

Wildlife Management Plan, Search Project Phase II, Geoscience BC

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● File: 1876-002.01
May 2016

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1.0 INTRODUCTION

Geoscience BC is a non-profit organization established in 2005 from an investment from the Province of British Columbia (BC). Geoscience BC generates earth science information in partnership with First Nations, resource sector, universities, governments and communities to encourage investment and enable informed land use decisions for the benefit of all British Columbians.

In 2015, Geoscience BC initiated a new multi-year minerals project in BC's west-central region. The Search Project, named for an area spanning two of BC's mineral-rich geological terranes – the Stikine and Quesnel, is gathering new, high-resolution geophysical data using airborne magnetic surveys. This data is made publically available for the purpose of advancing mineral exploration, science activities and for informing land use planning. The Search Project is generating regional data at a much higher resolution than is currently available from magnetic surveys conducted in the 1980s and from the 2008 airborne gravity and electromagnetic (EM) surveys conducted as part of Geoscience BC's QUEST-West project (a partnership with the Regional District of Bulkley-Nechako and the Northern Development Initiative Trust). The airborne magnetic surveys of the Search Project use magnetic sensor technology mounted on aircraft that gathers regional data during flights along east-west trending lines at a line spacing of 250 m and along north-south trending lines at a line spacing of 2,500 m. These magnetic surveys passively read the natural magnetic signature of the earth using a magnetometer, and improve on the results from surveys flown in 2008 which measured the resistivity and conductivity (EM) and gravity responses of the earth at two- and four-kilometre separation.

Phase I of the Search Project was completed in 2015, and Phase II is anticipated to commence in June 2016. These areas will join an area flown in 2013 as the TREK project (**Figure 1**). Phase II is anticipated to include up to 125,000 line kilometres (km) of lines surveyed over an approximate 28,600 km² area between Smithers and Vanderhoof, BC (**Figure 1**).

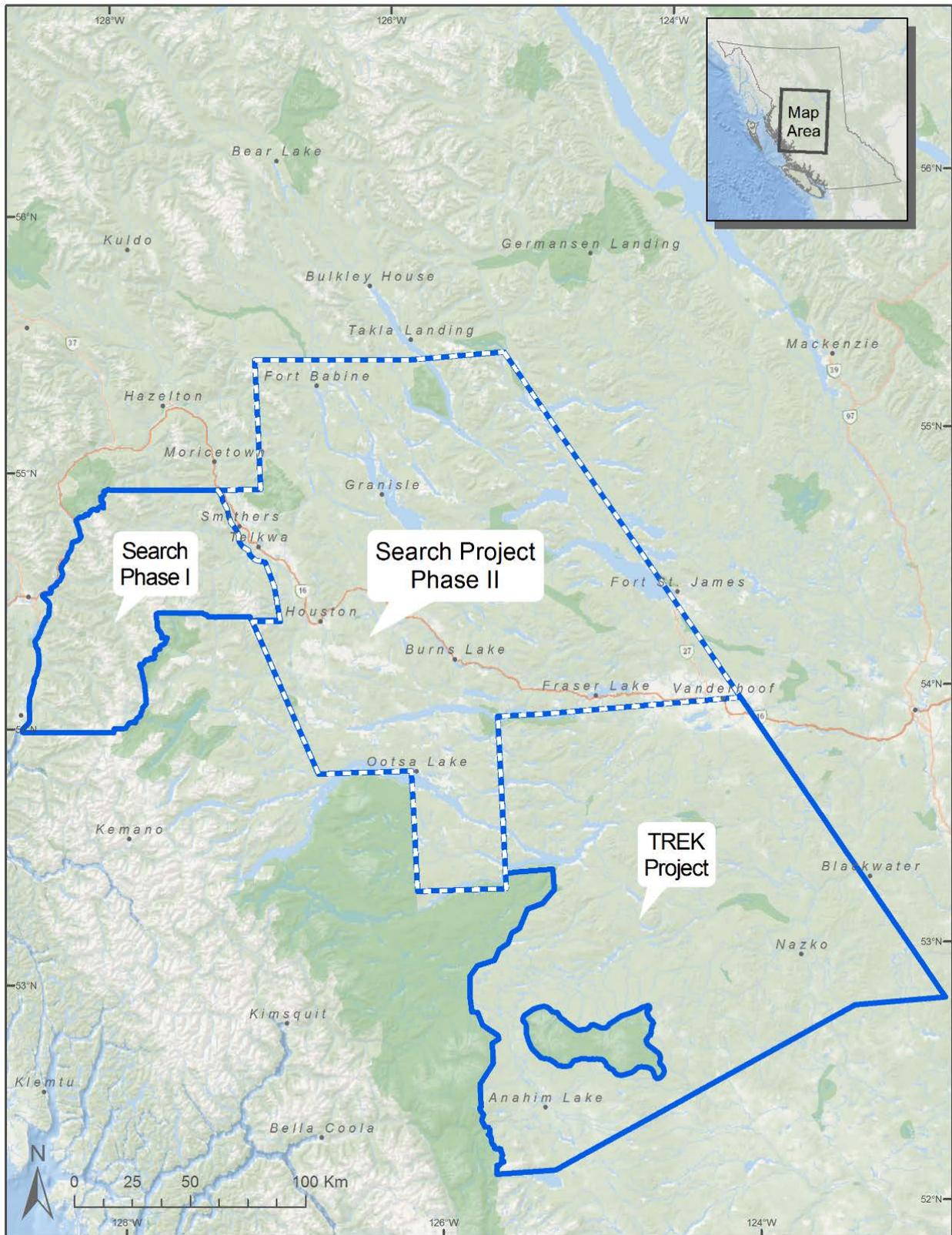


Figure 1 Search Project Phase II overview map.

Similar to the 2015 Phase I airborne survey, Geoscience BC has not planned activities on the ground during the time of the 2016 survey and therefore will not contribute to land disturbance in the Phase II survey area. With the anticipated footprint being roughly four times that of the Phase I survey, multiple aircraft will likely be deployed.

1.1 WILDLIFE MANAGEMENT PLAN OBJECTIVES AND BACKGROUND

The objective of this Wildlife Management Plan is to avoid and minimize the potential for disturbance effects on wildlife in association the 2016 summer through early fall airborne magnetic survey. The management measures outlined in the plan focuses on the following species of interest (SOI):

- Caribou (*Rangifer tarandus* (Telkwa, Takla, Tweedsmuir, and Wolverine sub-populations of the southern mountain population))
- Mountain goat (*Oreamnos americanus*)
- Mule deer (*Odocoileus hemionus*)
- Moose (*Alces americanus*)
- Elk (*Cervus elaphus*)
- Grizzly bear (*Ursus arctos*).

These SOI were selected because they are:

1. species at risk or are of conservation concern,
2. of importance to local First Nations (see **Section 1.2**),
3. are known to be both present and potentially affected by the activities, and
4. mentioned in management plans.

American black bear (*Ursus americanus*) are yellow-listed in BC (or not at risk) and ranked as Priority 6 on the Conservation Framework (CDC 2015), indicating a lower conservation priority relative to other species in the province. Black bear were not considered as a standalone SOI because they did not meet the criteria listed above, and potential effects to black bear will be sufficiently mitigated by measures proposed to address effects to grizzly bear.

The Telkwa, Takla, Tweedsmuir and Wolverine caribou sub-populations (or herds) are northern ecotype caribou classified by the Province of BC and the Government of Canada as a species at risk. Provincial and federal classifications differ, and the borders that each government recognises also differ. The Province of BC considers these herds as “blue-listed” (of special concern), and the federal government designates the herd as “Threatened” under Schedule 1 of the *Species at Risk Act*, SARA (Cichowski 2014, BC CDC 2015). These herds are also listed as an Identified Wildlife Management Species under the *Forest and Range Practices Act*, FRPA (Cichowski 2014).

The survey area overlaps with federally-designated critical habitat for the Telkwa, Takla and Wolverine caribou herds, and a proposed Wildlife Habitat Area (provincial) for the Telkwa caribou herd. There are approved Ungulate Winter Range (provincial) areas designated for caribou, mountain goats, mule deer, moose and elk throughout the survey area. These designations and overlaps are discussed in more detail in **Section 2.1**.

1.2 FIRST NATION TRADITIONAL LAND USE

Publically available information from First Nations with traditional territories in the Phase II survey area was reviewed and used to inform the selection of SOI. Small mammals, fish, birds and other traditional harvest species that are not affected by the Search Phase II project were not included. Using this approach information from the Babine Lake First Nation, Wet’suwet’en Nation, and Yekooche First Nation was obtained. Other First Nations and further

Table 1 Publically-available traditional land use information used to inform the management plan.

	Terrestrial wildlife species						
	Caribou	Mountain goat	Moose	Elk	Mule deer	Grizzly bear	Black bear
Babine Lake First Nation							
Known traditional use from publically available information (EAO 2012)	Y	Y	Y	-	-	-	Y
Wet’suwet’en Nation							
Known traditional use from publically available information (Gauthreau et al. 2007)	Y	Y	Y	-	Y	-	Y
Yekooche First Nation							
Known traditional use from publically available information (ILMB 2007)	Y	Y	Y	-	-	-	Y
Potential project interaction	Y	Y	Y	Y	Y	Y	Y

Notes: Y = yes; N = no; - = Unknown, traditional use of this species not discussed in public documents.

1.3 MANAGEMENT PLAN OVERVIEW

This plan uses information on the biology and known distributions of the wildlife SOI, relevant publically available First Nations traditional ecological knowledge, and a description of the Search Project Phase II activities to best understand the timing and magnitude of potential effects. Best management practices and mitigation measures that will be followed by the Geoscience BC and their contractors to avoid and or minimize potential effects during airborne magnetic surveys are then presented.

2.0 TERRESTRIAL WILDLIFE SPECIES OF INTEREST

2.1 UNGULATES

Ungulates are priority wildlife species in northern BC and are the focus of the provincial and federal guidance documents to manage effects, and in the case of caribou, recovery. Management guidance from the Government of Canada related to the southern mountain caribou population (a group that includes the Telkwa, Takla, Tweedsmuir and Wolverine herds) comes from the *Recovery Strategy for the Woodland Caribou, Southern Mountain population (Rangifer tarandus caribou) in Canada* (EC 2014). The goal of the recovery strategy is to achieve self-sustaining populations in all local population units within their current distribution, to the extent possible (EC 2014). The provincial *Mountain Goat Management Plan* (2010) outlines the management goal for mountain goats in BC, which is to maintain viable, healthy and productive populations of mountain goats throughout their native range. The *Provincial Framework for Moose Management in BC* (MFLNRO 2015) provides guidance and provincial direction for sustainable management of moose in BC. There are no guidance documents for the management of mule deer or elk in the Skeena and Omineca regions of BC, in which the Phase II survey area overlaps.

Under the SARA, critical habitat is defined as “the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species’ critical habitat in the recovery strategy or in an action plan for the species.” For southern mountain caribou, critical habitat identification was guided by the location, amount and type of habitat necessary to maintain or recover self-sustaining local population units throughout their distribution.

The western edge and northeastern corner of the Phase II survey area overlap with areas that have been identified by the Government of Canada as approved critical habitat under the SARA for caribou (**Figure 2a** and **2b**). The area along the western edge of the survey area has also been identified by the Province of BC as proposed Wildlife Habitat Area (WHA) for caribou designated under the *Forest and Ranges Practices Act* (FRPA). This area is also known as the Telkwa Caribou Recovery Area, an area not subject to formal designation or legislation that has been the focus of caribou management efforts by the community and the Province of BC since the 1960s (Vanderstar and Keim undated).

Also within the Phase II survey area are approved ungulate winter ranges (UWR) (**Figure 2a** and **2b**), areas designated under the FRPA requiring tenure holders to adhere to management guidance. UWR areas contain habitat necessary to meet the winter habitat requirements of an ungulate species, and the management restrictions do not apply to Geoscience BC activities. However, the General Wildlife Measures for the approved UWR offer good guidance in terms of spatial intersect areas and mitigation.

Potential effects on ungulates as a result of low level flights over may lead to increased energy expenditures, long term behavioural changes such as displacement from traditional ranges, and in extreme cases physical injury or death. The level of reaction by ungulates to low flying aircraft varies by species, season, quality of cover nearby and the vertical or horizontal distance of the flight from the animal (Webster 1997).

The following sections describe important habitat features and life requites for ungulate species of interest.

2.1.1 Caribou

Low elevation forested habitat and high elevation alpine habitat are used during both winter and summer, though specific use of these habitats during the year vary between herds (Cichowski et al. 2004). Northern ecotype caribou are more widely dispersed during the summer months than during another other season because they are not limited by snow and there is generally abundant herb and shrub forage available (Cichowski 2014). They feed on a variety of vegetation including grasses, forbs, sedges, fungi, lichens and the leaves of shrubs (Cichowski et al. 2004), and open habitats in riparian areas, or other forests with rich soils and open canopies, and terrestrial lichen habitats that produce large amounts of green forage during spring, summer and fall seasons are valuable (ILMB 2007).

During the winter most northern ecotype caribou live in areas of relatively shallow snowpack and primarily feed on terrestrial lichens; however some herds such as the Takla have adapted to their environment and instead feed primarily on arboreal lichens in winter, a forage resource unused by other local ungulates, and providing physical separation from most predators during much of the year (Poole et al. 2000, Stevenson et al. 2003, EC 2014). While habits vary between years and among animals, generally the herds are non-migratory (ILMB 2007).

The Telkwa Mountains supports an isolated caribou herd that has been identified for rehabilitation. From a minimum of 271 caribou in 1965, the Telkwa herd declined to about 13 in March 1996, despite a complete closure on hunting after 1973 (Bulkley Valley CRBIPT 1998). The herd was augmented with a translocation of ~30 caribou from the Sustat-Chase herd in 1998 (Vanderstar and Keim, undated). In 2013 the population was about 25 animals, based on 16 caribou counted during an October 2013 survey (FLNRO, unpublished data).

The most recent population estimates for the other herds are as follows:

- Takla herd –122 individuals in 2004 (EC 2014).
- Tweedsmuir herd - 300 individuals in 2002 (EC 2014).
- Wolverine herd - 341 individuals in 2010 (EC 2014).

Threats to caribou include habitat loss and disturbances from industrial developments, predation, roads, and recreational activities. Caribou are most sensitive to disturbance during the late winter and pre-calving season, when cows are at a late stage of pregnancy and in generally the poorest physical condition, and spring while calving and rearing (MFLNRO 2015). Noise-related disturbance, traffic and/or other anthropogenic factors could result in displacement of caribou from preferred habitat, increased stress, changes in movement patterns, increased energy expenditures, and/or physical injury or death (Cichowski et al. 2004).

2.1.2 Mountain Goats

Coastal and interior populations undergo seasonal movements tied to elevation. During the spring and early summer goats will usually remain in lower elevations to feed on early green vegetation and move to higher elevation at or above treeline during summer and fall to feed on alpine swales and boulder meadows beside steep cliffs (Blood 2000a). Summer habitat selection differs from winter selection in that goats seek thermal cover (e.g., rock walls and or higher elevations and persistent snow) to avoid warm temperatures, but is similar in the requirement for escape terrain. Winter is a critical season for mountain goat survival (Coté and Festa-Bianchet 2003, Poole et al. 2009) due to cold temperatures, reduced forage availability and the energetic costs of moving through deep snow (Dailey and Hobbs 1989).

Mountain goats are generalist herbivores, grazing and browsing on alpine and sub-alpine grasses, sedges, rushes and forbs in summer, and on a variety of shrubs, conifers, mosses and lichens in winter. Forage sites are selected based on topographical features rather than availability of specific forage species (Boyd et al. 1986). They select steep and rugged terrain of rock outcrops, fractured cliffs, ledges, and talus slopes (Gilbert and Raedeke 1992). This steep escape terrain is required throughout the year and is generally steep and broken surfaces with rock outcrops at 40° to 65° gradient (Smith 1976, Foster and Rahe 1983, Fox et al. 1989, Keim 2004). Goats spend little time greater than 500 m from steep rocky terrain and goats in the Morice LRMP area are found only where they have access to these habitats. Most of the goats in the Morice LRMP area are found south of the Bulkley River and north of Babine Lake (ILMB 2007).

Nursery groups comprised of adults and sub-adult females, sub-adult males, and young of both sexes, form not long after nannies and kids leave the parturition sites. The nursery groups will typically move upslope, following the growth of new forage vegetation to their summer range. Summer range typically associated with meadow-like openings that have rich forage and nearby escape terrain and is particularly important habitat for mountain goats during early rearing (Mountain Goat Management Team 2010). In the areas, such as the Telkwa Ranges, Nadina Mountain and Morice Mountain, goats use alpine habitats in summer (ILMB 2007).

Mountain goat population estimates in the Skeena and Omineca regions are estimated to be stable and in the range of 18,000 to 35,000 and 3,000 to 4,000, respectively (MOE 2014).

Mountain goats are considered to react to human disturbance to a higher degree than most ungulates. Human proximity can cause disturbance that varies from short term (e.g., increased vigilance and short flight response) to long term (displacement from preferred habitat). Nannies appear to be most sensitive to disturbance during the kidding and early rearing seasons (Penner 1988 in Mountain Goat Management Team 2010).

The literature relating to mountain goat sensitivity to human-caused disturbances is small and somewhat divided. Sources that are typically cited reporting adverse effects (Foster and RaHS 1983, Joslin 1986, Côté 1996) are related to low-level helicopter traffic and based on observed behavioral responses (short term study) rather than on documented population level effects (long-term study) (Hatler 2012). Other observers (Penner 1988) reported that goats accepted or tolerated (habituated) indirect and persistent noise disturbance not accompanied by harm or intentional harassment factors. There is currently little evidence to suggest that human-caused disturbances (human presence, mining activity, aircraft) will result in population level effects or the abandonment of nearby mountain goat habitat (Hatler 2012).

Depending on the season, proximity, duration, topography and their degrees of prior exposure to aircraft activity, mountain goat reactions to aircraft will vary (Varley 1998, Mountain Goat Management Team 2010). Fixed-wing aircraft appear to be less disruptive than helicopters for ungulates, including mountain goats (Frid 2003 in Mountain Goat Management Team 2010). Their behavioural reactions in response to helicopter activity can range from no disruption (weak response) to temporary abandonment of habitat (strong response) (Goldstein et al. 2005 in Mountain Goat Management Team 2010).

2.1.3 Moose

Moose are one of the most widely distributed ungulates in the province. In northern regions moose have high cultural and socioeconomic value for First Nations and throughout the province moose are an important game species (Blood 2000*b*).

In mountainous regions of the BC, moose usually migrate between winter-spring ranges in valley bottoms and higher-elevation summer ranges. In spring, when the snow has become patchy and no longer prevents them from traveling, many moose move quickly to spring ranges, which are essentially extensions of their winter ranges. Moose can stay on high-elevation ranges longer than other ungulates in the fall (Blood 2000*b*). Like other ungulates, moose are attracted to mineral licks. In spring and summer, aquatic vegetation like horsetail, burweed, and submerged pondweeds are eaten in addition to shrubby browse (Blood 2000*c*, MFLNRO 2014).

Population estimates in the Skeena region for moose are estimated to be stable and in the range of 25,000 to 45,000 (MOE 2014). In the Omineca region, population estimates are estimated to be declining and in the range of 15,000 to 35,000 (MOE 2014).

Potential threats to moose from industrial activities include habitat change, disturbance, access and harvest. Noise from land and aerial vehicles can affect habitat use by moose (MFLNRO 2014). Increased access and the corresponding hunting pressure can have an effect on moose numbers.

2.1.4 Elk

Elk are provincially yellow-listed and are not listed federally by COSEWIC or SARA. In northern regions elk have cultural socio-economic value for subsistence and recreational hunting (MFLNRO 2014).

Elk undergo annual seasonal horizontal and vertical (elevation) migrations to meet their life requisites, using higher-elevation habitats from spring to summer (Parker and Sittler 2003), and moving to lower elevations in the late winter. In mountainous regions, elk will utilize alpine meadows during the summer and spend the winters in valleys. On more level terrain, elk use wooded hillsides during the summer, and open grasslands in winter (BC CDC 2016).

In May and June, most elk migrate to subalpine and alpine basins and avalanche tracks, which support lush herbaceous vegetation. Their winter ranges include open forest, grassy benchlands, and floodplain marshes (Blood 2000c). Although primarily a grazing species, elk utilize a wide variety of forbs, shrubs, and tree species as forage. This adaptable diet enables elk to occupy a range of habitats (MoFLRNO 2014).

Population estimates in the Skeena region for elk range from 200 to 500, with populations either stable or increasing (MOE 2014). In the Omineca region, population estimates for elk range from 500 to 2,000 and the population trend is estimated to be increasing (MOE 2014).

Potential threats to elk from industrial activities include habitat change, disturbance, access and harvest. Elk are sensitive to anthropogenic disturbances including roads, traffic, and increased human presence, (Morrison et al. 1995, Cole et al. 1997), but there is evidence that elk will habituate to prolonged, repetitive disturbance (Thompson and Henderson 1998, Borkowski et al. 2006). Noise from land and aerial vehicles can affect habitat use by elk. Increased access and the corresponding hunting pressure can have an effect on elk numbers (MFLNRO 2014).

2.1.5 Mule Deer

Mule deer are provincially yellow-listed and are ranked as Priority 6 on the Conservation Framework (CDC 2015), indicating a lower conservation priority relative to other species in the province. Mule deer are of economic, management, and cultural value.

The migration distance between summer and winter range can be variable; mule deer require higher elevation meadows and riparian areas in the summer, and lower-elevation shallow snow packs in the winter (Blood 2000*d*). Mule deer forage on a variety of woody stemmed plants as well as various grasses and forbs. In early spring, mule deer are found on moderate to steep, south and west facing slopes at medium elevations where plants first emerge (Blood 2000*d*, Yaremko 2003). During summer, mule deer move to higher elevation meadows and riparian areas (Blood 2000*d*). The winter season forces them from high elevation habitats to low elevation areas with a combination of steep, south aspect slopes, shelter from deep snow packs and includes both dense and old-growth forests (Blood 2000*d*, Yaremko 2003).

Mule deer population estimates in the Skeena region are declining and range from 2,000 to 3,000 (MOE 2014). In the Omineca region, population estimates for mule deer range from 3,000 to 6,000 and the population trend is estimated to be stable (MOE 2014).

Similar to elk, potential threats to mule deer from industrial activities include habitat change, disturbance, access and harvest. Noise from land and aerial vehicles can affect habitat use by mule. Increased access and the corresponding hunting pressure can have an effect on mule deer numbers deer (MFLNRO 2014).

2.2 GRIZZLY BEAR

Grizzly bear are listed as Special Concern by COSEWIC, but have no status or schedule under SARA. Provincially they are a species of special concern (blue-listed), as well as identified wildlife under the provincial Identified Wildlife Management Strategy (IWMS).

Grizzly bears make considerable seasonable movements across the landscape in search of seasonal foods, mates and denning sites. In BC, female grizzly bears have home ranges of 25 to 200 km² and adult males have ranges of 60 to 700 km² or more (MFLNRO 2014). Productive grizzly bear foraging habitats are generally on forested, or partially forested sites, in older forest stands with abundant canopy gaps, or in regenerating stands affected by fire (Gyug et al. 2004). Disturbed sites, including regenerating cutblocks, transmission line, road, and pipeline rights-of-way can also provide early seral feeding habitat. In contrast, denning sites, thermal cover, and security cover habitats are typically located in closed-canopy forested stands with little human activity or disturbance. Roadless areas with a mosaic of early seral stands and natural openings, located in proximity to forested stands that provide security areas for day beds and hiding cover are considered to be optimal grizzly bear habitats (Hamer and Herrero 1987, Nielsen et al. 2004).

During the winter, grizzly bears hibernate in dens dug out into steep slopes where snow accumulates. They may also use or modify hollow trees or crevices for denning. Den sites may occur on well-drained slopes at high elevations and are often on north-facing slopes (Gyug et al. 2004, BC CDC 2016).

3.0 LAND USE PLANNING

The Phase II survey area is within six Land and Resource Management Plan (LRMP) areas (**Figure 2a** and **2b**) and is therefore subject to the guidance within the following plans.

- Bulkley LRMP (Bulkley Valley CRBIPT 1998)
- Morice LRMP (ILMB 2007)
- Lakes District LRMP (ILMB 2002)
- Vanderhoof LRMP (VLRPG 1997)
- Fort St. James LRMP (ILMB 1999)
- Kispoix LRMP (KLRMPT 1996)

To be consistent with the objectives of the above LRMPs, the following general management and mitigation measures for wildlife will be considered for the project:

Table 2 Relevant LRMP objectives and strategies by wildlife species of interest.

LRMP	Relevant LRMP Objectives	Relevant LRMP Strategy
Caribou		
Bulkley LRMP	No overlap with landscape planning units with objectives for caribou.	N/A
Morice LRMP	<p><i>Objectives and management direction for woodland caribou apply only in the Caribou Management Areas (see Map 12: Caribou Management Areas).</i></p> <p>9) Limit disturbance of caribou as a result of motorized activities in identified caribou management sub-areas.</p>	<ul style="list-style-type: none"> • Where practicable, avoid repeated flights in or near no-fly zones, identified through the Telkwa Caribou Recovery Plan on Map 12: Caribou Management Areas, during the period May 15 to June 30. • In other Caribou Management Areas, use best management practices when operating aircraft in the vicinity of caribou habitat. • Inform local pilots of known high value areas and season of use. • Provide information on flying and landing practices that minimize caribou disturbance.
Lakes District LRMP	<p>Caribou migration corridor sub-zone – Resource developed:</p> <p>3) To allow for resource development in a manner which minimizes impact to caribou habitat values.</p>	<ul style="list-style-type: none"> • The duration and extent of resource exploration and development disturbances within high and very high use areas will be managed to minimize impacts to identified caribou habitat values.
Vanderhoof LRMP	Management is focused on the applicable RMZs, in particular, the Entiako Protected Area and the Laidman Lake Multi-Value RMZ which occur outside of the survey area.	N/A

LRMP	Relevant LRMP Objectives	Relevant LRMP Strategy
Fort St. James	<p>General Management Direction – Maintain current caribou populations and habitat by reducing risk through carefully controlled resource development. (there is no specific direction for aerial surveys/disturbance in the Ft St James LRMP)</p>	<p>Management strategies for Specific Caribou Management Areas – pertaining to ground-based activities only.</p>
	<p>Takla-Middle Resource Management Zone - Manage valuable habitats for a variety of species.</p>	<ul style="list-style-type: none"> • No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
	<p>Mitchell Resource Management Zone - Manage to maintain identified valuable habitats for a variety of species.</p>	<ul style="list-style-type: none"> • No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Kispiox LRMP	No objectives for caribou.	N/A
Mountain goat		
Bulkley LRMP	<p>Planning Unit 5-8 – The relative importance for wildlife values in this unit is high. Mountain goats are found in abundance on Mount Seaton, Blunt Mountain, Goat Mountain, and in the Babine Recreation Area. Sub-unit 5-8: Blunt Mountain - to manage for a variety of values and activities in an integrated and compatible manner.</p>	<ul style="list-style-type: none"> • Ensure mountain goat habitat is maintained.
Morice LRMP	<p><i>Objectives and management direction for mountain goat apply only in Mountain Goat Management Areas (see Map 13 of the LRMP: Mountain Goat Habitat Areas).</i> <i>Map 13 shows suitable and known mountain goat use areas based on predictive habitat suitability modeling and extensive survey work.</i> 15) Limit disturbance to mountain goats as a result of motorized activities in identified mountain goat areas.</p>	<ul style="list-style-type: none"> • Use best management practices when operating aircraft in the vicinity of occupied mountain goat habitat. Inform local pilots of known high value areas and season of use. Provide information on flying and landing practices that minimize goat disturbance. • Where practicable, avoid repeated flights in or near occupied mountain goat areas identified. • Consider the use of an adaptive management approach to refine and test best management practices for helicopter and winter motorized access.
Lakes District LRMP	No relevant objectives for mountain goat.	N/A
Vanderhoof LRMP	No objectives for mountain goat.	N/A
Fort St. James	<p>General Management Direction – Manage alpine habitats and adjacent areas to maintain mountain goat populations.</p>	<ul style="list-style-type: none"> • Timing elements of resource development in the proximity of valuable goat habitat will be considered.
	<p>General Management Direction – Mitigate impacts of access to mountain goat habitat.</p>	<ul style="list-style-type: none"> • No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.

LRMP	Relevant LRMP Objectives	Relevant LRMP Strategy
	Takla-Middle Resource Management Zone – Manage valuable habitats for a variety of species.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Kispiox LRMP	General Management Direction - To protect or enhance populations and habitat of rare or endangered and regionally significant species. No relevant objectives for aerial surveys/disturbance.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Moose		
Bulkley LRMP	No objectives for moose	N/A
Morice LRMP	19) Maintain or enhance moose summer and winter forage habitats.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Lakes District LRMP	No relevant objectives for moose.	N/A
Vanderhoof LRMP	General Management Direction - Maintaining or enhancing moose populations and habitat.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Fort St. James	General Management Direction - Maintain (and enhance where appropriate) moose populations and habitats outside of areas managed for caribou.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Kispiox LRMP	General Management Direction - To protect or enhance populations and habitat of rare or endangered and regionally significant species.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Elk		
Bulkley LRMP	No objectives for elk.	N/A
Morice LRMP	No relevant objectives for elk.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Lakes District LRMP	No objectives for elk.	N/A
Vanderhoof LRMP	Survey area overlaps with Stuart River Resource Management Zone – Protected Area, which provides high-value habitats, including critical salmon habitat and deer and elk winter ranges. All objectives (General Management and Protected Areas RMZ) related to forestry and road access.	N/A
Fort St. James	Necoslie Resource Management Zone - Maintain elk habitat.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Kispiox LRMP	No objectives for elk.	N/A
Mule deer		

LRMP	Relevant LRMP Objectives	Relevant LRMP Strategy
Bulkley LRMP	No objectives for mule deer.	N/A
Morice LRMP	No relevant (summer) objectives for mule deer.	N/A
Lakes District LRMP	No relevant (summer) objectives for mule deer.	N/A
Vanderhoof LRMP	General Management Direction – To maintain or enhance mule deer populations and habitat Survey area overlaps with Stuart River Resource Management Zone – Protected Area, which provides high-value habitats, including critical salmon habitat and deer and elk winter ranges.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Fort St. James	General Management Direction - Maintain (and enhance where appropriate) deer populations and habitat.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Kispiox LRMP	General Management Direction - To protect or enhance populations and habitat of rare or endangered and regionally significant species.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.
Grizzly bear		
Bulkley LRMP	No overlap with landscape planning units with objectives for grizzly bear.	N/A
Morice LRMP	<p><i>Objectives and management direction for grizzly bear apply only in Grizzly Bear Management Areas (see Map 11: Grizzly Bear Management Areas).</i></p> <p>2) Limit disturbance from > 70% development activities adjacent to high value spring or salmon forage areas.</p>	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance.
	<p>4) Reduce mortality risk to grizzly bears due to industrial and range activities.</p>	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Industrial activities of concern in Grizzly Bear Management Areas include road building, timber harvesting, drilling, blasting, mining, mine deactivation, and tourism facilities.
Lakes District LRMP	General Ecosystem Health – 48) Maintain the diversity and a suitable abundance of wide ranging carnivore populations and the ecosystems upon which they depend.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance.
Vanderhoof LRMP	General Management Direction – To maintain or enhance grizzly populations and habitat.	<ul style="list-style-type: none"> No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.

LRMP	Relevant LRMP Objectives	Relevant LRMP Strategy
Fort St. James	General Management Direction - Minimize conflicts in human/bear interactions	<ul style="list-style-type: none"> • Improve communication and education of backcountry users (industrial, recreational) to ensure human/bear safety by: <ul style="list-style-type: none"> ▫ Educate pilots and other aircraft personnel about the potential impacts of repeated harassment of grizzly bears. ▫ Endeavour to schedule human activities (timber cruising, mineral exploration, recreation) to avoid coinciding with concentrated seasonal grizzly bear use in high grizzly bear use areas.
	Takla-Middle Resource Management Zone - Manage valuable habitats for a variety of species.	<ul style="list-style-type: none"> • Consider the maintenance of habitat when integrating resource development plans with: <ul style="list-style-type: none"> ▫ Grizzly bear habitat needs on the south slopes of Mt. Sidney Williams.
Kispiox LRMP	General Management Direction - To protect or enhance populations and habitat of rare or endangered and regionally significant species.	<ul style="list-style-type: none"> • No specific direction for aerial surveys/disturbance. Road and forestry mitigation only.

4.0 PROJECT ACTIVITIES AND MITIGATION MEASURES

Airborne geophysical surveys utilize an airborne electromagnetic system that collects data from a magnetic sensor(s) mounted on a fixed boom on the front of a helicopter or on the tail and wingtips of fixed-wing aircraft. Transects at 250 m spacing, and a flying height of at least 80 m above ground will be flown across the survey area once during surveys. The survey lines will be flown mostly in an east-west direction. Approximately 700 to 1,000 km per aircraft will be covered each day, depending on the weather. Aircraft will be mobilized from sites surrounding the survey area, as required by operations and weather.

Surveying of the Phase II area is expected to be completed in three to four months using up to three fixed-wing aircraft +/- helicopter. The survey is expected to start in early to mid-June 2016. If the survey work cannot be completed in 2016, it is expected to resume again in the summer of 2017.

There are no Ministry of Forests Lands and Natural Resource Operations (MOFLNRO) or Ministry of Energy and Mines permitting requirements for this airborne survey.

4.1 POTENTIAL INTERACTIONS WITH WILDLIFE SPECIES OF INTEREST

Airborne geophysical surveys have the potential to interact with or affect wildlife SOI in the following ways:

- Disturbance-related displacement of animals from important habitats due to noise and presence.
- Sensory disturbance associated with fixed-wing activity, potential habitat avoidance.

The timing (season), frequency and duration of disturbances is a factor when assessing effects on ungulates. Sensory disturbance may have a greater effect on wildlife if it is prolonged and occurs during a sensitive period such as winter, but may have a lesser affect if the disturbance occurs during a less-sensitive season.

4.2 MITIGATION

Geoscience BC has designed the Search Project Phase II survey with consideration for avoiding or minimising effects on ungulates and grizzly bear. A variety of mitigation measures or best management practices, including those that are suggested in provincial guidance (Bulkley Valley CRBIPT 1998, ILMB 1999, 2002, 2007, MFLNRO 2014) and federal guidance (EC 2014) have been used to create these recommendations.

Geophysics Contractor. At this time a contractor(s) to conduct the airborne surveys has not been selected. Geoscience BC intends require its contractor to operate in a manner that is least intrusive to wildlife.

Temporal Avoidance. Geoscience BC is planning project activities in and around ungulate and grizzly bear habitat to coordinate with the “low-risk” timing window (below). The timing windows are a broad-based management tool, and with other mitigation measures in place (i.e., this document) strict adherence to the windows may not be necessary. These guidelines assume that ungulates and grizzly bears are present.

Timing Windows	Caribou	Mountain goat	Moose	Elk		Mule deer		Grizzly bear
Region	Skeena & Omineca	Skeena & Omineca	Skeena & Omineca	Skeena	Omineca	Skeena	Omineca	Skeena & Omineca
Low risk - Restrictions would not normally apply	July 16 – Sept 14	July 16 – Oct 31	July 16 – Nov 15	July 16 – Nov 14	July 16 – Jan 14	July 16 – Nov 14	July 16 – Nov 14	There are no low-risk timing periods for grizzly bear
Caution - Operators should avoid development activities during these timeframes [if ungulates and grizzly bear are present]	Sept 15 – Jan 14	Nov 1 – Jan 14	Nov 16 – May 14	Nov 15 – May 14	Jan 15 – May 14	Nov 15 – May 14	Nov 15 – May 14	Early spring foraging: April through mid-June. Summer foraging: High-elevation feeding June through August. Berry feeding: July through October
Critical - Development activities are not appropriate during this timeframe [if ungulates and grizzly bear are present]	Jan 15 – Jul 15	Jan 15 – Jul 15	May 15 – July 15	May 15 – July 15		May 15 – July 15		Winter denning: October through the end of winter conditions (March to May). Birthing: January through March.

Source: MFLNRO 2014

Search Phase II project activities are planned for the summer through early-fall during 2016. Largely this is in the low-risk period for most of the species considered.

- This timing puts the activities in the ‘low-risk’ timing window for ungulate species.
- Project activities will occur within the ‘caution’ timing window for grizzly bear, as there are no low-risk timing periods for grizzly bear. Grizzly bear activities during the ‘caution’ timing window are related to spring and summer foraging.
- Where possible, Geoscience BC will liaise with hunting outfitters licensed for the area, and attempt to plan flight schedules with the contractor that may avoid designated areas occupied by goats during their scheduled hunts (typically occurring between August 1 – October 16), in order to avoid disturbing the hunters¹ and their target species (mountain goats).

Flight Activity. The survey may use multiple aircraft, which may include both fixed-wing airplanes and helicopters. If multiple aircraft are used for the survey, Geoscience BC and the contractor will plan and adapt daily flight coverage, as needed, to minimize potential disturbance to wildlife SOI. The survey will likely specify the aircraft to fly a drape pattern which will result in ground clearance that is mostly above the recommended 100 m above ground level minimum for ungulate inventory work (MFLNRO 2014) and vary between 80 m and greater than 1,000 m. In areas of moderate to low topographic relief, the ground clearance will be 80 m and therefore will be below the recommended 100 m minimum elevation for inventory work. Areas of low relief where lower elevation surveying is necessary will be outside of typical (high-relief/rugged) ungulate habitats.

Aircraft activity may result in disturbance and/or displacement of wildlife SOI. Some consider fixed-wing aircraft to be less disruptive than helicopters for ungulates and grizzly bear (IGBC 1987, Mountain Goat Management Team 2010), however helicopters may be able to respond quicker than fix wing aircraft when negative wildlife reactions are noted. For the purpose of this management plan, we have assumed that all wildlife SOI are equally sensitive to aircraft disturbance.

The following mitigation to minimize disturbance will be used:

- Flight lines (transects) will be predetermined, and will be completed in a staggered manner, as needed, when encountering caribou while flying over critical caribou habitat and when encountering mountain goats during core hunting period (August 1 – October 16)).
 - At the pilot’s discretion, every second transect or more, along the east-west lines could be flown in succession thus increasing the transect spacing in successive passes from 250 m to 500 m or more.
 - Transects will be flown in an east-west direction in a single pass over long distances, resulting in a lower frequency of aircraft passes daily over an area.

¹ Including mitigation for potential disturbance effects to hunters was included based on a conversation with FLNRO staff in mid-July 2015 for the Phase 1 project. The western portion of the Phase II survey area overlaps with Limited Entry Hunting (LEH) Zones for mountain goat.

Along east-west flight lines, this mitigation would result in an ungulate and/or on the ground observer at one location seeing the aircraft passing over a few times each hour and not likely again in a day. For long line segments this would be even less.

- The aircraft will not fly below 80 m above ground during surveys.
- The aircraft will not land in the survey area, except within staging areas or during a safety or operational emergency; no ground-based equipment or personnel are necessary for the surveys.
- The aircraft will fly in straight transects, generally avoiding sharp banking, turns, ascents and descents. The contractor will minimize erratic noise effects by flying continuously at moderate speed of approximately 250 km per hour for fixed-wing aircraft and in the range of 125 to 145 km per hour for helicopter flights.
- The aircraft will avoid flying directly towards to aggregations of ungulates, ungulates with young, or bears with young. No hovering will be conducted. Such activities are considered harassment and illegal under the *Wildlife Act*.
- Maintain a minimum of 500 m line-of-sight distance from areas where grizzly bears are known to be present.
- Geoscience BC, the contractor and/or the pilot will take immediate action to increase transect separation distances if wildlife SOI are observed to react to the aircraft. In the event that the pilot observes wildlife SOI directly within the planned flight path and/or reacting to the aircraft, Geoscience BC authorizes the pilot to fly out of contractual technical specifications, to avoid and/or minimize potential impact.
- The contractor will have georeferenced maps of areas with specific protections for the SOI available so that the pilot's position relative to protected areas is well-known.

5.0 CONCLUSION

Geoscience BC and their contractor(s) intend to do their part to minimize potential effects related to the surveys and their possible contribution to cumulative effects. While there are many other aircraft flying in and around the survey area, Geoscience BC and the contractor's level of control over potential effects are limited to their activities, and they have no control over the actions of others.

The combination of mitigation to avoid and minimize effects are considered a reasonable approach to managing the potential for effects on wildlife SOI as a result of Geoscience BC's Search Project Phase II survey activities. In particular:

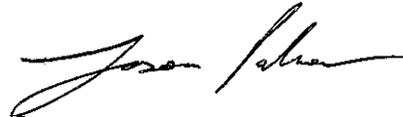
1. mitigation that avoids surveying in the winter-sensitive period,
2. flexibility in survey delivery that allows concessions to limit the effects on wildlife, and
3. minimising the frequency of transect passes over any one area in a day

These are considered to be very effective mitigation at reducing the potential effects of disturbance and habitat avoidance on at risk caribou and other wildlife SOI. The application of the above mitigation, particularly for flight lines that pass over areas designated critical habitat, UWR, and WHA, is both practical and effective.

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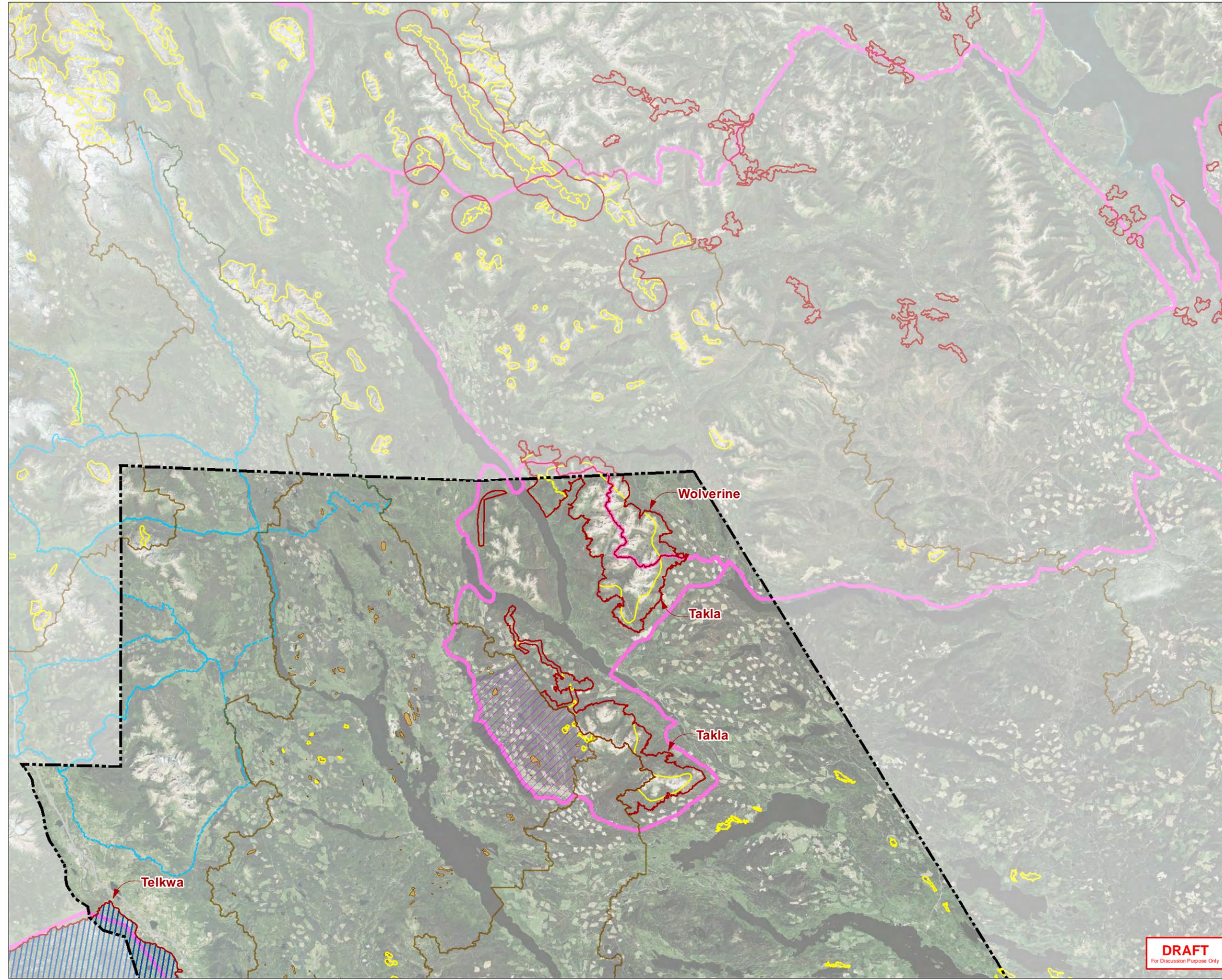
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FIGURES

Survey Area and Regional Habitat Data



Legend

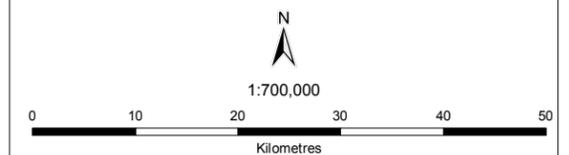
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- Land Resource Management Plan Boundary
- Area contains critical habitat identified under the Species at Risk Act for Caribou (*Rangifer tarandus*)
- Ungulate Winter Range
- Telkwa Caribou Recovery
- Caribou Habitat Management
- Tweedsmuir Caribou Calving Islands
- Limited Entry Hunting (LEH) Zones for Mountain Goat
- Mountain Goat Habitat Areas
- Caribou Migration Corridor
- Caribou Herd Locations
- Herd Name
- Herd Number

Notes

1. This product has been produced by Hemmera Envirochem Inc., and includes data provided by Environment Canada.
2. The incorporation of data sourced from Environment Canada within this product shall not be construed as constituting an endorsement by Environment Canada of our product.
3. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

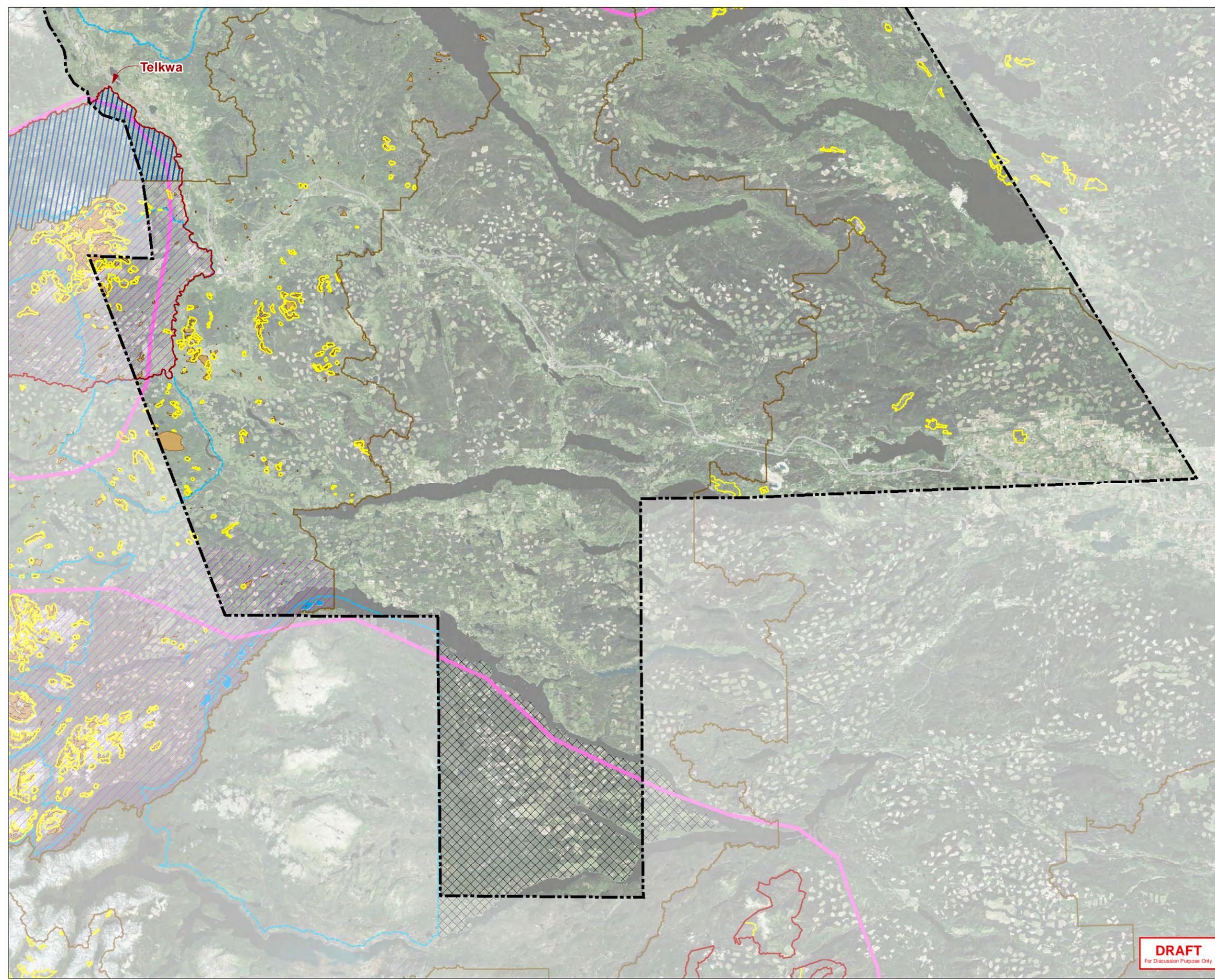
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- Ungulate winter range layer: Data BC. Dataset name: Ungulate Winter Range - Outlined. July 2015.
- Telkwa Caribou Recovery Area and Caribou Migration Corridor: Data BC. Dataset name: legal Planning Objectives - Current - Polygon. July 2015.
- Caribou Habitat Management Areas, Takla Caribou Winter Range, Tweedsmuir Caribou Calving Islands Telkwa Caribou Key Forested Habitats and Mountain Goat Habitat Areas: DataBC. Dataset name: Non Legal Planning Features - Current - Polygon. July 2015.
- Caribou Herd Locations: Data BC. Dataset name: WHSE_WILDLIFE_INVENTORY_GCPB_CARIBOU_POPULATION_SP_polygon. March 2016.
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Survey Area and Regional Habitat Data



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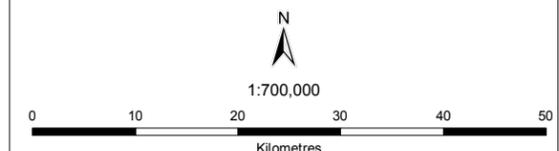
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