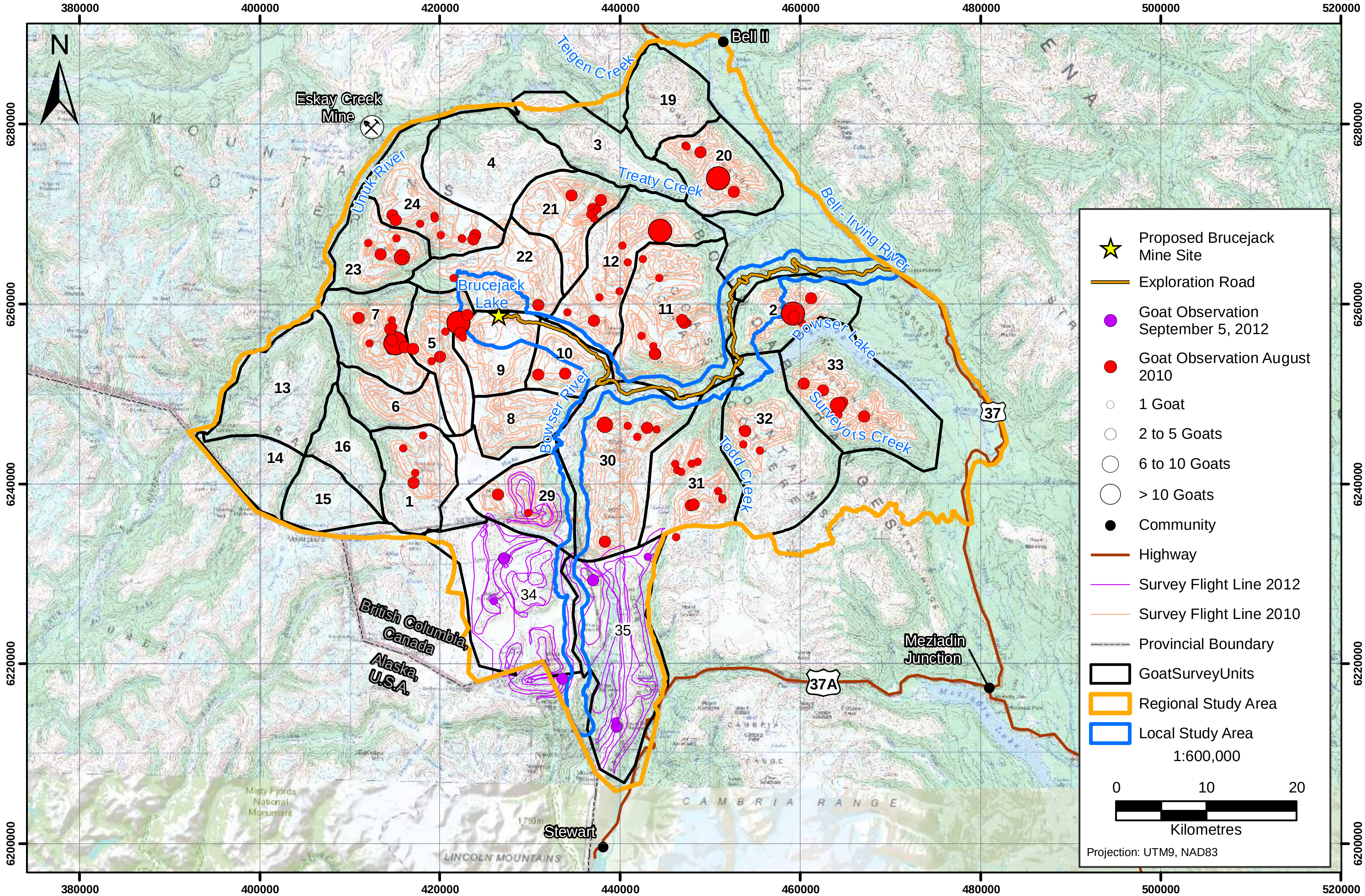

Figure 6.3-2

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Mountain Goat Summer Survey Observations, 2010 and 2012

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Table 6.3-3. Mountain Goat Observations and Population Characteristics, Summers of 2010 and 2012

Survey Unit (SU)	Within LSA	Number of Goats			Kidding (kid/adult)	Density (goat/km^2)	
		Total	Adults	Kids		Total Area	Census Area
2010 Survey							
1	No	6	5	1	0.20	0.07	0.16
2	Yes	27	21	6	0.29	0.32	0.79
5	Yes	21	16	5	0.31	0.28	0.40
6	No	0	0	0	0.00	0.00	0.00
7	No	31	24	7	0.29	0.33	0.57
8	Yes	0	0	0	0.00	0.00	0.00
9	Yes	4	3	1	0.33	0.06	0.10
10	Yes	6	5	1	0.20	0.11	0.19
11	Yes	17	13	4	0.31	0.09	0.15
12	Yes	24	19	5	0.26	0.18	0.31
20	No	20	17	3	0.18	0.21	0.38
21	No	12	11	1	0.09	0.14	0.21
22	Yes	5	4	1	0.25	0.05	0.08
23	No	13	9	4	0.44	0.17	0.42
24	No	15	12	3	0.25	0.14	0.27
29	Yes	6	5	1	0.20	0.07	0.14
30	Yes	15	11	4	0.36	0.08	0.15
31	Yes	16	14	2	0.14	0.14	0.33
32	Yes	6	6	0	0.00	0.03	0.14
33	No	21	15	6	0.40	0.12	0.31
Total		**265**	**210**	**55**	**0.26**		
Average						**0.13**	**0.26**
SD						**0.10**	**0.19**
2012 Survey							
29	Yes	0	0	0	0.00	0.00	0.00
34	Yes	10	8	2	0.25	0.05	0.05
35	Yes	11	11	0	0.00	0.06	0.06
Total		**21**	**19**	**2**	**0.11**	**0.05**	**0.05**
Average						**0.04**	**0.04**
SD						**0.03**	**0.03**

[a] *Based on all observations made for entire area surveyed.*

In the summer 2012 survey, 21 goats were observed in seven groups in SUs 34 and 35, and none in the control SU 29 (Figure 6.3-2). Six goats had been observed in SU 29 during the summer 2010 survey. Overall group composition was 90.5% adults and 9.5% kids, with a kidding ratio of 11 kids per 100 adults. Group sizes ranged from one to five individuals. On average, 0.054 (± 0.047 SD) goats were observed per minute of survey time.

Only density estimates for the census areas are discussed as they are representative of the most capable habitat, and provide a biologically meaningful comparison between SUs. From the 20 SUs surveyed during the summer of 2010, density averaged 0.26 (± 0.19 SD) goats per km^2 (range: 0 to 0.79)

(Table 6.3-3; Appendix 6.3-7). The majority of goats were observed in SU 7 (12%), 2 (10%), and 12 (9%). Survey unit 7 is within the RSA and SU 12 is mostly within the RSA but partially overlaps the LSA on its southern border. The highest density of goats was found in SUs 2, 7, and 23 (Table 6.3-3). Survey unit 23 is within the RSA and SU 2 overlaps the eastern part of the LSA. Surveys were conducted during a very warm period, with temperatures around 30°C, and habitat use by goats in the summer of 2010 appeared to be associated with higher (and cooler) elevations in the RSA.

Mountain goat density estimate for SUs surveyed was 0.04 (± 0.03 SD) goats per km^2 in 2012. The density calculated for the census area was less than 1/6th the average density calculated for the SUs surveyed in 2010. Ease of human access and historical disturbance have likely contributed to the lower goat population observed in SUs 29, 34 and 35 relative to the rest of the RSA, either from increased mortality, reduced productivity or possibly goats had moved to less disturbed areas in the region.

Winter

During winter 2011, a total of 202 mountain goats were observed among 82 groups in the 17 surveyed SUs (Plate 6.3-2; Table 6.3-4; Figure 6.3-3; Appendix 6.3-8). Adults accounted for 85.5% and kids accounted for 14.9% of the total number of goats. The kidding ratio was 19 kids per 100 adults (Table 6.3-4). The average group size was 2.5 (± 2.2 SD, range 1 to 12). Approximately half (51%) of the observations were of a single individual. Goats were not observed in SU 9 which overlaps the LSA and is the SU where the Brucejack Exploration Camp is located. On average, 0.12 (± 0.08 SD) goats were observed per minute of survey time.

Plate 6.3-2. Goats using high elevation winter escape terrain in the RSA, 2011.

Provincially designated mountain goat UWRs within the RSA are classified as Canyon or Mountain Dwelling UWRs and range in size between 0.05 km^2 and 14.8 km^2. A total of 309 UWRs are present in the RSA, consisting of 298 Mountain (131.6 km^2 of total area) and 11 Canyon (8.6 km^2 of total area) UWRs. The UWRs that overlapped those SUs surveyed during the winter 2011 supported 97 goats, 44% of all observations (Table 6.3-4). All goats were observed in Mountain Dwelling UWR units. The area of available UWR within a SU was not correlated with the number of goat observations (R^2 = 0.009; P = 0.72). Some of the SUs with the highest number of goats, such as SU 7 and SU 5, had very little overlap with an UWR (Table 6.3-4).

PROJECT #1042-009-04 GIS # BJP-23-057 March 11 2013

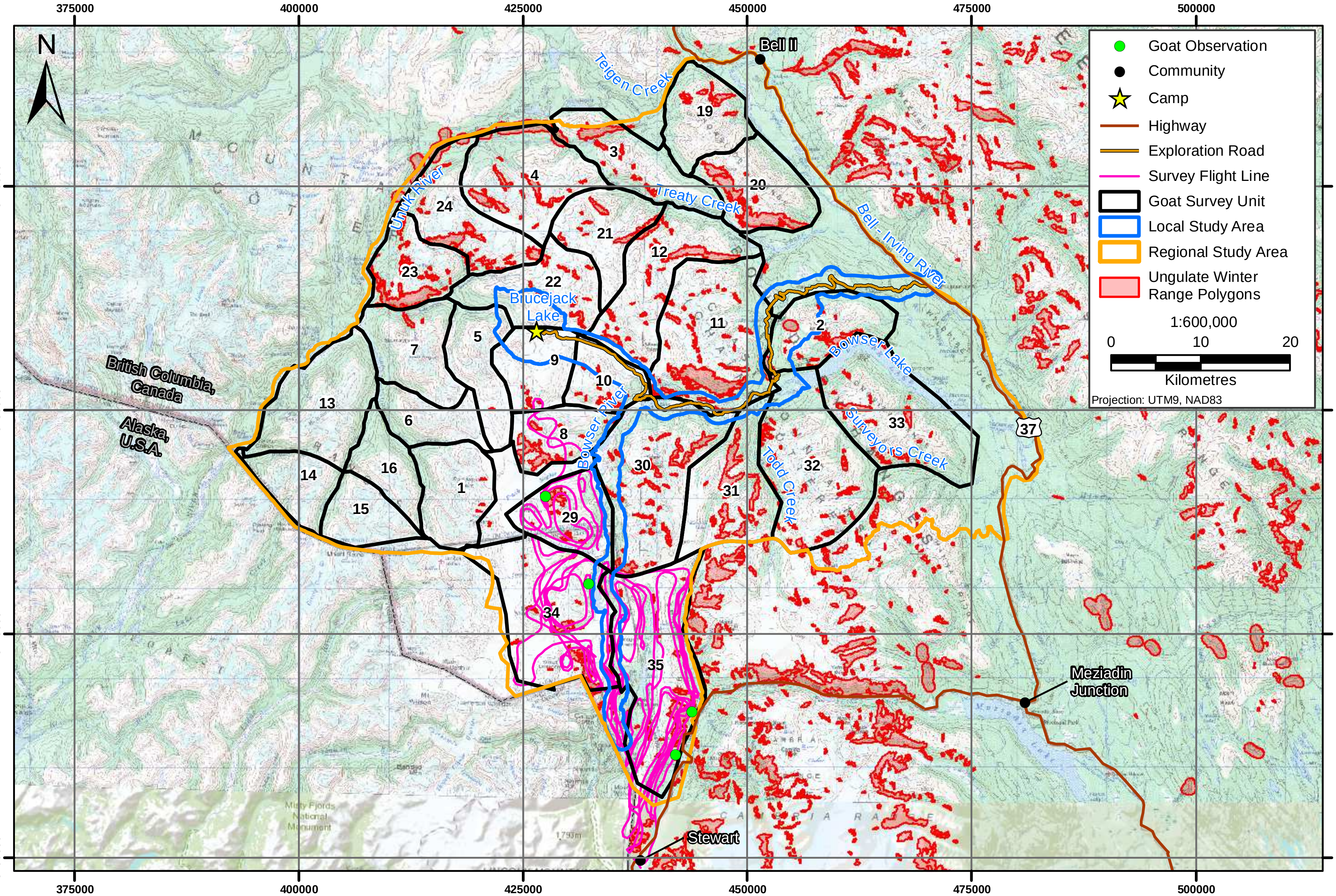

Figure 6.3-3

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Mountain Goat Winter Survey Observations, 2013

Figure 6.3-3

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Table 6.3-4. Mountain Goat Observations and Population Characteristics, Winters 2011 and 2013

Survey Unit (SU)	Within LSA	Number of Goats			Kid/Adult Ratio	No. Goats in UWR	Density (goat/km^2)		
		Total	Adults	Kids			Total Area	Census Area	UWR[a]
2011 Survey									
2	Yes	12	9	3	0.33	4	0.14	0.29	0.91
3	No	10	8	3	0.38	8	0.10	0.24	1.37
5	Yes	13	10	3	0.30	0	0.17	0.32	0
7	No	44	37	7	0.19	0	0.47	0.84	0
8	Yes	11	9	2	0.22	11	0.17	0.51	1.67
9	Yes	0	0	0	-	0	0.00	0.00	0
10	Yes	1	1	0	0.00	1	0.02	0.04	0.44
11	Yes	14	12	2	0.17	14	0.07	0.15	0.73
12	Yes	16	13	3	0.23	5	0.12	0.28	0.40
20	No	17	16	1	0.06	13	0.18	0.24	0.87
22	Yes	2	2	0	0.00	0	0.02	0.03	0
23	No	12	10	2	0.20	11	0.16	0.25	0.87
24	No	5	5	0	0.00	5	0.05	0.11	0.50
30	Yes	22	20	2	0.10	8	0.12	0.22	0.64
31	Yes	7	6	1	0.17	7	0.06	0.19	0.52
32	Yes	4	3	1	0.33	2	0.02	0.08	0.31
33	No	12	10	2	0.20	8	0.07	0.29	1.21
Total		**202**	**171**	**32**	**0.19**	**97**			
Average							**0.11**	**0.24**	**0.61**
SD							**0.11**	**0.20**	**0.50**
2013									
29	Yes	1	1	0	0	0	0.01	0.02	0
34	Yes	1	1	0	0	0	0.01	0.01	0
35	Yes	2	2	0	0	2	0.01	0.01	0.21
Total		**4**	**4**	**0**	**0**	**1**			
Average							**0.01**	**0.01**	**0.07**
SD							**0.00**	**0.00**	**0.12**

[a] *Note that all observations of goats were in UWRs classified by their provincial designation as Mountain Dwelling and no goats were observed in Canyon Dwelling UWRS.*

The majority of goat observations in the winter were observed in SUs 7 (N=44), 30 (N=22), and 20 (N=17) (Table 6.3-3). Of these SUs, SU 30 partially overlaps with the LSA along the proposed southern option transmission line route, SUs 7 and 20 are within the RSA only. Goat density over the 2010 winter census areas averaged 0.24 goats per km^2 (± 0.20 SD), with a maximum density of 0.84 goats per km^2. Goat density in UWRs that overlap with SUs surveyed in the winter averaged 0.61 goats per km^2 (± 0.50 SD), with a maximum of 1.67 goats per km^2.

During winter 2013, a total of 4 mountain goats were observed among four groups in the three surveyed SUs (Figure 6.3-3; Table 6.3-4; Appendix 6.3-8). The two goats observed within SU 35 were within a designated UWR. Adults accounted for 100% and no kids were observed. Goats were only observed singly. On average, 0.02 (± 0.01 SD) goats were observed per minute of survey time. Goats were observed within UWRs only within SU 35.

6.3.4.3 Habitat

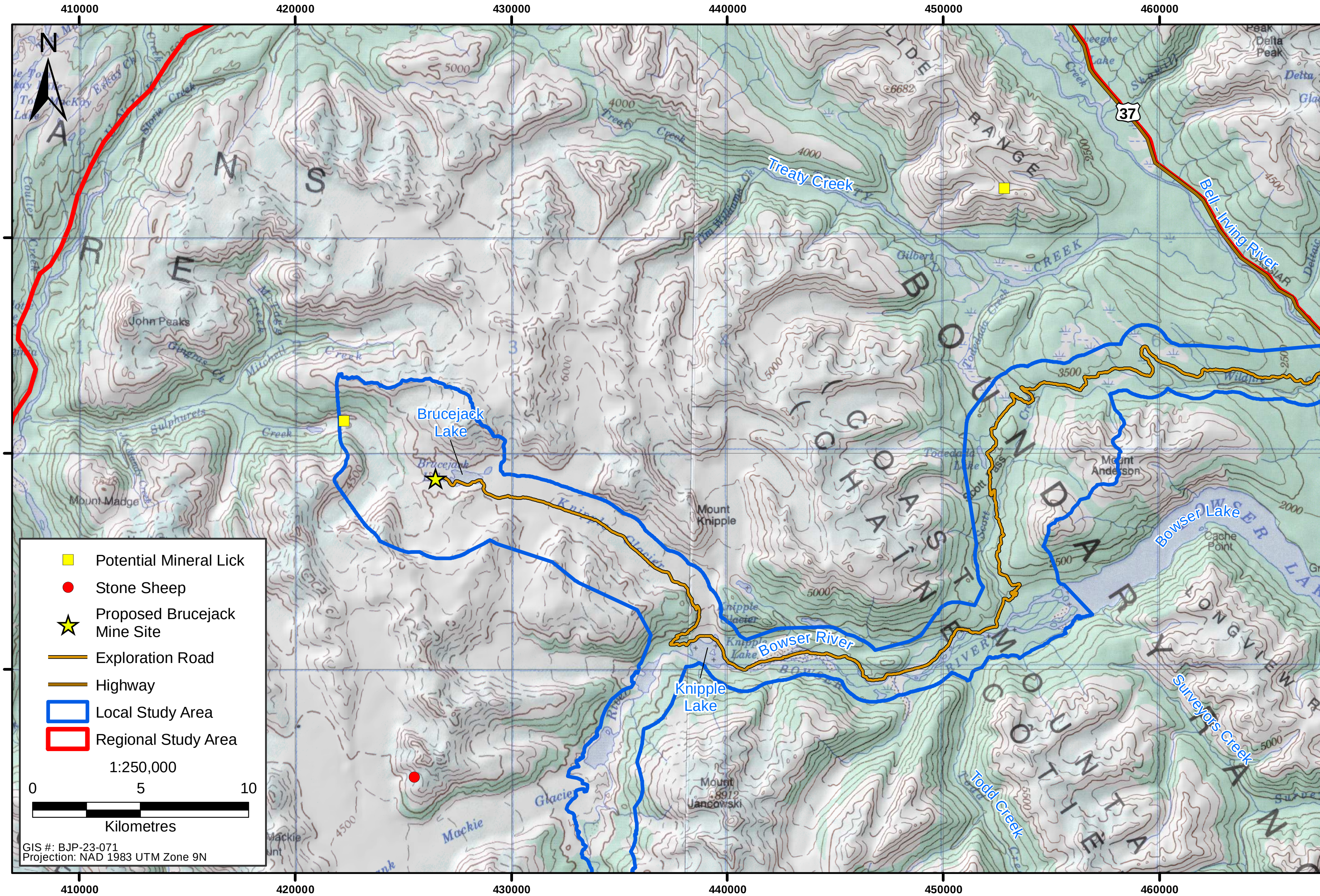
Several signs of mountain goat use (i.e., distinct paths, trails, bedding sites, digging activity) were noted throughout the study area, the majority of which were found in SUs where goats were encountered. Detailed evaluations of habitat use by goats were not conducted for this baseline; however, HSR values were recorded during aerial surveys to assist with the corresponding Brucejack wildlife habitat suitability models (Rescan 2013c). In general, goats were observed in areas that were identified as containing high value habitat in HSR models and were consistent with features important to goats in nearby areas (Rescan 2013c). Goat locations in the summer were primarily in high elevation areas that support herb and grass vegetation. Winter locations were associated with suitable winter range features, such as areas below tree line that contain suitable escape terrain. Higher elevation areas with a mix of high quality forage and escape terrain were also occupied by goats during winter. Plates 6.3-1 to 6.3-3 provide examples of summer and winter habitat used by mountain goats in the Brucejack RSA.

Plate 6.3-3. Goat summer habitat with beds and trails from goat use within the RSA, 2010.

6.3.4.4 Incidental Observations

An incidental observation of a small herd of 10 Stone's sheep was made within the RSA during breeding bird surveys on June 26, 2010. The sheep were observed grazing above tree line between Frank Mackie Glacier and Brucejack Lake (Figure 6.3-4).

Two potential mineral licks were identified within the Project study areas: one within the LSA and one within the RSA (Figure 6.3-4). The lick within the LSA was found near the proposed Brucejack Gold Mine Site above Sulphurets Lake and goats have been observed utilizing the area (Rescan 2011). The lick identified within the RSA was found between Treaty Creek and the Bell Irving River. Mineral licks receive annual use and are important for the local mountain goat population (Rescan 2013c).



Incidental Stone's Sheep Observation

Figure 6.3-4

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6.3.5 Discussion

The RSA supports a substantial population of mountain goats. A small herd of Stone's sheep was identified from an incidental observation; however, no other mountain ungulates were observed within the RSA during these surveys. The resident mountain goat population contains at least 286 individuals in the RSA. The observed kidding ratio (26 kids to 100 adults) in undeveloped areas of the Brucejack RSA is similar to those observed in populations from other pristine environments within the region; 23 kids to 100 adults in Schaft Creek (RTEC 2010), 27.7 kids to 100 adults reported along the NTL route (Rescan 2009b), 29.7 kids to 100 adults in the Galore Creek area (RTEC 2006d), and 28 kids to 100 adults in the overlapping KSM Project study area in 2008 (Appendix 6.3-1). This contrasted with the area near the proposed southern option transmission line route, which had a comparatively low productivity rate (11 kids to 100 adults). The juvenile mortality rate between summer 2010 and winter 2011 was approximately 27% (based on differences in kid to adult ratios). High kid mortality is common in goat populations and survival can be quite variable from year to year (Festa-Bianchet and Côté 2008).

Both SU 11 and SU 2, which overlap the LSA, had notable goat activity and include important low elevation habitat along the Bowser River and Bowser Lake, which is relatively near proposed Project activities. Both SUs have provincially-designated UWRs in the low elevation areas that were occupied by wintering goats. Mountain Goat UWRs have management regulations for development set-backs during sensitive periods of the year. Lower elevation habitat within SUs 5, 7, 27 and 22 was also near some aspects of the proposed development.

There was a lower density of goats in the SUs along the proposed southern option transmission line route. There has been substantial human activity in SU 35, which lies east of the proposed Southern Option Transmission Line route, associated with the Long Lake Hydroelectric Project and snowmobile recreation traffic along the Granduc Access Road and Cascade River drainage. This SU is the most disturbed (both current and historical) and most easily accessible by people of all the SUs in the RSA, likely resulting in disturbance that goats are known to be sensitive to (Mountain Goat Management Team 2010).

A large proportion (44%) of the mountain goats observed during winter aerial surveys were located in the provincial goat UWRs. An evaluation of habitat suitability of the UWR polygons was beyond the scope of this inventory; however, many unoccupied UWR units were encountered. Recognizing that the survey only represents a snap shot in time, and goats may use UWRs intermittently, some observations of UWR locations suggest that vacancy may be attributed to their smaller area, isolation, connectivity, or other habitat interspersion attributes that may not have been included in the models used to delineate UWRs. There were also cases where substantial numbers of goats occupied SUs with few designated UWR areas, despite the presence of high value habitat, most notably SU 7 (RSA) and SU 5 (LSA and RSA). These observations suggest that there are likely further opportunities to identify additional areas for conserving goat winter habitat, which may involve modifications to UWR designations within the RSA that may facilitate development while ensuring goat conservation.

Due to their proximity, results from the Brucejack baseline study were compared to baseline surveys conducted for the neighbouring KSM Project (Appendices 6.3-3 to 6.3-4). There were 15 SUs in common that were surveyed during the summer of 2008 (KSM) and 2010 (Brucejack), eight which were within the Brucejack LSA (SUs 2, 5, 8, 9, 10, 11, 12, and 22). A total of 116 goats were counted during the KSM inventory, compared to 201 counted for this project. Winter surveys included seven SUs in common; three were within the Brucejack LSA (SUs 5, 8, and 22). During the 2009 KSM surveys 126 goats were counted and during the 2011 Brucejack surveys 109 goats were counted. Reasons for these differences are speculative. Winter goat numbers for the proposed Brucejack Mine Site Project were 86.5% of the KSM tally, which is within the range of error associated with sightability correction (mean 85%; range 75% - 91%) suggesting there is no real difference in these estimates (Rice CG, Jenkins KJ, and WY 2009). The discrepancy in summer numbers (nearly double during the Brucejack survey) suggest other factors may be involved, such as different surveyors, survey effort, a shift in distribution, or weather conditions. Considering the similarity in winter observations and productivity, it is unlikely that the population increased substantially in two years.

6.4 BATS

6.4.1 Introduction

Based on the distribution of bat species in BC three species of provincial and federal conservation concern could occur in the area associated with the Project: northern long-eared myotis (*Myotis septentrionalis*), Keen's long-eared myotis (*M. keenii*), and little brown myotis (*M. lucifugus)* (Nagorson and Brigham 1993). The northern long-eared myotis is blue-listed in British Columbia and Keen's long-eared myotis is provincially red-listed (BC CDC 2013b) and federally listed as Special Concern under *SARA*, Schedule 3 (COSEWIC 2003a). Although little brown myotis was listed federally by COSEWIC as Endangered in 2012 is has yet to be legislated as a *SARA* Schedule 1 species (COSEWIC 2012). In addition, the silver-haired bat (*Lasionycteris noctivagans*) has been identified by BC MFLNRO as regionally important in the Skeena Region because of concerns with maintaining maternal roosts in tree cavities (BCTS 2008; Rescan 2010d).

The low elevation areas in the RSA and portions of the LSA support abundant flying insects such as mosquitos and moths that can be preyed upon by bats during summer, particularly in areas where there is open water or wetlands adjacent to forested areas. The riparian forests along the Bell-Irving River, Unuk River, Treaty Creek, and lower Bowser River support mature, large diameter cottonwood, hybrid spruce and subalpine fir that have features ideal for maternal and day roosting by bats. These include thick bark and cavities in the boles that provide security and thermal cover for roosting.

As part of baseline studies for the KSM Project (Rescan 2010b), bats were detected within areas of the Brucejack RSA in August 2009 in suitable habitat associated with the middle Teigan Creek and lower Sulphurets Creek. The Anabat sonograms identified the little brown myotis (*M. lucifugus*) and western long–eared myotis (*M. evotis*), while the silver-haired bat may have been detected. Appendix 6.4-1 identifies the KSM efforts and bat detections.

Determining the presence of these bat species in the proposed development area is required to meet the obligations of provincial regulations under the *BC Wildlife Act* (1996) for species protection. Bats are considered a main predator of night-flying insects, and are important in areas where the abundance of insect pest species is high (Whitaker 1996). Research suggests that bats exploit areas previously thought to be unsuitable, such as northern latitudes and cooler mid to high elevation habitats (C. Lausen 2006; RTEC 2006f, 2008b). Bats use a combination of habitat types during the year, primarily old growth conifer forests with snags for roosting and riparian areas for foraging (Nagorsen and Brigham 1995; Ormsbee 1996; Sasse and Pekins 1996; Grindal, Morissette, and Brigham 1999; Vonhof and Wilkinson 1999).

6.4.2 Objectives

An inventory directed at identifying the presence of bats within the study area was undertaken in 2012. The principal objectives of this bat baseline study were to determine if, and to what extent, bats (with consideration for species of conservation concern) inhabit the LSA within suitable low elevation habitat, and to attempt to characterize species or groups present in the area surrounding the proposed Project.

6.4.3 Methods

Methods included determining which species may be present by conducting a literature review, followed by a field survey using a bat detector, and analysis of sonograms to determine species or groups of bats present.

6.4.3.1 Evaluation of Species Presence

Nine species of bat were identified as species that potentially occur within the RSA, two of which were categorized as likely to occur and seven as possibly occurring (Table 6.4-1). This list provided a starting reference when analysing the sonograms generated by the Anabat for species identification.

Table 6.4-1. Bat Species Potentially Occurring within the RSA

Common Name	Scientific Name	Likelihood of Occurence[1]	Call Characteristics[2]			Additional Features
			High Freq. (kHz)	Low Freq. (kHz)	Max Duration (ms)	
California myotis	*Myotis californicus*	Possible	67-80	37-45	2-6	May have "soft J" on some calls
Western long-eared myotis	*M. evotis*	Likely	> 97	54-30	1-3	30 kHz low Fc distinguishes from other *Myotis*
Keen's long-eared myotis	*M. keenii*	Possible (Red L)	~78	38-40	5	None
Northern long-eared myotis	*M. septentrionalis*	Possible (Blue L)	110-80	35-40	1-3	None
Little brown myotis	*M. lucifugus*	Likely (Endangered)	> 60	35-40	2-5	Consistently may have low Fc to 35 kHz
Long-legged myotis	*M. volans*	Possible	89	35-40	5-10	None
Yuma myotis	*M. yumanansis*	Possible	> 60	40-46	3-5	May have "hard elbow" on search calls
Silver-haired bat	*Lasionycteris noctivagans*	Possible	37- to < 60	25-26	3-6	Rarely greater than 60 kHz which separates from big brown bat that can be above 60 kHz
Big brown bat	*Eptesicus fuscus*	Possible	33 to > 60	28	10	See above comment

[1] *(Nagorsen and Brigham 1995; RTEC 2006f, 2008b), Rescan (unpublished data)*
[2] *Fenton and Bell (1981), RIC (1998a), O'Farrell, Miller, and Gannon (1999), Rescan (unpublished data), (C. Lausen 2011) materials from Bat Acoustic Techniques Course, Creston BC)*

The likelihood that species occur within the study area was placed into two categories: likely and possible. Species were considered likely to occur if they have overlapping seasonal ranges within the RSA, suitable habitat is available within the RSA, and they have been detected in nearby areas. Species considered as possibly occurring within the RSA may or may not have overlapping seasonal ranges but their seasonal habitat requirements are met within the RSA. The call characteristics that were available for likely and possibly occurring species were compiled to assist in species identification during sonogram analysis.

6.4.3.2 Echolocation Call Survey

Echolocation call surveys were conducted in the summer of 2012. Survey locations within the LSA were selected based on their potential as foraging habitat, including the presence of open areas or wetlands, which attract flying insects. Survey sites were located next to mature or intermediate forest that may provide snags suitable for day roosts or night roosts during cooler weather. Plate 6.4-1 is an example of a sampling station with the Anabat set in mature conifer forest near a wetland.

Plate 6.4-1. An Anabat set at the interface of mature forest and a wetland at BAT 4.

High elevation areas within the LSA that were above treeline were not surveyed because bats are unlikely to inhabit those areas. The western most portion of the LSA, including the proposed Brucejack Mine Site, was not sampled because it was a glaciated landscape with alpine habitat that was unlikely to support bat foraging relative to other locations within the LSA.

Inventory methods adhered to RISC standards (RIC 1998a) and used a broad band bat detector, (specifically an Anabat II detector), which records the frequencies of bat vocalizations and allows species identification using sonograms. An external zero-crossings analysis interface module or ZCAIM was used to transfer data (sequence files) to a computer for analysis. Surveys were timed between dusk and dawn, when species are most active (RIC 1998a). Location, weather conditions, and time of operation were recorded at each survey site. For all six nights of survey, the Anabat II detector was set up remotely at dusk and was recovered the following morning in order to download sequence files. To keep the detector safe from wildlife and protected from weather, it was suspended in a tree approximately 3 m high.

6.4.3.3 Sonogram Analysis

Sonograms of bat echolocation calls were produced from downloaded Anabat sequence files using AnaLookW v. 3.3q. While foraging, bats emit calls with different frequencies, displayed as kilohertz (kHz) and durations displayed as milliseconds (ms). These are separated into three phases: search, approach, and terminal (Simmons, Fenton, and O'Farrell 1979; M. B. Fenton and Bell 1981). Search phase calls tend to be spaced apart from one another, as the animal actively searches the vicinity for prey. During approach and terminal phases, calls are emitted progressively closer to one another, as the bat identifies and targets the prey item (Simmons, Fenton, and O'Farrell 1979; M. B. Fenton and Bell 1981).

To differentiate between species and genus, the characteristics of the recorded calls (frequency and duration) were compared with available published accounts and voucher sonograms for several species (M. B. Fenton and Bell 1981; Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003) as well as unpublished provincial data (Network 2012). Search and approach phase calls are most diagnostic for species identification. In particular, the lowest or "fundamental" characteristic frequency (Fc) of search and approach phase calls has been used to distinguish between species (M. B. Fenton and Bell 1981; O'Farrell, Miller, and Gannon 1999; Bilecki 2003; Network 2012). For example, silver-haired bat search phase calls have exhibited a fundamental frequency of around 25 kHz in several studies (Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003).

Reliable differentiation between species in the genus *Myotis* is challenging (RIC 1998a). A number of Myotis species are classified as "40 kHz Myotis," because various species in this genus have overlapping characteristics of echolocation calls. These species share a search phase call that descends to a fundamental frequency of 40 kHz over a duration of one to two m/s (Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003; RTEC 2006f, 2008b; Network 2012). In situations where the call could belong to more than one species, the list of potentially occurring species was also used to refine the identification of species. Often, however, sonograms could only be associated with groups of bats, such as "40 kHz myotis" due to the ambiguity of the calls diagnostic features.

6.4.4 Results

6.4.4.1 Echolocation Call Survey, 2012

Echolocation call surveys were conducted at six survey locations within the LSA between July 24 and July 30, 2012, with one location surveyed per night (Figure 6.4-1). Table 6.4-2 provides location details, and Figure 6.4-2 includes the survey locations and the range of total bat detections. Sequence files were generated at five of six sites ranging from seven sonograms produced at site BAT 2, up to 94 at BAT 4. A technical issue resulted in no data being recorded on the first night at BAT 1; this area of the LSA was re-surveyed by locating the bat detector at site BAT 6, across the Bell Irving River.

Table 6.4-2. Details of Bat Detector Locations

Location Label and Date	BEC[1]	Habitat Description	Detections (anabat sequence files generated)
BAT 1 July 24/25, 2012	ICHvc 01	Structural stage 1 and 2 (barren and herb) gravel area in cut block near bridge site at Bell Irving River	None, bat detector did not record for unknown reasons
BAT 2 July 25/26 2012	ICHvc 06/03	New road at edge of structural stage 6/7 (mature/old forest) conifer (subablpine-fir, hybrid spruce, with black cottonwood) riparian forest along the Wildfire Creek	7 sequence files
BAT 3 July 27/28, 2012	ICHvc 01/06	Edge of structural stage 3 (shrub) cut block and structural stage 7 (old forest) subalpine-fir (with some hybrid spruce and black cottonwood)	19 sequence files
BAT 4 July 28/29, 2012	ICHvc wl/06	Structural stage 6/7 (mature/old forest) conifer forest at edge of sedge meadow by small unnamed lake	94 sequence files
BAT 5 July 29/30, 2012	ICHvc 05	Structural stage 4/5 (mature/old deciduous) black cottonwood dominated flood plain habitat at Scott Creek Camp	90 sequence files
BAT 6 July 30/31, 2012	ICHvc 01/03	Structural stage 7 (old forest) subalpine-fir forest at edge of road to Bell Irving bridge crossing	69 sequence files

[1] Interior Cedar Hemlock very wet cold subzone (ICHvc; (Banner et al. 1993)

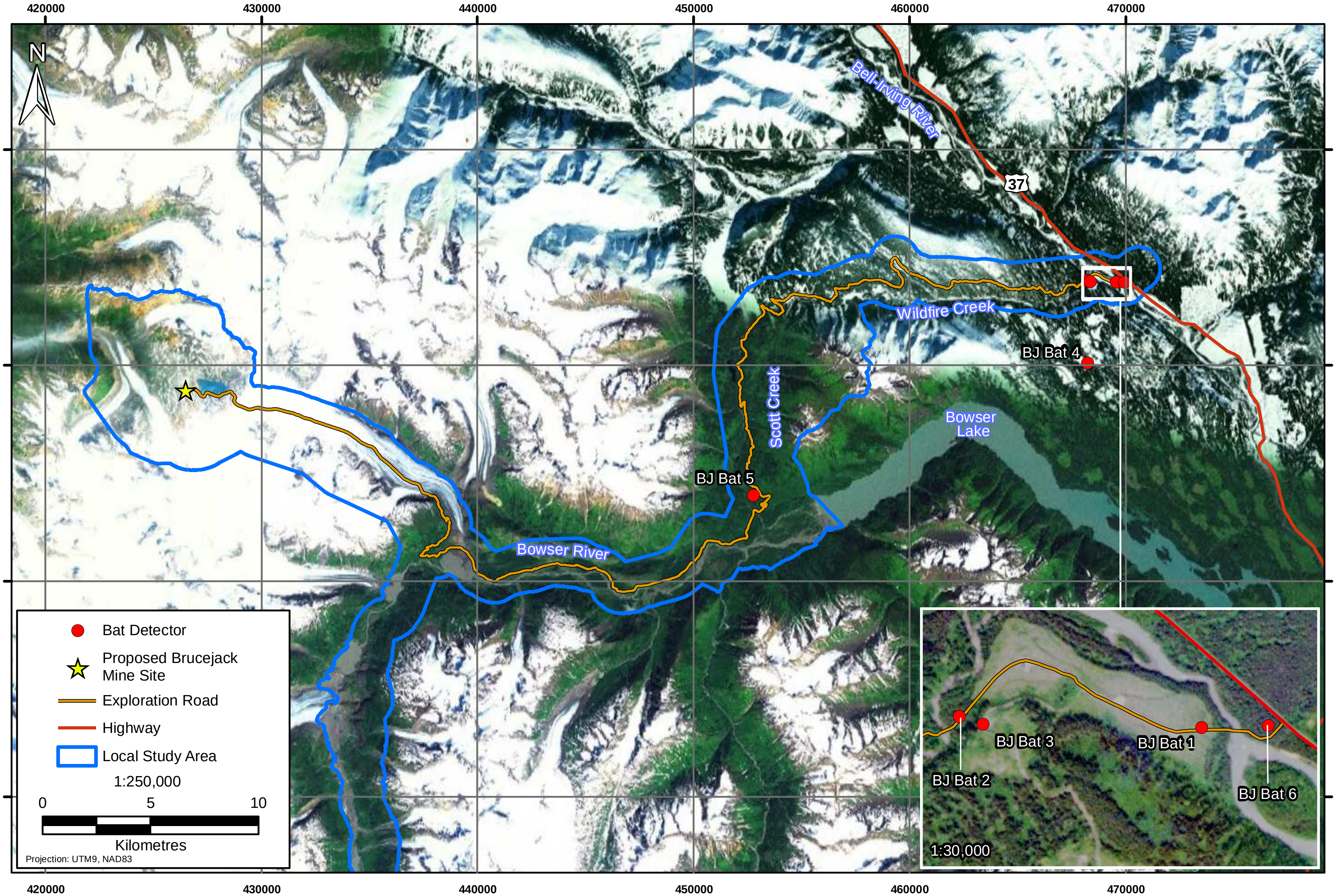

Figure 6.4-1

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Bat Survey Locations, 2012

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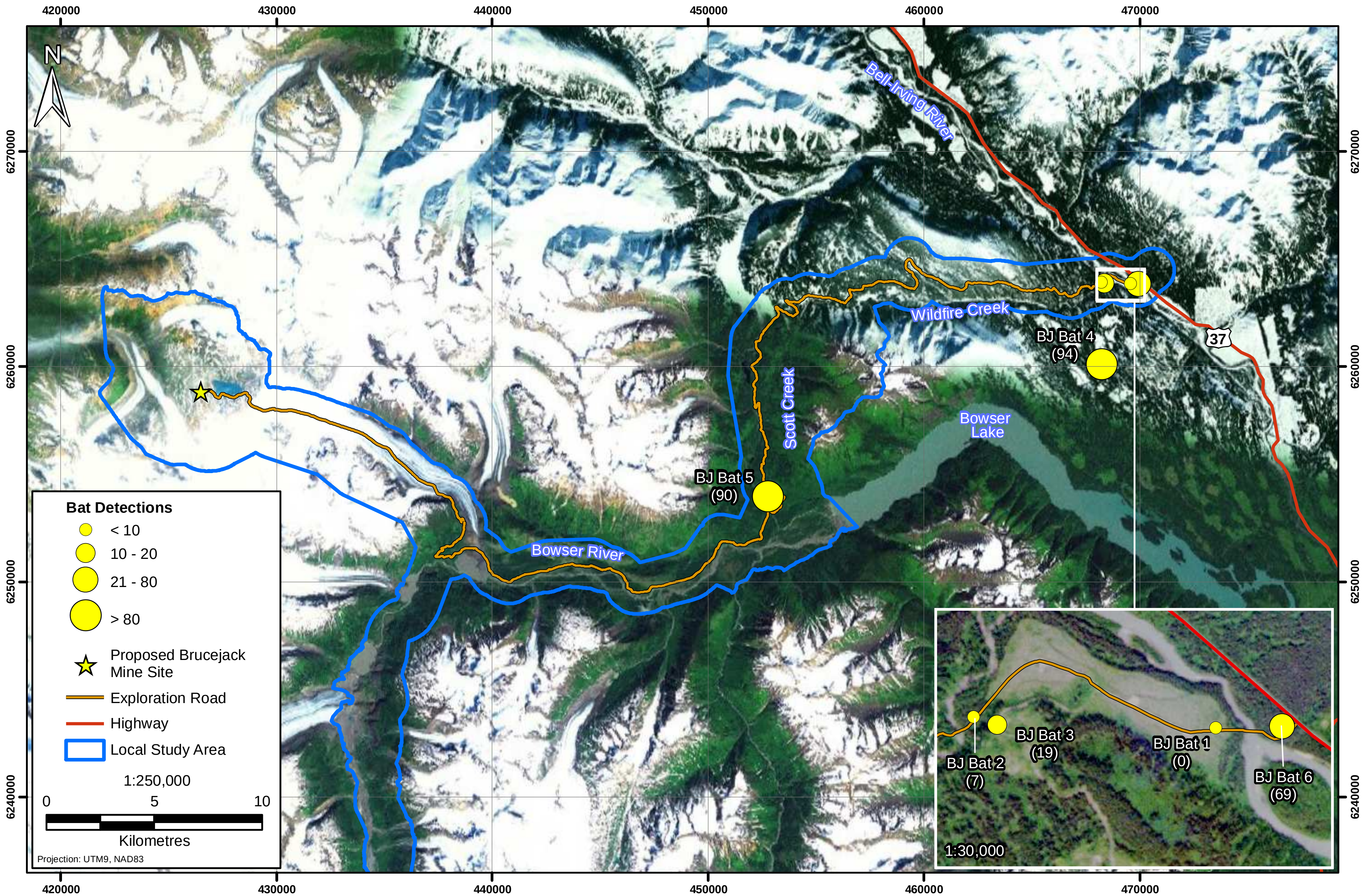

Figure 6.4-2

Bats Detected

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A substantial area of mature cottonwood, hybrid spruce, and subalpine-fir associated with riparian habitat existed in the RSA and portions of the LSA. Examples are illustrated by Plates 6.4-2 and Plate 6.4-3, which shows riparian forest near BAT 5 that provides large diameter and over mature stems suitable for bat roosting. Similar habitat occurs along the Bell Irving River, Unuk River, and Treaty Creeks in the LSA and RSA.

Plate 6.4-2. Old growth conifer riparian forest near Scott Creek that provides roosting habitat for bats.

Plate 6.4-3. Large cottonwood in riparian forest near Scott Creek that could support roosting bats.

6.4.4.2 Species Detected from Sonograms

Bats were detected at six out of seven sites that were monitored (Figure 6.4-2). There were 279 bat detections made during six nights of monitoring which indicated that the federally endangered little brown myotis and western long-eared myotis occurred, while more ambiguous sonogram results suggested that the silver-haired bat, long-legged myotis, California myotis, Yuma myotis, and the provincially blue listed northern myotis may also have been detected. Analysis of the sonograms indicated that the majority of detections were suggestive of *Myotis* spp, with two sonograms appearing to have call characteristics of silver-haired bat. These were detected at locations BAT 2 and BAT 6. Table 6.4-3 identifies the species that were detected, the relative confidence in the detection based on the clarity of the sonograms, and the location the detections were made.

Table 6.4-3. Species of Bat Detected, Confidence in Detection, and Location

Bat Species	Confidence in detection (High, Medium, Low)	Bat Detector Location Label
Little brown myotis	High	BAT 2, BAT 3, BAT 4, BAT 5, BAT 6
Western long-eared myotis	High	BAT 3
Silver-haired bat	Medium	BAT 2 and BAT 6
Long-legged myotis	Medium	BAT 6
California or Yuma myotis	Low	BAT 5 and BAT 6
Northern long-legged myotis	Low	BAT 5, and BAT 6

Sonograms generated by Analook software that had a low Fc (characteristic frequency) of 30 kHz (Plate 6.4-4 is an example). These detections were equated to western long-eared myotis and occurred on three sonograms at the BAT 3 location. Sonograms with an Fc of 35 kHz were recorded and these were associated with little brown myotis or possibly northern long-eared myotis at BAT 5 (Plate 6.4-5).

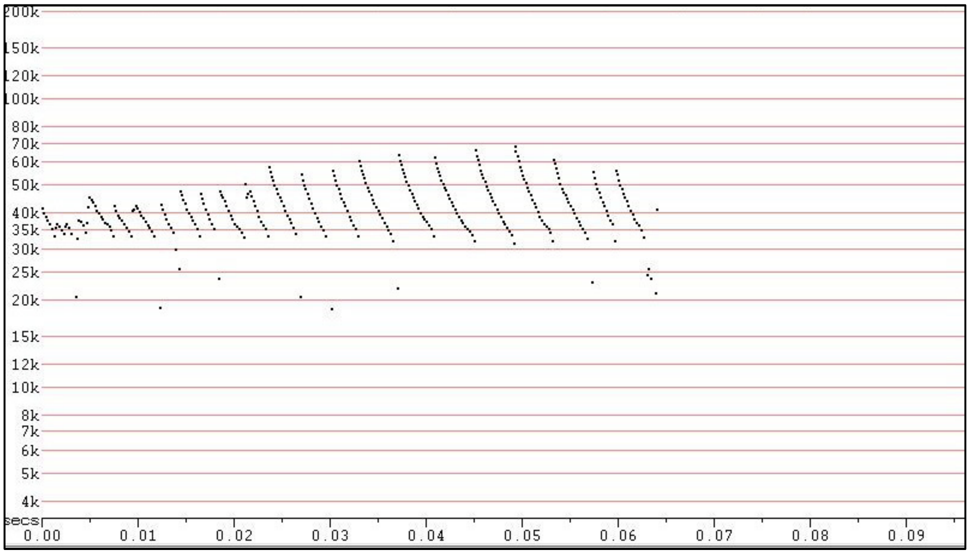

Plate 6.4-4. Example of a 30 kHz Sonogram equated to western long-eared myotis detected in the LSA, 2012.

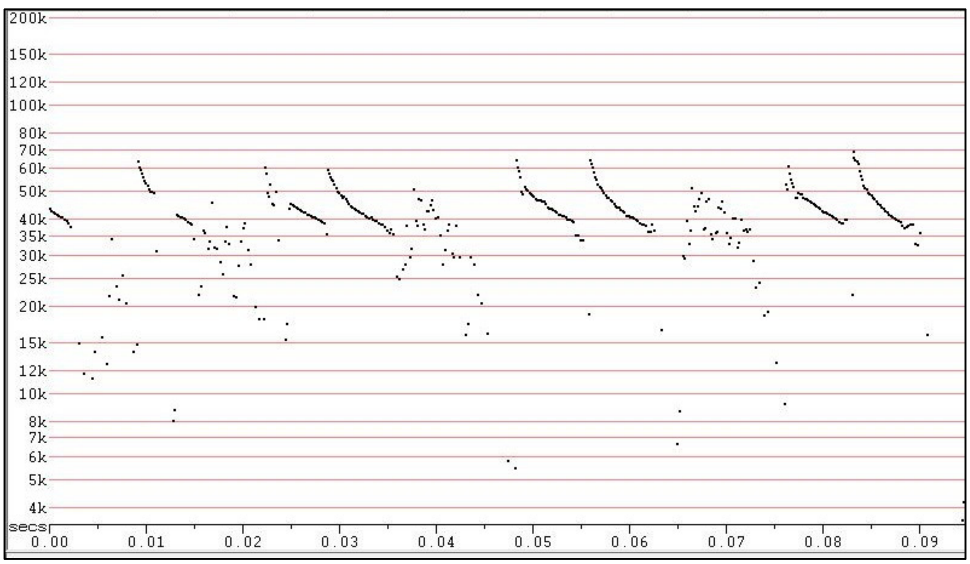

Plate 6.4-5. Example of a 35 kHz sonogram equated to little brown myotis detected in the LSA, 2012.

The majority (162) of sonograms were associated with a group known as the “40 kHz Myotis” (Plate 6.4-6). Sonograms displaying these characteristics were found at all five locations with bat detections. The little brown myotis and long-legged myotis are in this group and potentially occurring in the study area. While the echolocation calls of these two species are very similar and cannot be distinguished by sonograms, little brown myotis is the species that can exploit the widest range of habitats and is likely to be most abundant in the area. Little brown myotis can hibernate far north in Canada, including as far as southern NWT (C. L. Lausen, and and Barclay 2006; Network 2012).

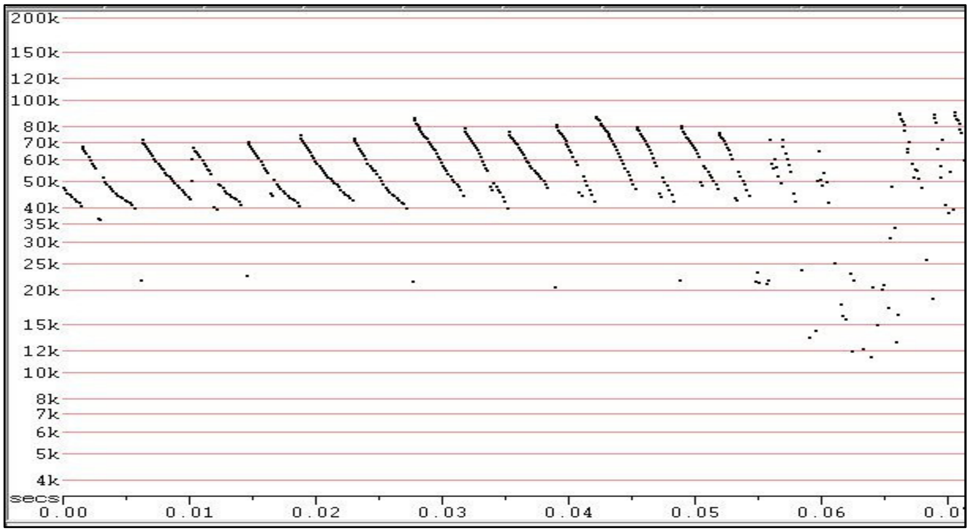

Plate 6.4-6. Example of a sonogram equated to a 40 kHz Myotis detected in the LSA, 2012.

Bat detections with sonograms displaying an Fc of 45 kHz were detected from a few sonograms at BAT 5 and BAT 6 (Plate 6.4-7), the higher Fc may indicate California myotis or Yuma myotis; however additional features used to differentiate between the two species where not clear. A few sonograms had echolocation calls which had upper Fc over 100 kHz. These detections were made at BAT 6. These had a lower Fc of 40 kHz but high Fc suggested they may also have been made by northern long-eared myotis, little brown myotis or long-legged myotis.

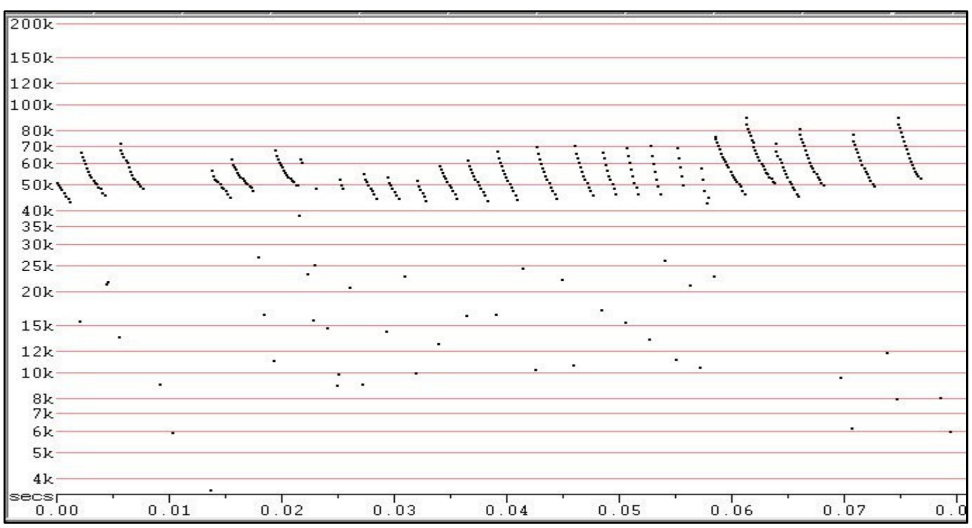

Plate 6.4-7. Example of a sonogram equated to 45 kHz Myotis detected in the LSA, 2012.

The results were not interpreted for relative abundance, as a greater number of detections does not infer more bats at one location or another as there are a number of factors that can influence the detections made. This includes weather conditions, bat activity based on moon phase, and insect activity. Bat data could include detecting one bat flying in front of the detector all night, multiple bats flying by, or missed detections based on flying behaviour as some species fly higher than others.

6.4.5 Discussion

Bats were detected within all habitat types sampled during the field inventory, and in some areas many bat detections were made, including the small lake between the Wildfire Creek and McInnes Creek watersheds (BAT 4), and large cottonwood and spruce dominated riparian forest at the Scott Creek and Bowser River confluence (BAT 5). A number of species were identified; little brown myotis, and western long-eared myotis were detected. Other species such as silver-haired bat, long-legged myotis, California or Yuma myotis, and possibly northern long-eared myotis may have been detected, however, due to ambiguity in the sonograms, their presence could not be confirmed.

Five of the nine species which may occur in the RSA are presumed migratory while the remaining four (little brown myotis, northern long-eared myotis, western long-eared myotis, and big brown bat), may occur during winter in northern latitudes. These species presumably hibernate close to where they occur in summer (C. Lausen 2006; C. L. Lausen, and and Barclay 2006; C. Lausen 2011). Hibernacula of little brown myotis, a species detected during this survey, have been found as far north as the North West Territories (C. Lausen 2011). This suggests that this species may occur year round in the RSA if suitable habitat exists.

Detection of species that have a more localised seasonal use, such as little brown myotis suggests that there may be areas that support conditions suitable for over wintering, such as hibernacula, nearby. Key winter habitat for several bat species has been associated with karst landscape including little brown myotis, northern long-eared myotis, and possibly big brown bat (Bilecki 2003). Karst topography is formed from the dissolving action of water on carbonate rock over thousands of years, resulting in caves, shafts, and sinkholes. Karst landscapes, although not as common as in other regions of BC (i.e. Vancouver Island and the Rocky Mountains) exists in northwest BC. Carbonate bedrock that may support karst topography has been mapped in the RSA, particularly south and west of Bowser Lake. Research suggests that hibernacula within karst caves have a high relative humidity and cool ambient temperature to keep bats metabolism low but warm enough to prevent freezing (Pike et al. 2010); (M. B. Fenton, and and Barclay 1980). Winter mean temperatures within karst bat caves have been found to average between 1.1 and 4.8°C and humidity above 96% (Bilecki 2003). Bat wintering caves have been identified as far north as The Pas, Manitoba, an area that experiences severe winter conditions with temperatures below -40°C, comparable to conditions within the RSA.

The results of the survey indicate that the LSA supports bats, particularly in lower elevation areas where habitat that produces insect prey is interspersed with forest that provides cover for roosting. There appears to be a diversity of bats species, the recorded sonograms suggest at least four and possibly as many as six species, including: the endangered little brown myotis and potentially the blue listed northern long-eared myotis.

6.5 HOARY MARMOTS

6.5.1 Introduction

First Nations have previously requested studies on the presence of hoary marmot (*Marmota caligata*) and Arctic ground squirrel (*Spermophilus parryii*) within the region, including in areas associated with the RSA. These species are collectively referred to as 'groundhogs' by Aboriginal People. Groundhogs are a valued cultural and subsistence species to local Aboriginal Peoples in the Northwest of BC. Past inventory (Rescan 2010b) only identified hoary marmot, and did not detect Arctic ground squirrel within an area overlapped with the Brucejack RSA.

The hoary marmot is named for the white tips on the fur of mature individuals. This species occupies high elevation open habitat, including herb-dominated meadows and boulder/talus fields with appropriate soil conditions (RTEC 2006f). Marmots also use boulders to watch for danger and to sun themselves (Banfield 1981). In areas of abundant food resources, hoary marmots tend to live in colonies. Hoary marmots feed on a variety of herbaceous plants, grasses, and seeds, and usually restrict their foraging to areas within 100 m of their dens (Banfield 1981). Plants commonly eaten by hoary marmots in British Columbia are western anemone (*Anemone occidentalis*), common red paintbrush (*Castilleja miniata*), avalanche lily (*Erythronoim grandiflorum*), lupine (*Lupinus* spp.), wood betony (*Pedicualris bracteosa*), ragwort (*Senecio* spp.), grouseberry (*Vaccinium scoparium*), and Indian hellebore (*Veratrum viride*; (Gray 1975; Hansen 1975).

A substantial effort was conducted to inventory hoary marmot and Arctic ground squirrel for the KSM Project (Rescan 2010b). The western portion of the KSM study area overlaps with the Brucejack LSA. During the summer of 2008 and 2009, 148 and 92 colonies were identified respectively within the total survey area (Appendix 6.5-1). Of these, 37 colonies were identified in the western portion of the KSM study area in 2008, and 19 in 2009. The density of marmot colonies was 0.46 marmots/km^2 for the entire western KSM survey unit, and 0.69 marmots/km^2 for the area above 1,100 m. Arctic ground squirrels were not observed during the inventory.

Habitat features were described for each colony, and the results were used to develop a marmot habitat suitability map for the KSM Project (Rescan 2010c). Areas around colonies tended to be dominated by herbs (82%), followed by mixed herbs and subalpine-fir krummholz (13%), mixed herbs and willow spp. (3%), and mixed herbs and barren (non-vegetated) areas (2%). A variety of plant species were documented at the colonies, including Indian hellebore, common red paintbrush, Sitka valerian (*Valeriana sitchensis*), partridgefoot (*Luetkea pectinata*), fireweed (*Epilobium augustifolium*), and several species of mosses, lichens, grasses and sedges.

Colonies were most frequently located on mesic soils (74%) with underlying soil textures ranging from medium textured (sandy loam) to coarse (gravel/cobble). Other colonies were mainly associated with finer textured soils such as sandy loam and slightly coarser soils with gravel components. Colonies were generally above treeline (> 1,100 m). The mean elevation of all colonies was 1,423 m, with 90% of all colonies located between 1,176 m and 1,629 m. The majority (66%) of colonies were on warmer southeast to west facing aspects, and located over a wide range of slopes (mean of 42%, range 19 to 64% for 90% of colonies).

6.5.2 Objectives

The overall objective of this study was to collect baseline information with respect to hoary marmot distribution and habitat use within the LSA. The specific objectives of the inventory were to identify the numbers and locations of colonies in representative areas within the LSA and to conduct site-specific surveys of a sample of colonies to identify habitat characteristics associated with occupied colonies.

6.5.3 Methods

The hoary marmot inventory involved aerial surveys followed by ground evaluation of a subset of colonies to assess marmot activity and to evaluate habitat features at the colonies.

6.5.3.1 Aerial Survey

During the summer of 2012, aerial surveys were conducted to locate hoary marmot colonies within the LSA, focusing on areas close to the proposed mine site and exploration access routes. Observations of sign (including burrows) are useful to index marmot and ground squirrel abundance and distribution (RIC 1998d). Hoary marmot and ground squirrel colonies can be very conspicuous and easily spotted from the air, particularly in barren high elevation areas. Seven survey units (SUs) that represented suitable marmot habitat within the LSA were delineated (Figure 6.5-1). Survey effort was focused above treeline (~1,100 m) to maximize colony visibility, and based on results of past surveys (Rescan 2010b), that found a majority of colonies above this elevation (Figure 6.5-1). Areas dominated by glacier or rock and without any soil cover were not surveyed.

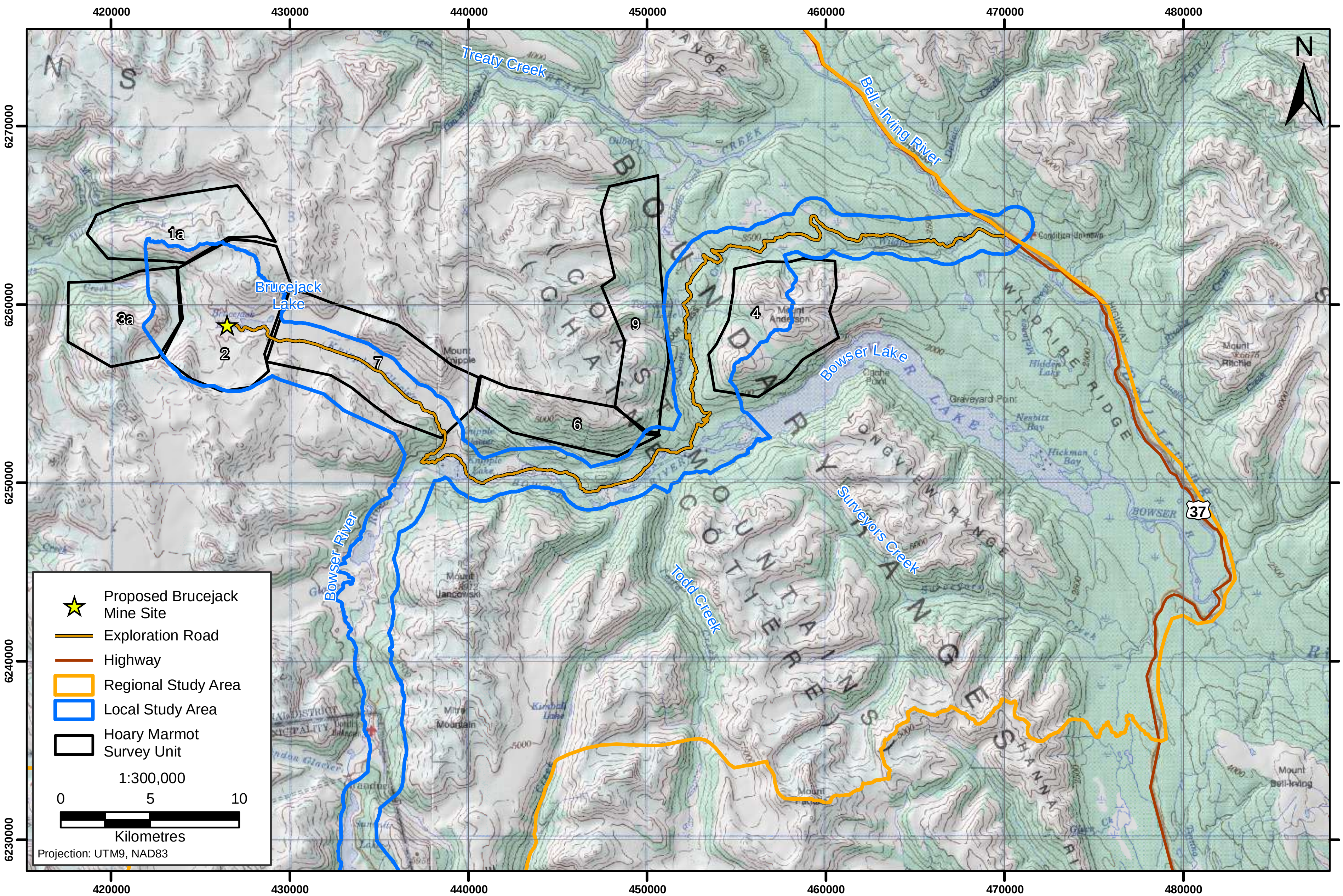

Figure 6.5-1

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Hoary Marmot Survey Units

Figure 6.5-1

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The aerial survey was conducted from a Hughs 500 helicopter with a pilot and two observers. A colony was delineated as a continuous cluster of burrow entrances that were reasonably close enough to one another to represent one family unit. Colony locations were geo-referenced with a handheld Garmin GPS 76. As den openings tend to be persistent on the landscape and are not expected to change over several years, information about colony locations in areas that were not surveyed in 2012 can be supplemented with the results from aerial surveys completed for the KSM Project (Rescan 2010b).

General habitat features were recorded at each colony, including an estimate of slope, aspect, soil texture, moisture regime, general vegetation cover, and plant species present (Table 6.5-1). A wildlife habitat rating (WHR) was also assigned to each colony location based on features identified in the hoary marmot habitat suitability model developed for the KSM Project (Rescan 2010c). A WHR of one (High) represented the most suitable habitat in the RSA, while a WHR of four (Nil) represented habitat devoid of features that could be used by marmots. A nil habitat rating was not expected to occur in association with an active colony, however due to persistence of evidence of dens, a situation may have occurred where changes in landscape (e.g. flooding, human excavation) may have made the habitat unsuitable and resulted in extirpation of the colony.

Table 6.5-1. Topographic and Vegetation Features Recorded during Aerial Surveys

Characteristic	Description	Value/Descriptor
Size of Colony	Colony defined as a cluster of burrow openings with sufficient space between clusters to be able to differentiate from another colony. Size was estimated by the number of entrance holes.	Small (< 5 holes), Medium (5 to 10 holes), Large > 10 holes), or Landscape Large (contiguous and colonies undistinguishable as separate)
HSR Field	Habitat suitability rating based on vegetation and topographic features.	4 class system: HSR class Nil (4), Low (3), Moderate (2) and High (1).
BEC	Biogeoclimatic zone and variant	Most effort was in the ESSFunp, BAFAun, MHmmp, and CMAun
Slope	Ground slope topographical relief	Percent slope estimated in 5% units
Aspect	Direction topography is facing	Cardinal directions
Soil depth	Estimated depth of mineral soil from observing features such as den entrances, slides etc.	Estimated as ≥1m or <1m.
Soil Texture	Visual estimate of soil composition from exposed soil and rock within the colony	Combination of rock, cobble, gravel, sand, or loam
Vegetation	Vegetation classification within the colony	Classified as a combination of Barren, Rock, Herb, Heather-heath, Shrub, Tree
Likely Species	Determined from den entrance size and observations of animals	Hoary marmot/Arctic ground squirrel or unidentified

Density estimates in colonies per km^2 were calculated to allow comparison of results to other inventories. The densities were calculated by dividing the number of colonies observed within an SU by the total area surveyed above 1,100 m (the lower elevation of survey), and by dividing the number of colonies by the area between 1,100 m and the highest observed colony (~1,600 m).

6.5.3.2 Ground Surveys

A subset of 18 accessible colonies found during aerial surveys were selected for detailed field-based assessments. At each location, in addition to verifying observations on terrain features recorded during aerial surveys, information was collected on elevation, soil moisture, soil nutrient regime, and soil drainage (Table 6.5-2), and recorded on provincial ground inspection forms (GIFs). Habitat features were assessed over an area of approximately one hectare around each colony. Locations of landforms (talus or boulder) relative to each colony was also recorded, as well as any evidence of occupancy (e.g., observations, fresh tracks or scat).

Table 6.5-2. Additional Habitat Features Recorded During Ground Surveys

Characteristic	Description	Value/Descriptor
Elevation	-	Metres above sea level.
Soil Nutrient Regime* Soil Moisture Regime*	Soil's ability to supply major nutrients for plant growth. Soil's moisture content.	A (very poor) through E (very rich) based on edatopic grid. 0 (very xeric) to 7 (subhydric) based on edatopic grid.
Soil Drainage*	Speed and extent to which water is removed from soil.	Slow (very poorly drained) to Fast (very rapidly drained).
Presence of Talus/Boulder	Identification of landform cover in relation to the colony.	Distance from colony (m).

**Source: (BC MELP and BC MOF 1998)*

6.5.4 Results

6.5.4.1 Aerial Surveys

Aerial surveys were flown July 24, 26, and 27, 2012 using 7.1 hours (427 minutes) of helicopter time (Appendix 6.5-2 and Appendix 6.5-3). Plate 6.5-1 is an example of a colony observed from the air. A total of 173 hoary marmot colonies were located across seven SUs (Figure 6.5-2; Table 6.5-3). The number of colonies varied amongst SUs, which was likely a reflection of SU habitat suitability.

Plate 6.5-1. An example of a colony identified from the air (highlighted burrow entrances associated with the single colony) within the LSA, 2012.

SUs where the highest value habitat occurred sporadically tended to have more small colonies (e.g., SU 6, 7 and 9). SUs that contained extensive, connected habitat (e.g., SU 4) tended to have larger colonies (and presumably more marmots). Within the LSA, average densities were 1.4 (± 0.8 SD) marmot colonies per km^2 for areas between 1,100 m and 1,600 m, and 0.9 (± 0.6 SD) for areas above 1,100 m (Table 6.5-3). Density for SUs associated with the Proposed Mine Site (SU 1a, 2, 3a) was calculated at 0.7 colonies per km^2 in areas above 1,100m while the remaining area within the LSA had a density of 1.0 colony per km ^{2}.

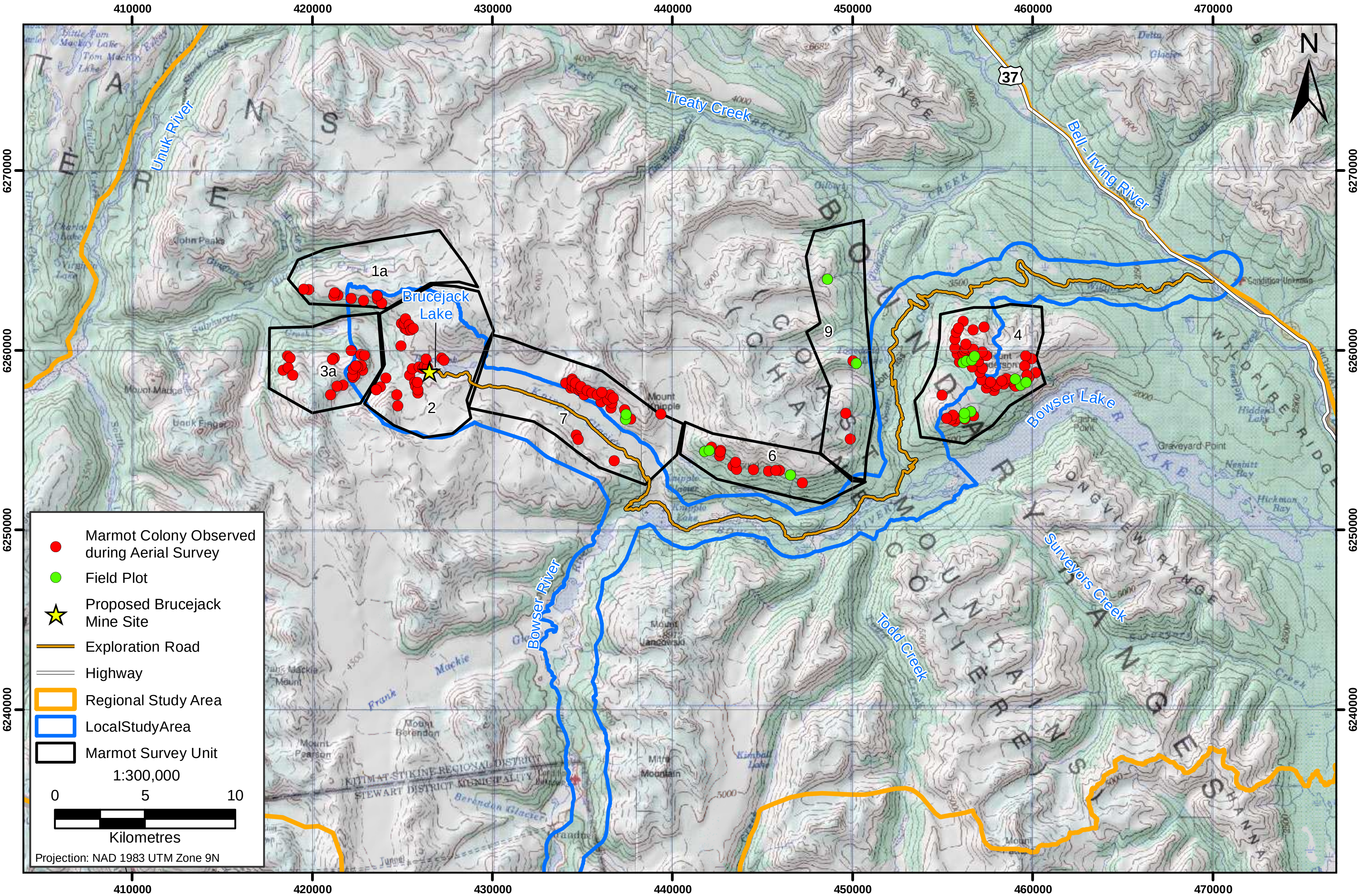

Figure 6.5-2

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Hoary Marmot Observations

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Table 6.5-3. Aerial Survey Observation Details for Marmot Colonies by Survey Unit

Survey Unit	Number of Colonies	Species Observed*	Time on Survey (minutes)	Large Colonies or Larger	Medium Colonies or Smaller	Colony/ Minute	Area (km^2) of SU 1,100 m to 1,600 m	Colony/km^2 1,100 m to 1,600 m	Area (km^2) of SU above 1,100 m	Colony/km^2 above 1,100 m
1a	10	HM	25	1	9	0.40	15.5	0.6	23.6	0.4
2	29	HM	82	8	21	0.35	20.0	1.5	41.1	0.7
3a	21	HM	45	11	10	0.46	11.9	1.8	17.1	1.2
4	62	HM	135	18	44	0.46	25.8	2.4	33.2	1.9
6	17	HM	60	0	17	0.28	8.3	2.1	16.1	1.1
7	30	HM	60	3	27	0.50	30.2	1.0	37.4	0.8
9	3	HM	20	0	3	0.15	18.8	0.2	20.4	0.1
Totals	**173**		**427**	**41**	**131**	**0.41**	**103.5**	**1.7**	**188.9**	**0.9**
Avg. (SD)						**0.37 (0.12)**		**1.4 (0.8)**		**0.9 (0.6)**

**HM = Hoary Marmot*

Approximately 75% of colonies were on slopes between 20% and 40%, and 86% of colonies were on west to southeast facing aspects (Table 6.5-4; Appendix 6.5-4). Mineral soil depths were deeper than 1 m at 72% of colonies, and 91% of soils had a loam component, mixed with either cobble (51%) or rock (41%). Ground cover at nearly all colonies (95%), consisted of herbs as the main vegetation, and 25% of colonies had significant heather-heath components. Shrubs, tree islands, and barren rock were also recorded at some colonies.

Table 6.5-4. Habitat Characteristics Associated with Marmot Colonies

Parameter	Class	Observations	Percent[1] of Colonies with these Features
Soil texture[2]	Loam	157	90.8%
	Rock	97	56.1%
	Cobble	71	41.0%
	Gravel	15	8.7%
Slope	10%	3	1.7%
	15%	7	4.0%
	20%	22	12.7%
	25%	14	8.1%
	30%	40	23.1%
	35%	17	9.8%
	40%	37	21.4%
	45%	8	4.6%
	50%	13	7.5%
	55%	1	0.6%
	60%	2	1.2%
	>60%	9	5.2%

(continued)

Table 6.5-4. Habitat Characteristics Associated with Marmot Colonies (completed)

Parameter	Class	Observations	Percent[1] of Colonies with these Features
Aspect	S	46	26.6%
	SW	48	27.7%
	W	49	28.3%
	SE	6	3.5%
	E	13	7.5%
	N	7	4.0%
	NW	1	0.6%
	NE	3	1.7%
Vegetation classification[2]	herb	164	94.8%
	rock	11	6.4%
	heather	43	24.9%
	barren	23	13.3%
	shrub	17	9.8%
	tree	1	0.6%
Soil depth	<1m	49	28.0%
	≥1m	124	72.0%

[1]*An area of one hectare was used so colonies often had a combination of habitat features thus the sum of percentages exceeds 100% for many parameters.*
[2] *mixed classification accounts for total exceeding 100%*

6.5.4.2 Ground Surveys

Habitat Features

Twelve of the 18 colonies selected for detailed site assessments were active and all belonged to hoary marmot (Figure 6.5-2; Appendix 6.5-5). The colonies were between 1,307 m and 1,594 m in elevation (mean 1,434 ± 77 SD), on slopes between 20 and 70% (mean 44% ± 13 SD), and 78% were on warmer aspects between 120° (southeast) and 270° (west).

Soil moisture was submesic (3) or mesic (4), while nutrient regimes were medium (C) to very rich (E) on the edatopic grid (Banner et al 1993). Soil texture was typically gravel, sandy loam with less than 20% coarse component (i.e. cobble, gravel, rock etc.), and 12 (67%) colonies were located in areas where soil depth was > 1 m, while only one colony was located on shallow soils (< 1 m). Over half of the colonies (56%) were located in areas where no rock or talus formations were nearby (i.e. > 100 m away).

Comparing habitat observations to available Predictive Ecosystem Mapping (PEM) classifications, 15 of 18 plots (83%) consisted of mesic or rich herb, with heather heath (4 plots), dry herb (2 plots), and Krumholtz (1 plot) also occurring at some colonies. Herbs were the most common vegetation and the species most often encountered included Indian hellebore, Sitka valerian (*Valeriana sitchensis*), sedges (*Carex* spp.), lupine, partridge foot (*Luetkea pectinata*), arrow-leaved groundsel (*Senecio triangularis*), and white mountain heather (*Cassiope mertensiana*; Table 6.5-5).

Table 6.5-5. Dominant* Plant Species Associated with Surveyed Hoary Marmot Colonies

Plant Species	Vegetation Type	Plots	% Cover	S.D.
Indian hellebore	herb	18	15.8	6.0
Sitka valerian	herb	17	14.7	5.1
sedges	herb	16	11.7	7.0
lupine	herb	16	16.3	4.3
partridge-foot	herb	16	9.7	5.9
arrow-leaved groundsel	herb	14	10.9	5.3
white mountain-heather	herb	11	24.1	27.5
subalpine buttercup	herb	9	8.9	7.4
grass	herb	7	6.4	6.3
black huckleberry	shrub	6	64.2	32.3
fireweed	herb	5	8.0	7.6
mountain ash	shrub	5	9.0	7.4
northern geranium	herb	4	3.8	2.5
pink mountain-heather	herb	4	7.5	2.9
subalpine fir	shrub	4	31.3	19.3

**Dominant = species that were observed in at least four colony plots*

6.5.4.3 Comparison of Aerial and Field Surveys

Habitat characteristics recorded during ground surveys were compared to those recorded during aerial surveys. Consistency between the two methods would support the use of aerial survey data for habitat evaluation and suitability modelling. The comparison was based on habitat features that were used to develop the hoary marmot habitat suitability model.

Results from ground and aerial results were similar (Table 6.5-6), supporting the use of aerial surveys to evaluate the habitat suitability map and to index hoary marmot abundance and distribution. This is likely related to the relatively coarse resolution (1:20,000 scale) of the digital map products used to model marmot habitat that are transferable to coarse scale evaluations from the air. The scale of the digital products limits the ability to accurately predict habitat features (i.e. PEM vegetation classification, slope, soil depth, aspect etc.) on the ground, and this resolution is considered when determining class bounds for habitat modelling. Of the 18 colonies that underwent detailed field assessments, 15 (83%) were assigned the same habitat suitability value as those determined by aerial surveys, while the remaining three were within one HSR (e.g. rated Moderate from the air and High on the ground).

Table 6.5-6. Comparison between Ground and Aerial Surveys

Parameter	Ground (N=18)	Air (N=173)
Soil depth	67% > 1 m	72% > 1 m
Slope	78% slopes 20% to 50%	87% slopes 20% to 50%
Aspect	78% warm (SE to W)	86% warm (SE to W)
Vegetation (types represented)	83% Mesic or Rich Herb, but also Heather-Heath (22%), and Dry Herb (11%), Krumholtz (6%)	95% Herb, but also Heather Heath (25%), Barren (13%) and Shrub (10%)
Structural Stage	94% structural stage two	90% structural stage two

Habitat suitability models were developed for the KSM Project based on observations made during surveys conducted in 2008 and 2009 (Rescan 2010c). Habitat features identified at colonies during these surveys were consistent with the models developed for the KSM Project. Detailed results are available in the Brucejack Habitat Suitability Report (Rescan 2013b).

6.5.5 Discussion

Hoary marmots are abundant in the LSA, although they are not evenly distributed throughout the area. Study Units 4 and 7 contained the most colonies. Individual colonies tended to be larger in SUs where suitable habitat was more extensive, as opposed to areas where habitat was patchily distributed between topographic features such as exposed bedrock and talus slopes. Field surveys determined that approximately 67% of the colonies are expected to be currently occupied by marmot. The structural integrity of abandoned colonies across the landscape is unknown, as is the extent that abandoned colonies may be reused. It is assumed that population numbers and occupancy of suitable habitat within the LSA will be variable across years.

The distribution of colonies found during this survey was similar to that observed during baseline studies for the KSM Project over a common area surveyed for both projects (Rescan 2010b). Areas around Brucejack Lake (SU 1a, 2, and 3) supported many active colonies. The density estimates calculated during the KSM study were similar to those calculated in this study. Colony density above 1,100 m in the three SUs near the proposed Brucejack Mine Site was 0.73 per km^2, comparable to an estimate of 0.69 per km^2 calculated for the same area in 2008 and 2009 during the KSM study.

Habitat features associated with marmot colonies found in this survey were consistent with those identified during the KSM survey (Rescan 2010b). These same habitat features were used to develop the hoary marmot habitat suitability model for the KSM project (Rescan 2010c). High suitability habitats for hoary marmot tend to be located at higher elevations, and on deeper soils, moderate slopes, and warm aspects. Vegetation associated at a majority of colonies tended to be structural stage two (herbaceous) and included Indian hellebore, lupine, sedges, and Sitka valerian that are indicative of medium of rich sites with mesic moisture regimes. The importance of talus or boulders does not appear imperative to the colonies in the study area, but these features are assumed to provide shelter to marmot, and were present in more than 50% of colonies found during field surveys for this Project and the KSM Project.

The habitat described at marmot colonies during the Brucejack inventory was consistent with habitat models generated for hoary marmot during baseline studies for the KSM Project. These past results can be extended to this project with little or no modification.

6.6 FURBEARERS

6.6.1 Introduction

In British Columbia furbearers are legally designated species that have traditionally been hunted or trapped for their fur. For the purpose of managing wildlife harvest in BC, the BC MFLNRO has divided the province into regions, and the Brucejack area falls within the Skeena Region (Region 6). Two species of furbearers that are of conservation concern occurring in the Brucejack RSA include wolverine (*Gulo gulo luscus*) and fisher (*Martes pennanti*). Both are provincially blue-listed and are considered Class 2 furbearers meaning they are sensitive to harvest and are primarily managed by provincial regulations. The Nass South SRMP (BC ILMB 2012) also suggests these two furbearer species require additional management consideration because of concerns for their conservation. American marten (*Martes americana*) are identified in the Cassiar Iskut - Stikine LRMP (BC ILMB 2000) as requiring increased management consideration as it is the most valuable component of the regional fur harvest.

High value habitat areas for marten were identified in the Brucejack RSA (Rescan 2013b), and in the Cassiar Iskut - Stikine LRMP (BC ILMB 2000).

Furbearers are both economically and culturally important resources in northwestern BC. The Project RSA contains eight trapline tenures. While licensed trapline holders have the right to trap most furbearers, some species, including black bear, grey wolf, coyote, wolverine, Canada lynx, and bobcat, may also be harvested for their furs by hunters. In addition to field surveys and incidental observations, assessing furbearer distribution within the study area can be supplemented by investigating fur harvest returns from the provincial Fur Harvest Database (RIC 1999c; BC MWLAP 2004b, 2004d) and use of habitat models developed for the project (Rescan 2013b).

The BC Fur Harvest Database can provide information about the presence of furbearers in an area, and an indication of the economic activity generated from the fur harvest. As a means to determine the population status of a furbearer, however, the Fur Harvest Database is limited because harvest effort typically varies by year and trapline, and the level of harvest is often under-reported for various reasons. In recent years, provincial regulation of traplines and harvest monitoring has been significantly scaled back due to lack of resources, further compromising the utility of these data for evaluating the population status for many species. This section presents what is known about furbearers in the region from a combination of results from past reports, incidental observations, and information from the Fur Harvest Database as of November, 2012. It also includes furbearer observations made during the wolverine inventory conducted for this project (Section 6.7).

During 2008 and 2009 baseline studies for the neighbouring KSM Project, that had a study area overlapping the Brucejack RSA, a total of 90 incidental observations of furbearers were recorded (Rescan 2010b). Observations of sign (e.g. tracks or scat) were recorded more often than animals. Nine furbearer species were documented: American beaver, American black bear, American marten, fisher, grey wolf, mink, red fox, red squirrel, and wolverine (Appendix 6.6-1 and Appendix 6.6-2).

6.6.2 Objectives

The objectives of this study were to assess the presence of furbearer species in the LSA and RSA, with a particular emphasis on determining whether fisher occur in the area and determine harvest levels of marten from the Fur Harvest Database as a general index for monitoring the ecological integrity of the RSA for furbearers and fur harvest activity.

6.6.3 Methods

Furbearers were assessed at a present/not detected level using incidental observations from various field studies, the most recent data in the provincial Fur Harvest Database, and socio-economic studies. An evaluation of marten harvest for their use as an index for monitoring of ecological fitness and fur harvest activity in the RSA was conducted using the extent of traplines contained within the RSA in combination with reported harvest levels. Inventory surveys were conducted specifically for wolverine and the results of that research are reported in the following section (6.7).

6.6.3.1 Present/Not Detected Surveys

The provincial Fur Harvest Database was accessed to determine the registered fur harvest associated with licensed traplines located in the RSA. Trapline locations were identified using provincial databases (e.g., the Integrated Land and Resource Registry, and the Land and Resource Data Warehouse). The most recent version of the Fur Harvest Database for Region 6 documents fur returns from 1985 to 2009, and provides information on the species and numbers of individual animals harvested by trappers operating in the RSA. This information was used to generate a furbearer list for the RSA.

During baseline land-use studies, local trappers operating in the RSA were asked to provide information about furbearing species in the area, and their views about local resource use and activities. This information was used to supplement the fur harvest data. In addition, furbearers were incidentally documented during winter wolverine inventory studies in 2012 that used infrared and motion triggered cameras (see Section 6.7). These photos supplemented the furbearer inventory for the RSA.

6.6.3.2 Marten Harvest Estimates

Evaluating marten harvest can provide an index for the local socio-economic importance of the entire fur harvest as marten are by far the greatest component of the harvest from both numbers and economic contribution. They are also dependent upon the availability of mature and old growth forest that is well linked at a regional scale in order to sustain harvest, allowing marten catch to provide an index of the ecological integrity of this habitat. Eight traplines have a portion of their total area within the RSA boundary. To determine what proportion of the harvest was likely to have come from the individual traplines, three assumptions had to be made: 1) available high and moderately suitable marten habitat supports a relatively uniform distribution of marten among individual traplines, 2) the proportion of suitable marten habitat is consistent along each individual trapline, both inside and outside the RSA, and 3) individual trappers access their tenures with relatively consistent effort.

Considering marten have small home ranges, are quite mobile, and the most suitable habitat occurs at low elevations along drainages with good regional connectivity, the first assumption is likely met. The similarity in geomorphology, ecology, and development history both within and outside the RSA suggest that the second assumption could be met. The area within the RSA is predominantly without roads, the exception being Highway 37, which is the eastern boundary of the RSA. The majority of the highway includes an area within one trapline. The majority of the trappers throughout the RSA would need to rely on their own trails and to follow watercourses to access their traplines, suggesting effort required to harvest fur from each line would be consistent within that trapline and not likely to require any different effort within or outside the RSA, meeting the final assumption.

There are eight traplines that overlap the RSA: TR0614T101, TR0616T010, TR0616T011, TR0616T012, TR0616T013, TR0617T015, TR0621T001 and TR0621T003 (Figure 6.6-1). Harvest data were only available for five of the traplines. To quantify marten harvest, the proportion of a trapline located within the RSA was compared to the distribution of marten winter habitat suitability to relate the proportion of harvest likely to have come from within the RSA to available habitat (Rescan 2013b, 2013e). The proportion of high and moderate suitability marten winter habitat was calculated along individual trapline sections located within the RSA. Habitat mapping may not have been available for trapline sections outside the RSA; therefore, this proportion was estimated based on available habitat along the section of trapline in the RSA, assuming a relatively uniform distribution. The total marten harvest compiled over 24 years of available data in the Fur Harvest Database was then pro-rated by the proportion of suitable marten habitat along each trapline section that is located within the RSA.

6.6.3.3 Furbearing Harvester Interviews

Interviews were conducted with four individuals in July 2009, and again in August and September, 2012 (Rescan 2013e). Two of the interviews were with guide outfitters primarily focused on large game animals. American black bear is a target furbearing species often harvested during guided hunts. Occasionally wolverine and wolf may be harvested opportunistically (R. Milligan, pers. comm.). The other two interviews were with trapline tenure holders. Trappers primarily target American marten for fur sales. The marten population appears to fluctuate with their rodent prey, with a peak or “bump” crop occurring every seven years (D. Green and D. Drinnan, pers.comm.). Seasonal catch of marten may be as high as 120 or as low as 40 depending on the year, but averages about 70 pelts per year (D.

Green, pers. comm.). Other target species include river otter, mink, wolverine, and beaver. By-catch of wolverine does occur occasionally while trapping marten.

6.6.4 Results

6.6.4.1 Furbearer Trapline Harvest

On the eight traplines within the RSA, 15 furbearer species were harvested, including fisher, wolverine, and marten (Table 6.6-1). Marten accounted for the majority of the reported trapper harvest (73% of all animals), followed by beaver (11%), squirrel (7%), and ermine (4%). Fishers are often caught in traps set for marten; however, only three fishers were reported in the 24 year period despite the effort directed at marten. Wolverine amounted to less than 1% of the total harvest, with 26 animals harvested over 24 years. The trapline with the greatest harvest was TR0616T011 with 2,146 individual furs trapped. The most commonly harvested furbearers included marten (1,393), red squirrel (310), beaver (221) and ermine (152). Approximately 59% (1,256 km^2) of this trapline is located within the north-eastern portion of the RSA, and includes Bowser Lake, Bell Irving River, and Treaty Creek. This trapline also includes the majority of the length of Highway 37 that runs through the RSA.

Table 6.6-1. Registered Harvest of Furbearer Species in Trapline Tenures within the RSA

Species	Scientific Name	Total Harvest *	Species	Scientific Name	Total Harvest *
Beaver	*Castor canadensis*	601	Mink	*Neovision vison*	114
Black Bear	*Ursus americanus*	16	Muskrat	*Ondatra zibethicus*	36
Marten	*Martes americana*	4,189	Red Fox	*Vulpes vulpes*	34
Bobcat	*Lynx rufus*	0	Red Squirrel	*Tamiasciurus hudsonicus*	402
Coyote	*Canis latrans*	25	River Otter	*Lontra canadensis*	35
Ermine	*Mustela erminea*	215	Skunk	*Mephitis mephitis*	1
Fisher	*Martes pennanti*	3	Wolverine	*Gulo gulo*	26
Grey Wolf	*Canis lupus*	18	**Total**	**all species**	**5,716**
Lynx	*Lynx canadensis*	1			

**Total Harvest from 1985 to 2009*

6.6.4.2 Marten Trapline Harvest Estimate

The amount of high and moderate suitability habitat was mapped for each of the eight traplines in the RSA (Figure 6.6-2). Harvest data were not available for three of the traplines. Based on the amount of available habitat in a given trapline tenure, an estimate of the total number of marten harvested was generated for the five traplines that had harvest information (Table 6.6-2). The estimated marten harvest within the RSA portions of the traplines was 1,904 for the 24 year period between 1985 and 2009, representing approximately 45.4% of the total marten harvest in the five tenures for which there were data. The highest reported marten harvest from the RSA was in TR0616T011 (826) located in the north-eastern portion of the study area, followed by TR0621T001 (666), TR0621T003 (167), TR0617T015 (128), and TR0616T012 (114).

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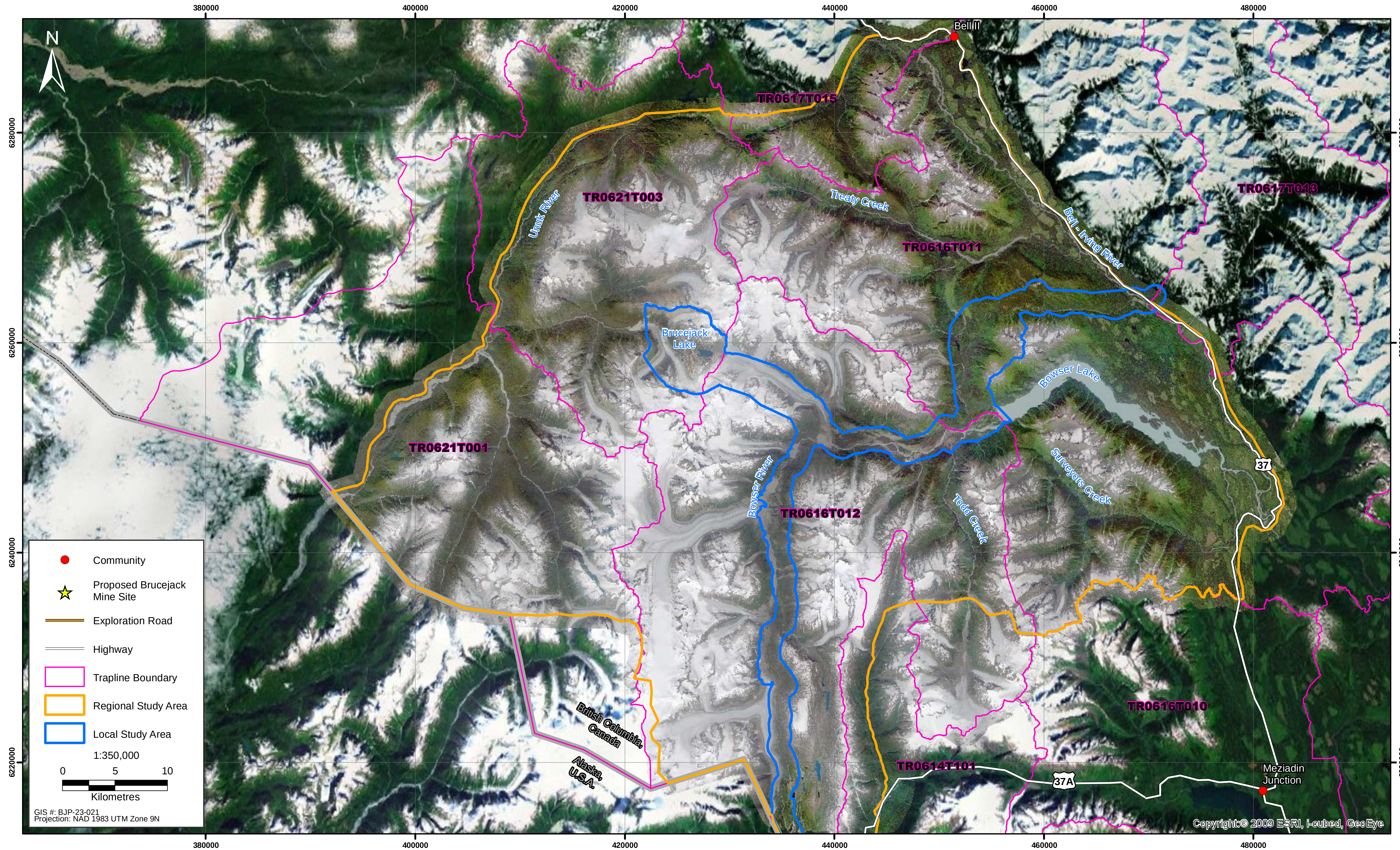

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Figure 6.6-1

Trapline Tenures Identified within the RSA

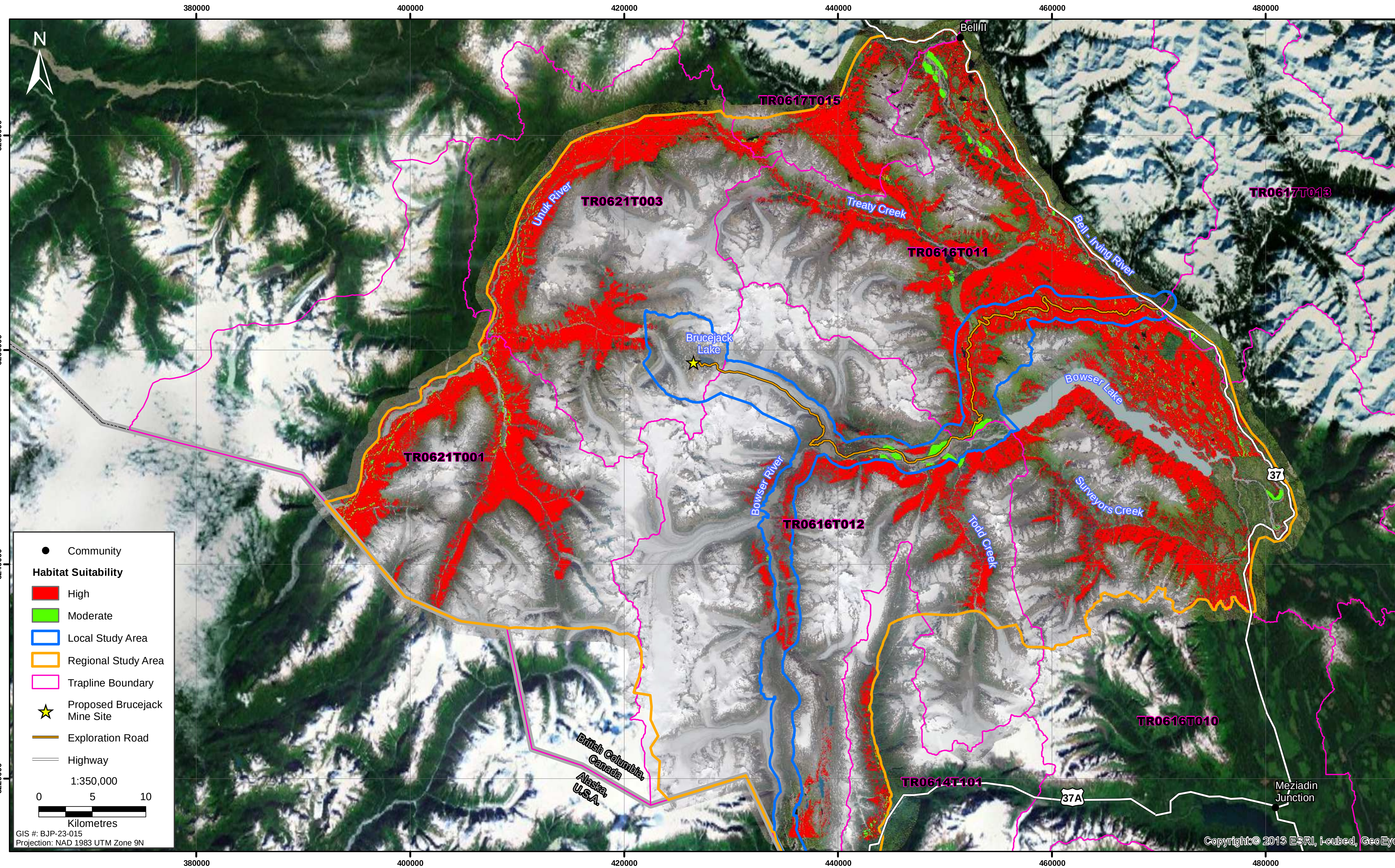

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Figure 6.6-2

Traplines and Area of High and Moderate Value Marten Habitat within the Brucejack RSA

Table 6.6-2. Marten Harvest Estimated for Area of Traplines within the RSA (1985 to 2009)

Trapline	Total Trapline Area (km^2)	Trapline Area in RSA (km^2)	High and Mod Marten Habitat in RSA (km^2)	Total Marten Trapline Habitat (km^2)	Total Marten Harvest	% Marten Harvest from RSA	Estimated Marten Harvest from RSA
Calculations	A	B	C	D =(C/B)*A	E	F =(C/D)	G =(F*E)
TR0614T101	683	79	10	86	No data	11.6%	Not estimated
TR0616T010	745	2	<1	n/a	No data	n/a	Not estimated
TR0616T011	2,116	1,256	369	622	1,393	59.4%	827
TR0616T012	1,274	1,118	77	88	130	87.8%	114
TR0617T013	496	6	1	83	No data	1.2%	Not estimated
TR0617T015	1,055	132	38	304	1,032	12.5%	129
TR0621T001	1,128	533	116	245	1,413	47.3%	668
TR0621T003	740	557	114	151	221	75.3%	166
Total	**8,238**	**3,682**	**725**	**1622**	**4,189**	**N/A**	**1,904**

6.6.4.3 Incidental Observations of Furbearers during Wolverine Inventory

A wolverine inventory was conducted between February 16 and April 19, 2012 using 10 baited hair capture stations and remote cameras deployed in the RSA. Wolverines were identified at eight CH sampling stations (see Section 6.7 for details). All of the ten remote cameras at the sampling stations recorded images of furbearing species, including red fox, marten, red squirrel, fisher, and grey wolf (Table 6.6-3).

Table 6.6-3. Incidental Observations of Furbearing Species Detected at CH Stations

CH Station	CHECK 1	CHECK 2	CHECK 3	CHECK 4
1	Marten	Marten	Marten, Red fox	Wolverine
2	Marten	Marten, Wolverine	Marten	Marten
3	None	Marten	Marten	Marten
	Marten	Marten	Marten, Wolverine	Marten
5	Marten, Red squirrel Wolverine	Marten, Red fox	Red fox, Grey wolf Marten, Red squirrel, Wolverine	Marten, Wolverine
6	Marten, Red squirrel, Wolverine	None	Red squirrel, Wolverine	Red squirrel, Marten, Wolverine
7	Marten	Marten	Marten, Wolverine	Red squirrel, Marten
8	Marten	Marten	Marten	Marten
9	Marten	Wolverine	Marten, Red squirrel	Fisher, Marten, Red squirrel, Wolverine
10	Marten	Marten	Marten, Grey wolf	Marten, Wolverine

Red squirrels were photographed at four sampling stations (5, 6, 7 and 9), wolves at two stations (5 and 10; Plate 6.6-1), and at least one fisher was observed at station 9 (Plate 6.6-2). This station was located at the confluence of the Bell Irving River and Treaty Creek at the eastern edge of the RSA. Marten (e.g., Plate 6.6-3) images were recorded at all ten camera stations, and accounted for the vast majority of images as they aggressively pursued the bait. Marten were encountered in nine of the ten CH stations on the first check (within two weeks) and the final CH station on the second check. The rapid detection is an indicator of marten being very abundant and widely distributed throughout the RSA during the inventory.

Plate 6.6-1. Grey Wolf observed on camera at CH Station 5.

Plate 6.6-2. Fisher observed on Camera at CH Station 9.

Plate 6.6-3. Marten observed on camera at CH Station 5.

6.6.5 Discussion

The provincial Fur Harvest Database indicated that 15 furbearer species were harvested from the RSA, nine of which were also confirmed to be present from incidental observations during baseline studies for the KSM Project. These species include wolverine, fisher, American marten, red squirrel, grey wolf, black bear, red fox, mink, and beaver.

Habitat suitability modelling for the blue-listed fisher indicated there is a substantial area of forest suitable for providing natal and maternal denning in the region, a key habitat required by fisher (Rescan 2013b). The presence of fisher in low elevation habitat along the Bell-Irving River and Treaty Creek was confirmed from images captured by a remote camera and at the confluence of the Bell-Irving River and Treaty Creek at the boundary of the LSA. This area was also identified as highly suitable fisher natal habitat (Rescan 2013b). While fisher harvest was low within the Fur Harvest Database (only three reported in 24 years), it is noted that WMU 6-12 to 6-18 do not have an open trapping season for fisher, and traplines in these WMUs support 2,593 km^2 or 70% of the trapline area in the RSA. This includes most of the area mapped as suitable fisher habitat within the RSA. Fisher harvested from these traplines may have been abandoned or sold through other tenures and thus not entered into the Fur Harvest Database, limiting the inferences of population the database may suggest. Fisher had also been identified near Mitchel Creek in association with the KSM Project (Rescan 2010b). While previous studies suggest that the Brucejack RSA is outside the known distribution of fisher and that little habitat exists in the area (McElhanney 2011), it has determined that fisher exist in the RSA.

Remote camera photography provided evidence that marten are present throughout the RSA in low elevation forest. The rapid and numerous detections at each camera after deployment (nine of ten sampling stations had images within the first two weeks) indicate that marten are abundant within these habitats. This was expected given results from the Fur Harvest Database that suggested marten were distributed throughout all trapline tenure areas for which data were available, (representing the greatest number of animals harvested overall). It is estimated that 1,904 have been harvested from the RSA. The marten habitat suitability model used as the basis for the RSA harvest estimate also shows abundant winter habitat in a broad and continuous distribution along valley bottoms, further suggesting this species is abundant in the RSA (Rescan 2013b). A number of other furbearers are anticipated to exploit the same habitat that is suitable for marten, including red squirrel, ermine, red fox, grey wolf and lynx. With the exception of lynx and ermine, these species were all detected by remote cameras.

Lynx were not observed in the RSA, either incidentally or by remote photography, and there was only one account of this species in the Fur Harvest Database between 1985 and 2009. Despite being wide spread across Canada and Alaska, the RSA is near the western most distribution of lynx suggesting its occurrence in the RSA may be rare (Novak et al. 1987). Ermine are often incidentally captured in marten trap sets, but its frequency in the Fur Harvest Database was also relatively low with only 215 individuals captured compared to 4,189 marten. Ermine were not incidentally observed in the study area, nor was it detected by remote cameras, suggesting its abundance in the RSA may be low relative to other areas of its range.

The Fur Harvest Database indicated that the aquatic furbearers beaver, muskrat, mink, and river otter have been harvested previously, while beaver and mink were incidentally observed during baseline studies. A number of large river systems are located in the RSA that will provide habitat for beaver (e.g., Bell-Irving River, Bowser River, Unuk River and Treaty Creek). These same systems will support a prey base that will make them suitable for the predatory mink and river otter. The low number of muskrats reported in the Fur Harvest Database is consistent with habitat availability in the RSA. Muskrat require water of sufficient depth to prevent freezing to the bottom in winter, and with an abundance of emergent vegetation such as bull rushes (*Scirpus* spp) and cattail (*Typha* sp; Novak et al 1987). These types of wetlands are quite rare within the RSA.

Overall, the RSA supports an abundant and diverse group of furbearers that as a group might serve as a basis for monitoring environmental effects of the proposed project. Marten in particular may be used as an index of low elevation habitat integrity, and any changes to this habitat (or subsequent marten abundance) may be indicative of potential effects to other furbearer species.

6.7 WOLVERINE INVENTORY

6.7.1 Introduction

The wolverine is the largest member of the weasel family in BC, it is a terrestrial carnivore associated with the more pristine areas in the province. Wolverines are broad and stocky with long, thick glossy black to brown coloured pelage. They have large feet and thick, frost resistant fur that makes them well adapted for winter in the north. Males are large and can reach 20 kg while females can reach 14 kg in weight. Wolverines have home ranges as large as 500 km^2 and can travel more than 30 km in a day while looking for food. The large home ranges and extensive movements are why the species is listed by the province as Class 2 for furbearer management as its population can be influenced by actions on multiple traplines. Most movements are associated with searching for food and a substantial part of wolverines' diet is scavenging carrion. They are known as generalists and opportunistic in their feeding strategies and will feed on available prey as well as plant forage such as berries. Wolverines mate in June and July and give birth to kits in suitable dens in late winter, often dug in deep snow at high elevations.

Wolverine are observed to use a broad range of habitats, however, selection is more dependent on the availability of food, especially carrion, than any particular habitat feature. Their territories occupy extensive areas in their search to find food. Both male and female wolverine will select areas that support moose during winter, although females may also range into high elevation alpine areas as well to avoid predators and find suitable areas for natal denning in late winter (Krebs, Lofroth, and Parfitt 2007). Winters that are more severe and result in greater winter kill tend to benefit wolverine. Avalanche areas near goat habitat that result in goat mortality were also identified as areas exploited by wolverine. During the summer, wolverines use a much wider range of habitat including high elevation areas that support hoary marmot and ground squirrel. Wolverine will avoid areas with human activity and development including roads, heli-skiing activity, and resource extraction (Krebs, Lofroth, and Parfitt 2007).

Wolverine habitat selection is negatively influenced by human activity, including roads, infrastructure and backcountry recreation (May R et al. 2006; Krebs, Lofroth, and Parfitt 2007). Roads and human density have been found to be important factors explaining current wolverine distributions (Carroll et al. 2003; Rowland et al. 2003). Human density and road density have negative effects on the "environmental index" of Bayesian belief network and habitat models for wolverine (May R et al. 2006; Krebs, Lofroth, and Parfitt 2007). Research has suggested that wolverine would be negatively impacted by human activities and that they would be displaced by human disturbance or motorized vehicles in both summer and winter (May R et al. 2006; Krebs, Lofroth, and Parfitt 2007).

The conservation of the wolverine (*Gulo gulo luscus*) is receiving increasing attention in north-western BC by provincial regulators. This requires more focus on identifying impacts to this species when evaluating regional development. It is a species important for its contribution to biodiversity as well as its social and economic values. The BC Conservation Data Centre currently lists the *G. gulo luscus* subspecies as provincially S3 blue listed and it is a Species of Special Concern as ranked federally by COSEWIC (COSEWIC 2003b; CDC 2012). Wolverines are important regionally as they are one of the most valuable furbearers available to trappers in the north west of the province. Approximately 35% of the total provincial harvest is generated from the Skeena Region second only to the 43% from the Omenica-Peace Region (Hatler D.F and Beale 2003). Wolverines are also classified as a game species which allows them to be hunted by both resident and non-resident hunters in in BC.

Estimates of wolverine abundance and distribution across British Columbia at a landscape level of resolution identified habitat values as having high and moderate quality through much of the RSA (Lofroth and Krebs 2007). Seventy-four provincial wolverine population units were identified for management in BC (Lofroth and Ott 2007). Population unit (PU) 14 (Upper Skeena-Nass) is representative of most of the area within the RSA. Between 1985 and 2004 the PU 14 trapping harvest was 72 wolverine and hunting harvest was six for a total harvest of 78 wolverine during a 20 year period (Lofroth and Ott 2007). A total of 26 wolverine were harvested by traplines just within the RSA between 1985 and 2009 (Table 6.6-1). A population estimate was calculated for PU 14 of 134 (95% CI 93–202). The area of PU 14 is 23,723 km^2 with a calculated density of 5.6 wolverine per 1,000 km^2. Net recruitment was calculated for this population unit and at current harvest rates it was identified as a sustainable population, however, additional mortality within this unit of greater than four wolverines per year could jeopardise the stability of the population (Lofroth and Ott 2007).

6.7.2 Objectives

The objectives of the wolverine inventory were to estimate the population of wolverine most likely influenced by the potential development and relate it as a proportion of the PU 14 population estimates. Observations and detections were also used to determine movement and relative use of available habitat within the RSA.

6.7.3 Methods

The wolverine population inventory was conducted with remote cameras and DNA hair sampling analysis. Additional incidental DNA hair sampling methods from grizzly bear inventory studies were included, for which wolverine sampling was a secondary objective.

6.7.3.1 Field Inventory

Wolverine Remote Camera Photo and DNA Hair Capture Sampling

During the late winter of 2012, a combination of remote camera and DNA hair capture methods (CH stations) were used to identify individual wolverines, to detect their spatial distribution, and to "mark" samples which aids in determining statistical population estimates (Magoun, Long, et al. 2011b; Magoun, P. Valkenburg, et al. 2011). Identifying variability in wolverine ventral pelage is a method of detecting individual wolverines (Magoun, Long, et al. 2011a; Magoun, P. Valkenburg, et al. 2011; Royle, Magoen, et al. 2011). DNA technologies have effectively been used for identifying wolverine individuals (G Mowat, C Kyle, and Paetkau. 2003; Fisher 2004). Methods for remote camera image and DNA hair capture sample collection were combined at all of the sites.

CH stations were set up at ten locations in the RSA. These sites were associated with mapped moose winter range in anticipation of a greater concentration of winter use by wolverine due to the potential of moose prey. CH stations were distributed between areas potentially impacted by proposed activities including areas along the Bell-Irving River, Wildfire Creek and Bowser River and a control area associated with Unuk River drainage. The moose winter range was overlaid with a 5 km by 5 km grid to assist selection of sites and provide reference for future efforts. The five km grid represented 25 km^2, about ¼ of the 100 km^2 area recommended for wolverine population monitoring by track surveys, and about ¾ of the area recommended for bait stations (RIC 1999c). The smaller grids were used to reflect concentrated use, and increase sampling effort intensity. The grid system was initiated early in the inventory to facilitate future monitoring strategies that may be required.

CH stations included the use of a running pole attached to a tree with beaver meat as bait suspended about 0.5 m over the outer edge of the pole. This was combined with a remote Recoynx camera set 3-4 m away (Magoun, Long et al. 2011). Commercially available wolverine lure was also added to each site. In addition, lengths of barbed wire were fastened to the running pole, tree trunk, and between the tree trunk and support post to capture hair samples. Barbed wire was recommended by Wildlife Genetics International President, David Paetkau as a tool to pull out hair leaving more tissue for DNA analysis. Sets were installed in mid-February and checked and re-baited every two weeks until mid-April (four checks). Flash cards were swapped out of the digital camera and hair samples were collected off the barbed wire at each visit.

Digital images of wolverine were reviewed for ventral pelage patterns and other features which may assist in identifying individuals. Images of wolverines were separated manually from each CH station for each session. A reference photo for each individual was identified and this reference photo was selected and used to compare to all digital images of the wolverine taken. The reference photos tended to be the first clear image that could be used to distinguish the ventral patterns, and the reviewer manually filtered the images to compare by separating the clearest photos from CH stations for concurrent sessions. If patterns could not be identified that would allow individuals to be distinguished the wolverine was classified as unidentifiable (UI).

To compare results to other studies, individual CH station detections and density estimates were calculated. The camera capture rate was calculated by dividing the number of individual wolverines detected by the number of CH stations. The DNA capture rate was calculated by dividing the number of individuals genetically identified by the number of CH stations. Density of wolverines was calculated by dividing the estimated population by the area of capable moose winter habitat which was equated to wolverine winter habitat. Density was expressed as wolverine per 1,000 km^2.

<u>Incidental Wolverine DNA Hair Capture</u>

During genetic analysis of hair samples collected for the Brucejack and KSM grizzly bear population inventory studies, lab technicians pre-screened hair samples for species testing and wolverine analysis. These incidental DNA hair samples were run with microsatellite markers specific to wolverine (Rescan 2010a, 2013d).

6.7.3.2 Genetic Analysis

DNA analysis was conducted by Wildlife Genetics International (WGI), using the following techniques.

<u>DNA Extraction</u>

Hair samples were subsampled for analysis limiting analysis to one in three samples from a given adjacency group. Higher quality samples, such as those with ten guard hair roots, were preferentially selected for DNA extraction and PCR processes.

<u>Species Testing</u>

A species test was used as a sequence-based analysis of the mitochondrial 16S rRNA gene. The profiles from samples were compared to WGI's lab reference library, which contains sequence profiles from over 100 mammalian species. WGI analyzed all 73 extracted samples from this project as well as 21 failed (identified technically as *Xbomb*) samples from the 2011 grizzly hair collection (Rescan 2011).

<u>DNA Analysis</u>

The genetic analysis procedure involves amplification of the DNA region of interest. Control reactions were run with each set of extractions and each set of amplifications to ensure cross contamination did not occur between samples. WGI analyzed samples 12 wolverine microsatellite markers and a ZFX/ZFY gender marker. Genotyping of the 14 wolverine samples followed WGI's usual three phase approach starting with a first pass of all 13 markers and followed by a cleanup phase in which the data were reanalyzed that were weak or difficult to read the first time. The last phase of analysis was error-checking, following WGI's published protocol of reanalyzing the mismatching markers in pairs of genotypes that match at all-but-one or all-but-two markers (Paetkau 2003). An individual was defined for each unique multilocus genotype, taking identification numbers from the first sample to be assigned to each individual.

6.7.4 Results

6.7.4.1 Wolverine Remote Camera Photo and DNA Hair Capture

The ten CH stations were set between February 16 and April 19, 2012 resulting in a total of 619 capture nights. The first check was made February 29 to March 1; the second March 14 and 15; the third March 29; and the final check and pick up was on April 19, 2012. Wolverines were detected at eight of the ten CH stations (Plate 6.7-1). The combination of hair capture and remote cameras identified a minimum of five individuals from DNA analysis (0.5 wolverine per CH station), and seven from digital photographs (0.7 wolverine per CH station). All but one individual identified by camera and confirmed as unique (W4) were detected in the area associated with the Bowser River, Bell Irving River and Treaty Creek watersheds. Figure 6.7-1 illustrates the location of the CH stations and identifies where the wolverines were detected. Table 6.7-1 summarises the CH stations and sessions associated with the wolverines that were detected. Individuals identified by camera were labelled as W1, W2, while individuals identified from DNA analysis were identified by the first hair sample ID label they were detected. CH Stations 4 to 10 were representative of the area most likely influenced by the development, while CH stations 1 to 3 were selected within a control area.

Plate 6.7-1. A wolverine image captured by remote camera at a CH Station, 2012.

There were few re-detections. Individuals W1 and W13 moved between cameras during the same survey period with W1 being observed at both CH 5 and CH 6 during survey period one. Wolverine W13 was observed at both CH 6 and CH 7 during survey period three. Individual wolverines W13, W5, and W6 were observed at the same site on multiple surveys, with W13 being observed at CH 5 twice and W5 and W6 both observed at CH 6 twice (Table 6.7-1).

Table 6.7-1. Summary of Wolverines Detected by Photos (W), DNA (ID Number), and CH Station

Station	Within LSA?	Check 1	Check 2	Check 3	Check 4	Total Capture Nights
CH 1	No	None	None	None	W4	61
CH 2	No	None	(W7-UI) (not W4 from tail condition)	None	None	61
CH 3	No	None	None	None	None	61
CH 4	No	None	None	W13	None	61
CH 5	Yes	W1, W13 (DNA 373, 371)	None	W13	(W8-UI)	62
CH 6	No	W1	None	W5, W6	W5, W6, (W12 - UI) (DNA 521 and 532)	62
CH 7	No	None	None	(W3-UI)	None	62
CH 8	No	None	None	None	None	63
CH 9	No	None	W2 (DNA 400)	None	(W9-UI)	63
CH 10	Yes	None	None	None	W11	63

UI=unidentified to individual from camera picture results

6.7.4.2 Remote Cameras

The remote cameras from the ten CH stations resulted in over 95,500 photos. This included 3,543 images of wolverine. From these images 13 series of wolverine photographs were taken of which seven could be identified as unique individuals. Wolverine W7 was not included in this total because although the wolverine was identifiably different from W4 (which had a truncated tail) and the only other wolverine identified from the Unuk River watershed, it could not be distinguished from other wolverine in the RSA. Table 6.7-2 summarizes features used for identification and the sex of the wolverine, while Table 6.7-3 identifies details of observations made during the inventory. Plate 6.7-2 illustrates an example of individuals W1 and W2 showing distinct ventral pelage markings used for identification. Appendix 6.7-1 includes reference photos of all wolverine encountered.

Table 6.7-2. Individual Wolverine Characteristics Used for Identification

ID	Description and Sex	Identified as Individual
W1	Ventral pelage, and white toes with one black toe. Male	Y
W2	Ventral pelage, and has a mouth malformation that exposes an upper right fang. Female	Y
W3	Can't distinguish from the photo, consider unidentified. Unidentified sex	N
W4	Has no tail. Unidentified sex	Y
W5	Ventral pelage, and white dribble marking left chest/neck. Unidentified sex	Y
W6	Ventral pelage, and VERY blonde and smaller. Male	Y
W7	Unidentifiable as an individual, but has complete tail so not W4. Unidentified sex	N
W8	Could be W5 –but cannot distinguish from the photo, but possibly W5 based on photo1281 which shows some similar pelage characteristics. Unidentified sex	N
W9	Cannot distinguish from the photo, but likely not W5 based on visible pelage characteristics. Unidentifiable sex	N
W10	Could possibly be W5 or W6 – but cannot distinguish sufficient pelage characteristics from the photographs. Unidentifiable sex)	N
W11	Ventral pelage, complete chevron and very blond. Unidentifiable sex	Y
W12	Very few markings, but nigh time photograph so may not show up possibly W6 but uncertain. Male	N
W13	Ventral pelage and Very solid marking on shoulder and around neck. Unidentifiable sex	Y

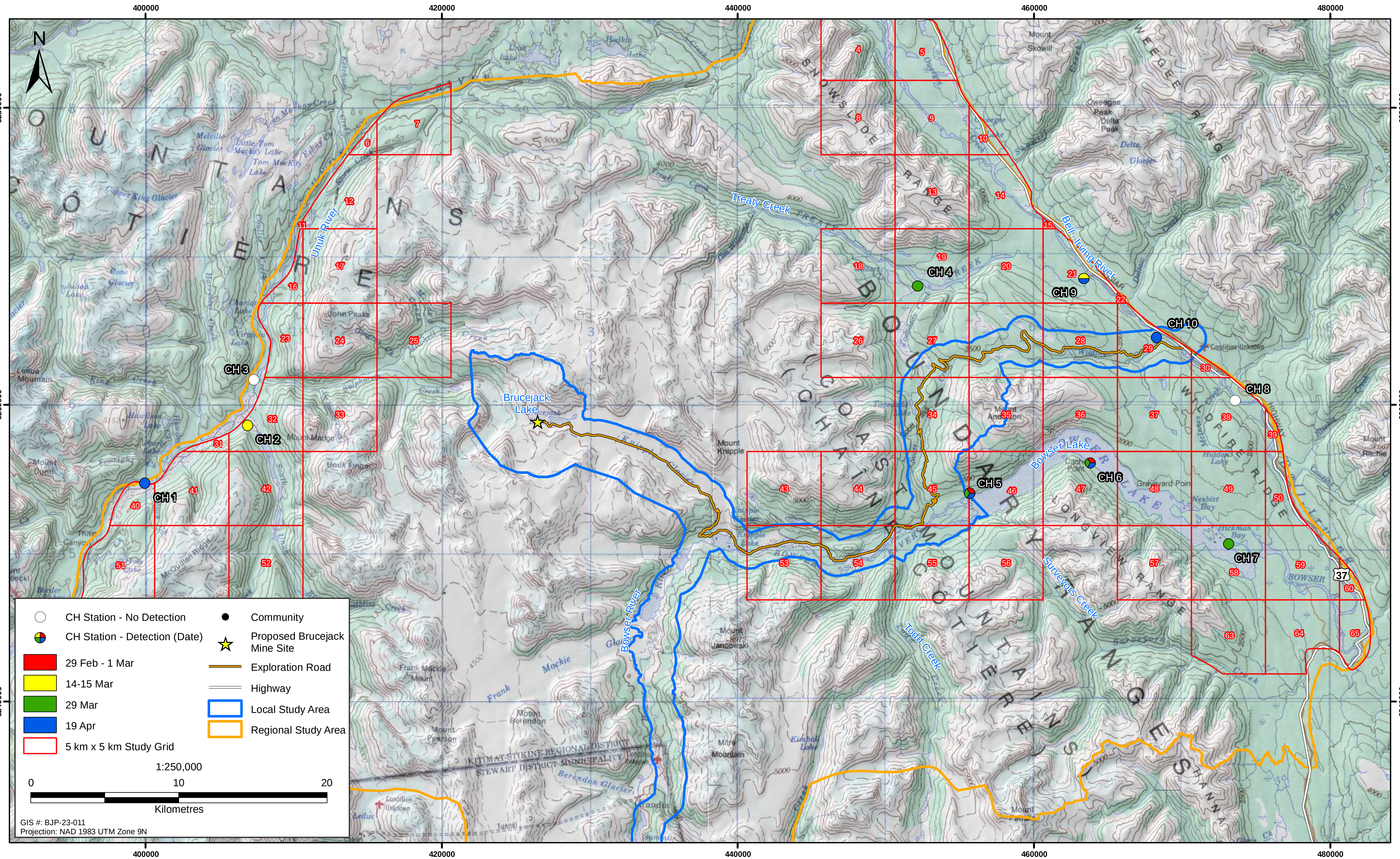

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Figure 6.7-1

Location of the CH Stations and Wolverine Detections

Plate 6.7-2. Wolverine W1 (left) and W2 (right) illustrating identifiable ventral pelage.

Table 6.7-3. Summary of Location and Time of Wolverine Photos

Check #	Wolverine	# of Photos	CH Station	Date
Check 1	W1	147	6	25-Feb
Check 1	W1	119	5	25-Feb
Check 1	W13	15	5	27-Feb
Check 2	W2	1,009	9	3-Mar
Check 2	W2	5	9	4-Mar
Check 2	W7	3	2	14-Mar
Check 3	W3	2	7	16-Mar
Check 3	W13	15	5	18-Mar

(continued)

Table 6.7-3. Summary of Location and Time of Wolverine Photos (completed)

Check #	Wolverine	# of Photos	CH Station	Date
Check 3	W5	60	6	24-Mar
Check 3	W13	7	4	24-Mar
Check 3	W13	9	5	28-Mar
Check 4	W12	3	6	4-Apr
Check 4	W8	6	5	4-Apr
Check 4	W4	3	1	5-Apr
Check 4	W11	11	10	6-Apr
Check 4	W9	39	9	6-Apr
Check 4	W6	6	6	7-Apr
Check 4	W6	447	6	10-Apr
Check 4	W6	541	6	11-Apr
Check 4	W5	24	6	16-Apr
Check 4	W5	436	6	18-Apr

6.7.4.3 DNA Analysis

There were 116 hair samples collected at the CH stations of which 73 had sufficient material and appeared to be wolverine hair and were analyzed. The 73 samples collected produced the following species results: 49 marten, 14 wolverine, 9 fox, and 1 fisher. From the 14 wolverine hair samples collected at the CH stations, the DNA analysis identified five individuals, the location and session when they were detected are identified in Table 6.7-1. Of the five individuals, wolverines identified as sample ID numbers 532, 521 and 400 were female while 373 and 371 were male. Based on these gender identifications the sex ratio is therefore 60% female and 40% male. Appendix 6.7-2 includes details from the laboratory genetic analysis.

There was no wolverine hair collected from the 2011 or 2012 grizzly bear hair capture stations. This included a review of samples visually identified as species other than bear, and 24 X-bombed samples that were analyzed and found not to be bear but could have been another species such as fox or wolf. Remote cameras were placed at ten grizzly bear hair capture stations during the spring inventory effort in 2012 (Rescan 2013d). The images captured by the cameras were reviewed and it was determined that the wire set for capturing grizzly bear hair was too high to effectively collect hair samples from wolverine. Plate 6.7-3 is an example of a wolverine exiting a grizzly bear hair capture station without snagging hair on the barbed wire. Modifying wire height or adding additional strands was not an option in 2012 as it may have influenced bear hair capture, the primary objective of the inventory.

Plate 6.7-3. Example of wolverine exiting grizzly bear hair capture station underneath the wire.

6.7.5 Population, Spatial Distribution, and Habitat Use

The winter inventory suggests that there is a minimum of seven wolverines using the area identified as late winter moose habitat within the RSA. Within the RSA, the topography capable of supporting moose winter range (HSR 1 to 5) includes 702 km^2 of area. Of that, 545 km^2 is in the area associated with potential disturbance from proposed development activities, including the access road, and 158 km^2 is in the area of the Unuk watershed that will likely to be uninfluenced by proposed Project activities. The density for the RSA was calculated at 10.0 wolverine per 1,000 km^2 this includes at least two (12.7 wolverine/1,000 km^2) within the area of Unuk and at least six wolverine (11.0 wolverine/1,000 km^2) associated with the Bowser River, Treaty Creek, and Bell Irving Rivers. Two wolverines detected in the Unuk area of the RSA could be confidently differentiated from the other because one had a deformed tail (W4). Unfortunately, however, the wolverine with a complete tail (W7) could not be identified to individual from its ventral pelage and could not be ruled out as having also been detected in the Bell-Irving River area of the RSA.

The observation records had very little repeat detection which limits the interpretation that can be made from the information. No statistical analysis could be conducted. The number of wolverine identified, however, suggests that the low elevation valleys are important during late winter for movement and for providing prey or carrion.

6.7.6 Other Wildlife Observations

There were a number of other wildlife species detected during the survey (Figure 6.7-2). Most notable was a provincially blue-listed fisher detected March 30 and 31, 2010 at CH station 9 at the confluence of the Treaty Creek and Bell Irving River (Plate 6.7-4). Other species include marten, which were very abundant and observed at all sites (Table 6.7-4). Other mammal images captured were of wolf, red fox, red squirrel, and moose. Bird species that were also captured by the cameras were gray jay, Steller’s jay, bald eagle, golden eagle, ravens, and crows. At least two wolf depredated moose were located on the Bell Irving River near CH station 10 on February 16, 2012 and a winter killed moose was observed in late April on the shore of the Bowser Lake just east of CH station 5.

6.7.7 Discussion

The inventory identified five individual wolverines from DNA analysis and at least seven from remote camera images within the RSA. Four individuals were detected within sample sites located within or near the LSA. There were very few recaptures to aid statistical analysis and it is assumed that the actual number of wolverine in the area of inventory is greater than seven. The observed sex ratio of 60% females is based on a small sample size, but was similar to the 52% female sex ratio found in a nearby south east Alaska population (Magoun, Long, et al. 2011a). Considering the distribution of moose winter range with the location of wolverine detections in the RSA, a minimum of two wolverine for three CH stations were identified in the coastal influenced Unuk River control area (one of which could not be identified as an individual but could be differentiated from W4 which had a deformed tail) while six wolverine for seven CH stations were identified in the interior ecology.

The wolverine population estimate for unit 14 was estimated at 134 in 2007 and includes all of the RSA (Lofroth and Ott 2007). It was suggested that additional mortality of four wolverines per year could jeopardise the stability of the PU 14 population. Based on a combination of genetic and camera image analysis, a minimum of seven wolverine individuals were detected within the RSA. The results of this inventory represent greater than 5% of the estimated population for unit 14. This suggests the RSA supports a sub-population of wolverine that is key to sustaining the population within PU 14.

The entire RSA area of 3,178 km^2 is just over 13% of the spatial extent of PU 14 (23,723 km^2), however the area of moose winter habitat which was the focus of this inventory was 702 km^2 or 3.0% of the PU, supporting a higher percentage of wolverine relative to the total PU area. This indicates that the selected area is important to wolverine with respect to the population unit.

Other wolverine studies can be used for comparison. In south east Alaska 21 individuals wolverine were detected from 37 cameras (0.57 wolverine per camera) in a 2,140 km^2 study area (Royle, Magoun, et al. 2011). One wolverine was detected from 48 stations (0.02 wolverine per station) in an extensive area of the Foothills and Montane regions of western Alberta (Fisher 2004). The south east Alaskan study area was approximately 120 km to 200 km west-northwest of the RSA, suggesting more similar ecology to the RSA than the Alberta study. The Alaskan detection rate was quite similar to the 0.70 wolverine per CH station encountered within the RSA and the density estimate of 9.7 individuals per 1,000 km^2 was similar to the minimum of 10.0 individuals per km^2 of moose winter habitat achieved for this effort.

There were very few re-detections of previously encountered wolverine at the CH stations. This suggests that many wolverines are using a relatively small geographic area. It may also indicate that wolverines are travelling through the area and only staying a short time, or that more CH stations or additional maintenance was required to increase the number of re-detections. Maintaining bait at sites (and keeping them attractive to wolverine) was an issue with the abundance of marten in the study area. A review of the camera images showed that marten were relentless when feeding on the beaver bait and fed nearly non-stop until the meat was gone. This likely resulted in some missed opportunity to identify wolverine, particularly at the end of the two week check period. Thus, it is anticipated seven individuals is a conservatively low estimate of wolverine in the RSA.

Of the re-detections made, wolverines W1 and W13 moved between cameras during the same survey period with W1 being observed at both CH station 5 and CH station 6 during survey period one. This was likely associated with the wolverine moving along the frozen shoreline of Bowser Lake, a winter travel corridor. Wolverine W13 was observed at both CH station 6 and CH station 7 during survey period three, possibly having moved along the Scott Creek drainage into the Treaty Creek drainage. Individual wolverines W13, W5, and W6 were observed at the same site on multiple surveys, with W13 being observed at CH station 5 twice and W5 and W6 both observed at CH station 6 twice. This type of activity is expected as wolverines cover a large area and are extremely mobile in winter while searching for food. The moose winter range that was the focus habitat of this inventory appears important for wolverine and is consistent with previous studies (Krebs, Lofroth, and Parfitt 2007). The low elevation habitat areas also provide connectivity between the many watersheds within the RSA, likely providing areas that wolverine travel in winter.

6.8 GRIZZLY BEARS

6.8.1 Introduction

Grizzly bears (*Ursus arctos*) are found throughout British Columbia, from sea level and river-valley riparian areas to high alpine regions. Currently it is estimated there are 15,000 grizzly bears in the province, approximately 50% of the entire Canadian population of grizzly bears (Gyug et al. 2004). Grizzly bear management in BC is organized by grizzly bear population units (GBPU). The RSA intersects three GBPUs. The most recent population estimates indicate that approximately 755 grizzly bears occupy the Upper Skeena Nass GBPU, 398 grizzly bears occur in the Edziza-Lower Stikine GBPU, and 358 grizzly bears occupy the Stewart GBPU (Hamilton 2012). The grizzly bear is considered a species of Special Concern by the Committee on the Status of Endangered Species in Canada (COSEWIC 2010), and is provincially blue-listed in BC (BC CDC 2010b). The grizzly bear was selected as a focal species for baseline study because of its high profile as a species of conservation concern. Their large territories and wide range of habitat use make the grizzly bear a valuable umbrella species for conservation initiatives.

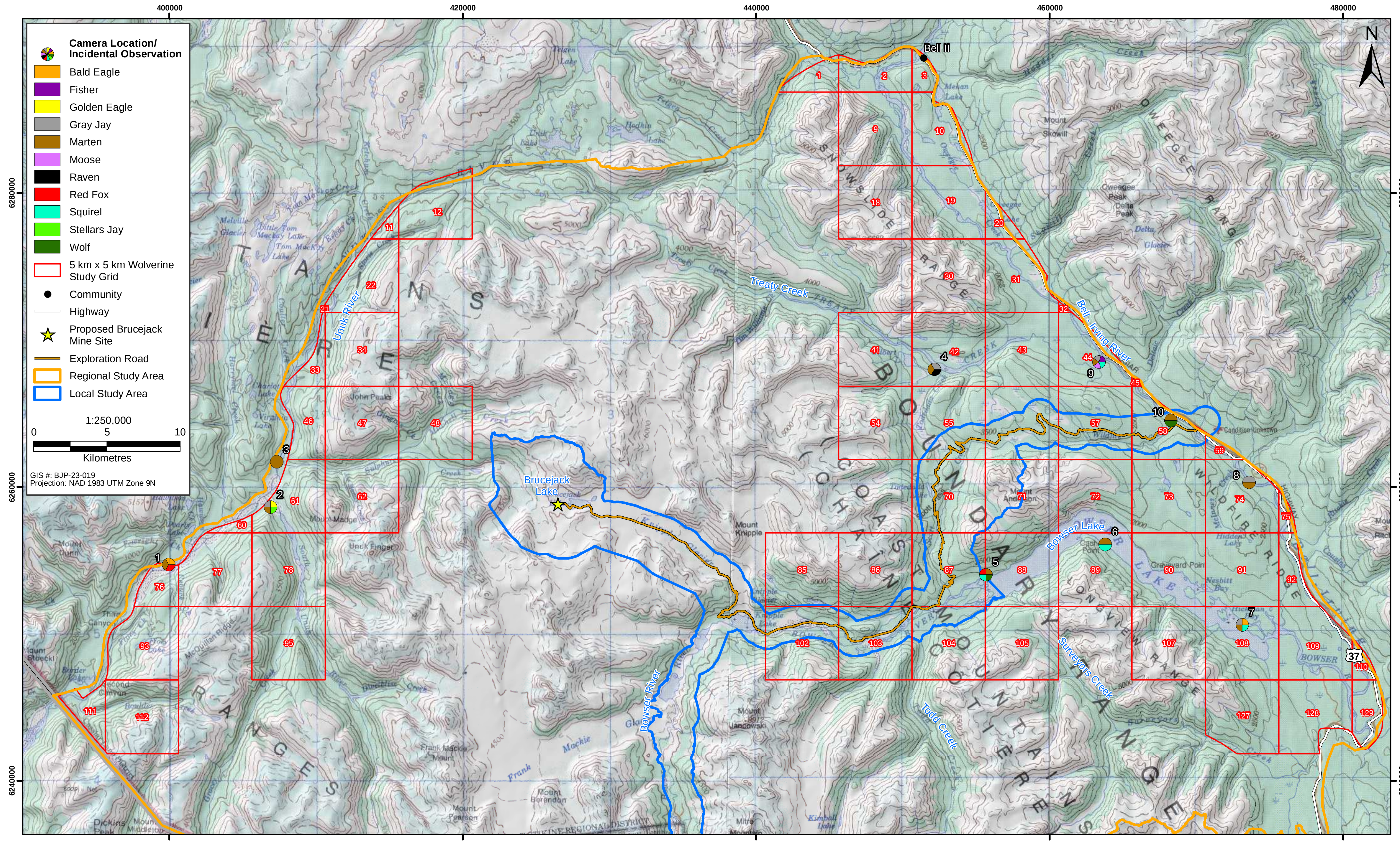

Figure 6.7-2

Incidental Observations Recorded during Wolverine Inventory

An enormous range of learned behavioural adaptations of grizzly bears to diverse regional ecosystems make generalization about their habitat requirements challenging. Some bears adopt a highly mobile, seasonally transient strategy, while others adopt a more resident strategy (Gyug 2004). Some bears rely more heavily on predation, while others use higher elevation annual home ranges as opposed to migrating to lower elevations on a seasonal basis (Gyug 2004). While nutritional requirements drive habitat selection, thermal cover (e.g. dens/bedding sites), security (e.g. females protecting cubs), or access to potential mates during the breeding season are additional factors in habitat choice. Habitat selection is also strongly influenced by intra-specific (social) interactions and the presence and activities of people (Gyug 2004).

Grizzly bears consume a wide variety of foods, including roots and green vegetation, small and large mammals, fish, and insects. Grizzly bears are omnivorous and opportunistic in their feeding habits. Habitat selection is governed by forage availability during the growing season, and diet also varies seasonally to make use of the most digestible foods. Forage tends to be more abundant in non-forested sites, sites with partial forest cover, or sites with many tree gaps in older forest (Gyug 2004). However, security habitat and day bedding areas (for thermoregulation or rain interception) tend to be closed forest sites near higher quality foraging areas. In general, the largest differences in feeding patterns are between coastal and interior grizzly bears (Gyug 2004). The RSA contains both coastal and interior grizzly bears.

In the interior of BC, grizzly bears are efficient predators and scavengers but rely on a vegetative diet (Gyug 2004). During spring, grizzly bears move to snow-free areas at lower elevations to feed on early green vegetation such as skunk cabbage (*Lysichiton americanum*) and sedges (*Carex* spp.) located in estuaries (near the coast), wetlands, and seepage sites. Forest openings, such as meadows and herb-dominated avalanche paths along southerly exposures, provide excellent foraging opportunities. Riparian areas are also heavily-used, particularly low gradient areas with back channels and meandering streams that provide favourable conditions for succulent forbs and grasses (Ash 1985). As the season advances, grizzly bears follow the receding snow up avalanche chutes and south facing slopes, feeding on emerging vegetation and roots. Later in the growing season, ripe berries attract grizzly bears down onto the floodplain and adjacent slopes where they consume devil's club (*Oploplanax horridus*), salmonberry (*Rubus spectabilis*), raspberry (*Rubus* sp.), black twinberry (*Lonicera involucrata*), elderberry (*Sambucus* sp.), and a variety of blueberries (*Vaccinium* sp.). Varying plant phenology provides a wide diversity of available plant foods that grizzly bears can exploit throughout the growing season.

In coastal areas, grizzly bears will feed on salmon as they become available in the spawning beds and continue to do so until late fall, sometimes into early December (Hilderbrand et al. 1999). Salmon may provide a resource for bears up until hibernation depending on the density of salmon species that use the area and the extent of the spawning population. After the main salmon runs, bears feed on late senescing plants, autumn berries, roots, and insects before hibernation (L. M. Ciarniello 2006). Throughout their range, grizzly bears are also known to supplement their diet with scavenged or depredated small mammals and available ungulate species.

Various factors affect the size, shape, and degree of overlap of home ranges: age, sex, location of food sources, spring-fall critical habitat, denning sites, individual variation, human influences, and bear density (Craighead and Craighead 1972; Pearson 1975; Schallenberger and Jonkel. 1980; Jonkel 1987). Additionally, home ranges may be proportional to food quality, quantity, and distribution (Gyug 2004). Range sizes and rates of movement across the landscape are typically greater for male than female grizzly bears, and differ between adults and sub-adults, and between lone adult females and females with young (C. Servheen 1983; Christopher Servheen and Klaver 1983; Blanchard and Knight. 1991; Mace and Waller 1997). Generally, grizzly bear home ranges in productive coastal habitats near salmon streams are smaller than ranges in interior mountains, which are again smaller than ranges in interior plateau habitats (Gyug 2004). In coastal BC, annual home ranges averaged 137 km^2 and 52 km^2 for males and females respectively (MacHutchon, Himmer, and Bryden 1993). For wet interior mountains, home ranges averaged 187 km^2 for males and 103 km^2 for females (Simpson, Terry, and Hamilton 1997; L.M. Ciarniello et al. 2002). In drier interior mountains and plateau areas, home ranges average 804 km^2 for males and 222 km^2 for females (Russell et al. 1979; B. N. McLellan 1981; Wielgus 1986).

Related females tend to have overlapping home ranges, while male home ranges are large and tend to overlap with several adult females (Bunnell and McCann 1993). The larger home ranges of males are more likely related to breeding than to habitat requirements for feeding (Gyug 2004). Social intolerance and security needs of young bears combine to distribute bears widely over the available range (Gyug 2004). Adult females may occupy marginal habitats or disturbed areas, such as road margins, where human activities exclude larger males (B.N. McLellan and Shackleton 1988). The size of individual home ranges varies annually in response to variation in quality and abundance of food (Picton et al. 1985). Bear habitat use is influenced by intraspecific interaction and human influences (Gyug 2004). For example, it has been suggested that human impact may outweigh habitat quality in predicting bear densities in some areas in the central interior of BC (G. Mowat et al. 2002).

Estimating carnivore abundance is central to their conservation; however, options for estimating abundance are few and often require specific circumstances or assumptions that are difficult to meet (G. Mowat and Strobeck 2000). Wildlife researchers use various forms of ear tags, coloured bands, neck collars, radio transmitters, and natural markings to identify and track individual animals under field conditions. Each method has its advantages and limitations. The ideal mark would be non-invasive, highly visible, clearly read, inexpensive, and permanent (Woods et al. 1999).

Genetic tags in the form of microsatellite genotypes have the potential to meet several of these criteria, and advances in technology are making deoxyribonucleic acid (DNA) methods accessible at the field level (Woods et al. 1999). In addition to individual identification, DNA samples can be used to confirm sex (P. Taberlet et al. 1993), species, genetic population structure (Proctor et al. 2005) and individual genealogies. In typical mark-recapture studies, an initial population sample is captured, marked, and released. The population is then re-sampled during ≥ 1 additional session (Woods et al. 1999). Then, the ratios of newly captured animals to recaptures are used to compute a population estimate (White et al. 1982). Genetic tags can replace conventional marks in these studies if the tags reliably identify individuals during a series of sampling sessions (Woods et al. 1999).

For free-ranging bears, hair is an attractive DNA source because bears frequently leave hair on rub trees, in beds, and at foraging sites (P. a. Taberlet and Bouvet. 1992). Because bears are readily attracted by scent lures, methods to obtain hair samples from free-ranging bears permit systematic sampling regimes necessary for many ecological studies, such as animal censuses (Woods et al. 1999). Recently, hair removal and DNA fingerprinting have been used to mark and recapture bears (Woods et al. 1999; G. Mowat and Strobeck 2000; Poole, Mowat, and Fear 2001) (Apps et al. 2004; Boulanger, Himmer, and Swan 2004; Boulanger et al. 2004; Proctor et al. 2005). This method has several benefits as individuals can be identified with a small risk of error, and hair removal sites are fast to set up and are checked less frequently than other capture methods, such as live-capture sites (G. Mowat and Strobeck 2000).

The status of the grizzly bear population in the RSA was assessed during baseline studies conducted in 2011 and 2012. The study involved a DNA-based mark-recapture design that used grizzly bear hairs snagged on baited stations as sources of DNA to identify individuals. The specific objectives of the grizzly bear study were to determine the relative abundance and distribution of grizzly bears in the RSA and to identify important grizzly bear habitat.

6.8.2 Methods

6.8.2.1 Study Area

The wildlife RSA was partitioned into grizzly bear sample grid cells measuring 7 x 7 km (Figure 6.8-1). The size of each sample cell (49 km^2) represents an estimate of the area (home range) used by local female grizzly bears. The cell size was also recommended by BC regional wildlife staff in Skeena Region, and similarly suggested by MacHutchon, Hummer et al. (1993). To ensure that grizzly bears were not attracted to areas where there was human activity, potentially resulting in human/bear conflicts, grid cells near these areas were not sampled for grizzly bear hair. Hair collection protocols were consistent with the terms of provincial permits SM12-78104 and SM11-71497, and adhered to RIC standards (RIC 1998b).

6.8.2.2 Spring/Summer Hair Collection

In 2011, baited hair collection stations were deployed in 42 grid cells (2,058 km^2). Stations were located in habitat that was most likely to be used by grizzly bears during the summer (Figure 6.8-1). Selected locations were typically in areas with abundant herbaceous forage of higher nutritional quality, which are generally found at higher elevations during this period (e.g., Plate 6.8-1). To encourage grizzly bears to fully investigate the sampling stations, a short-distance non-reward lure was applied, which consisted of 300 to 500 mL of fermented livestock blood. Due to the risks associated with attracting bears where Project personnel could possibly be during the study period, stations were not established near the camp, which was relatively close to the proposed Brucejack mine site.

Plate 6.8-1. Bear hair collection station: a baited brush pile enclosed with barbed wire.

In 2012, 36 grid cells (1,764 km^2) were sampled between mid-May and the end of June. Fewer cells were surveyed in the spring of 2012 than the summer of 2011 due to high snow cover earlier in the year. Hair collection stations were moved to different locations from those in 2011 to reflect differences in plant phenology and habitat suitability during spring and early summer.

In both years of sampling, hair collection stations were checked three times at approximately two week intervals. In 2011, hair collection stations were checked August 23 - 25, September 7 - 9, and September 19. In 2012, stations were checked May 29 - 31, June 11 - 13, and June 26 - 27. During each session the barbed wire, the ground at each station, and natural structures that may snag hair were all searched for grizzly bear hair. Clumps of hairs found on individual barbs and around the site were placed into separate labelled coin envelopes and air dried for proper storage.

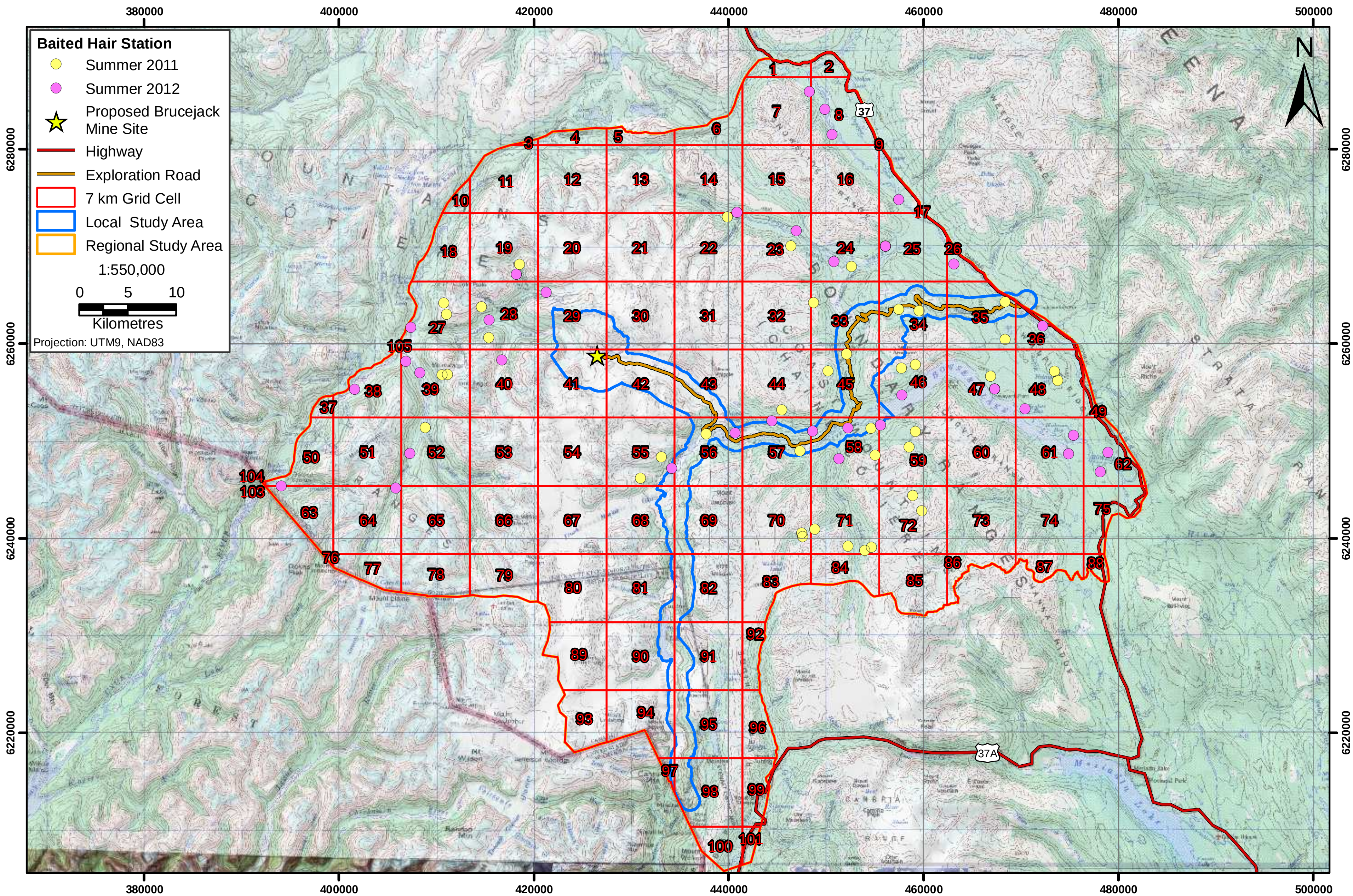

Figure 6.8-1

PRETIVM

Grizzly Baited Hair Collection Stations (2011 and 2012)

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Figure 6.8-1

In the event that grizzly bear hair was collected, the collection station was dismantled and reset within the same cell, but at a distance of at least one kilometre from the previous position. If no hair was collected, the collection station was re-baited and left for another session. The movement of bait stations between sessions maximizes the probability of capturing bears and avoids “marked” bears from becoming habituated to the scent lure, and therefore improves the precision of population estimates (Boulanger, McLellan et al. 2004). All barbs were burned with a propane torch to ensure that remaining hair samples were destroyed after each session. All baited collection stations were removed after the final sessions.

In addition to baited hair capture stations, 10 Reconyx remote motion and infrared triggered cameras were placed at select stations in 2012 to evaluate instances where grizzly bears may visit a station, but not leave a hair sample (Figure 6.8-2). Such cases can lead to underestimates in population sizes. The cameras were also utilized to record incidental wildlife sightings.

6.8.2.3 Fall Hair Collection

Non-baited trail snags (Plate 6.8-2) were set in 2011 and 2012 to assess the use of rivers and creeks by grizzly bears feeding on spawning salmon in the fall (Figure 6.8-3). Each station consisted of multiple strands of barbed wire placed across trails that lead to stream banks. A total of 16 stations were set in 2011 between October 27 - 28, and checked November 11 and November 24. In 2012, 21 stations were set October 10 - 11, and checked October 23 and November 6. Station locations were selected based on spawning habitat capability and available access for grizzly bears. Hair collection and data recording were the same as during the spring and summer sessions. All trail sets were removed following the final check.

Plate 6.8-2. Trail set location used during the fall to collect grizzly bear hair.

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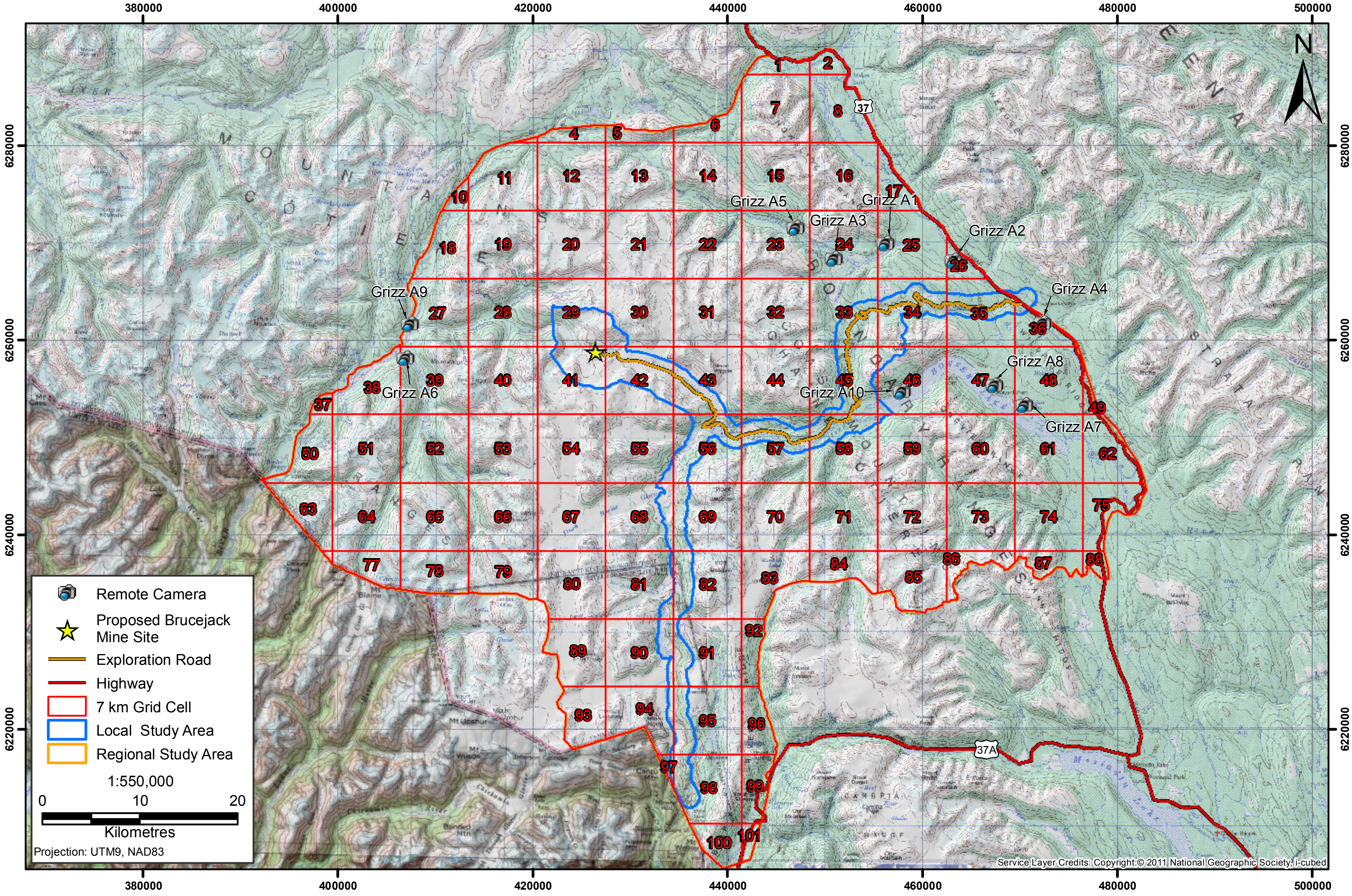

Figure 6.8-2

Location of Remote Cameras Set in Conjunction with Baited Hair Capture Sets Summer 2012

Figure 6.8-2

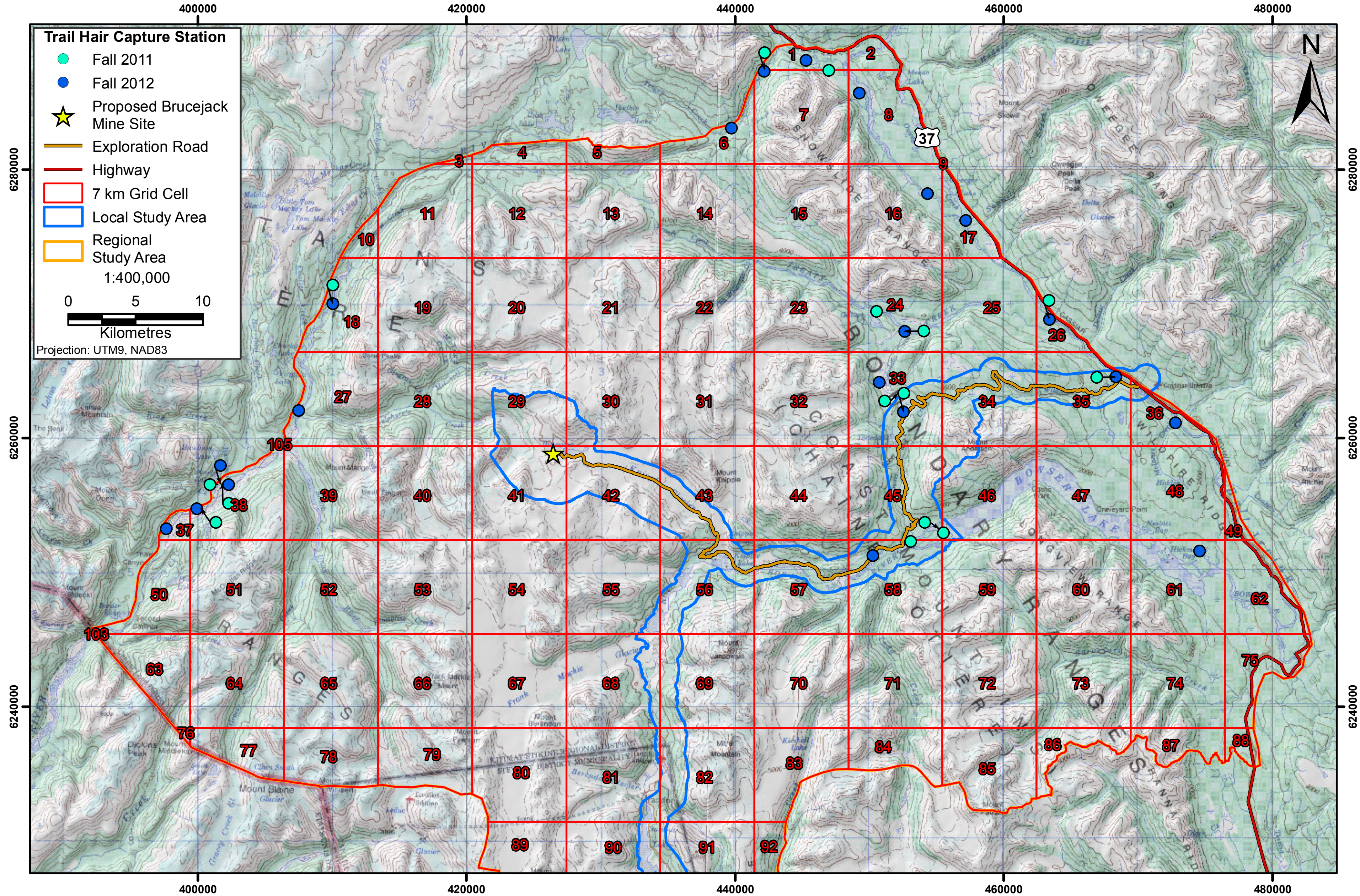

Figure 6.8-3

Figure 6.8-3

PRETIVM

Grizzly Trail Hair Collection Stations (2011 and 2012)

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6.8.2.4 DNA Analysis

Hair samples were submitted to Wildlife Genetics International (WGI) to be analyzed (Dr. David Paetkau, Nelson, BC). Genetic analysis provides information on species, individuals, and sex, but not age. These techniques have been used in many studies across BC, and as a result, a sizeable genetic database has been compiled on grizzly bear populations throughout the province from which comparisons can be drawn. Individual grizzly bears identified in this project were compared to those identified during inventories in Alaska, the Stikine-Iskut basin, and during KSM Project baseline studies (Rescan 2010a). Individual identification requires a suite of microsatellite markers. As many as 15 microsatellites may be used. The techniques used to identify which alleles are present in each individual are described by Paetkau et al. (1998). The following microsatellites were used: G10J (used to pre-screen black bears from grizzly bears), G1A, G10B, G10X, G10P, G10M, G10U, G10H, G10L, G10C, G1D, MU59, MU50, CXX20 and CXX110. Gender was determined using sex-specific markers.

6.8.3 Results

6.8.3.1 Grizzly Bear Individual Detections

In 2011, a total of 336 hair samples were collected during 1,608 trap days in the summer, and 29 hair samples during 445 trap days in the fall (Appendix 6.8-1). Of these samples, 74 were taken from 25 grizzly bears (12 males and 13 females), of which 22 were detected in the summer and three in the fall. There were no grizzly bears that were detected in both seasons. In 2012, 598 hair samples were collected over 1,176 trap days in the summer, and an additional 56 hair samples during 519 trap days in the fall (Appendix 6.8-2). There were 49 hair samples taken from 14 grizzly bears (8 males and 6 females). Of these, 12 were detected in the summer and 4 in the fall (i.e., two were detected across both seasons).

Overall, 37 individual grizzly bears were identified during the two years of baseline studies in the RSA. This includes 7 grizzly bears that were originally detected during 2008 and 2009 baseline studies for the neighbouring KSM Project (Appendix 6.8-3), and a single grizzly bear originally identified in Alaska (Flynn et al. 2007). Twenty grizzly bears detected in 2011 had not been detected previously, and were not recaptured in 2012. Nine grizzly bears detected in 2012 were also new to the dataset.

The grizzly bear dataset housed at WGI currently contains 61 individual grizzly bears detected from both the KSM and Brucejack Projects. The limited number of recaptures precluded statistical analyses to calculate a population estimate for the RSA. The population estimate obtained during the KSM Project, which had a similar number of detections as the Brucejack program, was 58 bears (22 to 93 95% CI). The Brucejack RSA straddles three provincial GBPUs (Hamilton 2012), and represents 8.2% of the area of these GBPUs. Considering the proportion of each GBPU that is contained in the RSA and relating that proportion to the estimated population size of grizzly bears in each GBPU, it is expected that the Brucejack RSA would support 108 grizzly bears.

6.8.3.2 Grizzly Bear Habitat

Grizzly bears were observed at hair capture stations throughout the RSA, although some concentrations of detections occurred. There were nine individual bears identified feeding on salmon in a small area along the Unuk River in the northwest corner of the RSA in the fall between 2008 and 2012 (Figure 6.8-4). The summer 2011 effort identified 14 individual bears in the high elevation habitat south of the Bowser drainage and six individuals were associated with riparian habitat along the Bell-Irving River near Bell Two in late spring 2012. This area was also associated with highly suitable moose winter range, suggesting a source of carrion in spring.

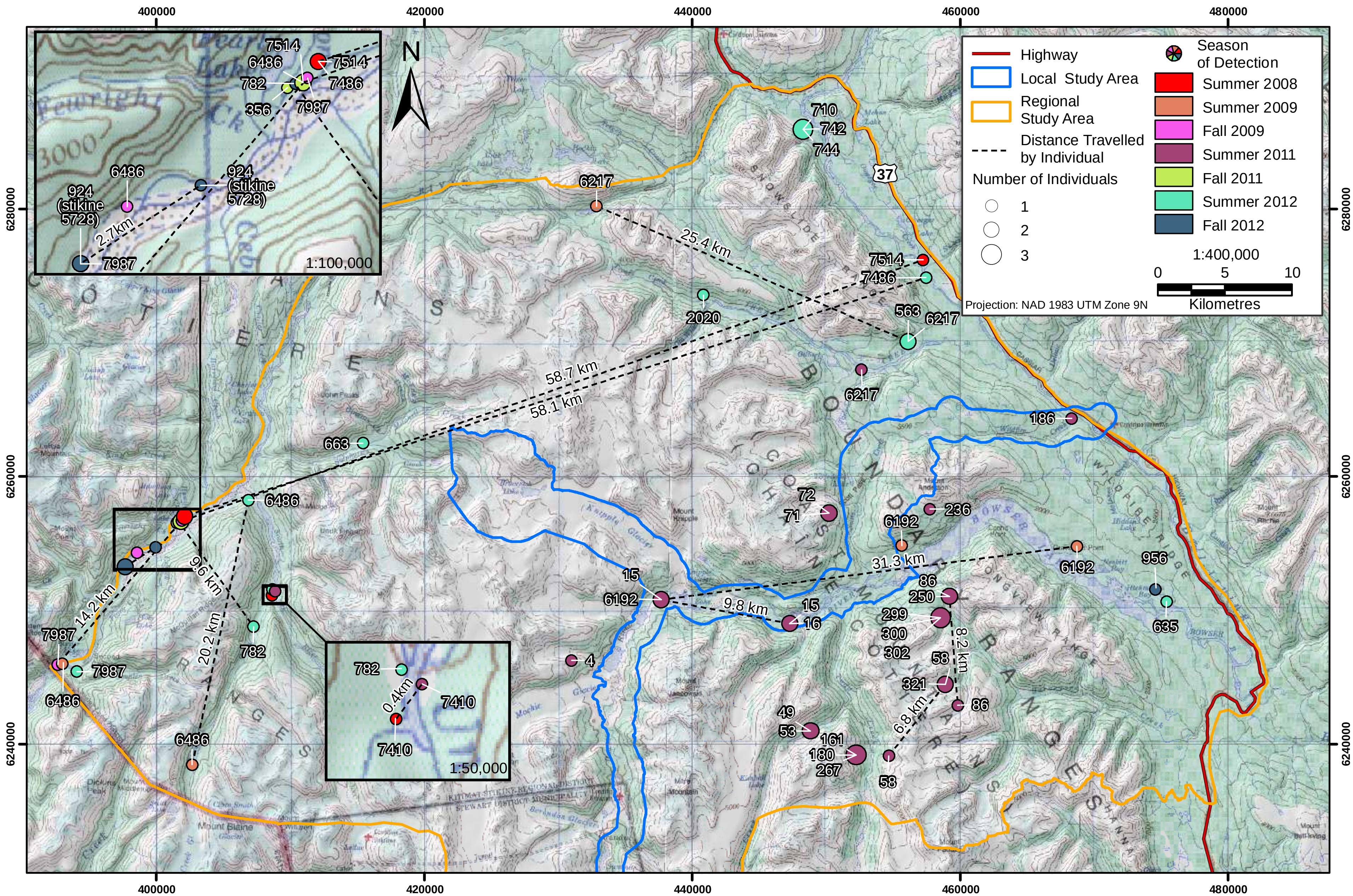

Figure 6.8-4

PRETIVM

Grizzly Bear Individual Detections and Distance Travelled

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Different grizzly bears were detected in 2011 from 2012. From the hair sample results a segregation of individuals appeared between bears detected that were using the high elevation habitat of the RSA in late summer 2011 and bears using the lower elevation area in the early summer 2012 (Figure 6.8-4). This possible difference in use of the RSA was indicated by the absence of recapture in 2012 of the 20 bears identified during baited hair capture effort in late summer at sites in alpine and parkland habitat while 10 new detections were made in 2012 occurring at low elevation areas, mostly associated with the riparian habitat along major rivers and streams.

6.8.3.3 Grizzly Bear Movements

The maximum movement distance of detected bears was calculated between sites where re-detections had occurred (Figure 6.8-4). Eleven grizzly bears were detected at two or more sites and the average distance was 22.1 km (SD ± 20.0 km) between sites. Two bears travelled across the RSA from the Unuk River to the Bell-Irving River, a distance of 58.7 km (bear 7514) and 58.1 km (bear 7486). A bear (924) was identified in the Unuk River at two locations during the fall of 2012, which had originally been identified by the Alaska Department of Fish and Game in association with ongoing monitoring work.

Minimum convex polygon (MCP) home ranges were calculated for bears with three or more observations to indicate minimum area used within the RSA (Figure 6.8-5). Of the six individuals with three or more detections, the average MCP was 41.0 km^2 (SD ± 49.3 km^2) and the largest MCP was 138 km^2 for bear 6486, a male first identified in the summer of 2009 along the Unuk River watershed by the KSM Project.

6.8.3.4 Effectiveness of Hair Stations

Remote motion triggered cameras were installed at 10 hair capture stations to evaluate the effectiveness of traps at capturing hair samples, and the behaviour of grizzly bears near the sets. Generally, grizzly bears appeared to be attracted to the baited hair stations, and showed mixed levels of caution around sets. This curiosity was also extended to the cameras and other features, and some bears were quite comfortable around the stations (Plate 6.8-3). Wire height and distance from the baited brush pile appeared suitable for obtaining grizzly bear hair (Plate 6.8-4). Genetic analysis indicated that grizzly bears were detected at three cells that had a camera installed (cameras A1, A3, and A6), but images were only captured at A1. The field of view may have had several blind spots around the wire as cameras were focused on the bait pile, but grizzly bears may have brushed up against wire without entering the penned area.

Plate 6.8-3. Grizzly bear at a bait site.

Plate 6.8-4. Wire collecting grizzly bear hair.

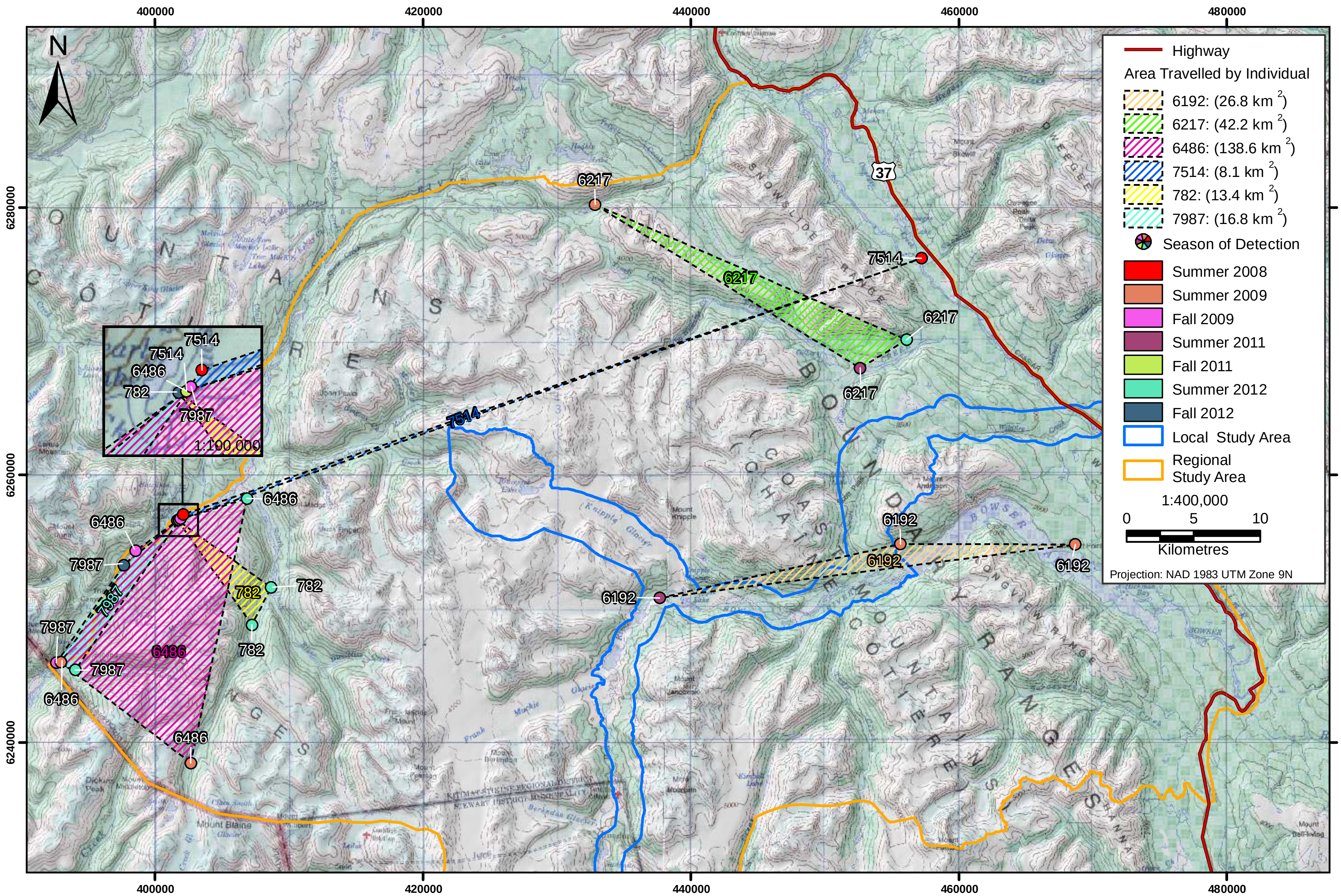

Figure 6.8-5

PRETIVM

Grizzly Bear Home Range Estimates

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6.8.3.5 Other Wildlife Observations

Incidental wildlife were photographed at all 10 remote camera sites. In addition to grizzly bears, images were captured of moose, black bear, marten, wolverine, porcupine, raven, and pine grosbeak (Table 6.8-1). Moose and black bear were the most common species captured on photographs. Moose appeared drawn to the collection stations, with many images of them investigating the scented brush pile (i.e. Plate 6.8-5).

Plate 6.8-5. Moose investigating blood bait.

Table 6.8-1. Wildlife Caught on Grizzly Bear Remote Cameras, May to August 2012

Camera	CHECK 1	CHECK 2	CHECK 3
A1	Grizzly Bear, Black Bear, Moose	Grizzly Bear, Black Bear, Moose	Grizzly Bear, Moose
A2	-	Moose	-
A3	Marten, Black Bear, Wolverine	Black Bear, Moose	-
A4	Moose, Black Bear	-	-
A5	Black Bear	Raven, Black Bear, Moose	-
A6	Porcupine	-	-
A7	Moose, Male Pine Grosbeak	-	-
A8	Black Bear, Moose	-	-
A9	-	Porcupine	-
A10	Black Bear	-	-

6.8.4 Discussion

The number of individual grizzly bears (37) identified in the Brucejack RSA was similar to the number (31) identified during baseline studies for the neighbouring KSM Project (Rescan 2010a). Overall, both projects were similar in sampling intensity, with three sessions of two week intervals during spring and summer, as well as similar trail sets during the fall salmon run (although fall sampling was only conducted during one year at KSM). Despite the similarity in sampling effort, there were insufficient recaptures during the Brucejack study to calculate a population estimate, unlike the KSM study that estimated a total of 58 grizzly bears (22 - 93 95% CI). Based on population estimates for the three GPBUs derived from habitat capability (Hamilton 2012), it is anticipated that as many as 108 grizzly bears may utilize the RSA to some degree.

Of particular interest was that none of the grizzly bears detected in 2011 were recaptured in 2012, and that nine grizzly bears detected in 2012 were new to the dataset. This may partially be the result of sample timing, as 2011 hair collections were conducted late in the growing season (August/September) at high elevation (alpine and parkland habitat), whereas 2012 sampling was conducted in the spring (May/June) when grizzly bears are anticipated to be concentrated at lower elevations where fresh spring forage and winter killed carrion are available. Sampling in 2012 was consistent with other projects (RTEC 2006b; Rescan 2010a).

The lack of recaptures between seasons and between years is not indicative of a high rate of immigration/emigration by grizzly bears, but rather suggests a geographically open population and a spatial dynamic that has not been captured in the current study area. Grizzly bears in other mountainous regions of Alberta and British Columbia have been found to pursue several movement strategies. Some grizzly bears are alpine specialists, some are low elevation riparian specialists, and some utilize both high and low elevation habitat throughout the growing season. These patterns can be driven by several factors, including habitat quality and productivity, prey availability, security, environmental conditions, and human activity. Spatial patterns may also be highly variable outside the RSA, influencing encounters within the RSA. Grizzly bears that were found using high elevation areas south of the Bowser system in one season, may use low elevation habitat located outside of the RSA during other parts of the year, while bears detected along riparian habitat in the Bell Irving area during spring, may use higher elevation areas to the north or east of the RSA later in the growing season. Movements by grizzly bears are highly variable, and the results suggest that use of the RSA may be more dynamic than previously anticipated, including activity from grizzly bears from three GBPUs.

Grizzly bears were observed at hair capture stations throughout the RSA, although some concentrations of detections occurred. Between 2008 and 2012, there were nine individual bears identified feeding on salmon during the fall in a small area along the Unuk River in the northwest corner of the RSA, including a male (bear 924) that was detected at two locations in 2012 that was originally documented in Alaska (Flynn et al. 2007). In summer 2011, 14 individual grizzly bears were detected in high elevation habitat south of the Bowser drainage. In late spring 2012, six grizzly bears were identified along riparian habitat along the Bell-Irving River near Bell Two. This area also contains highly suitable moose winter range, suggesting a source of carrion in spring.

7. Avian Community

Engineers and Scientists

7. Avian Community

7.1 OVERVIEW

Avian monitoring is important throughout the planning, implementation, and development phases of a project. Identification of avian species is a necessary step in meeting the obligations of federal and provincial regulations for species protection. Avian species that migrate between countries receive protection under the federal *Migratory Bird Convention Act* (1994b). Bird species, especially raptors, are also afforded protection under the provincial *Wildlife Act* (1996), while species at risk are protected under the federal *Species at Risk Act* (2002).

The following sections summarize avian studies conducted in 2012 for the proposed Project. Surveys focused on raptors, waterbirds (e.g., waterfowl, shorebirds), and terrestrial breeding birds. Studies were designed to collect baseline information on species presence, abundance, diversity, distribution during select life history periods (e.g., migration, breeding) and to identify important habitat areas within the wildlife LSA and RSA.

7.2 RAPTORS

7.2.1 Introduction

Raptors are long-lived top-level predators that require large home ranges, and use a variety of habitats throughout the year. These characteristics make raptors an excellent focal group for monitoring effects associated with industrial development across spatial and temporal scales.

Regional raptor diversity in the generalProject area is relatively high, consisting of up to a dozen different species including: American kestrel (*Falco sparverius*), peregrine falcon (subspecies not differentiated), gyrfalcon (*Falco rusticolus*), bald eagle (*Haliaeetus leucocephalis*), golden eagle (*Aquila chrysaetos*), northern harrier (*Circus cyaneus*), northern goshawk (*Accipiter gentiles*), merlin (*Falco columbarius*), osprey (*Pandion haliaetus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), sharp-shinned hawk (*Accipiter striatus*), and short-eared owl (*Asio flammeus*; (RTEC 2006a, 2007b; Rescan 2010b). The peregrine falcon, gyrfalcon, short-eared owl, Swainson's hawk, and rough-legged hawk are species of conservation concern that could potentially nest in the RSA (Table 7.2-1).

Table 7.2-1. Regional Raptor Species of Conservation Concern

Species	BC Status	COSEWIC Status	Probability of Occurrence	Rationale for Consideration
Peregrine Falcon	Blue	Special Concern	Possible	Cliff and ledge nesting habitat exists in the study area
Gyrfalcon	Blue	Not at Risk	Possible	Cliff and ledge nesting habitat exists in the study area
Short-eared Owl	Blue	Special Concern	Possible	Nesting habitat, including low elevation grassland areas exists in the study area
Swainson's Hawk	Red	None	Possible	Historically observed in the regional area
Rough-legged Hawk	Blue	Not at Risk	Possible	Historically observed in the regional area

The landscape surrounding the Brucejack Project is characterized by severe topographical relief that supports cliff nesting raptors and stands of mature forest at lower elevations that support tree nesting raptors. Active nests of all raptor species are protected under the BC *Wildlife Act*. The General Management Direction in the CIS LRMP provides a series of guidelines to maintain nesting and foraging habitat for raptors (BC ILMB 2000).

The northern goshawk was selected as a focal species during raptor baseline survey. Northern goshawks are particularly sensitive to habitat alteration and have been highlighted by the Nass South SRMP as a species requiring protection of nesting and associated foraging areas (Kaufman 2000; BC ILMB 2009). They require homogeneous stands of mature to old growth forest for nesting, and re-occupy nesting areas from year to year (Doyle and Mahon 2001). Available nesting habitat is critical for all breeding activity, from courtship through fledging. Suitable northern goshawk breeding habitat was identified in the LSA on the forested plateau above Wildfire Creek and up to the Treaty Creek plateau within the RSA (McElhanney 2011). The northern goshawk is yellow-listed in British Columbia.

7.2.2 Objectives

Baseline raptor surveys were conducted in 2010 and 2012 to determine the presence and distribution of raptor species in the study areas. Specifically, the objectives were to characterize raptor diversity and locate nests of cliff and tree nesting raptor species in the LSA and RSA, inventory northern goshawk abundance and distribution, and document any species of conservation concern in the area.

7.2.3 Methods

7.2.3.1 Stand-Watch Survey

Raptor stand-watch surveys were conducted during the breeding season in 2010 and 2012. Sites were selected in suitable forest and cliff nesting habitat areas near proposed Project infrastructure and along access roads (Figure 7.2-1). Large areas of the LSA were not surveyed near the proposed mine site and exploration access road because the habitat was dominated by glaciers. Sites were surveyed from a clear vantage point using binoculars and high-powered spotting scopes (RISC 2001). Surveyors scanned each stand-watch site for one hour and recorded any raptor activity above the canopy, around cliffs and cliff nest sites, and around recent (“white-wash”) and older perching areas (rocks covered in orange lichen associated with older bird droppings). All sites were geo-referenced with a handheld Garmin GPS 60.

7.2.3.2 Northern Goshawk Call Playback Survey

Call playback surveys (CPS) were conducted for northern goshawk during the breeding season in 2010 and 2012 by teams of two observers, focusing on areas with suitable nesting habitat. These types of surveys provide presence/not detected information for northern goshawks, which are typically inconspicuous and elusive but respond to calls during the breeding season (RIC 2001). Using pre-recorded calls to simulate the presence of an “intruder” in an already claimed territory can elicit a defensive response by nearby goshawks. The response of the bird, whether it is a close approach, distant vocalization or other aggressive behaviour, enables the observer to gauge territory occupancy and breeding activity.

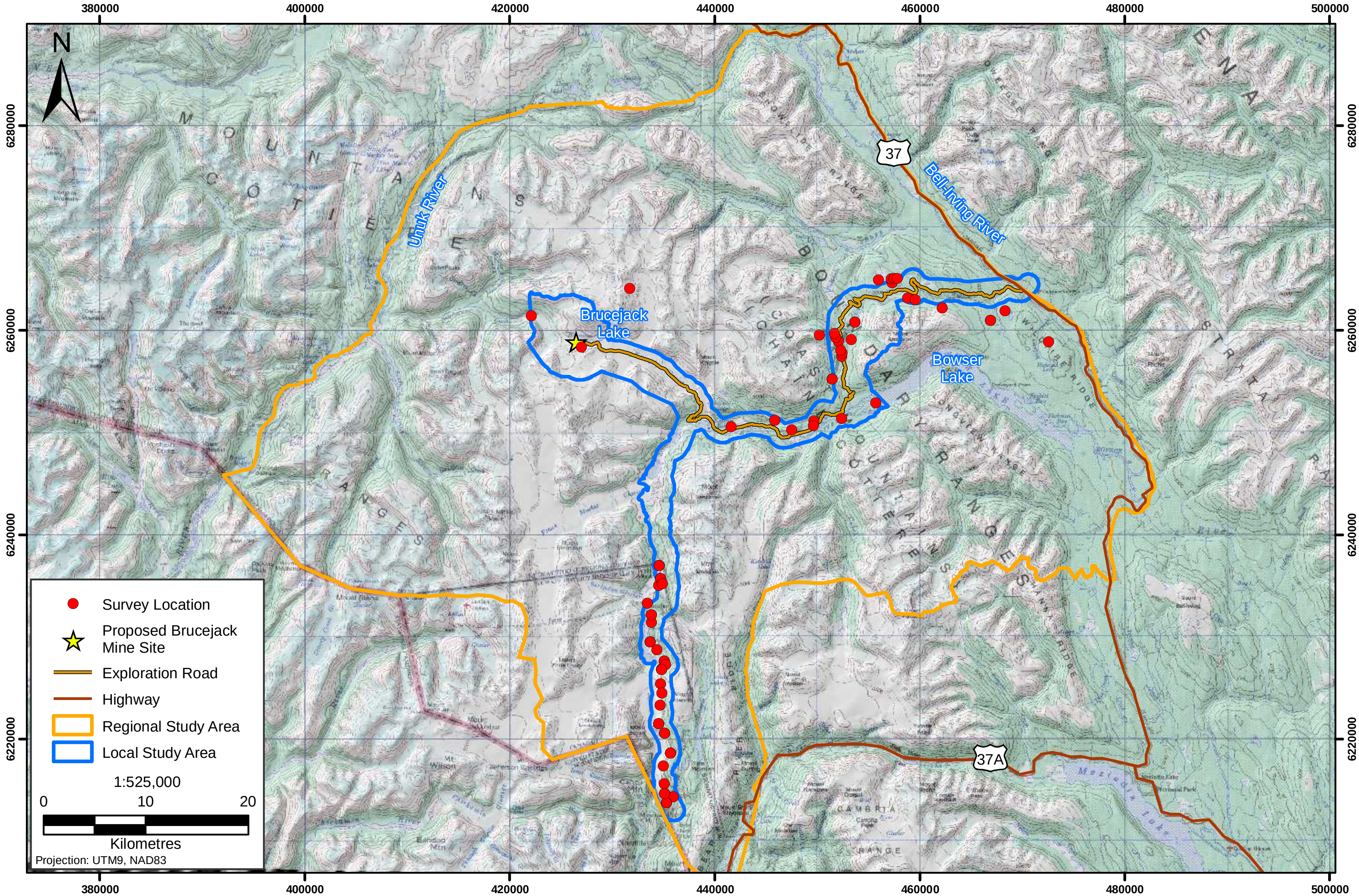

Figure 7.2-1

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2010 and 2012 Raptor Survey Locations

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Call Playback Surveys were conducted to provincial raptor inventory standards (RIC 2001). Inter-station distance (distance between consecutive CPS broadcasts) ranged between 200 m to 400 m. A digital game caller (FOXPRO Inc. NX3) was used to broadcast recordings of adult alarm calls. The estimated broadcast range was 200 m (based on a power output of greater than 1.2 W at 1 kHz and a known volume output of 100 to 110 dB at 1 m from the broadcast equipment).

Observers initially listened for spontaneous calls for approximately five minutes prior to conducting call playback surveys. Audio tracks for northern goshawk were then broadcast for three rounds, each round consisting of a 20-second call followed by 30 seconds of silence (total 2.5 minutes per audio track). After each round, the broadcast speaker was rotated 120° to cover the entire range around the focal playback location. Observers waited in silence for five and a half minutes after the third broadcast period to record any goshawk (or other raptor) activity before moving on to the next station (for a total survey time of eight minutes per CPS).

7.2.3.3 Incidental Observations

Incidental observations of raptors were collected between northern goshawk CPS and raptor stand watch surveys, and during other wildlife baseline surveys. These observations were geo-referenced and included in the raptor database.

7.2.4 Results

7.2.4.1 Summary

Six raptor species were detected during the 2010 and 2012 wildlife baseline field studies: northern goshawk, short-eared owl, bald eagle, golden eagle, northern harrier, and red-tailed hawk (Figure 7.2-2; Appendix 7.2-1). The short-eared owl is a provincially blue-listed species. Bald eagles were observed most frequently (47), followed by golden eagles (13), and red-tailed hawks (4). The rest were detected once or twice (Table 7.2-2). Most observations of raptors were incidental.

Table 7.2-2. Raptors Species Observed in the RSA during 2010 and 2012

	No. Raptors Observed During Surveys		No. Raptors Observed Incidentally		
Species	**2010**	**2012**	**2010**	**2012**	**Total**
Bald Eagle	0	2	2	43	47
Golden Eagle	2	1	0	10	13
Red-tailed Hawk	0	2	0	2	4
Northern Harrier	0	0	0	2	2
Northern Goshawk	0	0	0	1	1
Short-eared Owl	0	0	0	1	1

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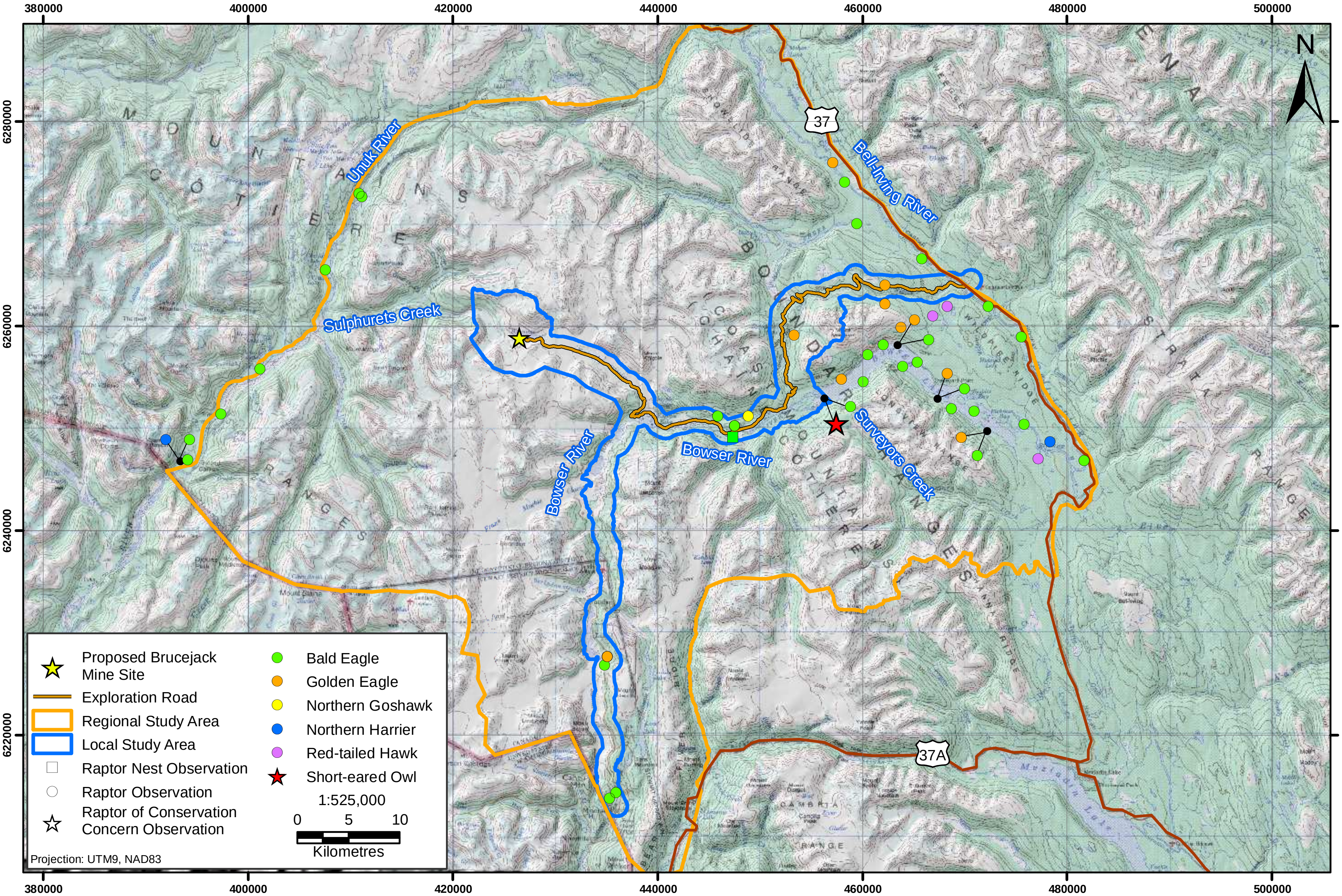

Figure 7.2-2

PRETIVM

2010 and 2012 Raptor Observations

Figure 7.2-2

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7.2.4.2 Raptor Stand-Watch Surveys

In 2010, five stand-watch surveys were conducted between June 22 and 25 (Figure 7.2-1). Two adult golden eagles were observed flying over the Scott Creek and Todedada Creek Valleys (Table 7.2-1; Figure 7.2-2). The forest habitat where the eagles were observed was mixed intermediate successional forest dominated by subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*). In 2012, 11 stand-watch surveys were conducted between June 8 and 11, and between June 22 and 24 (Figure 7.2-1; Plate 7.2-1). Two bald eagles were observed (Table 7.2-2; Figure 7.2-2). One was an adult perched on a snag tree in riparian habitat along the Bowser River, and the other was a juvenile flying over cliff habitat (Plate 7.2-2).

Plate 7.2-1. Stand-watch cliff habitat within the LSA along the proposed southern option transmission line route, 2012.

Plate 7.2-2. Juvenile bald eagle along the proposed southern option transmission line route, June 23, 2012.

7.2.4.3 Northern Goshawk Call Playback Survey

In 2010, 11 northern goshawk call playback surveys were conducted on June 25 and 26 and raptors were not detected (Figure 7.2-1). In 2012, 46 northern goshawk call playback surveys were conducted on June 7 to 11, and June 22 to 25 (Figure 7.2-1; Plate 7.2-3 and Plate 7.2-4). Northern goshawks were not detected, but two red-tailed hawks and a juvenile golden eagle were observed (Table 7.2-2; Figure 7.2-2; Plate 7.2-4). Nests were not identified near the red-tailed hawk observations.

Plate 7.2-3. Examples of a call Northern Goshawk playback station, 2012.

Plate 7.2-4. Juvenile golden eagle along the proposed southern option transmission line route during a call playback survey, June 24, 2012.

7.2.4.4 Incidental Raptor Observations

Incidental raptor observations accounted for 90% of total raptor observations recorded in 2010 and 2012 (Table 7.2-2). Incidental observations were recorded during variable radius point count surveys for breeding birds, waterbird brood aerial surveys, waterbird fall staging aerial surveys, waterbird spring staging aerial surveys, waterbird spring staging ground surveys, and at wolverine camera stations.

A bald eagle nest was identified along the Bowser River during waterbird spring staging surveys in 2012 (Figure 7.2-2). In 2010, two bald eagles were incidentally observed during June breeding bird surveys. One was observed near Todedada Lake and another was observed flying over the Bowser River (Figure 7.2-2).

A short-eared owl was incidentally observed flying near a cottonwood stand in riparian habitat at the mouth of the Bowser River, May 2012 (Figure 7.2-2). It was the only raptor species of conservation concern detected within the Brucejack RSA. The area where the short-eared owl was observed could potentially support nesting based on existing habitat characteristics, but no nest was observed. Suitable short-eared owl nesting habitat is very limited within the RSA due to the mainly mountainous terrain dominated by glaciers and dense vegetation cover along most riparian areas.

7.2.5 Discussion

In general, the mature conifer and mixed deciduous stands, riparian and wetland areas, and cliffs within the study areas offer a variety of suitable nesting and productive foraging habitats for raptors, which can potentially support a large diversity of species. Six raptor species were detected within the wildlife RSA during baseline studies in 2010 and 2012: northern goshawk, short-eared owl, bald eagle, golden eagle, northern harrier, and red-tailed hawk. The most common were bald eagles and golden eagles, which along with northern goshawk, were the only raptor species detected within the LSA.

Raptors that have been historically documented in the region that were not observed were: osprey, rough-legged hawk, Swainson’s hawk, sharp-shinned hawk, American kestrel, merlin, peregrine falcon, and gyrfalcon (e.g., RTEC 2006a; RTEC 2007b; Rescan 2010b). The osprey and bald eagle are both riparian raptors but only bald eagles were detected during survey conducted in that habitat type. The frequency of riparian areas that were surveyed for waterbirds would have enabled ospreys to be detected had they been in the vicinity, as can be seen by the high frequency of incidental bald eagle observations. Gyrfalcons typically nest farther north so are at the southern extent of their range within the study area and prefer nesting in the open tundra cliffs of the arctic and rough-legged hawks also typically nest in cliff habitats of the tundra and have been described as transient non-breeders for the region (BC CDC 2013b). These detections were likely migratory individuals since their known breeding ranges are limited to other areas (Campbell et al. 1997; Bechard and Swem 2002; BC MOE 2005). Swainson’s hawks prefer open habitat, such as grasslands or wetlands of southern BC but are confirmed breeders and seasonal residents (England, Sidney, and Houston 1997; BC MOE 2005; BC CDC 2013b).

The short-eared owl was the only species of conservation concern detected. It was observed along the LSA boundary near the Bowser lake floodplains. The short-eared owl is provincially blue-listed, which is defined as a species of “special concern” with characteristics that make it particularly sensitive or vulnerable to human activities or natural events (BC CDC 2013b). It is also designated as Special Concern by COSEWIC and listed on Schedule 3 of the federal *Species at Risk Act* (COSEWIC 2008b). The Province has outlined management provisions to maintain nesting and foraging habitat for raptors, particularly rare or at risk species such as the short-eared owl (BC ILMB 2000). Short-eared owls select nesting sites in well-drained areas near bogs, marshes, and wetlands with dense grass and small willows (Wiggins 2004; COSEWIC 2008b). Minimal suitable short-eared nesting habitat occurs within the RSA, primarily near the mouth of the Bowser River.

Northern goshawk are yellow listed in BC, which means they are considered secure and not at risk of extinction, however, due to regional concerns about habitat management for the species they were selected for target call play back surveys (BC ILMB 2009; BC CDC 2013b). Suitable goshawk habitat was identified through modeling in limited locations within the LSA, particularly in contiguous stands of mature to old growth forest above Wildfire Creek and north to Treaty Creek (McElhanney 2011). This area was surveyed in 2011 but no goshawks were detected. Habitat modeling identified other potentially suitable polygons within the LSA but many of those areas were associated with large openings, habitat fragmentation and riparian characteristics (BC ILMB 2009; McElhanney 2011). Goshawks prefer large connected forest stands for nesting and foraging so the results of the call play back surveys reflect the lack of high quality habitat within the LSA. Previous harvesting and road construction has also limited available nesting habitat.

7.3 WATERBIRDS

7.3.1 Introduction

The Brucejack wildlife RSA contains habitat that can support a large number of waterbirds, which includes diving and dabbling ducks, loons, geese, swans, and shorebirds. The term “waterbird” is used in this report to encompass all birds that exclusively use water as habitat for foraging, breeding, or staging during the year. The term waterfowl has generally been used interchangeably with waterbird but waterfowl includes only those species of dabbling and diving ducks, geese, and swans in the family *Anatidae*. Migratory waterbird species depend on available staging habitat en route to suitable breeding and wintering grounds for their continued persistence. Migratory waterbirds and their nests are protected under the federal *Migratory Birds Convention Act* (1994c).

Identifying species of conservation concern during the breeding season meets the obligations of the *Species At Risk Act* (2002) and the the BC *Wildlife Act*(1996). The harlequin duck (*Histronicus histronicus*), surf scoter (*Melanitta perspicillata*), great blue heron (*Ardea herodias fannini),* and the trumpeter swan (*Cygnus buccinators)* are species of conservation concern that have been historically observed in the region (RTEC 2007b; Rescan 2010b; BC CDC 2013b). Harlequin ducks are provincially ranked as vulnerable during the non-breeding season, the surf scoter is blue-listed and provincially ranked as vulnerable during the breeding season, the great-blue heron is provincially blue listed and listed as a species of Special Concern under Schedule 1 of the *SARA* (COSEWIC 2008a), and the trumpeter swan is a species of regional concern (BC MSRM 2000). The harlequin duck is of particular concern because it occupies a unique habitat niche and Pacific populations have undergone significant declines (Robertson and Goudie 1999; BC MSRM 2002). The western grebe (*Aechmophorus occidentalis*), which has a historic distribution that overlaps the RSA (BC CDC 2013b), is provincially red listed and is a candidate for assessment by COSEWIC.

Waterbirds are an important component of biodiversity. The presence of waterbirds is an indicator of the availability of functional wetland habitat. Waterbirds are often used as indicators of ecosystem health and quality of wetlands, which are crucial for many ecosystem functions, such as erosion control, water and air purification, and flood control. Different species of waterbirds using a lake can represent multiple facets of site productivity, such as the presence of aquatic food resources (e.g., fish species, benthic invertebrates), and water quantity and quality. Waterbirds are often a considerable dietary component for raptors and carnivores, particularly foxes and wolves. Waterbirds, particularly waterfowl, are important locally and regionally as sustenance game species for resident hunters and First Nations.

7.3.2 Objectives

Baseline surveys were designed to investigate the waterbird community within the study area. Waterbirds were anticipated to use the area for spring and fall staging as well as localized breeding by some species. Specifically, the objectives were to characterize seasonal diversity and distribution throughout the study area, identify important habitats (e.g., breeding sites, migratory staging lakes), compare baseline conditions in the LSA to the RSA, and identify species of conservation concern during breeding or staging periods.

7.3.3 Methods

Baseline surveys for waterbirds were conducted during four periods in 2012: spring staging (April), spring pairing (May), summer brooding (July), and fall staging (October). A variety of water bodies throughout the LSA and RSA, such as lakes, rivers, and creeks, were included in the surveys.

7.3.3.1 Aerial Staging Surveys

Staging surveys were conducted to identify important staging areas that support large congregations of waterbirds. Staging waterbirds gather in large groups during the spring and fall migratory periods. Survey timing corresponded to expected migratory peaks in northern Canada (Campbell 1990). Wherever possible, the species, number of individuals, and sex was recorded for each observation. However, differentiation between species and between males and females becomes difficult after the breeding season because many waterbird species moult to winter plumage. Winter plumages are often similar for both sexes. First year offspring (i.e., born that year) may also have plumages that are similar to adults in winter. As a result, aerial identification of waterbirds is more difficult during the fall staging period.

Waterbird aerial surveys were conducted according to RISC protocols (RIC 1998f, 1998c). Aerial surveys during the spring staging and pairing periods were conducted in a Bell 206 LT helicopter with bubble windows. A Hughes/MD 500 helicopter without bubble windows was used for the summer brooding and fall staging surveys. Two biologists were present on each survey to identify birds, one in the front of the helicopter to navigate and the other in the back to record notes. The helicopter flew at speeds of 40 to 100 km/hour depending on weather conditions, and approximately 30 to 50 m above the water. Waterbirds were identified using binoculars. A handheld Garmin GPS 62s equipped with a remote antenna was used to record survey routes and bird locations.

7.3.3.2 Breeding Surveys

Both aerial and ground surveys were conducted during the early breeding period in May to document the presence of paired waterbirds. Evidence of breeding used physical or behavioural cues. For sexually dimorphic species (i.e., where males and females look different), males and females in close proximity were considered to be a pair. For species where males and females look alike, a pair was defined as two individuals observed in close proximity to one another. Aerial surveys during the summer brooding period were also conducted across the LSA to document productivity in the area.

Following the May aerial survey that identified breeding sites, subsequent ground surveys were conducted at locations where >200 birds were observed. Ground survey counts were compared to aerial survey counts to verify the original estimates and species identification. A 55x-power Celestron spotting scope and binoculars were used by two qualified observers to record waterbirds within a 200 m radius for a period of 20 minutes.

Species, number of individuals, gender of individuals (if possible), age of individuals (if possible), and behaviour were recorded at each location. When broods were observed, the number of young and brood class (Table 7.3-1) was noted. Although brood classes were developed specifically for waterfowl, they can also be applied to other waterbirds, such as loons, because plumage development is similar in these species. The habitat associated with each bird observation was classified as river (RI), creek

(CR), backchannel (BK), pond (PO), lake (LK), wetland (WT), swamp (SW), or marsh (MA) habitats. Rivers were defined as streams greater than 4 m wet width, while creeks had widths of less than 4 m. Backchannels were defined as smaller branches of rivers or creeks that may or may not form islands or oxbows. Ponds were defined as shallow water bodies with organic substrate and substantial emergent vegetation, while lakes were deeper with predominantly mineral soil substrata. Marshes were areas of shallow water, dominated by rush (*Scirpus* spp.) and sedge (*Carex* spp.) vegetation. Swamps were defined as areas where shrubby or woody vegetation persisted in areas with high water tables. Wetlands were areas that could not be defined exclusively as a marsh or swamp as both habitat characteristics may be present. Habitat that was pond, lake, wetland, swamp or marsh was also rated as small (< 0.5 ha), medium (0.5 to 2 ha), or large (> 2 ha).

Table 7.3-1. Brood Class Descriptions for Waterbirds

Brood Class	Description
IA	Young are covered in bright down, neck and tail not prominent; 1-7 days old
IB	Young are covered in fading down, neck and tail not prominent; 8-13 days old
IC	Young are downed-covered, but colour faded, body elongated; 14-18 days old
IIA	First feathers appear, replacing down on sides and tail; 19-27 days old
IIB	Over half of body covered with feathers; 28-42 days old
IIC	Small amount of down remains, among feathers of back; 28-42 days old
III	Fully feathered but incapable of flight; 43-55 days of age, flying at 56-60 days old

7.3.3.3 Data Analysis

Waterbird data were summarized by abundance and species richness. Abundance is the number of individuals counted and species richness is the total number of species observed during each survey. These estimates included only those data that were collected during formal waterbird surveys. Ground survey data that were included in the analyses were those collected within 200 m of the observer and within the 20 minute survey period. Waterbirds were classified as dabbling ducks, diving ducks (including sea ducks), geese and swans, loons and grebes, shorebirds, and terns and gulls.

7.3.3.4 Incidental Observations

Waterbird observations beyond the standardized limits for aerial and ground surveys were considered incidental. Waterbirds observed during other wildlife field surveys have also been reported but were not included in the summary analyses for waterbirds. The species, number of individuals, and UTM coordinates of other wildlife observed during waterbird surveys are also reported.

7.3.4 Results

A total of 28 species were identified from seven waterbird groups (Table 7.3-2): dabbling ducks (6), diving and sea ducks (7), loons and grebes (3), riverine birds (2), gulls and terns (3), geese and swans (2), shorebirds (4), and herons (1). A total of 3,639 birds were observed; however, to potentially avoid double counting the ground survey results are not included so a total of 2,795 birds were observed. The most commonly observed species were ring-necked duck, mallard, Canada goose, American green-winged teal, and greater scaup. The harlequin duck and great-blue heron were the only species of conservation concern that were observed. Trumpeter swan, a species of regional concern, was also observed (BC ILMB 2000).

Table 7.3-2. Total Waterbird Observations, 2012

Group	Species	Scientific Name	Waterbird Survey					
			Spring Staging	Spring Pair		Summer Brood	Fall Staging	Total
				Aerial	Ground			
Dabbling Ducks	American Green-winged Teal	*Anas crecca*	37	197	77	9	9	329
	American Widgeon	*Anas americana*	13	48	36	-	13	110
	Eurasian Widgeon	*Anas penelope*	1	-	-	-	-	1
	Mallard	*Anas platyrhynchos*	326	253	44	69	99	791
	Northern Pintail	*Anas acuta*	23	28	4	-	5	60
	Northern Shoveller	*Anas clypeata*	8	25	22	-	2	57
	Unknown Duck		-	-	-	5	-	5
Diving and Sea Ducks	Barrow's Goldeneye	*Buchephala islandica*	23	50	6	45	2	126
	Bufflehead	*Bucephala albeola*	-	1	-	-	-	1
	Common Merganser	*Mergus merganser*	22	13		1	18	54
	Greater Scaup	*Aythya marila*	-	58	184	-	4	246
	Hooded Merganser	*Lophodytes cucullatus*	5	-	-	-	-	5
	Red-breasted Merganser	*Mergus serrator*	-	-	-	-	2	2
	Ring-necked Duck	*Aythya collaris*	-	668	426	39	1	1,134
	Unknown Diver		-	2	-	1	-	3
	Unknown Scaup	*Aythya sp.*	-	160	-	-	-	160
Loons and Grebes	Common Loon	*Gavia immer*	-	2	-	7	-	9
	Pacific Loon	*Gavia pacifica*	-	-	-	2	-	2
	Red-necked Grebe	*Podiceps grisegena*	-	-	-	-	4	4
	Unknown Loon	*Gavia sp.*	-	-	-	1	-	1
Riverine Birds	American Dipper	*Cinclus mexicanus*	2	5	-	4		11
	Harlequin Duck*	*Histrionicus histrionicus*	-	13	-	10	-	23

(continued)

Table 7.3-2. Total Waterbird Observations, 2012 (completed)

Group	Species	Scientific Name	Waterbird Survey					
			Spring Staging	Spring Pair		Summer Brood	Fall Staging	Total
				Aerial	Ground			
Gulls and Terns	Arctic Tern	*Sterna paradisaea*	-	19	4	-	-	23
	Herring Gull	*Larus smithsonianus*	-	-	-	-	6	6
	Ring-billed Gull	*Larus delawarensis*	-	-	-	10	-	10
	Unknown Gull	*Larus sp.*	-	-	-	1	-	1
Geese and Swans	Canada Goose	*Branta canadensis*	64	155	6	72	69	366
	Trumpeter Swan*	*Cygnus buccinator*	9	6	-	1	1	17
Shorebirds	Greater Yellowlegs	*Tringa melanoleuca*	-	4	-	-	-	4
	Pectoral Sandpiper	*Calidris melanotos*	-	-	1	-	-	1
	Semipalmated Plover	*Charadrius semipalmatus*	-	-	3	-	-	3
	Semipalmated Sandpiper	*Calidris pusilla*	-	-	31	-	-	31
	Unknown Sandpiper†		-	38	-	4	-	42
Heron	Great-blue Heron*	*Ardea herodias fannini*	-	-	-	-	1	1
			533	**1,745**	**844**	**281**	**236**	**3,639**

**Species of conservation concern*
†Potentially Spotted or Solitary Sandpiper

7.3.4.1 Spring Staging Survey

The spring staging survey was conducted April 19 – 20, 2012 using five hours of helicopter time. A total of 12 species and 533 individual birds were observed (Figure 7.3-1). The majority of birds were dabbling ducks (77%), followed by geese and swans (14 %), and diving and sea ducks (9 %). By far, the most abundant waterbird was the mallard (326), followed by Canada goose (64). Most observations were outside the LSA along the Bell-Irving River, Treaty Creek, eastern Bowser River, and the Unuk River; however, three large concentrations of waterbirds were observed within the LSA along Bowser River, Knipple Lake, and at the confluence of the Bowser River and Bowser Lake (Figure 7.3-2).

Waterbirds were detected primarily in river (41%) and lake (38%) habitat types, followed by ponds (10%) and backchannels (9%; Figure 7.3-3). River and lake habitats typically support larger groups of waterbirds and these habitat types were relatively common within the RSA. Dabblers and divers accounted for 97% of all waterbirds in river habitats, and 74% in lake habitats. Geese and swans accounted for the remaining 26% of observations in lakes. Dabbling waterbirds exploited the widest range of habitat types. No waterbirds were observed in wetland, marsh, or swamp habitat types; however, most of the water bodies, other than fast flowing rivers and creeks and the shorelines of medium to large lakes and ponds, were covered with ice, limiting their availability for spring staging.

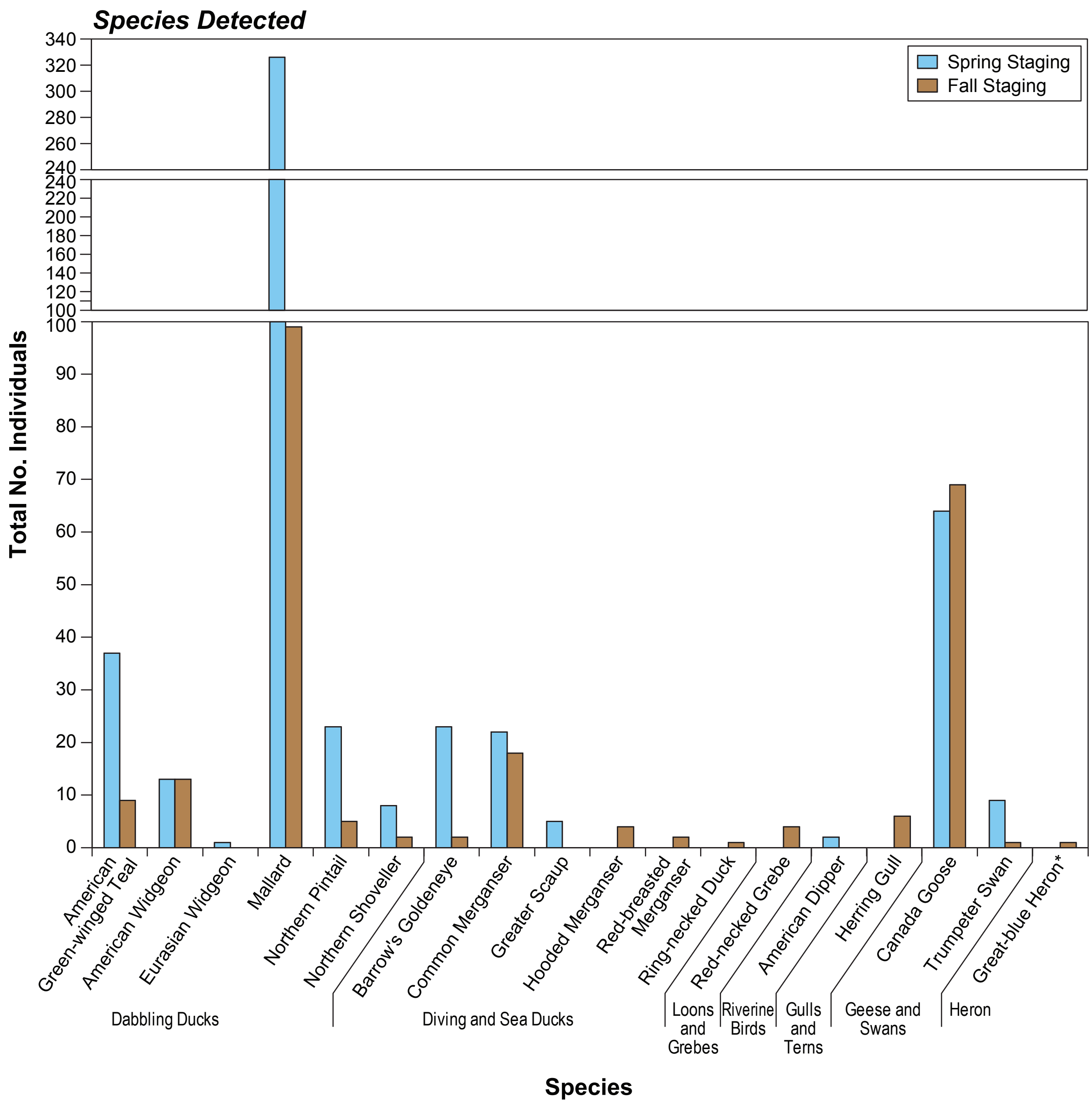
7.3.4.2 Fall Staging Survey

The fall staging survey was conducted October 9 – 10, 2012 using six hours of helicopter time. A total of 236 individual birds were identified during the fall staging survey, representing 15 species (Figure 7.3-1). Over half (54 %) of the birds observed were classified as dabbling ducks, followed by geese and swans (30%), and diving and sea ducks (11%). The most common species observed were mallard (99) and Canada goose (69). Most fall staging waterbirds were found outside the LSA near Border Lake (south western area of the RSA), and along the Bell Irving River; however, small groups of waterbirds were found in the LSA at Bowser River, Scott Creek, Todedada Lake, and the confluence of Bowser Lake and Bowser River (Figure 7.3-4).

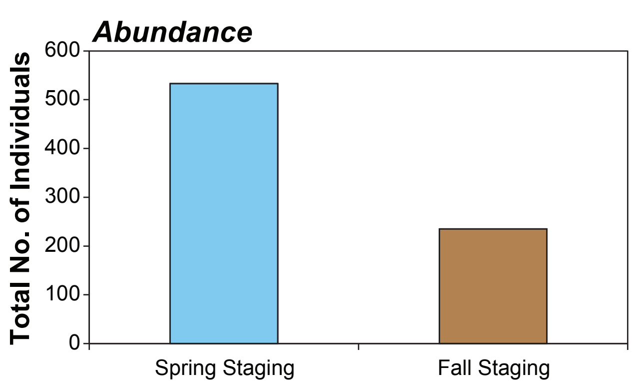
During fall staging, waterbirds were primarily detected in lake habitats (34%), followed by backchannels (17%), ponds (16%), and rivers (14%; Figure 7.3-3). Overall, dabblers and divers exploited the largest range of habitat types compared to the other five waterbird groups, which were exclusively found in lake habitat.

7.3.4.3 Spring Pair Survey

Spring pair surveys were conducted May 13 – 16, 2012 using 10 hours of helicopter time. A total of 1,745 birds from 17 species were counted during aerial surveys, and 844 birds from 13 species were counted during ground surveys (Figure 7.3-5). Approximately half (54%) of the waterbirds observed during aerial surveys were diving and sea ducks, followed by dabbling ducks (32%), and geese and swans (10%). The most abundant species were ring-necked duck, mallard, American green-winged teal, greater scaup, and Canada goose. The highest number of birds was found outside the LSA along Treaty Creek, Scott Creek, and Bowser River; however, within the LSA, the largest concentrations of waterbirds were found at the confluence of Bowser River and Bowser Lake and near Knipple Lake, where groups of more than 200 individuals and breeding pairs were observed (Figure 7.3-6).



Note: *Species of conservation concern.



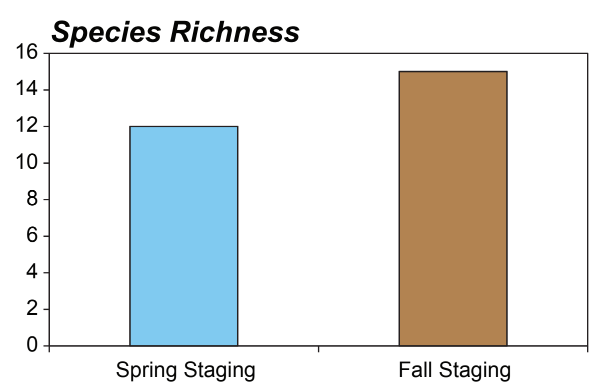


Figure 7.3-1

Waterbird Species and Species Abundance and Richness Observed during Staging Surveys, 2012

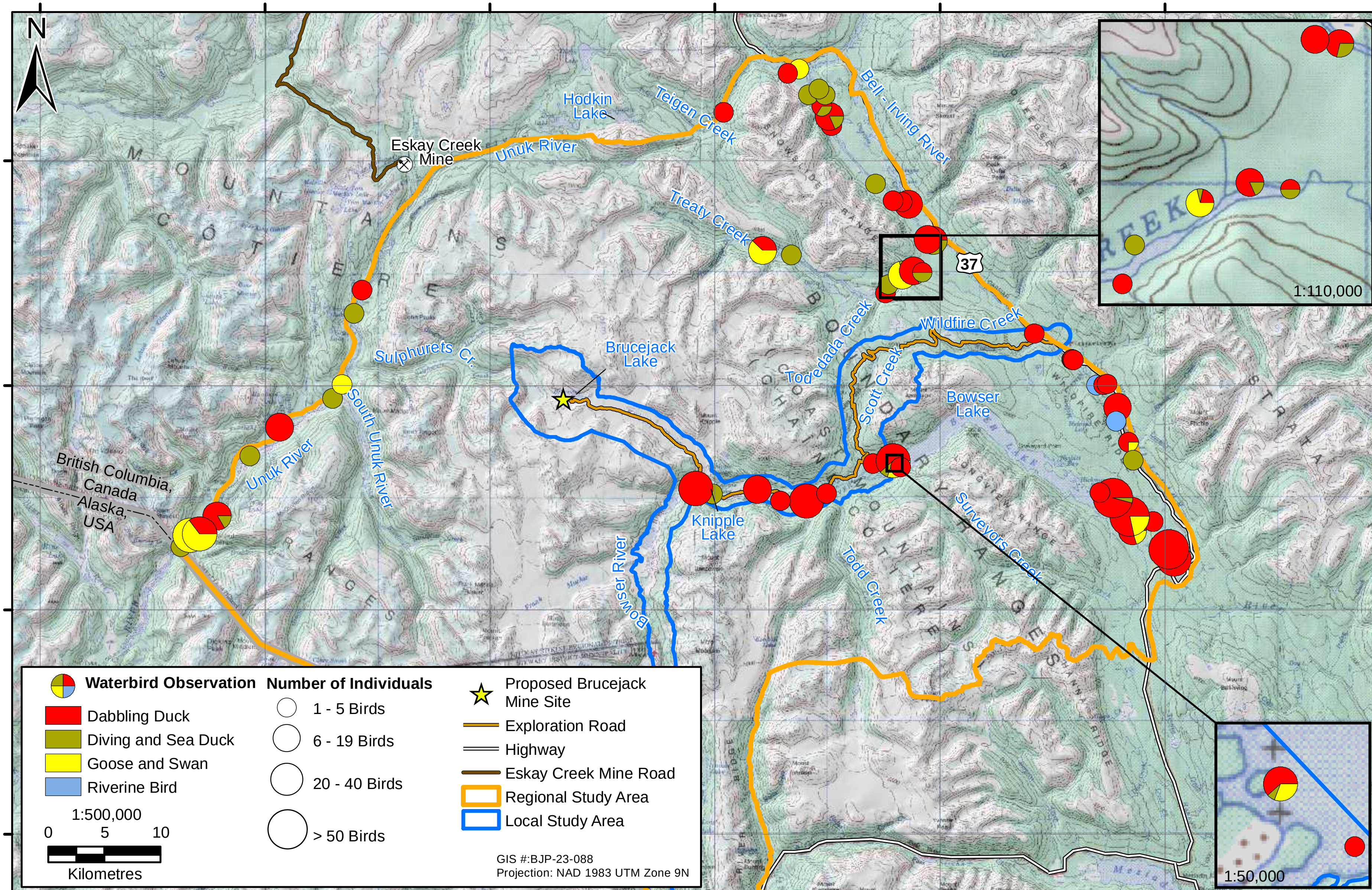


Figure 7.3-2

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Distribution of Waterbirds during Spring Staging Surveys, 2012

Figure 7.3-2

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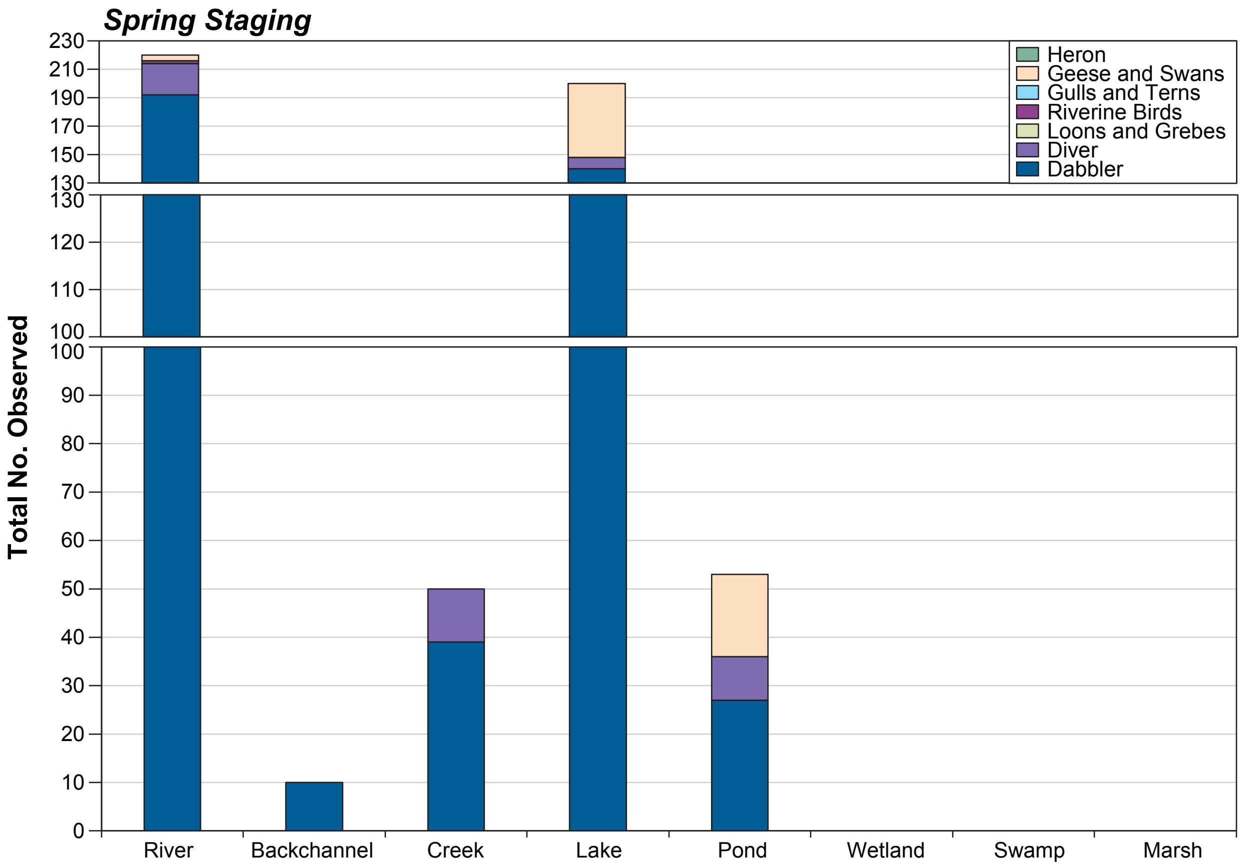

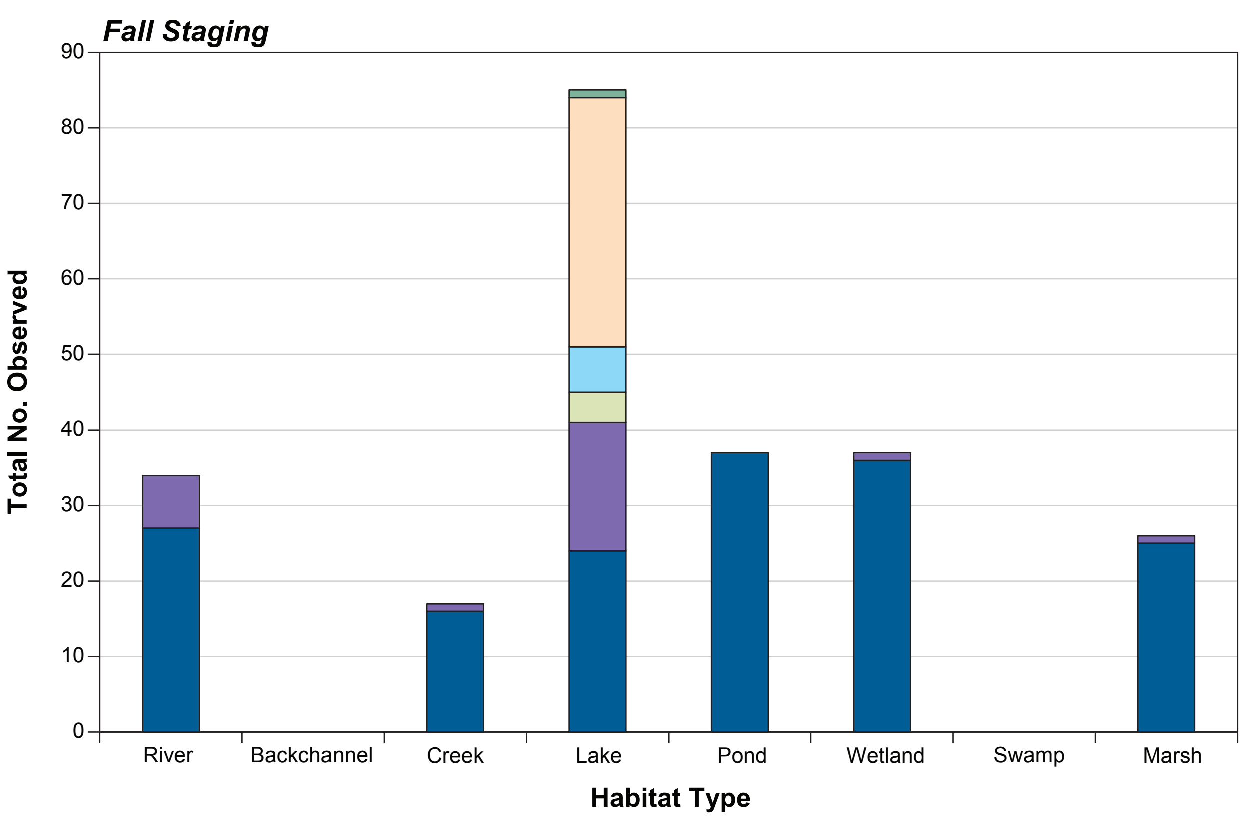

Figure 7.3-3

Habitat Associations of Waterbirds during Staging Surveys, 2012

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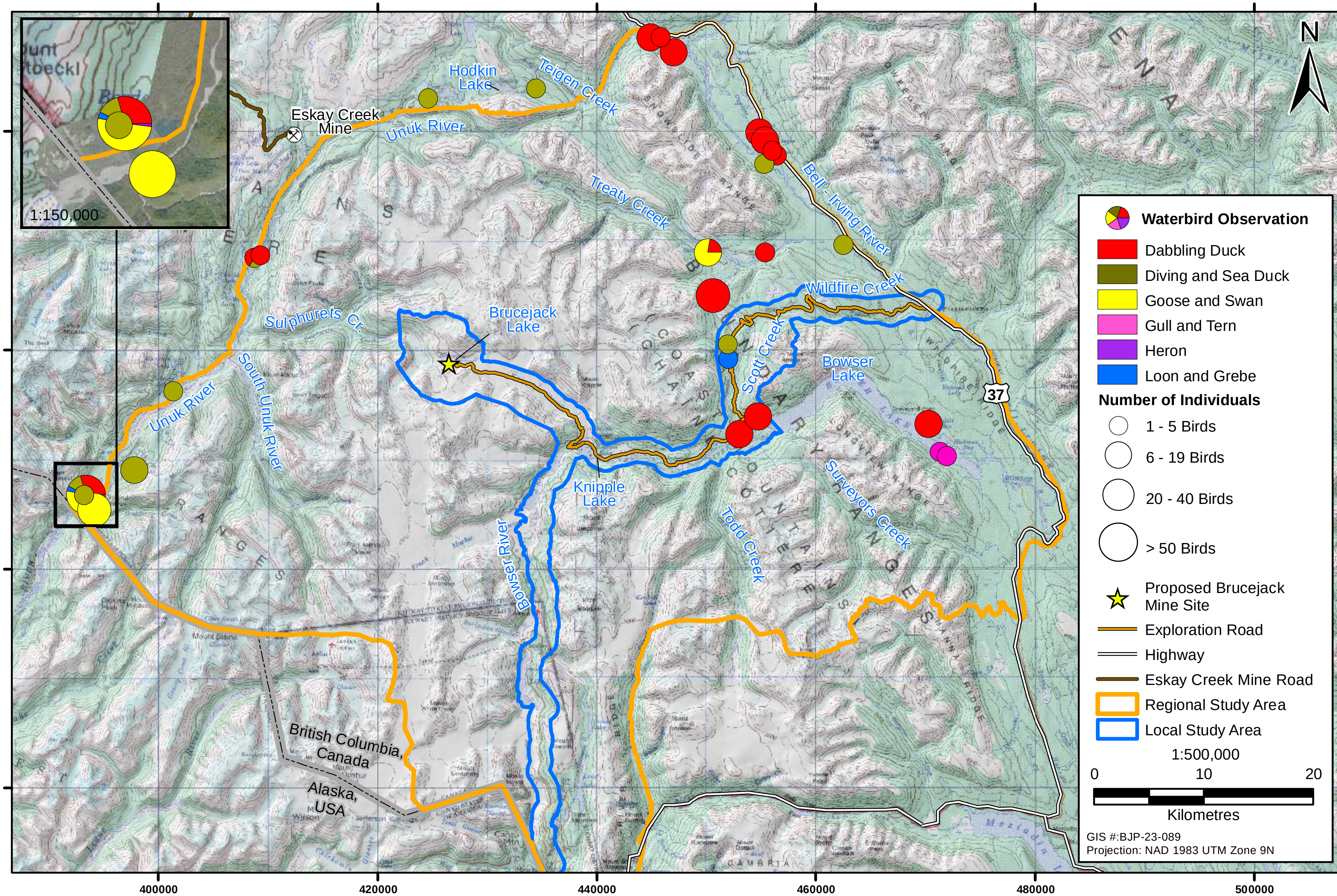

Figure 7.3-4

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Distribution of Waterbirds during Fall Staging Surveys, 2012

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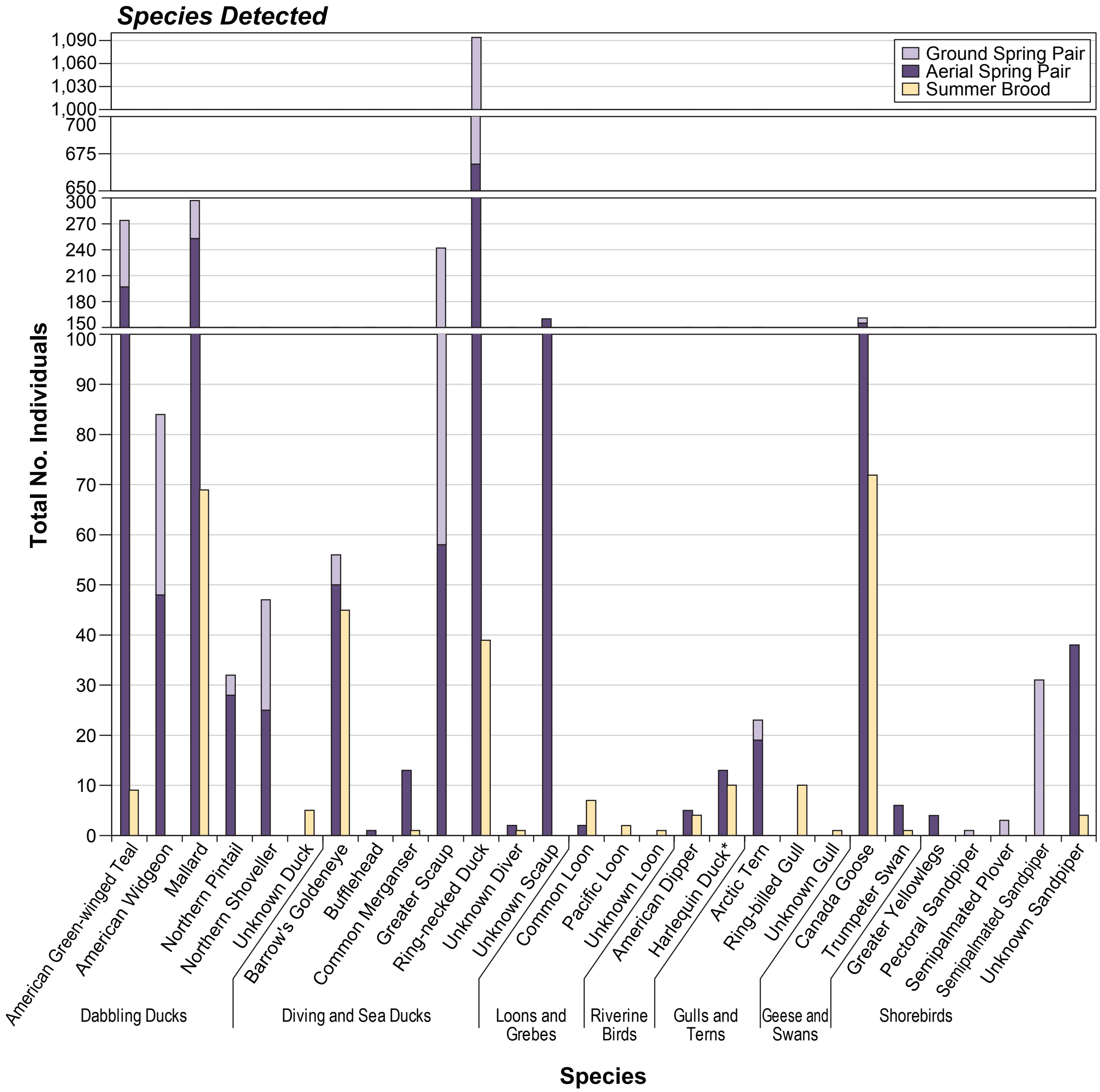
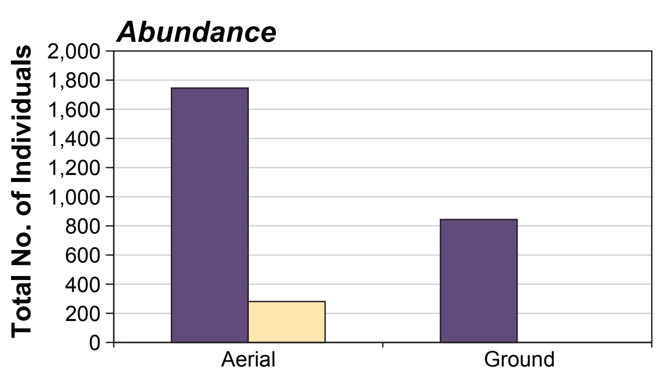
Figure 7.3-4



Note: *Species of conservation concern.



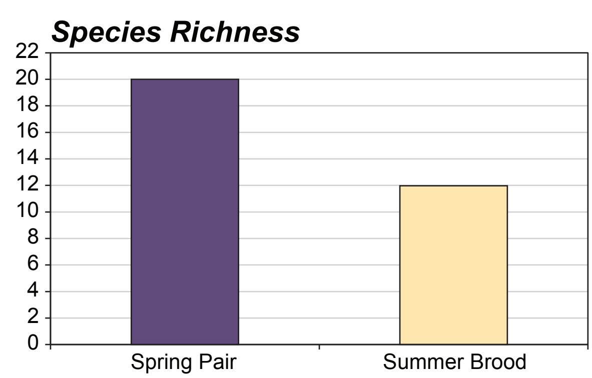


Figure 7.3-5

Waterbird Species and Species Abundance and Richness during Breeding Surveys, 2012

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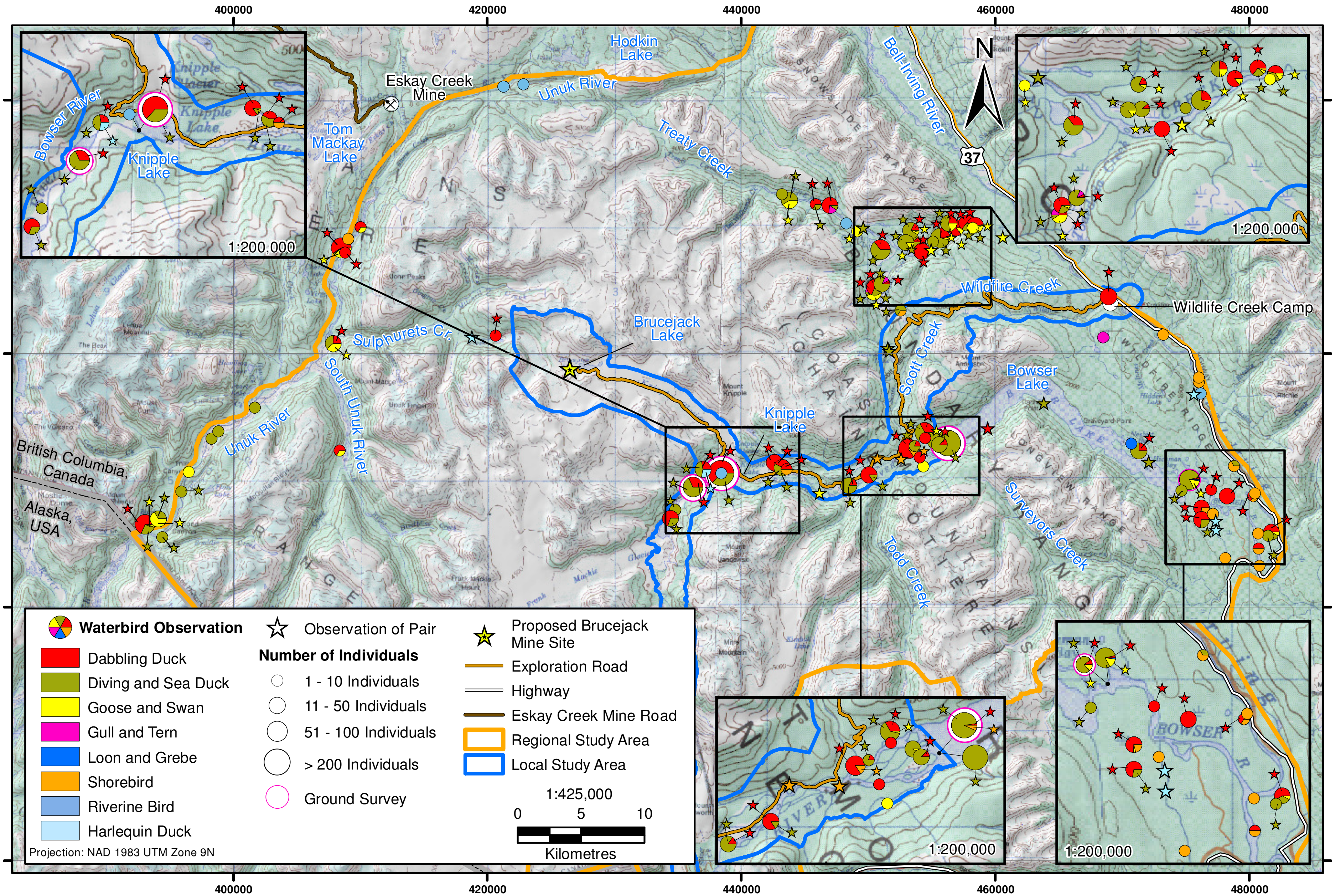

Figure 7.3-6

Distribution of Waterbirds during Aerial Spring Pair Surveys, 2012

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A total of 312 pairs during ground surveys (Table 7.3-3) and 621 pairs were detected during aerial surveys (Table 7.3-4).The numbers of breeding pairs are likely underestimated because it is difficult to discern pair behaviour and the numbers of pairs within large congregations of waterbirds. Ring-necked duck, mallard, Canada goose, and American green-winged teal had the most breeding pairs. Large groups of greater scaup and unknown scaups were observed in the LSA at the confluence of Bowser Lake and Bowser River and at Knipple Lake, but these groups were probably late spring migrants heading further north to breed (Figure 7.3-6). Harlequin duck pairs were detected in the LSA along Bowser River, Survey Creek, and Sulphurets Creek, and outside the LSA along the eastern Bowser River (Figure 7.3-6; Plate 7.3-1).

Table 7.3-3. Summary of Waterbirds and Pairs Observed during Ground Pair Survey, 2012

Group	Species	Individuals	Pairs	Species Total
Dabbling Ducks	American Green-winged Teal	21	28	77
	American Widgeon	12	12	36
	Mallard	16	14	44
	Northern Pintail	2	1	4
	Northern Shoveller	8	7	22
Group Total				**183**
Diving and Sea Ducks	Barrow's Goldeneye	4	1	6
	Greater Scaup	52	66	184
	Ring-necked Duck	94	166	426
Group Total				**616**
Gulls and Terns	Arctic Tern	4	-	4
Group Total				**4**
Geese and Swans	Canada Goose	-	3	6
Group Total				**6**
Shorebirds	Pectoral Sandpiper	1	-	1
	Semipalmated Plover	3	-	3
	Semipalmated Sandpiper	3	14	31
Group Total				**35**
Total		**220**	**312**	**844**

Table 7.3-4. Summary of Waterbirds and Pairs Observed during Aerial Pair Survey, 2012

Group	Species	Individuals	Pairs	Species Total
Dabbling Ducks	American Green-winged Teal	9	94	197
	American Widgeon	14	17	48
	Mallard	107	73	253
	Northern Pintail	8	10	28
	Northern Shoveler	7	9	25
Group Total				**551**
Diving and Sea Ducks	Barrow’s Goldeneye	14	18	50
	Bufflehead	1	-	1
	Common Merganser	5	4	13
	Greater Scaup	26	16	58

(continued)

Table 7.3-4. Summary of Waterbirds and Pairs Observed during Aerial Pair Survey, 2012 (completed)

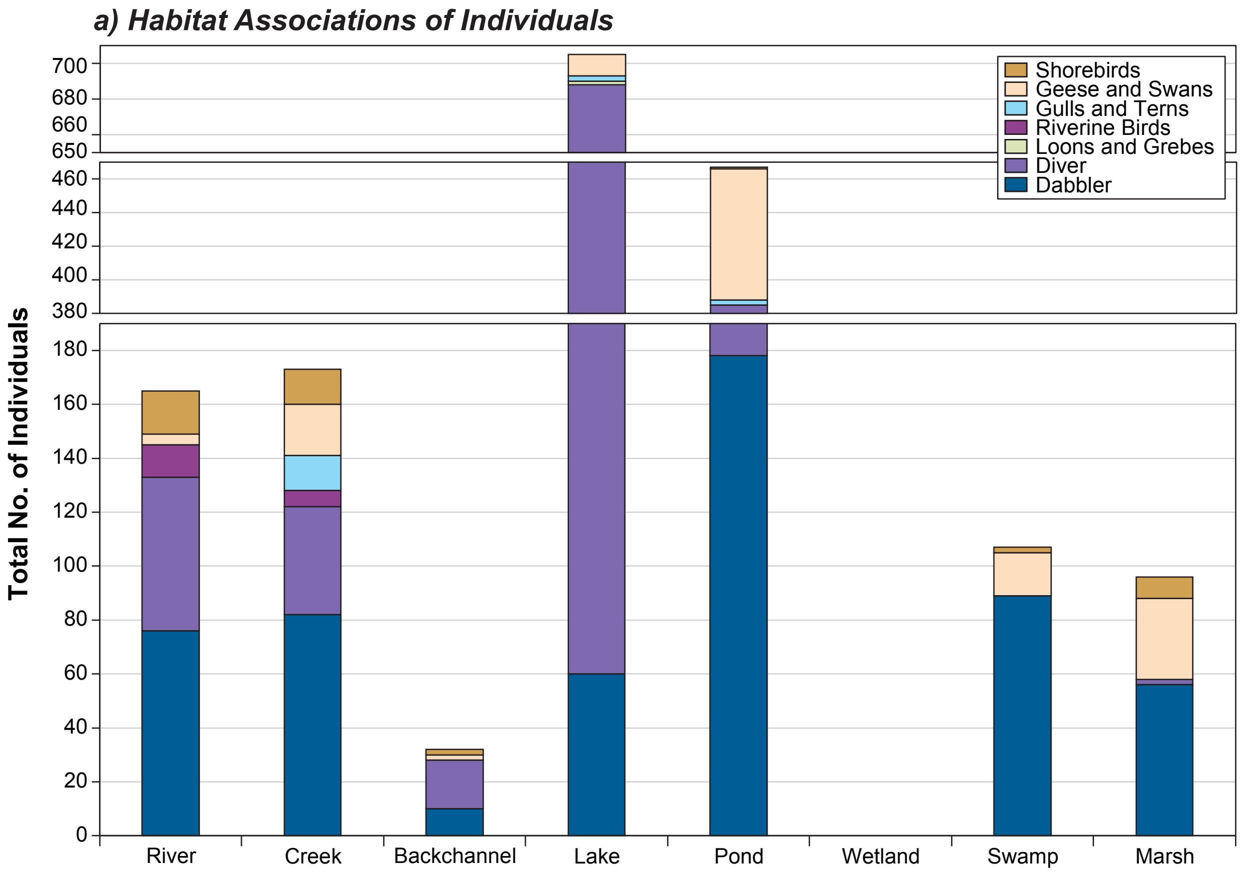
Group	Species	Individuals	Pairs	Species Total
Diving and Sea Ducks (cont'd)	Ring-necked Duck	202	233	668
	Unknown Diver	2	-	2
	Unknown Scaup	26	67	160
Group Total				**952**
Geese and Swans	Canada Goose	29	63	155
	Trumpeter Swan*	4	1	6
Group Total				**161**
Gulls and Terns	Arctic Tern	19	-	19
Group Total				**19**
Loons and Grebes	Common Loon	2	-	2
Group Total				**2**
Riverine Birds	American Dipper	5	-	5
	Harlequin Duck*	1	6	13
Group Total				**18**
Shorebirds	Greater Yellowlegs	2	1	4
	Unknown Sandpiper	22	8	38
Group Total				**42**
Total		**503**	**621**	**1,745**

**Species of conservation concern*

Plate 7.3-1. Pair of harlequin ducks observed on Bowser Lake.

Waterbirds were detected primarily in lake (40%) and pond (27%) habitat followed by creek (10%), river (9%) swamp (6%), marsh (6%), and backchannel (2%) habitat. Dabbling waterfowl exploited the widest range of habitat types; however, over half (60%) of the dabbling ducks were associated with shallow and calm, low flowing water bodies including ponds, marshes, swamps, and meandering backchannels (Figure 7.3-7a). Conversely, over 75% of individual diving waterfowl were found in deeper or faster flowing water bodies, such as rivers, creeks, and lakes.

Over 69% of all breeding pairs were associated with lake or pond habitat, and consisted primarily of dabbling and diving ducks (Figure 7.3-7b). Suitable habitat for harlequin ducks was noted within the LSA along Bowser River and Sulphurets Creek close to Sulphurets Lake as a number of pairs were detected in these areas (Figure 7.3-6; Plate 7.3-1).



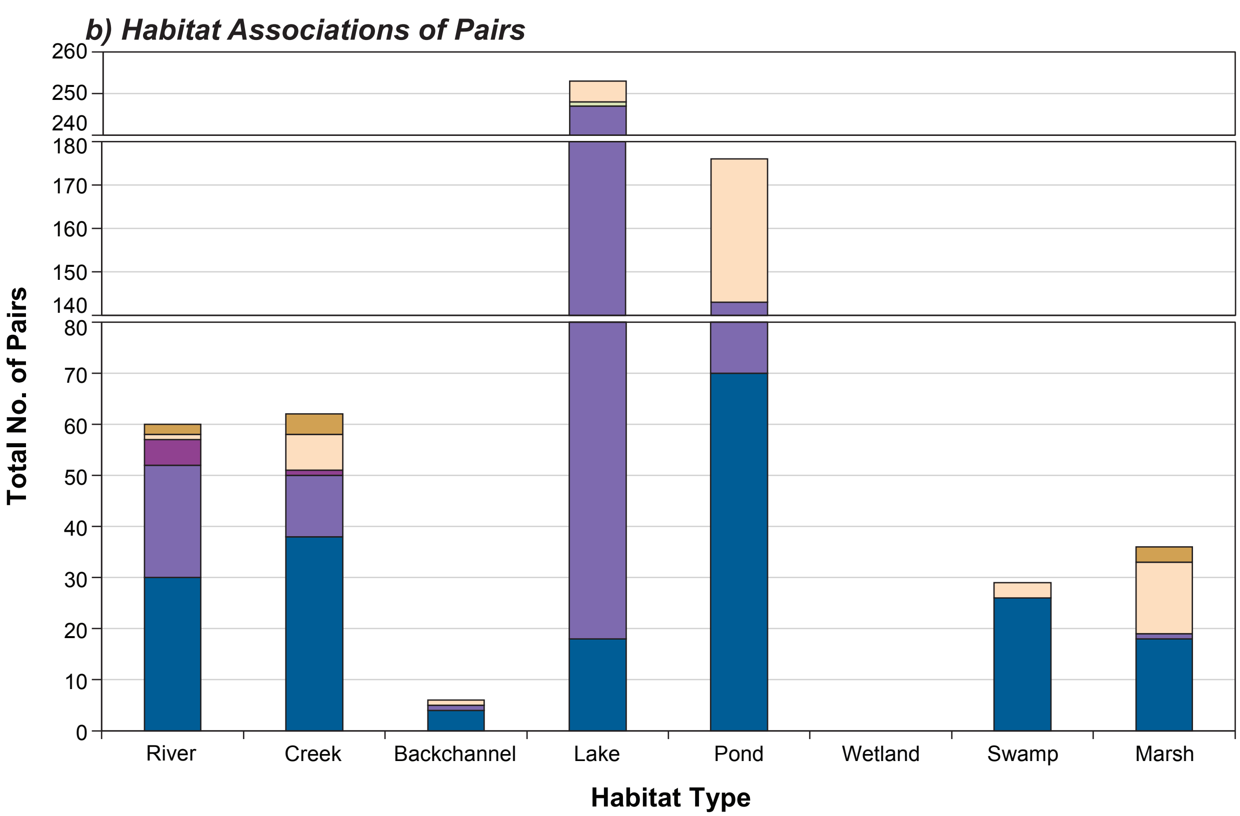


Figure 7.3-7

Habitat Associations of Waterbirds during Spring Pair Survey, 2012

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7.3.4.4 Summer Brood Survey

Summer brood surveys were conducted July 28 – 29, 2012 using 7.5 hours of helicopter time. A total of 281 individual birds were counted from 12 species (Figure 7.3-5). Over half (60%) of the waterbirds were dabbling and diving ducks, followed by geese and swans (26%). The most common species observed were Canada goose, mallard, Barrow's goldeneye, and ring-necked duck. The largest concentrations of waterbirds with broods within the LSA occurred along Bowser River and at the west end of Bowser Lake (Figure 7.3-8). Outside the LSA, large concentrations of waterfowl broods were detected along Treaty Creek, at the northern end of the Bell-Irving River, and in small lakes along Wildfire Ridge (Figure 7.3-8). The eclipse plumage of male ducks (drakes) of many species and the cryptic nature of hens with broods can limit species and sex identification from helicopters; however, productivity information and identification of important breeding locations was possible.

A total of 37 broods of six species were observed during the brood survey (Table 7.3-5). Over 2/3 (70%) of the broods were from either diving or dabbling ducks. The species with the highest number of broods were Barrow's goldeneye, mallard, and Canada goose. Overall, the average number of young per brood ranged from 2 to 4 for all six species; however, Canada goose, ring-necked duck, American green-winged teal, and mallard had broods of 6 or more. Average brood class was 28 to 42 days old (IIB) for diving ducks, and 43 to 60 days old (III or fledged) for Canada geese and dabbling ducks.

Table 7.3-5. Summary of Waterbird Brood Surveys, 2012

Group	Species	Brood Size*	Brood Class	Total No. Broods
Dabbling Ducks	American Green-winged Teal	7	IIC	1
	Mallard	2	IIB	9
		3	III	
		4, 4, 4, 4	III, III, III, III+	
		6,6	IC, III	
		7	IIA	
	Unknown Duck	4	IIB	1
Diving and Sea Ducks	Barrow's Goldeneye	1, 1	IC, IIB	12
		2, 2, 2, 2, 2, 2	IC, IIA, IIA, IIB, IIB, IIB	
		3, 3	IIB, IIB	
		4	IIIA	
		5	IIB	
	Ring-necked Duck	1, 1	IIC, III	3
		8	IIC	
Riverine Birds	Harlequin Duck*	1, 1	IIB, IIC	3
		4	IIA	
Geese and Swans	Canada Goose	3, 3	IIA, III+	8
		4, 4	III, III+	
		5	IIC	
		6	III	
		10	III+	
		13	IIA	
Total				**37**

**Different broods of the same size are separated by a comma*

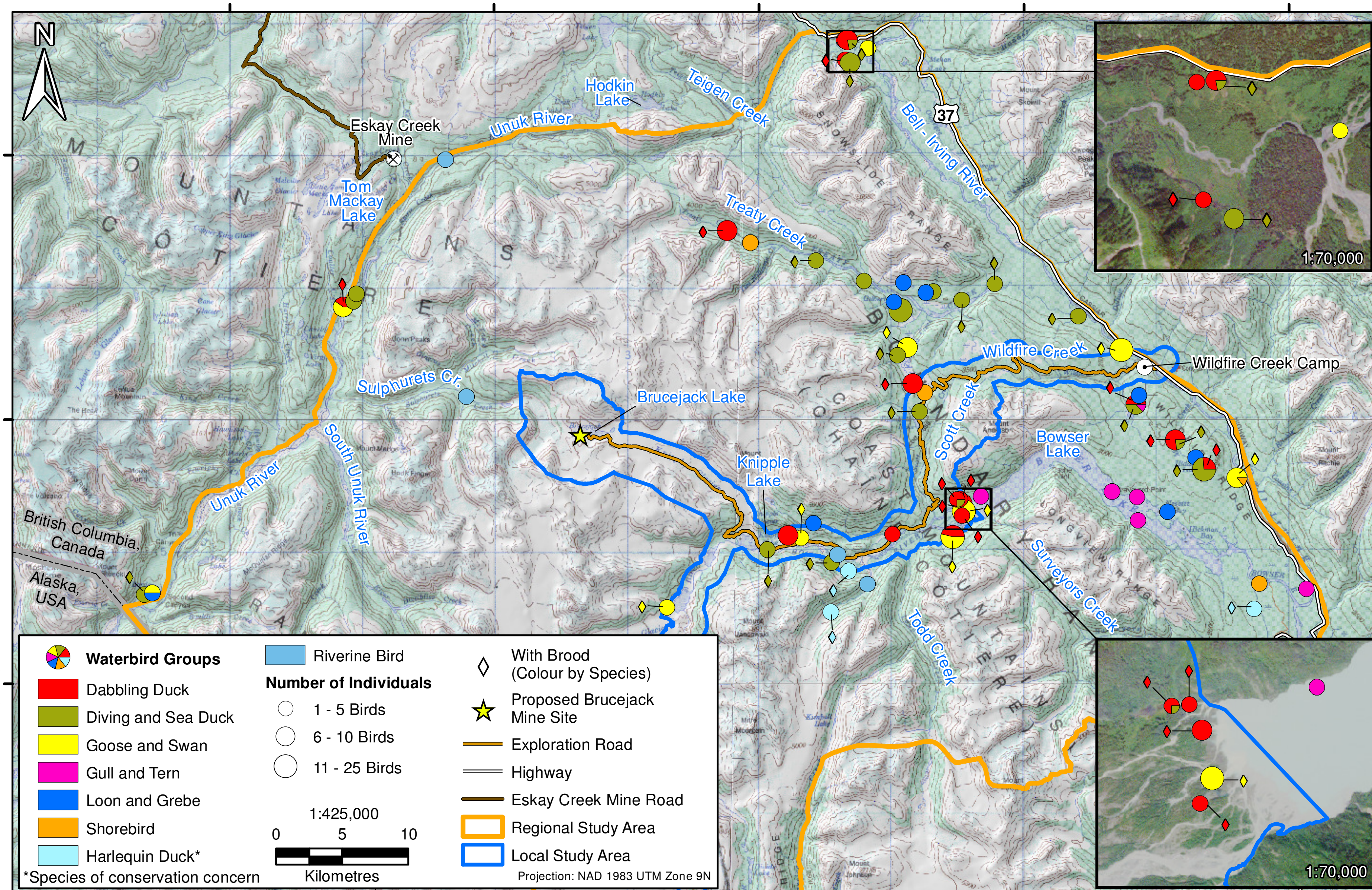

Figure 7.3-8

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Distribution of Waterbirds during Summer Brood Surveys, 2012

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Overall, dabblers and divers accounted for 86% of the total waterbirds observed in ponds, and 63% of all waterbirds in lake habitats (Figure 7.3-9a). Geese and swans exploited the widest range of habitat types; however, over half (55%) of geese and swans were in backchannel habitats. The majority (91%) of broods were associated with calm, low flowing water bodies that included pond, lake, and backchannel habitats, and primarily consisted of dabblers, divers, and geese (Figure 7.3-9b). Harlequin duck broods, like dabblers and divers, were also found at large pond or lake habitats. For example, one brood was observed in a high elevation (approximately 2000 m), glacier-fed lake less than 5 km outside the LSA (Figure 7.3-8). This species typically nests near fast flowing rivers and mountain streams (Campbell et al. 1990).

7.3.4.5 Species of Conservation Concern

Three species of conservation concern were observed during baseline waterbird surveys in 2012: harlequin duck, trumpeter swan, and great-blue heron.

Harlequin ducks are of particular interest to federal regulators as they occupy a unique habitat niche and Pacific populations have undergone declines (Robertson and Goudie 1999). Harlequin ducks are currently yellow-listed (apparently secure) in BC; however, the BC MOE has identified this species as requiring additional conservation and monitoring activities under the BC Conservation Framework to prevent the species from becoming at risk in the future (BC MOE 2009; BC CDC 2012c). Six pairs of harlequin ducks and three broods were observed during baseline surveys. The pairs were observed within the RSA along Bowser River and near the LSA along the Sulphurets Creeks. Broods were observed along Bowser River and within the LSA near Knipple Lake.

Trumpeter swans are considered a species of regional concern. The CIS LRMP identified trumpeter swan wintering habitat as important areas to maintain and recommended that nesting and staging inventories of trumpeter swan be prioritized for research (BC ILMB 2000). Trumpeter swans were observed during spring and fall staging surveys, with the majority of observations near Border Lake in the RSA. A breeding pair was observed near Border Lake during the spring pair survey.

Great-blue herons are provincially blue listed, and designated as Special Concern under Schedule 1 of the *SARA* (COSEWIC 2008a). One individual was observed near Border Lake during the fall staging survey. No evidence of nesting heron colonies were observed in the LSA.

7.3.4.6 Incidental Observations

A total of 65 incidental observations of waterbirds were collected during 2010 and 2012 wildlife surveys (Table 7.3-6; Figure 7.3-10). In 2010, 10 incidental observations of waterbirds were collected during raptor and breeding bird surveys, and 55 observations were collected in 2012 during breeding bird surveys and grizzly bear DNA hair collections including two pairs of harlequin ducks within the RSA. Four species of waterbirds were incidentally observed that were not detected during baseline waterbird surveys: blue-winged teal, Bonaparte’s gull, lesser yellowlegs, and Wilson’s snipe.

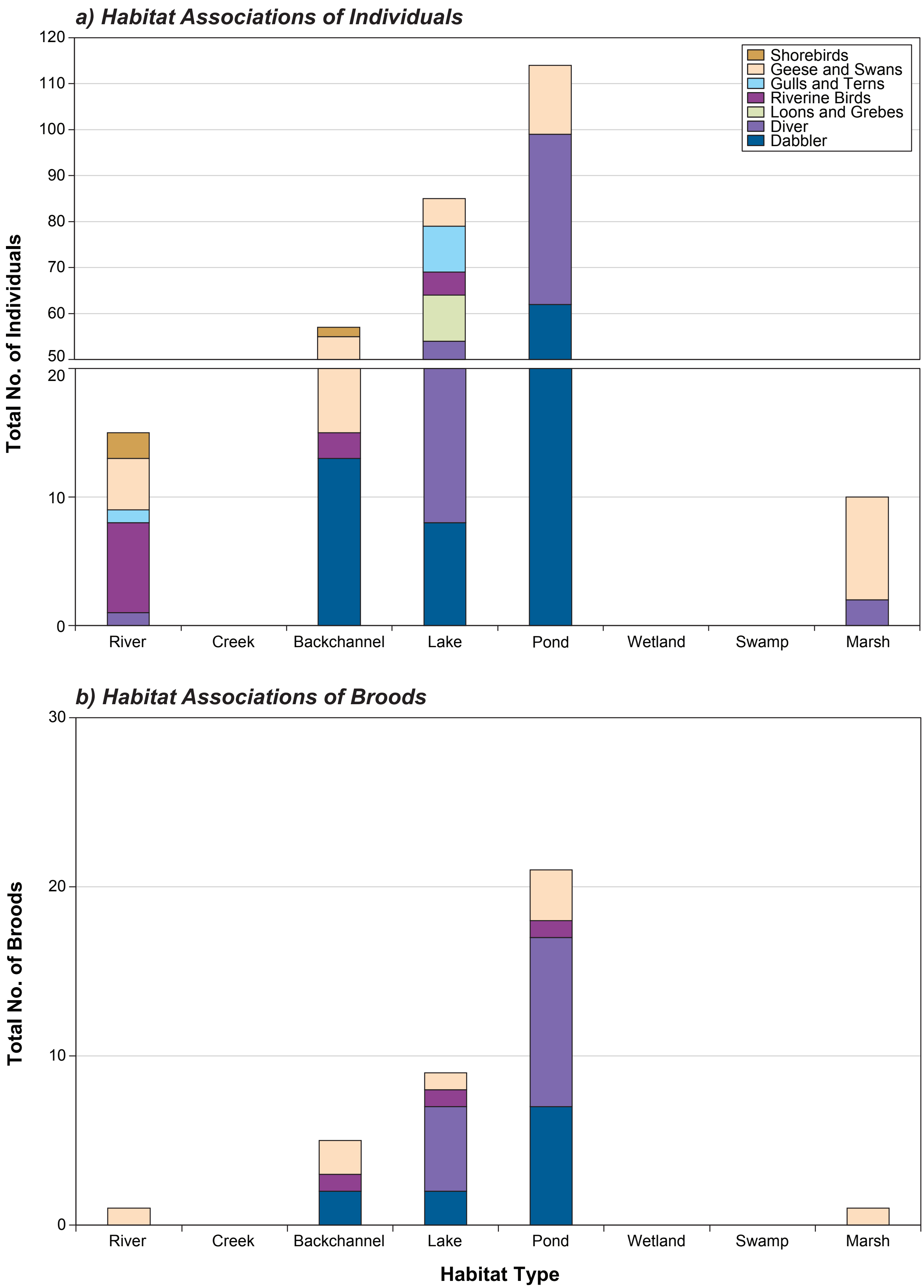

Figure 7.3-9

Habitat Associations of Waterbirds during Summer Brood Survey, 2012

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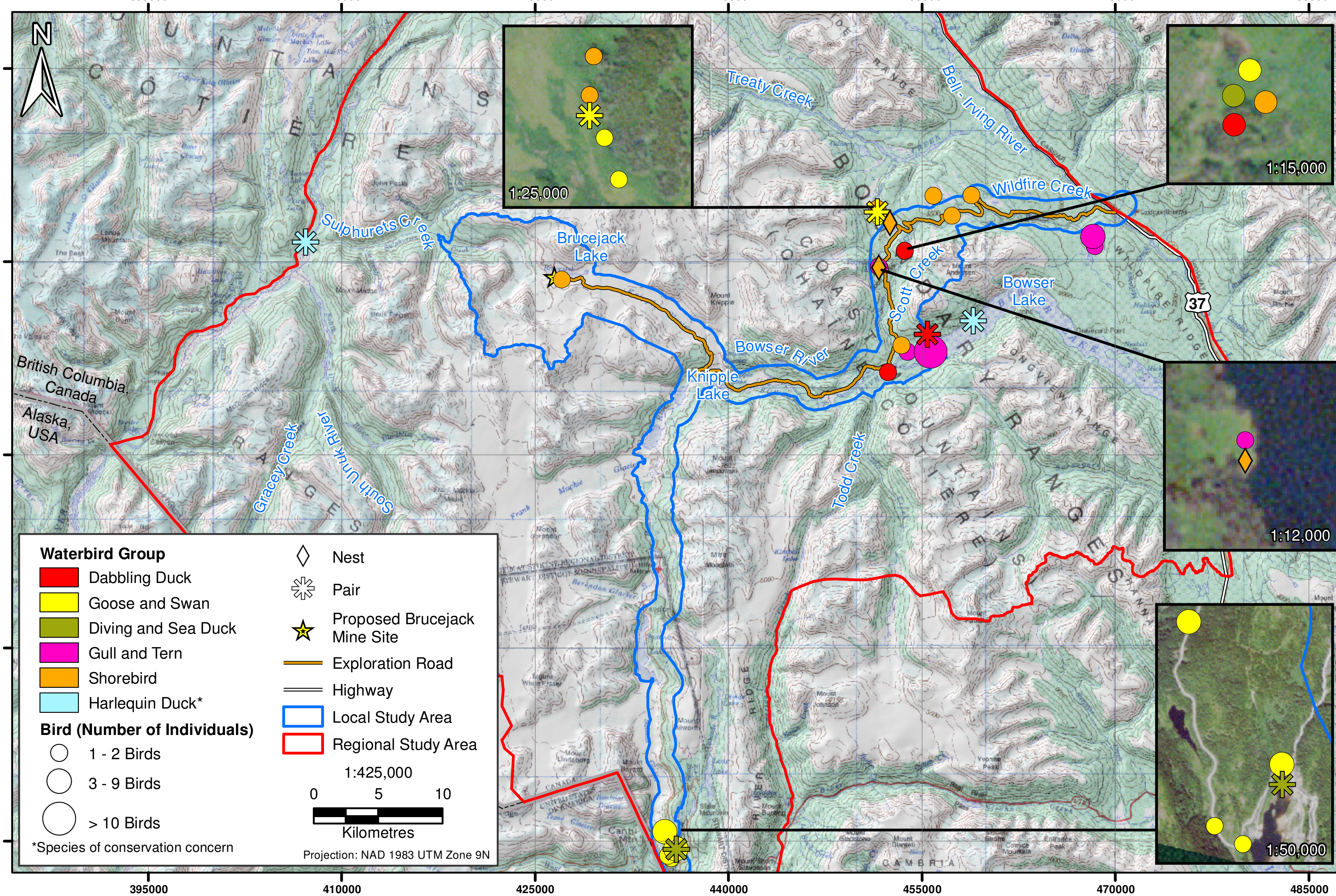

Figure 7.3-10

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Distribution of Incidental Observations of Waterbirds, 2010 and 2012

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Table 7.3-6. Incidental Observations of Waterbirds, 2010 and 2012

Group	Species	No. Observed 2010	2012	Total	Comment
Dabbling Duck	Blue-winged Teal	-	3	3	
	Mallard	-	3	3	
Diving Ducks	Barrow's Goldeneye	-	3	3	
Riverine Bird	Harlequin Duck*	-	4	4	Two pairs
Geese and Swans	Canada Goose	-	21	21	
Gulls and Terns	Arctic Tern	1	10	11	
	Bonaparte's Gull	2	5	7	
Shorebirds	Lesser Yellowlegs	-	2	2	
	Semipalmated Plover	4	-	4	
	Solitary Sandpiper	3	1	4	Two nests with 4 eggs per nest found in 2010
	Wilson's Snipe	-	3	3	
Total		**10**	**55**	**65**	

**Species of conservation concern*

7.3.5 Discussion

A total of 28 species and 3,639 individuals were observed in the RSA and LSA during baseline waterbird surveys in 2012. An additional four species were incidentally recorded during other wildlife surveys. The species richness of waterbirds in the Brucejack area is comparable to the number of species (25) found during baseline surveys conducted in 2008 and 2009 for the neighbouring KSM Project, which overlaps with the Brucejack RSA. The surf scoter, a species of conservation concern, was detected during fall staging surveys in the KSM study area, but was not detected in this baseline study. The most commonly observed species during Brucejack baseline surveys were ring-necked duck, mallard, Canada goose, American green-winged teal, and Barrow’s goldeneye.).It is important to monitor the spatial and temporal distribution and quantities of waterbirds that occur in the project area to correlate its habitat contribution to the Pacific Flyway, a major north-south migration route for migratory birds.

Three species of conservation concern were observed in 2012 including: harlequin duck, trumpeter swan, and great-blue heron. Eight breeding pairs of harlequin ducks were observed, most of which were within the LSA, along sections of the Bowser River and upper Sulphurets Creek. Two harlequin duck broods were observed in river or backchannel habitat, and the other was located on a high elevation, glacier-fed lake indicating that lakes connected to riverine habitat may be important for harlequin duck brood rearing. Of the 17 trumpeter swans that were observed, approximately half were found during spring staging in pond or marsh habitat near Border Lake, outside the LSA. One great-blue heron was observed during fall staging near Border Lake, in marsh habitat. Both of these species are typically associated with wetlands. Other wetland habitat within the LSA that might support great-blue herons includes areas along Todedada Creek, upper Bell-Irving River, and eastern Bowser River. Riverine habitat associated with large, mature cottonwoods; particularly along Bell-Irving River, Treaty Creek, and the confluence of Bowser Lake and Bowser River, could potentially be used for nesting heron colonies. However, the limited available food sources for herons; such as fish, amphibians, and small aquatic mammals, and the short growing season in the eastern part of the RSA likely restricts nesting. No evidence of nesting heron colonies were observed in the LSA.

During the staging surveys, it was found that overall abundance was greatest during the spring when over twice as many birds were observed compared to the fall. The extent of fall migration may be more prolonged than in spring, thus capturing a lower concentration of waterbirds at any particular point in time. Fall staging surveys for the KSM Project were conducted September 27, 2008 approximately two weeks earlier than the Brucejack fall staging surveys but a comparable number of individual birds (301) were detected (Appendix 7.3-5).These low concentrations during both surveys are explained by timing differences in migration of certain species. For example, species such as mallard, Barrow's goldeneye, common merganser, and trumpeter swan will either overwinter in the area or be among the last species to migrate south in the fall, whereas other species, such as northern shoveller and northern pintail, will be among the first species to migrate south (Austin and Miller 1995; Dubowy 1996; Mallory and Metz 1999; Eadie, Savard, and Mallory 2000; Drilling, Titman, and Mckinney 2002). Late fall migrants including mallards, Barrow's goldeneye, Canada goose, and common merganser were the most prevalent species detected during fall staging and few early migrants, such as northern shoveller, were detected, which indicates that surveys most likely hit the late peak or early tail end of fall migration for most species.

Important staging habitats include swamps, beaver ponds, shallow lakes, and low flow, meandering backchannels, and are found along the Bell-Irving River, Treaty Creek, Bowser River, and the lower Unuk River. These areas are usually the first to become ice-free in the early spring. Three large concentrations of waterbirds were observed within the LSA along Bowser River, Knipple Lake, and at the confluence of Bowser River and Bowser Lake during spring staging. The majority of fall staging waterbirds were found outside the LSA near Border Lake, along the upper Bell Irving River, and Snowbank Creek.

The timing of the spring staging and pair surveys enabled the detection of early (e.g., mallard, Canada goose, and northern pintail) and late (e.g., northern shoveller and greater scaup) migrants in large flocks. Large concentrations of waterbirds (> 200 individuals) were observed during the pair survey within the LSA at the confluence of Bowser River and Bowser Lake, and on Knipple Lake. The large number of birds suggests that these areas are important for early breeding pairs and late spring migrants, and that the peak or tail end of spring staging in the Brucejack Project area occurs approximately in mid-May. A large number of breeding pairs were also detected outside the LSA along Treaty Creek, Scott Creek, and the lower Bowser River, which contain numerous swamps, beaver ponds, and meandering backchannel habitats that many species prefer for breeding.

The largest abundances of birds were observed during staging (~800 birds) or pair surveys (> 2,000 birds) compared to the brood survey (< 300 birds), suggesting that the available habitat in the Brucejack RSA may be more important for staging than for breeding. These large congregations of staging waterbirds court and form breeding pairs that may either breed in the Brucejack area or continue migrating north to breed. Staging areas are critical to the overall life cycle of waterbirds because food and rest obtained in these areas provides energy necessary for survival during continued migration and nutrient reserves essential for successful reproduction upon arrival at breeding areas (Ankney and MacInnes 1978; Farmer and Parent 1997). Large portions of the Brucejack RSA are ice covered until early June; therefore, nesting habitat is likely limited. It should be noted that many of the important spring staging areas were also the locations where the majority of broods were detected.

A total of 37 broods were observed, the majority belonging to Barrow's goldeneye, mallard, and Canada goose. Breeding habitat was generally associated with calm, low flowing water bodies including ponds, lakes, and backchannels bordered by dense shrub and tree cover. The largest concentrations of broods within the LSA occurred along Bowser River and at the west end of Bowser Lake. Outside the LSA, large concentrations of broods were detected along Treaty Creek, at the northern end of the Bell Irving River, and in small lakes along Wildfire Ridge. These locations contain important tree and shrub cover that are used by many species to avoid predation, and some species will nest in the cavities of large trees. For example, most Barrow's goldeneye broods were observed along Treaty Creek and Todedada Creek, which are both bordered by large, mature cottonwoods and spruce that may provide suitable nesting cavities.

The Brucejack Project area is largely dominated by glaciers and mountain ranges restricting the available waterbird habitat to important, key areas. Waterbirds, for example, were not observed using Brucejack Lake, which is within the LSA next to the proposed Brucejack mine site. Brucejack Lake was likely unsuitable for foraging or nesting because of the short growing season for vegetation and extensive period which it is covered with ice. Areas within the RSA that contained the largest concentrations of staging waterbirds, breeding pairs, and broods included the extent of the Bowser River, shoreline areas of Bowser Lake, Snowbank Creek, upper and lower Bell-Irving River, and Treaty Creek, and thus are important areas to maintain for waterbirds. These results are consistent with previous studies conducted for the KSM Project (Appendices 7.3-3 to 7.3-6).

7.4 UPLAND BREEDING BIRDS

7.4.1 Introduction

Baseline studies were conducted on upland birds (i.e., passerines, hummingbirds, swifts, woodpeckers, grouse, and ptarmigan) in the Brucejack LSA during the breeding season in June, 2012. Upland breeding birds represent an abundant and diverse group that can be surveyed with relative ease (Hutto 1998). Generating baseline information on the distribution, habitat associations, and species composition of the upland bird community is useful to measure the health of bird communities. Birds are also considered to be effective indicators of overall ecosystem function and health (Niemi and McDonald 2004). Birds perform important ecological roles (e.g., pollinators), and often respond rapidly to environmental change (Koch, Derver, and Martin 2011). For example, declines in the abundance of birds associated with riparian forests have been used to measure degradation of riparian sites (Rich 2002).

Upland breeding birds and their nests are protected by the federal *Migratory Birds Convention Act* (1994a) and the provincial BC *Wildlife Act* (1996). Additional conservation measures may be recommended for those species identified by COSEWIC or required for those listed under the federal *Species at Risk Act* (SARA (2002).

7.4.2 Objectives

The objectives of baseline breeding bird surveys in the Brucejack LSA were to estimate the relative abundance and species richness of upland bird species, determine habitat associations of upland birds, and determine the locations of breeding territories of upland bird species of conservation concern in the LSA.

7.4.3 Methods

7.4.3.1 Variable Radius Point Counts

Relative to other wildlife, the forest bird community is relatively easily surveyed, because territorial males frequently sing to defend their territories. In some species, both members of breeding pairs use sound to mark territory boundaries (e.g., drumming by woodpeckers). Bird species can be identified by trained observers according to the unique songs and other sounds that breeding pairs make to defend territories.

The Variable Range Point Count (VRPC) is a common survey technique used to estimate species richness and relative abundance of forest birds (Ralph, Droege, and Sauer 1995). Observers stand quietly at survey stations (point counts) for a specified duration of time, to identify to species all birds seen and heard. To keep track of birds as they move around, bird detections are recorded within 25 m distance bands, according to their approximate distance from the observer. Using mostly auditory cues, the number of nesting pairs of each species can be counted at each station as a measure of relative abundance, as well as the total number of species detected (species richness). VRPC surveys are conducted when male birds more actively defend territories, which is usually in the morning during the nesting period in June.

Upland bird surveys were conducted from June 21 to 26, 2010, and from June 7 to 13, 2012, following standard VRPC inventory methods for songbirds (RIC 1999b). Surveys were conducted between sunrise (~4:30 a.m.), when birds are most active and sing most frequently, and continued until 10 am when bird activity declines. Point count stations were spaced at least 200 m apart. Surveys were not conducted when wind speeds exceeded approximately 30 km/h (5 on the Beaufort scale) or during rain or snow storms.

After allowing a one to two minute settling time after arriving at point count stations, observers recorded for five minutes all birds seen and heard within 100 m. All bird observations were assigned to a 25 m radii interval (i.e., 0 to 25 m, 25 to 50 m, 50 to 75 m, and 75 to 100 m). Detections of birds flying over the point count station and not landing, and birds detected beyond 100 m were recorded as incidental detections but were not included in any analyses. Observers recorded species, the number of birds, and the cues by which birds were detected (e.g., singing male, calling, visual, drumming). Observations of breeding behaviour, habitat descriptions, Biogeoclimatic Ecosystem Classification (BEC) zone, and weather were also recorded. Evidence of breeding activity included observations of nests, nest material carries, food carries, faecal sac carries, distraction displays, pair bonding, and copulation. Incidental observations of upland birds detected during other wildlife field inventories were also recorded and geo-referenced.

7.4.3.2 Study Design

Sampling was concentrated within the LSA along the exploration access road and Granduc access road. At the time of the surveys, the exploration access road had not been built; therefore, surveys in that area provide pre-construction data and will be referred to as non-roadside habitat for the remainder of Section 7.4. Some areas within the LSA along the Granduc access road (which is near the proposed southern option transmission line route), were not surveyed due to a lack of access, avalanche safety concerns, snow conditions and glaciated habitat. Nevertheless, representative habitats were evaluated in other areas of the LSA.

In roadside habitat, the Granduc Access Road within the LSA was considered one main 24 km transect with three 800 m sub-transects; point counts were spaced at least 1 km apart on the main transect and 200 m apart on the 800 m sub-transects. In non-roadside habitat, point counts were conducted along 800 m transects for a total of three to five point counts per transect. The starting point of each transect was randomly selected, and then observers located each transect start point using a handheld Garmin GPS 60 or 62s (advertised accuracy 3 to 15 m). Once at the start location, observers walked each transect along a randomly chosen compass bearing. Where obstructions (ridges, rivers, etc.) were encountered that prevented further travel along the bearing, transects continued along a new randomly chosen bearing.

A total of 142 VRPC stations were sampled in the LSA, 61 in 2010 and 81 in 2012 (Figure 7.4-1 and Figure 7.4-2; Table 7.4-1) and 2012 (41), and 40 were conducted along roadside habitat in 2012. Overall, the majority of plots were located in the ESSFwv (60), followed by ICHvc (49), CMAunp (23), BAFAunp (6), and MHmm (4) BEC zones. Sampling within the higher elevation BAFA and CMA BEC zones, in which the main deposit and project infrastructure occur, was limited because heavy snow packs restricted safe access to these areas in 2010 and 2012.

For each point count, relative abundance of each species was calculated as the number of breeding pairs per species, which was determined by translating detection cues into counts of breeding pairs (e.g., one singing male songbird represented one breeding pair). The numbers of breeding pairs (i.e., territory counts) per species per point count were then averaged. Frequency of occurrence for each species was measured as the proportion of all VRPC stations at which each species was detected.

Table 7.4-1. Survey Design to Relate Breeding Forest Birds to Habitat

Year	Habitat Type	BEC Zone		Number of Point Count Stations
2010	Non-Roadside	CMAunp		5
		ESSFwv		33
		ICHvc		23
			Subtotal	61
2012	Non-Roadside	CMAunp		4
		ESSFwv		16
		ICHvc		21
			Subtotal	41
2012	Roadside	BAFAunp		6
		CMAunp		14
		ESSFwv		11
		ICHvc		5
		MHmm		4
			Subtotal	40
Total				**142**

7.4.3.3 Habitat Associations

To relate birds to habitat, point count stations were stratified according to two broad habitat types – BEC Zone, and roadside (along gravel logging roads) and non-roadside (Table 7.4-1). Non-roadside stations were a minimum distance of 200 m from logging roads. In 2010 and 2012, point count stations were located in one of three BEC Zones, which were classified using Terrestrial Ecosystem Mapping (TEM) and Predictive Ecosystem Mapping (PEM) to the subzone level: Coastal Mountain-heather Alpine undifferentiated and parkland (CMAunp), Engleman Spruce–Subalpine Fir wet very cold (ESSFwv), Interior Cedar-Hemlock very wet cold (ICHvc). Within these BEC Zones, point counts were conducted in both non-roadside habitat in 2010 and 2012, and additionally along roads in 2012. Two additional BEC Zones were sampled in 2012 along roads - Boreal Altai Fescue Apline undifferentiated and parkland (BAFAunp), and Mountain Hemlock windward moist maritime (MHmm1). To relate birds to smaller scale habitats, TEM and PEM were used to classify forest structural stage at each point count station.

To quantify community-level differences across broad scale habitats, average species richness and relative abundance (counts of breeding pairs for all forest bird species combined) were compared across the two broad habitat categories (roadside versus non-roadside, and BEC subzone). Generalized Linear Modelling (Poisson regression) was used to determine whether there were differences in species richness and relative abundance between the survey years, roadside versus non-roadside, and BEC Zones, and along and off roads (CMA, ESSF, ICH). An interaction term was added to the model to determine whether differences in species richness and relative abundance across BEC Zones were similar across both survey years.

To quantify the habitat associations of individual species, relative abundance per species was compared across the two broad habitat categories using only the 2012 data. However, both 2010 and 2012 data were pooled between the two categories of forest structural stage - shrubby, open-seral (structural stages zero to three) and mature forest (structural stages four to seven). Quantification of the habitat associations of individual species was limited to commonly detected species, defined as those occurring at > 20% of point count stations.

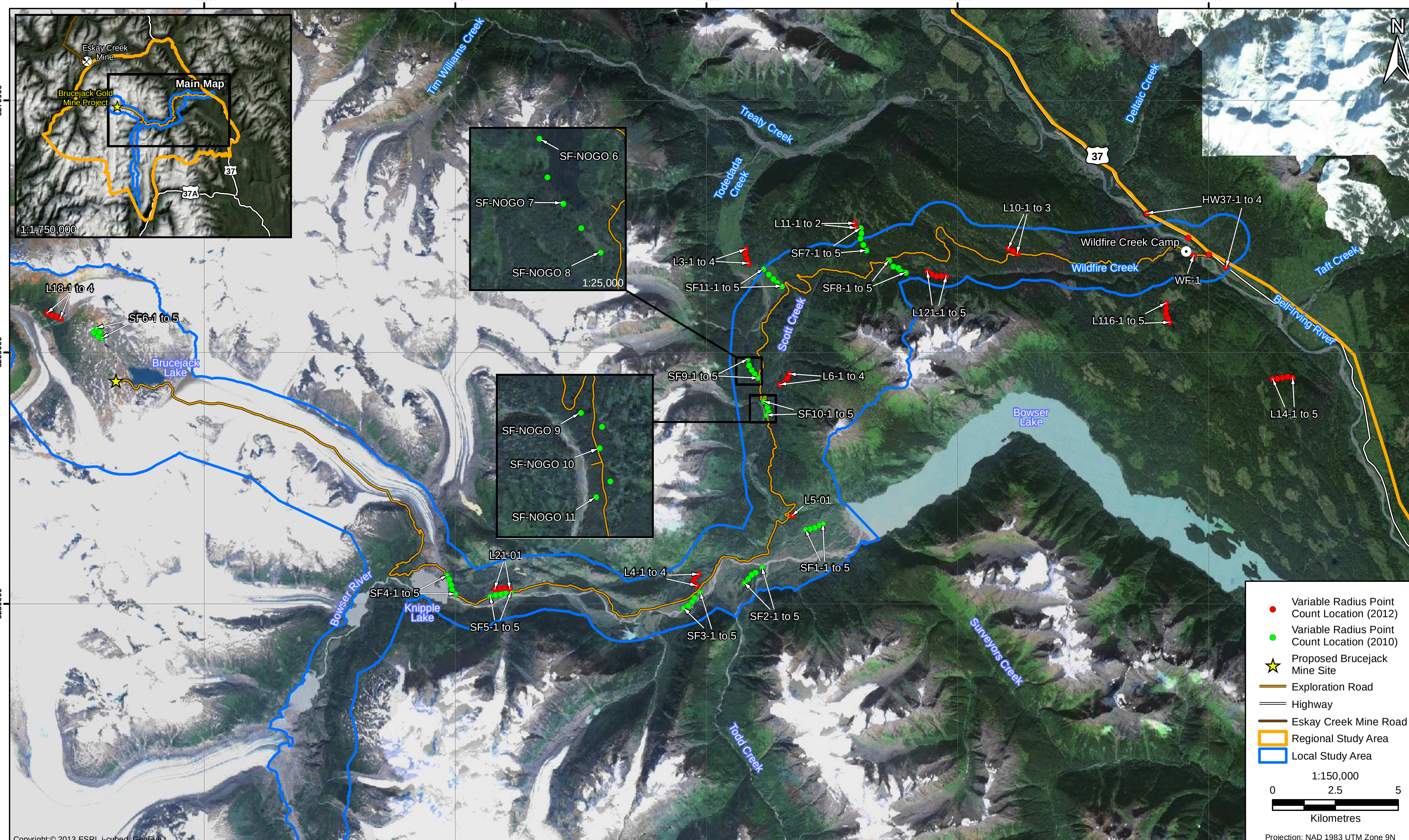

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Figure 7.4-1

Breeding Bird Variable Radius Point Count (VRPC) Central Survey Locations, 2010 and 2012

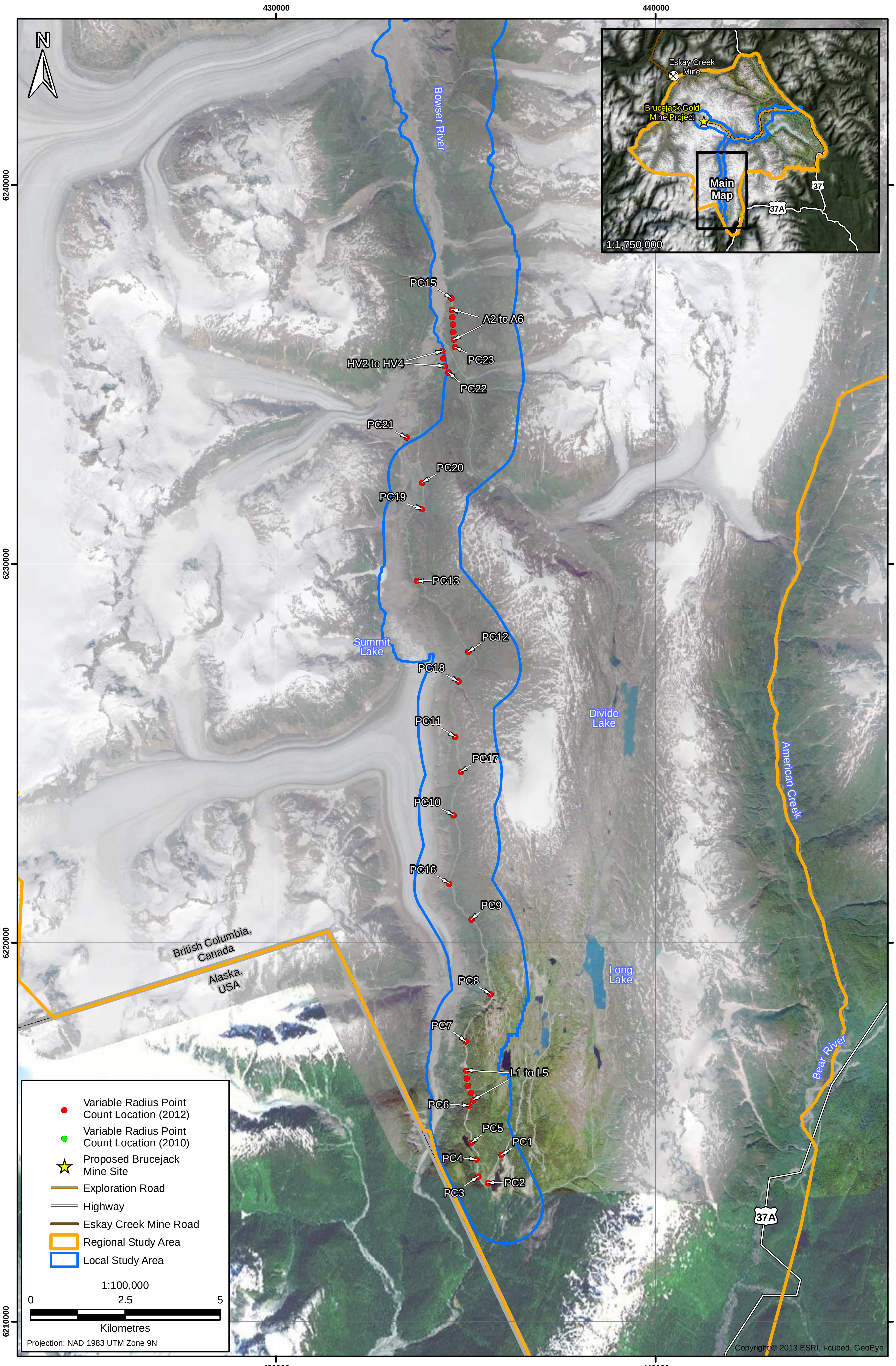

Figure 7.4-2

Breeding Bird Variable Radius Point Count (VRPC) Southern Survey Locations, 2010 and 2012

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Figure 7.4-2

7.4.4 Results

7.4.4.1 Variable Radius Point Count Surveys

<u>Summary</u>

A total of 1,155 individuals of 1,119 territories of upland breeding birds representing 55 species were counted during point count surveys in 2010 and 2012 (Table 7.4-2; Appendix 7.4-1 to 7.4-6). An additional 408 birds of 9 additional species were incidentally recorded. Ten common species, defined as those detected in more than 20% of point counts: Swainson's thrush, varied thrush, dark-eyed junco, ruby-crowned kinglet, Wilson's warbler, yellow-rumped warbler, yellow warbler, pine siskin, Townsend's warbler, and hermit thrush (Table 7.4-2; Plate 7.4-1). Three species of conservation concern were observed: barn swallow (BC Blue listed), olive-sided flycatcher (BC Blue listed), and sooty grouse (BC Blue listed).

a)

b)

c)

d)

Plate 7.4-1. Commonly detected breeding bird species observed during VRPC surveys in 2010 and 2012: a) male yellow warbler; b) male Wilson's warbler; c) male varied thrush; and d) pine siskin of unknown sex.

Table 7.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, 2010 and 2012

Common Name	Scientific Name	Average Territory Count	S.E.	Frequency of Occurrence
Swainson's Thrush	*Catharus ustulatus*	0.76	0.10	0.40
Varied Thrush	*Ixoreus naevius*	0.71	0.07	0.47
Dark-eyed Junco	*Junco hyemalis*	0.57	0.08	0.36
Ruby-crowned Kinglet	*Regulus calendula*	0.56	0.07	0.35
Wilson's Warbler	*Cardellina pusilla*	0.53	0.06	0.39
Yellow-rumped Warbler	*Setophaga coronata*	0.50	0.07	0.32
Yellow Warbler	*Setophaga petechia*	0.47	0.08	0.25
Pine Siskin	*Carduelis pinus*	0.40	0.09	0.22
Townsend's Warbler	*Dendroica townsendi*	0.40	0.06	0.29
Hermit Thrush	*Catharus guttatus*	0.38	0.07	0.23
Fox Sparrow	*Passerella iliaca*	0.30	0.06	0.18
Black-capped Chickadee	*Poecile atricapillus*	0.23	0.05	0.16
Pacific Wren	*Troglodytes pacificus*	0.20	0.04	0.15
Savannah Sparrow	*Passerculus sandwichensis*	0.18	0.05	0.11
American Robin	*Turdus migratorius*	0.15	0.04	0.13
Red-breasted Nuthatch	*Sitta canadensis*	0.15	0.04	0.11
Golden-crowned Kinglet	*Regulus satrapa*	0.15	0.04	0.11
Chipping Sparrow	*Spizella passerina*	0.14	0.04	0.09
Golden-crowned Sparrow	*Zonotrichia atricapilla*	0.14	0.04	0.11
Hammond's Flycatcher	*Empidonax hammondii*	0.11	0.03	0.08
Alder Flycatcher	*Empidonax alnorum*	0.09	0.03	0.06
Gray-cheeked Thrush	*Catharus minimus*	0.09	0.03	0.05
Blackpoll Warbler	*Dendroica striata*	0.05	0.02	0.04
Sooty Grouse	*Dendragapus fuliginosus*	0.05	0.02	0.04
Western-wood Peewee	*Contopus sordidulus*	0.05	0.02	0.04
Northern Waterthrush	*Seiurus noveboracensis*	0.04	0.02	0.04
American Pipit	*Anthus rubescens*	0.03	0.02	0.02
Brown Creeper	*Certhia americana*	0.03	0.02	0.02
Warbling Vireo	*Vireo gilvus*	0.03	0.01	0.03
American Tree Sparrow	*Spizella arborea*	0.02	0.02	0.01
*Barn Swallow	*Hirundo rustica*	0.02	0.02	0.01
Gray Jay	*Perisoreus canadensis*	0.02	0.01	0.02
Mountain Chickadee	*Poecile gambeli*	0.02	0.02	0.01
Orange-crowned Warbler	*Oreothlypis celata*	0.02	0.02	0.01
Purple Finch	*Carpodacuz pupureus*	0.02	0.02	0.01
American Three-toed Woodpecker	*Picoides dorsalis*	0.01	0.01	0.01
Common Yellowthroat	*Geothlypis trichas*	0.01	0.01	0.01

(continued)

Table 7.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, 2010 and 2012 (completed)

Common Name	Scientific Name	Average Territory Count	S.E.	Frequency of Occurrence
MacGillivray's Warbler	*Oporornis tolmiei*	0.01	0.01	0.01
*Olive-sided Flycatcher	*Contopus cooperi*	0.01	0.01	0.01
Say's Phoebe	*Sayornis saya*	0.01	0.01	0.01
Song Sparrow	*Melospiza melodia*	0.01	0.01	0.01
Veery	*Catharus fuscescens*	0.01	0.01	0.01
Winter Wren	*Troglodytes troglodytes*	0.01	0.01	0.01
American Dipper	*Cinclus mexicanus*	0.01	0.01	0.01
Black-backed Woodpecker	*Picoides arcticus*	0.01	0.01	0.01
Bushtit	*Psaltriparus minimus*	0.01	0.01	0.01
Chestnut-backed Chickadee	*Poecile rufescens*	0.01	0.01	0.01
Magnolia Warbler	*Setophaga magnolia*	0.01	0.01	0.01
Mountain Bluebird	*Sialia currucoides*	0.01	0.01	0.01
Northern Flicker	*Colaptes auratus*	0.01	0.01	0.01
Pine Grosbeak	*Pinicola enucleator*	0.01	0.01	0.01
Ruffed Grouse	*Bonasa umbellus*	0.01	0.01	0.01
Rufous Hummingbird	*Selasphorus rufus*	0.01	0.01	0.01
Townsend's Solitaire	*Myadestes townsendi*	0.01	0.01	0.01
White-crowned Sparrow	*Zonotrichia leucophrys*	0.01	0.01	0.01
Western Tanager	*Piranga ludoviciana*	0.01	0.01	0.01

**Species of conservation concern*

In order to determine whether sampling effort was adequate to describe the upland breeding bird community, rarefaction was used to generate a species accumulation curve (SAC). The SAC for this study begins to level at the maximum survey effort (142 point counts), indicating relatively low detection rates of new species with additional survey effort (Figure 7.4-3). Using the Chao Estimator (Chao et al. 2009), estimated species richness was 66 species, and an estimated 36 additional point counts would be needed to detect all species present in the LSA.

In general, areas with the highest average bird abundance and highest species richness were in the eastern half of the LSA, including Scott Creek near Todedada Lake, the Bowser River (within 2 km of the Granduc airstrip, and near the south end of the proposed southern option transmission line route), and areas within 2 to 5 km of Highway 37 (Figure 7.4-3 and Figure 7.4-4).

<u>Upland Breeding Bird Community Level Analysis</u>

Generalized Linear Modelling revealed that species richness and the relative abundance of upland breeding birds differed between roadside and non-roadside habitats, and between the CMA, ESSF, and ICH BEC Zones (regression slopes for each factor were significantly different from one another at $P < 0.05$). However, the year by BEC Zone interaction relationship was also significant, indicating that species richness and relative abundance differed between years within some, but not all BEC Zones.

The BEC zone within non-roadside habitat that had the greatest average number of territories and average species richness was ICH (Figure 7.4-5a; maximum species richness shown above bars).

On average, the CMA BEC Zone supported fewer breeding pairs (2.3 ± 1.4) and fewer species (2.0 ± 0.9) per VRPC station than the ESSF BEC Zone, which was similar in richness and abundance to the ICH BEC Zone. Both the average number of territories and the average number of species were significantly lower in 2010 than in 2012 at non-roadside VRPC stations in BEC Zones CMA and ICH, but not within ESSF (Figure 7.4-5). Because differences were not consistent across all BEC Zones, it was assumed that differences were “true” year effects, and not due to differences in the bird detection ability of observers. Therefore, data from non-roadside VRPC stations were pooled across years to derive estimates of species richness and relative abundance for each BEC Zone (Figure 7.4-5a).

Species richness and relative abundance were consistently higher along roadsides than at non-roadside VRPC stations across all three BEC Zones. Averaged over all BEC Zones, more species (1.2 ± 0.54) and more breeding pairs (2.3 ± 0.90) were detected along roadside VRPC stations than at non-roadside stations. To quantify differences in the bird community between roadside and non-roadside VRPC stations, the confounding effect of year differences in bird abundance was removed by using only 2012 data (Figure 7.4-5c).

<u>Species Level Analysis</u>

During 2010 and 2012, ruby-crowned kinglets and the Swainson’s thrush were twice as abundant in mature forest as in open-seral shrub habitat, while the distribution of the hermit thrush showed the opposite pattern (Figure 7.4-6). Differences in abundance between mature forest and open-seral shrub habitat were smaller and not statistically significant (non-overlapping error bars) for the remaining eight common species, three of which were more abundant in mature forest, and four in open-seral shrub habitat.

Some species showed clear patterns in distribution with respect to the BEC subzones. Four species (Swainson’s thrush, Wilson’s warbler, Townsend’s warbler, and yellow warbler) were not detected in the higher elevation BAFAunp zone (Figure 7.4-7a and Figure 7.4-7b). The dark-eyed junco and Wilson’s warbler were more abundant in the CMAunp and MHmm; in CMAunp average overall bird abundance and species richness were relatively low. Along with the CMAunp, the hermit thrush was most abundant in BAFAunp. The ruby-crowned kinglet was not detected in MHmm. All species were detected in the remaining three BEC zones (Figure 7.4-7a and Figure 7.4-7b).

To avoid the confounding effect of differences in relative abundance between survey years, only the 2012 data were used to compare relative abundances of common species between roadside and non-road sites in each BEC Zone (Figure 7.4-7). Despite low samples sizes along roads in the ICHvc and at non-road sites in the CMAunp, several distinct patterns in species distribution are apparent from these data. Four of the ten common species showed different abundance at roadside VRPC stations – the Swainson’s thrush and yellow-rumped warbler were more abundant along the road, while the varied thrush and ruby-crowned kinglet were more abundant at non-roadside VRPC stations (Figure 7.4-7). No clear patterns with respect to the roadside VRPC stations were discernible for the remaining six common species.

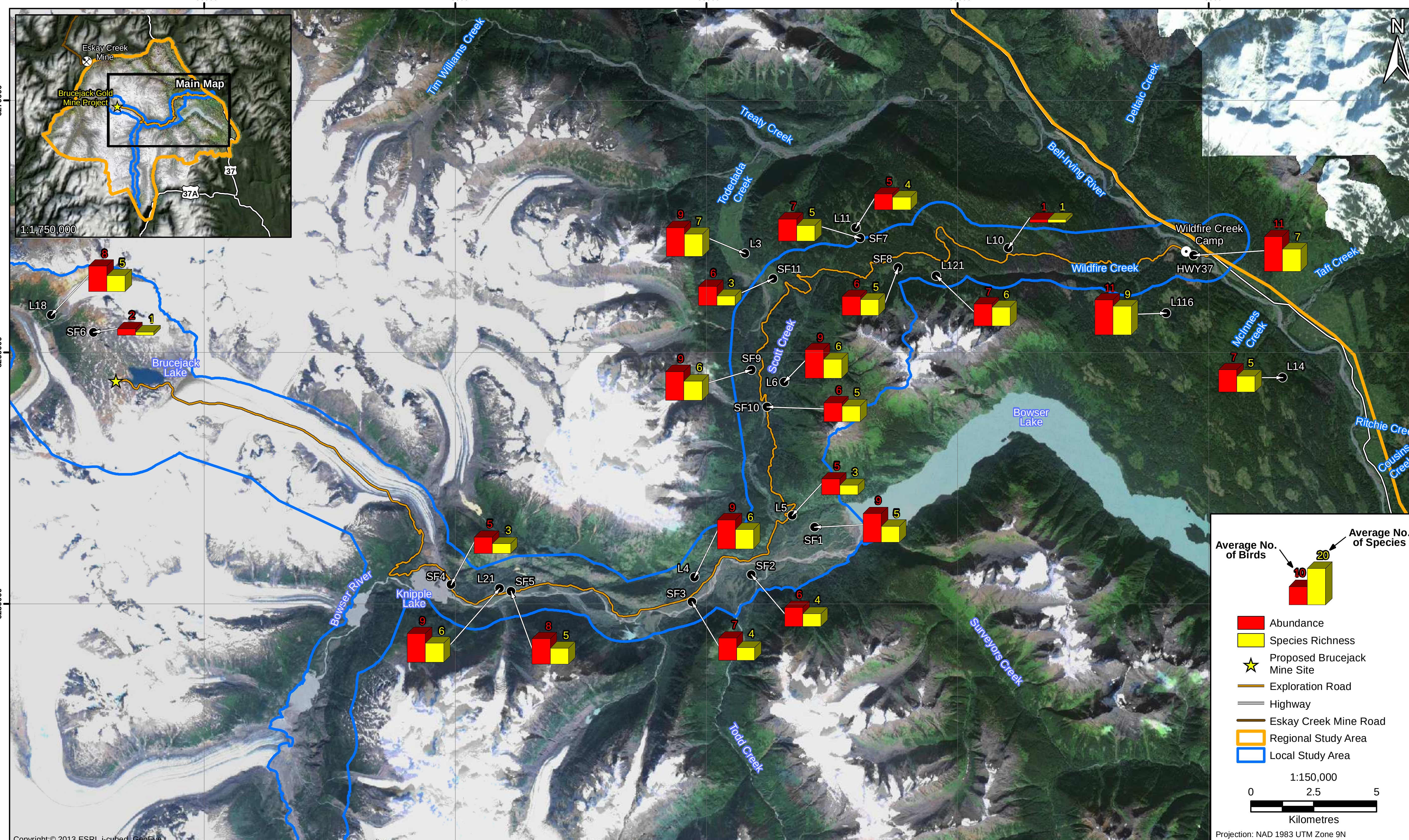

Figure 7.4-3

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Abundance and Species Richness of Upland Breeding Birds at Central VRPC Transects and Stations, 2010 and 2012

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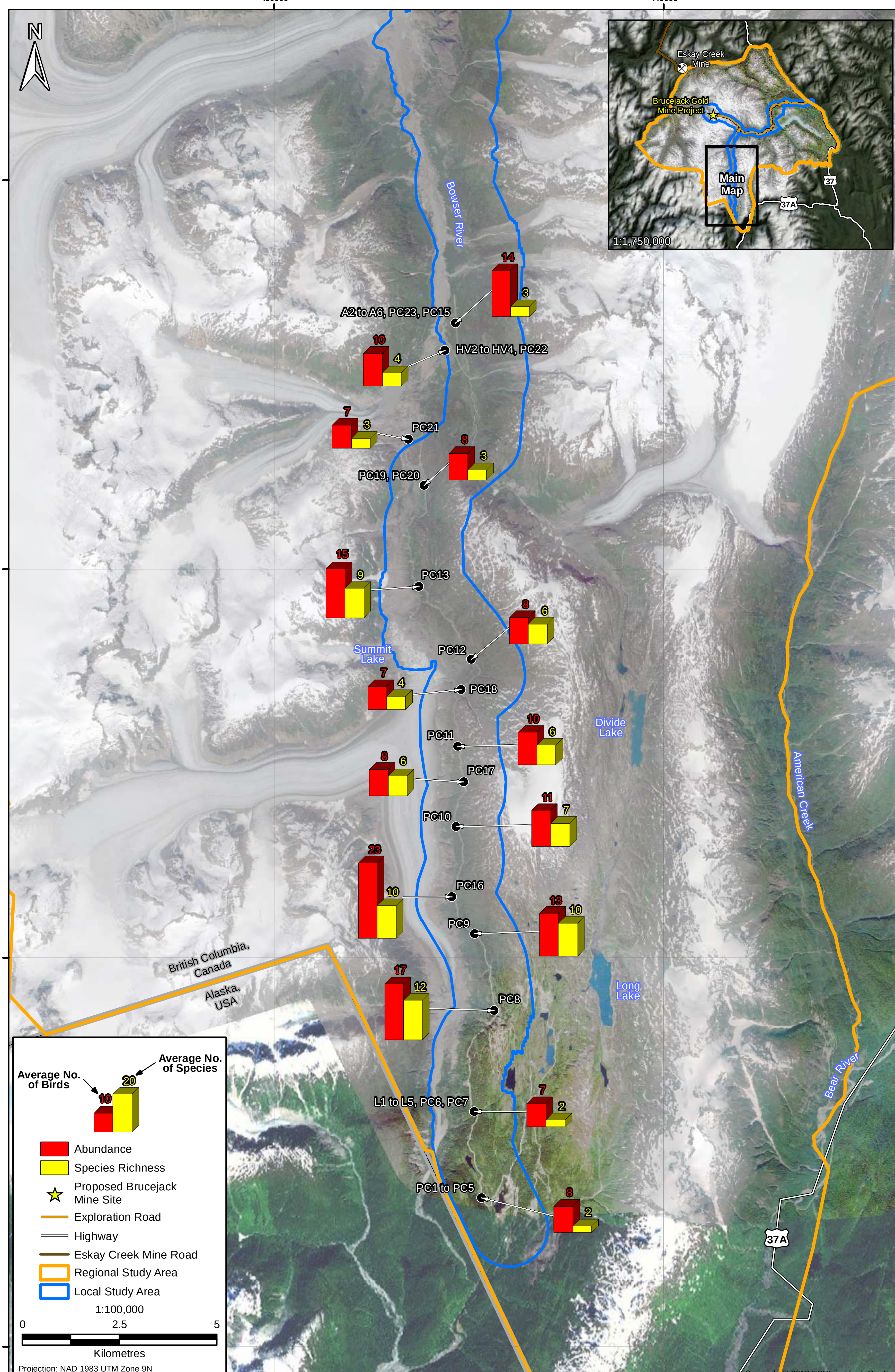

Figure 7.4-4

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Abundance and Species Richness of Upland Breeding Birds at Central VRPC Transects and Stations, 2010 and 2012

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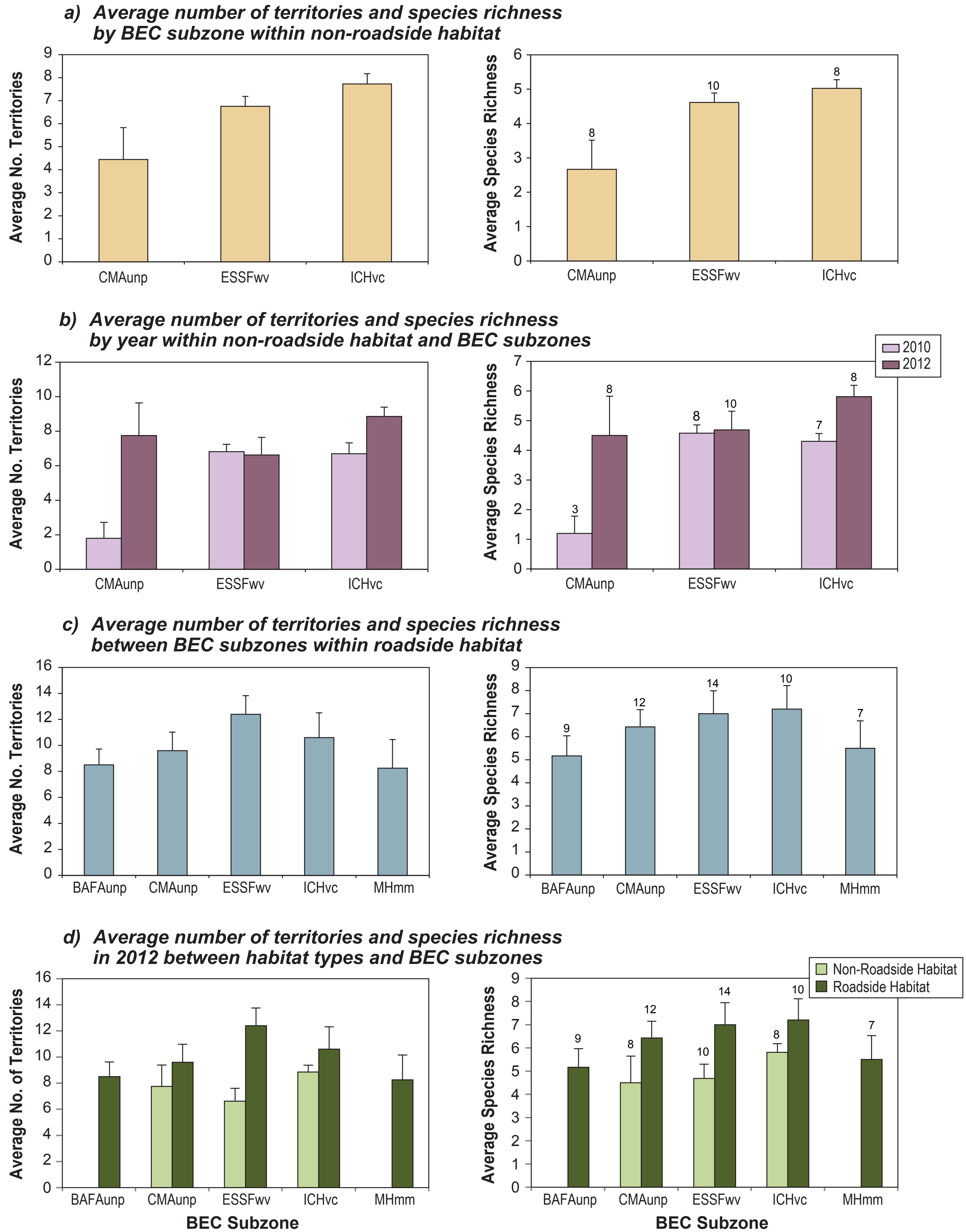

Note: Error bars represent standard error of the mean.
Numbers above bars represent species totals.

Figure 7.4-5

Distribution of Upland Breeding Bird Community in Broad Habitat Types and Subzones, 2010 and 2012

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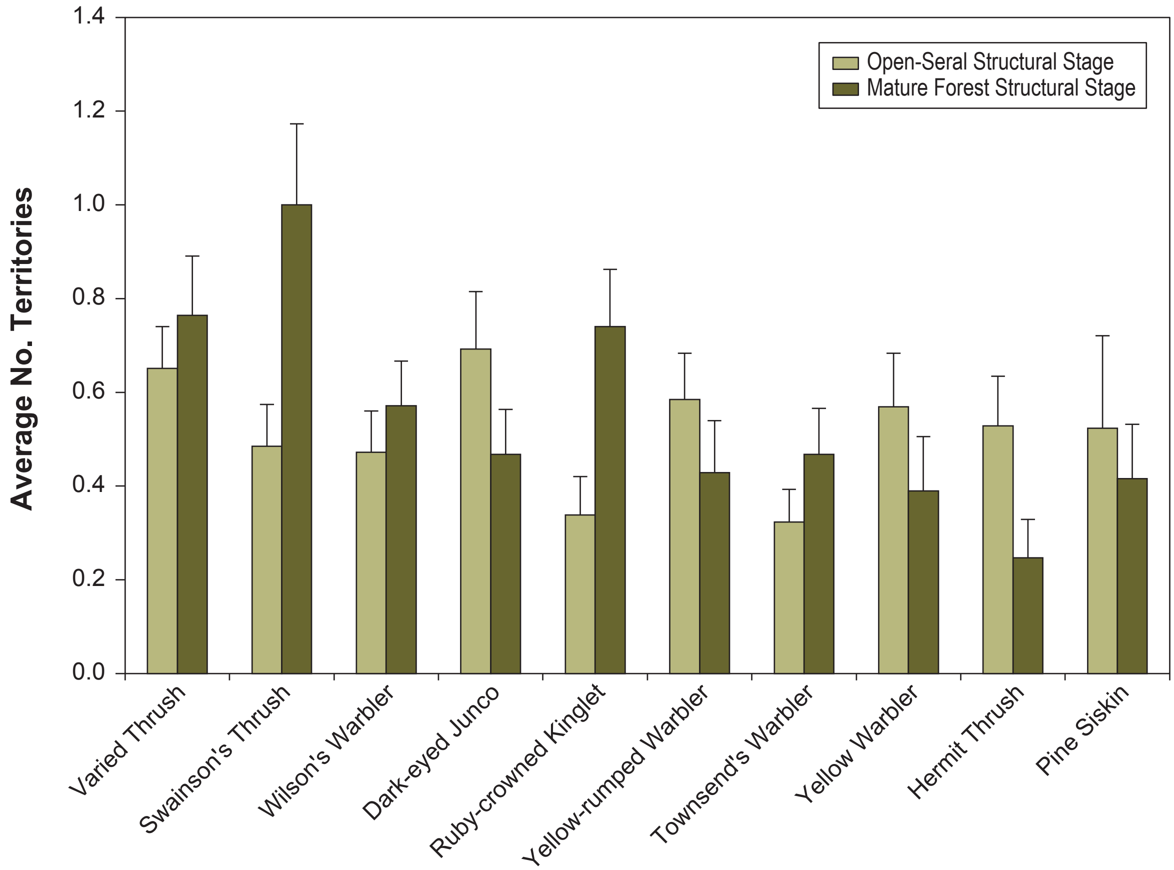

Notes: Error bars represent standard error of the mean.
Average number of territories pooled across 2010 and 2012 and BEC subzones.

Figure 7.4-6

Distribution of Common Bird Species in Structural Stages, 2010 and 2012

PRETIVM

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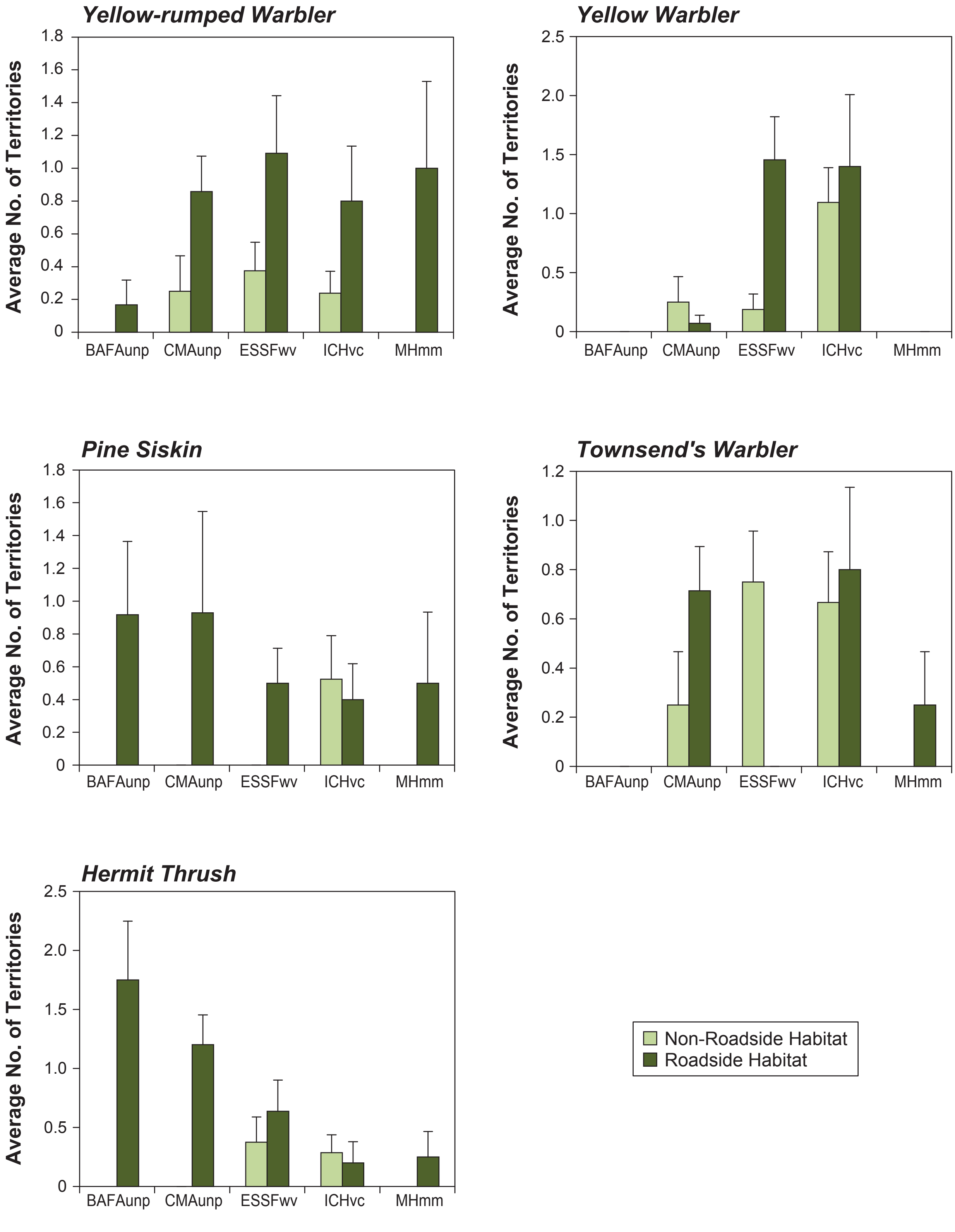

Notes: Error bars represent standard error of the mean.
BAFAunp and MHmm were not sampled in Non-Roadside Habitat.

Figure 7.4-7a

Distribution of Common Bird Species in Broad Habitat Types and BEC Subzones, 2012

PRETIVM

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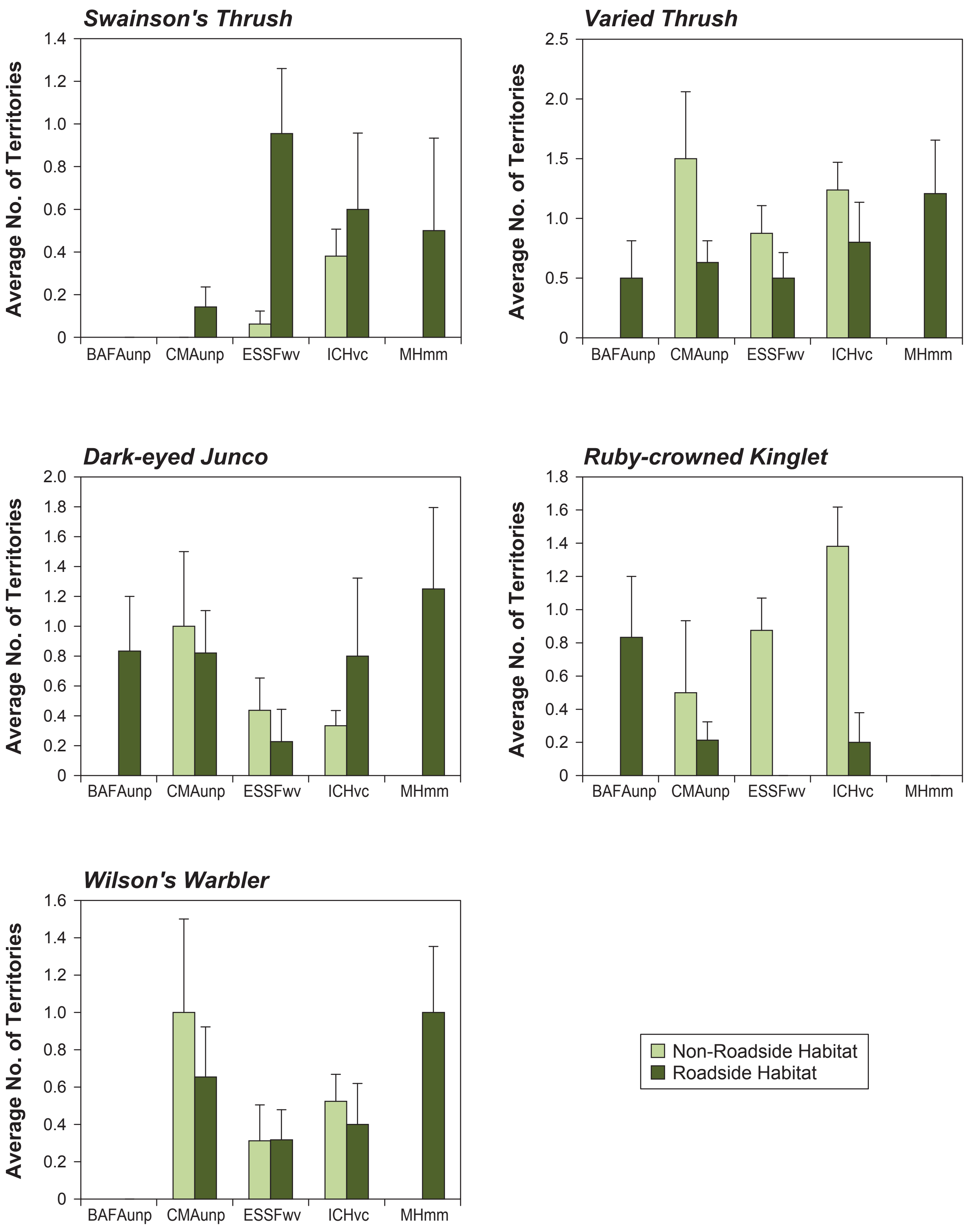

Notes: Error bars represent standard error of the mean.
BAFAunp and MHmm were not sampled in Non-Roadside Habitat.

Distribution of Common Bird Species in Broad Habitat Types and BEC Subzones, 2012

Figure 7.4-7b

7.4.4.2 *Breeding Activity*

Six nests were observed within the LSA during VRPCs in 2010 and 2012 (Table 7.4-3; Figure 7.4-8). Nests of three species (barn swallow, dark-eyed junco, and Say's phoebe) were found in 2010, and a Mountain bluebird nest was found in 2012. Barn swallows displayed nesting behaviour (e.g. pair bonding) in both years near buildings at the Brucejack Exploration Camp and Wildfire Creek Camp, suggesting that nests may have been present (Table 7.4-3). The Wildlife Creek Camp was a construction camp supporting construction of the exploration access road. Two barn swallow nests with nestlings were incidentally observed on July 24, 2012 at Wildfire Creek Camp. All young fledged from the nests by August 2, 2012 (Plate 7.4-2). Most nests and nesting behaviour of barn swallows observed occurred in disturbed habitat (near roads or buildings) in the ICHvc and CMAunp BEC subzones (Plate 7.4-3).

Table 7.4-3. Evidence of Reproduction and Nesting Behaviour, 2010 and 2012

Species	Year	No. of Nests	No. of Eggs	Behaviour	Habitat Type	BEC Zone
Barn Swallow	2010	1	NA	Incubating	Building at Brucejack Exploration Camp	CMA
Barn Swallow	2010	-	-	Pair Bonding; Potential nest close by	Building at Brucejack Exploration Camp	CMA
Dark-eyed Junco	2010	2	5, 4	Incubating; Flushed	Dry Forest	ICH
Say's Phoebe	2010	1	6	Incubating; Flushed	Building at Brucejack Exploration Camp	CMA
Barn Swallow	2012	1	NA	Incubating	Tunnel along Disturbed Roadside Creek	BAFA
Barn Swallow	2012	2	4, 3	Pair Bonding; Fledglings observed in July	Buildings at Wildfire Creek Camp	ICH
Mountain Bluebird	2012	1	NA	Material Carry	Trailer near Wildfire Creek Camp	ICH

**Comma denotes a separate nest and NA = number of eggs unknown.*

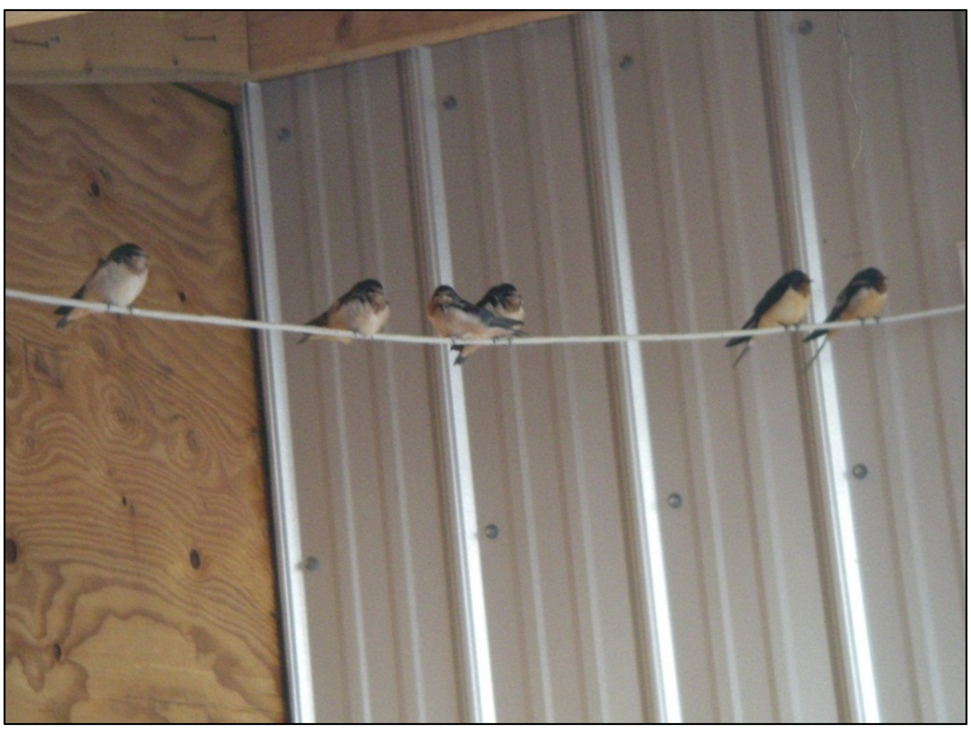

Plate 7.4-2. Four barn swallow fledglings and two adults observed August 2, 2012 at Wildfire Camp.

Plate 7.4-3. Barn swallow nest observed June 23, 2012 along the proposed transmission line at VRPC station PC 13 within a tunnel structure.

7.4.4.3 Species of Conservation Concern

Four species of conservation concern (barn swallow, olive-sided flycatcher, rusty blackbird, and sooty grouse) were observed during VRPC surveys or incidentally during other wildlife baseline surveys (Figure 7.4-8). The barn swallow was observed near Brucejack Exploration Camp in 2010 in barren alpine habitat, and again in 2012 at Wildfire Creek Camp in ICH mesic to wet shrub habitat, either nesting or displaying nesting behaviour near human-made structures. The barn swallow is on the BC blue list and designated as 'threatened' by COSEWIC (BC CDC 2013a; SARA 2013).

Six olive-sided flycatchers were detected near large forest openings and along roadsides. In 2012, the olive-sided flycatcher was observed during VRPC surveys in roadside habitat in ESSF barren and MH moist to mesic forest habitat and in a cut-block in ICH mesic forest habitat during raptor standwatch surveys. The olive-sided flycatcher is ranked on the BC blue list as 'vulnerable to apparently secure' during the breeding season, and is also designated as Threatened on Schedule 1 under the *Species at Risk Act* (BC CDC 2013a; SARA 2013). Also in 2012, the rusty blackbird was observed incidentally in the RSA in ICH moist, nutrient rich, mature forest habitat adjacent to wetland habitat during the grizzly bear DNA surveys. The rusty blackbird is on the BC blue list, and is listed on Schedule 1 as of Special Concern under the *Species at Risk Act* (BC CDC 2013a; SARA 2013).

Seven sooty/dusky grouse were detected by sound only, and thus could not be identified to species. One sooty grouse was observed in 2012 along the proposed southern option transmission line route between VRPC station PC 6 and PC 7 within alpine dry to mesic herb and shrub habitat in the CMAunp BEC subzone (Figure 7.4-8 and Plate 7.4-4). The sooty grouse is blue-listed in BC, and the dusky grouse is listed provincially as not at risk.

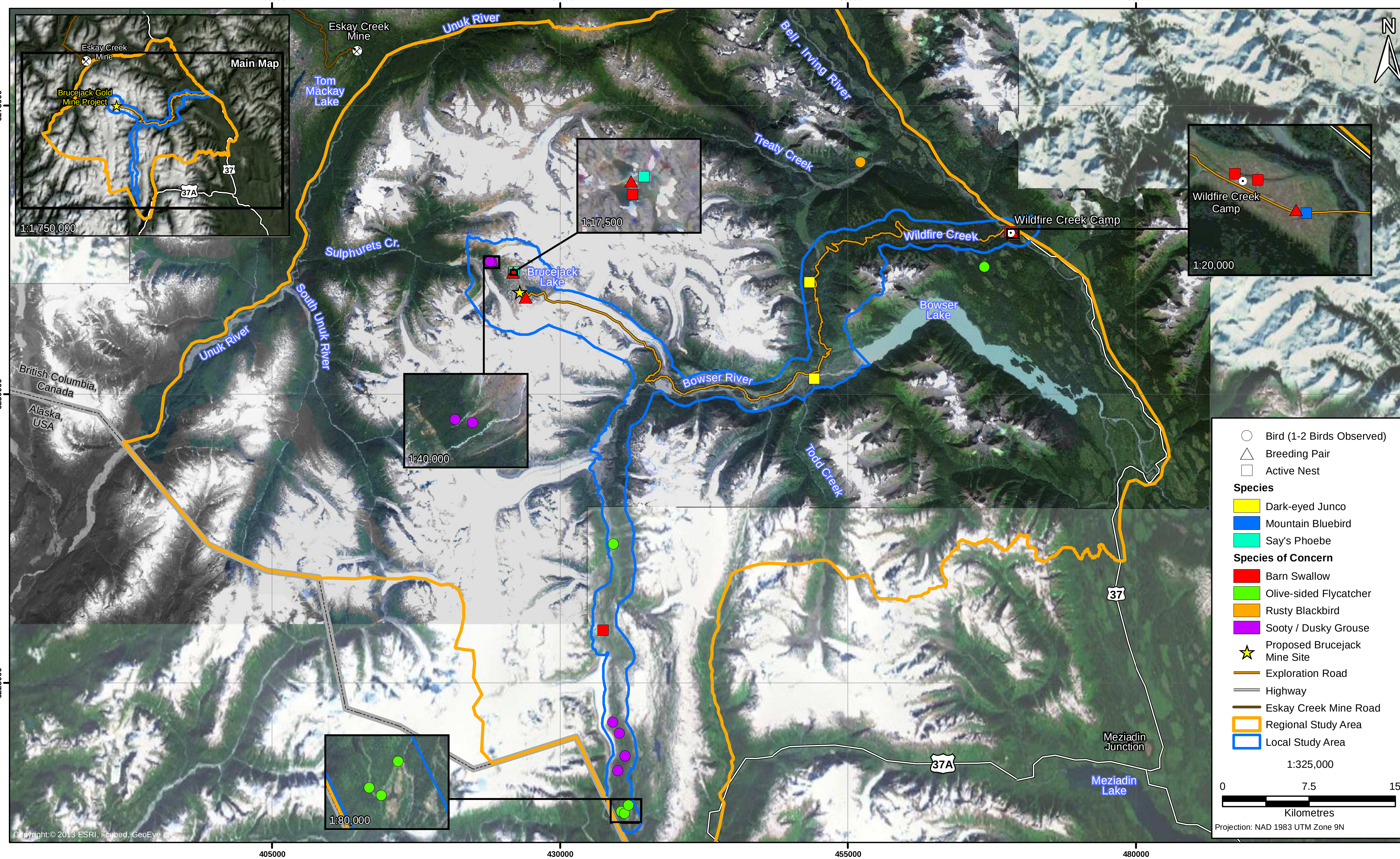

Figure 7.4-8

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Evidence of Reproduction and Species of Conservation Concern, 2010 and 2012

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Plate 7.4-4. Sooty grouse observed June 23, 2012 along the proposed transmission line between VRPC stations PC 6 and PC 7.

7.4.5 Discussion

A total of 1,155 individuals of 1,119 breeding territories representing 55 upland bird species were detected during baseline point count surveys in the Brucejack LSA. Using rarefaction, an estimated 66 species occurred in the study area, of which 83% (55 of 66) were detected. Thus, it is concluded that sampling effort was adequate to describe the upland breeding bird community.

Four species of conservation concern were observed within the LSA and RSA, all of which have been listed as at risk due to population decline. The olive-sided flycatcher (Threatened) and rusty blackbird (Special Concern) are listed on Schedule 1 of *SARA*. The barn swallow has been assessed by COSEWIC as Threatened, and the sooty grouse is provincially listed as Threatened on the BC Blue List. Barn swallows have adapted to living in urban areas and often build nests on vertical surfaces of human-made structures, such as under the eaves of buildings, in culverts, and under bridges. Four barn swallow nests were found within human-constructed infrastructure within the LSA.

One other species of conservation concern, the common nighthawk, may occur in the LSA, but was not detected during baseline studies. During baseline studies in the Galore Creek area (approximately 87.5 km away from the Brucejack RSA),the common nighthawk was observed along the lower Stikine River in floodplain habitat dominated by soap berry shrubs and cotton grass (RTEC 2006a, 2007b). Habitat likely to be supportive of common nighthawks is found along the upper Bowser River in the Brucejack RSA.

On average, more upland bird species and breeding territories were observed in roadside habitats compared to non-roadside habitat during VRPC surveys. Roadside habitat is often associated with dense shrubby vegetation and exposed areas of grasses and forbs, which provide preferred nesting and foraging habitat for some bird species (Hutto et al. 1995). In this study, the Swainson’s thrush and yellow-rumped warbler were detected more frequently along roadsides. In particular, the Swainson's thrush was found most abundantly along roads through mature forest. Both of these species are known to occur often along forest edges, such as roadsides through forests (Mack and Yong 2000).

In contrast, the varied thrush, which prefers shaded forest (George 2000) and the ruby-crowned kinglet, which often forages and nests in conifer tree canopies (Swanson, Ingold, and Wallace 2008), were found more often at non-roadside sites in mature forest, probably because their preferred resources were more abundant there.

On average, fewer breeding pairs and fewer species of upland birds were detected in the high elevation alpine CMA and BAFA BEC Zones, in which the main deposit and project infrastructure occur. In this study, Swainson's thrush, Wilson's warbler, Townsend's warbler, and yellow warbler were not detected in the BAFA Zone. These species are typically found at lower elevations, where the shrubs and trees they use for nesting and foraging are more abundant. The yellow warbler in particular is found at lower elevations, where it breeds in moist, deciduous forests especially in riparian corridors with abundant shrubs (Lowther et al. 1999).

Despite limited sampling in the alpine, the pattern of low bird abundance in alpine areas that was observed in this study parallels findings of low abundance and species richness of alpine bird communities in general (Martin 2001). However, despite low abundance, the alpine bird community is unique (Martin 2001). Two characteristic alpine species, Say's phoebe and American pipit, were rarely detected in this study, but detections only occurred in the higher elevation CMA BEC zone. The commonly-detected hermit thrush, which is closely related to the Swainson's thrush and tends to replace it at higher elevations (Mack and Yong 2000), was most abundant in the higher elevation BAFA and CMA BEC zones.

8. Amphibian Community

8. Amphibian Community

8.1 OVERVIEW

The valley bottom floodplains and large wetland drainage systems located throughout the Brucejack RSA provide suitable habitat for amphibians (Plate 8.1-1). There are six amphibian species expected to occur in or near the region surrounding the proposed Brucejack Project (Table 8.1-1): western toad (*Anaxyrus boreas)*, Columbia spotted frog (*Rana luteiventris*), wood frog (*Lithobates sylvaticus*), long-toed salamander (*Ambystoma macrodactylum*), northwestern salamander (*Ambystoma gracile*) and roughskin newt (*Taricha granulosa*; (Stebbins 2003; BC CDC 2013b). Western toads are the only listed amphibian species. They are blue listed in BC and are a species of Special Concern under COSEWIC. Hence, the wildlife characterization baseline for amphibians focuses on western toad.

Plate 8.1-1. Wetland amphibian habitat found in the Brucejack study areas.

Table 8.1-1. List of Amphibian Species Potentially Occurring within the Brucejack Study Areas

Common Name	Species Name	BC Status	Federal Status (COSEWIC)
Western Toad	*Anaxyrus boreas*	Blue List	Special Concern
Columbia Spotted Frog	*Rana luteiventris*	Yellow List	Not at Risk
Wood Frog	*Lithobates sylvaticus*	Yellow List	Not Assessed
Long-toed Salamander	*Ambystoma macrodactylum*	Yellow List	Not at Risk
Northwestern Salamander	*Ambystoma gracile*	Yellow List	Not at Risk
Roughskin newt	*Taricha granulosa*	Yellow List	Not Assessed

8.2 WESTERN TOAD

The western toad is provincially blue-listed, and is protected under the British Columbia *Wildlife Act* (1996), which states that western toads cannot be killed, collected, or held in captivity without a permit. Federally, it has been designated a species of Special Concern by COSEWIC (COSEWIC 2002), and is listed on Schedule 1 of the *Species at Risk Act* (BC CDC 2013b), which requires monitoring under section 79(2; (SARA 2012). The western toad is red-listed as near threatened by the International Union for Conservation of Nature (IUCN) for being at risk of extinction in the wild and it is the only international red-listed amphibian in Canada (Wind and Dupuis 2002; IUCN 2013).

British Columbia has recognized the importance of protecting wetland breeding sites because of the key role they play in supporting source populations for surrounding areas (BC MWLAP 2004a). Adult toads are capable of travelling over five kilometres to breeding sites, and occasional excursions of up to seven kilometres have been noted (Davis 2002). Migrations typically span several days, with a significant proportion of the local population travelling to breeding sites within a few hours of each other (COSEWIC 2002). Toadlets also migrate but do not appear to move more than 300 m from their natal site within the first year (Pyare 2005).

Western toad breeding habitat is variable, and includes open water wetlands, the shallow margins of lakes, and seasonal pools such as ditches. They breed more frequently in areas with habitat characteristics that promote higher water temperatures, such as shallow and/or muddy margins, low water flow, and open forest canopy. They can utilize temporary ponds, including large puddles and roadside ditches, because they typically provide warm water with some movement and emergent vegetation (Pyare et al. 2005; C. E. Stevens, Paszkowski, and Stringer 2006). High water temperature promotes larval growth and differentiation rates, which strongly determine developmental time and toadlet size (Smith-Gill and Berven 1979; Ultsch, Bradford, and Freda 1999).

Metamorphosing tadpoles and toadlets will form post-metamorphic aggregations (PMAs) at the edge of natal waterbodies (COSEWIC 2002). These PMAs will occur throughout the species' range by midsummer (COSEWIC 2002). The PMAs are likely a function of deteriorating productivity in the natal waterbody, and may provide some level of protection from environmental conditions and predators. Complete metamorphosis from egg to toadlet takes approximately three months.

Chytridiomycosis (chytrid disease) is an amphibian skin disease caused by the fungus *Batrachochytrium dendrobatidis,* which has been responsible for declines in western toad and other amphibian populations (COSEWIC 2002). The chytrid fungus cultivates rapidly at lower temperatures, exposing amphibian populations that inhabit colder climates to potential outbreaks (COSEWIC 2002). Therefore, supplementary chytrid disease screening was conducted during baseline field studies.

Baseline studies focused on identifying western toad breeding habitat within the LSA because of its conservation designations and its sensitivity to disturbance. Migratory behaviour, seasonal aggregations, fluctuations in breeding success, high turnover rates, dependence on ephemeral ponds, and their highly permeable skin make western toads particularly vulnerable to changes in environmental conditions caused by human activities or natural events (COSEWIC 2002; Pyare 2005). The other amphibian species that potentially occur within the RSA select similar habitat for breeding and foraging. They are all yellow-listed (apparently secure) in BC (BC CDC 2013b).

8.2.1 Objectives

Amphibian baseline studies were conducted in 2012, and limited to the LSA due to concerns over potential direct effects of the proposed development on breeding areas. The objectives of the baseline study were to document western toad breeding areas, and determine occupancy of other amphibian species in the LSA.

8.2.2 Methods

Amphibian surveys were conducted in July 2012. Both aerial and ground-based surveys were conducted, focusing on sensitive and ecologically important habitat types, particularly in areas where proposed infrastructure may have the greatest influence on toads. The assessment was completed for the LSA and an additional wetland area within the RSA north of Bowser Lake, that was selected because of proximity to the LSA, potential for migratory road crossing risks and the extent of potential high value habitat in that area relative the rest of the RSA. Disease screening was conducted to identify the presence of chytrid fungus.

8.2.2.1 Aerial Survey

An aerial reconnaissance survey was flown on July 23, 2012 to identify potential western toad breeding habitat within the LSA. Characteristics of highly suitable breeding habitat included low elevation, low water flow, south facing aspects, muddy banks, open canopy, and emergent vegetation (Pyare 2005). Sites meeting these criteria were typically historic back channels of rivers, blown out beaver dams, and shallow edged ponds or lakes. Priority was given to sites within 500 m of the exploration access road, and other proposed infrastructure in the LSA.

8.2.2.2 Ground Survey

<u>Systematic Presence/Not Detected Survey</u>

Sites that were classified as highly suitable during aerial reconnaissance were ground-verified with perimeter searches. Sites that were ranked as moderately suitable because they consisted of some (but not all) of the high value site characteristics were also assessed on the ground if they were in close proximity to a high suitability site.

Field assessments followed the BC standards for amphibian inventory using presence/not detected survey techniques (RIC 1998e). Surveys and handling of amphibians adhered to the BC Ministry of Forests Lands and Natural Resource Operations (MFLNRO) permit SM12-79768. Survey timing in late summer corresponded to the period when western toadlets would be easily detected as aggregate groups along margins of water bodies (COSEWIC 2002).

The Visual Encounter Survey (VES) technique (Crump and Scott 1994; Leonard, Bury, and Olson 1997) and net sweeps were used to examine water bodies, shorelines, and the adjacent terrestrial habitat for evidence of breeding (i.e., tadpoles and emerging toadlets). Observers did not communicate with each other for the duration of the timed survey, so as to reduce disturbance and improve detectability during surveys. Water temperature, elevation, and other habitat characteristics were recorded at identified breeding sites. Amphibians were classified into two broad life stages: breeding (tadpole, metamorph/toadlet, and yearling) or adult (> 2 years of age). Photographs were taken whenever it was possible to clearly see the amphibians or capture them by net. Amphibians were handled using powder-free latex gloves, and standard protocols were followed to sterilize field gear to minimize the transfer of pathogens and toxins (e.g., insect repellent, hand moisturizers).

<u>Disease Screening</u>

Disease screening followed the methodology developed by the Amphibian Research and Monitoring Initiative (Pyare 2005; Brem, J.R. Mendelson III, and Lips 2007; BC Wildlife Health Program 2008). Amphibians were examined for malformations and other signs of disease, including posture, behaviour and other abnormalities. A skin swab was collected from a western toad and analysed for chytrid.

8.2.3 Results

8.2.3.1 Aerial Surveys

Western toad breeding potential was assessed during aerial surveys at 66 wetland sites on July 23, 2012 (Plate 8.2-1). Twenty-four sites were selected for additional ground surveys based on characteristics that made them likely to support western toad breeding.

Plate 8.2-1. Potential toad breeding habitat.

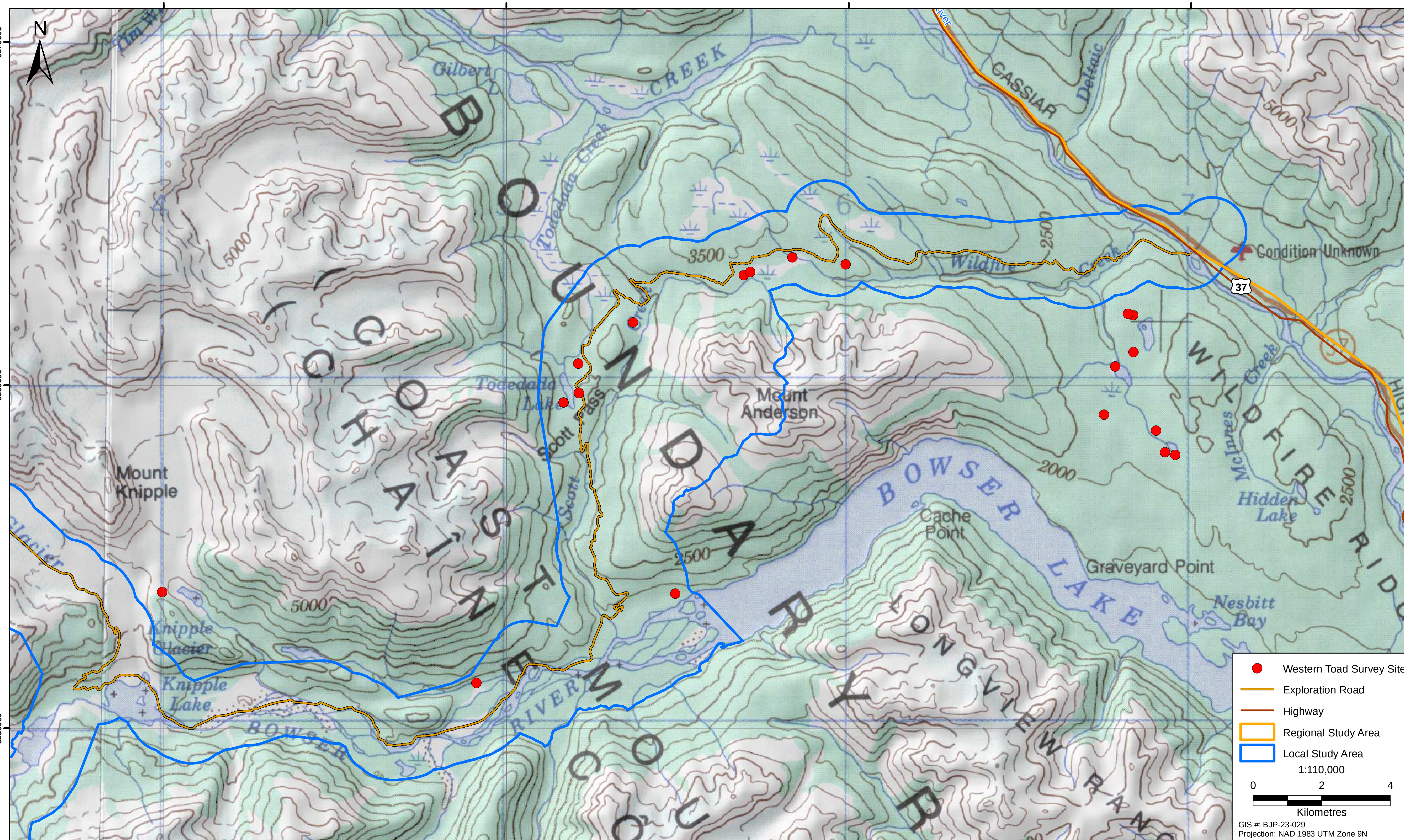
8.2.3.2 Ground Surveys

Western toad surveys were conducted from July 23 to July 28, 2012 within the LSA and in an area near the LSA due to proximity to previously proposed infrastructure in the Wildlife Creek area (Figure 8.2-1). Western toads were observed at 10 sites (five sites were within the LSA), and Columbia spotted frogs were observed at 14 sites (Figure 8.2-2; Plates 8.2-2 to 8.2-5). In total, seven adult western toads and 78 adult Columbia spotted frogs were observed (Table 8.2-1; Appendix 8.2-1). A total of 14 amphibian breeding sites were identified (Table 8.2-1). Western toad breeding sites were identified within the LSA (Figure 8.2-2).

Table 8.2-1. Ground Survey Amphibian Observations, Brucejack (2012)

Species	Detection Sites	Breeding Sites	Adult Sites	# of Adults Observed
Western Toad	10	7	6	7
Columbia Spotted Frog	14	8	14	78
Total*	18	14	16	85

* *Some sites contained both western toad and Columbia Spotted frog observations, whereas some were unique to a single species.*



PRETIVM Rescan Engineers & Scientists

Figure 8.2-1

2012 Brucejack Gold Mine Project
Western Toad Survey Sites

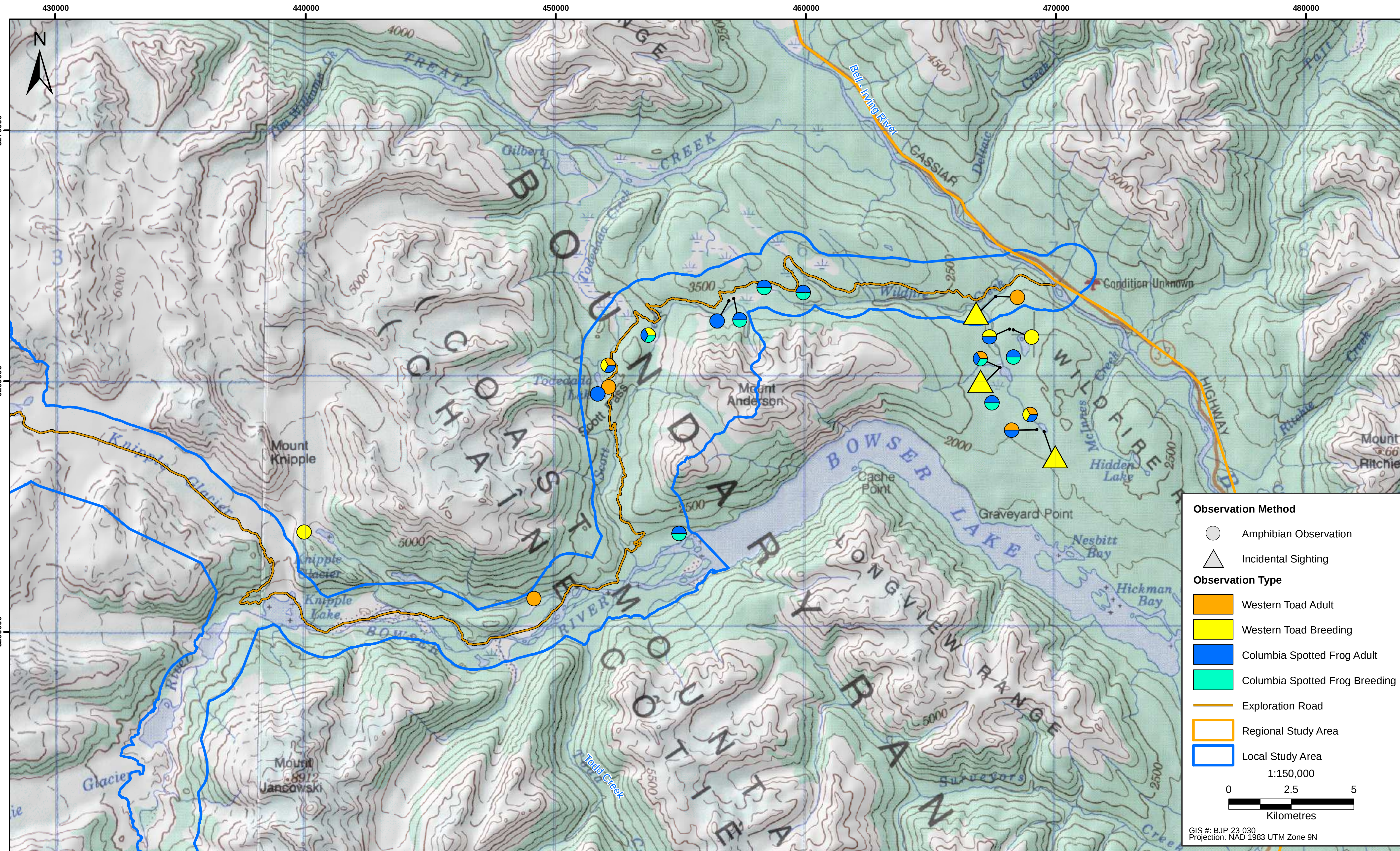


Figure 8.2-2

2012 Brucejack Gold Mine Project
Amphibian Observations

PRETIVM
Rescan Engineers & Scientists

Plate 8.2-2. An adult western toad dip-net capture at Pond 1, July 24.

Plate 8.2-3. A western toad at Pond 6, July 28.

Plate 8.2-4. A western toad at Potential Toad Site 22, July 27.

Plate 8.2-5. Western toad tadpoles at Pond 5, July 27.

8.2.3.3 Incidental Observations

A western toad breeding site was identified incidentally on July 3, 2011 by wildlife personnel. Tadpoles were observed. This site was re-visited in 2012, but only a single adult was observed. Western toad toadlets were observed incidentally by Rescan personnel conducting fisheries surveys on August 30, 2012 (Figure 8.2-2; Plate 8.2-6; Table 8.2-1). Three adult western toads were observed in the Wildlife Creek on Aug 1, 2012 (Figure 8.2-2).

Plate 8.2-6. Incidental toadlet found in 2012 just beyond the southern edge of the LSA.

8.2.3.4 Western Toad Breeding Habitat

Western toad breeding habit was identified at seven sites during amphibian surveys and at two sites incidentally (Figure 8.2-2; Table 8.2-2; Appendix 8.2-1). Seven (78%) western toad breeding sites were located within five km of the exploration access road, and six (67%) were less than 2 km away (Figure 8.2-2; Table 8.2-2). Two sites were less than 250 m from the access road. Tadpoles or toadlets were observed exclusively at four sites each, while only one site had both metamorphic stages.

Table 8.2-2. Western Toad Breeding Habitat Site Characteristics, Brucejack 2012

Survey Date	Breeding Stage	Water Temp (°C)	Elevation (m)	Distance from Road (m)	Habitat Type
03-Jul-11	tadpoles	unk	612	2,844	wetland/lake edge
25-Jul-12	juveniles and toadlets	unk	733	34	unk
25-Jul-12	toadlet and tadpoles	19.2	653	244	wetland/lake edge
25-Jul-12	toadlet	N/A	646	550	terrestrial dispersing
26-Jul-12	tadpoles	25.6	681	1,657	pond, near road culvert
26-Jul-12	tadpoles	28.0	676	1,580	pond, near road culvert
27-Jul-12	tadpoles	22.7	1001	1,677	pond: alpine pool
28-Jul-12	juveniles and toadlets	20.1	654	5,034	pond, near road culvert
30-Aug-12	toadlets	unk	646	5,834	wetland

The temperature at western toad breeding sites ranged from 19.2°C to 28.0°C (mean 22.5°C). With one exception, western toad breeding sites occurred within a narrow range in elevation (between 612 m and 733 m). A correlation was not found between developmental stage and elevation given that the range in elevation between sites was narrow and the sample size relatively small. All but one of the sites were within the ICHvc (Interior Cedar Hemlock very wet cold) biogeoclimatic (BEC) zone (Integrated Land Management Bureau 2013). The breeding site not within ICHvc was within the Mountain Hemlock BEC zone and had the relatively distinct higher elevation of 1001 m.

8.2.3.5 Disease Screening Sampling

A tissue swab sample was collected from an adult western toad captured on July 25, 2012 at Toad Site 13 (UTMs: 9 V, Easting 452111, Northing 6259782). The sample was analysed by molecular PCR tests at the Abbotsford Animal Health Centre and it was found to be negative for the chytrid fungus *Batrachochytrium dendrobatidis* (Appendix 8.2-2).

8.2.4 Discussion

Determining the presence of amphibian species of conservation concern and identifying their critical habitats can inform future Project planning. The western toad is a species of conservation concern that appears on provincial, federal, and international conservation listings. Particularly important for western toads is the removal of migratory barriers between breeding areas (Carr and Fahrig 2001). Maintaining breeding habitat and connectivity at a regional scale is important for supporting populations of a migratory amphibian that can travel up to 7 km from its natal pond, and is potentially vulnerable to human disturbance.

Collectively, the breeding sites located during these studies likely represent the largest overall extent of potentially suitable western toad breeding habitat within the RSA. The LSA consisted of many high value habitat types due to the exploration access road location along relatively low elevation corridors through mountain passes with multiple connected waterbodies and wetlands (e.g., Bower River, Bowser Lake, Wildfire Creek, Scott Creek, Knipple Lake, Todedada Creek, Todedada Lake, and the Bell-Irving River).

Important Western toad habitat identified near proposed Project activities were: the two breeding sites on each side of the road near Scott Creek that were 250 m from the road, the breeding site also near Scott Creek but closer to the Todedada Creek wetland area that was 550 m from road, and the zone of low elevation ICH habitat along Wildfire Creek with the multiple breeding sites located in the wetland habitat south of the road (Figure 8.2-2).

Of particular note was the breeding habitat located within the RSA, north of Bowser Lake where five amphibian breeding sites were observed (Figure 8.2-2). This location is a regionally important area for western toads. The habitat is connected to multiple potential breeding sites along the eastern boundary of the RSA, enhancing its significance for supporting source populations and presenting a potential risk for habitat fragmentation and road mortality issues with habitat areas that cross the exploration access road.

The long winters, potential for flash floods in many areas, and alpine influence limit the overall availability of suitable breeding habitat throughout the RSA (Rescan 2010b). Additional corridors of potentially suitable riparian habitat do exist within the RSA along areas such as Treaty Creek and Unuk River, but they are infrequent and relatively isolated in the mountainous terrain.

Confirmed breeding in the LSA is consistent with previous studies conducted for the KSM Project which had a study area overlapping the Brucejack RSA. KSM studies identified three western toad breeding sites along Teigen creek and in an unnamed lake connected to Teigen Creek (Appendix 8.2-3).

Some differences in developmental stage was observed at the nine breeding sites in the LSA, with four sites containing only tadpoles, four sites containing only toadlets/juveniles, and one site containing a mix of tadpoles and toadlets. This is potentially due to differences in micro-habitat conditions that can influence temperatures and therefore the onset of breeding, hatching and the timing of tadpole metamorphosis (COSEWIC 2002). Some breeding sites may undergo migratory movements one to two months later than others due to those conditions (COSEWIC 2002). Determining the timing of breeding on a site specific scale or within a seasonal risk work window is the only way to ensure effective migratory mitigation measures. The variability between sites that determines the onset of breeding necessitates pre-construction surveys unless permanent measures are installed.

The ICHvc zone has habitat characteristics that can support western toad breeding within the RSA. Most sites (8 of 9) were in this BEC zone because of moisture, nutrients, elevation and associated vegetation types (Integrated Land Management Bureau 2013). The ICHvc zone is primarily located along the entire eastern boundary of the RSA and was surveyed where the exploration access road is located. There may be more breeding sites within this zone. Interestingly one of the three KSM breeding sites from regional surveys was also located in the ICHvc zone.

Chytrid disease was not detected in this study, or during baseline studies for the neighbouring KSM project (Rescan 2010); however, sample sizes are too small to conclude the absence of the disease. A comprehensive study on the prevalence of chytrid disease in regional amphibian populations has not been undertaken, and the distribution of the fungus that causes this disease is unknown (Deguise and Richardson 2009).

In addition to the western toad, baseline surveys confirmed Columbia spotted frog breeding in several ponds in the LSA. Previous studies have also confirmed the presence of wood frog in the regional area (Rescan 2010b). These amphibians have similar seasonal life requisites for breeding, however, may have slight variations in fine scale habitat selection, as only one breeding site was shared between Columbia spotted frog and western toad, but many were in close proximity (Figure 8.2-2).

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Rescan
Engineers and Scientists

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Appendix 5-1

Potentially Occurring Vertebrate Species in the Wildlife Study Area

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Appendix 5-1. Potentially Occurring Vertebrate Species in the Wildlife Study Area

Common Name	Scientific Name	Likelihood of Occurrence	Detected During Regional Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area[1]					Conservation Status					
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank
Herpetiles															
Columbia Spotted frog	*Rana luteiventris*	L	Y	resident_hibernator		X	X	X	X	S4	Yellow		NAR		G4
Long-toed salamander	*Ambystoma macrodactylum*	L	N	resident_hibernator	X	X	X	X		S4S5	Yellow		NAR		G5
Northwestern salamander	*Ambystoma gracile*	U	N	resident_hibernator		X			X	S4S5	Yellow		NAR		G5
Roughskin newt	*Taricha granulosa*	P	N	resident_hibernator		X				S4S5	Yellow				G5
Western toad	*Anaxyrus boreas*	L	Y	resident_hibernator		X	X	X	X	S3S4	Blue		SC	1-SC	G4
Wood frog	*Lithobates sylvaticus*	P	Y	resident_hibernator				X		S4	Yellow				G5
Common garter snake	*Thamnophis sirtalis*	U	N	resident_hibernator		X				S5	Yellow				G5
Birds															
Red-throated loon	*Gavia stellata*	L	N	breeder		X				S4B	Yellow				G5
Common loon	*Gavia immer*	L	Y	breeder	X	X	X	X	X	S5B	Yellow		NAR		G5
Canada goose	*Branta canadensis*	L	Y	breeder	X	X	X	X	X	S5	Yellow				G5
Green-winged teal	*Anas crecca*	L	Y	breeder		X		X		S5B,S5N	Yellow				G5
Mallard	*Anas platyrhynchos*	L	Y	breeder		X	X	X	X	S5B,S5N	Yellow				G5
Northern pintail	*Anas acuta*	L	N	breeder		X		X		S4B,S5N	Yellow				G5
Blue-winged teal	*Anas discors*	L	Y	breeder	X	X	X	X	X	S4S5B	Yellow				G5
Northern shoveler	*Anas clypeata*	L	N	breeder		X		X	X	S5B,S5N	Yellow				G5
Gadwall	*Anas strepera*	L	N	breeder		X				S5B	Yellow				G5
American wigeon	*Anas americana*	L	Y	breeder		X		X		S5B,S5N	Yellow				G5
Ring-necked duck	*Aythya collaris*	L	Y	breeder	X	X	X	X	X	S5B,S5N	Yellow				G5
Lesser scaup	*Aythya affinis*	L	Y	breeder	X	X	X	X	X	S4S5B,S5N	Yellow				G5
Harlequin duck	*Histrionicus histrionicus*	L	Y	breeder, offshore winter	X	X	X	X	X	S4B,S3N	Yellow				G4
Barrow's goldeneye	*Bucephala islandica*	L	Y	breeder	X	X	X	X	X	S4B	Yellow				G5
Bufflehead	*Bucephala albeola*	L	Y	breeder	X	X	X	X	X	S5B	Yellow				G5
Common merganser	*Mergus merganser*	L	Y	breeder	X	X	X	X	X	S5B	Yellow				G5
Red-breasted merganser	*Mergus serrator*	L	N	breeder		X		X		S4B	Yellow				G5
Osprey	*Pandion haliaetus*	L	Y	breeder		X		X		S5B	Yellow				G5
Bald eagle	*Haliaeetus leucocephalus*	L	Y	resident		X	X	X	X	S5B,S5N	Yellow		NAR		G5
Northern harrier	*Circus cyaneus*	L	N	breeder		X	X	X		S4B	Yellow		NAR		G5
Sharp-shinned hawk	*Accipiter striatus*	L	N	breeder	X	X	X	X	X	S5B,S5N	Yellow		NAR		G5
Northern goshawk	*Accipiter gentilis*	L	Y	resident	X	X	X	X	X	S4B,S4N	Yellow				G5
Red-tailed hawk	*Buteo jamaicensis*	L	Y	breeder	X	X	X	X	X	S5B	Yellow		NAR		G5
Golden eagle	*Aquila chrysaetos*	L	Y	breeder	X	X	X	X	X	S4S5B	Yellow		NAR		G5
American kestrel	*Falco sparverius*	L	N	breeder	X	X	X	X	X	S4B	Yellow				G5
Merlin	*Falco columbarius*	L	Y	breeder	X	X	X	X	X	S5B	Yellow		NAR		G5
Spruce grouse	*Falcipennis canadensis*	L	Y	resident			X	X		S5	Yellow				G5
Sooty Grouse	*Dendragapus fuliginosus*	L	?	resident	X	X	X	X	X	S3S4	Blue				G5
Ruffed grouse	*Bonasa umbellus*	L	Y	resident		X		X		S4	Yellow				G5
Willow ptarmigan	*Lagopus lagopus*	L	Y	resident	X					S5	Yellow				G5
Rock ptarmigan	*Lagopus muta*	L	Y	resident	X				X	S5	Yellow				G5
White-tailed ptarmigan	*Lagopus leucura*	L	N	resident	X				X	S5	Yellow				G5
Semipalmated plover	*Charadrius semipalmatus*	L	N	migrant		X	X			S4S5B	Yellow				G5
Killdeer	*Charadrius vociferus*	L	N	breeder	X	X		X	X	S4B	Yellow				G5
Greater yellowlegs	*Tringa melanoleuca*	L	Y	breeder	X	X	X	X	X	S5B	Yellow				G5
Solitary sandpiper	*Tringa solitaria*	L	Y	migrant	X	X	X	X	X	S5B	Yellow				G5

Appendix 5-1. Potentially Occurring Vertebrate Species in the Wildlife Study Area

Common Name	Scientific Name	Likelihood of Occurrence	Detected During Regional Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area[1]					Conservation Status					
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank
Birds (cont'd)															
Spotted sandpiper	*Actitis macularius*	L	Y	breeder	X	X	X	X	X	S5B	Yellow				G5
Wilson's snipe	*Gallinago delicata*	L	Y	breeder	X	X	X	X	X	S4S5B	Yellow				G5
Mew gull	*Larus canus*	L	N	breeder	X	X	X	X	X	S5B	Yellow				G5
Great horned owl	*Bubo virginianus*	L	N	resident		X	X	X		S5	Yellow				G5
Barred owl	*Strix varia*	L	Y	resident		X			X	S5B	Yellow				G5
Boreal owl	*Aegolius funereus*	L	N	resident			X	X	X	S4	Yellow		NAR		G5
Common nighthawk	*Chordeiles minor*	L	N	breeder		X		X		S4B	Yellow		T	1-T	G5
Black swift	*Cypseloides niger*	L	N	breeder	X	X		X		S4B	Yellow		C		G4
Vaux's swift	*Chaetura vauxi*	L	Y	breeder		X		X		S4S5B	Yellow				G5
Rufous hummingbird	*Selasphorus rufus*	L	Y	breeder	X	X	X	X	X	S4B	Yellow				G5
Belted kingfisher	*Megaceryle alcyon*	L	Y	breeder		X	X	X		S4S5B	Yellow		C		G5
Red-breasted sapsucker	*Sphyrapicus ruber*	L	Y	breeder		X		X	X	S5B	Yellow				G5
Downy woodpecker	*Picoides pubescens*	L	N	resident		X	X	X		S5B	Yellow				G5
Hairy woodpecker	*Picoides villosus*	L	N	resident		X	X	X	X	S5B	Yellow				G5
American three-toed woodpecker	*Picoides dorsalis*	L	Y	resident		X	X	X	X	S5B	Yellow				G5
Black-backed woodpecker	*Picoides arcticus*	L	N	resident			X	X		S5B	Yellow				G5
Northern flicker	*Colaptes auratus*	L	Y	breeder		X		X	X	S5	Yellow				G5
Olive-sided flycatcher	*Contopus cooperi*	L	Y	breeder		X	X	X	X	S3S4B	Blue		T	1-T	G4
Western wood-pewee	*Contopus sordidulus*	L	Y	breeder		X		X		S4B	Yellow				G5
Alder flycatcher	*Empidonax alnorum*	L	Y	breeder		X		X		S5B	Yellow				G5
Hammond's flycatcher	*Empidonax hammondii*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Pacific-slope flycatcher	*Empidonax difficilis*	L	Y	breeder		X		X	X	S4S5B	Yellow				G5
Horned lark	*Eremophila alpestris*	L	Y	breeder	X	X	X			S4S5B	Yellow				G5
Tree swallow	*Tachycineta bicolor*	L	N	breeder	X	X	X	X	X	S4S5B	Yellow				G5
Northern rough-winged swallow	*Stelgidopteryx serripennis*	L	N	breeder		X	X	X		S4B	Yellow				G5
Cliff swallow	*Petrochelidon pyrrhonota*	L	N	breeder	X	X	X	X	X	S4B	Yellow				G5
Barn swallow	*Hirundo rustica*	L	N	breeder	X	X	X	X	X	S3S4B	Blue		T		G5
Gray jay	*Perisoreus canadensis*	L	Y	resident		X	X	X	X	S5B	Yellow				G5
Steller's jay	*Cyanocitta stelleri*	L	Y	resident		X	X	X	X	S5	Yellow				G5
American crow	*Corvus brachyrhynchos*	L	N	breeder			X	X	X	S5	Yellow				G5
Northwestern crow	*Corvus caurinus*	L	Y	resident		X		X	X	S5	Yellow				G5
Common raven	*Corvus corax*	L	N	resident		X	X	X	X	S5B	Yellow				G5
Black-capped chickadee	*Poecile atricapillus*	L	Y	resident		X		X		S5B	Yellow				G5
Mountain chickadee	*Poecile gambeli*	L	Y	resident			X	X	X	S5B	Yellow				G5
Boreal chickadee	*Poecile hudsonica*	L	Y	resident			X	X	X	S5B	Yellow				G5
Chestnut-backed chickadee	*Poecile rufescens*	L	Y	resident		X		X	X	S4S5B	Yellow				G5
Red-breasted nuthatch	*Sitta canadensis*	L	Y	resident		X	X	X	X	S5B	Yellow				G5
Brown creeper	*Certhia americana*	L	Y	resident		X	X	X	X	S4S5B	Yellow				G5
Winter wren	*Troglodytes troglodytes*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
American dipper	*Cinclus mexicanus*	L	Y	resident		X	X	X	X	S5	Yellow				G5
Golden-crowned kinglet	*Regulus satrapa*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Ruby-crowned kinglet	*Regulus calendula*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Townsend's solitaire	*Myadestes townsendi*	L	Y	breeder	X		X	X	X	S4S5B	Yellow				G5
Gray-cheeked thrush	*Catharus minimus*	L	Y	migrant		X	X			S4S5B	Yellow				G5

Appendix 5-1. Potentially Occurring Vertebrate Species in the Wildlife Study Area

Common Name	Scientific Name	Likelihood of Occurrence	Detected During Regional Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area[1]					Conservation Status					
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank
Birds (cont'd)															
Swainson's thrush	*Catharus ustulatus*	L	Y	breeder		X		X		S4S5B	Yellow				G5
Hermit thrush	*Catharus guttatus*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
American robin	*Turdus migratorius*	L	Y	breeder	X	X	X	X	X	S5B	Yellow				G5
Varied thrush	*Ixoreus naevius*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
American pipit	*Anthus rubescens*	L	Y	breeder	X	X	X	X	X	S5B	Yellow				G5
Bohemian waxwing	*Bombycilla garrulus*	L	N	resident		X	X	X	X	S5B	Yellow				G5
Cedar waxwing	*Bombycilla cedrorum*	L	Y	breeder		X		X	X	S5B	Yellow				G5
Warbling vireo	*Vireo gilvus*	L	Y	breeder		X		X		S5B	Yellow				G5
Tennessee warbler	*Oreothlypis peregrina*	L	Y	breeder		X		X		S5B	Yellow				G5
Orange-crowned warbler	*Oreothlypis celata*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Yellow warbler	*Setophaga petechia*	L	Y	breeder		X		X	X	S4S5B	Yellow				G5
Yellow-rumped warbler	*Setophaga coronata*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Townsend's warbler	*Setophaga townsendi*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Blackpoll warbler	*Setophaga striata*	L	Y	breeder			X	X		S5B	Yellow				G5
American redstart	*Setophaga ruticilla*	L	Y	breeder		X	X	X		S5B	Yellow				G5
Northern waterthrush	*Geothlypis noveboracensis*	L	Y	breeder			X	X		S4S5B	Yellow				G5
MacGillivray's warbler	*Oporornis tolmiei*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Common yellowthroat	*Geothlypis trichas*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Wilson's warbler	*Cardellina pusilla*	L	Y	breeder		X	X	X	X	S4B	Yellow				G5
Western tanager	*Piranga ludoviciana*	L	Y	breeder		X		X		S5B	Yellow				G5
Chipping sparrow	*Spizella passerina*	L	Y	breeder		X	X	X		S5B	Yellow				G5
Savannah sparrow	*Passerculus sandwichensis*	L	Y	breeder	X	X		X	X	S4S5B	Yellow				G5
Fox sparrow	*Passerella iliaca*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Song sparrow	*Melospiza melodia*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Lincoln's sparrow	*Melospiza lincolnii*	L	Y	breeder		X		X	X	S5B	Yellow				G5
Golden-crowned sparrow	*Zonotrichia atricapilla*	L	Y	breeder	X	X		X	X	S5B	Yellow				G5
White-crowned sparrow	*Zonotrichia leucophrys*	L	N	breeder	X	X	X	X	X	S5B	Yellow				G5
Dark-eyed junco	*Junco hyemalis*	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Rusty blackbird	*Euphagus carolinus*	L	N	breeder			X	X		S3S4B	Blue		SC	1-SC	G4
Brown-headed cowbird	*Molothrus ater*	L	N	breeder		X		X	X	S5B	Yellow				G5
Gray-crowned rosy finch	*Leucosticte tephrocotis*	L	Y	breeder	X	X	X	X	X	S5B	Yellow				G5
Pine grosbeak	*Pinicola enucleator*	L	Y	resident		X	X	X	X	S5B	Yellow				G5
Red crossbill	*Loxia curvirostra*	L	N	resident		X	X	X	X	S4S5B	Yellow				G5
White-winged crossbill	*Loxia leucoptera*	L	N	resident		X	X	X	X	S5B	Yellow				G5
Pine siskin	*Spinus pinus*	L	Y	breeder		X	X	X	X	S4B	Yellow				G5
Pacific loon	*Gavia pacifica*	P	Y	offshore winter	X	X	X	X	X	S4S5B,S4N	Yellow				G5
Yellow-billed loon	*Gavia adamsii*	P	N	offshore winter		X		X		S2S3N	Blue		NAR		G4
Horned grebe	*Podiceps auritus*	P	N	offshore winter		X		X		S4B	Yellow		SC		G5
Red-necked grebe	*Podiceps grisegena*	P	N	breeder		X	X	X	X	S4S5B	Yellow		NAR		G5
Western grebe	*Aechmophorus occidentalis*	P	N	offshore winter		X				S1B,S2N	Red		C		G5
Fork-tailed storm petrel	*Oceanodroma furcata*	P	N	offshore migrant		X				S4B	Yellow				G5
Double-crested cormorant	*Phalacrocorax auritus*	P	N	offshore breeder		X				S3B	Blue		NAR		G5
Pelagic cormorant	*Phalacrocorax pelagicus*	P	N	offshore resident		X				S4B	Yellow				G5
American bittern	*Botaurus lentiginosus*	P	N	breeder		X				S3B	Blue				G4

Appendix 5-1. Potentially Occurring Vertebrate Species in the Wildlife Study Area

Common Name	Scientific Name	Likelihood of Occurrence	Detected During Regional Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area[1]					Conservation Status					
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank
Birds (cont'd)															
Great blue heron	*Ardea herodias*	P	N	resident		X			X	S3B	No Status				G5
Tundra swan	*Cygnus columbianus*	P	N	migrant		X		X		S3N	Blue				G5
Trumpeter swan	*Cygnus buccinator*	P	Y	migrant		X		X		S4B,S5N	Yellow		NAR		G4
Greater white-fronted goose	*Anser albifrons*	P	N	migrant		X				S4M	Yellow				G5
Snow goose	*Chen caerulescens*	P	N	migrant		X		X		S4M	Yellow				G5
Brant	*Branta bernicla*	P	N	migrant		X				S3M	Blue				G5
Canvasback	*Aythya valisineria*	P	N	migrant		X		X		S4B	Yellow				G5
Redhead	*Aythya americana*	P	N	migrant		X				S4S5B,S5N	Yellow				G5
Greater scaup	*Aythya marila*	P	N	migrant		X		X		S4N	Yellow				G5
Long-tailed duck	*Clangula hyemalis*	P	N	migrant	X	X	X	X		S2S3B	Blue				G5
Black scoter	*Melanitta americana*	P	N	offshore winter		X				S4N	Yellow				G5
Surf scoter	*Melanitta perspicillata*	P	Y	offshore winter	X	X	X	X		S3B,S4N	Blue				G5
White-winged scoter	*Melanitta fusca*	P	Y	breeder, offshore winter	X	X	X	X	X	S5B	Yellow				G5
Common goldeneye	*Bucephala clangula*	P	N	breeder	X	X	X	X	X	S4S5B	Yellow				G5
Hooded merganser	*Lophodytes cucullatus*	P	Y	resident		X	X	X		S5B	Yellow				G5
Northern goshawk, *laingi* ssp	*Accipiter gentilis laingi*	P	N	resident		X			X	S2B	Red	Y	T	1-T	G5T2
Rough-legged hawk	*Buteo lagopus*	P	Y	migrant	X	X	X	X	X	S2S3N	Blue		NAR		G5
Peregrine Falcon, *pealei* ssp	*Falco peregrinus pealei*	P	N	resident		X				S3B	Blue		SC	1-SC	G4T3
Peregrine Falcon, *anatum* ssp	*Falco peregrinus anatum*	P	N	resident			X			S2?B	Red		SC	1-T	G4T4
Swainson's Hawk	*Buteo swainsoni*	P	Y	migrant		X	X	X	X	S2B	Red				G5
Gyrfalcon	*Falco rusticolus*	P	N	migrant		X		X		S3S4B	Blue		NAR		G5
Dusky grouse	*Dendragapus obscurus*	P	?	resident	X	X	X	X	X	S4	Yellow				G5
Sora	*Porzana carolina*	P	N	breeder		X		X		S4S5	Yellow				G5
American coot	*Fulica americana*	P	N	offshore winter		X		X		S4B	Yellow		NAR		G5
Sandhill crane	*Grus canadensis*	P	N	migrant		X		X		S4B	Yellow	Y	NAR		G5
Black-bellied plover	*Pluvialis squatarola*	P	N	offshore migrant		X				S5N	Yellow				G5
American golden-plover	*Pluvialis dominica*	P	N	migrant		X				S3S4B	Blue				G5
Black oystercatcher	*Haematopus bachmani*	P	N	offshore resident		X				S4	Yellow				G5
Lesser yellowlegs	*Tringa flavipes*	P	N	migrant	X	X	X	X	X	S5B	Yellow				G5
Wandering tattler	*Tringa incana*	P	N	migrant		X				S3S4B	Blue				G5
Upland sandpiper	*Bartramia longicauda*	P	N	migrant		X		X		S1S2B	Red				G5
Whimbrel	*Numenius phaeopus*	P	N	offshore migrant		X				S4S5M	Yellow				G5
Ruddy turnstone	*Arenaria interpres*	P	N	offshore migrant		X				S4M	Yellow				G5
Black turnstone	*Arenaria melanocephala*	P	N	offshore migrant		X				S4N,S5M	Yellow				G5
Surfbird	*Aphriza virgata*	P	N	offshore migrant		X				S4M	Yellow				G5
Sanderling	*Calidris alba*	P	N	offshore migrant				X		S4S5M	Yellow				G5
Semipalmated sandpiper	*Calidris pusilla*	P	N	offshore migrant		X		X		SNRM	No Status				G5
Western sandpiper	*Calidris mauri*	P	N	offshore migrant		X		X		S4S5M	Yellow				G5
Least sandpiper	*Calidris minutilla*	P	N	migrant	X		X		X	S4?B	Yellow				G5
Baird's sandpiper	*Calidris bairdii*	P	N	offshore migrant		X	X	X		SUB,SUM	Unknown				G5
Rock sandpiper	*Calidris ptilocnemis*	P	N	offshore migrant		X				S4N	Yellow				G5
Dunlin	*Calidris alpina*	P	N	offshore winter		X				S4N	Yellow				G5
Stilt sandpiper	*Calidris himantopus*	P	N	offshore migrant		X				SNRM	No Status				G5
Short-billed dowitcher	*Limnodromus griseus*	P	N	offshore migrant		X				S2S4B	Blue				G5

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Common Name	Scientific Name	Likelihood of Occurrence	Detected During Regional Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area[1]					Conservation Status					
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank
Birds (cont'd)															
Long-billed dowitcher	*Limnodromus scolopaceus*	P	N	offshore migrant		X				S5M	Yellow				G5
Red-necked phalarope	*Phalaropus lobatus*	P	N	offshore migrant	X	X	X	X	X	S3S4B	Blue		C		G4G5
Parasitic jaeger	*Stercorarius parasiticus*	P	N	offshore migrant		X		X		S1B,S4M	No Status				G5
Long-tailed jaeger	*Stercorarius longicaudus*	P	N	offshore migrant		X				SNRM	No Status				G5
Bonaparte's gull	*Chroicocephalus philadelphia*	P	Y	migrant	X	X	X	X	X	S5B	Yellow				G5
Ring-billed gull	*Larus delawarensis*	P	Y	breeder		X				S4B	Yellow				G5
Herring gull	*Larus argentatus*	P	N	offshore migrant	X	X	X	X	X	S4S5B	Yellow				G5
Thayer's gull	*Larus thayeri*	P	N	offshore migrant		X				S5M	Yellow				G5
Glaucous-winged gull	*Larus glaucescens*	P	N	offshore resident		X				S5B	Yellow				G5
Glaucous gull	*Larus hyperboreus*	P	N	offshore migrant		X				SNRM	No Status				G5
Black-legged kittiwake	*Rissa tridactyla*	P	N	offshore resident		X				SNRM	No Status				G5
Caspian tern	*Hydroprogne caspia*	P	N	offshore migrant		X				S3B	Blue		NAR		G5
Arctic tern	*Sterna paradisaea*	P	Y	offshore migrant		X				S4B	Yellow				G5
Western screech-owl	*Megascops kennicottii*	P	N	resident		X		X		S4	No Status		T	1	G5
Snowy owl	*Bubo scandiacus*	P	N	migrant		X				S3N	Blue		NAR		G5
Northern hawk owl	*Surnia ulula*	P	N	migrant		X			X	S4S5B	Yellow		NAR		G5
Northern pygmy-owl	*Glaucidium gnoma*	P	N	resident		X		X	X	S4S5B	Yellow				G4G5
Great gray owl	*Strix nebulosa*	P	N	resident		X				S4B	Yellow		NAR		G5
Short-eared owl	*Asio flammeus*	P	N	breeder		X		X		S3B,S2N	Blue	Y	SC	1-SC	G5
Northern saw-whet owl	*Aegolius acadicus*	P	N	resident		X			X	S5B,S5N	Yellow				G5
Say's phoebe	*Sayornis saya*	P	N	migrant	X	X		X		S5B	Yellow				G5
Violet-green swallow	*Tachycineta thalassina*	P	N	breeder	X	X	X	X	X	S4S5B	Yellow				G5
Bank swallow	*Riparia riparia*	P	N	breeder				X		S4S5B	Yellow		C		G5
Mountain bluebird	*Sialia currucoides*	P	N	breeder	X	X	X	X		S4S5B	Yellow				G5
Northern shrike	*Lanius excubitor*	P	N	winter		X	X	X		S4S5B,S4N	Yellow				G5
Red-eyed vireo	*Vireo olivaceus*	P	N	breeder		X		X		S4B	Yellow				G5
Black-throated gray warbler	*Setophaga nigrescens*	P	Y	breeder		X				S4B	Yellow				G5
American tree sparrow	*Spizella arborea*	P	N	breeder		X		X		S5B	Yellow				G5
Harris's sparrow	*Zonotrichia querula*	P	N	migrant		X		X		SNRM	No Status				G5
Lapland longspur	*Calcarius lapponicus*	P	N	migrant		X				SNRM	No Status				G5
Snow bunting	*Plectrophenax nivalis*	P	N	winter	X	X	X			S4S5B,S4N	Yellow				G5
Red-winged blackbird	*Agelaius phoeniceus*	P	N	breeder		X		X		S5B,S5N	Yellow				G5
Purple finch	*Carpodacus purpureus*	P	N	breeder		X		X	X	S4S	Yellow				G5
Common redpoll	*Acanthis flammea*	P	N	migrant			X	X		S4B	Yellow				G5
Hoary redpoll	*Acanthis hornemanni*	P	N	migrant			X	X		SNRN	No Status				G5
Evening grosbeak	*Coccothraustes vespertinus*	P	N	breeder		X	X	X	X	S5	Yellow				G5
Brandt's cormorant	*Phalacrocorax penicillatus*	U	N	offshore winter		X				SHB,S4N	Red				G5
Emperor goose	*Chen canagica*	U	N	offshore migrant		X				SNA	Accidental				G3G4
Tufted duck	*Aythya fuligula*	U	N	offshore winter		X				SNA	Accidental				G5
Hudsonian godwit	*Limosa haemastica*	U	N	migrant		X				S2B	Red				G4
Red knot	*Calidris canutus*	U	N	offshore migrant		X				S1S2M	Red		E/T	1-T/E	G4
Pectoral sandpiper	*Calidris melanotos*	U	N	offshore migrant	X	X	X	X	X	S5M	Yellow				G5
Sharp-tailed sandpiper	*Calidris acuminata*	U	N	offshore migrant		X				S4M	Yellow				G5
Black-headed gull	*Chroicocephalus ridibundus*	U	N	offshore migrant		X				SNA	Accidental				G5

Appendix 5-1. Potentially Occurring Vertebrate Species in the Wildlife Study Area

Common Name	Scientific Name	Likelihood of Occurrence	Detected During Regional Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area[1]					Conservation Status					
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank
Birds (cont'd)															
Common murre	*Uria aalge*	U	N	offshore resident		X				S2B,S4N	Red				G5
Pigeon guillemot	*Cepphus columba*	U	N	offshore resident		X				S4B	Yellow				G5
Marbled murrelet	*Brachyramphus marmoratus*	U	N	offshore resident		X				S3B,S3N	Blue	Y	T	1-T	G3G4
Ancient murrelet	*Synthliboramphus antiquus*	U	N	offshore resident		X				S2S3B,S4N	Blue	Y	SC	1-SC	G4
Cassin's auklet	*Ptychoramphus aleuticus*	U	N	offshore resident		X				S2S3B,S4N	Blue	Y	C		G4
Rhinoceros auklet	*Cerorhinca monocerata*	U	N	offshore breeder		X				S4B	Yellow				G5
Tufted puffin	*Fratercula cirrhata*	U	N	offshore resident		X				S3B,S4N	Blue				G5
Anna's hummingbird	*Calypte anna*	U	N	migrant		X		X		S4S5B	Yellow				G5
Black-billed magpie	*Pica hudsonia*	U	N	resident		X				S5B	Yellow				G5
Smith's longspur	*Calcarius pictus*	U	N	breeder	X					S3S4B	Blue				G5
Mammals															
American beaver	*Castor canadensis*	L	Y	resident		X	X	X	X	S5	Yellow				G5
American black bear	*Ursus americanus*	L	Y	resident_hibernator	X	X	X	X	X	S5	Yellow		NAR		G5
American marten	*Martes americana*	L	Y	resident		X	X	X	X	S4S5	Yellow				G5
American mink	*Neovison vison*	L	Y	resident		X	X	X	X	S5	Yellow				G5
Arctic ground squirrel	*Urocitellus parryii*	L	Y	resident_hibernator						S5	Yellow				G5
Bushy-tailed woodrat	*Neotoma cinerea*	L	N	resident	X	X	X	X	X	S5	Yellow				G5
Canada lynx	*Lynx canadensis*	L	N	resident			X	X		S4	Yellow		NAR		G5
Cinereus shrew	*Sorex cinereus*	L	Y	resident		X	X	X	X	S5	Yellow				G5
Red fox	*Vulpes vulpes*	L	Y	resident	X	X	X	X	X	S5	Yellow				G5
Common muskrat	*Ondatra zibethicus*	L	N	resident	X	X	X	X	X	S5	Yellow				G5
Cougar	*Puma concolor*	L	N	resident	X	X	X	X	X	S4	Yellow				G5
Coyote	*Canis latrans*	L	N	resident		X	X	X	X	S5	Yellow				G5
Dusky shrew	*Sorex monticolus*	L	Y	resident		X	X	X	X	S5	Yellow				G5
Ermine	*Mustela erminea*	L	N	resident		X		X	X	S5	Yellow				G5
Fisher	*Martes pennanti*	L	Y	resident		X	X	X	X	S2S3	Blue	Y			G5
Grey wolf	*Canis lupus*	L	Y	resident	X	X	X	X	X	S4	Yellow		NAR		G4
Grizzly bear	*Ursus arctos*	L	Y	resident_hibernator	X	X	X	X	X	S3	Blue	Y	SC		G4
Hoary marmot	*Marmota caligata*	L	Y	resident_hibernator	X			X	X	S5	Yellow				G5
Least chipmunk	*Neotamias minimus*	L	N	resident			X			S5	Yellow				G5
Least weasel	*Mustela nivalis*	L	N	resident				X		S4	Yellow				G5
Little brown myotis	*Myotis lucifugus*	L	Y	resident_hibernator		X	X	X	X	S5	Yellow		E		G5
Long-tailed vole	*Microtus longicaudus*	L	N	resident		X	X	X	X	S5	Yellow				G5
Meadow jumping mouse	*Zapus hudsonius*	L	Y	resident		X	X	X		S5	Yellow				G5
Meadow vole	*Microtus pennsylvanicus*	L	Y	resident			X	X		S5	Yellow				G5
Moose	*Alces americanus*	L	Y	resident		X	X	X	X	S5	Yellow				G5
Mountain goat	*Oreamnos americanus*	L	Y	resident	X	X	X		X	S4	Yellow				G5
Nearctic brown Lemming	*Lemmus trimucronatus*	L	Y	resident	X			X	X	S5	Yellow				G5
North American deermouse	*Peromyscus maniculatus*	L	N	resident	X	X	X	X	X	S5	Yellow				G5
North American porcupine	*Erethizon dorsatum*	L	N	resident		X	X	X	X	S4	Yellow				G5
Northern bog lemming	*Synaptomys borealis*	L	N	resident	X	X	X	X	X	S5	Yellow				G5
Northern red-backed vole	*Myodes rutilus*	L	Y	resident			X		X	S5	Yellow				G5
Northern river otter	*Lontra canadensis*	L	N	resident		X	X	X	X	S4S5	Yellow				G5
Keen's mouse	*Peromyscus keeni*	L	Y	resident						S5	Yellow				G5

Appendix 5-1. Potentially Occurring Vertebrate Species in the Wildlife Study Area

		Likelihood of	Detected During	Presence Relative	Presence Detected in BEC Zones Associated with Wildlife Study Area[1]					Conservation Status					
Common Name	Scientific Name	Occurrence	Regional Studies	to Wildlife Study Area	BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank
Mammals (cont'd)															
Red squirrel	*Tamiasciurus hudsonicus*	L	Y	resident		X	X	X	X	S5	Yellow				G5
Snowshoe hare	*Lepus americanus*	L	Y	resident		X	X	X	X	S5	Yellow				G5
Stone's Sheep	*Ovis dalli stonei*	L	N	resident			X			S4	Yellow				G5T4
Western heather vole	*Phenacomys intermedius*	L	N	resident		X	X		X	S5	Yellow				G5
Western jumping mouse	*Zapus princeps*	L	N	resident		X	X	X	X	S5	Yellow				G5
Western long-eared myotis	*Myotis evotis*	L	Y	resident_hibernator		X	X	X	X	S4S5	Yellow				G5
Wolverine, *luscus* spp	*Gulo gulo luscus*	L	Y	resident	X	X	X	X		S3	Blue	Y	SC		G4T4
Amercian water shrew	*Sorex palustris*	P	N	resident		X	X	X	X	S5	Yellow				G5
American Pygmy Shrew	*Sorex hoyi*	P	N	resident			X	X		S5	Yellow				G5
Californian myotis	*Myotis californicus*	P	N	resident_hibernator		X	X			S4S5	Yellow				G5
Northern Caribou (population 15)	*Rangifer tarandus* pop. 15	P	N	resident			X	X		S3	Blue	Y	T/SC	1-SC	G5T5
Keen's myotis	*Myotis keenii*	P	N	resident_hibernator		X				S1S3	Red	Y	DD	3	G2G3
Long-legged myotis	*Myotis volans*	P	?	resident_hibernator		X	X	X	X	S4S5	Yellow				G5
Mule Deer, *sitkensis* ssp	*Odocoileus hemionus sitkensis*	P	N	resident		X	X		X	S5	Yellow				G5
Northern flying squirrel	*Glaucomys sabrinus*	P	N	resident		X		X	X	S5	Yellow				G5
Northern myotis	*Myotis septentrionalis*	P	N	resident_hibernator						S2S3	Blue		E		G4
Silver-haired bat	*Lasionycteris noctivagans*	P	?	resident_migrant		X	X	X	X	S4S5	Yellow				G5
Southern red-backed vole	*Myodes gapperi*	P	N	resident	X	X	X	X	X	S5	Yellow				G5
Big brown bat	*Eptesicus fuscus*	U	N	resident_hibernator		X				S5	Yellow				G5
Brown rat	*Rattus norvegicus*	U	N	resident		X				SNA	Exotic				G5
House mouse	*Mus musculus*	U	N	resident						SNA	Exotic				G5

[1] *species that have been detected in BEC zones associated with the Project area, according to Stevens (1995).*

Appendix 5-2

Conservation Status Definitions

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Appendix 5-2. Conservation Status Definitions

BC Status/List (Provincial)

Status	Definition
Red list	List of species that are extirpated, endangered, or threatened
Blue list	List of species that are special concern
Yellow list	List of species that are not at risk
Accidental	Species occurring infrequently and unpredictably, outside their usual range. Accidental species are excluded from the Red, Blue, and Yellow list.
Exotic	Species that have been moved beyond their natural range as a result of human activity. Exotic species are also known as alien species, foreign species, introduced species, non-indigenous species, and non-native species. Exotic species are excluded from the Red, Blue and Yellow lists.

Provincial Rank

Rank		Definition
S#S#:		A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the status of the species or community.
S?:	Unranked	Province conservation status not yet assessed.
SU:	Unrankable	Currently unrankable due to lack of information or substantially conflicting information about status or trends.
S1:	Critically Imperilled	Critically imperilled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province.
S2:	Imperilled	Imperilled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province.
S3:	Vulnerable	Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4:	Apparently Secure	Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5:	Secure	Common, widespread, and abundant in the province.
SNA:	Not Applicable	A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Breeding Status Qualifier

Status		Definition
B:	Breeding population	Conservation status refers to the breeding population of the species in the province.
N:	Non-breeding population	Conservation status refers to the non-breeding population of the species in the province.
M:	Migrant	Migrant species occurring regularly on migration. Conservation status refers to the aggregating transient population of the species in the province.

COSEWIC (National)

Status		Definition
E:	Endangered	A species facing imminent extirpation or extinction.
T:	Threatened	A species that is likely to become endangered if limiting factors are not reversed.
SC:	Special Concern	A species of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.
NAR:	Not at Risk	A species that has been evaluated and found to be not at risk.
DD:	Data Deficient	A species for which there is insufficient scientific information to support status designation.

SARA (National)

Schedule	Definition
1	Protected under SARA as of proclamation in June 2003. These species were assessed by COSEWIC using the revised assessment criteria. The list classifies the species as being extirpated, endangered, threatened, or a special concern.
2 and 3:	Assessed before October 1999, and require re-assessment using the revised criteria, following which the Governor in Council may, on the recommendation of the Minister, add the species to the Federal List of Wildlife Species at Risk.

NatureServe (Global)

Rank		Definition
G#G#:	Range Rank	A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty about the status of the species or community.
G2:	Imperilled	At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3:	Vulnerable	At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread.
G4:	Apparently Secure	Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5:	Secure	Common, widespread, and abundant.
T:	Intraspecific Taxon (trinomial)	The status of intraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. e.g., the global rank of a critically imperilled subspecies of an otherwise widespread and common species would be G5T1.

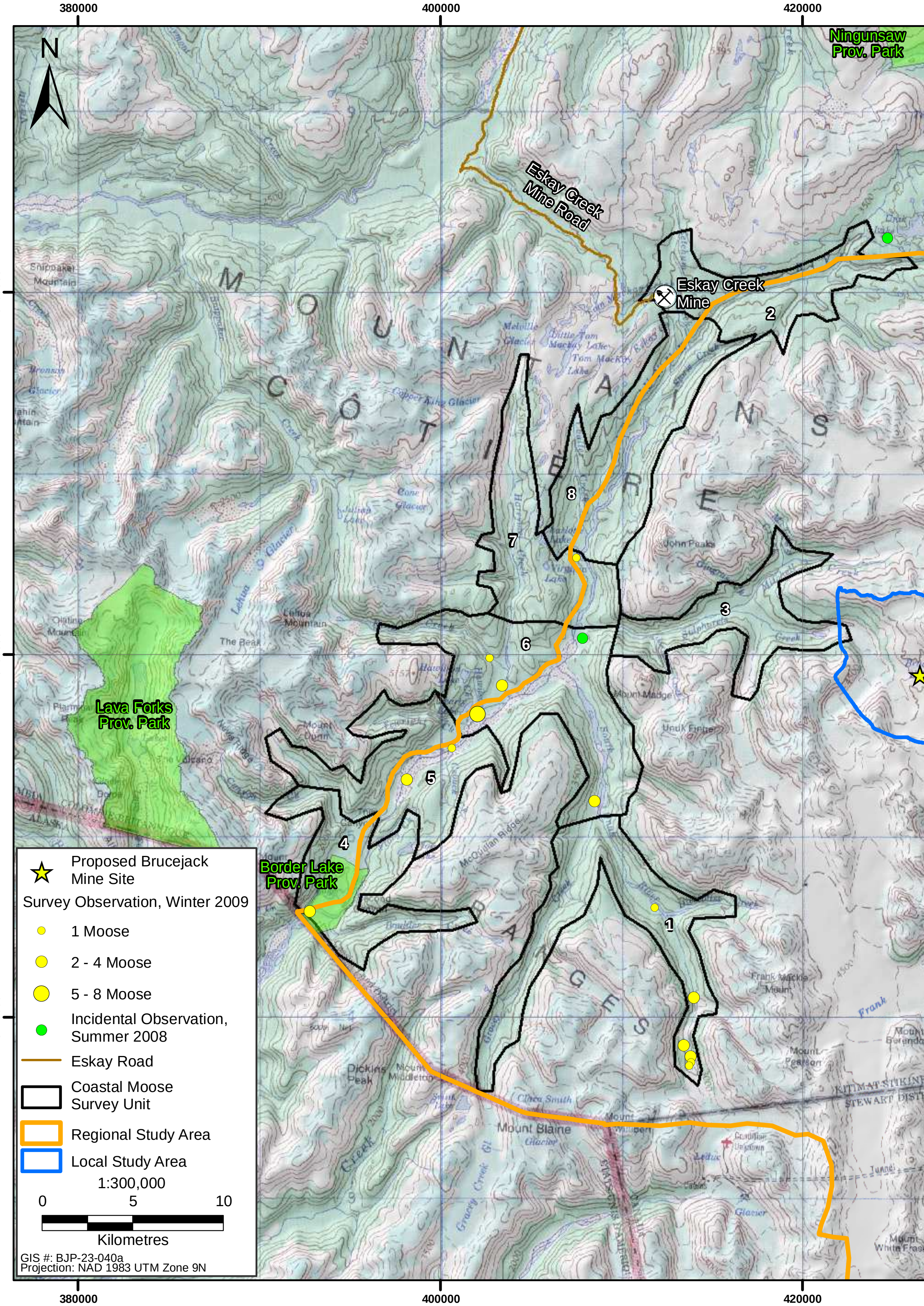
International Union for Conservation of Nature, IUCN Red List for Threatened Species (Global)

Rank		Detailed definitions can be found at: http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf
Extinct	EX	
Extinct in the Wild	EW	
Critically Endangered	CR	
Endangered	EN	
Vulnerable	VU	Extinction Risk
Near Threatened	NT	
Least Concern	LC	
Data Deficient	DD	
Not Evaluated	NE	

Appendix 6.2-1

Moose Winter Survey Observations in the Coastal Survey Area, 2009

Engineers and Scientists



PRETIVM

Moose Winter Survey Observations in the Coastal Survey Area, 2009

Appendix 6.2-1

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Appendix 6.2-2

Moose Winter Survey Observations in the Interior Survey Area, 2009

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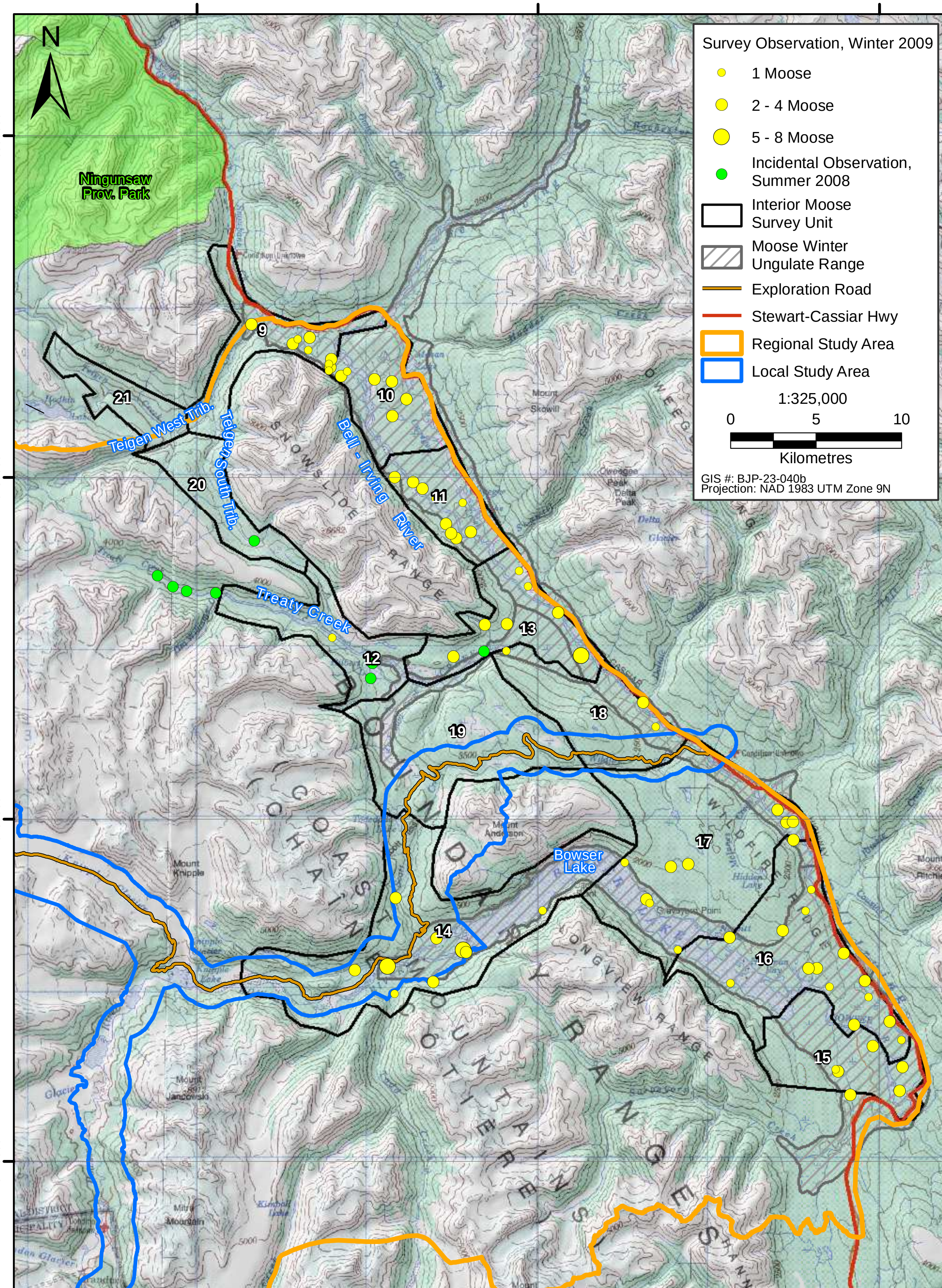

Appendix 6.2-2

PRETIVM

Moose Winter Survey Observations in the Interior Survey Area, 2009

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Appendix 6.2-3

Summary of Winter Moose Observations within Coastal and Interior Survey Areas, KSM 2009

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Appendix 6.2-3. Summary of Winter Moose Observations within Coastal and Interior Survey Areas, KSM 2009

Parameter	Coastal Survey Area			Interior Survey Area		
	Observed Number	Adjusted Number[a]	90% Confidence Interval[b]	Observed Number	Adjusted Number[a]	90% Confidence Interval[b]
Bulls	16	19	5	36	47	12
Cows	11	12	3	79	93	10
Calves	2	2	2	33	40	8
Unclassified	0	0	0	3	17	20
Total	29	33	6	151	198	28

[a] *Adjustments for sightability and estimates of variance were derived using the program Aerial Survey (Unsworth et al. 1998) with the BC moose model (Quayle et al. 2001).*

[b] *90% confidence intervals = 1.65*(variance)0.5.*

Appendix 6.2-4

Moose Aerial Survey Effort, Winter 2011

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Appendix 6.2-4. Moose Aerial Survey Effort, Winter 2011

Date	Survey Unit (SU)	Total Time (min)	Total Area (km^2)	Total Area Effort (min/km^2)	Census Area (km^2)	Census Area Effort (min/km^2)	Capable Habitat (km^2)	Capable Habitat Effort (min/km^2)	Temp. (°C)	Cloud Cover (%)	Wind	Lighting	Survey Area
Interior Survey Area													
16-Feb-11	9	58	31.3	1.9	20.2	2.9	22.7	2.6	-18	100%	25 km/hr	flat	Bell Irving
16-Feb-11	10	81	34.1	2.4	32.5	2.5	30.8	2.6	-18	overcast	10 km/hr	flat	Bell Irving
15-Feb-11	11	61	27.5	2.2	22.4	2.7	25.7	2.4	-12	high overcast	10 km/hr	flat	Bell Irving
15-Feb-11	12	28	33.7	0.8	13.6	2.1	19.9	1.4	-12	high overcast	10 km/hr	flat	Bowser/Treaty
15-Feb-11	13	102	39.3	2.6	33.0	3.1	34.5	3.0	-12	high overcast	10 km/hr	flat	Bowser/Treaty
15-Feb-11	14	157	107.3	1.5	54.4	2.9	77.3	2.0	-10	overcast	35 km/hr	flat	Bowser/Treaty
19-Feb-11	15	72	40.8	1.8	30.9	2.3	39.4	1.8	-19	100%	calm	flat	Bell Irving/Bowser
16-Feb-11	16	84	73.0	1.2	51.5	1.6	65.4	1.3	-16	100%	35 km/hr	flat	Bowser Lake
16-Feb-11	17	115	101.0	1.1	61.5	1.9	82.4	1.4	-18	100%	20 km/hr	flat	Bowser/Treaty
16-Feb-11	18	49	40.8	1.2	23.5	2.1	21.1	2.3	-18	75%	20 km/hr	flat	Treaty/Bowser
15-Feb-11	19	38	73.8	0.5	21.6	1.8	20.4	1.9	-12	overcast	10 km/hr	flat	Bowser/Treaty
19-Feb-11	22	15	34.7	0.4	9.0	1.7	23.7	0.6	-18	100%	calm	flat	Bell Irving/Bowser
19-Feb-11	23	21	29.9	0.7	8.6	2.5	2.5	8.6	-18	100%	20 km/hr	flat	Bell Irving/Bowser
All		**881**	**667**		**383**		**466**						
Average				**1.4**		**2.3**		**2.4**					
± SD				**0.71**		**0.50**		**1.94**					
Coastal Survey Area													
20-Feb-11	1	50	61.2	0.82	26.5	1.88	26.9	1.86	-8	10%	calm	bright	Unuk
20-Feb-11	3	17	39.2	0.43	11.0	1.55	16.1	1.06	-10	70%	5-10 km/hr	flat	Unuk/Sulphurets
20-Feb-11	6	29	77.5	0.37	17.0	1.71	45.0	0.64	-10	50%	5-10 km/hr	flat	Unuk/Sulphurets
20-Feb-11	7	7	47.9	0.15	4.4	1.61	20.2	0.35	-8	15%	calm	bright	Unuk/Sulphurets
All		**103**	**226**		**59**		**108**						
Average				**0.44**		**1.69**		**0.98**					
± SD				**0.28**		**0.15**		**0.66**					

Appendix 6.2-5

Moose Raw Observation Data, Winter 2011

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Appendix 6.2-5. Moose Raw Observation Data, Winter 2011

						No. Moose									
Date	Survey Area	Survey Unit	Easting	Northing	Observation No.	Bulls	Lone Cows	Cow and Calf	Cow and 2 Calves	Unknown	Total	Activity	HSR	% Cover	Comment(s)
15-Feb-11	Interior	14	6257929	461685	1	2	3				5	ld	4	0	Visibility = 3 miles
15-Feb-11	Interior	14	6254273	456701	2			1			2	ld	4	0	
15-Feb-11	Interior	14	6253177	455319	3				1		3	sd	2	10	
15-Feb-11	Interior	14	6252854	455674	4		1				1	sd	2	10	
15-Feb-11	Interior	14	6252519	455929	5		1				1	sd	1	10	
15-Feb-11	Interior	14	6249157	447389	6										
15-Feb-11	Interior	14	6251115	448760	7				1		3	ld	2	5	
15-Feb-11	Interior	14	6251759	455544	8			1			2	ld	2	5	
15-Feb-11	Interior	14	6250057	451581	9		1				1	ld	3	0	
15-Feb-11	Interior	14	6253430	453563	10			1			2	ld	2	30	
15-Feb-11	Interior	14	6253265	453292	11	1	1			3	5	ld	2	30	2 unk are possibly cows
15-Feb-11	Interior	14	6253237	453193	12		1			1	2	ld	2	30	
15-Feb-11	Interior	14	6253954	455013	13	3	5				8	ld	1	0	
15-Feb-11	Interior	19	6267931	454405	14			1			2	ld	2	15	
15-Feb-11	Interior	12													no moose observed. Deep snow.
15-Feb-11	Interior	13	6268956	453307	15	1					1	ld	2	15	
15-Feb-11	Interior	13	6274301	458036	16	1					1	ld	2	40	
15-Feb-11	Interior	13	6272715	458858	17			1			2	ld	2	20	
15-Feb-11	Interior	13	6273393	459487	18			1			2	sd	2	15	
15-Feb-11	Interior	13	6274478	458715	19			1			2	sd	1	30	
15-Feb-11	Interior	13	6274324	458714	20	3	2				5	ld	1	25	
15-Feb-11	Interior	13	6275927	457844	21	1					1	ld	1	25	
15-Feb-11	Interior	13	6275927	457844	22	1					1	ld	1	25	
15-Feb-11	Interior	11	6275889	456797	23			1			2	sd	2	15	
15-Feb-11	Interior	11	6276210	456544	24	1	2				3	ld	1	20	
15-Feb-11	Interior	11	6279383	453048	25		4				4	ld	2	0	
15-Feb-11	Interior	11	6279383	453048	26		2				2	sd	2	15	
15-Feb-11	Interior	11	6280250	452072	27				1		3	sd	3	0	
15-Feb-11	Interior	11	6278306	453308	28		1				1	ld	2	5	
15-Feb-11	Interior	11	6275612	457173	29	1					1	sd	3	0	
15-Feb-11	Interior	11	6277501	455446	30		1				1	ld	2	25	
15-Feb-11	Interior	11	6278295	456477	31	4					4	ld	1	15	
16-Feb-11	Interior	10	6281609	450605	32	1					1	sd	2	5	
16-Feb-11	Interior	10	6286671	447710	33				1		3	ld	1	20	
16-Feb-11	Interior	10	6281839	450830	34			1			2	sd	3	0	
16-Feb-11	Interior	10	6282718	450730	35			1			2	sd	2	40	
16-Feb-11	Interior	10	6285407	449881	36		1				1	sd	2	0	
16-Feb-11	Interior	10	6285773	449703	37	1	2				3	sd	1	20	
16-Feb-11	Interior	10	6283899	451293	38	1				2	3	sd	3	35	2 unk, possibly 1 cow & 1 bull
16-Feb-11	Interior	10	6285379	450230	39		1				1	ld	2	10	
16-Feb-11	Interior	10	6286251	450054	40	1					1	sd	2	40	
16-Feb-11	Interior	10	6286948	449760	41	1					1	wk	2	10	

Appendix 6.2-5. Moose Raw Observation Data, Winter 2011

						No. Moose									
Date	Survey Area	Survey Unit	Easting	Northing	Observation No.	Bulls	Lone Cows	Cow and Calf	Cow and 2 Calves	Unknown	Total	Activity	HSR	% Cover	Comment(s)
16-Feb-11	Interior	9	6288748	447626	42				1		3	ld	2	25	
16-Feb-11	Interior	9	6288837	446365	43	1		1			3	sd	2	40	
16-Feb-11	Interior	9	6287227	442110	44		2				2	ld	2	10	
16-Feb-11	Interior	18	6269625	458636	45										6 wolves on moose kill - photos 587 - 596
16-Feb-11	Interior	17	6263059	470466	46		3				3	ld	3	0	
16-Feb-11	Interior	17	6261008	473394	47			1			2	sd	2	20	
16-Feb-11	Interior	17	6255029	467354	48			1			2	ld	3	60	
16-Feb-11	Interior	17	6255115	468453	49	3					3	ld	2	30	
16-Feb-11	Interior	17	6252633	467501	50			1			2	ld	4	0	next to habitat 2. Snowpack extremely deep above 700m - 6 foot bluffs
16-Feb-11	Interior	16	6250889	470242	51	3					3	sd	3	0	
16-Feb-11	Interior	16	6247981	477613	52	1	1				2	ld	3	0	
16-Feb-11	Interior	16	6247893	478527	53		1				1	sd	3	0	
16-Feb-11	Interior	16	6252365	477808	54		1				1	sd	2	10	
16-Feb-11	Interior	16	6246409	481453	55		1				1	sd	2	15	
16-Feb-11	Interior	16	6247402	479674	56	1			1		4	sd	3	0	
19-Feb-11	Interior	23													no moose observed. Snow close to 6 feet deep.
19-Feb-11	Interior	15	6247227	479607	57		1				1	wk	1	30	
19-Feb-11	Interior	15	6245352	479925	58	1					1	ld	2	30	
19-Feb-11	Interior	15	6243161	478333	59		1				1	ld	3	0	
19-Feb-11	Interior	15	6243005	478349	60			1			2	ld	3	0	
19-Feb-11	Interior	15	6242802	478209	61			1			2	sd	3	0	
19-Feb-11	Interior	15	6245164	478780	62	1					1	ld	2	5	
19-Feb-11	Interior	22	6241863	476855	63			1			2	ld	3	50	
19-Feb-11	Interior	22	6241882	477222	64			1			2	ld	2	15	
20-Feb-11	Coastal	3													no moose observed. Snow over 5' deep on top side of 3.
20-Feb-11	Coastal	6	6258738	406915	65	2					2	sd	2	0	
20-Feb-11	Coastal	6	6258050	405695	66		2				2	sd/ld	2	0	
20-Feb-11	Coastal	1	6237372	413593	67			1			2	ld	2	5	
20-Feb-11	Coastal	1	6237899	413922	68	2					2	sd/ld	2	15	
20-Feb-11	Coastal	1	6243795	413300	69	1					1	ld	2	0	
20-Feb-11	Coastal	1	6250164	407790	70	3					3	sd/ld	2	0	
20-Feb-11	Coastal	1	6246930	406766	71		1				1	sd	2	5	
20-Feb-11	Coastal	7													no moose observed.

Appendix 6.2-6

Moose Density Calculations by Survey Unit, Winter 2011

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Appendix 6.2-6. Moose Density Calculations by Survey Unit, Winter 2011

Survey Unit	No. Of Moose	Total Area (km^2)	Total Area Density ($moose/km^2$)	Census Area (km^2)	Census Area Density ($moose/km^2$)	Capable Habitat Area (km^2)	Habitat Density ($moose/km^2$)
Interior Survey Area							
9	8	31.3	0.26	20.2	0.40	22.7	0.35
10	18	34.1	0.53	32.5	0.55	30.8	0.59
11	21	27.5	0.76	22.4	0.94	25.7	0.82
12	0	33.7	0.00	13.6	0.00	19.9	0.00
13	15	39.3	0.38	33.0	0.45	34.5	0.44
14	35	107.3	0.33	54.4	0.64	77.3	0.45
15	8	40.8	0.20	30.9	0.26	39.4	0.20
16	12	73.0	0.16	51.5	0.23	65.4	0.18
17	12	101.0	0.12	61.5	0.20	82.4	0.15
18	0	40.8	0.00	23.5	0.00	21.1	0.00
19	2	73.8	0.03	21.6	0.09	20.4	0.10
22	4	34.7	0.12	9.0	0.44	23.7	0.17
23	0	29.9	0.00	8.6	0.00	2.5	0.00
24	n/s	8.6	-	-	-	1.3	-
Total	**135**	**676**	**0.20**	**383**	**0.35**	**467**	**0.29**
Coastal Survey Area							
1	9	61.2	0.15	26.5	0.34	26.9	0.33
2	n/s	41.9	-	-	-	7.6	-
3	0	39.2	0.00	11.0	0.00	16.1	0.00
4	n/s	45.1	-	-	-	24.7	-
5	n/s	52.7	-	-	-	27.0	-
6	4	77.5	0.05	17.0	0.24	45.0	0.09
7	0	47.9	0.00	4.4	0.00	20.2	0.00
8	n/s	61.3	-	-	-	32.6	-
Total	**13**	**427**	**0.03**	**59**	**0.22**	**200**	**0.06**

n/s = not surveyed

Appendix 6.3-1

Mountain Goat Observations and Population Characteristics by Survey Unit, KSM Summer 2008

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Appendix 6.3-1. Mountain Goat Observations and Population Characteristics by Survey Unit, KSM Summer 2008

	No. Goats			Kidding	Density (goat/km^2)	
Survey Unit	Total	Adults	Kids	(kid/adult)	Total Area	Capable Habitat
1	3	3	0	-	0.04	0.05
2	17	12	5	0.42	0.21	0.43
3	23	19	4	0.21	0.28	0.59
4	10	7	3	0.43	0.07	0.16
5	4	4	0	-	0.05	0.08
6	4	4	0	-	0.07	0.1
7	15	15	0	-	0.18	0.27
8	0	0	0	-	0	0
9	1	1	0	-	0.01	0.02
10	0	0	0	-	0	0
11	11	9	0	0	0.06	0.08
12	8	7	1	0.14	0.06	0.08
13	4	2	2	1	0.03	0.06
14	2	1	1	1	0.03	0.04
15	11	6	5	0.83	0.19	0.26
16	0	0	0	-	0	0
17	33	25	8	0.32	0.44	0.89
18	5	5	0	-	0.05	0.09
19	26	19	7	0.37	0.33	0.53
20	14	9	5	0.56	0.15	0.21
21	7	7	0	-	0.08	0.12
22	0	0	0	-	0	0
23	31	22	9	0.41	0.41	0.74
24	1	1	0	-	0.01	0.02
Total	**230**	**178**	**50**	**0.28**		
Average					**0.11 ± 0.03**	**0.20 ± 0.05**

Appendix 6.3-2

Mountain Goat Observations and Population Characteristics by Survey Unit, KSM Winter 2009

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Appendix 6.3-2. Mountain Goat Observations and Population Characteristics by Survey Unit, KSM Winter 2009

Survey Unit	No. Goats			Recruitment	Density (goat/km^2)	
	Total	Adults	Kids	(kid/adult)	Total Area	Capable Habitat
1	0	0	0	-	0	0
3	16	13	3	0.23	0.19	0.41
4	14	13	1	0.08	0.1	0.22
5	30	22	8	0.36	0.4	0.58
6	0	0	0	-	0	0
7	37	29	8	0.28	0.44	0.67
8	5	4	1	0.25	0.08	0.09
17	0	0	0	-	0	0
19	23	17	6	0.35	0.29	0.47
20	10	8	2	0.25	0.11	0.15
21	9	6	3	0.5	0.11	0.15
22	10	8	2	0.25	0.1	0.15
23	18	17	1	0.06	0.24	0.43
24	3	2	1	0.5	0.03	0.05
25	3	2	1	0.5	0.01	0.04
26	0	0	0	-	0	0
Total	**178**	**141**	**37**	**0.26**		
Average					**0.13 ± 0.04**	**0.21 ± 0.06**

Appendix 6.3-3

Summer Results from the KSM Survey

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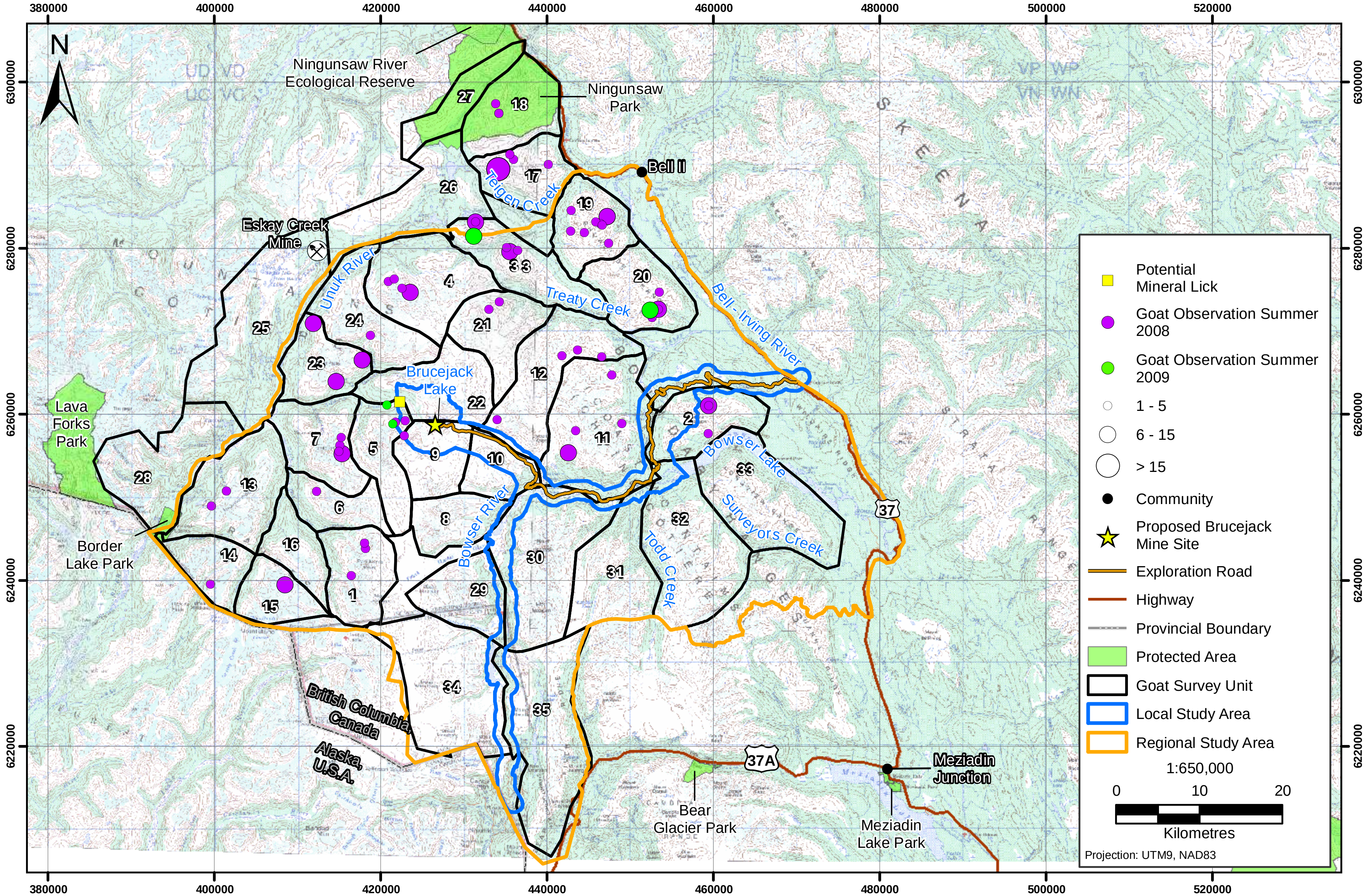

Appendix 6.3-3

PRETIVM

Summer Mountain Goat Results from the KSM Survey

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Appendix 6.3-4

Winter Results from the KSM Survey

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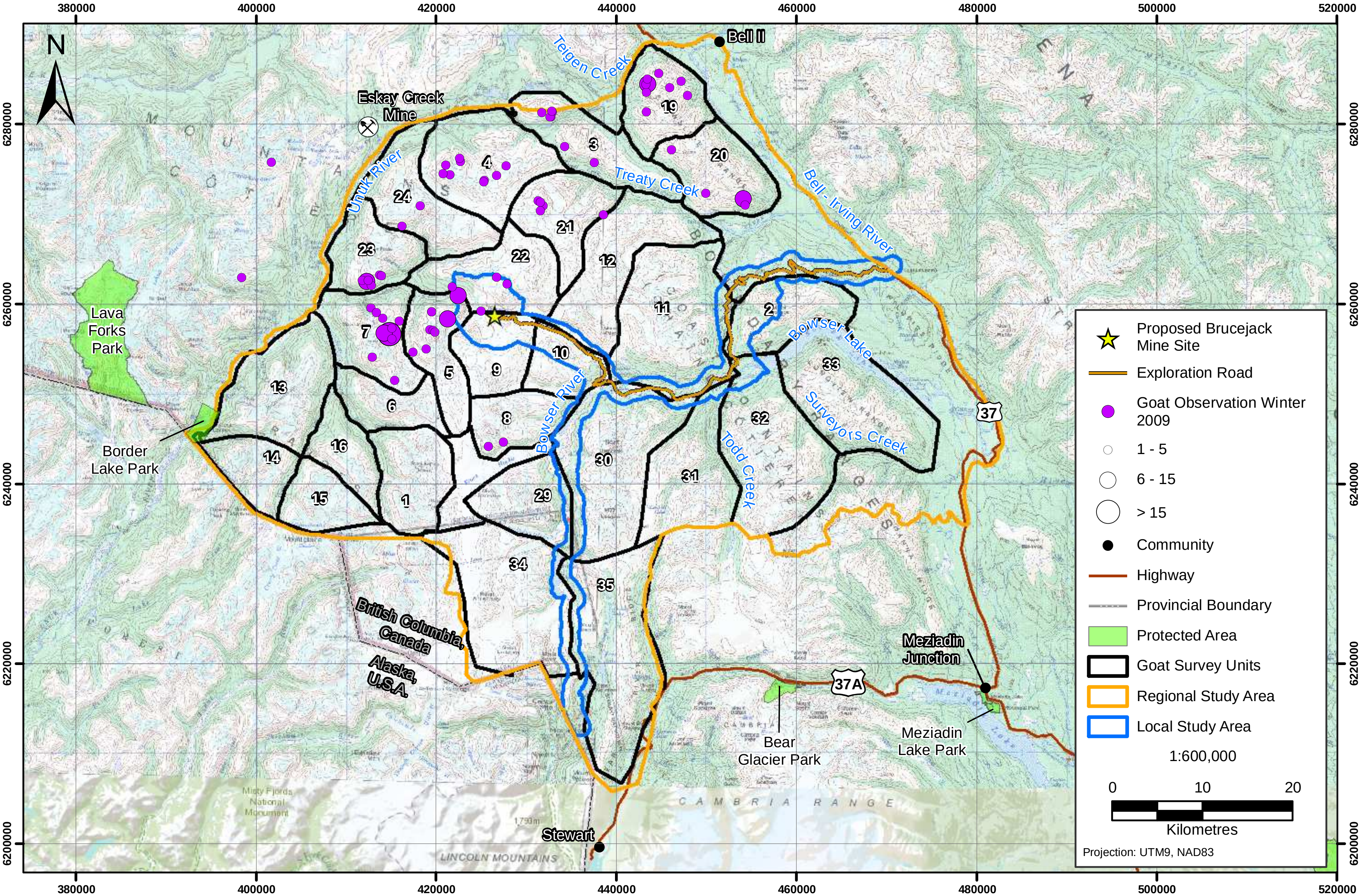
PROJECT #1042-006-04 GIS # BJP-23-020 March 13 2013



Appendix 6.3-4

PRETIVM

Winter Mountain Goat Results from the KSM Survey

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Appendix 6.3-4

Appendix 6.3-5

2010 and 2012 Summer Aerial Goat Survey Effort

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Appendix 6.3-5. 2010 and 2012 Summer Aerial Goat Survey Effort

Survey Unit	Date	Survey Area	Aerial/ Ground	Pilot	Navigator	Observers	Temp. (°C)	Cloud Cover %	Wind	Lighting	Start Time	Stop	Re-start	Stop	Re-start	End Time	Total Time	No. of Groups	Mtn Goat Adult	Mtn Goat Kids	Total Mtn Goats
Summer 2010 Results																					
2	10-Aug-10	Snowfields - Bowser Lake	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Josh Hoetzel	8	bands 10	calm		10:20					11:43	1:23	4	21	6	27
6	16-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	15	40	3 km N	light smoke haze	8:17					9:11	0:54	0	0	0	0
7	15-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	19	0	calm	clear	8:58	10:24	10:58			11:24	1:52	11	24	7	31
8	12-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	10	0	2 km	clear sunny	11:20					12:45	1:25	0	0	0	0
9	13-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	14	0	1 km	high band smoke/very bright blue sky	10:23	10:45	11:43			12:20	0:59	4	3	1	4
10	10-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison	10	high 100	calm		16:39					17:20	0:41	2	5	1	6
11	10-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Josh Hoetzel	8	high	5 km		11:48	11:58	12:24	14:15	15:30	16:35	3:06	9	13	4	17
12	12-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	12	0	10 km NW	clear sunny	12:50	13:06	14:45			16:24	1:55	7	19	5	24
20	14-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	19	0	calm	clear	9:53	10:20	11:15			12:21	1:33	5	17	3	20
21A	14-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	15	1	12 km S	clear/high smoke band	8:46					9:47	1:01	7	11	1	12
22	12-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	8	0	2 km SW	clear sunny	8:58					10:50	1:52	2	4	1	5
23	10-Aug-10	Snowfields 23	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Josh Hoetzel	8	light/clear	5 km calm		8:45					9:50	1:05	5	9	4	13
24	13-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	14	0	1 km SW	high band smoke/very bright blue sky	8:45					10:20	1:35	10	12	3	15
29	15-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	23	0	8 km W	smoke haze	15:05	15:49	15:59			16:15	1:00	2	5	1	6
30	13-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	14	0	7 km SW	smoke band peaks	12:23	14:34	14:55			16:20	3:36	6	11	4	15
31A	13-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	14	0	calm	clear	16:22					16:52	0:30	5	5	0	5
31B	14-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	20	1	calm	clear	14:38					15:29	0:51	6	9	2	11
32A	14-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	19	2	calm	haze light smoke	12:30	12:57	14:03			14:36	1:00	5	6	0	6
1A	16-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	15	40	calm	light haze	9:13					9:58	0:45	4	5	1	6
33A	15-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	21	0	calm	clear	11:39	12:43	13:56			14:03	1:11	9	14	5	19
33B	15-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	21	0	5 km N	smoke haze	14:03					14:51	0:48	1	1	1	2
5A	14-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	21	0	0-5 km	clear	15:50					16:46	0:56	4	5	1	6
5B	15-Aug-10	Snowfields	Aerial	VIH Keith	Shaun Freeman	Marnee Allison, Isaac Blackburn	18	1	calm	clear	8:28					8:57	0:29	2	11	4	15
Summer 2012 Results																					
29	5-Sep-12	Salmon Glacier	Aerial	Kief Khanlarian	Shaun Freeman	Erin Boyle, Jonathon Bishop	10	<10	S.moderate	bright	17:27					18:00	0:33	0	0	0	0
34	5-Sep-12	Long Lake	Aerial	Kief Khanlarian	Shaun Freeman	Erin Boyle, Jonathon Bishop	7	<10	S.light	bright	15:05	16:10	16:31			17:25	1:59	3	8	2	10
35	5-Sep-12	Salmon Glacier	Aerial	Kief Khanlarian	Shaun Freeman	Erin Boyle, Jonathon Bishop	8	70	nil	bright	12:22	13:30	13:52			15:02	2:18	4	11	0	11

Appendix 6.3-6

2011 and 2013 Winter Aerial Goat Survey Effort

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Appendix 6.3-6. 2011 and 2013 Winter Aerial Goat Survey Effort

Date	Survey Unit	Survey Area	Pilot	Navigator	Observers	Temp. (˚C)	Cloud Cover %	Wind	Lighting	Start Time	End Time	Time Elapsed	Mins	No. of Groups	Adult	Female and Kid w/ 1 Kid	Female and Kid w/ 2 Kids	Lone Kid	Total
2011 Results																			
17-Feb-11	2	Bowser	Derek Weismiller	Shaun Freeman	SF, TL, DF	-22	0	20 km/hr	bright	8:53	10:13	1 hr 20 mins	80	4	6	3	0	0	12
17-Feb-11	3A	Treaty/Snowfields	Derek Weismiller	Shaun Freeman	SF, TL, DF	-22	0	10 km/hr	bright - shadows	16:08	16:45	37 mins	37	0					0
21-Feb-11	3B	Treaty/Snowfields	Derek Weismiller	Shaun Freeman	SF, TL, CS	-10	5%	calm	bright	16:00	16:33	33 mins	33	4	5	3	0	0	10
18-Feb-11	5	Brucejack	Derek Weismiller	Shaun Freeman	SF, TL, DF	-17	0	calm	bright	12:50	14:00	1 hr 10 mins	70	5	7	3	0	0	13
21-Feb-11	7	Mitchel/Unik	Derek Weismiller	Shaun Freeman	SF, TL, CS	-15	30%	10 km/hr	bright	12:39	15:04	2 hrs 24 mins	144	16	31	6	0	1	44
22-Feb-11	8	Bowser	Derek Weismiller	Shaun Freeman	SF, TL, CS	-18	5-10%	10-20 km/hr	bright	11:20	13:38	49 mins	49	6	7	2	0	0	11
18-Feb-11	9	Brucejack	Derek Weismiller	Shaun Freeman	SF, TL, DF	-20	0	light & variable	bright	12:09	12:50	41 mins	41	0					0
18-Feb-11	10	Bowser	Derek Weismiller	Shaun Freeman	SF, TL, DF	-22	0	calm	bright	9:11	9:50	39 mins	39	1	1				1
17-Feb-11	11	Treaty/Bowser	Derek Weismiller	Shaun Freeman	SF, TL, DF	-18	0	20 km/hr	bright	10:13	13:39	2 hrs 21 mins	141	9	10	2	0	0	14
17-Feb-11	12	Treaty/Snowfields	Derek Weismiller	Shaun Freeman	SF, TL, DF	-23	0	25 km/hr	bright	13:39	16:04	1 hr 35 mins	95	4	10	3	0	0	16
20-Feb-11	20A	?	Derek Weismiller	Shaun Freeman	SF, TL, CS	-10	5%	calm	bright & flat	15:23	16:25	1 hr 2 mins	62	6	12	1	0	0	14
21-Feb-11	20B	Bell/Irving	Derek Weismiller	Shaun Freeman	SF, TL, CS	-10	20%	5-10 km/hr	bright	9:27	11:42	2 hrs 15 mins	135	3	3	0	0	0	3
18-Feb-11	22	Brucejack	Derek Weismiller	Shaun Freeman	SF, TL, DF	-22	0	calm	bright	9:51	11:07	1 hr 16 mins	76	2	3	0	0	0	3
20-Feb-11	23	Sulpherets/Mitchell	Derek Weismiller	Shaun Freeman	SF, TL, CS	-8	15%	calm	bright	12:29	15:07	1 hr 40 mins	100	5	9	1	0	1	12
22-Feb-11	24	Sulpherets/Mitchell/Unik	Derek Weismiller	Shaun Freeman	SF, TL, CS	-18	5-10%	20 km/hr	bright	9:22	11:11	1 hr 49 mins	109	2	5	0	0	0	5
18-Feb-11	30	Brucejack	Derek Weismiller	Shaun Freeman	SF, TL, DF	-18	0	light & calm	bright	14:07	17:00	2 hrs	120	5	12	1	0	0	14
19-Feb-11	30B	Bowser	Derek Weismiller	Shaun Freeman	SF, TL, CS	-16	100%	10 km/hr	flat	9:17	9:44	27 mins	27	4	17	1	0	0	19
19-Feb-11	31A	Bowser	Derek Weismiller	Shaun Freeman	SF, TL, CS	-10	100%	10 km/hr	flat	9:44	10:37	53 mins	53	1	6			1	7
19-Feb-11	32A	Bowser	Derek Weismiller	Shaun Freeman	SF, TL, CS	-10	100%	10 km/hr	flat	10:39	13:05	1 hr 24 mins	84	3	8	1	0	1	11
22-Feb-11	33A	Bowser	Derek Weismiller	Shaun Freeman	SF, TL, CS	-20	10%	10 km/hr	bright	13:52	15:05	1 hr 13 mins	73	2	10	0	0	2	12
2013 Results																			
4-Mar-13	35	Long Lake	Andy Ramsey	Shaun Freeman	SF, TA, JH	-2	none	light	clear, bright	9:35	13:15	2 hr 10 min	130	2	2	0	0	0	2
4-Mar-13	34	Salmon Glacier	Andy Ramsey	Shaun Freeman	SF, TA, JH	-6	none	20 -30 km/hr	clear, bright	13:20	14:17	53 mins	53	1	1	0	0	0	1
5-Mar-13	29	Granduc	Andy Ramsey	Shaun Freeman	SF, TA, JH	-7	none	variable	clear, bright	9:26	10:10	34 mins	34	1	1	0	0	0	1

Appendix 6.3-7

2010 and 2012 Summer Goat Density Summary

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Appendix 6.3-7. 2010 and 2012 Summer Goat Density Summary

SU	Total Area (Ha)	Census Area (ha)	Total Time (minutes)	Total Adult	Total Kid	Total Goat	Goat (obs/min)	Density (min/km^2)	Census (min/km^2)
Summer 2010									
1	8731.9	3824.5	45	5	1	6	0.133	0.515	1.177
2	8555.5	3404.8	83	21	6	27	0.325	0.970	2.438
5	7511.3	5232.1	85	16	5	21	0.247	1.132	1.625
6	5861.9	3209.4	54	0	0	0	0.000	0.921	1.683
7	9271.7	5454.3	112	24	7	31	0.277	1.208	2.053
8	6396.2	4278.9	85	0	0	0	0.000	1.329	1.986
9	7036.7	4165.3	59	3	1	4	0.068	0.838	1.416
10	5388.2	3176.6	41	5	1	6	0.146	0.761	1.291
11	19128.1	10975.8	236	13	4	17	0.072	1.234	2.150
12	13555.0	7658.1	115	19	5	24	0.209	0.848	1.502
20	9544.3	5210.1	93	17	3	20	0.215	0.974	1.785
21	8360.9	5585.4	61	11	1	12	0.197	0.730	1.092
22	10548.2	6066.1	112	4	1	5	0.045	1.062	1.846
23	7595.2	3062.7	65	9	4	13	0.200	0.856	2.122
24	10399.3	5569.6	95	12	3	15	0.158	0.914	1.706
29	8082.0	4352.7	60	5	1	6	0.100	0.742	1.378
30	18589.8	10169.8	156	11	4	15	0.096	0.839	1.534
31	11760.2	4890.5	81	14	2	16	0.198	0.689	1.656
32	17758.0	4315.0	60	6	0	6	0.100	0.338	1.390
33	16919.0	6702.4	119	15	6	21	0.176	0.703	1.775
						average	**0.148**	**0.880**	**1.680**
						ST Dev	**0.088**	**0.241**	**0.350**
Summer 2012									
29	8082.0	3114.9	33	0	0	0	0.000	0.408	1.059
34	18780.6	18240.4	119	8	2	10	0.084	0.634	0.652
35	19465.9	18251.9	138	11	0	11	0.080	0.709	0.756
						average	**0.055**	**0.584**	**0.823**
						stdev	**0.047**	**0.156**	**0.212**

Appendix 6.3-8

Winter Mountain Goat Density 2011 and 2013

Engineers and Scientists

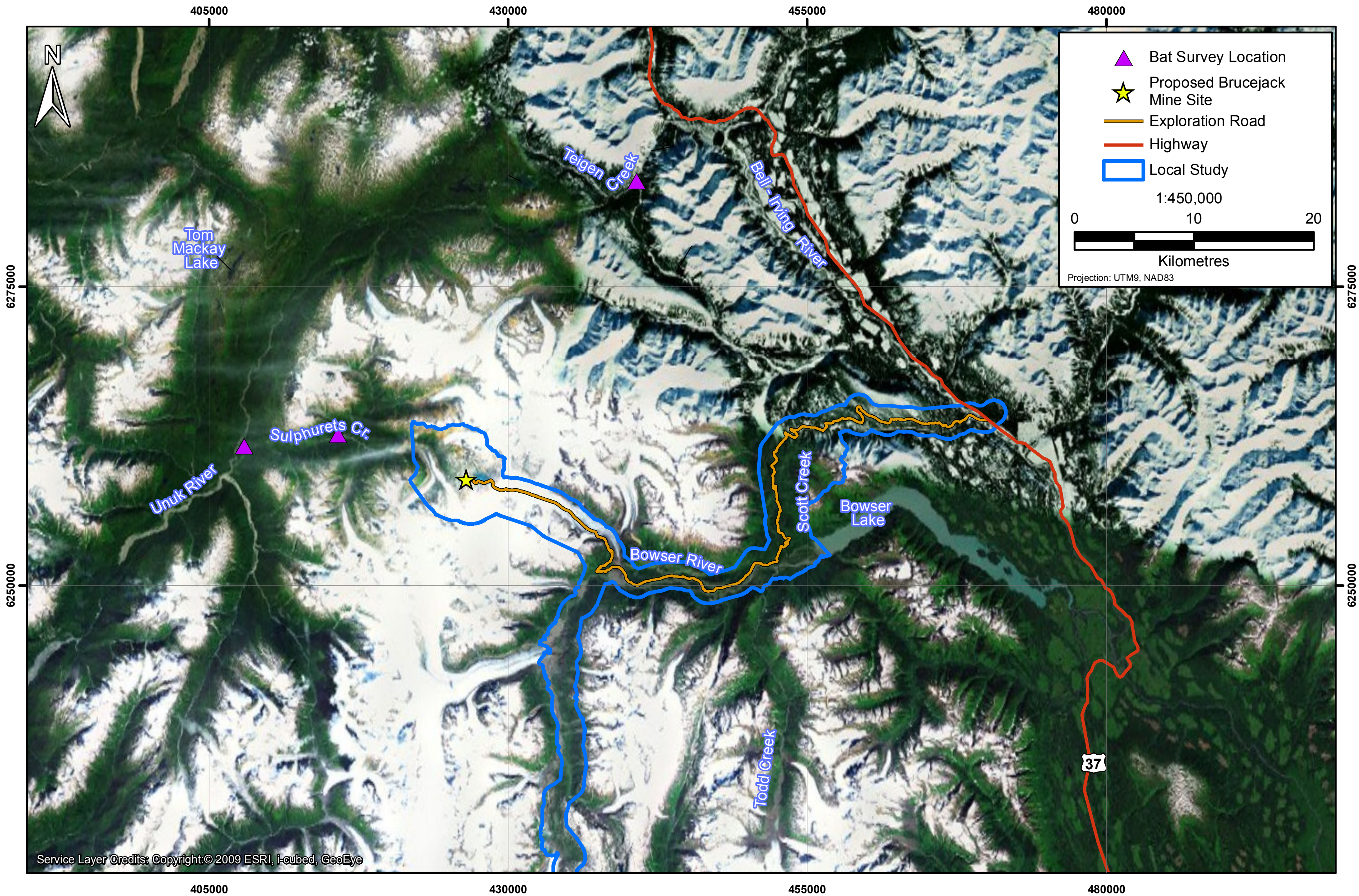
Appendix 6.3-8. Winter Mountain Goat Density 2011 and 2013

Survey Unit	Total Area (km^2)	Census Area (km^2)	Goats in Survey Unit	Goats in UWR* (all obs were Mtn Dwelling)	Goat Obs in UWR	Mnt Dwelling UWR* Total (km^2)	Density Census Area (Goats/km^2)	Density Total Survey Unit (Goat/km^2)	Density Obs in UWR (Goat/km^2)	Time Surveying (min)	Survey Effort Total Area (Min/km^2)	Census Area (Min/km^2)	Goat/min
2011													
2	86	41.6	12	4	33.33%	4.389	0.288	0.140	0.911	80	0.935	1.922	0.150
3	99	41.8	10	8	80.00%	5.854	0.239	0.101	1.367	70	0.709	1.674	0.143
5	75	41.1	13		0.00%	0.090	0.316	0.173	0.000	70	0.932	1.703	0.186
7	93	52.2	44		0.00%	0.736	0.843	0.475	0.000	144	1.553	2.760	0.306
8	64	21.7	11	11	100.00%	6.599	0.507	0.172	1.667	49	0.766	2.257	0.224
9	70	33.0	0		0.00%	0.651	0.000	0.000	0.000	41	0.583	1.243	0.000
10	54	27.3	1	1	100.00%	2.291	0.037	0.019	0.436	39	0.724	1.428	0.026
11	191	91.9	14	14	100.00%	19.131	0.152	0.073	0.732	141	0.737	1.534	0.099
12	136	57.2	16	5	31.25%	12.386	0.279	0.118	0.404	95	0.701	1.659	0.168
20	95	71.7	17	13	76.47%	15.028	0.237	0.178	0.865	197	2.064	2.747	0.086
22	105	59.0	3		0.00%	2.957	0.051	0.028	0.000	76	0.721	1.287	0.039
23	76	48.0	12	11	91.67%	12.598	0.250	0.158	0.873	100	1.317	2.084	0.120
24	104	47.6	5	5	100.00%	9.946	0.105	0.048	0.503	109	1.048	2.290	0.046
30	186	100.5	33	8	24.24%	12.434	0.328	0.178	0.643	147	0.791	1.463	0.224
31	118	36.4	7	7	100.00%	13.528	0.192	0.060	0.517	53	0.451	1.455	0.132
32	178	53.1	11	2	18.18%	6.405	0.207	0.062	0.312	84	0.473	1.582	0.131
33	169	41.1	12	8	66.67%	6.603	0.292	0.071	1.212	73	0.431	1.776	0.164
Total	**1898**	**865**	**221**	**97**	**43.89%**					**Ave**	**0.879**	**1.816**	**0.132**
										stdev	**0.424**	**0.466**	**0.079**
										min	**0.431**	**1.243**	**0.000**
										max	**2.064**	**2.760**	**0.306**
2013													
34	188	104	1	0	0%	8.6	0.010	0.005	0.000	53	0.282	0.510	0.019
35	195	157	2	2	100%	9.6	0.013	0.010	0.208	130	0.667	0.828	0.015
29	81	63	1	0	0%	3.2	0.016	0.012	0.000	34	0.420	0.540	0.029
Total	**464**	**324**	**4**	**2**	**50%**					**Ave**	**0.456**	**0.626**	**0.021**
										stdev	**0.195**	**0.176**	**0.007**
										min	**0.282**	**0.510**	**0.015**
										max	**0.667**	**0.828**	**0.029**

**UWR = Ungulate Winter Range*

Appendix 6.4-1

Bats Observed at KSM



Appendix 6.4-1

PRETIVM

KSM Bats

Appendix 6.4-1

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Appendix 6.5-1

KSM Marmot Surveys 2008 and 2009

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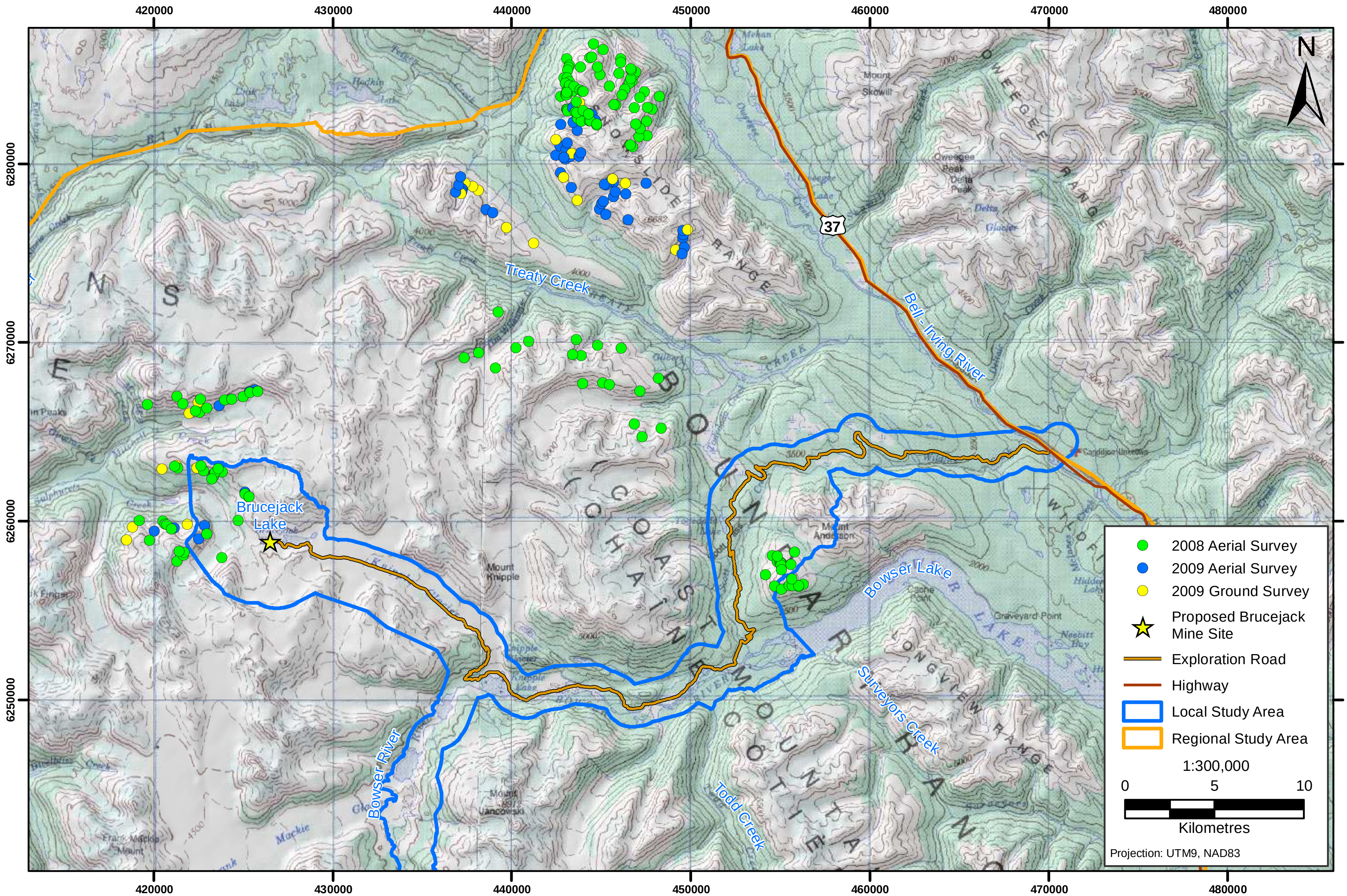


Appendix 6.5-1

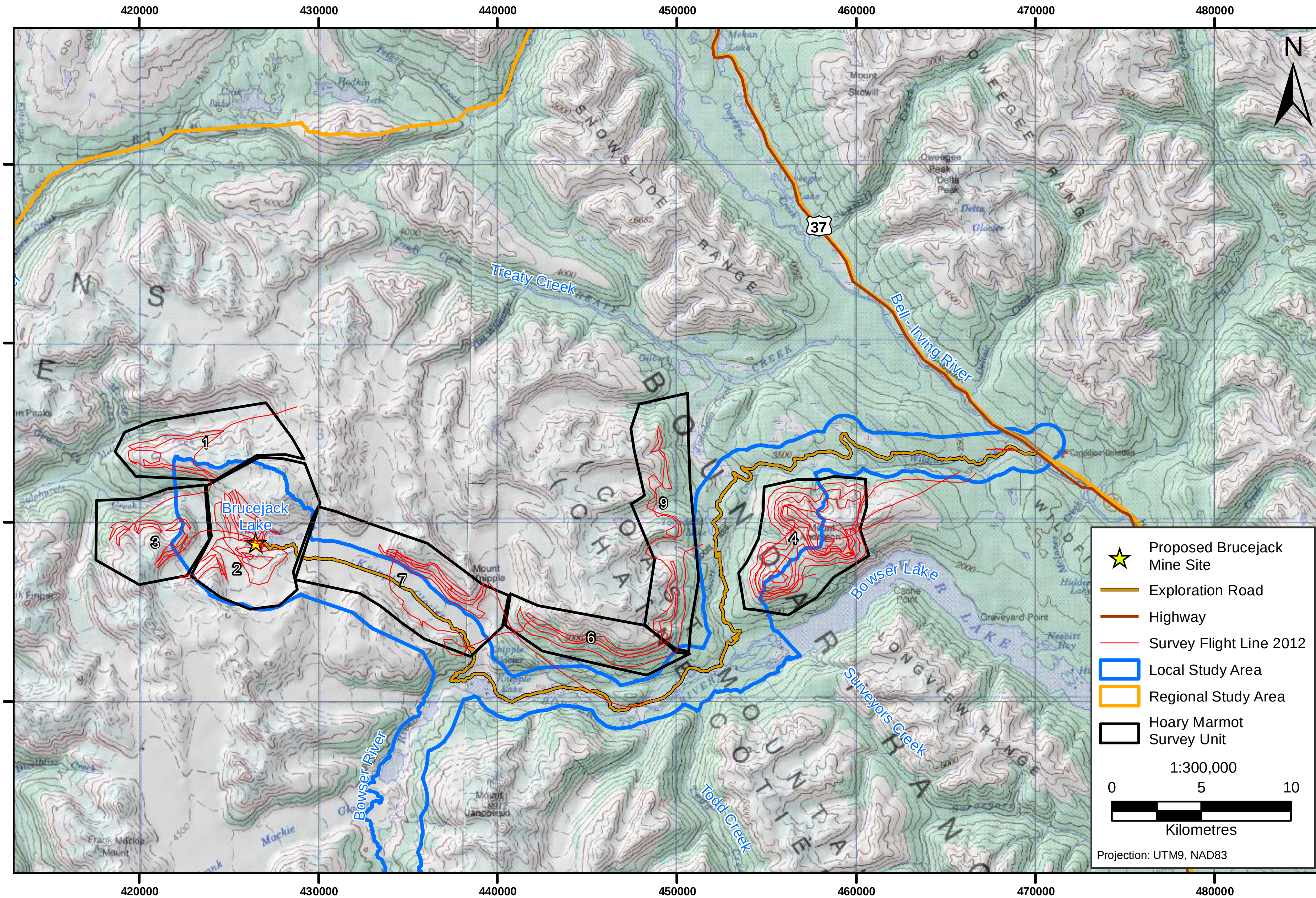
KSM Marmot Surveys 2008 and 2009

PRETIVM

Rescan Engineers & Scientists

Appendix 6.5-2

Brucejack Marmot Aerial Survey, 2012



Appendix 6.5-2

PRETIVM

Brucejack Gold Mine Project Marmot Aerial Survey, 2012

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Appendix 6.5-3
Marmot Aerial Survey Effort

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Appendix 6.5-3. Marmot Aerial Survey Effort

Survey Unit	Date	Survey Area	Pilot	Navigator	Observer	Temp. (˚C)	Cloud Cover %	Wind	Lighting	Start Time	Fuel Break	Re-start Time	End Time	Time Elapsed (minutes)
Marmot 4	24-Jul-12	BJ LSA	Nathan	S.Freeman	R. Wright	10	15	calm/5 km N	mixed	8:55	10:20	10:55	11:55	135
Marmot 6	24-Jul-12	BJ LSA	Nathan	S.Freeman	R. Wright	15	10	5-15 km	bright	12:15			13:15	60
Marmot 9	24-Jul-12	BJ LSA	Nathan	S.Freeman	R. Wright	15	0	0-15	bright	13:15			13:35	20
Marmot 2	26-Jul-12	BJ LSA	Nathan	S.Freeman	R. Wright	21	0	5 km	bright	15:00			16:22	82
Marmot 3a	26-Jul-12	BJ LSA	Nathan	S.Freeman	R. Wright	19	0	0	bright	16:30			17:15	45
Marmot 1a	26-Jul-12	BJ LSA	Nathan	S.Freeman	R. Wright	18	0	5 km	bright	17:20			17:45	25
Marmot 7	27-Jul-12	BJ LSA	Nathan	S.Freeman	R. Wright	11	60	5 km	mixed	9:30			10:38	60

Appendix 6.5-4

Brucejack Marmot Aerial Survey Results, 2012

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Appendix 6.5-4. Brucejack Marmot Aerial Survey Results, 2012

						HSR (1 TO 4)								
WPT	Y_PROJ	X_PROJ	SU	Species	Size*	Model	Field	BEC (BAFA/SWB)	Est. Slope	Aspect	Soil Depth	Soil Texture	Veg.	Species
001	6259342	456134	4	H	S	1/2	1	ESSFp	20%	s/w	>1	cobble/sand	herb	H marmot
002	6259384	455931	4	H	S	1/2	2	ESSFp	20%	s/w	>1	cobble/sand	herb/s	H marmot
003	6258787	460138	4	H	M		2	BAFA	35%	s/e	<1	rock/loam	herb	H marmot
004	6258116	458963	4	H	S		2	BAFA	30%	s/w	<1	loam	herb	H marmot
005	6258043	459039	4	H	S		2	BAFA	30%	s/w	<1	loam	herb	H marmot
006	6257775	457835	4	H	L		1	BAFA	25%	s	>1	cobble/loam	herb	H marmot
007	6257939	457397	4	H	L		1	BAFA	20%	s	>1	cobble/loam	herb	H marmot
008	6256398	456683	4	H	L		1	BAFA	20%	s	>1	cobble/loam	herb	H marmot
009	6256202	456237	4	H	M		2	BAFA	30%	s	<1	rock/loam	herb (s)	H marmot
010	6256084	455692	4	H	S		2	BAFA	30%	s (w)	<1	rock/loam	herb	H marmot
011	6259433	456304	4	H	LL		1	BAFA	20%	s/w	>1	rock/loam	herb	H marmot
012	6259854	455801	4	H	L		1	BAFA	30%	s/w	~1	rock/loam	herb	H marmot
013	6261659	456137	4	H	S		2	BAFA	15%	w	<1	loam	herb (t/s)	H marmot
014	6259560	459915	4	H	M		3/2	BAFA	30%	w	<1	rock/loam	barren	H marmot
015	6258521	459765	4	H	M		2	BAFA	45%	s/w	1	rock/loam	herb	H marmot
016	6258102	459304	4	H	M		1	BAFA	20%	s	>1	loam	herb	H marmot
017	6258332	458809	4	H	M		2/3	BAFA	40%	s/w	<1	rock/loam	barren	H marmot
018	6258034	457898	4	H	LL		2	BAFA	40%	s	>1	rock/loam	herb	H marmot
019	6258192	457491	4	H	LL		1	BAFA	25%	s	>1	cobble/loam	herb	H marmot
020	6258394	457158	4	H	M		2	BAFA	15%	s/w	>1	cobble/loam	herb	H marmot
021	6258796	457041	4	H	L		1	BAFA	20%	s	>1	cobble/loam	heather/heath	H marmot
022	6256619	456540	4	H	M		1	BAFA	20%	s	>1	cobble/loam	herb	H marmot
023	6256263	456205	4	H	M		1/2	BAFA	25%	s/w	>1	cobble/loam	heather/heath	H marmot
024	6256238	455752	4	H	L		1/2	BAFA	30%	s	>1	cobble/loam	herb	H marmot
025	6256194	455484	4	H	M		2	BAFA	35%	s	<1	cobble/loam	herb (s)	H marmot
026	6257544	454970	4	H	M		2	BAFA	40%	s/e	<1	rock/loam	barren	H marmot
027	6256524	456221	4	H	M		2	BAFA	30%	s	>1	cobble/loam	herb (HA)	H marmot
028	6256409	455585	4	H	L		1	BAFA	35%	s	>1	cobble/loam	herb	H marmot
029	6256245	455213	4	H/U ?	L		2	BAFA	35%	s	<1	shale/loam	herb (barren)	H marmot &?
030	6259109	456612	4	H	M		2	BAFA	25%	s/w	>1	loam	herb (hether/heath & barren)	H marmot
031	6259477	456598	4	H	M		2	BAFA	40%	s	>1	cobble/loam	herb (HH)	H marmot
032	6259849	456143	4	H	L		2	BAFA	40%	s	>1	cobble/loam	herb (S)	H marmot
033	6260146	455691	4	H	M		2	BAFA	30%	s/w	1	cobble/loam	herb (S)	H marmot
034	6260657	455688	4	H	S		2	BAFA	45%	w	1	cobble/loam/rock	herb (barren)	H marmot
035	6261037	455749	4	H	S		2	BAFA	45%	w	1	cobble/loam	herb (barren)	H marmot
036	6261265	455889	4	H	M		2	BAFA	35%	n/w	1	rock/loam	herb (barren)	H marmot
037	6261177	456680	4	H	S		3	BAFA	40%	n/e	<1	rock (loam)	herb (barren)	H marmot
038	6261313	457269	4	H	S		3	BAFA	40%	e	<1	rock/loam	herb (barren)	H marmot
039	6259715	459587	4	H	M		2	BAFA	30%	s/w	1	cobble/loam	herb (barren)	H marmot
040	6259151	459542	4	H	S		2	BAFA	30%	w	<1	rock/loam	herb (barren)	H marmot
041	6258645	459662	4	H	L		2	BAFA	30%	s	1	rock/loam	herb (barren)	H marmot
042	6258247	459614	4	H	M		1	BAFA	15%	s	>1	cobble/loam	herb	H marmot
043	6258416	459010	4	H	M		1	BAFA	30%	sw	1	rock/loam	herb	H marmot
044	6258389	458591	4	H	M		2	BAFA	35%	se	>1	cobble/loam	herb (barren)	H marmot
045	6258147	458370	4	H	S		1/2	BAFA	40%	sw	1	cobble/loam	herb	H marmot

Appendix 6.5-4. Brucejack Marmot Aerial Survey Results, 2012

						HSR (1 TO 4)								
WPT	Y_PROJ	X_PROJ	SU	Species	Size*	Model	Field	BEC (BAFA/SWB)	Est. Slope	Aspect	Soil Depth	Soil Texture	Veg.	Species
046	6258130	458004	4	H	L		1	BAFA	30%	sw	>1	cobble/loam	herb	H marmot
047	6258273	457632	4	H	L		1	BAFA	30%	sw	>1	cobble/loam	herb	H marmot
048	6259035	457188	4	H	S		2	BAFA	30%	s	1	rock/loam	herb (heather, heath)	H marmot
049	6259422	456963	4	H	S		2	BAFA	30%	w	>1	cobble/loam	herb (heather, heath)	H marmot
050	6259684	456735	4	H	L		1/2	BAFA	30%	s	>1	cobble/loam	herb (heather, heath)	H marmot
051	6259958	456361	4	H	M		2	BAFA	35%	w	>1	cobble/loam	herb (heather, heath)	H marmot
052	6260017	456220	4	H	L		1	BAFA	35%	s	>1	cobble/loam	herb	H marmot
053	6258447	458530	4	H	M		2	BAFA	30%	s	>1	cobble/loam	herb (barren)	H marmot
054	6259810	457162	4	H	M		2	BAFA	25%	sw	>1	sand/loam	herb (heather, heath)	H marmot
055	6260033	456556	4	H	S		2	BAFA	20%	sw	>1	sand/loam	herb (heather, heath)	H marmot
056	6260094	456367	4	H	M		2	BAFA	20%	sw	>1	cobble/loam	herb (heather, heath)	H marmot
057	6260142	456272	4	H	L		1	BAFA	30%	sw	>1	cobble/loam	herb	H marmot
058	6258330	458267	4	H	S		2	BAFA	40%	sw	>1	cobble/loam	herb (barren)	H marmot
059	6259737	457412	4	H	M		2	BAFA	35%	w	>1	cobble/loam	herb (barren/heather, heath)	H marmot
060	6259953	457189	4	H	S		2	BAFA	35%	w	>1	cobble/loam	herb (barren/heather, heath)	H marmot
061	6260110	456675	4	H	S		2	BAFA	40%	sw	>1	cobble/loam	herb (barren/heather, heath)	H marmot
062	6260370	456297	4	H	S		2	BAFA	40%	sw	>1	cobble/loam	herb (heather, heath)	H marmot
063	6254396	441768	6	H	S		1	BAFA	40%	sw	<1	rock/loam	herb	H marmot
064	6253602	443335	6	H	S		1	BAFA	35%	sw	<1	rock/loam	herb	H marmot
065	6253405	443526	6	H	M		1/2	BAFA	30%	sw	<1	rock/loam	herb (s)	H marmot
066	6253326	445310	6	H	S		1/2	BAFA	30%	sw	<1	rock/loam	herb	H marmot
067	6256523	449616	6	H	S		2/3	BAFA	35%	s	<1	rock/loam	heather, heath/herb	H marmot
068	6255096	449856	6	H	S		2/3	BAFA	30%	se	<1	rock/loam	heather, heath/s	H marmot
069	6252646	447188	6	H	M		3	BAFA	30%	s	<1	rock/loam	heather,heath/s	H marmot
070	6253329	445935	6	H	S		2	BAFA	20%	s	<1	rock/loam	herb/heather, heath/s	H marmot
071	6253331	445709	6	H	S		2	BAFA	25%	s	<1	rock/loam	herb/heather, heath/s	H marmot
072	6253397	444486	6	H	M		1	BAFA	30%	s	~1	rock/loam	herb (heather, heath)	H marmot
073	6253795	443482	6	H	S		1	BAFA	20%	s	>1	cobble/loam	herb (heather, heath)	H marmot
074	6254167	442599	6	H	S		2	BAFA	20%	s	<1	rock/loam	herb (s)	H marmot
075	6254466	442002	6	H	M		1	BAFA	25%	sw	>1	rock/loam	herb (heather, heath)	H marmot
076	6254643	442148	6	H	S		2	BAFA	10%	s	>1	rock/loam	heather,heath	H marmot
077	6254466	442650	6	H	S		2	BAFA	10%	s	>1	rock/loam	heather,heath(herb)	H marmot
078	6254386	442626	6	H	M		2	BAFA	15%	s	>1	rock/loam	herb (heather, heath)	H marmot
079	6253097	446522	6	H	M		2	BAFA	20%	s	>1	rock/loam	herb/heather, heath	H marmot
080	6259315	450185	9	H	M		2	BAFA	20%	w	>1	cobble/loam	herb/heather,herb/s	H marmot
081	6263976	448580	9	H	S		1	BAFA	30%	sw	>1	cobble/loam	herb	H marmot
082	6259435	450026	9	H	S		1/2	BAFA	25%	sw	>1	cobble/loam	herb (heather, heath)	H marmot
083	6257671	425819	2	H	M		M	BAFA	30%	e	<1	gravel/rock	herb/barren	H marmot
084	6258638	425363	2	H	S		M/L	BAFA	35%	e	<1	gravel/loam/rock	herb/heather, heath/s	H marmot
085	6258255	425651	2	H	S		M/L	BAFA	45%	e	<50cm	gravel/loam	heather, heath/herb/barren	H marmot 2X
086	6258039	425713	2	H	M		M	BAFA	50%	e	<1	gravel/loam,rock	herb/barren	H marmot
087	6257825	425838	2	H	M		M	BAFA	45%	e	<1	gravel/rock/loam	herb/barren	H marmot
088	6258256	425798	2	H	M		M/L	BAFA	50%	e	<1	gravel/sand/rock	herb/barren	H marmot
089	6258489	424063	2	H	L		M	BAFA	40%	n	>1	cobble/loam/rock	herb/barren	H marmot
090	6257567	424659	2	H	S		M	BAFA	50%	w	~1	rock/loam	herb/barren	H marmot

Appendix 6.5-4. Brucejack Marmot Aerial Survey Results, 2012

						HSR (1 TO 4)								
WPT	Y_PROJ	X_PROJ	SU	Species	Size*	Model	Field	BEC (BAFA/SWB)	Est. Slope	Aspect	Soil Depth	Soil Texture	Veg.	Species
091	6256948	424716	2	H	M		M	BAFA	40%	w	~1	cobble/loam/rock	herb/barren	H marmot
092	6257998	423746	2	H	S		M	BAFA	45%	n	~1	rock/loam	herb	H marmot
093	6257846	423507	2	H	S		M	BAFA	55%	n	~1	cobble/loam	herb	H marmot P 2X
094	6260275	424890	2	H	S		L	BAFA	30%	w	>1	cobble/loam	herb/s/t	H marmot
095	6261527	424906	2	H	L		H	BAFA	30%	w	>1	cobble/loam	herb	H marmot
096	6261251	425109	2	H	M		H	BAFA	25%	w	>1	cobble/loam	herb	H marmot
097	6258997	425521	2	H	S		H	BAFA	20%	sw	>1	cobble/loam	herb	H marmot
098	6259119	425903	2	H	S		H	BAFA	30%	w	>1	cobble/loam	herb	H marmot
099	6259043	426117	2	H	S		M/L	BAFA	15%	w	<1	cobble/loam	herb/lichen	H marmot
100	6259165	426204	2	H	L		H	BAFA	20%	sw	>1	cobble/loam	herb	H marmot
101	6259079	426371	2	H	M		M	BAFA	30%	sw	<1	loam/rock	herb (barren)	H marmot
102	6259587	427162	2	H	M		M	BAFA	25%	sw	~1	loam	herb/heather, heath	H marmot
103	6259490	427276	2	H	S		M	BAFA	30%	sw	~1	loam	herb/heather,heath	H marmot
104	6259529	426294	2	H	S		M	BAFA	30%	sw	~1	loam/rock	herb/s	H marmot
105	6261150	425301	2	H	S		M	BAFA	15%	w	<1	loam/rock	herb/lichen	H marmot
106	6261220	425197	2	H	M		H	BAFA	20%	sw	>1	loam/rock	herb	H marmot
107	6261512	425057	2	H	LL		H	BAFA	35%	sw	>1	cobble/loam	herb	H marmot
108	6261767	425148	2	H	L		H	BAFA	35%	sw	>1	cobble/loam/cobble	herb	H marmot
109	6261442	425342	2	H	LL		H	BAFA	40%	sw	>1	cobble/rock	herb	H marmot
110	6261171	425448	2	H	L		M	BAFA	40%	sw	>1	rock/loam	herb/barren	H marmot
111	6261233	425589	2	H	L		H	BAFA	35%	sw	>1	cobble	herb	H marmot
112	6258934	422791	3a	H	M		H	BAFA	50%	s	>1	cobble/rock	herb	H marmot
113	6258102	421702	3a	H	S		H	BAFA	60%	s	>1	cobble	herb	H marmot
114	6257546	421001	3a	H	S		M	BAFA	60%	s	<1	cobble/rock	herb/barren	H marmot
115	6258031	421354	3a	H	S		L	BAFA	60+%	s	<1	loam/rock	herb	H marmot
116	6258514	422251	3a	H	LL	H	H	BAFA	50%	s	>1	loam	herb	H marmot
117	6258637	422343	3a	H	LL		H	BAFA	50+%	s	>1	loam/cobble	herb	H marmot
118	6259173	422699	3a	H	LL		H	BAFA	50+%	s	>1	loam/cobble	herb	H marmot
119	6259111	422510	3a	H	LL		H	BAFA	50+%	s	>1	loam/cobble	herb	H marmot
120	6258644	422211	3a	H	L		H	BAFA	50+%	s	>1	loam/cobble	herb	H marmot
121	6258990	422261	3a	H	L		H	BAFA	50+%	s	>1	loam/cobble	herb	H marmot
122	6259147	422406	3a	H	LL		H	BAFA	40%	s	>1	loam/rock	herb	H marmot
123	6260027	422148	3a	H	M		M	BAFA	40%	e	>1	cobble/loam	herb	H marmot
124	6259806	422677	3a	H	M		H	BAFA	40%	e	>1	cobble/loam	herb	H marmot
125	6259768	422858	3a	H	S		M	BAFA	35%	e	>1	cobble/loam	herb	H marmot
126	6259583	421215	3a	H	M		M	BAFA	50+%	se	~1	cobble/loam	herb	H marmot
127	6259502	421112	3a	H	LL		M/H	BAFA	50+%	se	~1	cobble/loam	herb	H marmot
128	6259726	418606	3a	H	S		M	BAFA	40%	ne	~1	cobble/loam	herb	H marmot
129	6258939	418350	3a	H	L		H	BAFA	40%	n	>1	cobble/loam	herb	H marmot
130	6259598	418736	3a	H	S		M	BAFA	30%	n	>1	cobble/loam/boulder	herb	H marmot
131	6259060	418632	3a	H	LL		H	BAFA	25%	n	>1	cobble/loam	herb	H marmot
132	6258656	418887	3a	H	LL		H	BAFA	25%	n	>1	cobble/loam/boulder	herb (barren)	H marmot
133	6262791	422802	1a	H	M		M	BAFA	50+%	w	1	cobble/loam	herb/barren	H marmot
134	6262914	422155	1a	H	S		M/L	BAFA	20%	w	>1	cobble/loam	herb/barren	H marmot
135	6263100	421408	1a	H	M		M	BAFA	20%	w	>1	cobble/loam	herb/heather,heath	H marmot

Appendix 6.5-4. Brucejack Marmot Aerial Survey Results, 2012

						HSR (1 TO 4)								
WPT	Y_PROJ	X_PROJ	SU	Species	Size*	Model	Field	BEC (BAFA/SWB)	Est. Slope	Aspect	Soil Depth	Soil Texture	Veg.	Species
136	6263058	421184	1a	H	M		M	BAFA	10%	w	>1	cobble/loam	herb/heather,heath	H marmot
137	6263395	419773	1a	H	S		M	BAFA	15%	s	>1	cobble/loam	herb/heather,heath	H marmot
138	6263437	419505	1a	H	S		L	BAFA	30%	w	~1	cobble/loam	herb/heather,heath	H marmot
139	6263230	421224	1a	H	M		M	BAFA	20%	w	1	cobble/loam	herb/heather,heath	H marmot
140	6262865	423597	1a	H	L		H	BAFA	40%	w	1	cobble/loam/rock	herb	H marmot
141	6262657	423814	1a	H	S		H	BAFA	40%	w	1	cobble/loam/rock	herb	H marmot
142	6263064	423564	1a	H	S		M	BAFA	40%	w	1	cobble/loam/rock	herb/barren	H marmot
143	6256498	439355	7	H	S		L	ESSF un	30%	e	<1	rock/loam	herb/barren	H marmot
144	6257937	434349	7	H	M		M	ESSF	30%	w	<1	rock/loam	herb/rock	H marmot
145	6258207	434062	7	H	S		L	ESSF	25%	w	<1	rock/loam	herb/rock	H marmot
146	6258044	434413	7	H	L		L	ESSF	30%	w	<1	rock/loam	herb/heather,heath/rock	H marmot
147	6257904	434599	7	H	M		M	ESSF	40%	w	~1	loam/gravel	herb/heather,heath	H marmot
148	6257811	434800	7	H	S		L/M	ESSF	50%	w	<1	gravel/rock	herb/rock	H marmot
149	6257679	434992	7	H	S		M	ESSF	45%	w	~1	gravel/rock	herb/barren	H marmot
150	6257554	435088	7	H	S		M/H	ESSF	40%	w	>1	gravel/rock	herb/rock	H marmot
151	6257144	436007	7	H	M		H	ESSF	30%	sw	>1	cobble/loam	herb	H marmot
152	6256820	436579	7	H	S		H	ESSF	25%	sw	>1	cobble/loam	herb	H marmot
153	6256192	437394	7	H	S		M	ESSF	30%	sw	<1	rock/loam	herb/rock	H marmot
154	6257090	436622	7	H	S		H	ESSF	40%	w	>1	cobble/loam	herb	H marmot
155	6257274	436402	7	H	M		H	ESSF	40%	w	>1	cobble/rock	herb	H marmot
156	6257923	434862	7	H	S		M	ESSF	40%	w	>1	cobble/rock	herb/barren	H marmot
157	6258430	434427	7	H	M		M	ESSF	40%	w	<1	rock/loam	herb/rock	H marmot
158	6258332	434410	7	H	S		M	ESSF	40%	w	<1	rock/loam	herb/rock	H marmot
159	6258219	434587	7	H	L		H	ESSF	45%	w	<1	gravel/loam	herb	H marmot
160	6258012	434893	7	H	M		H	ESSF	50%	w	<1	gravel/rock	herb/barren	H marmot
161	6257792	435250	7	H	S		M	ESSF	40%	w	<1	gravel/loam	herb/rock	H marmot
162	6257648	435521	7	H	S		M	ESSF	40%	w	~1	gravel/loam	herb/barren	H marmot
163	6257548	435809	7	H	M		H	ESSF	50%	sw	~1	gravel/loam	herb	H marmot
164	6257560	436516	7	H	M		M	ESSF	40%	w	1	cobble/rock	herb/heather,heath	H marmot
165	6257383	436711	7	H	M		H/M	ESSF	50%	w	>1	cobble/loam	herb/heather,heath	H marmot
166	6256467	437410	7	H	L		H/M	ESSF	40%	w	>1	cobble/loam/boulder	herb/heather,heath	H marmot
167	6256218	437674	7	H	M		M	ESSF	50%	w	~1	cobble/loam/boulder	herb/rock	H marmot
168	6256708	437335	7	H	S		M	ESSF	50%	w	>1	cobble/loam	heather,heath	H marmot
169	6257676	436064	7	H	M		H	ESSF	50%	s	>1	cobble/loam	herb	H marmot
170	6255321	434657	7	H	S		M	ESSF	40%	e	<1	cobble/loam	herb/barren	H marmot
171	6255078	434736	7	H	S		M	ESSF	40%	e	<1	cobble/loam	herb/barren	H marmot
172	6253872	436764	7	H	S		L	ESSF	50%	ne	<1	rock/loam	herb/rock	H marmot

** Size Codes Are: S= <5 holes, M= 5-10 holes, L= >10 holes*

Appendix 6.5-5

Brucejack Marmot Ground Survey Results, 2012

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Appendix 6.5-5. Brucejack Marmot Ground Survey Results, 2012

Marmot WPT	GIF Plot	Elevation	BEC Zone (BAFA/SWB)	Slope	Aspect	Moisture	Nutrient	Soil Texture	Soil Depth	Boulder Talus Dist	Veg	HSR	Ground Rating Standardized	Active?	Size
011	17	1476	bafa	38	225	3	d	sandy loam with cobbles/gravel	>1m	within 100m	rich/mesic herb meadow	h	1	y	large
050	18	1594	bafa	43	165	3	c	sandy loam with cobbles	>1m	none	mesic/dry herb	H	1	y	s/m
031	22	1540	bafa	40	226	3	d	sandy loam with 20% gravel	1m	none	moist/mesic herb	h	1	y	l
001	23	1374	bafa/essfun	22	238	4	d/e	cobble silt loam	>1m	none	rich/moist herb	h	1	y	small
063	26	1420	essfunp	60	290	3	d	gravel loam, 30-40% coarse frag	>1m	in colony	moist/mesic herb	h	1	y	?
075	27	1507	essfun/bafa	40	205	3	c	sandy loam with 20% gravel	>1m	in colony	dry/mesic herb	h	1	y	?
166	30	1381	essfunp	45	220	3.50	c/d	gravelly loam with cobbles and angular	<1m	in colony	hh/mesic herb	m	2	n	m
153	31	1326	essfunp	45	180	3	d	sandy/gravel/loam, >50% cobble/coarse	1m	in colony	hh/mh/ms	m	2	n	s
081	57	1429	essfunp	45	120	4	d	gravelly/sandy loam with 35-30% coarse	>1m	none	hh/mh	h (m)	1	y	l
079	77	1404	bafa/essfunp	70	100	4	d	gravelly loam with 35-40% coarse	1m	none	moist/mesic herb	m	2	n	s
080	78	1345	essfunp	60	100	4	d	gravelly/sandy loam with 35-30% coarse	1m	within 150m	hh	l	3	n	s
080	79	1307	essfunp	32	100	4	d/e	gravelly/sandy loam with 35-30% coarse	>1m	within 150m	krumholtz	m	2	n	s
042	80	1474	essfunp/bafa	28	175	4	d	loam with 30-35% corse gravel /cobbles	>1m	none	mesic/rich herb	h	1	y	s
016	81	1449	essfunp	40	185	4	d/e	gravely loam, 20-30% coarse	1m	none	mesic/rich herb	h	1	y	
043	82	1529	essfunp	60	200	4	d/e	gravelly loam with 20-30% coarse	>1m	none	rich herb	h	1	y	m/s
027	84	1450	essfunp	40	140	4	d/e	gravelly loam, 30% coarse	>1m	some small blders within colony	rich herb	h	1	y	l
023	85	1421	essfunp	58	165	4	d	gravelly loam, 25-30% coarse	>1m	none	mesic herb	h	1	y	l
022	87	1379	essfunp	28	120	4	d	gravelly loam, 25-30% coarse	>1m	none	rich herb	h	1	n	m

Appendix 6.6-1

Incidental Observations of Furbearers during KSM Wildlife Baseline Studies, 2008 and 2009

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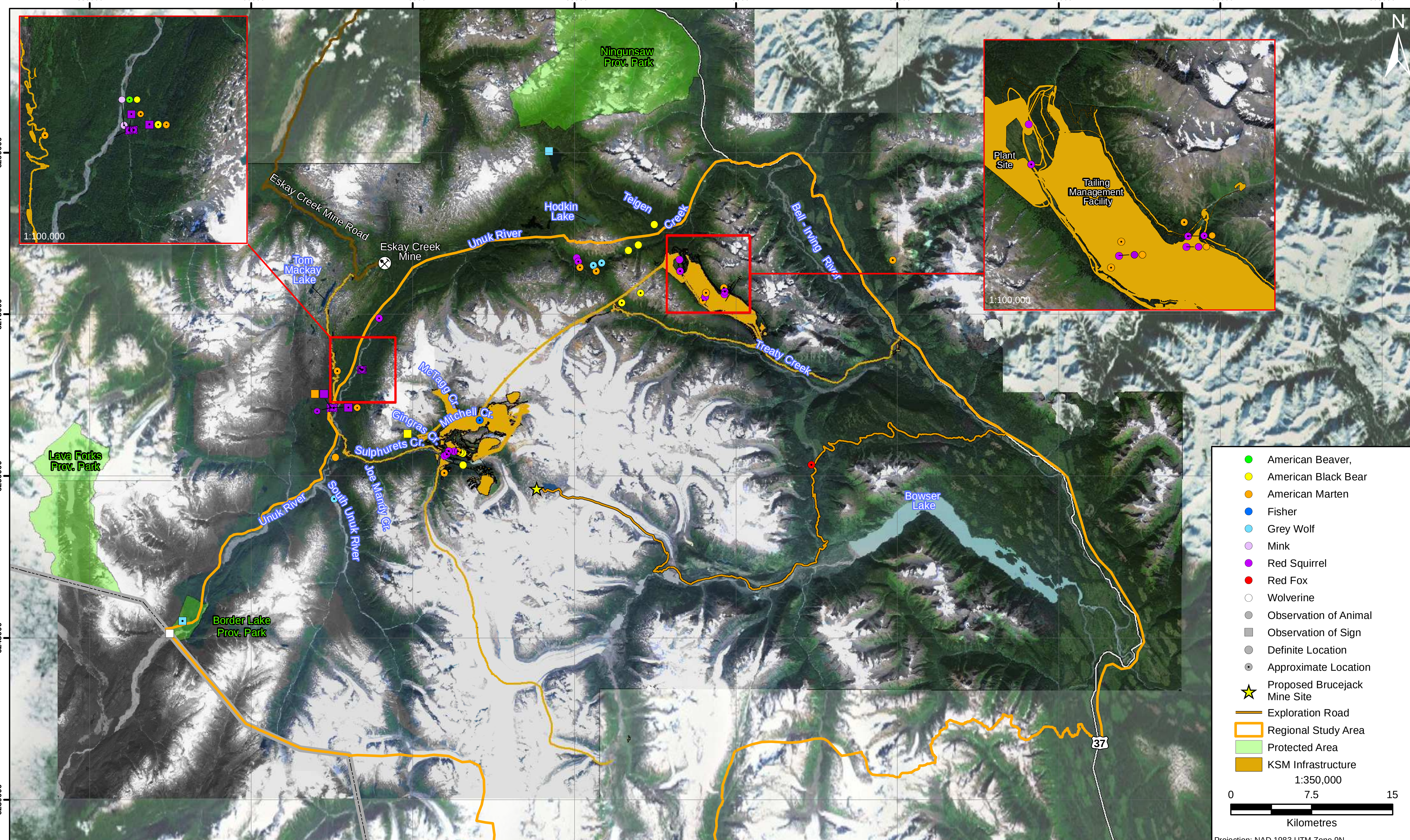

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Appendix 6.6-1

Incidental Observations of Furbearers during KSM Wildlife Baseline Studies, 2008 and 2009

Appendix 6.6-2

Summary of Furbearer Observations during KSM Wildlife Studies, 2008 and 2009

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Appendix 6.6-2. Summary of Furbearer Observations during KSM Wildlife Studies, 2008 and 2009

	No. Observations in 2008		No. Observations in 2009		
Species	**Animal**	**Sign**	**Animal**	**Sign**	**Total**
American Beaver	-	1	-	-	**1**
American Black Bear	3	16	-	7	**26**
American Marten	1	21	-	3	**25**
Fisher	-	1	-	-	**1**
Grey Wolf	2	5	1	-	**8**
Mink	-	1	-	-	**1**
Red Fox	-	1	-	-	**1**
Red Squirrel	5	21	-	-	**26**
Wolverine	-	-	1	-	**1**
Total	**9**	**65**	**2**	**10**	**90**

Appendix 6.7-1

Wolverine Reference Photos, 2012

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Appendix 6.7-1. Wolverine Reference Photos, 2012

Plate 1. W1.

Plate 2. W2.

Plate 3. W2.

Plate 4. W3 (unidentifiable).

Plate 5. W4.

Plate 6. W5.

Plate 7a. W6. *Plate 7b. W6.*

Plate 8. W7 (unidentifiable).

Plate 9. W8 (could be W5).

Plate 10. W9.

Plate 11. W10 (could be W5 but considered unidentifiable).

Plate 12. W11.

Appendix 6.7-2

Genetic and Sample Collection Data

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Appendix 6.7-2. Genetic and Sample Collection Data

			Genetic Data														
Individual	List of Samples	#	# Loci	*Gg-7*	*Ggu101*	*Ggu216*	*Mvis075*	*Tt-4*	*Gg-4*	*Lut604*	*Ma-19*	*Ma-2*	*MP0182*	*MP0197*	*Gg-14*	Sex
532	532;	1	12	157.159	141.145	169.169	127.137	168.168	204.206	112.118	00.200	134.134	179.195	252.268	129.129	F
521	536; 521; 531;	3	13	157.157	145.145	169.175	135.137	168.174	204.206	118.126	200.200	134.134	179.187	252.252	129.129	F
400	400; 399; 406; 404; 408; 407	6	13	157.159	129.145	169.177	133.135	168.168	198.204	112.118	200.200	134.134	183.195	252.268	127.131	F
373	373;	1	13	147.159	129.139	171.177	131.135	168.168	202.204	118.118	192.198	134.134	187.191	252.268	129.133	M
371	371;	1	13	157.159	139.145	165.171	133.135	168.168	204.204	118.124	192.198	134.134	179.191	264.264	129.129	M

		Sample Capture Information													
Sample ID	Individual	Group	Barb	Cell	Site	Check	Location	Date	Species	Cell	Site	Zone	UTM	UTM	Camera
371	371	A	2	46	1	1	P	2/29/2012	wolverine	46	1	9	455655	6254041	5
373	373	B	1	46	1	1	T	2/29/2012	wolverine	46	1	9	455655	6254041	5
400	400	A	2	21	1	2	P	3/14/2012	wolverine	21	1	9	463364	6268478	9
399	400	C	1	21	1	2	P	3/14/2012	wolverine	21	1	9	463364	6268478	9
406	400	D	1	21	1	2	P	3/14/2012	wolverine	21	1	9	463364	6268478	9
404	400	E	1	21	1	2	P	3/14/2012	wolverine	21	1	9	463364	6268478	9
408	400	J	1	21	1	2	G	3/14/2012	wolverine	21	1	9	463364	6268478	9
407	400	Z	1	21	1	2	G	3/14/2012	wolverine	21	1	9	463364	6268478	9
452		C	1	21	1	3	T	3/29/2012	wolverine	21	1	9	463364	6268478	9
533		A	5	47	1	4	P	4/19/2012	wolverine	47	1	9	463791	6256083	6
536	521	A	1	47	1	4	P	4/19/2012	wolverine	47	1	9	463791	6256083	6
521	521	B	5	47	1	4	P	4/19/2012	wolverine	47	1	9	463791	6256083	6
531	521	B	3	47	1	4	P	4/19/2012	wolverine	47	1	9	463791	6256083	6
532	532	B	1	47	1	4	P	4/19/2012	wolverine	47	1	9	463791	6256083	6

Appendix 6.8-1

Brucejack Grizzly Bear DNA Data, 2011

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Appendix 6.8-1. Brucejack Grizzly Bear DNA Data, 2011

			Project			Genetic Data								
Individual	List of Samples	#	g0501	g0769	g1153	# Loci	*G10J*	*G1A*	*G10B*	*G10H*	*G10M*	*G10U*	*MU50*	Sex
5250	5250; 6078; 7990;	3	1	1		8	190.190	190.194	150.160	221.255	208.214	161.163	122.130	M
5264	5264; 5268; 5267; 5217; 5632; 5835; 5821; 5828; 5974; 6371; 7965; 7967; 7966; 7974;	14	1	1		8	190.194	194.198	158.160	231.255	208.214	163.163	122.122	F
5299	5299; 5193; 5201; 5909; 5054;	5	1	1		8	186.190	194.198	150.160	221.223	206.208	163.163	138.138	M
5696	5696; 5699; 5673; 5674; 5633; 5634; 6246; 6247;	8	1	1		8	190.196	194.194	158.160	221.231	206.212	161.171	128.132	M
5971	5971; 5925; 6258; 6256;	4	1	1		8	186.194	198.198	150.150	223.255	208.208	161.175	122.132	F
5285	5285;	1	1			8	186.190	186.198	150.158	231.233	208.208	163.177	132.138	F
5337	5337; 5339; 5335; 5409; 5417; 5418;	6	1			8	186.190	190.198	160.166	221.221	206.206	163.163	120.138	F
5442	5445; 5442; 5468; 5469;	4	1			8	186.190	194.198	148.152	231.233	204.210	161.161	132.138	M
5672	5672;	1	1			8	186.194	194.198	152.160	221.231	208.208	161.163	122.132	F
5740	5740; 5741; 5773; 5638;	4	1			8	180.190	180.184	152.158	231.231	206.208	161.163	138.142	M
5920	5920; 5919; 5778; 5783;	4	1			8	186.190	194.196	150.160	221.255	206.214	163.165	130.138	F
5948	5948;	1	1			8	190.190	184.190	150.160	221.255	206.214	163.171	136.138	F
6010	6010; 6009; 5994; 6053; 6051;	5	1			8	186.190	194.198	150.158	221.231	206.208	161.161	128.138	F
6097	6097;	1	1			8	190.194	190.198	150.164	221.255	212.212	161.161	132.132	M
6120	6120;	1	1			8	190.194	194.198	158.164	255.255	212.212	161.163	132.138	F
7486	7486;	1	1			8	186.196	194.198	152.158	223.223	206.214	161.175	110.132	M
6214	6214; 6506;	2		1		8	186.186	194.198	152.160	221.233	214.214	163.175	130.138	M
6336	6336; 6340;	2		1		8	186.186	194.194	160.164	231.255	206.214	161.163	120.130	F
6338	6338; 6342;	2		1		8	186.186	180.194	152.152	221.223	208.212	163.163	138.138	M
6425	6425; 6428;	2		1		8	186.186	184.198	150.164	223.233	208.208	163.175	136.142	M
6441	6441;	1		1		8	186.186	194.196	158.164	221.255	212.214	163.165	130.138	F
6485	6485;	1		1		8	186.190	198.198	150.158	221.255	208.212	161.163	132.132	F
6520	7969; 6520; 6525; 6524;	4		1		8	190.192	198.198	152.160	223.231	210.214	161.163	122.138	M
7987	7987; 6516; 6517;	3		1		8	186.190	180.198	158.160	221.231	212.212	159.161	130.138	F
7991	7991; 8000; 7999;	3		1		8	186.190	184.194	148.164	221.233	206.206	175.175	122.130	M

Appendix 6.8-1. Brucejack Grizzly Bear DNA Data, 2011

			Project			Genetic Data								
Individual	List of Samples	#	g0501	g0769	g1153	# Loci	*G10J*	*G1A*	*G10B*	*G10H*	*G10M*	*G10U*	*MU50*	Sex
8006	8006; 8008;	2		1		8	190.196	194.198	152.164	221.223	206.214	163.175	120.122	F
67412	067412;	1		1		8	186.190	196.198	160.164	223.231	204.206	163.171	130.138	M
100678	100678;	1		1		8	180.186	180.198	148.148	223.231	206.210	161.163	120.138	M
105553	105553;	1		1		8	186.190	184.198	150.150	221.255	206.212	161.171	110.136	F
106945	106945;	1		1		8	186.190	194.198	152.158	221.223	212.214	163.171	130.142	M
107235	107235;	1		1		8	190.196	194.194	150.158	221.233	212.214	163.171	130.138	F
107237	107237;	1		1		8	186.186	190.194	150.160	221.223	206.214	175.175	130.142	M
107239	107239;	1		1		8	186.186	190.196	152.160	221.221	206.208	161.171	122.138	M
107810	107810;	1		1		8	180.190	198.198	152.152	231.233	206.212	163.175	138.138	M
107816	107816;	1		1		8	186.190	184.190	152.160	221.231	206.208	161.171	132.138	F
107818	107818;	1		1		8	190.190	190.194	140.152	223.252	212.212	163.175	130.138	M
107998	107998;	1		1		8	186.190	190.194	150.152	223.231	210.212	161.161	120.136	M
108536	108536;	1		1		8	186.186	198.198	164.164	221.233	206.208	177.177	138.138	M
109904	109904;	1		1		8	186.190	180.180	152.158	223.233	208.208	161.163	132.132	M
109906	109906;	1		1		8	186.190	184.194	152.158	221.221	212.214	161.175	142.142	F
109909	109909;	1		1		8	186.196	184.194	152.152	231.231	206.208	161.161	138.142	M
109910	109910;	1		1		8	186.190	180.198	150.152	231.233	206.212	163.175	132.132	M
109911	109911;	1		1		8	186.190	196.198	158.160	223.233	206.206	163.163	110.138	M
109916	109916;	1		1		8	186.190	194.198	154.164	221.233	206.206	163.175	110.130	F
109917	109917;	1		1		8	190.190	194.196	150.152	223.231	212.214	171.171	138.138	M
109955	109955;	1		1		8	190.190	190.198	150.150	221.233	212.214	161.171	130.138	F
110038	110038;	1		1		8	180.186	184.198	148.158	221.255	206.208	161.163	122.138	M
110724	110724;	1		1		8	186.190	180.194	158.160	223.231	212.212	163.175	138.138	M
112207	112207;	1		1		8	186.192	194.198	150.150	231.231	206.206	163.163	132.138	M
112247	112247;	1		1		8	180.186	180.194	158.162	231.231	206.210	161.163	110.122	M
7410	7410; 5218; 5261; 5219; 140;	5	1		1	8	186.190	190.198	164.164	231.233	206.212	161.161	132.138	M
7514	7514; 340; 342; 347;	4	1		1	8	180.190	194.198	150.158	221.231	206.208	161.163	122.132	F
6192	6192; 6195; 6197; 6495; 6492; 6493; 6199; 6499; 325; 327; 329; 330; 332; 336;	14		1	1	8	186.186	194.198	152.152	221.223	206.214	159.161	138.138	M

Appendix 6.8-1. Brucejack Grizzly Bear DNA Data, 2011

			Project			Genetic Data								
Individual	List of Samples	#	g0501	g0769	g1153	# Loci	*G10J*	*G1A*	*G10B*	*G10H*	*G10M*	*G10U*	*MU50*	Sex
6217	6217; 85;	2		1	1	8	186.190	198.198	150.160	221.233	212.212	161.175	110.130	M
6486	6486; 6488; 6241; 6242; 6518; 344;	6		1	1	8	186.196	180.198	158.160	221.255	208.212	163.163	138.138	M
4	4; 7; 8;	3			1	8	186.186	198.198	150.158	223.231	206.212	161.161	130.132	F
15	15; 21; 22; 284;	4			1	8	180.186	198.198	150.164	223.255	214.214	161.171	122.138	M
16	16;	1			1	8	186.186	184.194	152.158	223.231	206.208	161.175	130.138	M
49	49; 51; 52; 54; 57;	5			1	8	186.190	184.198	150.158	221.231	212.212	161.175	132.138	F
53	53;	1			1	8	186.186	184.194	158.160	221.231	212.212	175.175	138.138	M
58	58; 60; 62; 63; 65; 66; 69; 159; 312; 315; 318; 320; 323;	13			1	8	186.186	194.198	152.152	221.221	206.206	163.163	138.138	F
71	71; 74;	2			1	8	186.186	194.198	158.164	221.233	208.208	171.175	130.136	F
72	72;	1			1	8	186.186	194.198	148.164	231.233	206.208	175.175	130.142	F
86	86; 251;	2			1	8	186.190	194.194	150.160	223.231	206.206	163.175	138.138	M
161	161; 181; 182; 183; 266; 285;	6			1	8	180.186	194.198	164.164	231.231	210.212	161.163	138.138	F
180	180; 270; 271; 288;	4			1	8	186.190	194.198	150.164	231.231	204.212	163.171	128.138	F
186	186; 187;	2			1	8	186.190	190.198	150.152	223.223	206.212	163.171	130.138	F
236	236; 237; 239; 291; 292;	5			1	8	186.190	194.196	152.164	231.231	206.214	171.175	138.138	M
250	250; 274; 275; 276; 281;	5			1	8	180.190	198.198	152.160	223.231	206.212	161.163	120.138	F
267	267;	1			1	8	186.186	194.198	150.152	221.231	206.212	161.163	110.138	M
299	299;	1			1	8	190.192	180.194	164.164	231.231	206.206	161.161	132.132	F
300	300;	1			1	8	186.190	194.198	164.164	231.233	206.212	161.163	128.132	M
302	302; 304; 310;	3			1	8	186.190	180.194	164.164	231.231	206.212	161.163	120.132	M
321	321;	1			1	8	180.186	180.198	152.158	221.221	206.212	163.171	138.138	F
356	356;	1			1	8	190.194	194.194	158.158	221.255	206.212	161.161	132.138	F

Appendix 6.8-2

Brucejack Grizzly Bear DNA Data, 2012

Engineers and Scientists

Appendix 6.8-2. Brucejack Grizzly Bear DNA Data, 2012

			Project					Genetic Data									
Individual	List of Samples	#	g0501	g0769	g1153	g1247	Stikine	# Loci	*G10J*	*G1A*	*G10B*	*G10H*	*G10M*	*G10U*	*MU50*	Sex
956	956; 958;	2				1		8	186.186	194.198	150.150	231.231	208.212	161.163	120.132	M
924	924; 926; 929; 931; 951; 963; 964; 967; 969; 970; 987; 1003;	12				1	5728	8	186.190	194.198	150.160	231.255	208.210	163.171	130.138	M
86	86; 251;	2			1			8	186.190	194.194	150.160	223.231	206.206	163.175	138.138	M
8006	8006; 8008;	2		1				8	190.196	194.198	152.164	221.223	206.214	163.175	120.122	F
7991	7991; 8000; 7999;	3		1				8	186.190	184.194	148.164	221.233	206.206	175.175	122.130	M
7987	7987; 6516; 6517; 681; 788; 2111; 942; 960; 962; 965; 966;	11		1		1		8	186.190	180.198	158.160	221.231	212.212	159.161	130.138	F
782	782; 794; 795; 2124; 971; 974;	6				1		8	186.190	190.198	152.158	231.255	208.214	161.163	122.130	F
7514	7514; 340; 342; 347;	4	1		1			8	180.190	194.198	150.158	221.231	206.208	161.163	122.132	F
7486	7486; 595;	2	1			1		8	186.196	194.198	152.158	223.223	206.214	161.175	110.132	M
744	744; 745;	2				1		8	186.190	194.194	152.152	221.233	210.214	161.161	110.120	M
742	742;	1				1		8	186.190	194.194	152.158	221.255	210.212	161.161	110.138	F
7410	7410; 5218; 5261; 5219; 140;	5	1		1			8	186.190	190.198	164.164	231.233	206.212	161.161	132.138	M
72	72;	1			1			8	186.186	194.198	148.164	231.233	206.208	175.175	130.142	F
710	710; 718;	2				1		8	186.190	184.194	152.158	233.255	212.214	161.175	110.138	F
71	71; 74;	2			1			8	186.186	194.198	158.164	221.233	208.208	171.175	130.136	F
663	663; 664; 666; 669; 673;	5				1		8	186.194	194.198	152.158	223.255	208.214	171.175	120.130	M
6520	7969; 6520; 6525; 6524;	4		1			5574	8	190.192	198.198	152.160	223.231	210.214	161.163	122.138	M
6486	6486; 6488; 6241; 6242; 6518; 344; 677;	7		1	1	1		8	186.196	180.198	158.160	221.255	208.212	163.163	138.138	M
6485	6485;	1		1			5011	8	186.190	198.198	150.158	221.255	208.212	161.163	132.132	F
6441	6441;	1		1				8	186.186	194.196	158.164	221.255	212.214	163.165	130.138	F
6425	6425; 6428;	2		1				8	186.186	184.198	150.164	223.233	208.208	163.175	136.142	M
635	635; 637; 639;	3				1		8	186.186	194.198	150.160	221.255	208.214	163.175	130.138	M
6338	6338; 6342;	2		1				8	186.186	180.194	152.152	221.223	208.212	163.163	138.138	M
6336	6336; 6340;	2		1				8	186.186	194.194	160.164	231.255	206.214	161.163	120.130	F
6217	6217; 85; 699;	3		1	1	1		8	186.190	198.198	150.160	221.233	212.212	161.175	110.130	M
6214	6214; 6506;	2		1				8	186.186	194.198	152.160	221.233	214.214	163.175	130.138	M

Appendix 6.8-2. Brucejack Grizzly Bear DNA Data, 2012

			Project					Genetic Data								
Individual	List of Samples	#	g0501	g0769	g1153	g1247	Stikine	# Loci	*G10J*	*G1A*	*G10B*	*G10H*	*G10M*	*G10U*	*MU50*	Sex
6192	6192; 6195; 6197; 6495; 6492; 6493; 6199; 6499; 325; 327; 329; 330; 332; 336;	14		1	1			8	186.186	194.198	152.152	221.223	206.214	159.161	138.138	M
6120	6120;	1	1					8	190.194	194.198	158.164	255.255	212.212	161.163	132.138	F
6097	6097;	1	1					8	190.194	190.198	150.164	221.255	212.212	161.161	132.132	M
6010	6010; 6009; 5994; 6053; 6051;	5	1				0297	8	186.190	194.198	150.158	221.231	206.208	161.161	128.138	F
5971	5971; 5925; 6258; 6256;	4	1	1				8	186.194	198.198	150.150	223.255	208.208	161.175	122.132	F
5948	5948;	1	1					8	190.190	184.190	150.160	221.255	206.214	163.171	136.138	F
5920	5920; 5919; 5778; 5783;	4	1				0859	8	186.190	194.196	150.160	221.255	206.214	163.165	130.138	F
58	58; 60; 62; 63; 65; 66; 69; 159; 312; 315; 318; 320; 323;	13			1			8	186.186	194.198	152.152	221.221	206.206	163.163	138.138	F
5740	5740; 5741; 5773; 5638;	4	1					8	180.190	180.184	152.158	231.231	206.208	161.163	138.142	M
5696	5696; 5699; 5673; 5674; 5633; 5634; 6246; 6247;	8	1	1				8	190.196	194.194	158.160	221.231	206.212	161.171	128.132	M
5672	5672;	1	1					8	186.194	194.198	152.160	221.231	208.208	161.163	122.132	F
563	563; 2059; 2065;	3				1		8	186.186	194.194	150.152	223.233	206.208	161.163	136.138	F
5442	5445; 5442; 5468; 5469;	4	1					8	186.190	194.198	148.152	231.233	204.210	161.161	132.138	M
5337	5337; 5339; 5335; 5409; 5417; 5418;	6	1					8	186.190	190.198	160.166	221.221	206.206	163.163	120.138	F
53	53;	1			1			8	186.186	184.194	158.160	221.231	212.212	175.175	138.138	M
5299	5299; 5193; 5201; 5909; 5054;	5	1	1				8	186.190	194.198	150.160	221.223	206.208	163.163	138.138	M
5285	5285;	1	1					8	186.190	186.198	150.158	231.233	208.208	163.177	132.138	F
5264	5264; 5268; 5267; 5217; 5632; 5835; 5821; 5828; 5974; 6371; 7965; 7967; 7966; 7974;	14	1	1				8	190.194	194.198	158.160	231.255	208.214	163.163	122.122	F
5250	5250; 6078; 7990;	3	1	1				8	190.190	190.194	150.160	221.255	208.214	161.163	122.130	M
49	49; 51; 52; 54; 57;	5			1			8	186.190	184.198	150.158	221.231	212.212	161.175	132.138	F

Appendix 6.8-2. Brucejack Grizzly Bear DNA Data, 2012

			Project					Genetic Data								
Individual	List of Samples	#	g0501	g0769	g1153	g1247	Stikine	# Loci	*G10J*	*G1A*	*G10B*	*G10H*	*G10M*	*G10U*	*MU50*	Sex
4	4; 7; 8;	3			1			8	186.186	198.198	150.158	223.231	206.212	161.161	130.132	F
356	356;	1			1			8	190.194	194.194	158.158	221.255	206.212	161.161	132.138	F
321	321;	1			1			8	180.186	180.198	152.158	221.221	206.212	163.171	138.138	F
302	302; 304; 310;	3			1			8	186.190	180.194	164.164	231.231	206.212	161.163	120.132	M
300	300;	1			1			8	186.190	194.198	164.164	231.233	206.212	161.163	128.132	M
299	299;	1			1			8	190.192	180.194	164.164	231.231	206.206	161.161	132.132	F
267	267;	1			1			8	186.186	194.198	150.152	221.231	206.212	161.163	110.138	M
250	250; 274; 275; 276; 281;	5			1			8	180.190	198.198	152.160	223.231	206.212	161.163	120.138	F
236	236; 237; 239; 291; 292;	5			1			8	186.190	194.196	152.164	231.231	206.214	171.175	138.138	M
2020	2020; 2023;	2				1		8	186.192	190.194	150.164	231.255	208.212	163.163	122.130	F
186	186; 187;	2			1			8	186.190	190.198	150.152	223.223	206.212	163.171	130.138	F
180	180; 270; 271; 288;	4			1			8	186.190	194.198	150.164	231.231	204.212	163.171	128.138	F
161	161; 181; 182; 183; 266; 285;	6			1			8	180.186	194.198	164.164	231.231	210.212	161.163	138.138	F
16	16;	1			1			8	186.186	184.194	152.158	223.231	206.208	161.175	130.138	M
15	15; 21; 22; 284;	4			1			8	180.186	198.198	150.164	223.255	214.214	161.171	122.138	M
112247	112247;	1		1				8	180.186	180.194	158.162	231.231	206.210	161.163	110.122	M
112207	112207;	1		1				8	186.192	194.198	150.150	231.231	206.206	163.163	132.138	M
110724	110724;	1		1				8	186.190	180.194	158.160	223.231	212.212	163.175	138.138	M
110038	110038;	1		1				8	180.186	184.198	148.158	221.255	206.208	161.163	122.138	M
109955	109955;	1		1				8	190.190	190.198	150.150	221.233	212.214	161.171	130.138	F
109917	109917;	1		1				8	190.190	194.196	150.152	223.231	212.214	171.171	138.138	M
109916	109916;	1		1				8	186.190	194.198	154.164	221.233	206.206	163.175	110.130	F
109911	109911;	1		1				8	186.190	196.198	158.160	223.233	206.206	163.163	110.138	M
109910	109910;	1		1				8	186.190	180.198	150.152	231.233	206.212	163.175	132.132	M
109909	109909;	1		1				8	186.196	184.194	152.152	231.231	206.208	161.161	138.142	M
109906	109906;	1		1			7604	8	186.190	184.194	152.158	221.221	212.214	161.175	142.142	F
109904	109904;	1		1				8	186.190	180.180	152.158	223.233	208.208	161.163	132.132	M
108536	108536;	1		1				8	186.186	198.198	164.164	221.233	206.208	177.177	138.138	M
107998	107998;	1		1				8	186.190	190.194	150.152	223.231	210.212	161.161	120.136	M
107818	107818;	1		1				8	190.190	190.194	140.152	223.252	212.212	163.175	130.138	M
107816	107816;	1		1			0007	8	186.190	184.190	152.160	221.231	206.208	161.171	132.138	F
107810	107810;	1		1				8	180.190	198.198	152.152	231.233	206.212	163.175	138.138	M
107239	107239;	1		1			1535	8	186.186	190.196	152.160	221.221	206.208	161.171	122.138	M

Appendix 6.8-2. Brucejack Grizzly Bear DNA Data, 2012

			Project					Genetic Data								
Individual	List of Samples	#	g0501	g0769	g1153	g1247	Stikine	# Loci	*G10J*	*G1A*	*G10B*	*G10H*	*G10M*	*G10U*	*MU50*	Sex
107237	107237;	1		1				8	186.186	190.194	150.160	221.223	206.214	175.175	130.142	M
107235	107235;	1		1				8	190.196	194.194	150.158	221.233	212.214	163.171	130.138	F
106945	106945;	1		1				8	186.190	194.198	152.158	221.223	212.214	163.171	130.142	M
105553	105553;	1		1				8	186.190	184.198	150.150	221.255	206.212	161.171	110.136	F
100678	100678;	1		1				8	180.186	180.198	148.148	223.231	206.210	161.163	120.138	M
67412	067412;	1		1				8	186.190	196.198	160.164	223.231	204.206	163.171	130.138	M

Appendix 6.8-3

KSM Grizzly Bear DNA Data, 2008 and 2009

Appendix 6.8-3. Regional Grizzly Bear Detections

			2008 g0501			2009 g0769					2011 (g 1153)					2012 g1247				
	Individual	sex	KSM June 17-20/2008	June 30-July 4/2008	July 14-18/2008	June 8-12/2009	June 22-26/2009	July 3-7/2009	Oct 11-13/2009	Oct 26-27/2009	Aug 23 to 26/2011	Sept 7 to 9/2011	Sept 18, 19/2011	Nov 12/2011	Nov 25/2011	ck 1 May 30/2012	ck 2 June 11/2012	ck 3 June 24/2012	ck 1 24 Oct/2012	ck 2 Nov 7/2012
BJP 2011	4	F									1	0	0	0	0	0	0	0	0	0
	15	M									1	1	0	0	0	0	0	0	0	0
	16	M									1	0	0	0	0	0	0	0	0	0
	49	F									1	0	0	0	0	0	0	0	0	0
	53	M									1	0	0	0	0	0	0	0	0	0
	58	F									1	0	1	0	0	0	0	0	0	0
	71	F									1	0	0	0	0	0	0	0	0	0
	72	F									1	0	0	0	0	0	0	0	0	0
	86	M									1	1	0	0	0	0	0	0	0	0
	161	F									0	1	0	0	0	0	0	0	0	0
	180	F									0	1	0	0	0	0	0	0	0	0
	186	F									0	0	1	0	0	0	0	0	0	0
	236	M									0	0	1	0	0	0	0	0	0	0
	250	F									0	1	0	0	0	0	0	0	0	0
	267	M									0	1	0	0	0	0	0	0	0	0
	299	F									0	0	1	0	0	0	0	0	0	0
	300	M									0	0	1	0	0	0	0	0	0	0
	302	M									0	0	1	0	0	0	0	0	0	0
	321	F									0	0	1	0	0	0	0	0	0	0
	356	F									0	0	0	0	1	0	0	0	0	0
BJP 2012	563	F														1	0	0	0	0
	635	M														1	0	0	0	0
	663	M														1	0	0	0	0
	710	F														0	1	0	0	0
	742	F														0	1	0	0	0
	744	M														0	1	0	0	0
	782	F														0	1	1	0	1
	924 *stikine 5728	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	956	M														0	0	0	1	0
	2020	F														0	0	1	0	0
KSM 2008/09	6192	M	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	6217	M	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0
	6486	M	0	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	0	0
	7410	M	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	7514	F	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	7987	F	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	1	0
	7486	M	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

Appendix 7.2-1

Brucejack 2010 and 2012 Raptor Observations

Engineers and Scientists

Appendix 7.2-1. Brucejack 2010 and 2012 Raptor Observations

Species	Total	Date	Survey	Zone	Easting	Northing	Habitat	Comments
Bald eagle	1	24-Jun-10	Incidental Observation	9 V	451668	6259497	LK	pilot observed at Todedada Lake
Bald eagle	1	26-Jun-10	Incidental Observation	9 V	447492	6250296		
Bald Eagle	1	24-Jun-12	VRPC survey - ground	9V	435323	6213825	PC-3	
Bald Eagle	1	28-Jul-12	WB Brood Surveys - aerial	9 V	6251733	470855	LK (L)	Imature Bald Eagle, Wildfire Creek mouth/End Bowser Lake - lakes above Wildfire camp
Bald Eagle	1	29-Jul-12	WB Brood Surveys - aerial	9 V	6251466	397362	RI (M)	Imature Bald Eagle, Brucejack Lake/Upper Unuk
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	407581	6265546	RI	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	411121	6272696	RI	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	410852	6273026	RI	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	459442	6270046	RI	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	472227	6261928	RI	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	481598	6246874	RI	Bell Irving - Treaty Creek
Bald Eagle	2	9-Oct-12	WB Fall staging Survey - aerial	9 V	472130	6249745	LK	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	468681	6251959	LK	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	467343	6252922	LK	Bell Irving - Treaty Creek
Bald Eagle	3	9-Oct-12	WB Fall staging Survey - aerial	9 V	463940	6256055	LK	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	460074	6254623	LK	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	460501	6257215	LK	Bell Irving - Treaty Creek
Bald Eagle	4	9-Oct-12	WB Fall staging Survey - aerial	9 V	462000	6258225	LK	Bell Irving - Treaty Creek
Bald Eagle	2	9-Oct-12	WB Fall staging Survey - aerial	9 V	463439	6258177	LK	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	465334	6256533	LK	Bell Irving - Treaty Creek
Bald Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	475755	6250446	LK	Bell Irving - Treaty Creek
Bald Eagle	2	10-Oct-12	WB Fall staging Survey - aerial	9 V	393379	6246829	LK	Bell Irving - Treaty Creek
Bald Eagle	2	20-Apr-12	WB Spring Staging- aerial	9 V	465813	6266587	RI	juveniles
Bald Eagle	1	20-Apr-12	WB Spring Staging- aerial	9 V	458258	6274126	RI	
Bald Eagle	1	20-Apr-12	WB Spring Staging- aerial	9 V	475479	6258977	RI	Basic 4 - adult
Bald Eagle	5	13-May-12	WB Spring Staging Pair Survey - ground	9 V	456297	6252951	LK	Adult and 4 juveniles
Bald Eagle	1	13-May-12	WB Spring Staging Pair Survey - ground	9 V	447304	6249199	RI	Bald Eagle Nest
Bald Eagle	1	16-May-12	WB Spring Staging Pair Survey - ground	9 V	401189	6255837	RI	
Bald Eagle	1	16-May-12	WB Spring Staging Pair Survey - ground	9 V	394098	6246964	LK	
Bald Eagle	1	9-Jun-12	Standwatch Survey	9 V	445839	6251210		
Bald Eagle	1	24-Jun-12	VRPC survey - ground	9V	435936	6214386	PC-1	MHun
Bald Eagle	1	1-Apr-12	Wolverine camera/hair sampling	9 V	399941	6254720	CH 1	
Bald Eagle	1	2-Apr-12	Wolverine camera/hair sampling	9 V	473133	6250623	CH 7	
Bald Eagle Juvenile	1	23-Jun-12	Standwatch Survey	9 V	434826	6226823		
Golden Eagle	1	24-Jun-12	Call Playback Survey	9 V	435066	6227670		

Appendix 7.2-1. Brucejack 2010 and 2012 Raptor Observations

Species	Total	Date	Survey	Zone	Easting	Northing	Habitat	Comments
Golden Eagle	2	24-Jun-10	Standwatch Survey	9 V	462209	6262223		
Golden Eagle	1	7-Jun-12	VRPC survey - ground	9V	462199	6264036	L10-02	
Golden Eagle	1	9-Jun-12	VRPC survey - ground	9V	453315	6259138	L6-01	
Golden Eagle	1	24-Jun-12	VRPC survey - ground	9V	435066	6227670	PC-12	Alpine shrubs and rocky cliffs
Golden Eagle	1	10-Jun-12	VRPC survey - ground en route…	9V	463731	6259901	N/A	en route…
Golden Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	457098	6276029	BK	Bowser Lake/River - Scott Creek
Golden Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	472130	6249745	LK	Bowser Lake/River - Scott Creek
Golden Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	467343	6252922	LK	Bowser Lake/River - Scott Creek
Golden Eagle	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	463439	6258177	LK	Bowser Lake/River - Scott Creek
Golden Eagle	1	20-Apr-12	WB Spring Staging- aerial	9 V	457927	6254851	LK	Bell Irving north of Wildfire Creek (edge of RSA) - Start
Golden Eagle	1	17-Apr-12	Wolverine camera/hair sampling	9 V	406889	6258617	CH 2	
Northern Goshawk	1	9-Oct-12	WB Fall staging Survey - aerial	9 V	448805	6251220	WT	Bowser Lake/River - Scott Creek
Northern Harrier	1	10-Oct-12	WB Fall staging Survey - aerial	9 V	393379	6246829	LK	1 female, Bowser Lake/River - Scott Creek
Northern Harrier	1	13-May-12	WB Spring Staging Pair Survey - ground	9 V	478287	6248757	SW	
Raven	1	22-Jun-12	VRPC survey - ground	9V	434997	6217395	PC-7	Mature Sx to the East and dropoff to Salmon River to the west
Raven	1	25-Jun-12	VRPC survey - ground	9V	434643	6236515	A5	a flyover
Redtailed Hawk	1	8-Jun-12	VRPC survey - ground	9V	468294	6261948	L116-05	
Redtailed Hawk	1	20-Apr-12	WB Spring Staging- aerial	9 V	477125	6247075	RI	overland/forest
Red-tailed Hawk	2	11-Jun-12	Call Playback Survey	9 V	466864	6261022		
Short-eared Owl	1	13-May-12	WB Spring Staging Pair Survey - ground	9 V	456297	6252951	LK	flying near cottonwood trees, RUHU

Appendix 7.3-1

Brucejack Gold Mine Project Waterbird Survey Data, 2012

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Appendix 7.3-1. Brucejack Gold Mine Project Waterbird Survey Data, 2012

Survey Data						Species Data									Habitat Data*		Behaviour and Comments*	
Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Spring Staging	003	19-Apr-12	9 V	398618	6253744	Common Merganser	COME						1	2	RI	L		
Spring Staging	004	19-Apr-12	9 V	395732	6248384	Mallard	MALL	5	5					10	RI	L		
Spring Staging	004	19-Apr-12	9 V	395732	6248384	Common Merganser	COME						1	2	RI	L		
Spring Staging	005	19-Apr-12	9 V	392531	6245647	Common Merganser	COME						1	2	BK	M		
Spring Staging	007	19-Apr-12	9 V	393333	6246665	Trumpeter Swan	TRSW			8				8	LK	S		
Spring Staging	007	19-Apr-12	9 V	393333	6246665	Canada Goose	CAGO			12				12	LK	S		
Spring Staging	009	19-Apr-12	9 V	394156	6246784	Canada Goose	CAGO			13				13	LK	S		
Spring Staging	009	19-Apr-12	9 V	394156	6246784	Mallard	MALL						1	2	LK	S		
Spring Staging	009	19-Apr-12	9 V	394156	6246784	American Green-winged Teal	AGWT	3	2					5	LK	S		
Spring Staging	010	19-Apr-12	9 V	401274	6256295	Mallard	MALL	8	7					15	BK	L		
Spring Staging	011	19-Apr-12	9 V	405974	6258860	Common Merganser	COME						1	2	RI	L		
Spring Staging	012	19-Apr-12	9 V	406832	6260102	Trumpeter Swan	TRSW			1				1	RI	L		
Spring Staging	013	19-Apr-12	9 V	407890	6266444	Common Merganser	COME						1	2	RI	M		
Spring Staging	014	19-Apr-12	9 V	408609	6268509	Mallard	MALL						1	2	PO	M		
Spring Staging	016	20-Apr-12	9 V	465813	6266587	Bald Eagle	BAEA			2				2	RI	L		juveniles
Spring Staging	017	20-Apr-12	9 V	459396	6272950	Mallard	MALL	2					4	10	BK	M		
Spring Staging	017	20-Apr-12	9 V	459396	6272950	Barrow's Goldeneye	BAGO						2	4	BK	M		
Spring Staging	018	20-Apr-12	9 V	458909	6273028	Mallard	MALL			7				7	CR	L		mixed sexes
Spring Staging	018	20-Apr-12	9 V	458909	6273028	American Green-winged Teal	AGWT			3				3	CR	L		mixed sexes
Spring Staging	019	20-Apr-12	9 V	458258	6274126	Bald Eagle	BAEA			1				1	RI	L		4 wolves just upstream
Spring Staging	020	20-Apr-12	9 V	457185	6276142	Mallard	MALL						3	6	BK	L		
Spring Staging	021	20-Apr-12	9 V	456614	6276358	Mallard	MALL			4				4	RI	L		
Spring Staging	022	20-Apr-12	9 V	455804	6276468	Mallard	MALL						1	2	RI	L		
Spring Staging	023	20-Apr-12	9 V	454247	6277975	Common Merganser	COME						2	4	RI	L		
Spring Staging	024	20-Apr-12	9 V	450364	6283131	American Green-winged Teal	AGWT	3	2					5	RI	L		
Spring Staging	025	20-Apr-12	9 V	450179	6283989	Barrow's Goldeneye	BAGO						1	2	RI	L		
Spring Staging	025	20-Apr-12	9 V	450179	6283989	Mallard	MALL			9				9	RI	L		mixed sexes
Spring Staging	026	20-Apr-12	9 V	449498	6284899	Barrow's Goldeneye	BAGO			1				1	BK	L		
Spring Staging	026	20-Apr-12	9 V	449498	6284899	American Green-winged Teal	AGWT						1	2	BK	L		
Spring Staging	027	20-Apr-12	9 V	448322	6285903	Barrow's Goldeneye	BAGO						1	2	BK	S		
Spring Staging	028	20-Apr-12	9 V	449796	6285895	Common Merganser	COME						1	2	RI	L		
Spring Staging	029	20-Apr-12	9 V	449251	6286406	Common Merganser	COME						1	2	RI	L		
Spring Staging	030	20-Apr-12	9 V	447476	6288208	Canada Goose	CAGO						1	2	RI	M		
Spring Staging	031	20-Apr-12	9 V	446481	6287808	Mallard	MALL						1	2	RI	M		
Spring Staging	032	20-Apr-12	9 V	440761	6284339	Mallard	MALL	1	3					4	RI	S		
Spring Staging	033	20-Apr-12	9 V	444228	6272049	Mallard	MALL	2	1					3	PO	S		
Spring Staging	033	20-Apr-12	9 V	444228	6272049	Canada Goose	CAGO			5				5	PO	S		
Spring Staging	034	20-Apr-12	9 V	446812	6271645	Barrow's Goldeneye	BAGO						1	2	PO	M		
Spring Staging	035	20-Apr-12	9 V	455142	6268233	Mallard	MALL						1	2	PO	M		
Spring Staging	036	20-Apr-12	9 V	455381	6268998	Barrow's Goldeneye	BAGO						2	4	PO	L		
Spring Staging	037	20-Apr-12	9 V	456655	6269825	Canada Goose	CAGO			10				10	PO	L		
Spring Staging	037	20-Apr-12	9 V	456655	6269825	Mallard	MALL	2	1					3	PO	L		
Spring Staging	037	20-Apr-12	9 V	456655	6269825	Hooded Merganser	HOME	1						1	PO	L		
Spring Staging	038	20-Apr-12	9 V	457626	6270227	Mallard	MALL						1	2	PO	L		
Spring Staging	038	20-Apr-12	9 V	457626	6270227	American Green-winged Teal	AGWT						1	2	PO	L		
Spring Staging	038	20-Apr-12	9 V	457626	6270227	Barrow's Goldeneye	BAGO						1	2	PO	L		
Spring Staging	038	20-Apr-12	9 V	457626	6270227	Mallard	MALL	3	2					5	PO	L		
Spring Staging	039	20-Apr-12	9 V	458421	6270092	Mallard	MALL						1	2	BK	M		

Appendix 7.3-1. Brucejack Gold Mine Project Waterbird Survey Data, 2012

Survey Data						Species Data									Habitat Data*		Behaviour and Comments*	
Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Spring Staging	039	20-Apr-12	9 V	458421	6270092	Hooded Merganser	HOME						1	2	BK	M		
Spring Staging	040	20-Apr-12	9 V	468381	6264641	Mallard	MALL						1	2	RI	L		
Spring Staging	041	20-Apr-12	9 V	471731	6262335	Barrow's Goldeneye	BAGO						1	2	RI	L		
Spring Staging	042	20-Apr-12	9 V	471757	6262325	Mallard	MALL						1	2	BK	L		
Spring Staging	043	20-Apr-12	9 V	471863	6262288	Mallard	MALL						1	2	BK	L		
Spring Staging	044	20-Apr-12	9 V	473948	6260031	American Dipper	AMDI			1				1	RI	L		
Spring Staging	045	20-Apr-12	9 V	474585	6260060	Mallard	MALL						1	2	RI	L		
Spring Staging	046	20-Apr-12	9 V	474870	6260149	Mallard	MALL	1						1	RI	L		
Spring Staging	047	20-Apr-12	9 V	475479	6258977	Bald Eagle	BAEA			1				1	RI	L		Basic 4 - adult
Spring Staging	048	20-Apr-12	9 V	475801	6258066	Mallard	MALL	3	3					6	RI	L		
Spring Staging	049	20-Apr-12	9 V	475687	6256829	American Dipper	AMDI			1				1	RI	L		
Spring Staging	050	20-Apr-12	9 V	476788	6254974	Canada Goose	CAGO			1				1	RI	L		
Spring Staging	050	20-Apr-12	9 V	476788	6254974	American Green-winged Teal	AGWT	2	1					3	RI	L		
Spring Staging	051	20-Apr-12	9 V	477189	6253364	Common Merganser	COME						1	2	RI	L		
Spring Staging	052	20-Apr-12	9 V	480787	6244560	Mallard	MALL	13	8					21	RI	L		
Spring Staging	053	20-Apr-12	9 V	480348	6245413	Mallard	MALL			45				45	RI	L		
Spring Staging	053	20-Apr-12	9 V	480348	6245413	Northern Pintail	NOPI	13	7					20	RI	L		
Spring Staging	053	20-Apr-12	9 V	480348	6245413	American Widgeon	AMWI	3	1					4	RI	L		
Spring Staging	054	20-Apr-12	9 V	478960	6247883	Mallard	MALL						1	2	RI	L		
Spring Staging	055	20-Apr-12	9 V	477125	6247075	Canada Goose	CAGO						1	2	PO	S		
Spring Staging	055	20-Apr-12	9 V	477125	6247075	Mallard	MALL	6	2					8	PO	S		
Spring Staging	055	20-Apr-12	9 V	477125	6247075	Red-tailed Hawk	RTHA			1				1	RI	L	F/O	overland/forest
Spring Staging	056	20-Apr-12	9 V	476887	6248340	Canada Goose	CAGO			11				11	LK/RI	L		
Spring Staging	056	20-Apr-12	9 V	476887	6248340	Mallard	MALL			30				30	LK/RI	L		
Spring Staging	056	20-Apr-12	9 V	476887	6248340	American Green-winged Teal	AGWT			10				10	LK/RI	L		
Spring Staging	057	20-Apr-12	9 V	475389	6249990	Mallard	MALL			40				40	LK	L		
Spring Staging	057	20-Apr-12	9 V	475389	6249990	Northern Shoveller	NSHO			8				8	LK	L		
Spring Staging	057	20-Apr-12	9 V	475389	6249990	Hooded Merganser	HOME						1	2	LK	L		
Spring Staging	058	20-Apr-12	9 V	474223	6250461	Mallard	MALL						1	2	LK	L		
Spring Staging	059	20-Apr-12	9 V	457927	6254851	Golden Eagle	GOEA			1				1	LK	L		
Spring Staging	060	20-Apr-12	9 V	448161	6249704	Mallard	MALL			40				40	RI	M		
Spring Staging	061	20-Apr-12	9 V	445839	6249725	Mallard	MALL						1	2	LK	S		
Spring Staging	062	20-Apr-12	9 V	439789	6250344	Barrow's Goldeneye	BAGO						1	2	LK	S		
Spring Staging	062	20-Apr-12	9 V	439789	6250344	Common Merganser	COME						1	2	LK	S		
Spring Staging	063	20-Apr-12	9 V	438281	6250835	Northern Pintail	NOPI	1	2					3	LK	S		
Spring Staging	063	20-Apr-12	9 V	438281	6250835	American Green-winged Teal	AGWT	3	2					5	LK	S		
Spring Staging	063	20-Apr-12	9 V	438281	6250835	Mallard	MALL			15				15	LK	S		
Spring Staging	064	20-Apr-12	9 V	443769	6250750	Eurasian Widgeon	EUWI	1						1	RI	S		
Spring Staging	064	20-Apr-12	9 V	443769	6250750	American Widgeon	AMWI	2	3					5	RI	S		
Spring Staging	065	20-Apr-12	9 V	449930	6250389	Mallard	MALL						1	2	RI	L		
Spring Staging	066	20-Apr-12	9 V	454018	6253052	American Widgeon	AMWI						1	2	RI	L		
Spring Staging	067	20-Apr-12	9 V	455833	6253295	Canada Goose	CAGO			8				8	LK	L		
Spring Staging	067	20-Apr-12	9 V	455833	6253295	Mallard	MALL	6	6					14	LK	L		
Spring Staging	067	20-Apr-12	9 V	455833	6253295	Barrow's Goldeneye	BAGO						1	2	LK	L		
Spring Staging	067	20-Apr-12	9 V	455833	6253295	American Widgeon	AMWI						1	2	LK	L		
Spring Staging	068	20-Apr-12	9 V	456492	6252736	American Green-winged Teal	AGWT						1	2	LK	L		

Appendix 7.3-1. Brucejack Gold Mine Project Waterbird Survey Data, 2012

Survey Data						Species Data									Habitat Data*		Behaviour and Comments*	
Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Spring Pair	003	13-May-12	9 V	468518	6261284	Arctic Tern	ARTE			3				3	LK	M	F/O	
Spring Pair	004	13-May-12	9 V	468954	6264503	Mallard	MALL			15				15	RI	L	F/O	mixed sexes
Spring Pair	005	13-May-12	9 V	473259	6261478	Unknown Sandpiper	SAND			1				1	RI	M	F/O	SPSA or SOSA - Spotted Sandpiper or Solitary Sandpiper
Spring Pair	006	13-May-12	9 V	476041	6257756	Unknown Sandpiper	SAND			1				1	RI	L		SPSA or SOSA - Spotted Sandpiper or Solitary Sandpiper
Spring Pair	007	13-May-12	9 V	476050	6258106	Unknown Sandpiper	SAND			1				1	RI	L		SPSA or SOSA - Spotted Sandpiper or Solitary Sandpiper
Spring Pair	008	13-May-12	9 V	475674	6256869	Harlequin Duck	HARD						1	2	RI	L		probable nest area
Spring Pair	009	13-May-12	9 V	476205	6256842	American Dipper	AMDI			1				1	CR	L		
Spring Pair	010	13-May-12	9 V	478823	6251144	Common Merganser	COME	1						1	RI	L		
Spring Pair	010	13-May-12	9 V	478823	6251144	Unknown Sandpiper	SAND			2				2	RI	L		
Spring Pair	011	13-May-12	9 V	480473	6248977	Wolf	CALU			1				1	RI	L		
Spring Pair	011	13-May-12	9 V	480473	6248977	Unknown Sandpiper	SAND			1				1	RI	L		
Spring Pair	012	13-May-12	9 V	480352	6248764	Mallard	MALL						1	2	BK	S		
Spring Pair	012	13-May-12	9 V	480352	6248764	Unknown Sandpiper	SAND			1				1	RI	L		
Spring Pair	013	13-May-12	9 V	480723	6245821	Unknown Sandpiper	SAND			1				1	RI	L		
Spring Pair	014	13-May-12	9 V	480767	6244618	Mallard	MALL	1						1	BK	M		
Spring Pair	014	13-May-12	9 V	480767	6244618	Unknown Sandpiper	SAND			1				1	BK	M		
Spring Pair	015	13-May-12	9 V	480847	6243248	Unknown Sandpiper	SAND			1				1	RI	L		
Spring Pair	018	13-May-12	9 V	481533	6245609	Ring-necked Duck	RNDU						2	4	PO	M		
Spring Pair	019	13-May-12	9 V	481783	6245919	Trumpeter Swan	TRSW			1				1	PO	L		
Spring Pair	019	13-May-12	9 V	481783	6245919	Mallard	MALL	2	1				1	5	PO	L		
Spring Pair	019	13-May-12	9 V	481783	6245919	Ring-necked Duck	RNDU	3	1					4	PO	L		
Spring Pair	019	13-May-12	9 V	481783	6245919	American Green-winged Teal	AGWT						1	2	PO	L		abundant swallows over river, river is quite silty
Spring Pair	020	13-May-12	9 V	477189	6247357	Greater Yellowlegs	GRYE			1				1	RI	M		
Spring Pair	021	13-May-12	9 V	477423	6246873	Harlequin Duck	HARD						1	2	RI	M		Survey Creek
Spring Pair	022	13-May-12	9 V	477442	6246121	Harlequin Duck	HARD						1	2	RI	M		Survey Creek
Spring Pair	023	13-May-12	9 V	478153	6243871	Unknown Sandpiper	SAND			1				1	BK	S		lots of moose tracks
Spring Pair	024	13-May-12	9 V	476263	6246900	Mallard	MALL	2						2	PO	M		
Spring Pair	024	13-May-12	9 V	476263	6246900	Ring-necked Duck	RNDU						3	6	PO	M		
Spring Pair	024	13-May-12	9 V	476263	6246900	American Widgeon	AMWI						1	2	PO	M		
Spring Pair	024	13-May-12	9 V	476263	6246900	American Green-winged Teal	AGWT	7	5					12	PO	M		
Spring Pair	025	13-May-12	9 V	476264	6247822	Canada Goose	CAGO			2				2	SW	L		
Spring Pair	025	13-May-12	9 V	476264	6247822	Mallard	MALL	5						5	SW	L		
Spring Pair	025	13-May-12	9 V	476264	6247822	Unknown Sandpiper	SAND			2				2	SW	L		
Spring Pair	025	13-May-12	9 V	476264	6247822	American Green-winged Teal	AGWT						2	4	SW	L		
Spring Pair	025	13-May-12	9 V	476264	6247822	Northern Pintail	NOPI	5					1	7	SW	L		
Spring Pair	025	13-May-12	9 V	476264	6247822	Mallard	MALL	12	1				2	17	MA	L		
Spring Pair	025	13-May-12	9 V	476264	6247822	Northern Pintail	NOPI	1	1					2	MA	L		
Spring Pair	025	13-May-12	9 V	476264	6247822	Greater Yellowlegs	GRYE			1				1	MA	L		
Spring Pair	025	13-May-12	9 V	476264	6247822	Unknown Sandpiper	SAND			7				7	MA	L		large SAND - long bill, poss LEYE
Spring Pair	026	13-May-12	9 V	475323	6250061	Ring-necked Duck	RNDU			40				40	LK	L		
Spring Pair	026	13-May-12	9 V	475323	6250061	Canada Goose	CAGO						3	6	LK	L		
Spring Pair	026	13-May-12	9 V	475323	6250061	Northern Shoveller	NSHO						1	2	LK	L		Bowser Lake with 15% broken ice cover
Spring Pair	026	13-May-12	9 V	475323	6250061	Canada Goose	CAGO						1	2	LK	L		
Spring Pair	026	13-May-12	9 V	475323	6250061	Common Loon	COLO			1				1	LK	L	F/O	
Spring Pair - Gound	026	13-May-12	9 V	475323	6250061	Northern Shoveller	NSHO	2	1					3	LK	L		

Appendix 7.3-1. Brucejack Gold Mine Project Waterbird Survey Data, 2012

Survey Data						Species Data									Habitat Data*		Behaviour and Comments*	
Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Spring Pair - Gound	026	13-May-12	9 V	475323	6250061	American Green-winged Teal	AGWT						1	2	LK	L		
Spring Pair - Gound	026	13-May-12	9 V	475323	6250061	Canada Goose	CAGO						3	6	LK	L		
Spring Pair - Gound	026	13-May-12	9 V	475323	6250061	Ring-necked Duck	RNDU	24	11					35	LK	L		
Spring Pair	027	13-May-12	9 V	474679	6249193	Ring-necked Duck	RNDU	3	1					4	LK	L		
Spring Pair	028	13-May-12	9 V	463834	6256141	Ring-necked Duck	RNDU						1	2	LK	L		
Spring Pair	029	13-May-12	9 V	459409	6254175	Mallard	MALL						1	2	LK	L		
Spring Pair	030	13-May-12	9 V	456297	6252951	Ring-necked Duck	RNDU			25				25	LK	L		large groups - mix of RNDU and SCAUP at mouth of Bowser River, west end of Bowser Lake
Spring Pair	030	13-May-12	9 V	456297	6252951	Ring-necked Duck	RNDU			270				270	LK	L		
Spring Pair	030	13-May-12	9 V	456297	6252951	Unknown Scaup	SCAUP			120				120	LK	L		
Spring Pair	030	13-May-12	9 V	456297	6252951	Unknown Scaup	SCAUP			40				40	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Greater Scaup	GRSC	89	49				1	140	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Ring-necked Duck	RNDU	183	131				1	316	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Arctic Tern	ARTE			4				4	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Northern Pintail	NOPI	2	1					3	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Bald Eagle	BAEA			5				5	LK	L	F/O	Adult and 4 juveniles
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Semipalmated Sandpiper	SESA			31				31	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Northern Shoveller	NSHO	3	1					4	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Semipalmated Plover	SPPL			3				3	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Pectoral Sandpiper	PESP	1						1	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	American Widgeon	AMWI	4	3					7	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Barrow's Goldeneye	BAGO						1	2	LK	L		
Spring Pair - Gound	030	13-May-12	9 V	456297	6252951	Short-eared Owl	SEOW			1				1	LK	L		flying near cottonwood trees, RUHU
Spring Pair	031	13-May-12	9 V	455308	6253118	Canada Goose	CAGO			1				1	PO	S		
Spring Pair	031	13-May-12	9 V	455308	6253118	Ring-necked Duck	RNDU	6	4					10	PO	S		
Spring Pair	032	13-May-12	9 V	455624	6252821	Ring-necked Duck	RNDU	8	5					13	BK	L		
Spring Pair	032	13-May-12	9 V	455624	6252821	Mallard	MALL						1	2	BK	L		
Spring Pair	033	13-May-12	9 V	454361	6251099	Canada Goose	CAGO			7				7	SW	L		
Spring Pair	034	13-May-12	9 V	452594	6251760	Greater Yellowlegs	GRYE						1	2	RI	L		
Spring Pair	035	13-May-12	9 V	450768	6246357	Wolverine	GUGU			1				1	RI	S		on mountain side - Todd Creek
Spring Pair	036	13-May-12	9 V	450059	6250424	American Green-winged Teal	AGWT			28				28	RI	M		mixed sexes
Spring Pair	036	13-May-12	9 V	450059	6250424	Ring-necked Duck	RNDU	3	2					5	RI	M		
Spring Pair	037	13-May-12	9 V	448475	6249589	Barrow's Goldeneye	BAGO						1	2	RI	M		
Spring Pair	037	13-May-12	9 V	448475	6249589	Greater Scaup	GRSC			33				33	RI	M		mixed sexes
Spring Pair	037	13-May-12	9 V	448475	6249589	Mallard	MALL			5			1	7	RI	M		
Spring Pair	037	13-May-12	9 V	448475	6249589	Ring-necked Duck	RNDU						1	2	RI	M		
Spring Pair	038	13-May-12	9 V	447304	6249199	Bald Eagle	BAEA							0	RI	M	nest	
Spring Pair	039	13-May-12	9 V	446152	6249072	Canada Goose	CAGO						1	2	SW	L		photos 553-555
Spring Pair	040	13-May-12	9 V	443606	6250869	Mallard	MALL						1	2	CR	M		
Spring Pair	040	13-May-12	9 V	443606	6250869	Unknown Sandpiper	SAND			2				2	CR	M		
Spring Pair	041	13-May-12	9 V	443256	6251000	American Widgeon	AMWI	3	5					8	PO	M		
Spring Pair	041	13-May-12	9 V	443256	6251000	Ring-necked Duck	RNDU	7	4					11	PO	M		
Spring Pair	042	13-May-12	9 V	442639	6251405	Canada Goose	CAGO			1				1	SW	L		
Spring Pair	042	13-May-12	9 V	442639	6251405	Mallard	MALL	12	6					18	SW	L		
Spring Pair	042	13-May-12	9 V	442639	6251405	Common Merganser	COME	1					1	3	PO	M		
Spring Pair	042	13-May-12	9 V	442639	6251405	Mallard	MALL	2	2					4	PO	M		
Spring Pair - Gound	043	13-May-12	9 V	438435	6250568	Barrow's Goldeneye	BAGO	4						4	LK	S	PA	Knipple Lake ~85% ice cover; photos 556-561
Spring Pair - Gound	043	13-May-12	9 V	438435	6250568	Mallard	MALL	25	13					38	LK	S	PA	

Appendix 7.3-1. Brucejack Gold Mine Project Waterbird Survey Data, 2012

Survey Data						Species Data									Habitat Data*		Behaviour and Comments*	
Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Spring Pair - Gound	043	13-May-12	9 V	438435	6250568	Northern Shoveller	NSHO	10	5					15	LK	S	PA	
Spring Pair - Gound	043	13-May-12	9 V	438435	6250568	American Green-winged Teal	AGWT	47	26					73	LK	S	PA	
Spring Pair - Gound	043	13-May-12	9 V	438435	6250568	American Widgeon	AMWI	13	6					19	LK	S	PA	
Spring Pair - Gound	043	13-May-12	9 V	438435	6250568	Greater Scaup	GRSC	12	5					17	LK	S	PA	
Spring Pair - Gound	043	13-May-12	9 V	438435	6250568	Ring-necked Duck	RNDU	44	20					64	LK	S	PA	
Spring Pair - Gound	043	13-May-12	9 V	438435	6250568	Northern Pintail	NOPI	1						1	LK	S	PA	
Spring Pair	043	13-May-12	9 V	438435	6250568	American Dipper	AMDI			1				1	CR	M		
Spring Pair	044	13-May-12	9 V	437010	6250867	Barrow's Goldeneye	BAGO	3						3	RI	S		
Spring Pair	044	13-May-12	9 V	437010	6250867	Mallard	MALL	3					1	5	RI	S		
Spring Pair	044	13-May-12	9 V	437010	6250867	Harlequin Duck	HARD	1					2	5	RI	S		nice rapidy area
Spring Pair	044	13-May-12	9 V	437010	6250867	Ring-necked Duck	RNDU	2	2					4	RI	S		
Spring Pair	044	13-May-12	9 V	437010	6250867	Bufflehead	BUFF	1						1	RI	S		
Spring Pair - Gound	045	13-May-12	9 V	436215	6249473	Mallard	MALL	5	1					6	LK	M	PA	no aerial count
Spring Pair - Gound	045	13-May-12	9 V	436215	6249473	American Widgeon	AMWI	7	3					10	LK	M	PA	
Spring Pair - Gound	045	13-May-12	9 V	436215	6249473	Greater Scaup	GRSC	15	12					27	LK	M	PA	
Spring Pair - Gound	045	13-May-12	9 V	436215	6249473	Ring-necked Duck	RNDU	7	4					11	LK	M	PA	
Spring Pair - Gound	045	13-May-12	9 V	436215	6249473	American Green-winged Teal	AGWT						1	2	LK	M		
Spring Pair	046	13-May-12	9 V	434819	6247674	Ring-necked Duck	RNDU						2	4	CR	L		
Spring Pair	047	13-May-12	9 V	434440	6246994	Mallard	MALL			5				5	LK	M		90% ice cover
Spring Pair	047	13-May-12	9 V	434440	6246994	American Widgeon	AMWI			4				4	LK	M		
Spring Pair	047	13-May-12	9 V	434440	6246994	Ring-necked Duck	RNDU						2	4	LK	M		
Spring Pair	048	13-May-12	9 V	450737	6251802	Unknown Sandpiper	SAND			3				3	RI	M		
Spring Pair	049	13-May-12	9 V	454068	6251811	Mallard	MALL		1					1	RI	M		
Spring Pair	050	13-May-12	9 V	454504	6253342	Mallard	MALL	1						1	BK	S		
Spring Pair	051	13-May-12	9 V	453670	6252709	Ring-necked Duck	RNDU						2	4	CR	M		
Spring Pair	051	13-May-12	9 V	453670	6252709	Mallard	MALL		1					1	CR	M		
Spring Pair	052	13-May-12	9 V	453180	6252498	Mallard	MALL	1		21			1	24	CR	M		
Spring Pair	052	13-May-12	9 V	453180	6252498	American Green-winged Teal	AGWT			30				30	CR	M		
Spring Pair	052	13-May-12	9 V	453180	6252498	Unknown Sandpiper	SAND			10				10	CR	M		
Spring Pair	054	13-May-12	9 V	454468	6253774	Ring-necked Duck	RNDU	2		26			4	36	PO	L		
Spring Pair	054	13-May-12	9 V	454468	6253774	American Green-winged Teal	AGWT						2	4	PO	L		
Spring Pair	054	13-May-12	9 V	454468	6253774	American Widgeon	AMWI	1		6			1	9	PO	L		
Spring Pair	054	13-May-12	9 V	454468	6253774	Canada Goose	CAGO						1	2	PO	L		
Spring Pair	054	13-May-12	9 V	454468	6253774	Mallard	MALL	5	1					6	PO	L		
Spring Pair	055	13-May-12	9 V	470724	6252909	Common Loon	COLO			1				1	LK	L		
Spring Pair	056	13-May-12	9 V	471320	6252322	Greater Scaup	GRSC			19				19	LK	L		
Spring Pair	056	13-May-12	9 V	471320	6252322	American Widgeon	AMWI	4	2					6	LK	L		
Spring Pair	057	13-May-12	9 V	472105	6251511	Greater Scaup	GRSC	2	1					3	LK	L		
Spring Pair	058	13-May-12	9 V	477022	6249247	Northern Pintail	NOPI	4	5					9	SW	S		
Spring Pair	059	13-May-12	9 V	478287	6248757	Mallard	MALL	19	4					23	SW	S		
Spring Pair	059	13-May-12	9 V	478287	6248757	Northern Harrier	NOHA		1					1	SW	S		
Spring Pair	061	13-May-12	9 V	460593	6269266	Canada Goose	CAGO						1	2	RI	S		
Spring Pair	062	13-May-12	9 V	458444	6270132	Mallard	MALL	1						1	PO	S		
Spring Pair	062	13-May-12	9 V	458444	6270132	Mallard	MALL	1						1	PO	S		
Spring Pair	062	13-May-12	9 V	458444	6270132	Canada Goose	CAGO						1	2	PO	S		
Spring Pair	062	13-May-12	9 V	458444	6270132	Barrow's Goldeneye	BAGO						1	2	PO	S		
Spring Pair	062	13-May-12	9 V	458444	6270132	Ring-necked Duck	RNDU			3				3	PO	S		
Spring Pair	062	13-May-12	9 V	458444	6270132	Mallard	MALL	4						4	PO	S		
Spring Pair	063	13-May-12	9 V	457792	6270321	American Green-winged Teal	AGWT			7			1	9	PO	M		

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Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Spring Pair	063	13-May-12	9 V	457792	6270321	Ring-necked Duck	RNDU						1	2	PO	M		
Spring Pair	063	13-May-12	9 V	457792	6270321	Canada Goose	CAGO			1				1	PO	M	Probable nest	
Spring Pair	063	13-May-12	9 V	457792	6270321	Barrow's Goldeneye	BAGO						1	2	PO	M		
Spring Pair	063	13-May-12	9 V	457792	6270321	American Green-winged Teal	AGWT						1	2	PO	M		
Spring Pair	063	13-May-12	9 V	457792	6270321	Unknown Sandpiper	SAND			1				1	PO	M		
Spring Pair	064	13-May-12	9 V	458236	6269907	Trumpeter Swan	TRSW			1				1	RI	M		Juvenile
Spring Pair	065	13-May-12	9 V	456938	6269931	American Widgeon	AMWI		1					1	SW	L		
Spring Pair	065	13-May-12	9 V	456938	6269931	Canada Goose	CAGO						2	4	SW	L		
Spring Pair	065	13-May-12	9 V	456938	6269931	American Green-winged Teal	AGWT			21				21	SW	L		mixed sexes
Spring Pair	065	13-May-12	9 V	456938	6269931	Mallard	MALL			1				1	SW	L		
Spring Pair	066	13-May-12	9 V	456351	6270292	Canada Goose	CAGO						1	2	PO	S		
Spring Pair	066	13-May-12	9 V	456351	6270292	Mallard	MALL						1	2	PO	S		
Spring Pair	066	13-May-12	9 V	456351	6270292	Ring-necked Duck	RNDU						4	8	PO	M		
Spring Pair	066	13-May-12	9 V	456351	6270292	Canada Goose	CAGO						1	2	PO	M		
Spring Pair	066	13-May-12	9 V	456351	6270292	Barrow's Goldeneye	BAGO	1						1	PO	M		
Spring Pair	066	13-May-12	9 V	456351	6270292	Mallard	MALL						1	2	PO	M		
Spring Pair	067	13-May-12	9 V	455690	6269131	Ring-necked Duck	RNDU	15	6				11	43	PO	M		
Spring Pair	067	13-May-12	9 V	455690	6269131	Canada Goose	CAGO			2				2	PO	M		
Spring Pair	067	13-May-12	9 V	455690	6269131	American Green-winged Teal	AGWT			13			1	15	PO	M		
Spring Pair	067	13-May-12	9 V	455690	6269131	Mallard	MALL	1						1	PO	M		
Spring Pair	067	13-May-12	9 V	455690	6269131	Barrow's Goldeneye	BAGO						1	2	PO	M		
Spring Pair	068	13-May-12	9 V	455116	6268835	Barrow's Goldeneye	BAGO		1					1	PO	M		
Spring Pair	069	13-May-12	9 V	454979	6268251	Canada Goose	CAGO			2				2	BK	M		
Spring Pair	070	13-May-12	9 V	454227	6268059	American Widgeon	AMWI			15				15	RI	M		mixed sexes
Spring Pair	071	13-May-12	9 V	453487	6268811	Mallard	MALL	3		1				4	PO	M		
Spring Pair	071	13-May-12	9 V	453487	6268811	Ring-necked Duck	RNDU	18	14					32	PO	M		
Spring Pair	072	13-May-12	9 V	452974	6268772	Ring-necked Duck	RNDU	2	1					3	PO	M		
Spring Pair	072	13-May-12	9 V	452974	6268772	Ring-necked Duck	RNDU						4	8	PO	M		
Spring Pair	072	13-May-12	9 V	452974	6268772	Canada Goose	CAGO						1	2	PO	M		
Spring Pair	073	13-May-12	9 V	453367	6269720	Barrow's Goldeneye	BAGO						1	2	LK	S		
Spring Pair	073	13-May-12	9 V	453367	6269720	Ring-necked Duck	RNDU		1					1	LK	S		
Spring Pair	073	13-May-12	9 V	453367	6269720	Canada Goose	CAGO			1				1	LK	S		
Spring Pair	073	13-May-12	9 V	453367	6269720	Ring-necked Duck	RNDU	3	1					4	LK	S		
Spring Pair	073	13-May-12	9 V	453367	6269720	Mallard	MALL			2			1	4	LK	S		
Spring Pair	073	13-May-12	9 V	453367	6269720	American Green-winged Teal	AGWT						1	2	LK	S		
Spring Pair	073	13-May-12	9 V	453367	6269720	Ring-necked Duck	RNDU	4	4	8				16	LK	S		
Spring Pair	073	13-May-12	9 V	453367	6269720	Canada Goose	CAGO						1	2	LK	S		
Spring Pair	073	13-May-12	9 V	453367	6269720	Barrow's Goldeneye	BAGO						1	2	LK	S		~70% ice cover on lake
Spring Pair	074	13-May-12	9 V	450965	6268202	Northern Pintail	NOPI			10				10	LK	M		
Spring Pair	074	13-May-12	9 V	450965	6268202	Mallard	MALL			5				5	LK	M		
Spring Pair	074	13-May-12	9 V	450965	6268202	Northern Shoveller	NSHO						1	2	LK	M		
Spring Pair	074	13-May-12	9 V	450965	6268202	American Green-winged Teal	AGWT			1				1	LK	M		
Spring Pair	074	13-May-12	9 V	450965	6268202	Ring-necked Duck	RNDU	6	6					12	LK	M		
Spring Pair	074	13-May-12	9 V	450965	6268202	Barrow's Goldeneye	BAGO	1					1	3	LK	M		
Spring Pair	074	13-May-12	9 V	450965	6268202	Mallard	MALL						1	2	LK	M		
Spring Pair	074	13-May-12	9 V	450965	6268202	Ring-necked Duck	RNDU	14	8					22	LK	M		
Spring Pair	075	13-May-12	9 V	449633	6270013	Ring-necked Duck	RNDU						1	2	PO	L		
Spring Pair	076	13-May-12	9 V	449142	6269674	Canada Goose	CAGO						2	4	PO	M		
Spring Pair	077	13-May-12	9 V	448269	6270285	American Dipper	AMDI			1				1	RI	S		

Appendix 7.3-1. Brucejack Gold Mine Project Waterbird Survey Data, 2012

Survey Data						Species Data									Habitat Data*		Behaviour and Comments*	
Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Spring Pair	078	13-May-12	9 V	446978	6271692	American Green-winged Teal	AGWT			5				5	RI	S		
Spring Pair	078	13-May-12	9 V	446978	6271692	Arctic Tern	ARTE			2				2	PO	S		
Spring Pair	078	13-May-12	9 V	446978	6271692	American Green-winged Teal	AGWT	2	1					3	PO	S		
Spring Pair	078	13-May-12	9 V	446978	6271692	Barrow's Goldeneye	BAGO	1						1	BK	M		
Spring Pair	079	13-May-12	9 V	445851	6271784	Mallard	MALL						2	4	BK	S		
Spring Pair	079	13-May-12	9 V	445851	6271784	Barrow's Goldeneye	BAGO						1	2	BK	S		
Spring Pair	080	13-May-12	9 V	443233	6272578	Barrow's Goldeneye	BAGO		1					1	BK	M		
Spring Pair	082	13-May-12	9 V	443827	6272098	Barrow's Goldeneye	BAGO	1					1	3	PO	L		
Spring Pair	082	13-May-12	9 V	443827	6272098	Canada Goose	CAGO			1			2	5	PO	L		
Spring Pair	082	13-May-12	9 V	443827	6272098	Ring-necked Duck	RNDU						2	4	PO	L		
Spring Pair	083	13-May-12	9 V	451088	6265505	Ring-necked Duck	RNDU			16				16	CR	M		
Spring Pair	083	13-May-12	9 V	451088	6265505	Barrow's Goldeneye	BAGO	1	1				2	6	CR	M		
Spring Pair	083	13-May-12	9 V	451088	6265505	Arctic Tern	ARTE			3				3	CR	M		
Spring Pair	083	13-May-12	9 V	451088	6265505	Mallard	MALL						1	2	CR	M		
Spring Pair	084	13-May-12	9 V	450528	6265229	Barrow's Goldeneye	BAGO						2	4	CR	M		
Spring Pair	084	13-May-12	9 V	450528	6265229	Mallard	MALL						2	4	CR	M		
Spring Pair	084	13-May-12	9 V	450528	6265229	Canada Goose	CAGO			1				1	CR	M	NF	NF=Nest found
Spring Pair	084	13-May-12	9 V	450528	6265229	Northern Shoveller	NSHO		1				1	3	CR	M		
Spring Pair	084	13-May-12	9 V	450528	6265229	American Green-winged Teal	AGWT						2	4	CR	M		
Spring Pair	085	13-May-12	9 V	450429	6264863	Mallard	MALL	2	1				1	5	CR	M		
Spring Pair	085	13-May-12	9 V	450429	6264863	Canada Goose	CAGO			18				18	CR	M		
Spring Pair	085	13-May-12	9 V	450429	6264863	Barrow's Goldeneye	BAGO						2	4	CR	M		
Spring Pair	085	13-May-12	9 V	450429	6264863	American Green-winged Teal	AGWT		1				3	7	CR	M		
Spring Pair	085	13-May-12	9 V	450429	6264863	Arctic Tern	ARTE			10				10	CR	M		
Spring Pair	086	13-May-12	9 V	452553	6263399	Barrow's Goldeneye	BAGO						1	2	CR	M		
Spring Pair	086	13-May-12	9 V	452553	6263399	Unknown Sandpiper	SAND			1				1	CR	M		
Spring Pair	087	13-May-12	9 V	451574	6260514	Barrow's Goldeneye	BAGO						1	2	LK	S		
Spring Pair	088	13-May-12	9 V	451664	6260305	Barrow's Goldeneye	BAGO						1	2	LK	M		
Spring Pair	090	16-May-12	9 V	401189	6255837	Bald Eagle	BAEA			1				1	RI	L		3 wolves about 1km from wpt
Spring Pair	091	16-May-12	9 V	396472	6250672	Canada Goose	CAGO			1				1	RI	L	Probable nest	nesting in canyon cliffs
Spring Pair	092	16-May-12	9 V	395925	6249115	Common Merganser	COME	1	1				1	4	RI	L		
Spring Pair	093	16-May-12	9 V	394400	6245516	Ring-necked Duck	RNDU	3	2					5	LK	S		
Spring Pair	093	16-May-12	9 V	394400	6245516	Barrow's Goldeneye	BAGO	1						1	LK	S		
Spring Pair	094	16-May-12	9 V	393042	6246520	Trumpeter Swan	TRSW			3				3	MA	L		
Spring Pair	094	16-May-12	9 V	393042	6246520	American Green-winged Teal	AGWT			7				7	MA	L		
Spring Pair	094	16-May-12	9 V	393042	6246520	Mallard	MALL						1	2	MA	L		
Spring Pair	094	16-May-12	9 V	393042	6246520	Common Merganser	COME						1	2	MA	L		
Spring Pair	094	16-May-12	9 V	393042	6246520	Mallard	MALL	15	10					25	MA	L		
Spring Pair	094	16-May-12	9 V	393042	6246520	American Widgeon	AMWI	3						3	MA	L		
Spring Pair	094	16-May-12	9 V	393042	6246520	Northern Shoveller	NSHO	7						7	LK	M		
Spring Pair	094	16-May-12	9 V	393042	6246520	Ring-necked Duck	RNDU			15				15	LK	M		about 50/50 sex ratio - est'ed count
Spring Pair	095	16-May-12	9 V	394098	6246964	Bald Eagle	BAEA			1				1	LK	M		
Spring Pair	095	16-May-12	9 V	394098	6246964	Unknown Diver	UNDI			2				2	LK	M		unknown diver
Spring Pair	095	16-May-12	9 V	394098	6246964	Trumpeter Swan	TRSW			1				1	LK	M		
Spring Pair	095	16-May-12	9 V	394098	6246964	Canada Goose	CAGO			27				27	MA	L		
Spring Pair	095	16-May-12	9 V	394098	6246964	Greater Scaup	GRSC	3						3	LK	M		
Spring Pair	095	16-May-12	9 V	394098	6246964	Ring-necked Duck	RNDU	7	2					9	LK	M		
Spring Pair	096	16-May-12	9 V	398240	6253285	Common Merganser	COME	1						1	BK	S		
Spring Pair	097	16-May-12	9 V	398802	6253853	Common Merganser	COME		1					1	RI	L		

Appendix 7.3-1. Brucejack Gold Mine Project Waterbird Survey Data, 2012

Survey Data						Species Data									Habitat Data*		Behaviour and Comments*	
Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Spring Pair	098	16-May-12	9 V	401656	6255737	Common Merganser	COME	1						1	RI	L		
Spring Pair	099	16-May-12	9 V	408352	6252352	Mallard	MALL	2						2	PO	S		
Spring Pair	099	16-May-12	9 V	408352	6252352	Canada Goose	CAGO			1				1	PO	S		
Spring Pair	100	16-May-12	9 V	407850	6260800	Canada Goose	CAGO			16				16	PO	L		
Spring Pair	100	16-May-12	9 V	407850	6260800	Ring-necked Duck	RNDU	15						15	PO	L		
Spring Pair	100	16-May-12	9 V	407850	6260800	Mallard	MALL	2						2	PO	L		
Spring Pair	100	16-May-12	9 V	407850	6260800	Northern Shoveller	NSHO	1					1	3	PO	L		
Spring Pair	100	16-May-12	9 V	407850	6260800	Mallard	MALL	3					1	5	PO	L		
Spring Pair	101	16-May-12	9 V	420664	6261412	Northern Shoveller	NSHO						4	8	LK	S		
Spring Pair	102	16-May-12	9 V	418771	6261364	Harlequin Duck	HARD						1	2	CR	L		
Spring Pair	104	16-May-12	9 V	408493	6268355	Barrow's Goldeneye	BAGO	2						2	PO	L		
Spring Pair	104	16-May-12	9 V	408493	6268355	Canada Goose	CAGO			36				36	PO	L		
Spring Pair	104	16-May-12	9 V	408493	6268355	Arctic Tern	ARTE			1				1	PO	L		
Spring Pair	104	16-May-12	9 V	408493	6268355	Mallard	MALL			25				25	PO	L		70% males observed
Spring Pair	104	16-May-12	9 V	408493	6268355	American Green-winged Teal	AGWT			17				17	PO	L		Est'ed count
Spring Pair	104	16-May-12	9 V	408493	6268355	American Green-winged Teal	AGWT			15				15	PO	L		Est'ed count - male dominated
Spring Pair	105	16-May-12	9 V	408808	6267987	American Green-winged Teal	AGWT	4	5					9	PO	M		
Spring Pair	106	16-May-12	9 V	409065	6269038	Unknown Sandpiper	SAND			1				1	RI	M		
Spring Pair	107	16-May-12	9 V	410030	6269986	Mallard	MALL	2						2	PO	S		
Spring Pair	107	16-May-12	9 V	410030	6269986	Canada Goose	CAGO			1				1	PO	M		
Spring Pair	108	16-May-12	9 V	421296	6281073	American Dipper	AMDI			1				1	CR	M		
Spring Pair	109	16-May-12	9 V	422843	6281270	American Dipper	AMDI			1				1	CR	M		
Spring Pair	110	16-May-12	9 V	425855	6281617	Mountain Goat	URAM			1				1	CR	M		Avalanche chute - high habitat suitability rating for bears
Summer Brood	173	28-Jul-12	9 V	476084	6255583	Canada Goose	CAGO			6	4	III		6	BK/RI	L		likely a III brood
Summer Brood	173	28-Jul-12	9 V	476084	6255583	Unknown Sandpiper	SAND			1				1	BK/RI	L		likely a spotted or solitary
Summer Brood	174	28-Jul-12	9 V	481346	6247178	Unknown Gull	GULL			1				1	RI	L		unidentified juvenille gull
Summer Brood	175	28-Jul-12	9 V	477769	6247583	Unknown Sandpiper	SAND			1				1	BK/RI	L		spotted or solitary
Summer Brood	176	28-Jul-12	9 V	477386	6245670	Harlequin Duck	HARD		1		1	IIC		2	BK/RI	L		HADU with 1 duckling
Summer Brood	177	28-Jul-12	9 V	470819	6253011	Common Loon	COLO			1				1	LK	L		Bowser Lake
Summer Brood	179	28-Jul-12	9 V	470855	6251733	Bald Eagle	BAEA			1				1	LK	L		Imature Bald Eagle
Summer Brood	180	28-Jul-12	9 V	468552	6254140	Ring-billed Gull	RBGU			4				4	LK	L		likely ring billed gull
Summer Brood	180	28-Jul-12	9 V	468552	6254140	Ring-billed Gull	RBGU			1				1	LK	L		likely ring billed gull
Summer Brood	181	28-Jul-12	9 V	466668	6254548	Ring-billed Gull	RBGU			1				1	LK	L		likely ring billed gull
Summer Brood	182	28-Jul-12	9 V	456765	6254184	Ring-billed Gull	RBGU			2				2	LK	L		
Summer Brood	183	28-Jul-12	9 V	455336	6253647	Mallard	MALL		1		6	IC		7	BK/RI	M		large brood of ducklings
Summer Brood	184	28-Jul-12	9 V	455461	6253050	Canada Goose	CAGO			13	10	III+		13	BK/RI	M		with fledged brood
Summer Brood	185	28-Jul-12	9 V	455311	6252737	Mallard	MALL			5	4	III+		5	BK/RI	M		may be a fledged brood
Summer Brood	186	28-Jul-12	9 V	468625	6252370	Ring-billed Gull	RBGU			1				1	LK	L		
Summer Brood	187	28-Jul-12	9 V	472973	6257114	Pacific Loon	PALO			2				2	LK	S		most likely pacific (maybe arctic)
Summer Brood	188	28-Jul-12	9 V	473591	6256230	Ring-necked Duck	RNDU		1		1	III		2	LK	S		
Summer Brood	188	28-Jul-12	9 V	473591	6256230	Ring-necked Duck	RNDU		1		8	IIC		9	LK	S		
Summer Brood	188	28-Jul-12	9 V	473591	6256230	Mallard	MALL				4	III		4	LK	S		
Summer Brood	189	28-Jul-12	9 V	471412	6258452	Mallard	MALL		1		6	III		7	PO	L		
Summer Brood	189	28-Jul-12	9 V	471412	6258452	Ring-necked Duck	RNDU		1		1	IIC		2	PO	L		looks like RNDU, difficult to ID
Summer Brood	190	28-Jul-12	9 V	468484	6261124	Barrow's Goldeneye	BAGO		1		2	IIA		3	LK	M		
Summer Brood	190	28-Jul-12	9 V	468484	6261124	Mallard	MALL				4	III (?)		4	LK	M		maybe moulting adults - but orange bills indicating females
Summer Brood	190	28-Jul-12	9 V	468484	6261124	Ring-billed Gull	RBGU			1				1	LK	M		

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Survey Data						Species Data									Habitat Data*		Behaviour and Comments*	
Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Summer Brood	191	28-Jul-12	9 V	468707	6261821	Common Loon	COLO			1				1	LK	M		
Summer Brood	192	28-Jul-12	9 V	455177	6253967	Mallard	MALL		1		2	IIB		3	PO	L		
Summer Brood	193	28-Jul-12	9 V	454957	6253950	Ring-necked Duck	RNDU			1				1	PO	L		
Summer Brood	193	28-Jul-12	9 V	454957	6253950	Mallard	MALL				3	III		3	PO	L		malls - likely old brood
Summer Brood	194	28-Jul-12	9 V	454616	6251110	Mallard	MALL			2				2	PO	L		look like drakes (eclipse moult)
Summer Brood	194	28-Jul-12	9 V	454616	6251110	Mallard	MALL			3				3	PO	L		yellow bills- eclipse moult drakes
Summer Brood	194	28-Jul-12	9 V	454616	6251110	Canada Goose	CAGO		1		5	IIC		6	PO	L		
Summer Brood	195	28-Jul-12	9 V	450063	6251335	Mallard	MALL		1					1	BC			
Summer Brood	196	28-Jul-12	9 V	448174	6247537	American Dipper	AMDI			1				1	RI	M		
Summer Brood	197	28-Jul-12	9 V	445446	6245445	Harlequin Duck	HARD		1		4	IIA		5	RI/LK	M		brood in glacier lake - two photos
Summer Brood	198	28-Jul-12	9 V	446745	6248531	Unknown Duck	UNDU				1	IIB		1	PO	L		duck alone - diver HADU
Summer Brood	199	28-Jul-12	9 V	445487	6249185	Barrow's Goldeneye	BAGO		1		4	IIIA		5	PO	L		divers diving - look like BAGO
Summer Brood	200	28-Jul-12	9 V	445943	6249767	Harlequin Duck	HARD		3					3	RI	M		full-sized ducks
Summer Brood	201	28-Jul-12	9 V	443179	6251031	Canada Goose	CAGO			3	3	III+		3	PO	L		maybe an older brood
Summer Brood	202	28-Jul-12	9 V	442187	6251235	Mallard	MALL			9				9	PO	L		went into trees - may be a brood
Summer Brood	203	28-Jul-12	9 V	440634	6250159	Barrow's Goldeneye	BAGO		1		3	IIB		4	LK	S		
Summer Brood	204	28-Jul-12	9 V	433041	6245787	Canada Goose	CAGO		2		3	IIA		5	LK	M		glacier lake - brood on bank
Summer Brood	205	28-Jul-12	9 V	444120	6252142	Common Loon	COLO			2				2	LK	M		
Summer Brood	206	28-Jul-12	9 V	452105	6260595	Barrow's Goldeneye	BAGO				2	IIB		2	LK	S		no hens - look like young BAGO
Summer Brood	207	28-Jul-12	9 V	452510	6262031	Unknown Sandpiper	SAND			1				1	RI	S		unk. sandpiper
Summer Brood	208	28-Jul-12	9 V	451190	6265455	Canada Goose	CAGO			8	6	III		8	MA/SW	L		likely a brood
Summer Brood	209	28-Jul-12	9 V	450683	6268254	Ring-necked Duck	RNDU			21				21	LK	M		moulting ring neck ducks
Summer Brood	209	28-Jul-12	9 V	450683	6268254	Ring-necked Duck	RNDU			2				2	LK	M		moulting
Summer Brood	209	28-Jul-12	9 V	450683	6268254	Ring-necked Duck	RNDU			2				2	LK	M		moulting
Summer Brood	210	28-Jul-12	9 V	450174	6268893	Common Loon	COLO			1				1	LK	M		
Summer Brood	211	28-Jul-12	9 V	450437	6264849	Barrow's Goldeneye	BAGO		1		2	IIB		3	PO/MA	M		
Summer Brood	212	28-Jul-12	9 V	451605	6262727	Mallard	MALL		3		7	IIA		10	PO	M		3 females, big brood
Summer Brood	213	28-Jul-12	9 V	467373	6265242	Canada Goose	CAGO			8	13	IIA		21	RI	L		back channel of Bell Irving River
Summer Brood	214	28-Jul-12	9 V	464117	6267799	Barrow's Goldeneye	BAGO		1		1	IC		2	PO	S		
Summer Brood	215	28-Jul-12	9 V	457794	6270243	Barrow's Goldeneye	BAGO		1		3	IIB		4	PO	S		
Summer Brood	216	28-Jul-12	9 V	453160	6269677	Barrow's Goldeneye	BAGO			5				5	PO	M		could be a brood - looks like hens
Summer Brood	217	28-Jul-12	9 V	452595	6269585	Common Loon	COLO			1				1	LK	M		
Summer Brood	218	28-Jul-12	9 V	450894	6270350	Unknown Loon	LOON			1				1	LK	M		unidentified loon - maybe PALO pacific loon
Summer Brood	219	28-Jul-12	9 V	455297	6269036	Barrow's Goldeneye	BAGO		1		2	IIB		3	PO	L		
Summer Brood	220	28-Jul-12	9 V	447894	6270477	Barrow's Goldeneye	BAGO			1				1	PO	M		
Summer Brood	221	28-Jul-12	9 V	444299	6272028	Barrow's Goldeneye	BAGO		1		2	IC		3	PO	L		
Summer Brood	222	28-Jul-12	9 V	439362	6273362	Unknown Sandpiper	SAND			1				1	RI	M		sandpiper solitary or spotted
Summer Brood	223	28-Jul-12	9 V	437603	6274287	American Green-winged Teal	AGWT		1		7	IIC		8	PO	S		not 100% sure - but likely GWTE
Summer Brood	224	28-Jul-12	9 V	446508	6287208	Unknown Duck	UNDU				4	IIB		4	PO	M		brood - no hen
Summer Brood	225	28-Jul-12	9 V	446887	6286974	Barrow's Goldeneye	BAGO		1		5	IIB		6	PO	L		
Summer Brood	226	28-Jul-12	9 V	446425	6288676	American Green-winged Teal	AGWT			1				1	PO	L		
Summer Brood	227	28-Jul-12	9 V	446665	6288696	Barrow's Goldeneye	BAGO		1		1	IIB		2	PO	L		
Summer Brood	227	28-Jul-12	9 V	446665	6288696	Mallard	MALL			2				2	PO	L		
Summer Brood	227	28-Jul-12	9 V	446665	6288696	Mallard	MALL			5				5	PO	L		
Summer Brood	228	28-Jul-12	9 V	448212	6288071	Canada Goose	CAGO			4				4	RI	L		Bell Irving River
Summer Brood	229	29-Jul-12	9 V	417913	6261714	American Dipper	AMDI			2				2	RI	S		
Summer Brood	230	29-Jul-12	9 V	397362	6251466	Bald Eagle	BAEA			1				1	RI	M		Imature Bald Eagle
Summer Brood	231	29-Jul-12	9 V	393584	6246754	Barrow's Goldeneye	BAGO				2	IIA		2	PO/MA	L		2 ducklings- BAGO? no hen - Border Lake

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Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Summer Brood	232	29-Jul-12	9 V	394197	6246881	Common Loon	COLO			1				1	LK	M		Border Lake
Summer Brood	232	29-Jul-12	9 V	394197	6246881	Trumpeter Swan	TRSW			1				1	LK	M		
Summer Brood	233	29-Jul-12	9 V	408598	6268497	Canada Goose	CAGO			6	4	III+		6	PO	L		maybe a mature brood
Summer Brood	233	29-Jul-12	9 V	408598	6268497	Mallard	MALL				4	III		4	PO	L		
Summer Brood	234	29-Jul-12	9 V	409376	6268942	Unknown Diver	UNDI			1				1	LK	S		
Summer Brood	235	29-Jul-12	9 V	409599	6269501	Common Merganser	COME		1	1				1	RI	S		
Summer Brood	236	29-Jul-12	9 V	416325	6279657	American Dipper	AMDI			1				1	RI	S		
Fall Staging	279	9-Oct-12	9 V	401361	6256259	Common Merganser	COME			1				1	BK	S		
Fall Staging	281	9-Oct-12	9 V	407581	6265546	Bald Eagle	BAEA			1				1	RI	L		
Fall Staging	282	9-Oct-12	9 V	408730	6268472	Greater Scaup	GRSC		1					1	WT	L		
Fall Staging	282	9-Oct-12	9 V	408730	6268472	American Widgeon	AMWI		2					2	WT	L		
Fall Staging	283	9-Oct-12	9 V	409280	6268686	American Green-winged Teal	AGWT		1					1	MA	S		
Fall Staging	284	9-Oct-12	9 V	411121	6272696	Bald Eagle	BAEA			1				1	RI	L		
Fall Staging	285	9-Oct-12	9 V	410852	6273026	Bald Eagle	BAEA			1				1	RI	M		
Fall Staging	286	9-Oct-12	9 V	424613	6283029	Barrow's Goldeneye	BAGO		1					1	LK	M		
Fall Staging	287	9-Oct-12	9 V	434429	6283931	Barrow's Goldeneye	BAGO		1					1	LK	L		
Fall Staging	289	9-Oct-12	9 V	444882	6288584	Mallard	MALL	2	4				2	10	BK	L		
Fall Staging	290	9-Oct-12	9 V	445825	6288614	Mallard	MALL	1	2					3	BK	L		
Fall Staging	293	9-Oct-12	9 V	459442	6270046	Bald Eagle	BAEA			1				1	RI	M		
Fall Staging	294	9-Oct-12	9 V	455379	6268946	Mallard	MALL		3					3	BK	M		
Fall Staging	297	9-Oct-12	9 V	447022	6287222	Mallard	MALL	3	7					10	RI	L		
Fall Staging	298	9-Oct-12	9 V	454830	6279926	Mallard	MALL			10				10	MA	M		
Fall Staging	299	9-Oct-12	9 V	455341	6279180	Mallard	MALL			3				3	MA	M		
Fall Staging	299	9-Oct-12	9 V	455341	6279180	American Widgeon	AMWI			7				7	MA	M		
Fall Staging	300	9-Oct-12	9 V	456020	6278243	Mallard	MALL		1					1	MA	M		
Fall Staging	301	9-Oct-12	9 V	456432	6277802	Mallard	MALL		3					3	MA	M		
Fall Staging	302	9-Oct-12	9 V	455277	6277030	Common Merganser	COME			3				3	RI	M		
Fall Staging	303	9-Oct-12	9 V	457098	6276029	Golden Eagle	GOEA			1				1	BK	L		fish in stream - WPT 304 and WPT 305 bear tracks
Fall Staging	306	9-Oct-12	9 V	462487	6269658	Common Merganser	COME			4				4	RI	L		
Fall Staging	307	9-Oct-12	9 V	472227	6261928	Bald Eagle	BAEA			1				1	RI	L		
Fall Staging	308	9-Oct-12	9 V	481598	6246874	Bald Eagle	BAEA			1				1	RI	L		
Fall Staging	312	9-Oct-12	9 V	472130	6249745	Golden Eagle	GOEA			1				1	LK	L		
Fall Staging	312	9-Oct-12	9 V	472130	6249745	Bald Eagle	BAEA			2				2	LK	L		
Fall Staging	313	9-Oct-12	9 V	471936	6250335	Herring Gull	HEGU			2				2	LK	L		
Fall Staging	314	9-Oct-12	9 V	471290	6250735	Herring Gull	HEGU			4				4	LK	L		
Fall Staging	315	9-Oct-12	9 V	468681	6251959	Bald Eagle	BAEA			1				1	LK	L		
Fall Staging	316	9-Oct-12	9 V	467343	6252922	Golden Eagle	GOEA			1				1	LK	L		
Fall Staging	316	9-Oct-12	9 V	467343	6252922	Bald Eagle	BAEA			1				1	LK	L		
Fall Staging	317	9-Oct-12	9 V	463940	6256055	Bald Eagle	BAEA			3				3	LK	L		
Fall Staging	318	9-Oct-12	9 V	460074	6254623	Bald Eagle	BAEA			1				1	LK	L		
Fall Staging	319	9-Oct-12	9 V	448805	6251220	Northern Goshawk	NOGO			1				1	WT	M		
Fall Staging	320	9-Oct-12	9 V	453021	6252349	Mallard	MALL	9	8					17	RI	L		
Fall Staging	322	9-Oct-12	9 V	451966	6260565	Ring-necked Duck	RNDU	1						1	MA	S		
Fall Staging	323	9-Oct-12	9 V	450608	6265011	Mallard	MALL	6	6					12	WT	M		
Fall Staging	323	9-Oct-12	9 V	450608	6265011	American Green-winged Teal	AGWT			8				8	WT	M		
Fall Staging	324	9-Oct-12	9 V	450128	6268951	Canada Goose	CAGO			7				7	LK	M		
Fall Staging	324	9-Oct-12	9 V	450128	6268951	Mallard	MALL		2					2	LK	M		
Fall Staging	325	9-Oct-12	9 V	452001	6259240	Red-necked Grebe	RNGR			2				2	LK	M		Todedada Lake

Appendix 7.3-1. Brucejack Gold Mine Project Waterbird Survey Data, 2012

Survey Data						Species Data									Habitat Data*		Behaviour and Comments*	
Survey	Waypoint ID	Date	Zone	Easting	Northing	Species Name	Species Code	No. Males	No. Females	No. Unknown	No. Brood	Brood Class	No. Pairs	Total	Habitat	Habitat Size	Behaviour	Comment
Fall Staging	326	9-Oct-12	9 V	454694	6253942	Mallard	MALL		9					9	WT	M		
Fall Staging	326	9-Oct-12	9 V	454694	6253942	Mallard	MALL	1	4					5	WT	M		
Fall Staging	327	9-Oct-12	9 V	460501	6257215	Bald Eagle	BAEA			1				1	LK	L		
Fall Staging	328	9-Oct-12	9 V	462000	6258225	Bald Eagle	BAEA			4				4	LK	L		
Fall Staging	329	9-Oct-12	9 V	463439	6258177	Bald Eagle	BAEA			2				2	LK	L		
Fall Staging	329	9-Oct-12	9 V	463439	6258177	Golden Eagle	GOEA			1				1	LK	L		
Fall Staging	330	9-Oct-12	9 V	465334	6256533	Bald Eagle	BAEA			1				1	LK	L		
Fall Staging	331	9-Oct-12	9 V	470240	6253294	Mallard	MALL	1	6					7	LK	L		
Fall Staging	333	9-Oct-12	9 V	475755	6250446	Bald Eagle	BAEA			1				1	LK	L		
Fall Staging	335	10-Oct-12	9 V	397827	6249069	Common Merganser	COME	6						6	LK	L		Border Lake, very marshy
Fall Staging	336	10-Oct-12	9 V	393218	6246783	Greater Scaup	GRSC	2						2	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Mallard	MALL		4					4	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Northern Pintail	NOPI			5				5	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Trumpeter Swan	TRSW			1				1	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Great-blue Heron	GBHE			1				1	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Northern Harrier	NOHA		1					1	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	American Widgeon	AMWI			2				2	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Canada Goose	CAGO			25				25	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Common Merganser	COME			4				4	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Northern Shoveller	NSHO		2					2	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Greater Scaup	GRSC		1					1	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	American Widgeon	AMWI		2					2	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Red-breasted Merganser	RBME			2				2	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Bald Eagle	BAEA			2				2	LK	L		
Fall Staging	337	10-Oct-12	9 V	393379	6246829	Red-necked Grebe	RNGR			2				2	LK	L		
Fall Staging	339	10-Oct-12	9 V	394138	6245439	Canada Goose	CAGO			37				37	PO	L		

**Habitat descriptor: LK=Lake, PO=Pond, RI=River, BK=Backchannel, CR=Creek, MA=Marsh, SW=Swamp, WT=Wetland; size descriptor: S=small, M=Medium, L=Large*

**Behaviour descriptor: F/O=Flyover, PA=Pair*

Appendix 7.3-2

Incidental Waterbird Observations, 2010 and 2012

Engineers and Scientists

Appendix 7.3-2. Incidental Waterbird Observations, 2010 and 2012

Date	Easting	Northing	Survey	Common Name	No. Observed	Comments
22-Jun-10	453901	6252999	Breeding Bird Survey	Arctic tern	1	
23-Jun-10	458858	6265141	Breeding Bird Survey	Semipalmated plover	2	
23-Jun-10	427100	6258595	Breeding Bird Survey	Semipalmated plover	2	
25-Jun-10	457364	6263570	Breeding Bird Survey	Solitary sandpiper	1	
26-Jun-10	451678	6259595	Breeding Bird Survey	Solitary sandpiper	1	nest observed, 4 eggs
26-Jun-10	451678	6259595	Breeding Bird Survey	Bonoparte's gull	2	
26-Jun-10	452515	6263048	Breeding Bird Survey	Solitary sandpiper	1	nest observed, 4 eggs
8-Jun-12	468442	6261182	Breeding Bird Survey	Bonoparte's gull	1	
8-Jun-12	455895	6265128	Breeding Bird Survey	Solitary sandpiper	1	
9-Jun-12	451671	6263532	Breeding Bird Survey	Canada Goose	1	
9-Jun-12	451538	6263917	Breeding Bird Survey	Canada Goose	1	
9-Jun-12	451538	6263917	Breeding Bird Survey	Wilson's Snipe	1	
9-Jun-12	451556	6264097	Breeding Bird Survey	Lesser Yellowlegs	1	
9-Jun-12	451556	6264097	Breeding Bird Survey	Wilson's Snipe	1	
9-Jun-12	453420	6253502	Breeding Bird Survey	Wilson's Snipe	1	
22-Jun-12	435579	6213657	Breeding Bird Survey	Canada Goose	1	
23-Jun-12	435323	6213825	Breeding Bird Survey	Canada Goose	1	
11-Jun-12	453666	6260834	Breeding Bird Survey	Barrow's Goldeneye	1	
11-Jun-12	453666	6260834	Breeding Bird Survey	Canada Goose	1	
11-Jun-12	453666	6260834	Breeding Bird Survey	Lesser Yellowlegs	1	
11-Jun-12	453666	6260834	Breeding Bird Survey	Mallard	1	
8-Jun-12	455699	6252983	Raptor Survey	Arctic Tern	10	
8-Jun-12	455699	6252983	Raptor Survey	Blue-winged Teal	3	
10-Jun-12	452367	6251399	Raptor Survey	Mallard	2	
8-Jun-12	451605	6263724	Raptor Survey	Canada Goose	1	
9-Jun-12	451538	6263917	Raptor Survey	Canada Goose	3	
22-Jun-12	435936	6214386	Raptor Survey	Canada Goose	5	
22-Jun-12	435936	6214386	Raptor Survey	Barrow's Goldeneye	2	
8-Jun-12	468294	6261948	Breeding Bird Survey	Bonoparte's gull	4	
9-Jun-12	451538	6263917	Raptor Survey	Canada Goose	2	
22-Jun-12	435083	6215690	Raptor Survey	Canada Goose	5	pair
16-May-12	467263	6255399	GB DNA Collection Set up	Harlequin duck	2	pair
16-May-12	407221	6261591	GB DNA Collection Set up	Harlequin duck	2	

Appendix 7.3-3

KSM Summary of Water Dependent Bird Spring Pair Survey, 2008

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Appendix 7.3-3. KSM Summary of Water Dependent Bird Spring Pair Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Drakes	Paired	Pair No	No. Unided	Total	Habitat Type*	Comment(s)
2-Jun-08	001	418012	6264268	1	American dipper	AMDI			N	0	1	1	RI-M	
2-Jun-08	002	418598	6265826	1	American dipper	AMDI			N	0	1	1	RI-M	
2-Jun-08	003	416024	6262491	1	American dipper	AMDI			N	0	3	3	RI-M	
2-Jun-08	004	407845	6261597	1	Canada goose	CAGO			N	0	1	1	RI-M	
2-Jun-08	005	407119	6261153	1	unidentified sandpiper	USAN			N	0	1	1	RI-M	
2-Jun-08	006	407172	6260748	1	Common merganser	COME	1		N	0		1	RI-M	
2-Jun-08	007	407243	6259558	1	Canada goose	CAGO			N	0	2	2	PO-L	
2-Jun-08	008	409161	6249846	1	American dipper	AMDI			N	0	1	1	RI-S	
2-Jun-08	009	412345	6245231	1	Canada goose	CAGO			N	0	1	1	RI-S	
2-Jun-08	010	413588	6237473	1	unidentified sandpiper	USAN			N	0	4	4	RI-S	
2-Jun-08	011	413836	6236223	1	unidentified sandpiper	USAN			N	0	4	4	RI-S	
2-Jun-08	012	414555	6240862	1	Canada goose	CAGO			N	0	3	3	PO-S	
2-Jun-08	014	394270	6246980	3	Blue-winged teal	BWTE	1	1	Y	1		2	LK-S	
2-Jun-08	014	394270	6246980	1	Common loon	COLO			N	0	4	4	LK-S	
2-Jun-08	014	394270	6246980	4	unidentified sandpiper	USAN			N	0	1	1	LK-S	
2-Jun-08	015	394104	6246798	1	Lesser scaup	LESC	2	2	Y	2		4	LK-S	
2-Jun-08	016	395617	6247552	1	Canada goose	CAGO			N	0	2	2	RI-M	
2-Jun-08	017	391334	6251804	1	American dipper	AMDI			N	0	1	1	RI-S	
2-Jun-08	018	388362	6252432	1	unidentified sandpiper	USAN			N	0	1	1	CR-L	
2-Jun-08	019	398843	6252610	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	LK-S	
2-Jun-08	019	398843	6252610	2	Barrow's goldeneye	BAGO	2	2	Y	2		4	LK-S	
2-Jun-08	020	397589	6252250	1	Barrow's goldeneye	BAGO			N	0	1	1	RI-L	
2-Jun-08	021	401438	6256997	1	Barrow's goldeneye	BAGO			N	0	2	2	LK-S	
2-Jun-08	021	401438	6256997	2	unidentified sandpiper	USAN			N	0	2	2	LK-S	
2-Jun-08	022	401186	6256262	2	Common merganser	COME	1		N	0		1	RI-L	King Cr.= good HADU habitat *survey earlier next year
2-Jun-08	022	401186	6256262	1	unidentified sandpiper	USAN			N	0	3	3	RI-L	
2-Jun-08	023	402930	6256326	1	Common merganser	COME		1	N	0		1	RI-L	
2-Jun-08	024	404127	6263286	1	American dipper	AMDI			N	0	2	2	RI-S	
2-Jun-08	025	404007	6273490	1	American dipper	AMDI			N	0	1	1	CR-L	
2-Jun-08	026	403672	6257714	1	Blue-winged teal	BWTE			N	0	2	2	RI-L	
2-Jun-08	027	404590	6258564	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	LK-S	
2-Jun-08	028	404511	6258914	1	Pacific loon	PALO		1	N	0	1	2	LK-S	
2-Jun-08	029	404593	6257758	1	Barrow's goldeneye	BAGO			N	0	1	1	RI-L	
2-Jun-08	030	407584	6262235	1	Common merganser	COME			N	0	1	1	RI-M	
2-Jun-08	031	408406	6262998	3	Barrow's goldeneye	BAGO	1		N	0		1	LK-S	
2-Jun-08	031	408406	6262998	1	Canada goose	CAGO			N	0	1	1	LK-S	
2-Jun-08	031	408406	6262998	2	Barrow's goldeneye	BAGO			N	0	5	5	LK-S	young (class I)
2-Jun-08	032	407883	6265294	1	Mallard	MALL		1	N	0		1	SW-M	
2-Jun-08	033	408036	6266711	1	unidentified sandpiper	USAN			N	0	1	1	CR-L	

Appendix 7.3-3. KSM Summary of Water Dependent Bird Spring Pair Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Drakes	Paired	Pair No	No. Unided	Total	Habitat Type*	Comment(s)
2-Jun-08	034	408608	6268745	1	Barrow's goldeneye	BAGO			N	0	1	1	LK-S	
2-Jun-08	034	408608	6268745	4	Barrow's goldeneye	BAGO			N	0	2	2	LK-S	
2-Jun-08	034	408608	6268745	2	Canada goose	CAGO	3	3	Y	3		6	LK-S	
2-Jun-08	034	408608	6268745	5	Mallard	MALL	3	2	Y	2		5	LK-S	
2-Jun-08	035	410158	6270208	1	unidentified sandpiper	USAN			N	0	1	1	LK-S	
2-Jun-08	035	410158	6270208	2	unidentified duck	UDUC			N	0	1	1	LK-S	ducklings
2-Jun-08	036	415932	6279998	1	Mallard	MALL	1	2	Y	1		3	MA-S	
2-Jun-08	037	415791	6279753	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	LK-S	
2-Jun-08	038	419461	6280575	1	American dipper	AMDI			N	0	1	1	RI-S	
2-Jun-08	039	432287	6279934	4	Arctic tern	ARTE			N	0	2	2	LK-M	
2-Jun-08	039	432287	6279934	1	Barrow's goldeneye	BAGO			N	0	2	2	LK-M	
2-Jun-08	039	432287	6279934	5	Barrow's goldeneye	BAGO			N	0	2	2	LK-M	
2-Jun-08	039	432287	6279934	6	Barrow's goldeneye	BAGO		1	N	0		1	LK-M	
2-Jun-08	039	432287	6279934	8	Common loon	COLO			N	0	2	2	LK-M	
2-Jun-08	039	432287	6279934	7	Mallard	MALL	1	1	Y	1		2	LK-M	
2-Jun-08	039	432287	6279934	3	Ring-billed gull	RGBU			N	0	3	3	LK-M	
2-Jun-08	39	432287	6279934	2	unidentified sandpiper	USAN			N	0	3	3	LK-M	
2-Jun-08	040	423069	6282209	1	unidentified sandpiper	USAN			N	0	2	2	LK-S	
2-Jun-08	041	423795	6281627	1	Barrow's goldeneye	BAGO	1	2	Y	1		3	LK-S	
2-Jun-08	042	426933	6282936	1	Common loon	COLO			N	0	1	1	LK-M	
2-Jun-08	043	427502	6282735	1	Barrow's goldeneye	BAGO			N	0	1	1	LK-S	
3-Jun-08	044	434549	6280918	1	unidentified sandpiper	USAN			N	0	2	2	CR-L	
3-Jun-08	045	437884	6282848	1	Canada goose	CAGO			N	0	1	1	SW-M	
3-Jun-08	046	437454	6283320	1	unidentified sandpiper	USAN			N	0	2	2	RI-S	
3-Jun-08	047	437094	6283792	1	Mallard	MALL	1	1	Y	1		2	SW-M	
3-Jun-08	047	437094	6283792	2	unidentified sandpiper	USAN			N	0	1	1	SW-M	
3-Jun-08	048	436456	6284366	1	unidentified sandpiper	USAN			N	0	2	2	SW-M	
3-Jun-08	050	432497	6283971	1	American dipper	AMDI			N	0	1	1	RI-S	Hodson Lake frozen
3-Jun-08	051	429670	6289869	1	Common loon	COLO			N	0	2	2	LK-M	Teigen Lake frozen
3-Jun-08	052	429036	6289625	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	PO-M	
3-Jun-08	053	430982	6290644	1	American dipper	AMDI			N	0	1	1	CR-M	
3-Jun-08	054	439722	6283033	1	Canada goose	CAGO			N	0	2	2	RI-M	
3-Jun-08	055	439638	6283330	1	unidentified sandpiper	USAN			N	0	1	1	SW-M	
3-Jun-08	056	440438	6281136	1	American dipper	AMDI			N	0	1	1	CR-L	
3-Jun-08	057	444155	6277084	1	American dipper	AMDI			N	0	1	1	CR-M	
3-Jun-08	058	441559	6285934	1	Harlequin duck	HADU		1	N	0		1	RI-M	
3-Jun-08	058	441559	6285934	2	unidentified sandpiper	USAN			N	0	2	2	RI-M	
3-Jun-08	059	445071	6288141	1	Canada goose	CAGO			N	0	2	2	RI-M	
3-Jun-08	059	445071	6288141	2	unidentified sandpiper	USAN			N	0	2	2	CR-S	

Appendix 7.3-3. KSM Summary of Water Dependent Bird Spring Pair Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Drakes	Paired	Pair No	No. Unided	Total	Habitat Type*	Comment(s)
3-Jun-08	060	446207	6287940	1	Canada goose	CAGO			N	0	1	1	RI-M	
3-Jun-08	061	446903	6287378	5	Barrow's goldeneye	BAGO			N	0	1	1	RI-M	
3-Jun-08	061	446903	6287378	7	Barrow's goldeneye	BAGO	1		N	0		1	RI-M	
3-Jun-08	061	446903	6287378	2	Blue-winged teal	BWTE			N	0	2	2	RI-M	
3-Jun-08	061	446903	6287378	6	Canada goose	CAGO			N	0	2	2	RI-M	
3-Jun-08	061	446903	6287378	3	Common merganser	COME			N	0	2	2	RI-M	
3-Jun-08	061	446903	6287378	1	Mallard	MALL	1		N	0	13	14	RI-M	
3-Jun-08	061	446903	6287378	4	Mallard	MALL	1	1	Y	1		2	RI-M	
3-Jun-08	062	446103	6287545	2	Barrow's goldeneye	BAGO		1	N	0		1	RI-M	
3-Jun-08	062	446103	6287545	1	Canada goose	CAGO			N	0	2	2	RI-M	
3-Jun-08	062	446103	6287545	3	Canada goose	CAGO			N	0	1	1	RI-M	
3-Jun-08	063	447261	6288616	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	RI-M	
3-Jun-08	063	447261	6288616	2	Barrow's goldeneye	BAGO	1	1	Y	1		2	RI-M	
3-Jun-08	064	446694	6288688	1	Canada goose	CAGO			N	0	1	1	RI-M	
3-Jun-08	064	446694	6288688	3	Mallard	MALL		1	N	0		1	RI-M	
3-Jun-08	064	446694	6288688	2	Ring-necked duck	RNDU		1	N	0		1	RI-M	
3-Jun-08	065	445961	6288655	1	Barrow's goldeneye	BAGO		1	N	0		1	RI-M	
3-Jun-08	066	445834	6288733	2	Green-winged teal	GWTE	1	1	Y	1	1	3	SW-L	
3-Jun-08	066	445834	6288733	1	Mallard	MALL		1	N	0		1	SW-L	
3-Jun-08	067	445225	6288488	1	Barrow's goldeneye	BAGO		2	N	0		2	SW-L	
3-Jun-08	067	445225	6288488	2	Barrow's goldeneye	BAGO			N	0	1	1	SW-L	
3-Jun-08	068	444146	6289239	1	Barrow's goldeneye	BAGO	1		N	0		1	SW-L	
3-Jun-08	068	444146	6289239	2	Canada goose	CAGO			N	0	2	2	SW-L	
3-Jun-08	069	443185	6289218	1	Barrow's goldeneye	BAGO	2	2	Y	2		4	SW-L	
3-Jun-08	070	449004	6289182	1	Barrow's goldeneye	BAGO		2	N	0		2	SW-M	
3-Jun-08	071	448518	6286700	1	unidentified sandpiper	USAN			N	0	1	1	RI-M	
3-Jun-08	072	449684	6284358	1	Canada goose	CAGO			N	0	1	1	RI-M	
3-Jun-08	073	447325	6286840	1	Canada goose	CAGO			N	0	2	2	PO-M	
3-Jun-08	074	452000	6279409	1	Barrow's goldeneye	BAGO		1	N	0		1	PO-S	
3-Jun-08	074	452000	6279409	2	Canada goose	CAGO			N	0	2	2	PO-S	
3-Jun-08	075	452916	6279229	1	Canada goose	CAGO			N	0	2	2	RI-L	
3-Jun-08	075	452916	6279229	2	unidentified sandpiper	USAN			N	0	1	1	RI-L	
3-Jun-08	076	456952	6276197	2	Common merganser	COME		1	N	0		1	RI-M	
3-Jun-08	076	456952	6276197	1	Mallard	MALL	1	1	Y	1		2	RI-M	
3-Jun-08	077	462340	6270313	1	Common merganser	COME		1	N	0		1	RI-M	
3-Jun-08	078	467324	6265210	2	Canada goose	CAGO			N	0	5	5	RI-M	
3-Jun-08	078	467324	6265210	1	Mallard	MALL	1	4	Y	1		5	RI-M	
3-Jun-08	079	468054	6264674	1	Harlequin duck	HADU	1	1	Y	1		2	RI-L	Riffle
3-Jun-08	080	464016	6267793	1	unidentified duck	UDUC			N	0	1	1	PO-L	diving duck

Appendix 7.3-3. KSM Summary of Water Dependent Bird Spring Pair Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Drakes	Paired	Pair No	No. Unided	Total	Habitat Type*	Comment(s)
3-Jun-08	081	461210	6269159	1	unidentified sandpiper	USAN			N	0	1	1	RI-M	
3-Jun-08	082	456106	6270096	2	Canada goose	CAGO			N	0	2	2	MA-L	
3-Jun-08	083	456525	6269677	2	Barrow's goldeneye	BAGO	3	3	Y	3		6	MA-L	
3-Jun-08	083	456525	6269677	1	Canada goose	CAGO			N	0	1	1	MA-L	
3-Jun-08	083	456525	6269677	1	unidentified sandpiper	USAN			N	0	1	1	MA-L	
3-Jun-08	083	456525	6269677	1	Trumpeter swan	TRSW			N	0	1	1	MA-L	
3-Jun-08	084	455461	6269163	4	Barrow's goldeneye	BAGO	1	3	Y	1		4	MA-M	
3-Jun-08	084	455461	6269163	3	Canada goose	CAGO			N	0	3	3	MA-M	
3-Jun-08	084	455461	6269163	4	Mallard	MALL		1	N	0	3	4	MA-M	
3-Jun-08	085	449401	6270074	2	Mallard	MALL	1	1	Y	1		2	SW-M	
3-Jun-08	087	451230	6265469	2	Barrow's goldeneye	BAGO	2	1	Y	1		3	MA-L	
3-Jun-08	087	451230	6265469	1	Canada goose	CAGO			N	0	1	1	MA-L	
3-Jun-08	087	451230	6265469	2	unidentified sandpiper	USAN			N	0	2	2	MA-L	
3-Jun-08	088	450541	6264549	2	Arctic tern	ARTE			N	0	2	2	PO-L	
3-Jun-08	088	450541	6264549	4	Barrow's goldeneye	BAGO			N	0	4	4	PO-L	
3-Jun-08	088	450541	6264549	2	Canada goose	CAGO			N	0	2	2	PO-L	
3-Jun-08	088	450541	6264549	2	unidentified sandpiper	USAN			N	0	2	2	PO-L	
3-Jun-08	089	450768	6265469	2	Blue-winged teal	BWTE	1	1	Y	1		2	MA-L	
3-Jun-08	089	450768	6265469	2	Green-winged teal	GWTE	1	1	Y	1		2	MA-L	
3-Jun-08	089	450768	6265469	4	Mallard	MALL	1	4	Y	1		5	MA-L	
3-Jun-08	090	451089	6263263	5	Canada goose	CAGO			N	0	5	5	MA-L	
3-Jun-08	091	452676	6263380	2	Canada goose	CAGO			N	0	2	2	MA-L	
3-Jun-08	091	452676	6263380	1	unidentified sandpiper	USAN			N	0	1	1	MA-L	
3-Jun-08	092	451591	6260482	1	Barrow's goldeneye	BAGO		1	N	0		1	PO-M	
3-Jun-08	093	451981	6260437	1	Arctic tern	ARTE			N	0	1	1	LK-M	
3-Jun-08	093	451981	6260437	2	Barrow's goldeneye	BAGO	1	1	Y	1		2	LK-S	
3-Jun-08	094	448941	6269645	1	Barrow's goldeneye	BAGO			N	0	1	1	PO-M	
3-Jun-08	094	448941	6269645	2	unidentified sandpiper	USAN			N	0	2	2	PO-M	
3-Jun-08	095	446902	6271596	1	Barrow's goldeneye	BAGO	1	2	Y	1		3	PO-L	
3-Jun-08	095	446902	6271596	3	Green-winged teal	GWTE		2	N	0		2	PO-L	
3-Jun-08	095	446902	6271596	2	Mallard	MALL		4	N	0		4	PO-L	
3-Jun-08	096	445286	6272179	1	Canada goose	CAGO			N	0	1	1	PO-S	
3-Jun-08	097	444845	6272358	1	Barrow's goldeneye	BAGO			N	0	1	1	PO-S	
3-Jun-08	098	443967	6272061	1	Barrow's goldeneye	BAGO			N	0	2	2	MA/PO-M	
3-Jun-08	099	444232	6271892	1	Barrow's goldeneye	BAGO			N	0	2	2	LK-S	
3-Jun-08	100	443251	6272636	1	Barrow's goldeneye	BAGO			N	0	2	2	PO-S	
3-Jun-08	101	442357	6272543	1	Barrow's goldeneye	BAGO		1	N	0		1	PO-L	
3-Jun-08	101	442357	6272543	2	unidentified sandpiper	USAN			N	0	1	1	PO-L	
3-Jun-08	102	437642	6274325	1	Canada goose	CAGO			N	0	1	1	PO-S	
3-Jun-08	102	437642	6274325	2	unidentified sandpiper	USAN			N	0	1	1	PO-S	

Appendix 7.3-4

KSM Summary of Water Dependent Bird Summer Brood Survey, 2008

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Appendix 7.3-4. KSM Summary of Water Dependent Bird Summer Brood Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Young	Class	No. Drake or Unided	Total Adult	Total	Habitat Type*	Comment(s)
15-Jul-08	002	413959	6240977	1	Blue-winged teal	BWTE				1	1	1	RI-M	start: S UNUK 7:55 am
15-Jul-08	002	413959	6240977	1	unidentified sandpiper	USAN				1	1	1	RI-M	
15-Jul-08	003	413650	6236957	1	unidentified sandpiper	USAN				2	2	2	RI-M	
15-Jul-08	004	414770	6235041	1	unidentified sandpiper	USAN				1	1	1	LK-S	stop: S UNUK 8:40 am
15-Jul-08	005	394314	6247136	1	unidentified loon	ULOO				2	2	2	LK-L	
15-Jul-08	006	397812	6252956	1	unidentified sandpiper	USAN				1	1	1	RI-L	
15-Jul-08	007	401285	6257197	1	unidentified loon	ULOO				1	1	1	LK-M	
15-Jul-08	008	401437	6258840	1	Pacific loon	PALO				2	2	2	LK-M	
15-Jul-08	009	397015	6261374	1	unidentified sandpiper	USAN				1	1	1	CR-L	
15-Jul-08	010	394368	6262009	1	Canada goose	CAGO				9	9	9	LK-S	
15-Jul-08	010	394368	6262009	1	unidentified sandpiper	USAN				1	1	1	LK-S	Stop: Harry Mel Cr. 11:30 am
15-Jul-08	011	408598	6263854	1	Mallard	MALL				1	1	1	LK-S	
15-Jul-08	012	415744	6279856		Bonaparte's gull	BOGU				1	1	1	LK-S	
15-Jul-08	013	424603	6283639	1	unidentified loon	ULOO				1	1	1	PO-S	
15-Jul-08	014	424703	6282997	1	Canada goose	CAGO				14	14	14	LK-M	
15-Jul-08	014	424703	6282997	1	unidentified goldeneye	UGOL	1	1		2	3	4	LK-M	
15-Jul-08	014	424703	6282997	2	unidentified goldeneye	UGOL	1				1	1	LK-M	
15-Jul-08	014	424703	6282997	3	unidentified goldeneye	UGOL				1	1	1	LK-M	
15-Jul-08	014	424703	6282997	4	unidentified goldeneye	UGOL				1	1	1	LK-M	
15-Jul-08	014	424703	6282997	1	unidentified loon	ULOO				1	1	1	LK-M	
15-Jul-08	014	424703	6282997	1	unidentified sandpiper	USAN				1	1	1	LK-M	
15-Jul-08	014	424703	6282997		unidentified waterfowl	UWAT				2	2	2	LK-M	
15-Jul-08	014	424703	6282997	1	White-winged scoter	WWSC				1	1	1	LK-M	
15-Jul-08	015	427719	6282826	1	Canada goose	CAGO				39	39	39	LK-M	
15-Jul-08	016	428235	6283552	1	Canada goose	CAGO				15	15	15	PO-S	
15-Jul-08	016	428235	6283552	1	unidentified goldeneye	UGOL	1				1	1	PO-M	
15-Jul-08	016	428235	6283552	1	unidentified loon	ULOO				1	1	1	PO-S	
15-Jul-08	017	429994	6283869	1	unidentified loon	ULOO				1	1	1	PO-M	
15-Jul-08	017	429994	6283869	1	unidentified sandpiper	USAN				1	1	1	LK-L	
15-Jul-08	018	431935	6279759	1	Bonaparte's gull	BOGU				1	1	1	LK-L	
15-Jul-08	018	431935	6279759	2	Bonaparte's gull	BOGU				1	1	1	LK-L	
15-Jul-08	018	431935	6279759	1	Canada goose	CAGO				13	13	13	PO-L	
15-Jul-08	018	431935	6279759	1	unidentified loon	ULOO				1	1	1	LK-L	
15-Jul-08	018	431935	6279759	1	Mallard	MALL	1	5	IA		1	6	LK-L	
15-Jul-08	018	431935	6279759	1	unidentified sandpiper	USAN				3	3	3	LK-L	
15-Jul-08	018	431935	6279759	2	unidentified sandpiper	USAN				15	15	15	LK-L	
15-Jul-08	019	429670	6289828	1	unidentified sandpiper	USAN				1	1	1	LK-L	
15-Jul-08	021	427845	6288845	1	unidentified sandpiper	USAN				1	1	1	LK-L	
15-Jul-08	022	440585	6283791	1	unidentified sandpiper	USAN				1	1	1	RI-M	
15-Jul-08	023	445180	6276066	1	Mallard	MALL				3	3	3	SW	

Appendix 7.3-4. KSM Summary of Water Dependent Bird Summer Brood Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Young	Class	No. Drake or Unided	Total Adult	Total	Habitat Type*	Comment(s)
15-Jul-08	023	445180	6276066	1	unidentified waterfowl	UWAT				1	1	1	SW	
15-Jul-08	024	447351	6271093	1	unidentified goldeneye	UGOL				1	1	1	PO-S	
15-Jul-08	024	447351	6271093	1	unidentified sandpiper	USAN				1	1	1	RI-M	
15-Jul-08	025	451761	6268725	1	unidentified sandpiper	USAN				1	1	1	RI-M	
15-Jul-08	026	456788	6269853	1	unidentified waterfowl	UWAT				3	3	3	PO-M	
15-Jul-08	027	457323	6269806	1	unidentified goldeneye	UGOL	1	5	IIB		1	6	PO-M	
15-Jul-08	027	457323	6269806	1	unidentified waterfowl	UWAT				2	2	2	PO-M	
15-Jul-08	028	456070	6270036	1	Mallard	MALL	1				1	1	PO-S	
15-Jul-08	028	456070	6270036	2	Mallard	MALL	2				2	2	PO-M	
16-Jul-08	029	445408	6288931	1	Canada goose	CAGO		3	IIB	2	2	5	SW-S	
16-Jul-08	029	445408	6288931	1	unidentified goldeneye	UGOL	1				1	1	PO-S	
16-Jul-08	030	444296	6289439	1	Mallard	MALL	3	1		4	7	8	PO-S	
16-Jul-08	031	444889	6288043	1	unidentified merganser	UMER	1	6	IIA		1	7	CR-M	
16-Jul-08	031	444889	6288043	2	unidentified merganser	UMER	1	15	IIB		1	16	CR-M	
16-Jul-08	032	446739	6288597	1	Bufflehead	BUFF	1				1	1	PO-M	
16-Jul-08	033	446081	6287516		unidentified goldeneye	UGOL				1	1	1	PO-M	
16-Jul-08	033	446081	6287516	1	unidentified sandpiper	USAN				1	1	1	CR-M	
16-Jul-08	034	449067	6289406	1	Mallard	MALL	1	5	IIB		1	6	SW-L	
16-Jul-08	035	448052	6287489	1	unidentified sandpiper	USAN				1	1	1	RI-S	
16-Jul-08	036	447554	6286609	1	unidentified goldeneye	UGOL	1			1	2	2	PO-M	
16-Jul-08	037	450668	6282325	1	Canada goose	CAGO				10	10	10	RI-L	
16-Jul-08	038	451189	6280614	1	Mallard	MALL	1	15	IIC		1	16	SW-M	
16-Jul-08	038	451189	6280614	1	unidentified waterfowl	UWAT				2	2	2	SW-M	
16-Jul-08	039	452130	6280227	1	unidentified goldeneye	UGOL				1	1	1	RI-L	
16-Jul-08	040	452296	6279258	1	unidentified goldeneye	UGOL	1	3	IIA		1	4	CR-M	
16-Jul-08	043	457137	6275820	1	unidentified merganser	UMER		4		1	1	5	RI-S	
16-Jul-08	044	460768	6272402	1	unidentified merganser	UMER				1	1	1	RI-L	
16-Jul-08	045	463055	6269671	1	Canada goose	CAGO	1	3	IIC	1	2	5	RI-L	
16-Jul-08	046	467044	6265207	1	unidentified sandpiper	USAN				1	1	1	RI-L	
16-Jul-08	047	451666	6260306	1	unidentified loon	ULOO				1	1	1	LK-M	
16-Jul-08	048	451637	6260568	1	Lesser scaup	LESC		1			0	1	PO-L	
16-Jul-08	048	451637	6260568	1	unidentified merganser	UMER	1	8	IIB		1	9	PO-L	
16-Jul-08	049	451136	6265415	1	American dipper	AMDI				2	2	2	MA-L	
16-Jul-08	050	450502	6264509	1	unidentified goldeneye	UGOL	1				1	1	PO-M	
16-Jul-08	050	450502	6264509	1	Mallard	MALL	1	11	III		1	12	PO-M	
16-Jul-08	051	452253	6267265	1	Canada goose	CAGO	1	6	IIA	1	2	8	PO-M	
16-Jul-08	052	450488	6268346	1	unidentified loon	ULOO		2	IIA	2	2	4	LK-L	
16-Jul-08	053	444635	6272323	1	unidentified goldeneye	UGOL	1				1	1	PO-S	
16-Jul-08	054	449087	6267607		unidentified goldeneye	UGOL				1	1	1	PO-S	
16-Jul-08	059	422055	6265407	1	unidentified sandpiper	USAN				1	1	1	CR-M	

Appendix 7.3-5

KSM Summary of Water Dependent Bird Fall Staging Survey, 2008

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Appendix 7.3-5. KSM Summary of Water Dependent Bird Fall Staging Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Drakes	No. Juv	No. Unided	Total Juvenile	Total Adult	Total	Habitat Type*	Comment(s)
27-Sep-08	002	401210	6256812	1	unidentified merganser	UMER			2		2	0	2	LK-M	juveniles
27-Sep-08	003	401220	6258546	1	Common merganser	COME			3		3	0	3	LK-M	juveniles
27-Sep-08	005	394083	6246642	1	Canada goose	CAGO				28	0	28	28	LK-M	
27-Sep-08	005	394083	6246642	2	Mallard	MALL		2			0	2	2	LK-M	
27-Sep-08	005	394083	6246642	2	Green-winged teal	GWTE				9	0	9	9	LK-M	
27-Sep-08	006	394523	6246311	1	Canada goose	CAGO				8	0	8	8	LK-M	
27-Sep-08	007	398340	6249464	1	unidentified scoter	USCO				1	0	1	1	LK-S	likely surf scoter
27-Sep-08	007	398340	6249464	2	unidentified waterfowl	UWAT				2	0	2	2	LK-S	likely merganser or goldeneye
27-Sep-08	010	409196	6269092	1	unidentified merganser	UMER				3	0	3	3	RI-M	flying up river
27-Sep-08	012	423185	6282272	2	Barrow's goldeneye	BAGO				2	0	2	2	PO-M	
27-Sep-08	013	431926	6279504	1	Mallard	MALL				49	0	49	49	LK-L	
27-Sep-08	013	431926	6279504	2	unidentified merganser	UMER				2	0	2	2	LK-L	
27-Sep-08	013	431926	6279504	3	Barrow's goldeneye	BAGO				2	0	2	2	LK-L	
27-Sep-08	014	433870	6275046	2	Canada goose	CAGO				4	0	4	4	PO-S	Treaty Creek Pond off channel
27-Sep-08	015	445436	6272110	1	Canada goose	CAGO				11	0	11	11	MA-M	Marsh with channel of Treaty Creek
27-Sep-08	016	446865	6271711	1	Canada goose	CAGO				7	0	7	7	MA/PO-M	Marsh with pond
27-Sep-08	016	446865	6271711	1	Greater yellowlegs	GRYE				1	0	1	1	MA/PO-M	
27-Sep-08	017	448654	6270375	1	Mallard	MALL				5	0	5	5	MA/PO-S	off channel
27-Sep-08	018	449011	6269790	1	unidentified scaup	USCA				4	0	4	4	MA+PO	
27-Sep-08	019	450061	6268884	1	Mallard	MALL				3	0	3	3	LK-L	
27-Sep-08	019	450061	6268884	2	American wigeon	AMWI				1	0	1	1	LK-L	
27-Sep-08	020	450252	6268723	3	unidentified scaup	USCA				7	0	7	7	LK-L	
27-Sep-08	020	450252	6268723	1	Surf scoter	SUSC				7	0	7	7	LK-L	
27-Sep-08	021	450152	6268266	1	Trumpeter swan	TRSW				1	0	1	1	LK-L	
27-Sep-08	021	450152	6268266	2	Lesser scaup	LESC				15	0	15	15	LK-L	
27-Sep-08	024	451080	6265485	1	Mallard	MALL				25	0	25	25	MA-L	
27-Sep-08	025	450345	6264871	1	Green-winged teal	GWTE				4	0	4	4	MA-L	
27-Sep-08	026	451767	6259490	1	unidentified loon	ULOO			11		11	0	11	LK-M	juvenile arctic or red-throated loon
27-Sep-08	027	456188	6270112	1	Mallard	MALL				23	0	23	23	MA-M	pond and marsh
27-Sep-08	028	456810	6269987	1	Mallard	MALL			7		7	0	7	MA-M	young (class III)
27-Sep-08	029	446858	6288783	1	Barrow's goldeneye	BAGO				4	0	4	4	MA/SW-L	
27-Sep-08	030	446501	6287394	1	Canada goose	CAGO				4	0	4	4	SW-L	Teigen Bog-Swamp Complex
27-Sep-08	031	446932	6287518	1	Mallard	MALL				8	0	8	8	SW-L	Teigen Bog-Swamp Complex
27-Sep-08	032	444739	6288495	1	Mallard	MALL				2	0	2	2	SW-L	Teigen Bog-Swamp Complex
27-Sep-08	033	444251	6289477	1	Green-winged teal	GWTE				5	0	5	5	PO/SW-M	
27-Sep-08	033	444251	6289477	2	American wigeon	AMWI				3	0	3	3	PO/SW-M	Part of large swamp/bog complex at Teigen
27-Sep-08	034	443264	6289211	1	unidentified goldeneye	UGOL			2		2	0	2	PO/SW-M	likely juvenile barrow's goldeneye
27-Sep-08	035	444940	6275704	1	Mallard	MALL				1	0	1	1	PO-M	

Appendix 7.3-5. KSM Summary of Water Dependent Bird Fall Staging Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Drakes	No. Juv	No. Unided	Total Juvenile	Total Adult	Total	Habitat Type*	Comment(s)
27-Sep-08	036	439774	6283395	1	Mallard	MALL				3	0	3	3	PO-S	
27-Sep-08	037	429895	6283918	1	Common loon	COLO				1	0	1	1	LK-L	Hodkin Lake
27-Sep-08	038	431097	6284646	1	Barrow's goldeneye	BAGO				2	0	2	2	PO-M	off Hodkin Lake
27-Sep-08	039	427485	6283746	1	unidentified goldeneye	UGOL			1		1	0	1	LK-M	juvenile or hen
27-Sep-08	039	427485	6283746	2	unidentified goldeneye	UGOL			5		5	0	5	LK-M	juvenile or hen
27-Sep-08	040	424647	6283083	1	unidentified goldeneye	UGOL				4	0	4	4	LK-S	
27-Sep-08	041	425286	6282323	1	unidentified goldeneye	UGOL				2	0	2	2	LK-S	
27-Sep-08	042	425424	6282596	1	unidentified goldeneye	UGOL				1	0	1	1	LK-S	
27-Sep-08	043	427411	6282650	1	unidentified goldeneye	UGOL				1	0	1	1	LK-S	
27-Sep-08	044	407250	6277386	1	Canada goose	CAGO				5	0	5	5	LK-L	Tom Mckay Lake

** Habitat descriptor: LK=lake, RI-river, PO=pond, MA=Marsh, SW=Swamp: size descriptor S=small, M=medium, L=large.*

Appendix 7.3-6

KSM Summary of Water Dependent Bird Spring Staging Survey, 2009

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Appendix 7.3-6. KSM Summary of Water Dependent Bird Spring Staging Survey, 2009

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Drakes	No. Unided	Total	Habitat Type*	Comment(s)
26-Apr-09	002	447213	6288610	1	Hooded merganser	HOME	1			1	PO-S	
26-Apr-09	004	442004	6298656	1	Mallard	MALL	1	1		2	CR-M	
26-Apr-09	005	451290	6281411	1	Common merganser	COME			3	3	RI-L	
26-Apr-09	005	451290	6281411	2	Common merganser	COME	1	1		2	RI-L	
26-Apr-09	006	450237	6284439	1	Common merganser	COME	1	1		2	RI-L	
26-Apr-09	007	394776	6246097	1	Common merganser	COME	1	1		1	RI-L	
26-Apr-09	009	393595	6246537	1	Trumpeter swan	TRSW			3	3	LK-M	
26-Apr-09	009	393595	6246537	2	Canada goose	CAGO			85	85	LK-M	
26-Apr-09	009	393595	6246537	3	Trumpeter swan	TRSW			1	1	LK-M	
26-Apr-09	009	393595	6246537	4	Mallard	MALL			10	10	LK-M	
26-Apr-09	010	394430	6246909	1	Lesser scaup	LESC			9	9	LK-M	
26-Apr-09	010	394430	6246909	1	Bufflehead	BUFF			1	1	LK-M	
26-Apr-09	010	394430	6246909	1	Lesser scaup	LESC			3	3	LK-M	
26-Apr-09	010	394430	6246909	2	Barrow's goldeneye	BAGO	1	1		2	LK-M	
26-Apr-09	010	394430	6246909	2	Trumpeter swan	TRSW			1	1	LK-M	

** Habitat descriptor: LK=lake, RI-river, PO=pond, MA=Marsh, SW=Swamp: size descriptor S=small, M=medium, L=large.*

Appendix 7.4-1

Upland Breeding Birds Observed during VRPC Surveys, 2010 and 2012

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Appendix 7.4-1. Upland Breeding Birds Observed during VRPC Surveys, 2010 and 2012

		LSA				
		2010		2012		
Common Name	Scientific Name	No. Oberved In Plot	No. Incidental	No. Observed In Plot	No. Incidental	Total
Alder Flycatcher	*Empidonax alnorum*	2	1	10	3	16
American Dipper	*Cinclus mexicanus*	1	1	-	1	3
American Pipit	*Anthus rubescens*	4	6	-	-	10
American Robin	*Turdus migratorius*	5	2	17	3	27
American Three-toed Woodpecker	*Picoides dorsalis*	-	-	2	2	4
American Tree Sparrow	*Spizella arborea*	-	-	3	-	3
Barn Swallow	*Hirundo rustica*	2	3	1	4	10
Black Swift	*Cypseloides niger*	-	5	-	-	5
Black-backed Woodpecker	*Picoides arcticus*	1	-	-	-	1
Black-capped Chickadee	*Poecile atricapillus*	2	-	31	6	39
Blackpoll Warbler	*Dendroica striata*	7	-	-	-	7
Brewer's sparrow	*Spizella breweri*	-	3	-	-	3
Brown Creeper	*Certhia americana*	2	-	2	-	4
Bushtit	*Psaltriparus minimus*	-	-	1	-	1
Chestnut-backed Chickadee	*Poecile rufescens*	-	-	1	1	2
Chipping Sparrow	*Spizella passerina*	6	4	14	5	29
Common Yellowthroat	*Geothlypis trichas*	-	-	2	-	2
Dark-eyed Junco	*Junco hyemalis*	35	3	50	8	96
Fox Sparrow	*Passerella iliaca*	-	-	44	1	45
Golden-crowned Kinglet	*Regulus satrapa*	13	-	9	-	22
Golden-crowned Sparrow	*Zonotrichia atricapilla*	1	3	20	7	31
Gray Jay	*Perisoreus canadensis*	2	1	1	2	6
Gray-cheeked Thrush	*Catharus minimus*	6	-	7	2	15
Gray-crowned rosy finch	*Leucosticte tephrocotis*	-	4	0	-	4
Hammond's Flycatcher	*Empidonax hammondii*	4	-	11	-	15
Hermit Thrush	*Catharus guttatus*	5	2	53	17	77
MacGillivray's Warbler	*Oporornis tolmiei*	-	-	2	-	2
Magnolia Warbler	*Setophaga magnolia*	-	-	1	-	1
Mountain Bluebird	*Sialia currucoides*	-	-	2	-	2
Mountain Chickadee	*Poecile gambeli*	1	-	2	2	5
Northern Flicker	*Colaptes auratus*	1	1	-	2	4
Northern Waterthrush	*Seiurus noveboracensis*	6	-	-	-	6
*Olive-sided Flycatcher	*Contopus cooperi*	-	-	3	3	6
Orange-crowned Warbler	*Oreothlypis celata*	-	-	3	1	4
Pacific Wren	*Troglodytes pacificus*	2	-	30	3	35
Pine Grosbeak	*Pinicola enucleator*	-	-	1	2	3
Pine Siskin	*Carduelis pinus*	18	16	50	76	160
Purple Finch	*Carpodacuz pupureus*	-	-	3	1	4
Red Crossbill	*Loxia curvirostra*	-	26	-	-	26
Red-breasted Nuthatch	*Sitta canadensis*	11	2	11	2	26
Red-breasted sapsucker	*Sphyrapicus ruber*	-	1	-	-	1
Rock Ptarmigan	*Lagopus muta*	-	-	-	1	1
Ruby-crowned Kinglet	*Regulus calendula*	25	6	52	11	94
Ruffed Grouse	*Bonasa umbellus*	-	-	1	-	1
Rufous Hummingbird	*Selasphorus rufus*	-	-	1	1	2
Savannah Sparrow	*Passerculus sandwichensis*	14	4	12	-	30
Say's Phoebe	*Sayornis saya*	2	1	-	-	3
Snow bunting	*Plectrophenax nivalis*	-	2	-	-	2
Song Sparrow	*Melospiza melodia*	1	-	1	-	2
Sooty Grouse	*Dendragapus fuliginosus*	-	-	5	3	8
Swainson's Thrush	*Catharus ustulatus*	82	14	27	8	131

Appendix 7.4-1. Upland Breeding Birds Observed during VRPC Surveys, 2010 and 2012

		LSA				
		2010		2012		
Common Name	**Scientific Name**	**No. Oberved In Plot**	**No. Incidental**	**No. Observed In Plot**	**No. Incidental**	**Total**
Townsend's Solitaire	*Myadestes townsendi*	-	1	1	-	2
Townsend's Warbler	*Dendroica townsendi*	15	-	43	4	62
Unknown Hummingbird		-	-	1	-	1
Unknown Ptarmigan	*Lagopus spp.*	1	6	1	-	8
Unknown Sparrow	*Spizella spp.*	-	-	2	-	2
Unknown Swallow	*Tachycineta spp.*	-	-	1	-	1
Unknown Woodpecker	*Picoides spp*	-	-	-	1	1
Varied Thrush	*Ixoreus naevius*	29	27	72	34	162
Veery	*Catharus fuscescens*	2	-	-	-	2
Violet-green Swallow	*Tachycineta thalassina*	-	-	-	4	4
Warbling Vireo	*Vireo gilvus*	3	1	1	-	5
Western Tanager	*Piranga ludoviciana*	-	-	1	1	2
Western-wood Peewee	*Contopus sordidulus*	-	-	7	1	8
White-crowned Sparrow	*Zonotrichia leucophrys*	-	-	1	-	1
Willow Ptarmigan	*Lagopus lagopus*	-	-	-	3	3
Wilson's Warbler	*Cardellina pusilla*	36	2	40	6	84
Yellow Warbler	*Setophaga petechia*	16	1	54	-	71
Yellow-rumped Warbler	*Setophaga coronata*	26	-	49	6	81
Total		**395**	**170**	**760**	**238**	**1536**

Appendix 7.4-2

Upland Breeding Bird VRPC Survey Details, June 2010

Appendix 7.4-2. Upland Breeding Bird VRPC Survey Details, June 2010

Date	Time	Temp. (˚)	Wind (1-5)	Cloud Cover (%)	VRPC Station	Easting	Northing	Habitat Type (Forest Interior)	Notes
22-Jun-10	4:35	5	1	90	SF1-1	454642	6253173	Decidous Forest	cottonwood
22-Jun-20	5:01	5	1	90	SF1-2	454498	6253115	Decidous Forest	cottonwood
22-Jun-10	5:15	5	1	90	SF1-3	454312	6253036	Decidous Forest	50% Cottonwood/ 30% red alder, 20% willow
22-Jun-10	5:33	5	1	90	SF1-4	454119	6252975	Decidous Forest	90% cottonwood/ 5% 5-10yr old spruce/ soapberry understory
22-Jun-10	5:59	5	1	90	SF1-5	453950	6252943	Decidous Forest	70% cottonwood/ 25% red alder/ 5% willow
22-Jun-10	6:23	8	1	100	SF2-1	452217	6251440	Riparian	50% mature cottonwood canopy with spruce understory/ 50% river, sandbars
22-Jun-10	6:48	8	1	100	SF2-2	451951	6251235	Riparian	50% grand fir balsam/ 50% cottonwood
22-Jun-10	7:08	8	1	100	SF2-3	451797	6251150	Coniferous Forest	80% grand fir/ 20% mature cottonwood
22-Jun-10	7:21	8	1	100	SF2-4	451663	6250990	Coniferous Forest	90% grand fir
22-Jun-10	7:34	8	1	100	SF2-5	451528	6250828	Mixed Forest	60% cottonwood/ 40% grand fir
22-Jun-10	8:14	9	1	100	SF3-1	449750	6250441	Riparian	well-spaced cottonwoods with some young spruce
22-Jun-10	8:30	9	1	100	SF3-2	449529	6250234	Riparian	
22-Jun-10	8:41	9	1	100	SF3-3	449418	6250071	Riparian	cottonwoods becoming more dense
22-Jun-10	8:53	9	1	100	SF3-4	449271	6249934	Riparian	
22-Jun-10	9:04	9	1	100	SF3-5	449095	6249824	Riparian	
24-Jun-10	5:17	6	3	100	SF4-1	439657	6251130	Riparian	40% gravel bar/ 20% lake/ 40% sparse cottonwood, a few spruce, and rocky outcrops
24-Jun-10	5:30	6	3	100	SF4-2	439769	6250963	Riparian	30% lake/ 50% MF cottonwood, spruce/ 20% bare rock
24-Jun-10	5:39	6	2	90	SF4-3	439830	6250763	Mixed Forest	60% cottonwood/ 40% spruce
24-Jun-10	5:49	6	2	100	SF4-4	439874	6250560	Mixed Forest	60% spruce/ 40% cottonwood - young forest 20yrs old
24-Jun-10	5:59	6	2	100	SF4-5	439999	6250390	Mixed Forest	60% spruce, 40% cottonwood
24-Jun-10	6:32	7	2	95	SF5-1	441391	6250285	Mixed Forest	70% cottonwood/ 30% spruce
24-Jun-10	6:47	7	2	95	SF5-2	441616	6250357	Mixed Forest	
24-Jun-10	6:57	7	2	95	SF5-3	441815	6250384	Mixed Forest	
24-Jun-10	7:07	7	2	95	SF5-4	442022	6250438	Mixed Forest	
24-Jun-10	7:19	7	2	95	SF5-5	442219	6250487	Short Shrub (SS3)	old runway, 1-3m cottonwood w/ some > 1m spruce, 40m from river
24-Jun-10	8:38	6	2	100	SF6-1	425921	6260560	Short Shrub (SS3)	old mine site
24-Jun-10	9:08	6	2	100	SF6-2	425770	6260641	Short Shrub (SS3)	
24-Jun-10	9:22	6	2	100	SF6-3	425596	6260781	Short Shrub (SS3)	
24-Jun-10	9:40	6	2	100	SF6-4	425722	6260936	Short Shrub (SS3)	

Appendix 7.4-2. Upland Breeding Bird VRPC Survey Details, June 2010

Date	Time	Temp. (˚)	Wind (1-5)	Cloud Cover (%)	VRPC Station	Easting	Northing	Habitat Type (Forest Interior)	Notes
24-Jun-10	9:58	6	2	100	SF6-5	425828	6260800	Short Shrub (SS3)	
25-Jun-10	6:59	8	2	90	SF7-1	456141	6264934	Herb/Grass (SS2)	50% wet meadow/ 50% conifer forest
25-Jun-10	7:13	8	2	90	SF7-2	456164	6264726	Coniferous Forest	
25-Jun-10	7:25	8	2	90	SF7-3	456135	6264523	Coniferous Forest	
25-Jan-10	7:46	8	2	90	SF7-4	456243	6264269	Coniferous Forest	
25-Jun-10	8:07	8	2	90	SF7-5	456368	6264049	Coniferous Forest	
25-Jun-10	9:06	7	2	90	SF8-1	457274	6263654	Coniferous Forest	
25-Jun-10	9:32	7	1	90	SF8-2	457444	6263413	Herb/Grass (SS2)	
25-Jun-10	9:47	7	1	90	SF8-3	457638	6263355	Herb/Grass (SS2)	1-2m tall willow
25-Jun-10	9:59	7	1	90	SF8-4	457748	6263216	Herb/Grass (SS2)	
25-Jun-10	10:07	7	1	90	SF8-5	457939	6263175	Herb/Grass (SS2)	1-2m tall willow
26-Jun-10	4:35	50	1	45	SF9-1	452045	6258976	Herb/Grass (SS2)	willow mixed in
26-Jun-10	4:54	5	1	45	SF9-2	451916	6259137	Coniferous Forest	willow mixed in
26-Jun-10	5:07	5	1	45	SF9-3	451797	6259298	Coniferous Forest	tree range up to 40cm dbh open canopy
26-Jun-10	5:33	5	1	50	SF9-4	451691	6259474	Coniferous Forest	
26-Jun-10	5:57	5	1	50	SF9-5	451638	6259730	Wetland	lake surrounded by coniferous forest
26-Jun-10	6:45	8	1	90	SF10-1	452392	6257499	Coniferous Forest	large tree, open canopy
26-Jun-10	7:06	8	1	90	SF10-2	452484	6257603	Coniferous Forest	very lush herb layer
26-Jun-10	7:20	8	1	90	SF10-3	452416	6257823	Coniferous Forest	willow mixed in
26-Jun-10	7:39	8	1	90	SF10-4	452430	6257963	Coniferous Forest	dense shrub layer
26-Jun-10	7:58	9	1	80	SF10-5	452290	6258055	Coniferous Forest	
26-Jun-10	8:40	9	1	80	SF11-1	453000	6262629	Wetland	fen surrounded by willow strips
26-Jun-10	8:53	9	1	80	SF11-2	452819	6262769	Wetland	fen with shrubby parts
26-Jun-10	9:03	9	1	80	SF11-3	452663	6262911	Wetland	fen
26-Jun-10	9:20	9	1	80	SF11-4	452483	6263090	Wetland	fen with riparian cottonwood, alder, willow
26-Jun-10	9:30	9	1	80	SF11-5	452271	6263303	Short Shrub (SS3)	willow shrub next to a fen

Appendix 7.4-3
Upland Breeding Birds Observed during VRPC Surveys, June 2010

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Appendix 7.4-3. Upland Breeding Bird Species Observed during VRPC Surveys, June 2010

Date	VRPC Station	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding Behaviour	Bird Notes
22-Jun-10	SF1-1	Swainson's Thrush	*Catharus ustulatus*	3	3	1	0		
22-Jun-10	SF1-1	Yellow Warbler	*Dendroica petechia*	2	1	0	0		
22-Jun-10	SF1-1	American Robin	*Turdus migratorius*	1	0	0	0		
22-Jun-10	SF1-1	Wilson's Warbler	*Wilsonia pusilla*	1	1	0	0		
22-Jun-10	SF1-1	Yellow-rumped Warbler	*Dendroica coronata*	0	2	0	0		
22-Jun-20	SF1-2	Swainson's Thrush	*Catharus ustulatus*	3	1	0	0		
22-Jun-20	SF1-2	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
22-Jun-20	SF1-2	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
22-Jun-20	SF1-2	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
22-Jun-20	SF1-2	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
22-Jun-10	SF1-1	Alder Flycatcher	*Empidonax alnorum*	1	0	0	0		
22-Jun-10	SF1-3	Swainson's Thrush	*Catharus ustulatus*	2	1	0	0		
22-Jun-10	SF1-3	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
22-Jun-10	SF1-3	Yellow Warbler	*Dendroica petechia*	2	0	0	0		
22-Jun-10	SF1-3	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
22-Jun-10	SF1-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
22-Jun-10	SF1-4	Swainson's Thrush	*Catharus ustulatus*	2	1	0	0		
22-Jun-10	SF1-4	Wilson's Warbler	*Wilsonia pusilla*	1	1	0	0		
22-Jun-10	SF1-4	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
22-Jun-10	SF1-4	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
22-Jun-10	SF1-5	Dark-eyed Junco	*Junco hyemalis*	1	1	0	0		
22-Jun-10	SF1-5	Swainson's Thrush	*Catharus ustulatus*	1	2	1	0		
22-Jun-10	SF1-5	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
22-Jun-10	SF1-5	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
22-Jun-10	SF2-1	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
22-Jun-10	SF2-1	Wilson's Warbler	*Wilsonia pusilla*	0	2	1	0		
22-Jun-10	SF2-1	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
22-Jun-10	SF2-2	Hammond's Flycatcher	*Empidonax hammondii*	1	0	0	0		
22-Jun-10	SF2-2	Ruby-crowned Kinglet	*Regulus calendula*	1	1	0	0		
22-Jun-10	SF2-2	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
22-Jun-10	SF2-2	Varied Thrush	*Ixoreus naevius*	0	1	0	0		

Appendix 7.4-3. Upland Breeding Bird Species Observed during VRPC Surveys, June 2010

Date	VRPC Station	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding Behaviour	Bird Notes
22-Jun-10	SF2-2	Red Crossbill	*Loxia curvirostra*	0	0	0	2		
22-Jun-10	SF2-2	Mountain Chickadee	*Poecile gambeli*	1	0	0	0		
22-Jun-10	SF2-3	Varied Thrush	*Ixoreus naevius*	1	2	0	0		
22-Jun-10	SF2-3	Red Crossbill	*Loxia curvirostra*	0	0	0	2		
22-Jun-10	SF2-3	Red-breasted Nuthatch	*Sitta canadensis*	0	1	0	0		
22-Jun-10	SF2-3	Swainson's Thrush	*Catharus ustulatus*	2	1	1	0		
22-Jun-10	SF2-3	Hermit Thrush	*Catharus guttatus*	1	0	0	0		
22-Jun-10	SF2-3	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
22-Jun-10	SF2-3	Black-capped Chickadee	*Poecile atricapillus*	2	0	0	0		
22-Jun-10	SF2-3	Ruby-crowned Kinglet	*Regulus calendula*	1	0	0	0		
22-Jun-10	SF2-4	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
22-Jun-10	SF2-4	Red-breasted Nuthatch	*Sitta canadensis*	0	1	0	0		
22-Jun-10	SF2-4	Varied Thrush	*Ixoreus naevius*	1	1	1	0		
22-Jun-10	SF2-4	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
22-Jun-10	SF2-4	Red Crossbill	*Loxia curvirostra*	0	0	0	6		
22-Jun-10	SF2-5	Swainson's Thrush	*Catharus ustulatus*	2	0	1	0		
22-Jun-10	SF2-5	Black-backed Woodpecker	*Picoides arcticus*	0	1	0	0		
22-Jun-10	SF2-5	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
22-Jun-10	SF2-5	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
22-Jun-10	SF2-5	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
22-Jun-10	SF2-5	Black Swift	*Cypseloides niger*	0	0	0	1		
22-Jun-10	SF3-1	Dark-eyed Junco	*Junco hyemalis*	3	0	0	0		
22-Jun-10	SF3-1	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
22-Jun-10	SF3-1	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
22-Jun-10	SF3-1	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
22-Jun-10	SF3-1	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
22-Jun-10	SF3-1	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
22-Jun-10	SF3-2	Dark-eyed Junco	*Junco hyemalis*	3	1	0	0		
22-Jun-10	SF3-2	Yellow-rumped Warbler	*Dendroica coronata*	3	0	0	0		
22-Jun-10	SF3-2	Swainson's Thrush	*Catharus ustulatus*	2	0	0	0		
22-Jun-10	SF3-2	Varied Thrush	*Ixoreus naevius*	0	1	0	0		

Appendix 7.4-3. Upland Breeding Bird Species Observed during VRPC Surveys, June 2010

Date	VRPC Station	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding Behaviour	Bird Notes
22-Jun-10	SF3-2	Red Crossbill	*Loxia curvirostra*	0	0	0	8		
22-Jun-10	SF3-2	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
22-Jun-10	SF3-3	Varied Thrush	*Ixoreus naevius*	1	0	1	0		
22-Jun-10	SF3-3	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
22-Jun-10	SF3-3	Red Crossbill	*Loxia curvirostra*	0	0	0	8		
22-Jun-10	SF3-3	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
22-Jun-10	SF3-3	Yellow Warbler	*Dendroica petechia*	0	0	1	0		
22-Jan-10	SF3-4	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
22-Jan-10	SF3-4	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
22-Jan-10	SF3-4	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
22-Jan-10	SF3-4	Dark-eyed Junco	*Junco hyemalis*	2	0	0	0		
22-Jan-10	SF3-4	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
22-Jun-10	SF3-5	Black Swift	*Cypseloides niger*	0	0	0	2		
22-Jun-10	SF3-5	Swainson's Thrush	*Catharus ustulatus*	0	2	0	0		
22-Jun-10	SF3-5	Dark-eyed Junco	*Junco hyemalis*	1	1	0	0		
22-Jun-10	SF3-5	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
22-Jun-10	SF3-5	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
24-Jun-10	SF4-1	Warbling Vireo	*Vireo gilvus*	0	0	1	0		
24-Jun-10	SF4-1	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
24-Jun-10	SF4-1	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
24-Jun-10	SF4-2	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
24-Jun-10	SF4-2	Swainson's Thrush	*Catharus ustulatus*	2	2	0	0		
24-Jun-10	SF4-2	Varied Thrush	*Ixoreus naevius*	1	1	0	0		
24-Jun-10	SF4-2	American Robin	*Turdus migratorius*	0	1	0	0		
24-Jun-10	SF4-2	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
24-Jun-10	SF4-3	Wilson's Warbler	*Wilsonia pusilla*	0	0	1	0		
24-Jun-10	SF4-3	Swainson's Thrush	*Catharus ustulatus*	1	2	1	0		
24-Jun-10	SF4-3	Dark-eyed Junco	*Junco hyemalis*	2	0	0	0		
24-Jun-10	SF4-3	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
24-Jun-10	SF4-5	Wilson's Warbler	*Wilsonia pusilla*	2	0	0	0		
24-Jun-10	SF4-5	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		

Appendix 7.4-3. Upland Breeding Bird Species Observed during VRPC Surveys, June 2010

Date	VRPC Station	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding Behaviour	Bird Notes
24-Jun-10	SF4-5	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
24-Jun-10	SF4-5	Pine Siskin	*Carduelis pinus*	0	0	0	6		
24-Jun-10	SF4-5	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
24-Jun-10	SF4-5	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
24-Jun-10	SF5-1	Swainson's Thrush	*Catharus ustulatus*	2	1	0	0		
24-Jun-10	SF5-1	Chipping Sparrow	*Spizella passerina*	1	0	0	0		
24-Jun-10	SF5-1	Hammond's Flycatcher	*Empidonax hammondii*	0	1	0	0		
24-Jun-10	SF5-1	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
24-Jun-10	SF5-1	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
24-Jun-10	SF5-2	Pine Siskin	*Carduelis pinus*	2	0	0	0		
24-Jun-10	SF5-2	Varied Thrush	*Ixoreus naevius*	1	1	0	2		
24-Jun-10	SF5-2	Swainson's Thrush	*Catharus ustulatus*	1	2	0	1		
24-Jun-10	SF5-2	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
24-Jun-10	SF5-2	Chipping Sparrow	*Spizella passerina*	1	1	0	0		
24-Jun-10	SF5-2	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
24-Jun-10	SF5-2	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
24-Jun-10	SF5-3	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
24-Jun-10	SF5-3	Chipping Sparrow	*Spizella passerina*	1	1	0	0		
24-Jun-10	SF5-3	Yellow-rumped Warbler	*Dendroica coronata*	3	2	0	0		
24-Jun-10	SF5-3	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
24-Jun-10	SF5-3	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
24-Jun-10	SF5-3	American Robin	*Turdus migratorius*	1	0	0	0		
24-Jun-10	SF5-4	Hammond's Flycatcher	*Empidonax hammondii*	1	0	0	0		
24-Jun-10	SF5-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
24-Jun-10	SF5-4	Wilson's Warbler	*Wilsonia pusilla*	0	2	0	0		
24-Jun-10	SF5-4	Pine Siskin	*Carduelis pinus*	1	0	0	0		
24-Jun-10	SF5-4	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
24-Jun-10	SF5-5	Yellow-rumped Warbler	*Dendroica coronata*	0	2	0	0		
24-Jun-10	SF5-5	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
24-Jun-10	SF5-5	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
24-Jun-10	SF5-5	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		

Appendix 7.4-3. Upland Breeding Bird Species Observed during VRPC Surveys, June 2010

Date	VRPC Station	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding Behaviour	Bird Notes
24-Jun-10	SF6-1	Say's Phoebe	*Sayornis saya*	0	2	0	0		
24-Jun-10	SF6-1	unkown ptarmigan		0	0	2	0		
24-Jun-10	SF6-1	American Pipit	*Anthus rubescens*	1	0	0	0		
24-Jun-10	SF6-1	Barn Swallow	*Hirundo rustica*	0	2	0	0		
24-Jun-10	SF6-3	Golden-crowned Sparrow	*Zonotrichia atricapilla*	1	0	0	0		
24-Jun-10	SF6-3	American Pipit	*Anthus rubescens*	1	0	0	0		
24-Jun-10	SF6-5	American Pipit	*Anthus rubescens*	2	0	0	0		
24-Jun-10	SF6-5	unkown ptarmigan		0	1	0	0		
25-Jun-10	SF7-1	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
25-Jun-10	SF7-1	Ruby-crowned Kinglet	*Regulus calendula*	2	1	1	0		
25-Jun-10	SF7-1	Gray Jay	*Perisoreus canadensis*	0	1	0	0		
25-Jun-10	SF7-1	Gray-cheeked Thrush	*Catharus minimus*	1	0	0	0		
25-Jun-10	SF7-2	Ruby-crowned Kinglet	*Regulus calendula*	1	1	0	0		
25-Jun-10	SF7-2	Gray-cheeked Thrush	*Catharus minimus*	1	1	0	0		
25-Jun-10	SF7-2	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
25-Jun-10	SF7-2	American Robin	*Turdus migratorius*	1	0	0	0		
25-Jun-10	SF7-2	Golden-crowned Kinglet	*Regulus satrapa*	0	1	0	0		
25-Jun-10	SF7-2	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
25-Jun-10	SF7-2	Gray Jay	*Perisoreus canadensis*	0	0	1	0		
25-Jun-10	SF7-2	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
25-Jun-10	SF7-3	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
25-Jun-10	SF7-3	Ruby-crowned Kinglet	*Regulus calendula*	1	1	0	0		
25-Jun-10	SF7-3	Varied Thrush	*Ixoreus naevius*	0	1	1	0		
25-Jun-10	SF7-3	Gray-cheeked Thrush	*Catharus minimus*	1	1	0	0		
25-Jun-10	SF7-3	Golden-crowned Kinglet	*Regulus satrapa*	0	1	0	0		
25-Jun-10	SF7-3	Pine Siskin	*Carduelis pinus*	1	0	0	0		
25-Jan-10	SF7-4	Varied Thrush	*Ixoreus naevius*	1	0	1	0		
25-Jan-10	SF7-4	Pine Siskin	*Carduelis pinus*	0	0	0	2		
25-Jan-10	SF7-4	Golden-crowned Kinglet	*Regulus satrapa*	1	1	0	0		
25-Jan-10	SF7-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
25-Jan-10	SF7-4	Brown Creeper	*Certhia americana*	2	0	0	0		

Appendix 7.4-3. Upland Breeding Bird Species Observed during VRPC Surveys, June 2010

Date	VRPC Station	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding Behaviour	Bird Notes
25-Jun-10	SF7-5	Ruby-crowned Kinglet	*Regulus calendula*	1	1	0	0		
25-Jun-10	SF7-5	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
25-Jun-10	SF7-5	Winter Wren	*Troglodytes troglodytes*	1	1	0	0		
25-Jun-10	SF7-5	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
25-Jun-10	SF7-5	Pine Siskin	*Carduelis pinus*	1	0	0	0		
25-Jun-10	SF8-1	Pine Siskin	*Carduelis pinus*	1	0	0	0		
25-Jun-10	SF8-1	Varied Thrush	*Ixoreus naevius*	0	1	1	0		
24-Jun-10	SF4-4	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
24-Jun-10	SF4-4	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
24-Jun-10	SF4-4	American Dipper	*Cinclus mexicanus*	0	1	0	0		
24-Jun-10	SF4-4	Varied Thrush	*Ixoreus naevius*	0	0	2	0		
24-Jun-10	SF4-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
25-Jun-10	SF7-1	Gray-cheeked Thrush	*Catharus minimus*	0	1	0	0		
25-Jun-10	SF8-1	Townsend's Warbler	*Dendroica townsendi*	1	0	0	0		
25-Jun-10	SF8-1	Varied Thrush	*Ixoreus naevius*	1	0	0	0		
25-Jun-10	SF8-1	Pine Siskin	*Carduelis pinus*	0	0	0	1		
25-Jun-10	SF8-2	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
25-Jun-10	SF8-2	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
25-Jun-10	SF8-2	Ruby-crowned Kinglet	*Regulus calendula*	1	0	0	0		
25-Jun-10	SF8-2	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
25-Jun-10	SF8-3	Ruby-crowned Kinglet	*Regulus calendula*	0	2	0	0		
25-Jun-10	SF8-3	Varied Thrush	*Ixoreus naevius*	0	2	0	0		
25-Jun-10	SF8-3	Swainson's Thrush	*Catharus ustulatus*	0	1	1	0		
25-Jun-10	SF8-3	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
25-Jun-10	SF8-3	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
25-Jun-10	SF8-3	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
25-Jun-10	SF8-3	Red-breasted Nuthatch	*Sitta canadensis*	0	0	1	0		
25-Jun-10	SF8-3	American Dipper	*Cinclus mexicanus*	0	0	0	1		
25-Jun-10	SF8-4	Varied Thrush	*Ixoreus naevius*	1	0	1	0		
25-Jun-10	SF8-4	Ruby-crowned Kinglet	*Regulus calendula*	0	2	1	0		
25-Jun-10	SF8-4	Wilson's Warbler	*Wilsonia pusilla*	1	1	0	0		

Appendix 7.4-3. Upland Breeding Bird Species Observed during VRPC Surveys, June 2010

Date	VRPC Station	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding Behaviour	Bird Notes
25-Jun-10	SF8-4	Yellow Warbler	*Dendroica petechia*	2	0	0	0		
25-Jun-10	SF8-5	American Robin	*Turdus migratorius*	0	1	0	0		
25-Jun-10	SF8-5	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
25-Jun-10	SF8-5	Wilson's Warbler	*Wilsonia pusilla*	2	0	0	0		
25-Jun-10	SF8-5	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
25-Jun-10	SF8-5	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
25-Jun-10	SF8-5	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	1		
25-Jun-10	SF8-5	Red-breasted Nuthatch	*Sitta canadensis*	0	0	0	1		
25-Jun-10	SF8-5	Savannah Sparrow	*Passerculus sandwichensis*	1	0	0	0		
26-Jun-10	SF9-1	Swainson's Thrush	*Catharus ustulatus*	2	2	2	0		
26-Jun-10	SF9-1	Wilson's Warbler	*Wilsonia pusilla*	1	1	0	0		
26-Jun-10	SF9-1	Varied Thrush	*Ixoreus naevius*	1	1	0	0		
26-Jun-10	SF9-1	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
26-Jun-10	SF9-1	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
26-Jun-10	SF9-1	Gray Jay	*Perisoreus canadensis*	0	1	0	0		
26-Jun-10	SF9-1	Northern Flicker	*Colaptes auratus*	1	0	0	0		
26-Jun-10	SF9-1	Ruby-crowned Kinglet	*Regulus calendula*	1	0	0	0		
26-Jun-10	SF9-2	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
26-Jun-10	SF9-2	Swainson's Thrush	*Catharus ustulatus*	1	1	1	0		
26-Jun-10	SF9-2	Townsend's Warbler	*Dendroica townsendi*	1	1	0	0		
26-Jun-10	SF9-2	Chipping Sparrow	*Spizella passerina*	1	0	0	0		
26-Jun-10	SF9-2	Blackpoll Warbler	*Dendroica striata*	1	0	0	0		
26-Jun-10	SF9-2	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
26-Jun-10	SF9-2	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
26-Jun-10	SF9-3	Red-breasted Nuthatch	*Sitta canadensis*	1	1	0	0		
26-Jun-10	SF9-3	Townsend's Warbler	*Dendroica townsendi*	1	0	0	0		
26-Jun-10	SF9-3	Ruby-crowned Kinglet	*Regulus calendula*	0	1	1	0		
26-Jun-10	SF9-3	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
26-Jun-10	SF9-3	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
26-Jun-10	SF9-3	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
26-Jun-10	SF9-3	Pine Siskin	*Carduelis pinus*	0	0	0	4		

Appendix 7.4-3. Upland Breeding Bird Species Observed during VRPC Surveys, June 2010

Date	VRPC Station	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding Behaviour	Bird Notes
26-Jun-10	SF9-4	Ruby-crowned Kinglet	*Regulus calendula*	1	1	0	0		
26-Jun-10	SF9-4	Hermit Thrush	*Catharus guttatus*	1	1	0	0		
26-Jun-10	SF9-4	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
26-Jun-10	SF9-4	Northern Waterthrush	*Seiurus noveboracensis*	1	0	0	0		
26-Jun-10	SF9-4	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
26-Jun-10	SF9-4	Blackpoll Warbler	*Dendroica striata*	1	0	0	0		
26-Jun-10	SF9-5	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
26-Jun-10	SF9-5	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
26-Jun-10	SF9-5	Blackpoll Warbler	*Dendroica striata*	1	0	0	0		
26-Jun-10	SF9-5	Hammond's Flycatcher	*Empidonax hammondii*	1	0	0	0		
26-Jun-10	SF9-5	Varied Thrush	*Ixoreus naevius*	0	1	1	0		
26-Jun-10	SF9-5	Red-breasted Nuthatch	*Sitta canadensis*	1	0	0	0		
26-Jun-10	SF9-5	Townsend's Warbler	*Dendroica townsendi*	1	0	0	0		
26-Jun-10	SF10-1	Red-breasted Nuthatch	*Sitta canadensis*	0	1	0	0		
26-Jun-10	SF10-1	Hermit Thrush	*Catharus guttatus*	1	0	0	0		
26-Jun-10	SF10-1	Blackpoll Warbler	*Dendroica striata*	1	0	0	0		
26-Jun-10	SF10-1	Pine Siskin	*Carduelis pinus*	2	1	0	0		
26-Jun-10	SF10-1	Varied Thrush	*Ixoreus naevius*	1	0	0	0		
26-Jun-10	SF10-2	Northern Waterthrush	*Seiurus noveboracensis*	1	0	0	0		
26-Jun-10	SF10-2	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
26-Jun-10	SF10-2	Pine Siskin	*Carduelis pinus*	1	0	0	0		
26-Jun-10	SF10-2	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
26-Jun-10	SF10-3	Red-breasted Nuthatch	*Sitta canadensis*	2	0	0	0		
26-Jun-10	SF10-3	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
26-Jun-10	SF10-3	Townsend's Warbler	*Dendroica townsendi*	2	0	0	0		
26-Jun-10	SF10-3	Pine Siskin	*Carduelis pinus*	1	0	0	0		
26-Jun-10	SF10-3	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
26-Jun-10	SF10-4	Townsend's Warbler	*Dendroica townsendi*	1	0	0	0		
26-Jun-10	SF10-4	Swainson's Thrush	*Catharus ustulatus*	0	2	0	0		
26-Jun-10	SF10-4	Northern Waterthrush	*Seiurus noveboracensis*	0	1	0	0		
26-Jun-10	SF10-4	Northern Waterthrush	*Seiurus noveboracensis*	1	0	0	0		

Appendix 7.4-3. Upland Breeding Bird Species Observed during VRPC Surveys, June 2010

Date	VRPC Station	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding Behaviour	Bird Notes
26-Jun-10	SF10-4	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
26-Jun-10	SF10-5	Pine Siskin	*Carduelis pinus*	2	0	0	0		
26-Jun-10	SF10-5	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
26-Jun-10	SF10-5	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
26-Jun-10	SF10-5	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
26-Jun-10	SF10-5	Townsend's Warbler	*Dendroica townsendi*	1	0	0	0		
26-Jun-10	SF11-1	Savannah Sparrow	*Passerculus sandwichensis*	2	0	0	0		
26-Jun-10	SF11-1	Swainson's Thrush	*Catharus ustulatus*	0	2	0	0		
26-Jun-10	SF11-1	Townsend's Warbler	*Dendroica townsendi*	0	1	0	0		
26-Jun-10	SF11-1	Dark-eyed Junco	*Junco hyemalis*	2	1	0	0		
26-Jun-10	SF11-2	Savannah Sparrow	*Passerculus sandwichensis*	3	0	0	2		
26-Jun-10	SF11-2	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
26-Jun-10	SF11-2	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
26-Jun-10	SF11-2	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
26-Jun-10	SF11-2	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
26-Jun-10	SF11-2	Song Sparrow	*Melospiza melodia*	0	1	0	0		
26-Jun-10	SF11-3	Savannah Sparrow	*Passerculus sandwichensis*	2	1	0	1		
26-Jun-10	SF11-3	Alder Flycatcher	*Empidonax alnorum*	0	0	1	0		
26-Jun-10	SF11-3	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
26-Jun-10	SF11-3	Veery	*Catharus fuscescens*	0	1	0	0		
26-Jun-10	SF11-4	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
26-Jun-10	SF11-4	Savannah Sparrow	*Passerculus sandwichensis*	1	0	0	0		
26-Jun-10	SF11-4	Alder Flycatcher	*Empidonax alnorum*	1	0	0	0		
26-Jun-10	SF11-4	Savannah Sparrow	*Passerculus sandwichensis*	0	1	0	1		
26-Jun-10	SF11-5	Savannah Sparrow	*Passerculus sandwichensis*	2	1	0	0		
26-Jun-10	SF11-5	Yellow Warbler	*Dendroica petechia*	1	1	0	0		
26-Jun-10	SF11-5	Veery	*Catharus fuscescens*	1	0	0	0		

Appendix 7.4-4

Incidental Observations of Upland Breeding Bird and Wetland Bird Species, 2010

Engineers and Scientists

Appendix 7.4-4. Incidental Observations of Upland Breeding Bird and Wetland Bird Species, 2010

Date	Easting	Northing	Common Name	Scientific Name	Group	No. Observed	Comment(s)
22-Jun-10	453901	6252999	Arctic tern	*Sterna paradisaea*	Gull/tern	1	BR-2
22-Jun-10	452065	6251345	Dark-eyed junco	*Junco hyemalis*	Passerine	0	nest observed; between points one and two along Transect SF2
22-Jun-10	452065	6251345	Red-breasted sapsucker	*Sphyrapicus ruber*	Woodpecker	1	drumming
22-Jun-10	452065	6251345	Northern flicker	*Colaptes auratus*	Woodpecker	1	drumming
22-Jun-10	458858	6265141	Unknown ptarmigan	*Lagopus spp.*	Gamebird	1	
22-Jun-10	447492	6250296	Varied thrush	*Ixoreus naevius*	Passerine	2	
22-Jun-10	447492	6250296	Dark-eyed junco	*Junco hyemalis*	Passerine	1	
22-Jun-10	458858	6265141	Barn swallow	*Hirundo rustica*	Passerine	2	searching for nest spot at camp
23-Jun-10	458858	6265141	Snow bunting	*Plectrophenax nivalis*	Passerine	2	
23-Jun-10	458858	6265141	Gray-crowned rosy finch	*Leucosticte tephrocotis*	Passerine	2	
23-Jun-10	458858	6265141	Semipalmated plover	*Charadrius semipalmatus*	Shorebird	2	
23-Jun-10	458858	6265141	American pipit	*Anthus rubescens*	Passerine	2	
23-Jun-10	427100	6258595	Gray-crowned rosy finch	*Leucosticte tephrocotis*	Passerine	2	
23-Jun-10	427100	6258595	Semipalmated plover	*Charadrius semipalmatus*	Shorebird	2	
23-Jun-10	427007	6258395	Common raven	*Corvus corax*	Passerine	1	
23-Jun-10	427007	6258395	American pipit	*Anthus rubescens*	Passerine	2	
24-Jun-10	458858	6265141	Unknown ptarmigan	*Lagopus spp.*	Gamebird	3	
24-Jun-10	442219	6250487	Black Swift	*Cypseloides niger*	Other	2	
24-Jun-10	425926	6260498	Barn swallow	*Hirundo rustica*	Passerine	1	female on nest
24-Jun-10	425979	6260581	Say's pheobe	*Sayornis saya*	Passerine	1	flushed female off nest with 6 eggs
24-Jun-10	450201	6259589	Golden-crowned sparrow	*Zonotrichia atricapilla*	Passerine	3	
24-Jun-10	450201	6259589	Chipping sparrow	*Spizella passerina*	Passerine	2	
24-Jun-10	450201	6259589	Townsend's solitaire	*Myadestes townsendi*	Passerine	1	
24-Jun-10	450201	6259589	American robin	*Turdus migratorius*	Passerine	2	
24-Jun-10	450201	6259589	Ruby-crowned kinglet	*Regulus calendula*	Passerine	1	
24-Jun-10	450201	6259589	Varied thrush	*Ixoreus naevius*	Passerine	1	
24-Jun-10	450201	6259589	Brewer's sparrow	*Spizella breweri*	Passerine	3	
24-Jun-10	450201	6259589	Hermit thrush	*Catharus guttatus*	Passerine	1	
24-Jun-10	462209	6262223	Ruby-crowned kinglet	*Regulus calendula*	Passerine	1	
24-Jun-10	462209	6262223	Varied thrush	*Ixoreus naevius*	Passerine	2	
24-Jun-10	462209	6262223	Chipping sparrow	*Spizella passerina*	Passerine	2	
24-Jun-10	462209	6262223	Pine siskin	*Carduelis pinus*	Passerine	3	
25-Jun-10	457364	6263570	Solitary sandpiper	*Tringa solitaria*	Shorebird	1	
25-Jun-10	431716	6264106	American pipit	*Anthus rubescens*	Passerine	2	
26-Jun-10	451662	6259681	Dark-eyed junco	*Junco hyemalis*	Passerine	0	nest observed along lake shore, 4 eggs
26-Jun-10	451678	6259595	Solitary sandpiper	*Tringa solitaria*	Shorebird	0	nest observed, 4 eggs
26-Jun-10	451678	6259595	Bonoparte's gull	*Chroicocephalus philadelphia*	Gull/tern	2	
26-Jun-10	452515	6263048	Solitary sandpiper	*Tringa solitaria*	Shorebird	0	nest observed, 4 eggs

Appendix 7.4-5

Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

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Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	RCKI	≥100	S	-	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	RCKI	75 - 100	S	-	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	VATH	≥100	S	-	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	VATH	25 - 50	S	-	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	VATH	75 - 100	S	-	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	WIWA	50 - 75	S	-	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	WIWA	75 - 100	S	-	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	PAWR	25 - 50	S	-	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	-	-	-	CBCH	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	-	-	-	PAWR	-	
7-Jun-12	L14-01	473340	6258980	5:59	1	2	4	1	Non-Roadside	-	-	-	VATH	PISI	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	PISI	50 - 75	S	-	-	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	RCKI	50 - 75	S	-	-	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	RCKI	75 - 100	S	-	-	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	TOWA	50 - 75	S	-	-	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	VATH	50 - 75	V	-	-	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	VATH	75 - 100	S	-	-	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	WIWA	50 - 75	S	-	-	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	-	-	-	VATH	PISI	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	VATH	75 - 100	-	-	-	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	-	-	-	WIWA	-	
7-Jun-12	L14 -02	473149	6259033	6:15	0	2	4	1	Non-Roadside	-	-	-	VATH	-	
7-Jun-12	L14-03	472952	6258988	6:35	2	2	3	1	Non-Roadside	PISI	75 - 100	S	-	-	
7-Jun-12	L14-03	472952	6258988	6:35	2	2	3	1	Non-Roadside	RCKI	75 - 100	S	-	-	
7-Jun-12	L14-03	472952	6258988	6:35	2	2	3	1	Non-Roadside	RCKI	75 -100	S	-	-	
7-Jun-12	L14-03	472952	6258988	6:35	2	2	3	1	Non-Roadside	VATH	≥100	S	-	-	
7-Jun-12	L14-03	472952	6258988	6:35	2	2	3	1	Non-Roadside	WIWA	25 - 50	S	-	-	
7-Jun-12	L14-03	472952	6258988	6:35	2	2	3	1	Non-Roadside	-	-	-	PAWR	-	
7-Jun-12	L14-04	472750	6258946	6:54	0	2	4	1	Non-Roadside	HETH	50 - 75	S	-	-	
7-Jun-12	L14-04	472750	6258946	6:54	0	2	4	1	Non-Roadside	PAWR	50 - 75	S	-	-	
7-Jun-12	L14-04	472750	6258946	6:54	0	2	4	1	Non-Roadside	RCKI	75 - 100	S	-	-	
7-Jun-12	L14-04	472750	6258946	6:54	0	2	4	1	Non-Roadside	TOWA	25 - 50	S	-	-	
7-Jun-12	L14-04	472750	6258946	6:54	0	2	4	1	Non-Roadside	TOWA	75 - 100	S	-	-	
7-Jun-12	L14-04	472750	6258946	6:54	0	2	4	1	Non-Roadside	VATH	75 - 100	S	-	-	
7-Jun-12	L14-05	472551	6258931	7:11	0	2	4	1	Non-Roadside	HETH	25 - 50	C	-	-	
7-Jun-12	L14-05	472551	6258931	7:11	0	2	4	1	Non-Roadside	PAWR	50 - 75	S	-	-	
7-Jun-12	L14-05	472551	6258931	7:11	0	2	4	1	Non-Roadside	TOWA	50 - 75	S	-	-	
7-Jun-12	L14-05	472551	6258931	7:11	0	2	4	1	Non-Roadside	TOWA	75 - 100	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
7-Jun-12	L14-05	472551	6258931	7:11	0	2	4	1	Non-Roadside	VATH	25 - 50	S	-	-	
7-Jun-12	L14-05	472551	6258931	7:11	0	2	4	1	Non-Roadside	VATH	75 - 100	S	-	-	
7-Jun-12	L14-05	472551	6258931	7:11	0	2	4	1	Non-Roadside	WIWA	50 - 75	S	-	-	
7-Jun-12	L14-05	472551	6258931	7:11	0	2	4	1	Non-Roadside	-	-	-	-	PISI	
7-Jun-12	L14-05	472551	6258931	7:11	0	2	4	1	Non-Roadside	-	-	-	-	PISI	
7-Jun-12	L10-01	462376	6263935	8:52	0	4	4	2	Non-Roadside	-	-	-	-	-	
7-Jun-12	L10-02	462199	6264036	9:08	0	4	4	1	Non-Roadside	PAWR	≥100	S	-	-	
7-Jun-12	L10-02	462199	6264036	9:08	0	4	4	1	Non-Roadside	RCKI	≥100	S	-	-	
7-Jun-12	L10-02	462199	6264036	9:08	0	4	4	1	Non-Roadside	-	-	-	DEJU	-	
7-Jun-12	L10-03	462025	6264138	9:25	0	4	4	0	Non-Roadside	BCCH	50 - 75	C	-	-	
7-Jun-12	L10-03	462025	6264138	9:25	0	4	4	0	Non-Roadside	TOWA	75 - 100	S	-	-	
7-Jun-12	L10-03	462025	6264138	9:25	0	4	4	0	Non-Roadside	-	-	-	HETH	-	
7-Jun-12	L10-03	462025	6264138	9:25	0	4	4	0	Non-Roadside	-	-	-	PISI	-	
8-Jun-12	L121-01	459551	6263022	4:47	0	3	1	1	Non-Roadside	BCCH	50 - 75	S	-	-	
8-Jun-12	L121-01	459551	6263022	4:47	0	3	1	1	Non-Roadside	FOSP	50 - 75	S	-	-	
8-Jun-12	L121-01	459551	6263022	4:47	0	3	1	1	Non-Roadside	RCKI	25 - 50	S	-	-	
8-Jun-12	L121-01	459551	6263022	4:47	0	3	1	1	Non-Roadside	RCKI	50 - 75	S	-	-	
8-Jun-12	L121-01	459551	6263022	4:47	0	3	1	1	Non-Roadside	YRWA	25 - 50	S	-	-	
8-Jun-12	L121-01	459551	6263022	4:47	0	3	1	1	Non-Roadside	YRWA	50 - 75	S	-	-	
8-Jun-12	L121-01	459551	6263022	4:47	0	2	1	1	Non-Roadside	-	-	-	PISI	-	
8-Jun-12	L121-01	459551	6263022	4:47	0	2	1	1	Non-Roadside	-	-	-	VATH	-	
8-Jun-12	L121-02	459355	6263038	5:12	0	2	2	0	Non-Roadside	BCCH	0 - 25	S	-	-	
8-Jun-12	L121-02	459355	6263038	5:12	0	2	1.5	0	Non-Roadside	RBNU	50 - 75	S	-	-	
8-Jun-12	L121-02	459355	6263038	5:12	0	2	1.5	0	Non-Roadside	RCKI	25 - 50	S	-	-	
8-Jun-12	L121-02	459355	6263038	5:12	0	2	1.5	0	Non-Roadside	TOWA	25 - 50	S	-	-	
8-Jun-12	L121-02	459355	6263038	5:12	0	2	1.5	0	Non-Roadside	VATH	75 - 100	S	-	-	
8-Jun-12	L121-02	459355	6263038	5:12	0	2	2	0	Non-Roadside	-	-	-	PISI	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	AMCR	≥100	C	-	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	AMRO	50 - 75	S	-	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	DEJU	25 - 50	S	-	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	MACW	50 - 75	S	-	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	PAWR	50 - 75	S	-	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	SWTH	50 - 75	S	-	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	WWPE	50 - 75	S	-	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	YEWA	25 - 50	S	-	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	YEWA	50 - 75	S	-	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	-	-	-	CAGO	-	
8-Jun-12	L3-02	451605	6263724	5:18	0	0	3	1	Non-Roadside	-	-	-	HETH	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	ATTW	25 - 50	D	-	-	
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	BCCH	25 - 50	S	-	-	
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	BRCR	25 - 50	C	-	-	
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	FOSP	50 - 75	S	-	-	
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	RCKI	25 - 50	S	-	-	
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	RCKI	50 - 75	S	-	-	
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	TOWA	0 - 25	S	-	-	
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	TOWA	25 - 50	S	-	-	
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	VATH	25 - 50	S	-	-	
8-Jun-12	L121-03	459158	6263031	5:27	0	2	2	0	Non-Roadside	-	-	-	-	PISI	
8-Jun-12	L121-04	458969	6263093	6:00	0	2	3	2	Non-Roadside	BCCH	25 - 50	S	-	-	
8-Jun-12	L121-04	458969	6263093	6:00	0	2	2.5	2	Non-Roadside	DEJU	0 - 25	V	-	-	
8-Jun-12	L121-04	458969	6263093	6:00	0	2	2.5	2	Non-Roadside	DEJU	0 - 25	V,P	-	-	
8-Jun-12	L121-04	458969	6263093	6:00	0	2	2.5	2	Non-Roadside	FOSP	0 - 25	S,V	-	-	
8-Jun-12	L121-04	458969	6263093	6:00	0	2	2.5	2	Non-Roadside	RBNU	50 - 75	S	-	-	
8-Jun-12	L121-04	458969	6263093	6:00	0	2	2.5	2	Non-Roadside	RCKI	25 - 50	S	-	-	
8-Jun-12	L121-04	458969	6263093	6:00	0	2	2.5	2	Non-Roadside	TOWA	25 - 50	S	-	-	
8-Jun-12	L121-04	458969	6263093	6:00	0	2	2.5	2	Non-Roadside	VATH	50 - 75	S	-	-	
8-Jun-12	L121-04	458969	6263093	6:00	0	2	3	2	Non-Roadside	-	-	-	ATTW	-	
8-Jun-12	L121-05	458803	6263203	6:21	0	1	3	0	Non-Roadside	ATTW	75 - 100	D	-	-	
8-Jun-12	L121-05	458803	6263203	6:21	0	1	3	0	Non-Roadside	BCCH	25 - 50	S	-	-	
8-Jun-12	L121-05	458803	6263203	6:21	0	1	3	0	Non-Roadside	DEJU	0 - 25	C,V,P	-	-	
8-Jun-12	L121-05	458803	6263203	6:21	0	1	3	0	Non-Roadside	FOSP	50 - 75	S	-	-	
8-Jun-12	L121-05	458803	6263203	6:21	0	1	3	0	Non-Roadside	TOWA	25 - 50	S	-	-	
8-Jun-12	L121-05	458803	6263203	6:21	0	1	3	0	Non-Roadside	VATH	75 - 100	S	-	-	
8-Jun-12	L121-05	458803	6263203	6:21	0	1	3	0	Non-Roadside	-	-	-	ATTW	-	
8-Jun-12	L121-05	458803	6263203	6:21	0	1	3	0	Non-Roadside	-	-	-	YRWA	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	BOGU	75 - 100	V,C	-	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	DEJU	25 - 50	S	-	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	GCKI	0 - 25	S	-	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	PISI	0 - 25	T	-	-	T=territorial
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	PISI	0 - 25	V	-	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	PISI	25 - 50	C	-	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	RBNU	25 - 50	S	-	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	SWTH	25 - 50	C	-	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	WIWA	0 - 25	S	-	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	YRWA	0 - 25	S	-	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	-	-	-	GRJA	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	-	-	-	PISI	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	-	-	-	WIWA	-	
8-Jun-12	L116-01	468442	6261182	7:04	0	1	3	1	Non-Roadside	-	-	-	YRWA	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	DEJU	0 - 25	C	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	GCKI	0 - 25	S	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	PISI	0 - 25	S	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	PISI	25 - 50	F	-	-	F=flock of 3 or more
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	PISI	25 - 50	(blank)	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	RCKI	0 - 25	S	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	RCKI	25 - 50	S	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	TOWA	0 - 25	S	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	TOWA	25 - 50	S	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	VATH	50 - 75	S	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	WIWA	25 - 50	S	-	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	-	-	-	RCKI	-	
8-Jun-12	L116-02	468374	6261365	7:24	0	1	3	1	Non-Roadside	-	-	-	VATH	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	BCCH	25 - 50	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	GCKI	0 - 25	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	MACW	25 - 50	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	RBNU	25 - 50	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	RBNU	75 - 100	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	RCKI	0 - 25	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	RCKI	25 - 50	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	RCKI	75 - 100	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	VATH	25 - 50	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	VATH	75 - 100	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	WWPE	25 - 50	S	-	-	
8-Jun-12	L116-03	468314	6261548	7:45	0	1	4	1	Non-Roadside	-	-	-	PISI	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	5	1	Non-Roadside	BRCR	25 - 50	S	-	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	4.5	1	Non-Roadside	CBCH	25 - 50	S	-	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	4.5	1	Non-Roadside	OCWA	0 - 25	S	-	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	4.5	1	Non-Roadside	OCWA	25 - 50	S	-	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	4.5	1	Non-Roadside	PISI	50 - 75	S	-	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	4.5	1	Non-Roadside	RCKI	50 - 75	S	-	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	4.5	1	Non-Roadside	TOWA	0 - 25	S	-	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	4.5	1	Non-Roadside	VATH	50 - 75	S	-	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	4.5	1	Non-Roadside	YEWA	25 - 50	S	-	-	
8-Jun-12	L116-04	468315	6261751	8:12	0	1	5	1	Non-Roadside	-	-	-	WIWA	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
8-Jun-12	L116-05	468294	6261948	8:35	0	1	5	0	Non-Roadside	ATSP	25 - 50	S	-	-	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	RBNU	75 - 100	S	-	-	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	TOWA	25 - 50	S	-	-	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	VATH	75 - 100	S	-	-	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	WIWA	25 - 50	S	-	-	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	WWPE	25 - 50	S	-	-	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	YEWA	0 - 25	S	-	-	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	YEWA	0 - 25	S	-	-	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	5	0	Non-Roadside	-	-	-	RTHA	BOGU	mobbing the RTHA
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	-	-	-	WWPE	BOGU	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	-	-	-	-	BOGU	
8-Jun-12	L116-05	468294	6261948	8:35	0	1	4.5	0	Non-Roadside	-	-	-	-	PISI	
8-Jun-12	L11-01	455895	6265128	9:30	1	0	6	0	Non-Roadside	MAGW	75 - 100	S	-	-	
8-Jun-12	L11-01	455895	6265128	9:30	1	0	6	0	Non-Roadside	RBNU	75 - 100	S	-	-	
8-Jun-12	L11-01	455895	6265128	9:30	1	0	6	0	Non-Roadside	SAVS	50 - 75	S	-	-	
8-Jun-12	L11-01	455895	6265128	9:30	1	0	6	0	Non-Roadside	SOSA	50 - 75	C,V	-	-	
8-Jun-12	L11-01	455895	6265128	9:30	1	0	6	0	Non-Roadside	YRWA	75 - 100	S	-	-	
8-Jun-12	L11-01	455895	6265128	9:30	1	0	6	0	Non-Roadside	-	-	-	RCKI	-	
8-Jun-12	L11-02	455951	6264940	9:46	0	1	6	0	Non-Roadside	RBNU	50 - 75	S	-	-	
8-Jun-12	L11-02	455951	6264940	9:46	0	1	6	0	Non-Roadside	SAVS	50 - 75	S	-	-	
8-Jun-12	L11-02	455951	6264940	9:46	0	1	6	0	Non-Roadside	YEWA	50 - 75	S	-	-	
8-Jun-12	L11-02	455951	6264940	9:46	0	1	6	0	Non-Roadside	-	-	-	BCCH	-	
8-Jun-12	L11-02	455951	6264940	9:46	0	1	6	0	Non-Roadside	-	-	-	DEJU	-	
8-Jun-12	L11-02	455951	6264940	9:46	0	1	6	0	Non-Roadside	-	-	-	MOCH	-	
8-Jun-12	L11-02	455951	6264940	9:46	0	1	6	0	Non-Roadside	-	-	-	RCKI	-	
9-Jun-12	L3-01	451671	6263532	4:52	0	0	3	1	Non-Roadside	CAGO	≥100	C	-	-	
9-Jun-12	L3-01	451671	6263532	4:52	0	0	3	1	Non-Roadside	DEJU	25 - 50	S	-	-	
9-Jun-12	L3-01	451671	6263532	4:52	0	0	3	1	Non-Roadside	SAVS	25 - 50	S	-	-	
9-Jun-12	L3-01	451671	6263532	4:52	0	0	3	1	Non-Roadside	SWTH	50 - 75	S	-	-	
9-Jun-12	L3-01	451671	6263532	4:52	0	0	3	1	Non-Roadside	SWTH	75 - 100	S	-	-	
9-Jun-12	L3-01	451671	6263532	4:52	0	0	3	1	Non-Roadside	VATH	25 - 50	S	-	-	
9-Jun-12	L3-01	451671	6263532	4:52	0	0	3	1	Non-Roadside	VATH	75 - 100	S	-	-	
9-Jun-12	L3-01	451671	6263532	4:52	0	0	3	1	Non-Roadside	YEWA	25 - 50	S	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	AMRO	75 - 100	S	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	ATSP	50 - 75	S	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	BCCH	0 - 25	S	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	CAGO	≥100	C	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	DEJU	0 - 25	C	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	GCKI	25 - 50	S	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	RCKI	0 - 25	S	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	WISN	50 - 75	C	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	YEWA	0 - 25	S	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	YEWA	25 - 50	S	-	-	
9-Jun-12	L3-03	451538	6263917	5:36	0	0	3	1	Non-Roadside	-	-	-	CAGO	CAGO	Pair flew over
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	ALFL	50 - 75	S	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	BCCH	50 - 75	S	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	LEYE	≥100	C	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	RCKI	50 - 75	S	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	SAVS	50 - 75	S	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	VATH	75 - 100	S	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	WCSP	25 - 50	S	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	WISN	75 - 100	C	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	WIWA	50 - 75	S	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	YEWA	0 - 25	S	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	YEWA	25 - 50	S	-	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	-	-	-	DEJU	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	-	-	-	PIGR	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	-	-	-	RCKI	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	-	-	-	TOWA	-	
9-Jun-12	L3-04	451556	6264097	6:03	0	0	4	1	Non-Roadside	-	-	-	VATH	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	GRJA	0 - 25	C	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	MOCH	25 - 50	C	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	MOCH	50 - 75	C	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	PIGR	50 - 75	S	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	RCKI	25 - 50	S	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	SWTH	50 - 75	C	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	TOWA	50 - 75	S	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	VATH	25 - 50	S	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	VATH	50 - 75	S	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	VATH	75 - 100	S	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	WIWA	25 - 50	S	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	WWPE	50 - 75	S	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3	1	Non-Roadside	YEWA	0 - 25	S	-	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	4	1	Non-Roadside	-	-	-	CHSP	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3.5	1	Non-Roadside	-	-	-	GOEA	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3.5	1	Non-Roadside	-	-	-	OCWA	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3.5	1	Non-Roadside	-	-	-	PISI	-	
9-Jun-12	L6-01	453315	6259138	7:03	0	0	3.5	1	Non-Roadside	-	-	-	YRWA	-	
9-Jun-12	L6-02	453223	6258964	7:31	0	0	4	2	Non-Roadside	GCKI	25 - 50	S	-	-	
9-Jun-12	L6-02	453223	6258964	7:31	0	0	3.5	2	Non-Roadside	RCKI	25 - 50	S	-	-	
9-Jun-12	L6-02	453223	6258964	7:31	0	0	3.5	2	Non-Roadside	VATH	50 - 75	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	BCCH	0 - 25	C	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	CHSP	50 - 75	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	GCSP	25 - 50	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	RCKI	25 - 50	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	RCKI	50 - 75	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	SWTH	50 - 75	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	TOWA	0 - 25	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	TOWA	25 - 50	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	VATH	25 - 50	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	WIWA	25 - 50	S	-	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	-	-	-	ALFL	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	-	-	-	PISI	-	
9-Jun-12	L6-03	453112	6258808	7:54	0	0	4	1	Non-Roadside	-	-	-	TOWA	-	
9-Jun-12	L6-04	452934	6258717	8:17	0	0	4	1	Non-Roadside	RCKI	25 - 50	S	-	-	
9-Jun-12	L6-04	452934	6258717	8:17	0	0	4	1	Non-Roadside	TOWA	50 - 75	S	-	-	
9-Jun-12	L6-04	452934	6258717	8:17	0	0	4	1	Non-Roadside	VATH	50 - 75	S	-	-	
9-Jun-12	L6-04	452934	6258717	8:17	0	0	4	1	Non-Roadside	-	-	-	-	PISI	
9-Jun-12	L5-01	453420	6253502	9:29	4	0	6	1	Non-Roadside	OCWA	0 - 25	S	-	-	
9-Jun-12	L5-01	453420	6253502	9:29	4	0	5.5	1	Non-Roadside	PUFI	50 - 75	S	-	-	
9-Jun-12	L5-01	453420	6253502	9:29	4	0	5.5	1	Non-Roadside	WISN	75 - 100	C	-	-	
9-Jun-12	L5-01	453420	6253502	9:29	4	0	5.5	1	Non-Roadside	YEWA	0 - 25	S	-	-	
9-Jun-12	L5-01	453420	6253502	9:29	4	0	5.5	1	Non-Roadside	YEWA	25 - 50	S	-	-	
9-Jun-12	L5-01	453420	6253502	9:29	4	0	6	1	Non-Roadside	-	-	-	FOSP	-	
9-Jun-12	L5-01	453420	6253502	9:29	4	0	5.5	1	Non-Roadside	-	-	-	PIGR	-	
9-Jun-12	L5-01	453420	6253502	9:29	4	0	5.5	1	Non-Roadside	-	-	-	RBNU	-	
9-Jun-12	L5-01	453420	6253502	9:29	4	0	5.5	1	Non-Roadside	-	-	-	YRWA	-	
10-Jun-12	L18-01	424265	6261345	4:45	1	0	3	2	Non-Roadside	WIWA	50 - 75	S	-	-	
10-Jun-12	L18-01	424265	6261345	4:45	1	0	3	2	Non-Roadside	YEWA	50 - 75	S	-	-	
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	AMRO	0 - 25	S	-	-	
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	DEJU	25 - 50	S	-	-	
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	FOSP	50 - 75	S	-	-	
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	FOSP	75 - 100	S	-	-	
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	RCKI	75 - 100	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	SOGR	≥100	C	-	-	Species of concern
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	VATH	75 - 100	S	-	-	
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	WIWA	25 - 50	S	-	-	
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	YRWA	50 - 75	S	-	-	
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	-	-	-	NOFL	-	
10-Jun-12	L18-02	424097	6261430	5:01	0	0	3	1	Non-Roadside	-	-	-	TOWA	-	
10-Jun-12	L18-03	423910	6261464	5:28	0	0	3	1	Non-Roadside	PAWR	25 - 50	S	-	-	
10-Jun-12	L18-03	423910	6261464	5:28	0	0	3	1	Non-Roadside	SOGR	≥100	C	-	-	Species of concern
10-Jun-12	L18-03	423910	6261464	5:28	0	0	3	1	Non-Roadside	VATH	25 - 50	S	-	-	
10-Jun-12	L18-03	423910	6261464	5:28	0	0	3	1	Non-Roadside	VATH	50 - 75	S	-	-	
10-Jun-12	L18-03	423910	6261464	5:28	0	0	3	1	Non-Roadside	-	-	-	GCSP	-	
10-Jun-12	L18-03	423910	6261464	5:28	0	0	3	1	Non-Roadside	-	-	-	MOCH	-	
10-Jun-12	L18-03	423910	6261464	5:28	0	0	3	1	Non-Roadside	-	-	-	PISI	PISI	
10-Jun-12	L18-03	423910	6261464	5:28	0	0	3	1	Non-Roadside	-	-	-	RCKI	-	
10-Jun-12	L18-04	423757	6261559	5:53	0	0	3	1	Non-Roadside	CHSP	75 - 100	S	-	-	
10-Jun-12	L18-04	423757	6261559	5:53	0	0	3	1	Non-Roadside	DEJU	0 - 25	S	-	-	
10-Jun-12	L18-04	423757	6261559	5:53	0	0	3	1	Non-Roadside	DEJU	25 - 50	S	-	-	
10-Jun-12	L18-04	423757	6261559	5:53	0	0	3	1	Non-Roadside	PAWR	25 - 50	S	-	-	
10-Jun-12	L18-04	423757	6261559	5:53	0	0	3	1	Non-Roadside	PAWR	50 - 75	S	-	-	
10-Jun-12	L18-04	423757	6261559	5:53	0	0	3	1	Non-Roadside	TOWA	75 - 100	S	-	-	
10-Jun-12	L18-04	423757	6261559	5:53	0	0	3	1	Non-Roadside	VATH	50 - 75	S	-	-	
10-Jun-12	L18-04	423757	6261559	5:53	0	0	3	1	Non-Roadside	-	-	-	-	PISI	
10-Jun-12	L21-01	442168	6250601	7:11	0	0	4	1	Non-Roadside	CHSP	25 - 50	S	-	-	
10-Jun-12	L21-01	442168	6250601	7:11	0	0	4	1	Non-Roadside	DEJU	50 - 75	C	-	-	
10-Jun-12	L21-01	442168	6250601	7:11	0	0	4	1	Non-Roadside	DEJU	50 - 75	S	-	-	
10-Jun-12	L21-01	442168	6250601	7:11	0	0	4	1	Non-Roadside	DEJU	75 - 100	S	-	-	
10-Jun-12	L21-01	442168	6250601	7:11	0	0	4	1	Non-Roadside	HETH	50 - 75	S	-	-	
10-Jun-12	L21-01	442168	6250601	7:11	0	0	4	1	Non-Roadside	HETH	75 - 100	S	-	-	
10-Jun-12	L21-01	442168	6250601	7:11	0	0	4	1	Non-Roadside	RCKI	75 - 100	S	-	-	
10-Jun-12	L21-01	442168	6250601	7:11	0	0	4	1	Non-Roadside	-	-	-	-	PISI	
10-Jun-12	L21-02	441968	6250625	7:29	0	0	4	1	Non-Roadside	HETH	50 - 75	S	-	-	
10-Jun-12	L21-02	441968	6250625	7:29	0	0	3.5	1	Non-Roadside	HETH	75 - 100	S	-	-	
10-Jun-12	L21-02	441968	6250625	7:29	0	0	3.5	1	Non-Roadside	RCKI	75 - 100	S	-	-	
10-Jun-12	L21-02	441968	6250625	7:29	0	0	3.5	1	Non-Roadside	VATH	≥100	S	-	-	
10-Jun-12	L21-02	441968	6250625	7:29	0	0	3.5	1	Non-Roadside	WIWA	50 - 75	S	-	-	
10-Jun-12	L21-02	441968	6250625	7:29	0	0	3.5	1	Non-Roadside	YRWA	50 - 75	S	-	-	
10-Jun-12	L21-02	441968	6250625	7:29	0	0	4	1	Non-Roadside	-	-	-	RUHU	-	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	ALFL	≥100	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	CHSP	25 - 50	S	-	-	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	CHSP	50 - 75	S	-	-	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	DEJU	25 - 50	S	-	-	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	HAFL	25 - 50	S	-	-	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	HETH	50 - 75	S	-	-	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	TOWA	50 - 75	S	-	-	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	VATH	50 - 75	S	-	-	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	YRWA	50 - 75	S	-	-	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	-	-	-	ALFL	PISI	
10-Jun-12	L21-03	441768	6250606	7:49	0	0	3	1	Non-Roadside	-	-	-	-	PISI	
10-Jun-12	L21-04	441572	6250597	8:09	0	0	3	1	Non-Roadside	GCKI	25 - 50	S	-	-	
10-Jun-12	L21-04	441572	6250597	8:09	0	0	3	1	Non-Roadside	RCKI	25 - 50	S	-	-	
10-Jun-12	L21-04	441572	6250597	8:09	0	0	3	1	Non-Roadside	RCKI	50 - 75	S	-	-	
10-Jun-12	L21-04	441572	6250597	8:09	0	0	3	1	Non-Roadside	TOWA	25 - 50	S	-	-	
10-Jun-12	L21-04	441572	6250597	8:09	0	0	3	1	Non-Roadside	VATH	75 - 100	S	-	-	
10-Jun-12	L21-04	441572	6250597	8:09	0	0	3	1	Non-Roadside	WIWA	0 - 25	S	-	-	
10-Jun-12	L21-04	441572	6250597	8:09	0	0	3	1	Non-Roadside	WIWA	25 - 50	S	-	-	
10-Jun-12	L21-04	441572	6250597	8:09	0	0	3	1	Non-Roadside	WIWA	50 - 75	S	-	-	
10-Jun-12	L21-04	441572	6250597	8:09	0	0	3	1	Non-Roadside	-	-	-	RCKI	PISI	
10-Jun-12	L4-01	449596	6250724	8:56	0	0	4	1	Non-Roadside	DEJU	75 - 100	S	-	-	
10-Jun-12	L4-01	449596	6250724	8:56	0	0	4	1	Non-Roadside	HAFL	0 - 25	S	-	-	
10-Jun-12	L4-01	449596	6250724	8:56	0	0	4	1	Non-Roadside	HAFL	25 - 50	S	-	-	
10-Jun-12	L4-01	449596	6250724	8:56	0	0	4	1	Non-Roadside	RCKI	25 - 50	S	-	-	
10-Jun-12	L4-01	449596	6250724	8:56	0	0	4	1	Non-Roadside	RCKI	50 - 75	S	-	-	
10-Jun-12	L4-01	449596	6250724	8:56	0	0	4	1	Non-Roadside	SWTH	50 - 75	S	-	-	
10-Jun-12	L4-01	449596	6250724	8:56	0	0	4	1	Non-Roadside	YRWA	25 - 50	S	-	-	
10-Jun-12	L4-01	449596	6250724	8:56	0	0	4	1	Non-Roadside	-	-	-	-	PISI	
10-Jun-12	L4-02	449462	6250866	9:14	0	0	4	1	Non-Roadside	RCKI	25 - 50	S	-	-	
10-Jun-12	L4-02	449462	6250866	9:14	0	0	4	1	Non-Roadside	SWTH	75 - 100	C	-	-	
10-Jun-12	L4-02	449462	6250866	9:14	0	0	4	1	Non-Roadside	VATH	25 - 50	S	-	-	
10-Jun-12	L4-02	449462	6250866	9:14	0	0	4	1	Non-Roadside	VATH	50 - 75	S	-	-	
10-Jun-12	L4-02	449462	6250866	9:14	0	0	4	1	Non-Roadside	-	-	-	RCKI	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	DEJU	50 - 75	S	-	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	HETH	50 - 75	S	-	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	RCKI	25 - 50	S	-	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	RCKI	50 - 75	S	-	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	RUGR	50 - 75	D	-	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	SWTH	50 - 75	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	VATH	25 - 50	S	-	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	YEWA	0 - 25	V	-	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	YEWA	25 - 50	S	-	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	YRWA	25 - 50	S	-	-	
10-Jun-12	L4-03	449529	6251046	9:34	0	0	4	1	Non-Roadside	-	-	-	WETA	-	
10-Jun-12	L4-04	449673	6251180	9:52	0	0	5	1	Non-Roadside	BUSH	0 - 25	C	-	-	
10-Jun-12	L4-04	449673	6251180	9:52	0	0	5	1	Non-Roadside	HAFL	50 - 75	S	-	-	
10-Jun-12	L4-04	449673	6251180	9:52	0	0	5	1	Non-Roadside	HETH	50 - 75	S	-	-	
10-Jun-12	L4-04	449673	6251180	9:52	0	0	5	1	Non-Roadside	HETH	75 - 100	S	-	-	
10-Jun-12	L4-04	449673	6251180	9:52	0	0	5	1	Non-Roadside	RBNU	50 - 75	S	-	-	
10-Jun-12	L4-04	449673	6251180	9:52	0	0	5	1	Non-Roadside	RCKI	50 - 75	S	-	-	
10-Jun-12	L4-04	449673	6251180	9:52	0	0	5	1	Non-Roadside	YEWA	25 - 50	S	-	-	
10-Jun-12	L4-04	449673	6251180	9:52	0	0	5	1	Non-Roadside	-	-	-	PUFI	-	
10-Jun-12	L4-04	449673	6251180	9:52	0	0	5	1	Non-Roadside	-	-	-	RBNU	-	
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Roadside	ALFL	50 - 75	S	-	-	
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Roadside	ALFL	75 - 100	S	-	-	
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Roadside	DEJU	75 - 100	S	-	-	
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Roadside	MOBL	0 - 25	S	-	-	Male with female with MC and nest found
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Roadside	RCKI	75 - 100	S	-	-	
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Roadside	TOWA	75 - 100	S	-	-	
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Roadside	VATH	75 - 100	S	-	-	
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Roadside	WWPE	50 - 75	C	-	-	
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Roadside	YEWA	50 - 75	S	-	-	
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Non-Roadside	-	-	-	BASW	-	Pair; Species of concern
13-Jun-12	WF-01	469403	6263847	7:14	0	1	4	1	Non-Roadside	-	-	-	VGSW	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	ALFL	25 - 50	S	-	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	PAWR	25 - 50	S	-	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	RUHU	0 - 25	C	-	-	flying by - buzzing sound
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	SWTH	50 - 75	S	-	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	TOWA	25 - 50	S	-	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	TOWA	50 - 75	S	-	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	UNSP	50 - 75	C	-	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	WETA	50 - 75	C	-	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	WIWA	25 - 50	S	-	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Roadside	YRWA	50 - 75	S	-	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Non-Roadside	-	-	-	AMRO	PISI	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Non-Roadside	-	-	-	NOFL	-	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Non-Roadside	-	-	-	PISI	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Non-Roadside	-	-	-	RCKI	PISI	
13-Jun-12	HW37-01	467533	6265522	8:14	0	1	8	1	Non-Roadside	-	-	-	TOWA	PISI	
13-Jun-12	HW37-02	470012	6263887	8:31	0	1	8	2	Roadside	HAFL	25 - 50	S	-	-	
13-Jun-12	HW37-02	470012	6263887	8:31	0	1	8	2	Roadside	HAFL	50 - 75	S	-	-	
13-Jun-12	HW37-02	470012	6263887	8:31	0	1	8	2	Roadside	HETH	50 - 75	S	-	-	
13-Jun-12	HW37-02	470012	6263887	8:31	0	1	8	2	Roadside	PAWR	50 - 75	S	-	-	
13-Jun-12	HW37-02	470012	6263887	8:31	0	1	8	2	Roadside	PISI	50 - 75	C	-	-	
13-Jun-12	HW37-02	470012	6263887	8:31	0	1	8	2	Non-Roadside	-	-	-	SWTH	PISI	
13-Jun-12	HW37-02	470012	6263887	8:31	0	1	8	2	Non-Roadside	-	-	-	-	PISI	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Roadside	HAFL	25 - 50	C	-	-	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Roadside	PISI	25 - 50	C	-	-	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Roadside	PUFI	25 - 50	S	-	-	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Roadside	PUFI	50 - 75	S	-	-	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Roadside	VATH	50 - 75	S	-	-	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Roadside	YEWA	0 - 25	S	-	-	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Roadside	YEWA	25 - 50	S	-	-	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Roadside	YRWA	25 - 50	S	-	-	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Non-Roadside	-	-	-	YRWA	PISI	
13-Jun-12	HW37-03	469188	6264549	8:43	0	2	8	2	Non-Roadside	-	-	-	-	PISI	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	ALFL	50 - 75	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	CHSP	25 - 50	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	CHSP	50 - 75	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	DEJU	0 - 25	C	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	DEJU	25 - 50	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	HAFL	50 - 75	C	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	SWTH	75 - 100	C	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	SWTH	75 - 100	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	TOWA	50 - 75	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	VATH	75 - 100	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	WIWA	50 - 75	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	YEWA	25 - 50	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	YEWA	50 - 75	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	YEWA	75 - 100	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Roadside	YRWA	50 - 75	S	-	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Non-Roadside	-	-	-	AMRO	PISI	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Non-Roadside	-	-	-	PISI	-	
13-Jun-12	HW37-04	470700	6263386	8:56	0	2	8	1	Non-Roadside	-	-	-	SWTH	PISI	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	AMRO	50 - 75	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	AMRO	75 - 100	S	-	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	HETH	25 - 50	S	-	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	UNHU	25 - 50	C	-	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	WIWA	75 - 100	S	-	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	AMRO	≥100	-	OCSP	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	VATH	≥100	-	CAGO	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	VATH	≥100	-	CAGO	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	VATH	≥100	-	CAGO	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	-	-	-	CAGO	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	-	-	-	CAGO	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	-	-	-	BCCH	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	-	-	-	BAGO	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	-	-	-	BAGO	-	
22-Jun-12	PC-1	435936	6214386	5:05	2	0	5	1	Roadside	-	-	-	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	CHSP	50 - 75	S	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	DEJU	0 - 25	S	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	DEJU	50 - 75	S	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	OSFL	50 - 75	S	-	-	Species of concern
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	PAWR	25 - 50	S	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	WAVI	25 - 50	S	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	WIWA	75 - 100	S	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	YRWA	50 - 75	S	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	YRWA	75 - 100	S	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	OSFL	≥100	-	-	-	Species of concern
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	CAGO	≥100	-	-	-	
22-Jun-12	PC-2	435579	6213657	5:39	2	0	5	1	Roadside	VATH	≥100	-	-	-	
22-Jun-12	PC-3	435323	6213825	6:02	1	0	5	1	Roadside	PAWR	50 - 75	S	-	-	
22-Jun-12	PC-3	435323	6213825	6:02	1	0	5	1	Roadside	VATH	50 - 75	S	-	-	
22-Jun-12	PC-3	435323	6213825	6:02	1	0	5	1	Roadside	VATH	75 - 100	S	-	-	
22-Jun-12	PC-3	435323	6213825	6:02	1	0	5	1	Roadside	YRWA	50 - 75	V	-	-	
22-Jun-12	PC-3	435323	6213825	6:02	1	0	5	1	Roadside	VATH	≥100	-	-	-	
22-Jun-12	PC-3	435323	6213825	6:02	1	0	5	1	Roadside	GRJA	≥100	-	-	-	
22-Jun-12	PC-3	435323	6213825	6:02	1	0	5	1	Roadside	OSFL	≥100	-	-	-	Species of concern
22-Jun-12	PC-3	435323	6213825	6:02	1	0	5	1	Roadside	UNWO	≥100	-	-	-	
22-Jun-12	PC-4	435275	6214273	6:24	1	0	7	1	Roadside	CHSP	50 - 75	S	-	-	
22-Jun-12	PC-4	435275	6214273	6:24	1	0	7	1	Roadside	DEJU	75 - 100	S	-	-	
22-Jun-12	PC-4	435275	6214273	6:24	1	0	7	1	Roadside	HETH	50 - 75	S	-	-	
22-Jun-12	PC-4	435275	6214273	6:24	1	0	7	1	Roadside	VATH	75 - 100	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
22-Jun-12	PC-4	435275	6214273	6:24	1	0	7	1	Roadside	WIWA	0 - 25	V	-	-	
22-Jun-12	PC-4	435275	6214273	6:24	1	0	7	1	Roadside	WIWA	50 - 75	S	-	-	
22-Jun-12	PC-4	435275	6214273	6:24	1	0	7	1	Roadside	HETH	≥100	-	-	-	
22-Jun-12	PC-4	435275	6214273	6:24	1	0	7	1	Roadside	HETH	≥100	-	-	-	
22-Jun-12	PC-4	435275	6214273	6:24	1	0	7	1	Roadside	HETH	≥100	-	-	-	
22-Jun-12	PC-5	435144	6214717	6:40	3	0	7	1	Roadside	HETH	75 - 100	S	-	-	
22-Jun-12	PC-5	435144	6214717	6:40	3	0	7	1	Roadside	PAWR	75 - 100	S	-	-	
22-Jun-12	PC-5	435144	6214717	6:40	3	0	7	1	Roadside	PISI	50 - 75	S	-	-	
22-Jun-12	PC-5	435144	6214717	6:40	3	0	7	1	Roadside	WIWA	75 - 100	S	-	-	
22-Jun-12	PC-5	435144	6214717	6:40	3	0	7	1	Roadside	VATH	≥100	-	-	-	
22-Jun-12	PC-5	435144	6214717	6:40	3	0	7	1	Roadside	SWTH	≥100	-	-	-	
22-Jun-12	PC-5	435144	6214717	6:40	3	0	7	1	Roadside	VATH	≥100	-	-	-	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	AMRO	50 - 75	S	-	-	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	TOWA	50 - 75	S	-	-	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	TOWA	75 - 100	S	-	-	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	VATH	75 - 100	S	-	-	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	VATH	≥100	-	-	PISI	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	-	-	-	-	CAGO	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	-	-	-	-	CAGO	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	-	-	-	-	CAGO	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	-	-	-	-	CAGO	
22-Jun-12	PC-6	435083	6215690	7:02	3	0	7	2	Roadside	-	-	-	-	CAGO	
22-Jun-12	PC-7	434997	6217395	7:20	4	0	7	2	Roadside	AMRO	0 - 25	S	-	-	
22-Jun-12	PC-7	434997	6217395	7:20	4	0	7	2	Roadside	DEJU	0 - 25	S	-	-	
22-Jun-12	PC-7	434997	6217395	7:20	4	0	7	2	Roadside	DEJU	75 - 100	S	-	-	
22-Jun-12	PC-7	434997	6217395	7:20	4	0	7	2	Roadside	HETH	50 - 75	S	-	-	
22-Jun-12	PC-7	434997	6217395	7:20	4	0	7	2	Roadside	VATH	50 - 75	S	-	-	
22-Jun-12	PC-7	434997	6217395	7:20	4	0	7	2	Roadside	WIWA	50 - 75	S	-	-	
22-Jun-12	PC-7	434997	6217395	7:20	4	0	7	2	Roadside	VATH	≥100	-	-	-	
22-Jun-12	PC-7	434997	6217395	7:20	4	0	7	2	Roadside	CORA	≥100	-	-	-	
22-Jun-12	PC-7	434997	6217395	7:20	4	0	7	2	Roadside	RCKI	≥100	-	-	-	
22-Jun-12	PC-8	435650	6218639	7:47	4	0	8	2	Roadside	DEJU	0 - 25	S	-	-	
22-Jun-12	PC-8	435650	6218639	7:47	4	0	8	2	Roadside	DEJU	50 - 75	S	-	-	
22-Jun-12	PC-8	435650	6218639	7:47	4	0	8	2	Roadside	PAWR	0 - 25	V	-	-	
22-Jun-12	PC-8	435650	6218639	7:47	4	0	8	2	Roadside	PAWR	75 - 100	S	-	-	
22-Jun-12	PC-8	435650	6218639	7:47	4	0	8	2	Roadside	VATH	50 - 75	S	-	-	
22-Jun-12	PC-8	435650	6218639	7:47	4	0	8	2	Roadside	WIWA	25 - 50	S	-	-	
22-Jun-12	PC-8	435650	6218639	7:47	4	0	8	2	Roadside	VATH	≥100	-	-	WIWA	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
22-Jun-12	PC-8	435650	6218639	7:47	4	0	8	2	Roadside	VATH	≥100	-	-	WIWA	
22-Jun-12	PC-8	435650	6218639	7:47	4	0	8	2	Roadside	HETH	≥100	-	-	-	
22-Jun-12	PC-9	435144	6220616	8:06	4	0	9	2	Roadside	AMRO	75 - 100	S	-	-	
22-Jun-12	PC-9	435144	6220616	8:06	4	0	9	2	Roadside	HETH	75 - 100	S	-	-	
22-Jun-12	PC-9	435144	6220616	8:06	4	0	9	2	Roadside	PAWR	0 - 25	V	-	-	
22-Jun-12	PC-9	435144	6220616	8:06	4	0	9	2	Roadside	RCKI	75 - 100	S	-	-	
22-Jun-12	PC-9	435144	6220616	8:06	4	0	9	2	Roadside	SOGR	25 - 50	C	-	-	Species of concern
22-Jun-12	PC-9	435144	6220616	8:06	4	0	9	2	Roadside	PAWR	≥100	-	-	-	
22-Jun-12	PC-10	434675	6223367	8:28	3	0	9	2	Roadside	BCCH	50 - 75	S	-	-	
22-Jun-12	PC-10	434675	6223367	8:28	3	0	9	2	Roadside	BCCH	75 - 100	S	-	-	
22-Jun-12	PC-10	434675	6223367	8:28	3	0	9	2	Roadside	HETH	75 - 100	S	-	-	
22-Jun-12	PC-10	434675	6223367	8:28	3	0	9	2	Roadside	PAWR	50 - 75	S	-	-	
22-Jun-12	PC-10	434675	6223367	8:28	3	0	9	2	Roadside	PISI	50 - 75	S	-	-	
22-Jun-12	PC-10	434675	6223367	8:28	3	0	9	2	Roadside	HETH	≥100	-	-	-	
22-Jun-12	PC-11	434713	6225432	8:41	3	0	11	2	Roadside	AMRO	50 - 75	S	-	-	
22-Jun-12	PC-11	434713	6225432	8:41	3	0	11	2	Roadside	BCCH	75 - 100	S	-	-	
22-Jun-12	PC-11	434713	6225432	8:41	3	0	11	2	Roadside	HETH	≥100	-	-	-	
22-Jun-12	PC-12	435066	6227670	8:57	2	0	11	1	Roadside	BCCH	50 - 75	S	-	-	
22-Jun-12	PC-12	435066	6227670	8:57	2	0	11	1	Roadside	BCCH	75 - 100	S	-	-	
22-Jun-12	PC-12	435066	6227670	8:57	2	0	11	1	Roadside	CHSP	75 - 100	S	-	-	
22-Jun-12	PC-12	435066	6227670	8:57	2	0	11	1	Roadside	GCSP	0 - 25	V	-	-	
22-Jun-12	PC-12	435066	6227670	8:57	2	0	11	1	Roadside	GCSP	25 - 50	S	-	-	
22-Jun-12	PC-12	435066	6227670	8:57	2	0	11	1	Roadside	VATH	75 - 100	S	-	-	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	HETH	25 - 50	S	-	-	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	HETH	50 - 75	S	-	-	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	PISI	0 - 25	S	-	-	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	PISI	50 - 75	S	-	-	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	RCKI	0 - 25	S	-	-	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	RCKI	75 - 100	S	-	-	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	VATH	≥100	-	-	PISI	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	HETH	≥100	-	-	PISI	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	-	-	-	-	PISI	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	-	-	-	-	PISI	
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	-	-	-	-	BASW	Species of concern
22-Jun-12	PC-13	433719	6229545	9:18	4	0	11	2	Roadside	-	-	-	-	BASW	Species of concern
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	ALFL	50 - 75	S	-	-	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	BCCH	50 - 75	S	-	-	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	GCSP	50 - 75	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	SWTH	75 - 100	S	-	-	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	TOSO	75 - 100	S	-	-	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	VATH	75 - 100	S	-	-	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	WIWA	75 - 100	S	-	-	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	YRWA	25 - 50	S	-	-	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	YRWA	50 - 75	S	-	-	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	HETH	≥100	-	-	WIWA	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	-	-	-	-	PISI	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	-	-	-	-	PISI	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	-	-	-	-	PISI	
22-Jun-12	PC-23	434718	6235719	9:56	1	0	12	1	Roadside	-	-	-	-	PISI	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	ALFL	50 - 75	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	ALFL	75 - 100	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	AMRO	25 - 50	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	BCCH	50 - 75	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	BCCH	75 - 100	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	COYE	75 - 100	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	FOSP	25 - 50	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	GCTH	25 - 50	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	GCTH	75 - 100	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	OSFL	75 - 100	S	-	-	Species of concern
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	SOSP	50 - 75	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	SWTH	75 - 100	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	WIWA	50 - 75	S	-	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	SWTH	≥100	-	WIPT	-	
22-Jun-12	PC-15	434612	6237010	10:13	1	0	13	1	Roadside	-	-	-	WIPT	-	
23-Jun-12	PC-3	435323	6213825	4:52	4	0	4	2	Roadside	CAGO	0 - 25	S	-	-	
23-Jun-12	PC-3	435323	6213825	4:52	4	0	4	2	Roadside	PAWR	25 - 50	S	-	-	
23-Jun-12	PC-3	435323	6213825	4:52	4	0	4	2	Roadside	PAWR	50 - 75	S	-	-	
23-Jun-12	PC-3	435323	6213825	4:52	4	0	4	2	Roadside	PISI	50 - 75	S	-	-	
23-Jun-12	PC-3	435323	6213825	4:52	4	0	4	2	Roadside	PISI	75 - 100	S	-	-	
23-Jun-12	PC-3	435323	6213825	4:52	4	0	4	2	Roadside	SWTH	75 - 100	S	-	-	
23-Jun-12	PC-3	435323	6213825	4:52	4	0	4	2	Roadside	VATH	75 - 100	S	-	-	
23-Jun-12	PC-7	434997	6217395	5:28	4	0	4	2	Roadside	RCKI	50 - 75	S	-	-	
23-Jun-12	PC-7	434997	6217395	5:28	4	0	4	2	Roadside	SOGR	0 - 25	V	-	-	Species of concern
23-Jun-12	PC-7	434997	6217395	5:28	4	0	4	2	Roadside	SOGR	75 - 100	C	-	-	Species of concern
23-Jun-12	PC-7	434997	6217395	5:28	4	0	4	2	Roadside	WIWA	50 - 75	S	-	-	
23-Jun-12	PC-7	434997	6217395	5:28	4	0	4	2	Roadside	YRWA	25 - 50	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	AMRO	25 - 50	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	DEJU	75 - 100	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	FOSP	25 - 50	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	GCKI	50 - 75	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	PAWR	75 - 100	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	RCKI	75 - 100	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	SOGR	75 - 100	C	-	-	Species of concern
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	SWTH	75 - 100	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	VATH	75 - 100	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	WIWA	50 - 75	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	YRWA	75 - 100	S	-	-	
23-Jun-12	PC-8	435650	6218639	5:50	2	0	5	2	Roadside	VATH	≥100	-	-	PISI	
23-Jun-12	PC-9	435144	6220616	6:20	4	0	6	2	Roadside	HETH	75 - 100	S	-	-	
23-Jun-12	PC-9	435144	6220616	6:20	4	0	6	2	Roadside	PAWR	25 - 50	S	-	-	
23-Jun-12	PC-9	435144	6220616	6:20	4	0	6	2	Roadside	RCKI	75 - 100	S	-	-	
23-Jun-12	PC-9	435144	6220616	6:20	4	0	6	2	Roadside	VATH	50 - 75	S	-	-	
23-Jun-12	PC-9	435144	6220616	6:20	4	0	6	2	Roadside	VATH	75 - 100	S	-	-	
23-Jun-12	PC-9	435144	6220616	6:20	4	0	6	2	Roadside	YRWA	25 - 50	S	-	-	
23-Jun-12	PC-9	435144	6220616	6:20	4	0	6	2	Roadside	YRWA	50 - 75	S	-	-	
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	AMRO	50 - 75	S	-	-	
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	BCCH	50 - 75	S	-	-	
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	DEJU	25 - 50	S	-	-	
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	GCSP	50 - 75	S	-	-	
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	PISI	50 - 75	S	-	-	
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	PISI	75 - 100	S	-	-	
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	SOGR	25 - 50	C	-	-	Species of concern
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	WIWA	25 - 50	S	-	-	
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	WIWA	50 - 75	S	-	-	
23-Jun-12	PC-16	434561	6221560	6:33	2	0	6	2	Roadside	HETH	≥100	-	-	-	
23-Jun-12	PC-17	434868	6224512	6:52	4	0	6	2	Roadside	PAWR	50 - 75	S	-	-	
23-Jun-12	PC-17	434868	6224512	6:52	4	0	6	2	Roadside	PAWR	75 - 100	S	-	-	
23-Jun-12	PC-17	434868	6224512	6:52	4	0	6	2	Roadside	YRWA	75 - 100	S	-	-	
23-Jun-12	PC-17	434868	6224512	6:52	4	0	6	2	Roadside	HETH	≥100	-	-	-	
23-Jun-12	PC-11	434713	6225432	7:02	4	0	7	2	Roadside	BCCH	75 - 100	S	-	-	
23-Jun-12	PC-11	434713	6225432	7:02	4	0	7	2	Roadside	HETH	50 - 75	S	-	-	
23-Jun-12	PC-11	434713	6225432	7:02	4	0	7	2	Roadside	HETH	75 - 100	S	-	-	
23-Jun-12	PC-11	434713	6225432	7:02	4	0	7	2	Roadside	PAWR	25 - 50	S	-	-	
23-Jun-12	PC-11	434713	6225432	7:02	4	0	7	2	Roadside	RCKI	50 - 75	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
23-Jun-12	PC-11	434713	6225432	7:02	4	0	7	2	Roadside	CHSP	≥100	-	-	BCCH	
23-Jun-12	PC-11	434713	6225432	7:02	4	0	7	2	Roadside	-	-	-	-	BCCH	
23-Jun-12	PC-18	434802	6226894	7:34	4	0	8	2	Roadside	FOSP	25 - 50	S	-	-	
23-Jun-12	PC-18	434802	6226894	7:34	4	0	8	2	Roadside	FOSP	50 - 75	S	-	-	
23-Jun-12	PC-18	434802	6226894	7:34	4	0	8	2	Roadside	GCSP	50 - 75	S	-	-	
23-Jun-12	PC-18	434802	6226894	7:34	4	0	8	2	Roadside	GCSP	75 - 100	S	-	-	
23-Jun-12	PC-12	435066	6227670	8:02	3	0	8	2	Roadside	DEJU	0 - 25	V	-	-	
23-Jun-12	PC-12	435066	6227670	8:02	3	0	8	2	Roadside	DEJU	50 - 75	S	-	-	
23-Jun-12	PC-12	435066	6227670	8:02	3	0	8	2	Roadside	GCSP	75 - 100	S	-	-	
23-Jun-12	PC-13	433719	6229545	8:19	3	0	8	2	Roadside	DEJU	0 - 25	S	-	-	
23-Jun-12	PC-13	433719	6229545	8:19	3	0	8	2	Roadside	DEJU	25 - 50	S	-	-	
23-Jun-12	PC-13	433719	6229545	8:19	3	0	8	2	Roadside	FOSP	0 - 25	S	-	-	
23-Jun-12	PC-13	433719	6229545	8:19	3	0	8	2	Roadside	HETH	50 - 75	S	-	-	
23-Jun-12	PC-13	433719	6229545	8:19	3	0	8	2	Roadside	PISI	25 - 50	S	-	-	
23-Jun-12	PC-13	433719	6229545	8:19	3	0	8	2	Roadside	VATH	50 - 75	S	-	-	
23-Jun-12	PC-13	433719	6229545	8:19	3	0	8	2	Roadside	VATH	75 - 100	S	-	-	
23-Jun-12	PC-13	433719	6229545	8:19	3	0	8	2	Roadside	-	-	-	BASW	-	BASW Nest; Species of Conern
23-Jun-12	PC-20	433853	6232147	8:43	3	0	9	2	Roadside	FOSP	25 - 50	S	-	-	
23-Jun-12	PC-20	433853	6232147	8:43	3	0	9	2	Roadside	HETH	50 - 75	S	-	-	
23-Jun-12	PC-20	433853	6232147	8:43	3	0	9	2	Roadside	PISI	50 - 75	V	-	-	
23-Jun-12	PC-20	433853	6232147	8:43	3	0	9	2	Roadside	RCKI	50 - 75	S	-	-	
23-Jun-12	PC-21	433443	6233331	9:00	2	0	9	2	Roadside	AMRO	0 - 25	V	-	-	
23-Jun-12	PC-21	433443	6233331	9:00	2	0	9	2	Roadside	AMRO	50 - 75	S	-	-	
23-Jun-12	PC-21	433443	6233331	9:00	2	0	9	2	Roadside	GCSP	50 - 75	S	-	-	
23-Jun-12	PC-21	433443	6233331	9:00	2	0	9	2	Roadside	GCSP	75 - 100	S	-	-	
23-Jun-12	PC-21	433443	6233331	9:00	2	0	9	2	Roadside	UNSW	75 - 100	S	-	-	
23-Jun-12	PC-21	433443	6233331	9:00	2	0	9	2	Roadside	PISI	≥100	-	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	GCSP	50 - 75	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	GCTH	0 - 25	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	GCTH	75 - 100	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	PISI	75 - 100	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	PISI	75 - 100	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	SWTH	50 - 75	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	VATH	75 - 100	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	WIWA	25 - 50	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	YEWA	50 - 75	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	YRWA	50 - 75	S	-	-	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	VATH	≥100	-	-	PISI	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	-	-	-	-	PISI	
23-Jun-12	PC-22	434548	6235051	9:13	2	0	9	2	Roadside	-	-	-	-	PISI	
23-Jun-12	HV-2	434441	6235221	9:30	2	0	11	1	Roadside	FOSP	25 - 50	S	-	-	
23-Jun-12	HV-2	434441	6235221	9:30	2	0	11	1	Roadside	SAVS	50 - 75	S	-	-	
23-Jun-12	HV-2	434441	6235221	9:30	2	0	11	1	Roadside	SWTH	50 - 75	S	-	-	
23-Jun-12	HV-2	434441	6235221	9:30	2	0	11	1	Roadside	YEWA	25 - 50	S	-	-	
23-Jun-12	HV-2	434441	6235221	9:30	2	0	11	1	Roadside	HETH	≥100	-	-	-	
23-Jun-12	HV-2	434441	6235221	9:30	2	0	11	1	Roadside	VATH	≥100	-	-	-	
23-Jun-12	HV-3	434414	6235419	9:38	2	0	11	1	Roadside	FOSP	50 - 75	V	-	-	
23-Jun-12	HV-3	434414	6235419	9:38	2	0	11	1	Roadside	HETH	75 - 100	S	-	-	
23-Jun-12	HV-3	434414	6235419	9:38	2	0	11	1	Roadside	SAVS	50 - 75	V	-	-	
23-Jun-12	HV-3	434414	6235419	9:38	2	0	11	1	Roadside	SAVS	75 - 100	S	-	-	
23-Jun-12	HV-4	434382	6235618	9:46	2	0	11	1	Roadside	FOSP	25 - 50	S	-	-	
23-Jun-12	HV-4	434382	6235618	9:46	2	0	11	1	Roadside	FOSP	75 - 100	S	-	-	
23-Jun-12	HV-4	434382	6235618	9:46	2	0	11	1	Roadside	SAVS	50 - 75	S	-	-	
23-Jun-12	HV-4	434382	6235618	9:46	2	0	11	1	Roadside	YEWA	75 - 100	V	-	-	
23-Jun-12	HV-4	434382	6235618	9:46	2	0	11	1	Roadside	VATH	≥100	-	-	-	
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	FOSP	25 - 50	S	-	-	
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	PISI	50 - 75	S	-	-	
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	PISI	75 - 100	S	-	-	
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	VATH	75 - 100	S	-	-	
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	YEWA	0 - 25	S	-	-	
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	YEWA	50 - 75	S	-	-	
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	YEWA	75 - 100	S	-	-	
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	SWTH	≥100	-	-	-	PISI
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	-	-	-	-	-	PISI
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	-	-	-	-	-	PISI
23-Jun-12	PC-23	434718	6235719	9:55	1	0	13	1	Roadside	-	-	-	-	-	PISI
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	AMRO	75 - 100	S	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	COYE	50 - 75	S	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	FOSP	25 - 50	S	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	FOSP	50 - 75	S	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	GCSP	25 - 50	S	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	GCTH	75 - 100	S	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	PISI	75 - 100	S	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	SWTH	75 - 100	S	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	WIWA	50 - 75	S	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	YEWA	25 - 50	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	GCSP	≥100	-	-	-	
23-Jun-12	PC-15	434612	6237010	10:04	1	0	14	1	Roadside	GCTH	≥100	-	-	-	
24-Jun-12	PC-1	435936	6214386	4:42	0	0	5	1	Roadside	BCCH	50 - 75	S	-	-	
24-Jun-12	PC-1	435936	6214386	4:42	0	0	5	1	Roadside	CHSP	75 - 100	S	-	-	
24-Jun-12	PC-1	435936	6214386	4:42	0	0	5	1	Roadside	COYE	75 - 100	S	-	-	
24-Jun-12	PC-1	435936	6214386	4:42	0	0	5	1	Roadside	HETH	75 - 100	S	-	-	
24-Jun-12	PC-1	435936	6214386	4:42	0	0	5	1	Roadside	PAWR	50 - 75	S	-	-	
24-Jun-12	PC-1	435936	6214386	4:42	0	0	5	1	Roadside	VATH	≥100	-	BAEA	-	
24-Jun-12	PC-1	435936	6214386	4:42	0	0	5	1	Roadside	YRWA	≥100	-	DEJU	-	
24-Jun-12	PC-1	435936	6214386	4:42	0	0	5	1	Roadside	OSFL	≥100	-	-	-	Species of concern
24-Jun-12	PC-1	435936	6214386	4:42	0	0	5	1	Roadside	VATH	≥100	-	-	-	
24-Jun-12	PC-2	435579	6213657	4:59	0	0	5	1	Roadside	OSFL	0 - 25	S	-	-	Species of concern
24-Jun-12	PC-2	435579	6213657	4:59	0	0	5	1	Roadside	PAWR	50 - 75	S	-	-	
24-Jun-12	PC-2	435579	6213657	4:59	0	0	5	1	Roadside	PAWR	75 - 100	S	-	-	
24-Jun-12	PC-2	435579	6213657	4:59	0	0	5	1	Roadside	YRWA	0 - 25	V	-	-	
24-Jun-12	PC-2	435579	6213657	4:59	0	0	5	1	Roadside	YRWA	50 - 75	S	-	-	
24-Jun-12	PC-2	435579	6213657	4:59	0	0	5	1	Roadside	BCCH	≥100	-	-	-	
24-Jun-12	PC-2	435579	6213657	4:59	0	0	5	1	Roadside	VATH	≥100	-	-	-	
24-Jun-12	PC-2	435579	6213657	4:59	0	0	5	1	Roadside	VATH	≥100	-	-	-	
24-Jun-12	PC-3	435323	6213825	5:16	1	0	5	1	Roadside	DEJU	50 - 75	S	-	-	
24-Jun-12	PC-3	435323	6213825	5:16	1	0	5	1	Roadside	PAWR	25 - 50	S	-	-	
24-Jun-12	PC-3	435323	6213825	5:16	1	0	5	1	Roadside	PAWR	50 - 75	S	-	-	
24-Jun-12	PC-3	435323	6213825	5:16	1	0	5	1	Roadside	VATH	50 - 75	S	-	-	
24-Jun-12	PC-3	435323	6213825	5:16	1	0	5	1	Roadside	WIWA	50 - 75	S	-	-	
24-Jun-12	PC-3	435323	6213825	5:16	1	0	5	1	Roadside	YRWA	75 - 100	S	-	-	
24-Jun-12	PC-3	435323	6213825	5:16	1	0	5	1	Roadside	-	-	-	AMDI	-	
24-Jun-12	PC-3	435323	6213825	5:16	1	0	5	1	Roadside	-	-	-	BAEA	-	
24-Jun-12	PC-4	435275	6214273	5:27	1	0	5	1	Roadside	DEJU	25 - 50	S	-	-	
24-Jun-12	PC-4	435275	6214273	5:27	1	0	5	1	Roadside	PAWR	75 - 100	S	-	-	
24-Jun-12	PC-4	435275	6214273	5:27	1	0	5	1	Roadside	VATH	50 - 75	S	-	-	
24-Jun-12	PC-4	435275	6214273	5:27	1	0	5	1	Roadside	VATH	75 - 100	S	-	-	
24-Jun-12	PC-4	435275	6214273	5:27	1	0	5	1	Roadside	WIWA	25 - 50	S	-	-	
24-Jun-12	PC-4	435275	6214273	5:27	1	0	5	1	Roadside	WIWA	50 - 75	S	-	-	
24-Jun-12	PC-4	435275	6214273	5:27	1	0	5	1	Roadside	VATH	≥100	-	-	-	
24-Jun-12	PC-4	435275	6214273	5:27	1	0	5	1	Roadside	CHSP	≥100	-	-	-	
24-Jun-12	PC-4	435275	6214273	5:27	1	0	5	1	Roadside	SWTH	≥100	-	-	-	
24-Jun-12	PC-5	435144	6214717	5:35	0	0	6	1	Roadside	DEJU	50 - 75	C	-	-	
24-Jun-12	PC-5	435144	6214717	5:35	0	0	6	1	Roadside	HETH	75 - 100	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
24-Jun-12	PC-5	435144	6214717	5:35	0	0	6	1	Roadside	PAWR	50 - 75	S	-	-	
24-Jun-12	PC-5	435144	6214717	5:35	0	0	6	1	Roadside	WIWA	25 - 50	S	-	-	
24-Jun-12	PC-5	435144	6214717	5:35	0	0	6	1	Roadside	CHSP	≥100	-	-	-	
24-Jun-12	PC-5	435144	6214717	5:35	0	0	6	1	Roadside	VATH	≥100	-	-	-	
24-Jun-12	PC-6	435083	6215690	5:54	1	0	6	2	Roadside	DEJU	0 - 25	S	-	-	
24-Jun-12	PC-6	435083	6215690	5:54	1	0	6	2	Roadside	DEJU	0 - 25	V	-	-	
24-Jun-12	PC-6	435083	6215690	5:54	1	0	6	2	Roadside	HETH	75 - 100	S	-	-	
24-Jun-12	PC-6	435083	6215690	5:54	1	0	6	2	Roadside	TOWA	0 - 25	S	-	-	
24-Jun-12	PC-6	435083	6215690	5:54	1	0	6	2	Roadside	TOWA	25 - 50	S	-	-	
24-Jun-12	PC-6	435083	6215690	5:54	1	0	6	2	Roadside	-	-	-	CHSP	-	
24-Jun-12	L5	435189	6215845	6:05	1	0	6	2	Roadside	TOWA	25 - 50	S	-	-	
24-Jun-12	L5	435189	6215845	6:05	1	0	6	2	Roadside	VATH	50 - 75	S	-	-	
24-Jun-12	L5	435189	6215845	6:05	1	0	6	2	Roadside	VATH	≥100	-	-	-	
24-Jun-12	L4	435139	6216041	6:13	1	0	8	2	Roadside	PAWR	50 - 75	S	-	-	
24-Jun-12	L4	435139	6216041	6:13	1	0	8	2	Roadside	TOWA	25 - 50	S	-	-	
24-Jun-12	L4	435139	6216041	6:13	1	0	8	2	Roadside	TOWA	75 - 100	S	-	-	
24-Jun-12	L4	435139	6216041	6:13	1	0	8	2	Roadside	VATH	75 - 100	S	-	-	
24-Jun-12	L3	435042	6216224	6:21	1	0	8	2	Roadside	BCCH	0 - 25	S	-	-	
24-Jun-12	L3	435042	6216224	6:21	1	0	8	2	Roadside	PAWR	50 - 75	S	-	-	
24-Jun-12	L3	435042	6216224	6:21	1	0	8	2	Roadside	VATH	75 - 100	S	-	-	
24-Jun-12	L3	435042	6216224	6:21	1	0	8	2	Roadside	HETH	≥100	-	-	-	
24-Jun-12	L2	435024	6216423	6:29	1	0	9	2	Roadside	BCCH	25 - 50	S	-	-	
24-Jun-12	L2	435024	6216423	6:29	1	0	9	2	Roadside	HETH	75 - 100	S	-	-	
24-Jun-12	L2	435024	6216423	6:29	1	0	9	2	Roadside	TOWA	25 - 50	S	-	-	
24-Jun-12	L2	435024	6216423	6:29	1	0	9	2	Roadside	YRWA	50 - 75	S	-	-	
24-Jun-12	L1	435010	6216628	6:37	1	0	9	2	Roadside	HETH	75 - 100	S	-	-	
24-Jun-12	L1	435010	6216628	6:37	1	0	9	2	Roadside	TOWA	75 - 100	S	-	-	
24-Jun-12	L1	435010	6216628	6:37	1	0	9	2	Roadside	VATH	75 - 100	S	-	-	
24-Jun-12	L1	435010	6216628	6:37	1	0	9	2	Roadside	YRWA	25 - 50	S	-	-	
24-Jun-12	L1	435010	6216628	6:37	1	0	9	2	Roadside	VATH	≥100	-	-	-	
24-Jun-12	PC-7	434997	6217395	6:45	1	0	9	2	Roadside	TOWA	50 - 75	S	-	-	
24-Jun-12	PC-7	434997	6217395	6:45	1	0	9	2	Roadside	VATH	25 - 50	S	-	-	
24-Jun-12	PC-7	434997	6217395	6:45	1	0	9	2	Roadside	YRWA	25 - 50	S	-	-	
24-Jun-12	PC-7	434997	6217395	6:45	1	0	9	2	Roadside	YRWA	50 - 75	S	-	-	
24-Jun-12	PC-7	434997	6217395	6:45	1	0	9	2	Roadside	YRWA	75 - 100	S	-	-	
24-Jun-12	PC-7	434997	6217395	6:45	1	0	9	2	Roadside	VATH	≥100	-	-	-	
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	AMRO	75 - 100	S	-	-	
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	GCKI	25 - 50	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	SOGR	75 - 100	C	-	-	Species of concern
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	TOWA	0 - 25	S	-	-	
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	VATH	75 - 100	S	-	-	
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	WIWA	25 - 50	S	-	-	
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	WIWA	50 - 75	S	-	-	
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	YRWA	50 - 75	S	-	-	
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	VATH	≥100	-	-	PISI	Flock of 20 PISI
24-Jun-12	PC-8	435650	6218639	6:57	1	0	11	2	Roadside	SOGR	≥100	-	-	-	Species of concern
24-Jun-12	PC-9	435144	6220616	7:23	1	0	11	2	Roadside	BCCH	75 - 100	S	-	-	
24-Jun-12	PC-9	435144	6220616	7:23	1	0	11	2	Roadside	DEJU	25 - 50	S	-	-	
24-Jun-12	PC-9	435144	6220616	7:23	1	0	11	2	Roadside	HETH	75 - 100	S	-	-	
24-Jun-12	PC-9	435144	6220616	7:23	1	0	11	2	Roadside	PAWR	50 - 75	S	-	-	
24-Jun-12	PC-9	435144	6220616	7:23	1	0	11	2	Roadside	TOWA	50 - 75	S	-	-	
24-Jun-12	PC-9	435144	6220616	7:23	1	0	11	2	Roadside	YRWA	50 - 75	S	-	-	
24-Jun-12	PC-9	435144	6220616	7:23	1	0	11	2	Roadside	SWTH	≥100	-	-	-	
24-Jun-12	PC-16	434561	6221560	7:35	1	1	11	1	Roadside	FOSP	0 - 25	S	-	-	
24-Jun-12	PC-16	434561	6221560	7:35	1	1	11	1	Roadside	FOSP	75 - 100	S	-	-	
24-Jun-12	PC-16	434561	6221560	7:35	1	1	11	1	Roadside	HETH	25 - 50	S	-	-	
24-Jun-12	PC-16	434561	6221560	7:35	1	1	11	1	Roadside	HETH	50 - 75	S	-	-	
24-Jun-12	PC-16	434561	6221560	7:35	1	1	11	1	Roadside	HETH	75 - 100	S	-	-	
24-Jun-12	PC-16	434561	6221560	7:35	1	1	11	1	Roadside	WIWA	25 - 50	S	-	-	
24-Jun-12	PC-16	434561	6221560	7:35	1	1	11	1	Roadside	WIWA	50 - 75	S	-	-	
24-Jun-12	PC-16	434561	6221560	7:35	1	1	11	1	Roadside	YRWA	50 - 75	S	-	-	
24-Jun-12	PC-10	434675	6223367	8:08	3	2	11	2	Roadside	FOSP	50 - 75	S	-	-	
24-Jun-12	PC-10	434675	6223367	8:08	3	2	11	2	Roadside	HETH	75 - 100	S	-	-	
24-Jun-12	PC-10	434675	6223367	8:08	3	2	11	2	Roadside	PAWR	25 - 50	S	-	-	
24-Jun-12	PC-10	434675	6223367	8:08	3	2	11	2	Roadside	PISI	75 - 100	S	-	-	
24-Jun-12	PC-10	434675	6223367	8:08	3	2	11	2	Roadside	YRWA	0 - 25	S	-	-	
24-Jun-12	PC-10	434675	6223367	8:08	3	2	11	2	Roadside	YRWA	50 - 75	S	-	-	
24-Jun-12	PC-17	434868	6224512	8:25	4	2	12	2	Roadside	BCCH	50 - 75	S	-	-	
24-Jun-12	PC-17	434868	6224512	8:25	4	2	12	2	Roadside	FOSP	75 - 100	S	-	-	
24-Jun-12	PC-17	434868	6224512	8:25	4	2	12	2	Roadside	HETH	75 - 100	S	-	-	
24-Jun-12	PC-17	434868	6224512	8:25	4	2	12	2	Roadside	PISI	25 - 50	S	-	-	
24-Jun-12	PC-17	434868	6224512	8:25	4	2	12	2	Roadside	UNPT	50 - 75	C	-	-	
24-Jun-12	PC-11	434713	6225432	8:45	4	2	12	2	Roadside	GCSP	50 - 75	S	-	-	
24-Jun-12	PC-11	434713	6225432	8:45	4	2	12	2	Roadside	HETH	50 - 75	V	-	-	
24-Jun-12	PC-11	434713	6225432	8:45	4	2	12	2	Roadside	ROPT	≥100	-	-	-	
24-Jun-12	PC-11	434713	6225432	8:45	4	2	12	2	Roadside	HETH	≥100	-	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
24-Jun-12	PC-18	434802	6226894	9:08	1	2	13	2	Roadside	DEJU	0 - 25	V	-	-	
24-Jun-12	PC-18	434802	6226894	9:08	1	2	13	2	Roadside	GCSP	50 - 75	S	-	-	
24-Jun-12	PC-18	434802	6226894	9:08	1	2	13	2	Roadside	HETH	50 - 75	S	-	-	
24-Jun-12	PC-18	434802	6226894	9:08	1	2	13	2	Roadside	HETH	75 - 100	S	-	-	
24-Jun-12	PC-18	434802	6226894	9:08	1	2	13	2	Roadside	GCSP	≥100	-	-	-	
24-Jun-12	PC-12	435066	6227670	9:31	1	2	13	2	Roadside	DEJU	25 - 50	S	-	-	
24-Jun-12	PC-12	435066	6227670	9:31	1	2	13	2	Roadside	FOSP	75 - 100	S	-	-	
24-Jun-12	PC-12	435066	6227670	9:31	1	2	13	2	Roadside	VATH	75 - 100	S	-	-	
24-Jun-12	PC-12	435066	6227670	9:31	1	2	13	2	Roadside	VATH	≥100	-	DEJU	-	
24-Jun-12	PC-12	435066	6227670	9:31	1	2	13	2	Roadside	HETH	≥100	-	DEJU	-	
24-Jun-12	PC-12	435066	6227670	9:31	1	2	13	2	Roadside	GCSP	≥100	-	-	-	
24-Jun-12	PC-12	435066	6227670	9:31	1	2	13	2	Roadside	GOEA	≥100	-	-	-	
25-Jun-12	PC-13	433719	6229545	4:38	3	3	4	2	Roadside	BASW	0 - 25	V	-	-	Species of concern
25-Jun-12	PC-13	433719	6229545	4:38	3	3	4	2	Roadside	BCCH	50 - 75	S	-	-	
25-Jun-12	PC-13	433719	6229545	4:38	3	3	4	2	Roadside	BCCH	75 - 100	S	-	-	
25-Jun-12	PC-13	433719	6229545	4:38	3	3	4	2	Roadside	DEJU	25 - 50	V	-	-	
25-Jun-12	PC-13	433719	6229545	4:38	3	3	4	2	Roadside	YRWA	0 - 25	S	-	-	
25-Jun-12	PC-19	433843	6231441	4:58	1	3	4	2	Roadside	FOSP	75 - 100	S	-	-	
25-Jun-12	PC-19	433843	6231441	4:58	1	3	4	2	Roadside	HETH	25 - 50	S	-	-	
25-Jun-12	PC-19	433843	6231441	4:58	1	3	4	2	Roadside	HETH	50 - 75	S	-	-	
25-Jun-12	PC-19	433843	6231441	4:58	1	3	4	2	Roadside	HETH	75 - 100	S	-	-	
25-Jun-12	PC-19	433843	6231441	4:58	1	3	4	2	Roadside	PISI	50 - 75	S	-	-	
25-Jun-12	PC-19	433843	6231441	4:58	1	3	4	2	Roadside	VATH	75 - 100	S	-	-	
25-Jun-12	PC-19	433843	6231441	4:58	1	3	4	2	Roadside	HETH	≥100	-	-	-	
25-Jun-12	PC-20	433853	6232147	5:14	3	3	5	2	Roadside	DEJU	0 - 25	C	-	-	
25-Jun-12	PC-20	433853	6232147	5:14	3	3	5	2	Roadside	FOSP	25 - 50	S	-	-	
25-Jun-12	PC-20	433853	6232147	5:14	3	3	5	2	Roadside	HETH	≥100	-	-	-	
25-Jun-12	PC-20	433853	6232147	5:14	3	3	5	2	Roadside	VATH	≥100	-	-	-	
25-Jun-12	PC-21	433443	6233331	5:32	3	3	6	2	Roadside	FOSP	75 - 100	S	-	-	
25-Jun-12	PC-21	433443	6233331	5:32	3	3	6	2	Roadside	DEJU	≥100	-	-	-	
25-Jun-12	PC-21	433443	6233331	5:32	3	3	6	2	Roadside	VATH	≥100	-	-	-	
25-Jun-12	PC-21	433443	6233331	5:32	3	3	6	2	Roadside	GCSP	≥100	-	-	-	
25-Jun-12	PC-22	434548	6235051	5:53	4	2	6	2	Roadside	FOSP	50 - 75	S	-	-	
25-Jun-12	PC-22	434548	6235051	5:53	4	2	6	2	Roadside	FOSP	75 - 100	S	-	-	
25-Jun-12	PC-22	434548	6235051	5:53	4	2	6	2	Roadside	HAFL	50 - 75	S	-	-	
25-Jun-12	PC-22	434548	6235051	5:53	4	2	6	2	Roadside	VATH	75 - 100	S	-	-	
25-Jun-12	PC-22	434548	6235051	5:53	4	2	6	2	Roadside	WIWA	25 - 50	S	-	-	
25-Jun-12	PC-22	434548	6235051	5:53	4	2	6	2	Roadside	YRWA	50 - 75	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
25-Jun-12	PC-22	434548	6235051	5:53	4	2	6	2	Roadside	YRWA	75 - 100	S	-	-	
25-Jun-12	HV-2	434441	6235221	6:01	4	2	6	2	Roadside	FOSP	0 - 25	V	-	-	
25-Jun-12	HV-2	434441	6235221	6:01	4	2	6	2	Roadside	FOSP	75 - 100	S	-	-	
25-Jun-12	HV-2	434441	6235221	6:01	4	2	6	2	Roadside	GCSP	50 - 75	S	-	-	
25-Jun-12	HV-2	434441	6235221	6:01	4	2	6	2	Roadside	HETH	75 - 100	S	-	-	
25-Jun-12	HV-2	434441	6235221	6:01	4	2	6	2	Roadside	SWTH	75 - 100	S	-	-	
25-Jun-12	HV-2	434441	6235221	6:01	4	2	6	2	Roadside	YEWA	25 - 50	S	-	-	
25-Jun-12	HV-2	434441	6235221	6:01	4	2	6	2	Roadside	YRWA	50 - 75	S	-	-	
25-Jun-12	HV-2	434441	6235221	6:01	4	2	6	2	Roadside	VATH	≥100	-	-	WIPT	
25-Jun-12	HV-3	434414	6235419	6:09	4	2	6	2	Roadside	FOSP	25 - 50	S	-	-	
25-Jun-12	HV-3	434414	6235419	6:09	4	2	6	2	Roadside	SAVS	50 - 75	S	-	-	
25-Jun-12	HV-3	434414	6235419	6:09	4	2	6	2	Roadside	VATH	75 - 100	S	-	-	
25-Jun-12	HV-4	434382	6235618	6:17	4	2	6	2	Roadside	FOSP	25 - 50	S	-	-	
25-Jun-12	HV-4	434382	6235618	6:17	4	2	6	2	Roadside	FOSP	50 - 75	S	-	-	
25-Jun-12	HV-4	434382	6235618	6:17	4	2	6	2	Roadside	FOSP	75 - 100	S	-	-	
25-Jun-12	HV-4	434382	6235618	6:17	4	2	6	2	Roadside	VATH	≥100	-	-	-	
25-Jun-12	PC-23	434718	6235719	6:31	4	2	6	2	Roadside	FOSP	25 - 50	S	-	-	
25-Jun-12	PC-23	434718	6235719	6:31	4	2	6	2	Roadside	FOSP	50 - 75	S	-	-	
25-Jun-12	PC-23	434718	6235719	6:31	4	2	6	2	Roadside	PISI	75 - 100	S	-	-	
25-Jun-12	PC-23	434718	6235719	6:31	4	2	6	2	Roadside	VATH	75 - 100	S	-	-	
25-Jun-12	PC-23	434718	6235719	6:31	4	2	6	2	Roadside	YEWA	75 - 100	S	-	-	
25-Jun-12	PC-23	434718	6235719	6:31	4	2	6	2	Roadside	YRWA	50 - 75	S	-	-	
25-Jun-12	PC-23	434718	6235719	6:31	4	2	6	2	Roadside	VATH	≥100	-	-	-	
25-Jun-12	A-2	434683	6235917	6:39	4	2	6	2	Roadside	FOSP	75 - 100	S	-	-	
25-Jun-12	A-2	434683	6235917	6:39	4	2	6	2	Roadside	HETH	75 - 100	S	-	-	
25-Jun-12	A-2	434683	6235917	6:39	4	2	6	2	Roadside	YEWA	50 - 75	S	-	-	
25-Jun-12	A-2	434683	6235917	6:39	4	2	6	2	Roadside	YEWA	75 - 100	S	-	-	
25-Jun-12	A-2	434683	6235917	6:39	4	2	6	2	Roadside	YRWA	25 - 50	S	-	-	
25-Jun-12	A-2	434683	6235917	6:39	4	2	6	2	Roadside	YRWA	50 - 75	S	-	-	
25-Jun-12	A-2	434683	6235917	6:39	4	2	6	2	Roadside	YRWA	75 - 100	S	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	FOSP	25 - 50	S	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	FOSP	50 - 75	S	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	GCSP	75 - 100	S	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	HETH	50 - 75	S	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	HETH	75 - 100	S	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	SWTH	25 - 50	S	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	SWTH	75 - 100	S	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	YEWA	0 - 25	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	YEWA	0 - 25	V	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	YRWA	50 - 75	S	-	-	
25-Jun-12	A-3	434669	6236116	6:48	4	2	6	2	Roadside	VATH	≥100	-	-	-	
25-Jun-12	A4	434658	6236317	7:05	4	2	6	2	Roadside	FOSP	50 - 75	S	-	-	
25-Jun-12	A4	434658	6236317	7:05	4	2	6	2	Roadside	FOSP	75 - 100	S	-	-	
25-Jun-12	A4	434658	6236317	7:05	4	2	6	2	Roadside	GCSP	50 - 75	S	-	-	
25-Jun-12	A4	434658	6236317	7:05	4	2	6	2	Roadside	GCSP	75 - 100	S	-	-	
25-Jun-12	A4	434658	6236317	7:05	4	2	6	2	Roadside	SAVS	75 - 100	S	-	-	
25-Jun-12	A4	434658	6236317	7:05	4	2	6	2	Roadside	SWTH	75 - 100	S	-	-	
25-Jun-12	A4	434658	6236317	7:05	4	2	6	2	Roadside	YEWA	25 - 50	S	-	-	
25-Jun-12	A4	434658	6236317	7:05	4	2	6	2	Roadside	YRWA	50 - 75	S	-	-	
25-Jun-12	A4	434658	6236317	7:05	4	2	6	2	Roadside	YRWA	75 - 100	S	-	-	
25-Jun-12	A5	434643	6236515	7:20	4	2	6	2	Roadside	FOSP	50 - 75	S	-	-	
25-Jun-12	A5	434643	6236515	7:20	4	2	6	2	Roadside	GCSP	75 - 100	S	-	-	
25-Jun-12	A5	434643	6236515	7:20	4	2	6	2	Roadside	GCTH	25 - 50	S	-	-	
25-Jun-12	A5	434643	6236515	7:20	4	2	6	2	Roadside	GCTH	75 - 100	S	-	-	
25-Jun-12	A5	434643	6236515	7:20	4	2	6	2	Roadside	PISI	50 - 75	V	-	-	
25-Jun-12	A5	434643	6236515	7:20	4	2	6	2	Roadside	SAVS	25 - 50	S	-	-	
25-Jun-12	A5	434643	6236515	7:20	4	2	6	2	Roadside	SAVS	75 - 100	S	-	-	
25-Jun-12	A5	434643	6236515	7:20	4	2	6	2	Roadside	GCSP	≥100	-	-	CORA	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	FOSP	25 - 50	S	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	FOSP	50 - 75	S	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	GCSP	50 - 75	S	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	GCSP	75 - 100	S	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	GCTH	75 - 100	S	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	YEWA	0 - 25	S	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	YEWA	25 - 50	S	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	YEWA	50 - 75	S	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	YEWA	75 - 100	S	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	GCTH	≥100	-	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	SWTH	≥100	-	-	-	
25-Jun-12	A6	434631	6236715	7:39	4	2	6	2	Roadside	VATH	≥100	-	-	-	
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	FOSP	50 - 75	S	-	-	
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	FOSP	75 - 100	S	-	-	
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	GCSP	75 - 100	S	-	-	
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	GCTH	75 - 100	S	-	-	
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	SAVS	50 - 75	S	-	-	
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	YEWA	0 - 25	S	-	-	

Appendix 7.4-5. Upland Breeding Bird Species Observed during VRPC Surveys, June 2012

Date	VRPC Station	Easting	Northing	Time	Wind	Sky	Temp (°C)	Noise	Habitat Type	Species	Distance Interval (m)	Cue	Before/After Survey Birds	Flyovers	Comments
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	YEWA	25 - 50	S	-	-	
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	YEWA	75 - 100	S	-	-	
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	SWTH	≥100	-	-	-	
25-Jun-12	PC-15	434612	6237010	7:50	4	2	6	2	Roadside	VATH	≥100	-	-	-	
25-Jun-12	L1	435010	6216628	8:56	4	4	7	2	Roadside	AMRO	25 - 50	S	-	-	
25-Jun-12	L1	435010	6216628	8:56	4	4	7	2	Roadside	TOWA	0 - 25	S	-	-	
25-Jun-12	L1	435010	6216628	8:56	4	4	7	2	Roadside	TOWA	25 - 50	S	-	-	
25-Jun-12	L1	435010	6216628	8:56	4	4	7	2	Roadside	VATH	50 - 75	S	-	-	
25-Jun-12	L1	435010	6216628	8:56	4	4	7	2	Roadside	YRWA	25 - 50	S	-	-	
25-Jun-12	L2	435024	6216423	9:10	4	4	7	2	Roadside	BCCH	25 - 50	V	-	-	
25-Jun-12	L2	435024	6216423	9:10	4	4	7	2	Roadside	HETH	75 - 100	S	-	-	
25-Jun-12	L2	435024	6216423	9:10	4	4	7	2	Roadside	HETH	≥100	-	-	PISI	
25-Jun-12	L2	435024	6216423	9:10	4	4	7	2	Roadside	VATH	≥100	-	-	PISI	
25-Jun-12	L3	435042	6216224	9:19	4	4	7	2	Roadside	BCCH	25 - 50	S	-	-	
25-Jun-12	L3	435042	6216224	9:19	4	4	7	2	Roadside	SWTH	75 - 100	S	-	-	
25-Jun-12	L3	435042	6216224	9:19	4	4	7	2	Roadside	TOWA	50 - 75	S	-	-	
25-Jun-12	L4	435139	6216041	9:30	3	4	7	2	Roadside	PAWR	25 - 50	S	-	-	
25-Jun-12	L4	435139	6216041	9:30	3	4	7	2	Roadside	TOWA	25 - 50	S	-	-	
25-Jun-12	L5	435189	6215845	9:37	3	4	7	2	Roadside	TOWA	25 - 50	S	-	-	
25-Jun-12	L5	435189	6215845	9:37	3	4	7	2	Roadside	VATH	75 - 100	S	-	-	

Appendix 7.4-6

Incidental Observations of Breeding Birds, Waterbirds, and Mammals during Baseline Surveys, June 2012

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Appendix 7.4-6. Incidental Observations of Breeding Birds, Waterbirds, and Mammals during Baseline Surveys, June 2012

Date	Baseline Survey	Easting	Northing	Common Name	Group	No. Observed	Comment
11-Jun-12	Raptor Standwatch	453666	6260834	Yellow Warbler	Passerine	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Townsend's Warbler	Passerine	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Orange-crowned Warbler	Passerine	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Varied Thrush	Passerine	1	
11-Jun-12	Raptor Standwatch	453666	6260834	American Green-winged Teal	Waterbird	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Barrow's Goldeneye	Waterbird	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Canada Goose	Waterbird	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Western-wood Peewee	Passerine	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Swainson's Thrush	Passerine	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Ruby-crowned Kinglet	Passerine	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Dark-eyed Junco	Passerine	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Lesser Yellowlegs	Waterbird	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Mallard	Waterbird	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Purple Finch	Passerine	1	
11-Jun-12	Raptor Standwatch	453666	6260834	Wilson's Warbler	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Olive-sided Flycatcher	Passerine	1	Species of concern
11-Jun-12	Raptor Standwatch	466864	6261022	Alder Flycatcher	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Townsend's Warbler	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Yellow Warbler	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Varied Thrush	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Black-capped Chickadee	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Swainson's Thrush	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Hermit Thrush	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Rufous Hummingbird	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Dark-eyed Junco	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	American Tree Sparrow	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Yellow-rumped Warbler	Passerine	1	
11-Jun-12	Raptor Standwatch	466864	6261022	Fox Sparrow	Passerine	1	
8-Jun-12	Raptor Standwatch	451449	6255263	Wilson's Warbler	Passerine	1	
8-Jun-12	Raptor Standwatch	451449	6255263	Yellow Warbler	Passerine	1	
8-Jun-12	Raptor Standwatch	451449	6255263	Townsend's Warbler	Passerine	1	
8-Jun-12	Raptor Standwatch	451449	6255263	Pine Siskin	Passerine	Flock	More than 4
8-Jun-12	Raptor Standwatch	455699	6252983	Arctic Tern	Waterbird	10	
8-Jun-12	Raptor Standwatch	455699	6252983	Blue-winged Teal	Waterbird	3	
9-Jun-12	Raptor Standwatch	422117	6261452	Mountain Goat	Mammal	3	
9-Jun-12	Raptor Standwatch	422117	6261452	Yellow Warbler	Passerine	1	
9-Jun-12	Raptor Standwatch	422117	6261452	Varied Thrush	Passerine	1	
9-Jun-12	Raptor Standwatch	422117	6261452	Chipping Sparrow	Passerine	1	
9-Jun-12	Raptor Standwatch	422117	6261452	Western-wood Peewee	Passerine	1	
10-Jun-12	Raptor Standwatch	452367	6251399	Mallard	Waterbird	2	
10-Jun-12	Raptor Standwatch	452367	6251399	Swainson's Thrush	Passerine	1	
10-Jun-12	Raptor Standwatch	452367	6251399	Yellow Warbler	Passerine	1	
10-Jun-12	Raptor Standwatch	452367	6251399	American Robin	Passerine	1	
12-Jun-12	GB DNA Collection	456092	6270105	Rusty Blackbird	Passerine	1	Species of concern

Appendix 8.2-1

Western Toad Observations, 2011 and 2012

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Appendix 8.2-1. Western Toad Observations, 2011 and 2012

		UTM's			Western Toads				Other Amphibians			
Date	Site	Zone	Easting	Northing	Adult	Juvenile	Toadlet	Tadpole	Species	Adult	Tadpole	Comments
24-Jul-12	Pond 1 (unlabelled wetland/pond/lake)	9 V	469236	6258057	1	0	0	0	Columbia Spotted Frog	5	0	Does not show fen area around edge of lake on map
24-Jul-12	Wetland 36	9 V	467771	6260556	1	0	0	1	Columbia Spotted Frog	3	2	Shaun Freeman has an observation of tadpoles here 01-Jul-11
25-Jul-12	Potential Toad Site 05	9 V	458347	6263741	0	N/A	N/A	N/A	Columbia Spotted Frog	6	7	
25-Jul-12	Potential Toad Site 12	9 V	451668	6259497	0	0	0	0	Columbia Spotted Frog	1	0	
25-Jul-12	Potential Toad Site 13	9 V	452111	6259782	2	2	0	0	Columbia Spotted Frog	0	0	Juvenile toads or smaller male toads? If Juvenile then breeding?
25-Jul-12	Wetland 35	9 V	452094	6260638	1	0	1	13	Columbia Spotted Frog	3	0	
25-Jul-12	Wetland 40	9 V	453697	6261833	0	0	1	0	Columbia Spotted Frog	5	10	Found 1 toadlet but probably dispersing from upland pond - not at breeding location
26-Jul-12	Pond 02	9 V	468296	6262048	0	0	0	300+	Columbia Spotted Frog	0	0	Dug out pond by logging road
26-Jul-12	Pond 03	9 V	468142	6262085	0	0	0	100+	Columbia Spotted Frog	1	0	Dug out pond by logging road
26-Jul-12	Pond 04	9 V	468306	6260970	0	0	0	0	Columbia Spotted Frog	3	10	
26-Jul-12	Potential Toad Site 06	9 V	456928	6263217	0	N/A	N/A	N/A	Columbia Spotted Frog	1	0	
26-Jul-12	Wetland 47	9 V	457119	6263310	0	N/A	N/A	N/A	Columbia Spotted Frog	28	36	Large wetland-several pond and meandering water through open grassy area
27-Jul-12	Pond 05	9 V	439933	6253979	0	0	0	1000+	N/A	0	0	shallow alpine pool
27-Jul-12	Potential Toad site 04	9 V	459902	6263534	0	0	0	0	Columbia Spotted Frog	15	30	
27-Jul-12	Potential Toad Site 22 (btw Wetland 6 and 10)	9 V	449126	6251326	1	0	0	0	N/A	0	0	
27-Jul-12	Wetland 11	9 V	454923	6253926	0	0	0	0	Columbia Spotted Frog	1	3	2 of the tadpoles were actually metamorphs - had tail and all limbs
28-Jul-12	Pond 06	9 V	468974	6258675	1	2	2	0	Columbia Spotted Frog	3	0	
28-Jul-12	Wetland 23 (Potential Toad Site 01)	9 V	467446	6259146	0	0	0	0	Columbia Spotted Frog	3	21	large tadpoles
30-Aug-12	incidental fisheries	9V	469533	6257982	0	0	50	0	N/A	0	0	
1-Aug-12	incidental @ camp	9V	467608	6263401	3	0	0	0	N/A	0	0	Incidental observation at wildfire exploration camp coming from under camp buildings
3-Jul-11	Wetland 36	9 V	467771	6260556	0	0	0	100	N/A	0	0	

Appendix 8.2-2

Western Toad Chytrid Analysis, 2012

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Facsimile: (604) 556-3010
Toll-Free : 1-800-661-9903

Final Report AHC Case: 13-132

Last Updated: 01/14/13 3:55 PM
Pathologist: Dr. J Robinson, DVM, PhD
Received Date: 01/11/13
Collected Date:
Client Ref No:

Veterinarian:
Clinic:
Phone:
Fax:

Submitter: Kate Fremlin
Phone:
Fax:
Owner: Rescan Environmental Serv
Phone:
Fax:(604) 687-4277

Animal Data
Species: Western Toad
Breed:
Sex:
Age:
Premise ID:

Case History
Submitted one Western Toad frog swab for Chytrid by PCR.

Brucejack chytrid sample. July 25/12 (ANBO). Weto 5. 9V452111, 6259282.

Molecular Diagnostics

Batrachochytrium dendroba Resulted by: Ken Sojonky Verified by: Dr. J. Robinson on 01/14/13 @ 3:55 PM

Specimen	ID	Test	Result
Swab	PCR - not specified	Batrachochytrium dendroba	Negative

History of Communication

Date	To	Description
01/15/13 11:53 AM	Rescan Environmental Serv - e-mail	bc report sent

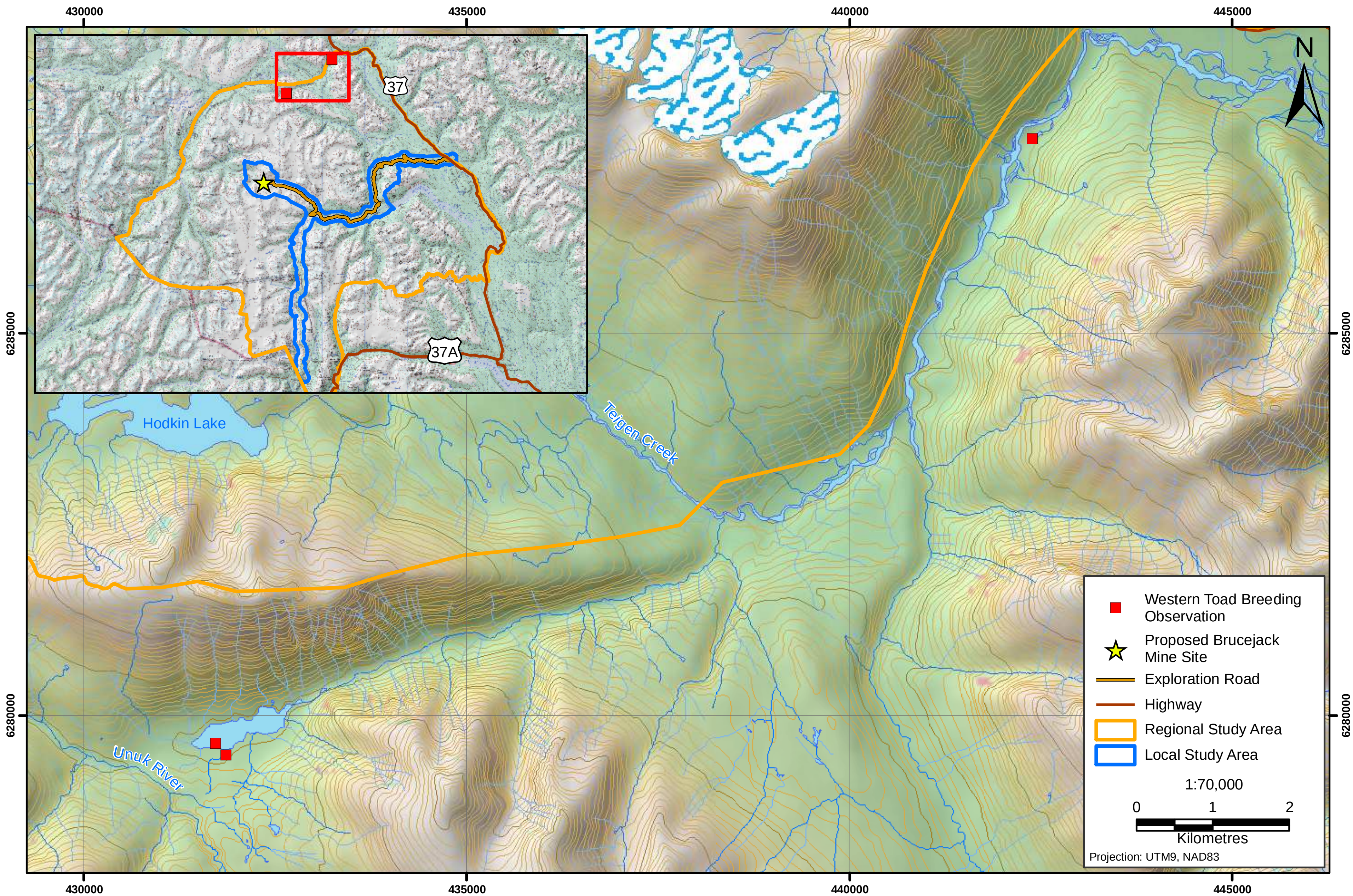
John H. Robinson

Dr. J Robinson, DVM, PhD
John.Robinson@gov.bc.ca

END OF REPORT

Appendix 8.2-3

Regional Western Toad Observations



Appendix 8.2-3

PRETIVM

Regional Western Toad Observations

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