Rook I Project

Environmental Impact Statement

Annex VIII.1: Wildlife Baseline Report 1 (Mammals, Waterfowl, and Raptors)

NexGen Energy Ltd.
Rook I Project

Terrestrial Environment
Wildlife Baseline Report 1
(Mammals, Waterfowl, and Raptors)

June 2024

OMNIA
ECOLOGICAL SERVICES

Terrestrial Environment
Wildlife Baseline Report 1 (Mammals, Waterfowl, and Raptors)

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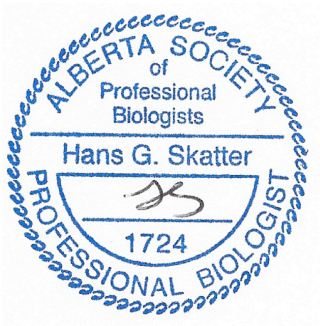

June 2024

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LIST OF ACRONYMS

VC – valued component
LSA – local study area
RSA – regional study area
CRSA – caribou regional study area
GPS – global positioning system
UTM – Universal Transverse Mercator
SRC – Saskatchewan Research Council
DBH – diameter at breast height
SK2 – Saskatchewan Boreal Plain Woodland Caribou Range
SK1 – Saskatchewan Boreal Shield Woodland Caribou Range
ASPB – Alberta Society of Professional Biologists

LIST OF UNITS

ha – hectare
km – kilometre
m – metre
cm – centimetre
km-day – kilometre day

1.0 INTRODUCTION

The Rook I Project (Project) is a proposed new uranium mining and milling operation that is 100% owned by NexGen Energy Ltd. (NexGen). The Project would be located in northwestern Saskatchewan, approximately 40 kilometres (km) east of the Alberta-Saskatchewan border, 130 km north of the town of La Loche, and 640 km northwest of the city of Saskatoon. The Project would reside within Treaty 8 territory and within the Métis Homeland. At a regional scale, the Project would be situated within the southern Athabasca Basin adjacent to Patterson Lake, and along the upper Clearwater River system. Access to the Project would be from an existing road off Highway 955. The Project would include underground and surface facilities to support the extraction and processing of uranium ore from the Arrow deposit, a land-based, basement-hosted, high-grade uranium deposit.

The wildlife baseline report represents a component of a comprehensive baseline program that documents the natural and socio-economic environments in the anticipated area of the Project. The wildlife baseline program was undertaken to provide context from which Project environmental wildlife effects could be assessed in the Environmental Impact Statement (EIS).

Since exploration at the Project commenced in 2013, NexGen has engaged regularly and established relationships with local First Nation and Métis Groups (collectively referred to as Indigenous Groups) and northern communities, specifically those closest and with greatest access to the proposed Project. NexGen respects the rights of Indigenous Peoples and the unique relationship Indigenous Peoples have with the environment, and recognizes the importance of full and open discussion with interested or potentially affected Indigenous communities regarding the development, operation, and decommissioning of the proposed Project. Engagement activities to date, as well as future planned engagement activities, reflect the value NexGen places on meaningful engagement with Indigenous and northern communities who could be potentially affected by the proposed Project. Engagement mechanisms have included, but are not limited to: meetings with leadership, workshops and community information sessions, Project site tours, establishing Joint Working Groups to support the gathering and incorporation of Indigenous and Métis Knowledge throughout the Environmental Assessment (EA) process, and providing funding for Traditional Land Use (TLU) Studies[1] to understand how the proposed Project may interact with the Indigenous communities' traditional use of the anticipated area of the Project.

Feedback received during engagement activities was documented for contribution to the EIS for the Project; examples of feedback received include discussion of concerns, interests, potential adverse effects, mitigation, and design alternatives. Many baseline studies were initiated in advance of formal engagement on the EA for the Project; however, engagement during the execution of baseline studies has helped inform the understanding of baseline conditions and confirmed components of the natural and socio-economic environments that required study. A summary of feedback related to the wildlife baseline program is presented in Appendix A of the Wildlife Baseline Road Map (Annex VIII).

[1] Traditional Land Use (TLU) Studies include all land use studies developed by the Project's affected Indigenous Groups, including Traditional Land Use and Occupancy studies, Traditional Knowledge and Use studies, and Indigenous Rights and Knowledge studies, henceforth referred collectively as TLU Studies.

2.0 STUDY OBJECTIVES

Omnia Ecological Services (Omnia) was retained by NexGen in February 2018 to collect terrestrial (wildlife and vegetation resources) baseline data in support of the proposed development of the Rook I Project. The terrestrial baseline data were used to support the environmental effects assessment for the Project.

The objectives of the wildlife baseline surveys were to:

- characterize the existing terrestrial environment in the Project area (natural and anthropogenic elements);
- gather information required to inform environmental effects and technical assessments;
- ensure the baseline studies meet all provincial and federal regulatory requirements for effects assessments;
- inventory wildlife species occurrence;
- capture information from community engagements and stakeholder considerations;
- establish a framework to facilitate future environmental effects monitoring; and
- support the development of Project specific mitigation strategies.

This report documents and summarizes baseline conditions for wildlife elements including waterfowl, terrestrial and semi-aquatic furbearers, and baseline chemistry of small mammals obtained during field programs completed in 2018, 2019, and 2020.

3.0 STUDY AREA

3.1 Study Area Selection

The Project is located approximately 130 km north of La Loche, Saskatchewan along Patterson Lake near the northern edge of the Boreal Plain Ecozone, in the Mid-Boreal Uplands Ecoregion. The regional study areas extend into the Boreal Shield Ecozone. These terrestrial baseline surveys were established using three nested study areas to guide impact assessments of Project-specific and cumulative impacts on potential wildlife valued components (VCs). These included a local study area (LSA), a regional study area (RSA), and a caribou regional study area (CRSA) (Figure 3.1-1). These study areas were developed to account for the entire Project footprint and surrounding regions to help assess both local and regional impacts.

Specifically, the LSA was 41 km^2 and sized to account for direct Project effects and includes a sensory buffer (1.0 km) for the proposed mine access road and mine site development footprint. The 1.0 km buffer was selected to take into account potential habitat alienation effects on large mammals from mining activity, construction noise and road traffic as per Cristescu et al. (2016); Gill et al. (2001); Benítez-López et al. (2010).

The RSA was 400 km^2 and designed to account for the potential cumulative effects of the Project at a sub-regional scale (including species with larger home ranges). The RSA was also designed to support future impact assessments on VCs and includes areas with potential direct and indirect effects of the Project in addition to suitable reference areas. The size of the RSA was selected to align with those from several other regional woodland caribou studies across Northern Saskatchewan as outlined by McLoughlin et al. (2016).

Both LSA and RSA boundaries are of an appropriate size and location for the inventory and assessment of both local and regional effects on vegetation and wildlife from existing and planned activities.

The CRSA was 2,380 km^2 and accounts for the mean annual home range size of woodland caribou (*Rangifer tarandus caribou*) in the region, and to provide regional context for caribou occurrence and habitat supply as mapped by ECCC (2018) and the ENV (2018).

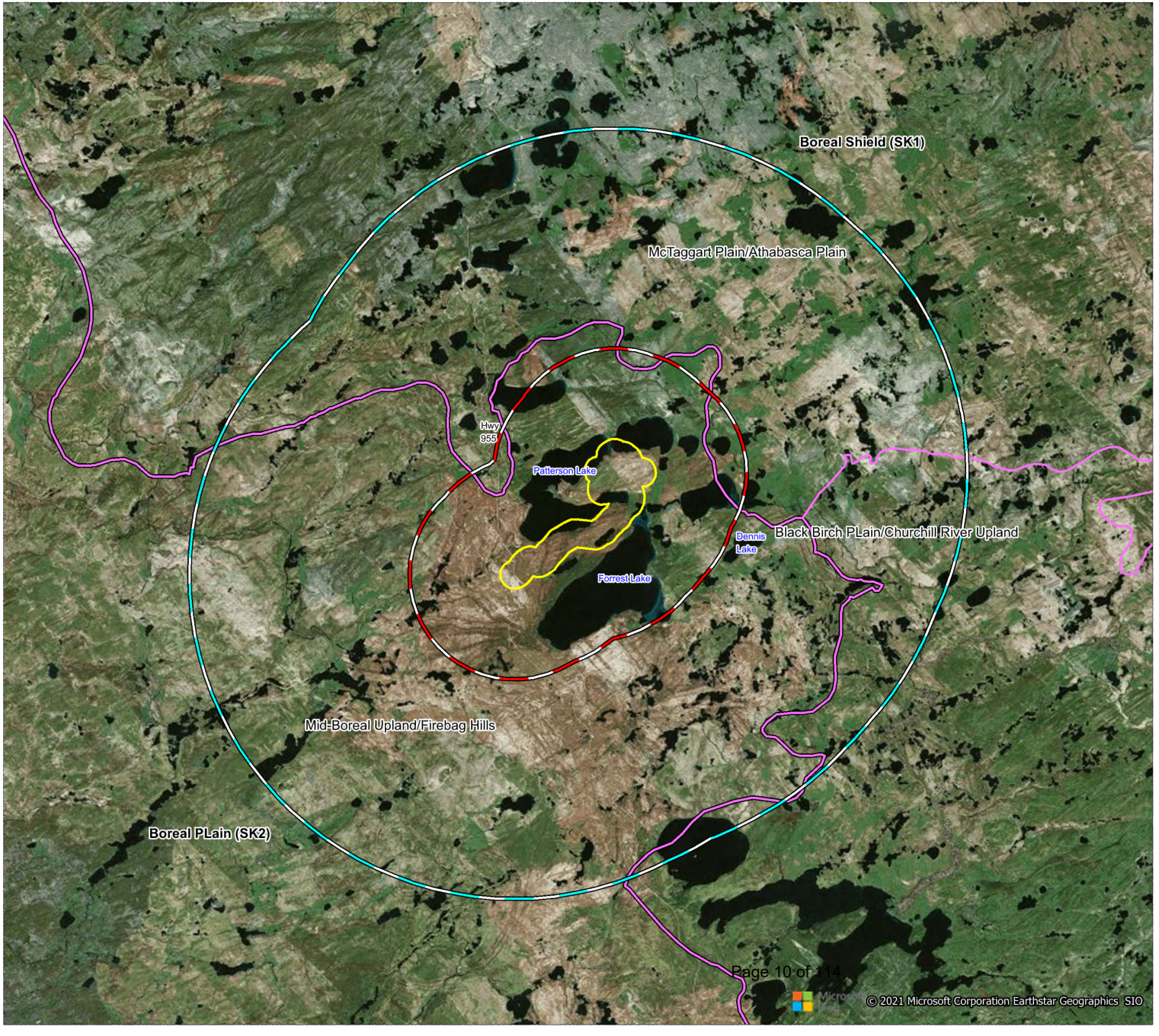

Figure 3.1-1 Omnia Terrestrial Baseline Study Areas of the Project

Legend

- Local Study Area (LSA)
- Regional Study Area (RSA)
- Caribou Regional Study Area (CRSA)
- Ecoregion / Landscape Area
- Ecozone

N
W E
S

0 7.5 15
kilometers
Scale = 1 : 270,000

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Produced by RA, Dec. 2018
Ref# O-F736_12-18

No woodland caribou home range data is available for the area of the Project. However, a study in the Boreal Shield to the east of the study area completed by McLoughlin et al. (2016) estimated the mean annual home range to be 407 km^2. The mean diameter (24 km) of the home range (McLoughlin et al., 2016) was used as a buffer for the proposed mine access road and mine site development and to delineate the CRSA.

3.2 Ecological Setting

3.2.1 Ecoregions and Landscape Areas

The Project study areas straddle two Ecozones, three Ecoregions, and three Landscape Areas (Acton et al. 1998) (Table 3.2-1, Figure 3.1-1). The entire LSA is situated within the Firebag Hills Plain Landscape Area (E1) in the Mid-Boreal Upland Ecoregion of the Boreal Plain Ecozone. The RSA is situated within the Firebag Hills Plain Landscape Area (93.7%) of the Boreal Plain, and the McTaggart Plain Landscape Area (C3) (6.3%), in the Athabasca Plain Ecoregion of the Boreal Shield Ecozone. The CRSA is situated within the Firebag Hills Landscape Area (58.8%) of the Boreal Plain, the McTaggart Plain Landscape Area of the Boreal Shield (approximately 33.5%), and the Black Birch Plain Landscape Area (D1) (7.6%), in the Churchill River Upland Ecoregion of the Boreal Shield.

Table 3.2-1 Distribution of Project Study Areas within Ecozones, Ecoregions & Landscape Areas.

Ecozone		Boreal Shield		Boreal Plain	**Total Area (km^2)**
Ecoregion		Athabasca Plain	Churchill River Upland	Mid Boreal Upland	
Landscape Area		McTaggart Plain (C3)	Black Birch Plain (D1)	Firebag Hills (E1)	
LSA	km^2	0	0	41.1	**41.1**
	%	0	0	100.0	**100.0**
RSA	km^2	25.1	0	375.0	**400.1**
	%	6.3	0	93.7	**100.0**
CRSA	km^2	798.4	181.2	1400.1	**2,379.7**
	%	33.6	7.6	58.8	**100.0**

Source: Acton et al. 1998.

3.2.2 Landforms

All three Landscape Areas (C3, D1, and E1) have similar landforms characterized by hummocky, sandy glacial till and glaciofluvial deposits, with large areas of bogs and peatlands (Acton et al. 1998). The landforms in these areas are more representative of Boreal Shield landforms than Boreal Plain landforms. Typically, the Boreal Plain usually contains more clay-sized materials and has a more diverse mineralogy (Acton et al. 1998).

3.2.3 Regional Vegetation

The three Landscape Areas are also similar in that jack pine (*Pinus banksiana*) with a lichen understory is prevalent due to the sandy surface materials and frequency of the fire regime. A mixture of black spruce (*Picea mariana*) and jack pine can be found on the slopes of eskers and closed stands of black spruce are found in the boggy lowland areas, with occasional tamarack (*Larix laricina*) trees found in fens (Acton et al. 1998).

Fire in lichen-dominated systems generally does not increase the amount of deciduous shrub, and the vegetation in this area is typical of the Boreal Shield where frequent fires have promoted the dominance of jack pine. The forests of the Boreal Plain (and particularly the Mid-Boreal Upland Ecoregion) are more commonly represented by a mixture of deciduous and coniferous trees, with closed stands of trembling aspen (*Populus tremoloides*), jack pine, black spruce, white spruce (*Picea glauca*), and balsam poplar (*Populus balsamifera*); these species are listed in order of dominance (Acton et al. 1998).

3.2.4 Regional Wildlife

Vertebrate wildlife species known, expected, or with the potential to occur within the area of the Project are summarized in Table 3.2-2 and listed in Appendix A. The list of species with potential to occur within the area of the Project was developed using information from regional and provincial references (Banfield 1974, Smith 1996, Sibley 2014, SKCDC 2019), field data collected in support of the Project, and the author's experience. All species observed during field investigations were noted in Appendix A, with all provincial and federally sensitive or species at risk designations noted where applicable (SKCDC 2019, GOC 2020). Many of these species were also identified as occurring in the region by traditional land use studies, community engagement, and working group discussions (WD Lewis 2020, Ya'thi Néné Lands and Resources 2020, McCullough 2020, and Olson and Firelight 2019a,b).

Table 3.2-2 Vertebrate Wildlife Species Groups Known, Expected or with Potential to Occur Within the Area of the Project

Species Group	Unique Species (n)	Species Group	Unique Species (n)
Shrews	5	Hares	1
Bats	5	Rodents	14
Dog Family	3	Bears	1
Weasel Family	8	Cat Family	1
Ungulates	3	Amphibians/ Reptiles	5
Waterfowl	27	Vireos	4
Grouse, Quails and Allies	4	Jays, Magpies, Crows, and Ravens	4
Loons	2	Larks	1
Grebes	3	Martins and Swallows	4
Herons, Ibis and Allies	2	Tits, Chickadees and Titmice	2
Pelicans	1	Nuthatches	1
Cormorants and Anhingas	1	Wrens	2
Vultures, Hawks and Allies	9	Kinglets	2
Falcons and Caracaras	4	Thrushes	5
Rails, Gallinules, and Allies	3	Starlings and Mynas	1
Cranes	2	Wagtails and Pipits	1
Shorebirds	23	Waxwings	2
Gulls, Terns and Skimmers	11	Wood-warblers	19
Owls	7	Cardinals, Grosbeaks and Allies	1
Nightjars	1	New World Sparrows	14
Kingfishers	1	Old World Sparrows	1
Woodpeckers	7	Longspurs and Snow Buntings	3
Tyrant Flycatchers: Pewees, Kingbirds and Allies	7	Blackbirds	6
Shrikes	1	Finches, Euphonias, and Allies	8

4.0 WINTER TRACK COUNT SURVEY

4.1 Study Objectives

The primary objectives of the winter track count survey were to:

- determine the presence/non-absence of winter-active animals;
- determine the relative abundance of winter-active animals;
- enhance the Project specific area understanding of species-ecosite affiliations; and
- provide a scientifically defensible baseline for effects assessments and potential follow-up/monitoring requirements.

4.2 Methods

Winter track count surveys were completed from 27 March 2018 to 30 March 2018 and 15 December 2018 to 19 December 2018 and replicated between 15 January 2020 to 20 January 2020. Three types of winter track count surveys were utilized. The first was recording all intersections of animal trails along the existing and proposed road alignments. The second method utilized triangle-shaped transects. Triangle transects measured 7.5 km in length (2.5 km per side) and were laid out randomly across the LSA and RSA. The third method was a series of opportunistic riparian transects of approximately 500 m to ensure representation from this less common vegetation cover type.

Data were collected at 50-m intervals (termed a 'sub-transect') along each transect. Methodology was developed with guidance from the Saskatchewan Ministry of Environment *Species Detection Survey Protocol: Snow Track Surveys* (2014) and the tracking triangle approach was adopted from long-term monitoring techniques originating in Finland (Linden et al. 1996) and adopted by the Alberta Biodiversity Monitoring Program (Shank and Farr 1999). Hand-held global positioning systems (GPS) were used for navigation and orientation purposes and to measure transect and sub-transect lengths. The transect routes were recorded using the track-log function in a hand-held GPS, recording points every 10 metres.

Data were collected by a two person team, with each team including at least one Professional Biologist (registered with the Alberta Society of Professional Biologists (ASPB) proficient in wildlife snow track identification. The number of fresh animal trails crossing the transect path since the last snowfall event were recorded for each species. Animal tracks were identified to species by print, stride, and straddle. Multiple-pass hare and red squirrel trails were enumerated as five animals, consistent with Thompson et al. (1989). Fresh bed sites (i.e., since last snowfall event), squirrel middens, and ungulate foraging events (i.e., current winter browse associated with fresh trails) were recorded within a 3-m band on either side of the transect path. Scat and/or scent posts were recorded within 1 m of the transect path. Detailed information on anthropogenic features (e.g., cut lines, roads) were also recorded at the end of each 50-m sub-transect; this information included occurrence, human use, and wildlife use. Wildlife tracking data were collected a minimum of 24 hours after a snowfall event and continued until the track record was obliterated by wind, snow melt, or new snowfall. Tracking data, snow depth measurements, and incidental wildlife observations (e.g., grouse flushes) were recorded at the end of each 50-m sub-transect. A Universal Transverse Mercator (UTM) coordinate marking the start and end of each 50-m sub-transect was recorded.

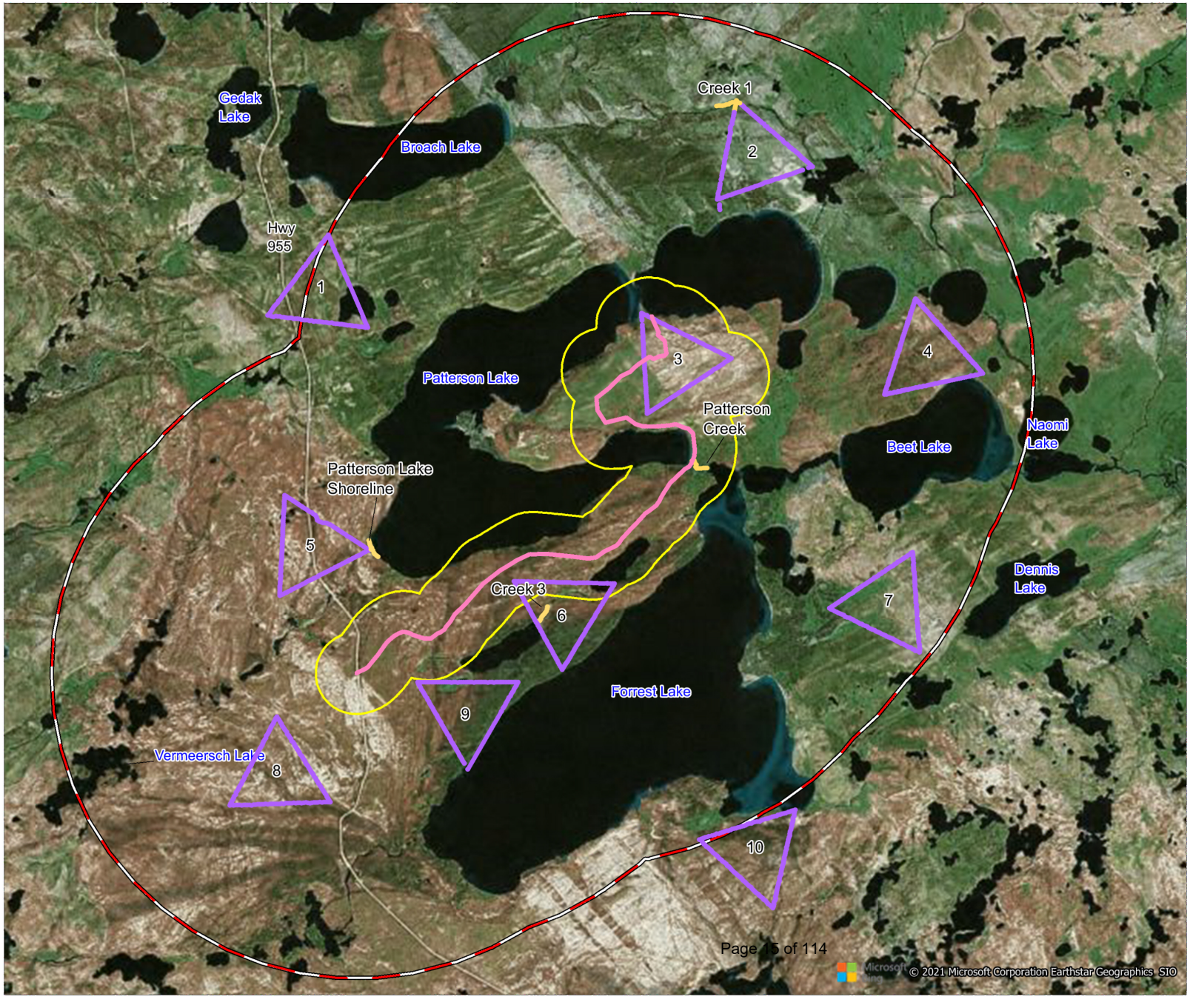
The number of kilometre-days (i.e., length of transect multiplied by the days since last snowfall) was calculated for each transect and sub-transect. The number of animal trails per km-day by species was calculated by Project area, ecosite type, and transect.

Survey design and field methodologies were guided by existing provincial protocols, where applicable, or peer-reviewed methodology, and were completed under Saskatchewan Government Research Permit/Species Detection #18FW031 and 18SD170.

4.3 Results

In 2018, a total of 10 triangle transects (approximately 75.3 km), four lakeshore/creek transects (approximately 2.1 km) and one road/anthropogenic transect (approximately 17.6 km) were completed. In 2020, all 10 triangle transects (approximately 75.2 km), three creek transects (approximately 1.5 km) and the road/anthropogenic transect (approximately 20.4 km) were replicated (Figure 4.3-1). Sampling intensity was approximately 216.5 km-days in 2018 and approximately 482.1 km-days in 2020 across the area of the Project. All surveyed lakes and creeks were frozen at time of surveys. Survey conditions are listed in Table 4.3-1. Fourteen species/species group trails were detected during winter tracking surveys across 21 ecosites (Table 4.3-2 and Table 4.3-3). Ecosite descriptions can be found in Table 4.3-4.

Figure 4.3-1 Winter Tracking Survey Transects



Legend

Transect Type

- Triangle
- Riparian / Shoreline
- Road / Anthropogenic
- Regional Study Area (RSA)
- Local Study Area (LSA)

N W E S

0 5 10

kilometers
Scale = 1 : 90,000

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Produced by RA, Dec. 2019
Ref# O-F736_12-18

Table 4.3-1 Winter Tracking Survey Timing and Weather Summary.

Transect	Date		Average Temperature (°C)		Mean Snow Depth (cm)		Mean Snow Age (Days)	
	2018	2020	2018	2020	2018	2020	2018	2020
1	15 December	15 January	-4.5	-33.0	24.5	49.9	1.9	2.5
2	17 December	16 January	-9.0	-26.9	26.7	47.2	1.7	3.5
3	27 March	19 January	-14.5	-30.0	76.1	48.0	1.2	6.5
4	15 December	15 January	-4.5	-33.0	20.9	45.9	1.9	2.5
5	28 March	18 January	-15.0	-25.5	75.5	48.2	2.0	6.3
6	29 March	20 January	-30.0	-15.0	72.4	45.5	3.0	7.5
7	17 December	18 January	-9.0	-25.5	26.9	46.7	1.6	5.5
8	19 December	17 January	-9.0	-29.0	25.4	47.6	1.8	4.5
9	30 March	16 January	-23.9	-26.9	72.3	45.2	4.0	3.5
10	19 December	17 January	-9.0	-29.0	24.8	45.1	1.8	4.5
Patterson Lake Lakeshore	28 March	-	-15.0	-	63.4	-	2.1	-
Creek 1	17 December	16 January	-9.0	-26.9	35.3	37.4	1.7	3.6
Creek 3	29 March	20 January	-30.0	-15.0	50.6	44.0	3.0	7.5
Patterson Creek	17 December	20 January	-9.0	-15.0	27.6	46.0	1.8	7.6
Road/ Anthro	29 March	18-19 January	-30.0	-20.0	65.5	7.6	3.1	5.9

Table 4.3-2 Number of Trails per Km-day by Transect in the RSA – Winter 2018 & 2020.

Transect	Length (Km)		Km-days		Microtines (Trails/ Km-Day)		Red Squirrel (Trails/ Km-Day)		Snowshoe Hare (Trails/ Km-Day)		Grouse/ Ptarmigan (Trails/ Km-Day)		Ermine (Trails/ Km-Day)		Mink (Trails/ Km-Day)		Least Weasel (Trails/ Km-Day)	
	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020
1	7.47	7.49	14.56	18.67	0.14	0.05	1.30	0	0.34	0.21	0.07	0.37	0.41	0.16	0	0	0	0
2	7.54	7.26	12.46	25.49	0.32	0.27	0	0.16	0.08	3.06	0	0	0.08	0.27	0	0	0	0
3	7.51	7.54	8.64	49.18	0	0.16	0.23	0.12	15.85	9.09	0.93	0.02	0.46	0.24	0	0	0	0
4	7.54	7.52	14.99	18.66	0	0	0.07	0.05	0.27	0.86	0	0	0	0	0.07	0	0	0.05
5	7.56	7.60	15.03	48.15	0.27	0.04	0.67	0.56	12.71	13.31	1.86	0	0	0.04	0	0	0	0
6	7.51	7.53	22.72	56.80	0.04	0.30	1.19	0.18	0.13	0.44	0.26	0.14	0.22	0.26	0.35	0.04	0	0
7	7.55	7.52	12.33	41.28	0.32	0.22	0.32	0	0	0	0.24	0	0	0.05	0	0	0	0.05
8	7.56	7.57	13.40	34.37	0	0	2.84	0.09	59.66	1.11	0	0.03	0.75	0.03	0	0	0	0
9	7.51	7.56	30.27	26.44	0	0.15	1.19	0.04	0.03	0.68	0.03	0.04	0.07	0.64	0.07	0	0	0
10	7.57	7.56	13.55	34.30	0.22	0.06	2.80	0.06	0.15	0.03	0.07	0.06	1.48	0	0.44	0	0	0
Patterson Lake Lakeshore	0.55	-	1.14	-	0	-	0	-	0	-	16.61	-	0	-	2.62	-	0	-
Creek 1	0.50	0.51	0.84	1.81	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Creek 3	0.50	0.51	1.50	3.80	5.32	0	0	0	0	0	2.00	0	0	0	0	0.53	0	0
Patterson Creek	0.53	0.51	0.96	3.83	0	0.26	0	0	0	0	0	0.52	0	1.04	1.05	0.52	0	0
Road/ Anthro	17.56	20.40	54.06	119.27	0	0	0.91	0	3.33	0	0.76	0	0.11	0.02	0	0	0	0
Total / Average	**94.95**	**97.07**	**216.46**	**482.07**	**0.12**	**0.11**	**1.03**	**0.11**	**4.50**	**2.63**	**0.51**	**0.05**	**0.25**	**0.13**	**0.10**	**0.01**	**0**	**0.01**
Mean	**96.01**		**349.27**		**0.11**		**0.57**		**3.57**		**0.28**		**0.19**		**0.05**		**0.003**	

Note:
Dash = not sampled.

Table 4.3-2 Number of Trails per Km-day by Transect in the RSA – Winter 2018 & 2020 - cont.

Transect	Length (Km)		Km-days		Marten (Trails/ Km-Day)		Fisher (Trails/ Km-Day)		Otter (Trails/ Km-Day)		Fox (Trails/ Km-Day)		Coyote (Trails/ Km-Day)		Lynx (Trails/ Km-Day)		Moose (Trails/ Km-Day)	
	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020
1	7.47	7.49	14.56	18.67	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0
2	7.54	7.26	12.46	25.49	3.13	0	0	0	0	0.04	0.08	0.04	0.16	0	0	0	0	0
3	7.51	7.54	8.64	49.18	0	0	1.27	0	0	0	0.69	0.18	0	0	0	0	0	0
4	7.54	7.52	14.99	18.66	0.27	0.43	0	0	0	0	0	0.27	0	0	0	0	0	0
5	7.56	7.60	15.03	48.15	0	0.25	0.20	0	0	0	0	0.04	0	0	0.07	0.04	0	0
6	7.51	7.53	22.72	56.80	0.13	0.58	1.10	0	0	0	0	0	0	0	0	0	0	0
7	7.55	7.52	12.33	41.28	0.08	0.05	0.08	0	0.32	0	0	0	0	0	0	0	0	0
8	7.56	7.57	13.40	34.37	0.22	0	0	0	0	0	0	0	0	0	0.22	0	0	0
9	7.51	7.56	30.27	26.44	0	0	1.32	0	0	0	0	0	0	0	0	0	0	0
10	7.57	7.56	13.55	34.30	3.69	0	0.07	0	0	0	0	0	0	0	0	0	0	0
Patterson Lake Lakeshore	0.55	-	1.14	-	0	-	0.87	-	0	-	0	-	0	-	0	-	0	0
Creek 1	0.50	0.51	0.84	1.81	0	2.76	0	0	0	0	0	0	0	0	0	0	0	0
Creek 3	0.50	0.51	1.50	3.80	0	0	1.33	0	0	0	0	0	0	0	0	0	0	0
Patterson Creek	0.53	0.51	0.96	3.83	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0
Road/ Anthro	17.56	20.40	54.06	119.27	0.30	0.18	0.02	0	0	0	0.96	0.07	0	0	0.04	0.18	0	0.02
Total / Average	**94.95**	**97.07**	**216.46**	**482.07**	**0.55**	**0.17**	**0.39**	**0**	**0.02**	**0.002**	**0.27**	**0.05**	**0.01**	**0**	**0.03**	**0.05**	**0**	**0.004**
Mean	**96.01**		**349.27**		**0.36**		**0.20**		**0.01**		**0.16**		**0.005**		**0.04**		**0.002**	

Note:
Dash = not sampled.

Table 4.3-3 Number of Trails per Km-day by Ecosite in the RSA – Winter 2018 & 2020.

Ecosite*	Length (Km)		Km-days		Microtines (Trails/ Km-Day)		Red Squirrel (Trails/ Km-Day)		Snowshoe Hare (Trails/ Km-Day)		Grouse/ Ptarmigan (Trails/ Km-Day)		Ermine (Trails/ Km-Day)		Mink (Trails/ Km-Day)		Least Weasel (Trails/ Km-Day)	
	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020
BP02	8.77	8.55	17.27	38.44	0.06	0.03	1.79	0.47	0.87	1.61	0.17	0.08	0.12	0.08	0	0	0	0
BP03	3.71	3.62	11.66	13.71	0	0.36	2.14	0.07	0.09	0	0	0	0	1.17	0	0	0	0
BP04	0.42	0.41	1.40	2.72	0	0	0	1.10	0	0	0	0	0	1.10	0	0	0	0
BP12	2.51	2.64	8.32	17.11	0	0.94	1.32	0.23	0.12	0	0.36	0.41	0.12	0.41	0.24	0.06	0	0
BP14	0.61	0.56	2.03	3.17	0	0	8.85	0	0	0	0	0	0	0	2.46	0	0	0
BP16	0.50	0.51	1.50	3.80	5.32	0	0	0	0	0	2.00	0	0	0	0	0.53	0	0
BP19	1.24	0.85	3.68	3.80	0	1.05	0	0	0	0.26	0	0	0	0	0.27	0.26	0	0
BP20	1.90	2.01	3.50	8.81	0	0	0	0	0.29	0.23	0	0	0	0	0	0	0	0
BP22	0.15	0.16	0.25	0.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BP24	0.25	0.20	0.40	1.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BP25	0.59	0.82	1.00	4.12	0	0	0	0	0	0	0	0.49	0	0.97	0	0.49	0	0
BP26	0.09	0.10	0.37	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BS14	0.56	0.05	1.25	0.35	0	0	0	0	0	0	9.58	0	0	0	3.19	0	0	0
RF1-C	0.49	0.49	0.63	3.27	0	0.61	0	0	0	0	0	0	0	1.22	0	0	0	0
RF2-B	0.15	0.20	0.44	1.50	0	0	0	0	0	0	0	0	0	0	2.28	0	0	0
RF2-C	24.47	24.64	47.48	141.48	0.08	0.09	1.18	0.18	16.22	8.33	0.72	0.04	0.40	0.14	0	0	0	0
RF2-D	0.14	0.14	0.40	1.11	0	0	0	0	0	7.24	7.54	0	0	0.90	0	0	0	0
RF3-C	0.66	0.66	1.23	1.67	0	0	0	0	0	0	0	0	4.07	0	0	0	0	0
RF4	15.93	15.71	28.29	60.92	0.28	0.16	0.18	0.02	0.18	0.26	0.11	0	0.04	0.03	0.04	0	0	0.05
Lake	4.44	4.38	13.33	16.25	0	0	0	0	0	0	0.53	0	0	0	0.08	0	0	0
Anthropogenic	17.56	20.40	54.06	119.27	0	0	0.91	0	3.33	0	0.76	0	0.11	0.02	0	0	0	0
Total	**85.14**	**87.09**	**198.50**	**443.80**	**0.11**	**0.11**	**0.74**	**0.12**	**4.90**	**2.85**	**0.55**	**0.04**	**0.17**	**0.14**	**0.08**	**0.01**	**0**	**0.01**
Mean	**86.12**		**321.15**		**0.11**		**0.43**		**3.88**		**0.29**		**0.16**		**0.04**		**0.003**	

* Refer to Table 4.3-4 for ecosite code descriptions.

Table 4.3-3 Number of Trails per Km-day by Ecosite in the RSA – Winter 2018 & 2020 - cont.

Ecosite*	Length (Km)		Km-days		Marten (Trails/ Km-Day)		Fisher (Trails/ Km-Day)		Otter (Trails/ Km-Day)		Fox (Trails/ Km-Day)		Coyote (Trails/ Km-Day)		Lynx (Trails/ Km-Day)		Moose (Trails/ Km-Day)	
	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020
BP02	8.77	8.55	17.27	38.44	0.35	0.13	0.58	0	0	0	0	0.026	0.06	0	0.17	0	0	0
BP03	3.71	3.62	11.66	13.71	3.00	0	1.46	0	0	0	0	0	0	0	0	0	0	0
BP04	0.42	0.41	1.40	2.72	0	2.58	1.43	0	0	0	0	0	0	0	0	0	0	0
BP12	2.51	2.64	8.32	17.11	0.12	0.99	2.52	0	0	0	0	0	0	0	0	0	0	0
BP14	0.61	0.56	2.03	3.17	0.98	0.32	0.98	0	0	0	0	0	0	0	0	0	0	0
BP16	0.50	0.51	1.50	3.80	0	0	1.33	0	0	0	0	0	0	0	0	0	0	0
BP19	1.24	0.85	3.68	3.80	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BP20	1.90	2.01	3.50	8.81	0	0	0.29	0	0	0	0	0	0	0	0	0	0	0
BP22	0.15	0.16	0.25	0.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BP24	0.25	0.20	0.40	1.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BP25	0.59	0.82	1.00	4.12	0	1.46	0	0	0	0	0	0	0	0	0	0	0	0
BP26	0.09	0.10	0.37	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BS14	0.56	0.05	1.25	0.35	0	0	0.80	0	0	0	0	0	0	0	0	0	0	0
RF1-C	0.49	0.49	0.63	3.27	0	0	0	0	0	0	0	0.306	0	0	0	0	0	0
RF2-B	0.15	0.20	0.44	1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RF2-C	24.47	24.64	47.48	141.48	0.06	0.11	0.55	0	0	0	0.13	0.06	0	0	0.02	0.01	0	0
RF2-D	0.14	0.14	0.40	1.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RF3-C	0.66	0.66	1.23	1.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RF4	15.93	15.71	28.29	60.92	0.35	0.16	0.04	0	0.14	0.02	0.04	0.10	0.04	0	0	0	0	0
Lake	4.44	4.38	13.33	16.25	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0
Anthropogenic	17.56	20.40	54.06	119.27	0.30	0.18	0.02	0	0	0	0.96	0.07	0	0	0.04	0.18	0	0.02
Total	**85.14**	**87.09**	**198.50**	**443.80**	**0.37**	**0.19**	**0.42**	**0**	**0.02**	**0.002**	**0.30**	**0.06**	**0.01**	**0**	**0.03**	**0.05**	**0**	**0.005**
Mean	**86.12**		**321.15**		**0.28**		**0.21**		**0.01**		**0.18**		**0.005**		**0.04**		**0.002**	

* Refer to Table 4.3-4 for ecosite code descriptions.

Table 4.3-4 Ecosites in the Area of the Project.

Ecosite Code		Ecosite Name/ Description	RSA (Ha)	LSA (Ha)	RSA (%)	LSA (%)
Boreal Plain	Boreal Shield					
RF4		Recent burn (Age: 1 year)	6,581.9	0.0	16.4	0.0
RF3-Coniferous		Regenerating coniferous forest - low shrub <1 m tall (15-20 years)	965.3	0.0	2.4	0.0
RF3-Bog		Regenerating bog- low shrub <1 m tall (15-20 years)	127.9	0.0	0.3	0.0
RF2-Coniferous		Regenerating coniferous forest - tall shrub 1-5 m tall (20-35 years)	10,636.5	2,123.6	26.6	51.6
RF2-Deciduous		Regenerating deciduous forest - tall shrub 1-5 m tall (20-35 years)	474.3	219.0	1.2	5.3
RF2-Bog		Regenerating bog - tall shrub 1-5 m tall (20-35 years)	343.5	52.6	0.9	1.3
RF1-Coniferous		Regenerating coniferous forest - treed >5 m tall (25-40 years)	612.9	20.6	1.5	0.5
RF1-Deciduous		Regenerating deciduous forest - treed >5 m tall (25-40 years)	919.8	133.7	2.3	3.3
BP2	BS3	Jack pine - lichen	3,729.2	282.3	9.3	6.9
BP3	BS4	Jack pine / feathermoss	1,972.4	187.8	4.9	4.6
BP4	BS6	Jack pine - trembling aspen / prickly rose / grass	173.1	104.5	0.4	2.5
BP12	BS4	Jack pine - spruce / feathermoss	216.2	0.0	0.5	0.0
N/A	BS14	White birch / lingonberry - Labrador tea	74.6	0.8	0.2	0.0
BP14	N/A	Black spruce / Labrador tea / feathermoss	132.2	28.8	0.3	0.7
BP16	BS16	Balsam poplar - trembling aspen / prickly rose	33.2	0.6	0.1	0.0
BP19	BS17	Black spruce treed bog	499.1	59.4	1.2	1.4
BP20	BS18	Labrador tea shrubby bog	1,321.2	95.6	3.3	2.3
BP21	BS19	Graminoid bog	25.3	0.0	0.1	0.0
BP22	BS20	Open bog	8.6	0.0	0.0	0.0
BP23	BS21	Tamarack treed fen	21.1	0.8	0.1	0.0
BP24	BS22	Leatherleaf shrubby poor fen	54.1	12.9	0.1	0.3
BP25	BS23	Willow shrubby rich fen	68.9	4.8	0.2	0.1
BP26	BS24	Graminoid fen	45.1	7.7	0.1	0.2
BP27	BS25	Open fen	55.6	0.0	0.1	0.0
N/A	BS26	Rush sandy shore	16.9	0.8	0.0	0.0
DL1		Disturbed lands - vegetated	0.3	0.0	0.0	0.0
LK		Water body	10,903.5	775.6	27.3	18.9
Total			**40,012.6**	**4,111.7**	**100.0**	**100.0**

Source: Annex VII.1 Vegetation Baseline Report 1 (Mapping).

Listed below in descending order are average species and trail densities from the winter 2018 and 2020 surveys, expressed as trails per km-day, for the RSA to provide an indication of relative abundance.

- Snowshoe hare (*Lepus americanus*) – 3.57 trails / km-day
- Red squirrel (*Tamiasciurus hudsonicus*) – 0.57 trails / km-day
- Marten (*Martes americana*) – 0.36 trails / km-day
- Grouse (*Phasianidea spp.*) or Ptarmigan (*Lagopus spp.*) – 0.28 trails / km-day
- Fisher (*Martes pennanti*) – 0.20 trails / km-day
- Ermine (*Mustela erminea*) – 0.19 trails / km-day
- Red fox (*Vulpes vulpes*) – 0.16 trails / km-day
- Microtine rodent species – 0.11 trails / km-day
- Mink (*Mustela vison*) – 0.05 trails / km-day
- Canada Lynx (*Lynx canadensis*) – 0.04 trails / km-day
- Otter (*Lontra canadensis*) – 0.01 trails / km-day
- Coyote (*Canis latrans*) – <0.01 trails / km-day
- Least Weasel (*Mustela nivalis*) – <0.01 trails / km-day
- Moose (*Alces alces*) – <0.01 trails / km-day

4.3.1 Carnivores

Nine species of carnivore trails were detected during winter tracking surveys: coyote; marten; ermine; least weasel; mink; fisher; red fox; lynx; and otter. Carnivore species were observed in approximately 86% (18/21) of Ecosites surveyed (Table 4.3-1 and Table 4.3-2). They were not detected in open bog (BP22), leatherleaf shrubby poor fen (BP24), or graminoid fen (BP26).

Marten trails were the most observed carnivore sign across both survey years. Trails were detected on all transect types (i.e., triangle, creek/lakeshore, and road/anthropogenic), with a mean density of 0.36 trails per km-day across both sampling years. Transect 10 (1.85 mean trails / km-day), Transect 2 (1.57 mean trails / km-day), and Creek 1 (1.38 mean trails / km-day) had the highest mean trail densities across both survey years. In 2018, the highest trail density was observed on Transect 10 (3.69 trails / km-day), while during the 2020 surveys the highest trail density was detected on Creek 1 (2.76 trails / km-day). Marten trails were detected in approximately 48% (10/21) of ecosites surveyed across both sampling years. The highest trail densities were observed in jack pine/feathermoss (BP3) (1.50 mean trails/ km-day), jack pine – trembling aspen/feathermoss (BP4) (1.3 mean trails/ km-day), and willow (*Salix spp.)* shrubby rich fen (BP25) (0.72 mean trails/ km-day) ecosites. In 2018, the highest trail density was observed in jack pine/feathermoss (BP3) (3.0 trails / km-day) ecosites, while during the 2020 sampling year the highest trail density was observed in jack pine – trembling aspen/feathermoss (BP4) (2.6 trails / km-day) ecosite.

Fisher trails were observed on all three transect types (i.e., triangle, creek/lakeshore, and road/anthropogenic) with a mean density of 0.20 trails per km-day across sampling years. Creek 3 (0.67 mean trails / km-day), Transect 9 (0.66 mean trails / km-day), and Transect 3 (0.64 mean trails / km-day) had the highest densities of trails. The highest trail density observed in 2018 was along Creek 3 (1.33 trails / km-day). No Fisher trails were detected in 2020. Fisher trails were detected in approximately 52% (11/21) of ecosites across both years. Trail densities were highest in ecosites BP12 (Jack pine – spruce/feathermoss) (1.26 mean trails / km-day), jack pine/feathermoss (BP3) (0.73 mean trails / km-day), and jack pine – trembling aspen/feathermoss (BP4) (0.71 mean trails / km-day) ecosites. Fisher trails were only observed in 2018 and not in 2020, with the highest density in ecosite jack pine – spruce/feathermoss (BP12) (2.52 trails / km-day).

Ermine trails were detected on all transect types (i.e., triangle, creek/lakeshore and road /anthropogenic), with a mean density of 0.19 trails per km-day across sampling years. Transects 10 (0.74 mean trails / km-day), Patterson Creek (0.52 mean trails / km-day), and Transect 8 (0.39 mean trails / km-day) had the highest trail densities across both sampling years. In 2018 the highest trail density was observed along Transect 10 (1.48 trails / km-day), while the highest trail density in 2020 was detected along Patterson Creek (1.04 trails / km-day). Ermine trails were detected in approximately 52% (11/21) of ecosites surveyed across both sampling years. The highest trail densities were observed in the regenerating coniferous forest – low shrub <1 m (RF3-C) (2.04 mean trails / km-day), regenerating coniferous forest - treed >5 m (RF1-C) (0.61 mean trails / km-day), and jack pine/feathermoss (BP3) (0.58 mean trails / km-day) ecosites. In 2018, the highest trail density was observed in regenerating coniferous forest – low shrub <1 m (RF3-C) (4.07 trails / km-day) ecosite, while during the 2020 sampling year the highest trail density was observed in the regenerating coniferous forest - treed >5 m (RF1-C) (1.22 trails / km-day) ecosite.

Red fox trails were detected on two transect types (i.e., triangle and road/anthropogenic) and averaged a density of 0.16 trails per km-day across sampling years. Road/anthropogenic (0.51 mean trails / km-day), Transect 3 (0.44 mean trails / km-day), and Transect 4 (0.13 mean trails / km-day) had the highest trail densities across both sampling years. The highest trail density in 2018 was observed along the road/anthropogenic transect (0.96 trails / km-day), while the 2020 sampling year detected the highest trail density along Transect 4 (0.27 trails / km-day). Red fox trails were detected in approximately 24% (5/21) of ecosites surveyed across both sampling years. The highest trail densities were observed in the linear and polygonal disturbance (anthropogenic) (0.51 mean trails / km-day), regenerating coniferous forest - treed >5 m (RF1-C) (0.15 mean trails / km-day), and regenerating coniferous forest – tall shrub 1-5 m (RF2-C) (0.13 mean trails / km-day) ecosites. In 2018, the highest trail density was observed in linear and polygonal disturbance (anthropogenic) (0.96 trails / km-day) ecosite, while during the 2020 sampling year the highest trail density was observed in the regenerating coniferous forest - treed >5 m (RF1-C) (0.31 trails / km-day) ecosite.

Mink trails were observed on two transect types (i.e., triangle and creek/lakeshore) with a mean density of 0.05 trails per km-day across sampling years. Patterson Creek (0.78 mean trails / km-day), Creek 3 (0.26 mean trails / km-day) and Transect 10 (0.22 mean trails / km-day) had the highest densities of trails across both sampling years. The highest trail density in 2018 was observed along the Patterson Lake Lakeshore (2.62 trails / km-day), while the 2020 survey detected the highest trail density along Creek 3 (0.53 trails / km-day). Mink trails were detected in approximately 43% (9/21) of ecosites surveyed across both sampling years. The highest trail densities were observed in the white birch (*Betula papyrifera*) /lingonberry (*Vaccinium vitis-idaea*) – Labrador tea (*Rhododendron groenlandicum*) (BS14) (1.60 mean trails / km-day), black spruce/Labrador tea/feathermoss (BP14) (1.23 mean trails / km-day), and regenerating bog – tall shrub 1-5 m (RF2-B) (1.14 mean trails / km-day) ecosites. In 2018, the highest trail density was observed in white birch/lingonberry – Labrador tea (BS14) (3.19 trails / km-day) ecosite while during the 2020 sampling year the highest trail density was observed in the balsam poplar – trembling aspen/prickly rose (*Rosa acicularis*) (BP16) (0.53 trails / km-day) ecosite.

Canada lynx trails were detected on triangle and road/anthropogenic transects with a mean density of 0.04 trails per km-day across sampling years. The road/anthropogenic transect had the highest trail density (0.11 mean trails / km-day), followed by Transect 8 (0.11 mean trails / km-day), and Transect 5 (0.05 mean trails / km-day). In 2018, trail density was highest along Transect 8 (0.22 trails / km-day), while trail density in 2020 was highest along the road/anthropogenic transect (0.18 trails / km-day). Canada lynx trails were detected in approximately 14% (3/21) of ecosites surveyed across both sampling years. The linear and polygonal disturbance (anthropogenic) (0.11 mean trails / km-day) ecosite had the highest trail density, followed by jack pine/lichen (BP2) (0.09 mean trails / km-day), and regenerating coniferous forest – tall

shrub 1-5 m (RF2-C) (0.02 mean trails / km-day) ecosites. In 2018, the highest trail density was observed in jack pine/lichen (BP2) (0.17 trails / km-day), while during the 2020 sampling year the highest trail density was observed in the linear and polygonal disturbance (anthropogenic) (0.18 trails / km-day) ecosite.

Otter trails were observed on Transect 7 (0.16 mean trails / km-day) and Transect 2 (0.02 mean trails / km-day) across both sampling years. Trails were detected in one (5%) ecosite across sampling years: the Recent burn (RF4) (0.08 mean trails / km-day).

Coyote trails were only observed on Transect 2 (0.08 mean trails / km-day) across sampling years. Coyote trails were detected in the jack pine/lichen (BP2) (0.03 mean trails / km-day) and recent burn (RF4) (0.02 mean trails / km-day) ecosites.

Least weasel trails were observed on Transects 4 and 7 in 2020 at a density of 0.05 trails per km-day. Least weasel trails were only detected in the recent burn (RF4) (<0.01 mean trail / km-day) ecosite.

4.3.2 Small Mammal Prey and Game Birds

The trails of four different species or species groups of small mammals and game birds were observed during winter tracking surveys including: snowshoe hare; red squirrel; grouse/ptarmigan; and microtine rodents. Small mammals/game birds were observed in approximately 76% (16/21) ecosites sampled across sampling years (Table 4.3-1 and Table 4.3-2). They were not detected in open bog (BP22), leatherleaf shrubby poor fen (BP24), graminoid fen (BP26), or regenerating bog - tall shrub 1-5 m tall (RF2-B).

Snowshoe hare trails were observed on two transect types (i.e., triangle and road/anthropogenic) averaging 3.57 trails per km-day across the study area. The highest densities of snowshoe hare trails were detected on Transect 8 (30.38 mean trails / km-day), Transect 5 (13.01 mean trails / km-day), and Transect 3 (12.47 mean trails / km-day) across both sampling years. The highest trail density during the 2018 survey was detected along Transect 8 (59.66 trails / km-day), while the 2020 survey detected the highest trail density along Transect 5 (13.31 trails / km-day). Snowshoe hare trails were observed in approximately 43% (9/21) of ecosites across sampling years. The highest trail densities were observed in the regenerating coniferous forest – tall shrub 1-5 m (RF2-C) (12.27 mean trails / km-day), regenerating deciduous forest – tall shrub 1-5 m (RF2-D) (3.61 mean trails / km-day), and linear and polygonal disturbance (anthropogenic) (1.66 mean trails / km-day) ecosites. In 2018 and 2020, the highest trail density was observed in the ecosite regenerating coniferous forest – tall shrub 1-5 m (RF2-C) at 16.22 and 8.33 trails per km-day, respectively.

Red squirrel trails were detected on two transect types (i.e., triangle and road/anthropogenic) across sampling years with a mean trail density of 0.57 trails per km-day across the study area. Transect 8 (1.46 mean trails / km-day), Transect 10 (1.43 mean trails / km-day), and Transect 6 (0.68 mean trails / km-day) had the highest trail densities across sampling years. The highest trail density during the 2018 survey was detected along Transect 8 (2.84 trails / km-day), while the 2020 survey detected the highest trail density along Transect 5 (0.56 trails / km-day). Red squirrel trails were observed in approximately 38% (8/21) of ecosites across sampling years. The highest trail densities were observed in the black spruce/Labrador tea/feathermoss (BP14) (4.42 mean trails / km-day), jack pine/lichen (BP2) (1.13 mean trails / km-day), and jack pine/feathermoss (BP3) (1.11 mean trails / km-day) ecosites. In 2018, the highest trail density was observed in black spruce/Labrador tea/feathermoss (BP14) (8.85 trails / km-day) ecosite, while during the 2020 sampling year the highest trail density was observed in the Jack pine – trembling aspen/feathermoss (BP4) (1.10 trails / km-day) ecosite.

Grouse/ptarmigan trails were observed on all three transect types (i.e., triangle, road/anthropogenic and creek/lakeshore) averaging 0.28 trails per km-day across sampling years. The highest density of grouse/ptarmigan trails were detected on Creek 3 (1.00 mean trails / km-day), Transect 5 (0.93 mean trails

/ km-day), and Transect 3 (0.47 mean trails / km-day). In 2018, the highest trail density was observed along Patterson Lake lakeshore (16.61 trails / km-day), while during the 2020 sampling year, the highest trail density was observed along Patterson Creek (0.52 trails / km-day). Grouse/ptarmigan trails were observed in approximately 48% (10/21) of ecosites across sampling years. The highest trail densities were observed in the white birch/lingonberry – Labrador tea (BS14) (4.79 mean trails / km-day), regenerating deciduous forest – tall shrub 1-5 m (RF2-D) (3.77 mean trails / km-day), and balsam poplar –trembling aspen/prickly rose (BP16) (1.00 mean trails / km-day) ecosites. In 2018, the highest trail density was observed in white birch/lingonberry – Labrador tea (BS14) (9.58 trails / km-day) ecosite, while during the 2020 sampling year the highest trail density was observed in the willow shrubby rich fen (BP25) (0.49 trails / km-day) ecosite.

Microtine rodent trails were observed on two transect types (i.e., triangle and creek/lakeshore) and averaged 0.11 trails per km-day across sampling years. The highest density of microtine rodent trails was observed along Creek 3 (2.66 mean trails / km-day), Transects 2 (0.30 mean trails / km-day), and Transect 7 (0.27 mean trails / km-day). In 2018, the highest trail density was observed along Creek 3 (5.32 trails / km-day), while during the 2020 sampling year the highest trail density was observed along Transect 6 (0.30 trails / km-day). Microtine rodent trails were observed in approximately 38% (8/21) of ecosites across sampling years. The highest trail densities were observed in the balsam poplar –trembling aspen/prickly rose (BP16) (2.66 mean trails / km-day), black spruce treed bog (BP19) (0.53 mean trails / km-day), and jack pine – spruce/feathermoss (BP12) (0.46 mean trails / km-day) ecosites. In 2018, the highest trail density was observed in balsam poplar –trembling aspen/prickly rose (BP16) (5.32 trails / km-day) ecosite, while during the 2020 sampling year the highest trail density was observed in the black spruce treed bog (BP19) (1.05 trails / km-day) ecosite.

Figure 10 presented by the Athabasca Denesųłiné also highlights the importance of the area and “represents the areas that were identified as small game and furbearing harvesting areas. Specific species identified were rabbits, mink, beaver, fisher, marten, muskrat, fox, wolf, otter, wolverine, squirrel, weasel, porcupine, and bears.” (Ya’thi Nene Lands and Resources 2020, pages 15 and 30).

4.3.3 Ungulates

The trails of one ungulate species were encountered during the winter track count surveys: moose. Moose trails were only encountered during the 2020 sampling year along the road/anthropogenic transect. The density of moose trails across sampling years was 0.002 trails per km-day (Table 4.3-2 and Table 4.3-3).

Although ungulate trails were less common than other species’ trails, traditional land use studies indicated that the area was important and well used for the harvesting of big game species. Specifically:

- The Metis Nation Saskatchewan Northern Region II indicated that “the area is still used, mostly to hunt moose (WD Lewis 2020).”
- The Athabasca Denesųłiné have indicated that “the area was identified for harvesting of big game including caribou, moose and whitetail deer” (Ya’thi Nene Lands and Resources 2020).
- During working group engagement, it was also indicated that “there is a migration route for moose, caribou and bear at the narrows between the intake and discharge for the mine” (NexGen 2020, BNDN-183).

5.0 WINTER BACKTRAILING SURVEY

5.1 Study Objectives

Winter backtrailing surveys of mammal species in the RSA and LSA was completed to gather information on local habitat/anthropogenic use by ungulates and ungulate-associated predator species. The objectives of this survey were to:

- collect data on the use and avoidance of natural and manmade features;
- collect data on the ecosite use by ungulates and the associated predators; and
- provide a scientifically defensible baseline for potential follow-up/monitoring requirements.

5.2 Methods

Candidate trails for backtrailing were detected through systematic surveys along linear features with winter vehicle access within the RSA and LSA between 30 March 2019 and 1 April 2019. A total of 120 km were surveyed. Survey conditions are listed in Table 5.2-1. All trails of target species (i.e., moose, woodland caribou, and wolf (*Canis lupus*)) encountered were documented using a handheld GPS to mark a waypoint. Due to limited number of trails observed, all trails encountered were selected to be backtrailed. It is understood that this survey has limitations, and in-depth statistics cannot be completed for the data set. It does however provide information on local habitat/anthropogenic use by species within the RSA.

The animal(s) path of travel was mapped by two observers using the track-log function in a handheld GPS unit. Observers included a Professional Biologists and an assistant, both proficient in wildlife snow track identification. Track point intervals were recorded every three seconds. The track-log points delineate fine-scale travel paths, record habitat use, and document behavioural observations (e.g., response to and use of linear features). Recorded observations included: direction of travel; bedding; feeding; defecation; trail interactions with other species; and general behaviour. Caribou feeding craters were recorded according to Stepaniuk (1997) as small (<2 m in diameter), medium (2 to 5 m in diameter), large (>5 m), or as complex (many craters over a large area). The frequency of each crater size was recorded at feeding bouts. The UTM coordinates marked the locations of documented observations. Interactions with and distance travelled on linear features, such as all-season roads, seasonal roads, trails, conventional cut lines, and hand-cut lines, were recorded. The length of each backtrail event per ecosite phase travelled was calculated.

Survey design and field methodologies were guided by peer-reviewed methodology and were completed under Saskatchewan Government Research Permit/Species Detection #18FW031 and 18SD170.

Table 5.2-1 Winter Backtrailing Survey Timing and Weather Summary

Backtrailing Event (Species)	Date	Temperature (°C)		Mean Snow Depth (cm)
		Minimum	Maximum	
Woodland Caribou	31-March-2019	-7.3	-1.0	19.0
Moose	1-Apil-2019	-9.8	-1.2	20.0
Wolf	30-March-2019	-16.2	0.2	19.0

5.3 Results

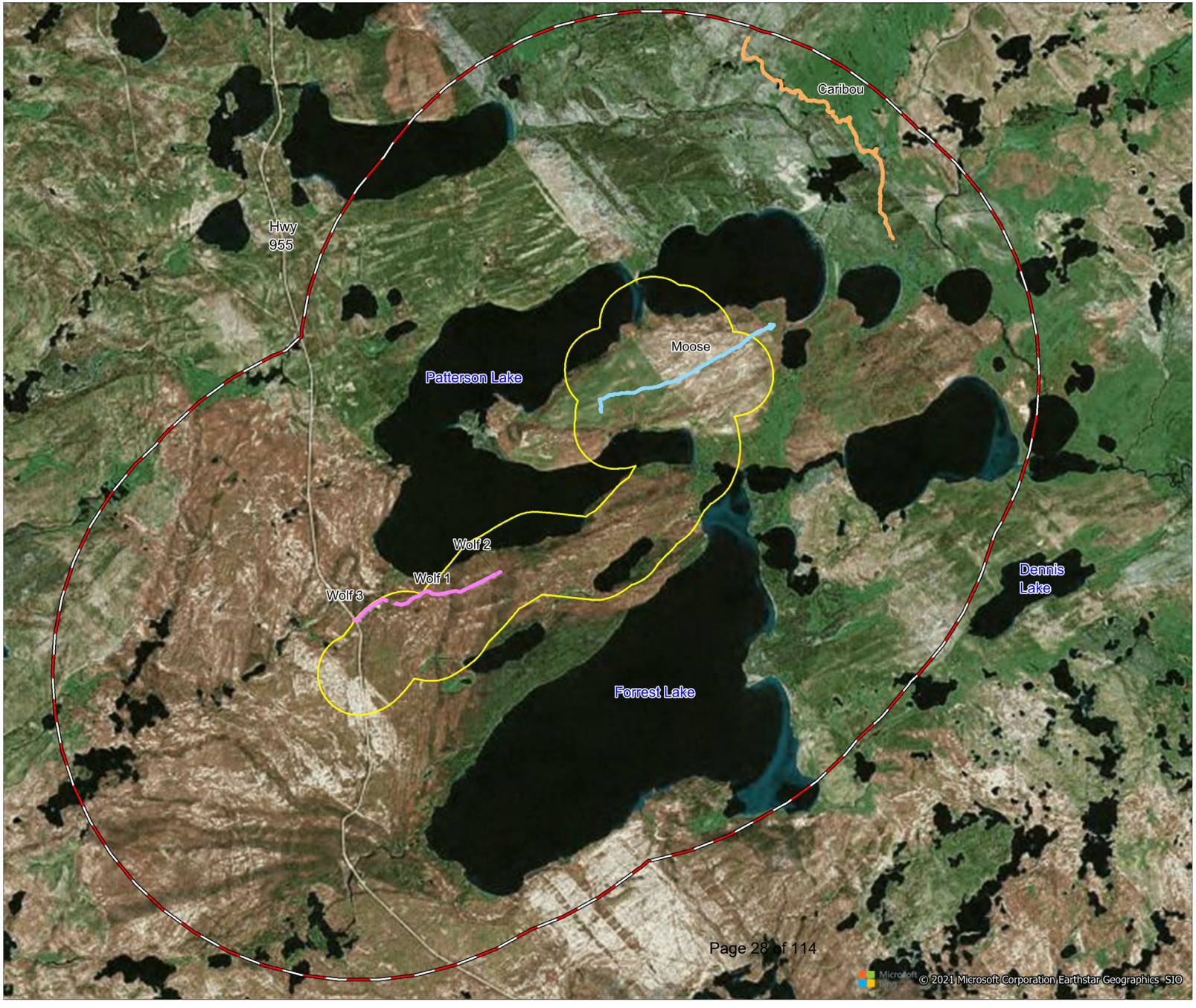
Three species, woodland caribou, moose, and grey wolf were backtrailed in the area of the Project (Figure 5.3-1).

Four woodland caribou travelling together were backtrailed for a total of 10.1 km in the RSA. The most utilized ecosites/vegetation cover types were recent burn (RF4) (54%) and Labrador tea shrubby bog (BP20) (38%). Woodland caribou did not utilize any ecosites/vegetation cover types that overlapped with use by predators (e.g., wolves) or alternate prey (e.g., moose) in this survey (Table 5.3-1). One documented browse event in a residual Labrador tea shrubby bog (BP20) and four pellet groups were documented during the entirety of the backtrail event. The First Nation Community engagement database indicated that “there is a migration route for moose, caribou and bear at the narrows between the intake and discharge for the mine.” (NexGen 2020, BNDN-183).

Two wolves were backtrailed for a total of 4.2 km within the LSA. The wolves utilized linear features for 99% of the backtrail event. The ecosites/vegetation cover types most frequently travelled were regeneration – deciduous tall shrub dominated (RF2-D) (48%) and regeneration – coniferous tall shrub dominated (RF2-C) (31%) (Table 5.3-1). One urination and one intercept of a prey species (e.g., moose) trail was observed during the entirety of the backtrail event.

One moose was backtrailed for a total of 7.1 km within the LSA and RSA. The entire backtrail event occurred with the regeneration – coniferous tall shrub dominated (RF2-C) (Table 5.3-1); however, observers noted patches of deciduous vegetation with heavy use along the backtrail event. In particular, 28 bed-sites, 19 browse events, and 16 pellet groups occurred within these patches, suggesting continued multi-day use of the area. The browse events occurred most frequently on white birch trees and shrubs (84%), with a small amount of browse occurring on alder (*Alnus spp.*) and jack pine shrubs.

Figure 5.3-1 Winter Backtrail Surveys



Legend

- Caribou Trail
- Moose Trail
- Wolf Trail
- Regional Study Area (RSA)
- Local Study Area (LSA)

N
W E
S

0 5 10

kilometers
Scale = 1 : 90,000

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Table 5.3-1 Winter Backtrail Events in the RSA – March 30-April 1, 2019.

Species	Total Distance (km)	Distance in LSA (km)	Distance in RSA (km)	Distance on Linear Feature (km)	Distance (km) by Ecosite/Vegetation Cover Type								
					BP2	BP3	BP20	BP26	BP27	RF2-C	RF2-D	RF4	Lake
Woodland Caribou	10.1	0	10.1	0	0	0	3.8	0.04	0.4	0	0	5.5	0.4
Moose	7.1	5	2.1	0	0	0	0	0	0	7.1	0	0	0
Wolf	4.2	4.1	0.1	4.1	0.6	0.3	0	0	0	1.3	2.0	0	0

6.0 SPRING UNGULATE PELLET GROUP/BROWSE AVAILABILITY SURVEY

6.1 Study Objectives

Pellet group/browse availability surveys were completed between 6 June 2018 and 15 June 2018 and replicated between 21 May 2019 and 30 May 2019 along the same transects established for the winter track count surveys. The objectives of this survey were to:

- collect data on the presence of ungulates (i.e., moose and woodland caribou) and carnivores in the Project area by transect and ecosite;
- collect data on the relative abundance of ungulates (i.e., moose and woodland caribou) and carnivores in the Project area by transect and ecosite;
- collect data on browse availability and use of woody forage species for moose;
- describe the frequency of occurrence and abundance of terrestrial and arboreal lichen for woodland caribou;
- collect data on the presence and relative abundance of game birds (e.g., grouse/ptarmigan species); and
- develop a scientifically defensible baseline to support effects assessments and to allow for potential future follow up/monitoring requirements.

6.2 Methods

Handheld GPS and satellite imagery were used to navigate the pre-established transects (i.e., same transects used for winter track counts) and to measure sub-transect lengths. Observers searched for ungulate pellet groups and carnivore scats one metre on either side of the transect line. Data were collected by a Professional Biologist registered with the ASPB, proficient in pellet and vegetation identification, and an assistant. Each transect was broken into 50-m sub-transects. The UTM coordinates for the start and end points of each 50-m sub-transect were recorded. Winter (i.e., non-growing season) pellet groups were recorded separately from summer (i.e., growing season) pellet groups based on shape and texture. Observed pellet groups that were deposited before the previous winter were also recorded but were labelled as “Old”.

In addition to pellets, systematic records of squirrel midden locations and grouse flushes were also recorded to collect information on the occurrence, spatial distribution, relative abundance, and ecosite affiliations of these important prey species. Squirrel middens were recorded within 3 m of the transect patch and grouse flushes were recorded using the methods adapted from the Government of BC (1997).

At the end of each 50 m sub-transect, a detailed browse availability/use plot was completed using a 5.6-m radius (100 m^2) plot. Terrestrial and arboreal lichen are important forage for woodland caribou, and woody browse species are important forage for moose and deer. The percent cover class of each woody shrub species available within the plot was recorded. Cover classes included: nil (0%); very low (0 to 5%); low (5 to 25%); moderate (25 to 50%); and high (>50%) (Daubenmire 1959). An estimate of the percent of available twigs browsed was also completed using the same classes. The browse use classes measured forage use of woody plants by all ungulates and did not make a distinction as to the species of ungulate using these plants. Terrestrial lichen cover was estimated using a representative 1-m x 1-m plot nested within the larger 5.6-m radius plot. Arboreal lichen cover was estimated using five relative abundance cover classes as per the methods of Armleder et al. (1992).

Pellet group/browse survey transects were overlain onto ecosite mapping within a geographic information system (GIS). Each sub-transect was assigned an ecosite type using field notes and GIS query data. Pellet counts were made for the number of pellets or scats per sub-transect (50-m x 2-m, or 100 m^2) and for all

segments and transects. The resultant measure of ungulate use was the number of pellet groups/ha per animal species and ecosite type. Frequency of occurrence (i.e., constancy) and mean percent canopy coverage (i.e., midpoints of canopy closure classes) of each available woody browse species were calculated for sub-transects by vegetation cover type. These two values were multiplied to provide an availability index value for each browse species and vegetation type. The frequency of use and mean percent browsing (i.e., midpoints of vegetation cover classes) of woody browse species were calculated for each species and vegetation cover type. These two values were multiplied to determine a browse use index value for each woody browse species and ecosite type.

Survey design and field methodologies were guided by Neff (1968), and were completed under Saskatchewan Government Research Permit/Species Detection #18FW031 and 18SD170.

6.3 Results

A total of 10 triangle shaped transects and three riparian transects were surveyed. A total of approximately 15 hectares (ha) was searched each year (Figure 6.3-1 and Table 6.3-1). Six species or species groups were detected across the surveys (Table 6.3-1). Listed below in descending order are the mean pellet group and scat densities, expressed as pellet groups or scats per hectare in the RSA for each species detected:

- Grouse/ptarmigan – 13.8/ha
- Moose – 1.0/ha
- Black bear (*Ursus americanus*) – 1.0/ha
- Woodland caribou – 0.8/ha
- Mink – 0.03/ha
- Otter – 0.03 ha

Additional observations included squirrel middens, detected at a frequency of 2.7/ha and grouse flushes detected at a frequency of 0.1/ha.

6.3.1 Pellet Group Densities

Ungulates

Two species of ungulate pellet groups were observed during the survey: moose; and woodland caribou.

Moose winter pellet groups were observed along seven different transects and summer pellet groups along two transects across both years. Winter pellet groups were detected most frequently on Transect 9 (4.1 pellet groups/ha), Transect 5 (3.9/ha), and Transect 6 (2.6/ha) in 2018. Winter pellet groups were most frequently detected along Creek 3 (10/ha), Transect 9 (2.1/ha), and Transect 5 (2.0/ha) in 2019. Summer pellet groups were observed along Patterson Creek (10.0/ha) in 2018 and Transect 9 (0.7/ha) in 2019. (Figure 6.3-1 and Table 6.3-1).

Moose winter pellet groups were detected in approximately 42% (10/24) ecosites/vegetation cover types and summer pellet groups were detected in approximately 8% (2/24) ecosite/vegetation cover types across both survey years. Ecosites/vegetation cover types with the highest densities of winter pellet groups in 2018 included: willow shrubby rich fen (BP25) (200 pellet groups/ha); Labrador tea shrubby bog (BP20) (5.5/ha); and regeneration – coniferous low shrub dominated (RF3-C) (4.4/ha). The ecosites/vegetation cover types with the highest pellet densities in 2019 included: regeneration – deciduous tall shrub dominated (RF2-D) (11.8/ha); tamarack treed fen (BP23) (5.9/ha); and jack pine/feathermoss (BP3) (1.5/ha). Summer pellet groups were detected in the black spruce treed bog (BP19) (4.6/ha) and the regeneration – deciduous tall

shrub dominated (RF2-D) (11.8/ha) ecosite/vegetation cover types in 2018 and 2019, respectively (Table 6.3-2).

Traditional land use studies all indicated that area was important and well used for the harvesting of big game species. Specifically:

- The Metis Nation Saskatchewan Northern Region II indicated that “the area is still used, mostly to hunt moose" (WD Lewis 2020, p. 10).
- The Athabasca Denesųłiné have indicated that “the area was identified for harvesting of big game including caribou, moose and whitetail deer” (Ya’thi Nene Lands and Resources 2020).

Woodland caribou pellet groups were observed along four transects, with only winter pellet groups detected. Winter pellet groups were detected on Transect 9 (8.8/ha), Transect 6 (3.9/ha), and Transect 7 (1.3/ha) in 2018 and at a Transect 1 (0.6/ha) in 2019 (Figure 6.3-1 and Table 6.3-1). Woodland caribou pellet groups were detected in five ecosites/vegetation cover types and were detected most frequently in the open bog (BP22) (100.0/ha) and black spruce/Labrador tea/feathermoss (BP14) (31.0/ha) ecosite/vegetation cover types in 2018, while in 2019 the highest pellet density was also detected in the black spruce/Labrador tea/feathermoss (BP14) (2.6/ha) ecosite/vegetation cover type (Table 6.3-2).

The First Nation Community engagement database indicated that “there is a migration route for moose, caribou and bear at the narrows between the intake and discharge for the mine.” (NexGen 2020, BNDN-183).

Carnivores

Three species of carnivore scat was detected during pellet group surveys: black bear; otter; and mink. Black bear scat was detected on eight transects. The highest densities of black bear scat were detected on Creek 1 (50 scat/ha), Transect 6 (4.6 scat/ha) and Transect 5 (3.9 scat/ha) in 2018 and along Patterson Creek (10 scat/ha) in 2019. Mink scat was detected on Transect 6 (0.7 scat/ha) in 2018 and no detections in 2019. Otter scat was only detected in 2019, along Patterson Creek (10 scat/ha) (Figure 6.3-1 and Table 6.3-1).

Black bear scat was widespread and observed in approximately 46% (11/24) ecosites/vegetation cover types. Black bear scat densities were highest in the willow shrubby rich fen (BP25) (100.0 scat/ha), tamarack treed fen (BP23) (21.4 scat/ha) and jack pine-trembling aspen/feathermoss (BP4) (12.5 scat/ha) ecosites/vegetation cover types in 2018. The highest scat density was detected in the black spruce treed bog (BP19) (4.2 scat/ha) ecosite/vegetation cover type in 2019. Mink scat was detected in the Labrador tea shrubby bog (BP20) (1.8 scat/ha) and black spruce/Labrador tea/feathermoss (BP14) (1.7 scat/ha) ecosites/vegetation cover types. Otter scat was detected in the black spruce treed bog (BP19) (4.2 scat/ha) ecosite/vegetation cover type (Table 6.3-2).

Figure 6.3-1 Pellet Group Survey Transects

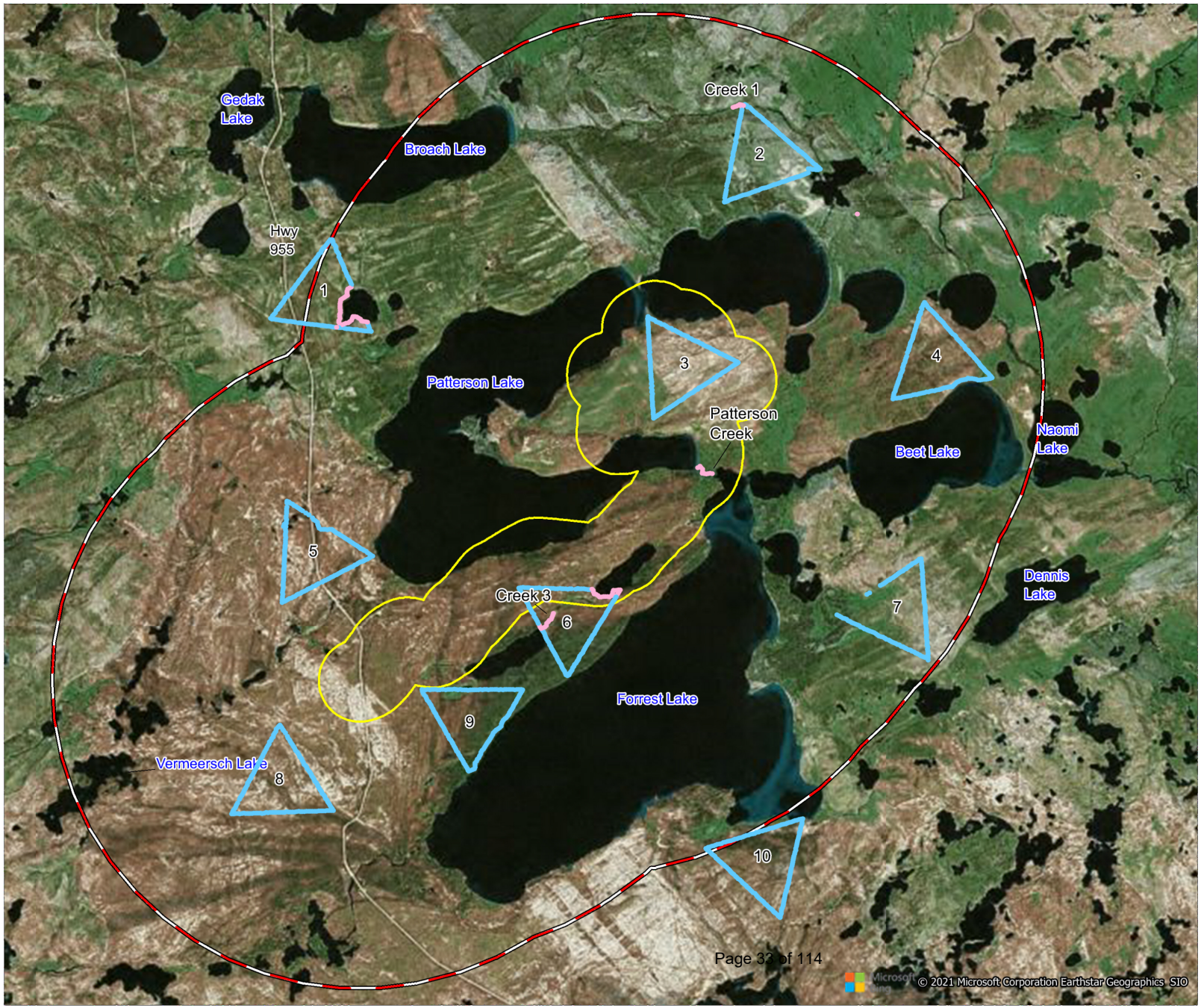

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Table 6.3-1 Pellet Groups per Hectare by Transect in the RSA – June 2018 and May 2019.

Transect	Area (HA)		Species																			
			Winter Moose (Pellets/HA)		Summer Moose (Pellets/HA)		Winter Caribou (Pellets/HA)		Summer Caribou (Pellets/ HA)		Grouse (Pellets/ HA)		Bear (Scats /HA)		Mink (Scats /HA)		Otter (Scats/HA)		Squirrel Midden/HA		Grouse Flush/HA	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
1	1.60	1.68	1.88	0.00	0.00	0.00	0.00	0.60	0.00	0.00	9.38	22.62	3.13	0.00	0.00	0.00	0.00	0.00	0.63	1.79	0.00	0.00
2	1.47	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.21	13.79	0.68	0.00	0.00	0.00	0.00	0.00	2.72	1.38	0.68	0.00
3	1.51	1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.15	54.30	2.65	0.00	0.00	0.00	0.00	0.00	1.32	0.00	0.00	0.66
4	1.51	1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.00	0.00
5	1.53	1.54	3.92	1.95	0.00	0.00	0.00	0.00	0.00	0.00	4.58	17.53	3.92	0.00	0.00	0.00	0.00	0.00	3.27	6.49	0.00	0.00
6	1.54	1.54	2.60	0.00	0.00	0.00	3.90	0.65	0.00	0.00	14.29	3.25	4.55	1.30	0.65	0.00	0.00	0.00	9.75	1.95	0.00	0.00
7	1.51	1.33	1.32	0.00	0.00	0.00	1.32	0.00	0.00	0.00	1.99	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00
8	1.51	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.62	15.33	0.00	0.00	0.00	0.00	0.00	0.00	1.32	3.33	0.00	0.00
9	1.47	1.46	4.08	2.05	0.00	0.68	8.84	0.00	0.00	0.00	13.61	2.05	0.00	0.00	0.00	0.00	0.00	0.00	5.44	3.42	0.68	0.00
10	1.51	1.50	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	25.83	12.67	1.32	0.00	0.00	0.00	0.00	0.00	3.31	6.67	0.00	0.00
Creek 1	0.04	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Creek 2	0.03	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
Creek 3	-	0.10	-	10.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00
Patterson Creek	0.10	0.10	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	10.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00
Total area surveyed (HA)	**15.32**	**15.32**																				
Average (Pellets / HA)			**1.37**	**0.52**	**0.07**	**0.07**	**1.37**	**0.13**	**0.00**	**0.00**	**13.25**	**14.30**	**1.83**	**0.20**	**0.07**	**0.00**	**0.00**	**0.07**	**2.81**	**2.55**	**0.13**	**0.07**

Note:
Dash = not sampled.

Table 6.3-2 Pellet Groups per Hectare by Ecosite in the RSA – June 2018 and May 2019.

Ecosite Type	Area (ha)		Species																			
			Winter Moose (Pellets/HA)		Summer Moose (Pellets/HA)		Winter Caribou (Pellets/HA)		Summer Caribou (Pellets/HA)		Grouse (Pellets/HA)		Bear (Scats/HA)		Mink (Scats/HA)		Otter (Scats/HA)		Squirrel Middens/HA		Grouse Flush/HA	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
BP2	1.93	1.63	0.52	0.00	0.00	0.00	0.52	0.00	0.00	0.00	29.53	28.83	2.59	0.00	0.00	0.00	0.00	0.00	3.11	2.45	0.52	0.00
BP3	1.02	1.37	0.00	1.46	0.00	0.00	0.00	0.00	0.00	0.00	4.90	6.57	2.94	0.00	0.00	0.00	0.00	0.00	6.86	6.57	0.00	0.00
BP4	0.16	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.25	0.00	12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BP11	0.09	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	1.04	-	0.00	-	0.00	-	11.63	-	0.00	-
BP12	0.57	0.63	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.58	3.17	8.77	0.00	0.00	0.00	0.00	0.00	14.04	6.35	0.00	0.00
BP14	0.58	0.39	0.00	0.00	0.00	0.00	31.03	2.56	0.00	0.00	17.24	5.13	1.72	0.00	1.72	0.00	0.00	0.00	12.07	5.13	0.00	0.00
BP18	0.08	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
BP19	0.22	0.24	0.00	0.00	4.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.17	0.00	0.00	0.00	4.17	0.00	0.00	0.00	0.00
BP20	0.55	0.46	5.45	0.00	0.00	0.00	1.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BP21	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BP22	0.01	0.01	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BP23	0.14	0.17	0.00	5.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BP24	0.05	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
BP25	0.01	-	200.00	-	0.00	-	0.00	-	0.00	-	0.00	-	100.00	-	0.00	-	0.00	-	0.00	-	0.00	-
BP26	0.01	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
DL1	0.01	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
DL2	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RF1c	0.27	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.70	9.09	3.70	0.00	0.00	0.00	0.00	0.00	0.00	9.09	0.00	0.00
RF1d	-	0.06	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00
RF2c	5.95	6.25	1.85	0.48	0.00	0.16	0.00	0.16	0.00	0.00	12.94	22.72	0.84	0.32	0.00	0.00	0.00	0.00	1.85	2.56	0.17	0.00
RF2d	-	0.17	-	11.76	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	5.88	-	0.00
RF2b	-	0.15	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	6.67
RF3c	0.45	0.33	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.67	12.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RF4	3.23	3.13	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.60	3.19	0.00	0.00	0.00	0.00	0.00	0.00	0.93	0.32	0.00	0.00
Total (HA)	**15.32**	**15.32**																				
Average (Pellets/HA)			**1.37**	**0.52**	**0.07**	**0.07**	**1.37**	**0.13**	**0.00**	**0.00**	**13.25**	**14.30**	**1.83**	**0.20**	**0.07**	**0.00**	**0.00**	**0.07**	**2.81**	**2.55**	**0.13**	**0.07**

Note:
Dash = not sampled.

6.3.2 Upland Game Birds and Squirrel Middens

Grouse/ptarmigan pellet groups were observed frequently in the area of the Project, with detections along 10 transects. Transect 2 (27.2 pellet groups/ha), Transect 3 (27.1 pellet groups/ha), and Transect 10 (25.8 pellet groups/ha) had the highest densities of pellet groups in 2018. Transect 3 (54.3/ha), Transect 1 (22.6 pellet groups/ha) and Transect 5 (17.5 pellet groups/ha) had the highest densities of pellet groups in 2019. No pellet groups were observed along the riparian transects. Grouse were recorded twice in 2018, along Transects 2 and 9 and once in 2019 along Transect 3. Squirrel middens were observed with the highest densities in Transect 6 (9.8 middens/ha) and Transect 9 (5.4 middens/ha) in 2018, while the highest densities in 2019 occurred in Transect 10 (6.7 midden/ha) and Transect 5 (6.5 midden/ha) (Figure 6.3-1 and Table 6.3-1).

Grouse/ptarmigan pellet groups were detected in approximately 48% (10/21) of ecosites/vegetation cover types. The ecosites/vegetation cover types with the highest density of pellet groups in 2018 were jack pine –spruce/feathermoss (BP12) (31.9 pellet groups/ha), jack pine/lichen (BP2) (29.5 pellet groups/ha), and black spruce/Labrador tea/feathermoss (BP14) (14 pellet groups/ha). The ecosites/vegetation cover types with the highest density pellet groups in 2019 were jack pine/lichen (BP2) (28.8 pellet groups/ha), regeneration – coniferous tall shrub dominated (RF2-C) (22.7 pellet groups/ha) and disturbed lands – non-vegetated (DL2) (14.3 pellet groups/ha). Squirrel middens were observed with the highest densities in jack pine –spruce/feathermoss (BP12) (14.0 middens/ha) and black spruce/Labrador tea/feathermoss (BP14) (12.1 middens/ha) in 2018, while densities in 2019 were highest in regeneration – coniferous tree dominated (RF1-C) (9.1 middens/ha) and jack pine feathermoss (BP3) (6.6 middens/ha). Grouse were flushed in jack pine/lichen (BP2) and tall shrub coniferous regenerating forests (RF2-C) in 2018 and regeneration – bog tall shrub dominated (RF2-B) in 2019 (Table 6.3-2).

6.3.3 Woody Browse and Lichen Availability

Terrestrial Lichen

Terrestrial lichen occurred in approximately 79% (19/24) of ecosite/vegetation cover types encountered. Frequency of occurrence was very high (greater than 90%) in the following ecosites/vegetation cover types: disturbed lands – vegetated (DL1); jack pine – lichen (BP2); regeneration – bog tall shrub dominated (RF2-B); and regeneration – coniferous tall shrub dominated (RF2-C); however, it should be noted the sampling intensity was low for disturbed lands – vegetated (DL1). Terrestrial lichen importance values (i.e., frequency of occurrence multiplied by mean cover) were highest in disturbed lands – vegetated (DL1), jack pine – lichen (BP2) and regeneration – coniferous tree dominated (RF1-C). The area of the Project as whole, where sampled, had a 70% terrestrial lichen frequency of occurrence and a mean cover of approximately 25% (Appendix B).

Arboreal Lichen

Arboreal lichen occurred in approximately 79% (19/24) of ecosites/vegetation cover types encountered. Arboreal lichen occurred very frequently (greater than 95%) in the following ecosites/vegetation cover types: disturbed lands – vegetated (DL1); jack pine – lichen (BP2); spruce/Labrador tea//feathermoss (BP14); and jack pine/feathermoss (BP3); however, it should be noted that sampling intensity in the disturbed lands – vegetated (DL1) was low as a result of the disbursed and generally small patch size nature of the mapped type. Where sampling occurred, arboreal lichen was present in 37% of the Project area with a class 3 loading encountered 33% of the time, class 2 encountered 27% of the time, and class 4 encountered 24% of the time (Appendix B).

Woody Browse

The availability and browse use importance values of 10 species or species groups of woody browse encountered in the area of the Project are detailed in (Appendix C). The most encountered species were alder species (44% of segments), paper birch (12% of segments), and willow species (7% of segments). Alder spp. was observed in approximately 83% (20/24) of ecosites/vegetation cover types, paper birch was observed in approximately 79% (19/24) ecosites/vegetation cover types, and willow was observed in approximately 79% (19/24) of ecosites/vegetation cover types. Alder spp., paper birch, willow spp., birch spp. and sweet gale (*Myrica gale*) were the only species browsed. Willow spp. was browsed at a frequency of 4%, while all other species were less than 1%.

7.0 SMALL MAMMAL TRAPPING SURVEY AND TISSUE ANALYSIS

7.1 Study Objectives

Mice, voles, and shrews are primary prey for several mammalian carnivore species including fisher, marten, and ermine (Pattie and Fisher 1999). Avian raptors such as owls and hawks also rely on small mammals as prey. Small mammals are often also used as bio-indicators. In support of the Project, the objectives of this survey were to:

- determine the species composition and relative abundance of voles, mice and shrews;
- determine ecosite-small mammal habitat associations for the study area;
- collect micro-habitat information at trap sites to assist in the future development of optimum reclamation targets geared towards small mammal species;
- collect small mammal specimens for baseline/background metal and radionuclide tissue analysis; and
- provide a scientifically defensible baseline for potential follow-up/monitoring requirements.

7.2 Methods

The small mammal trapping program was completed between 12 September 2018 and 21 September 2018. A total of 26 trap-lines were established to sample 19 different ecosites/vegetation cover types, resulting in a total trapping effort of 2,552 trap nights. The small mammal trap-lines were stratified by three general areas: future Project footprint, future exposure, and reference sites. The survey was completed by a Professional Biologist and a Biologist in Training (ASPB), proficient in species and habitat identification.

7.2.1 Trapping/Inventory

Sampling was stratified by ecosite and completed in areas with potential to be affected by the proposed Project footprint and in suitable reference areas. Small mammal trap-lines consisted of 15 trap stations spaced 10 m apart. Each trap station consisted of two Victor snap traps spaced 3 m apart. In addition, three pit-fall traps were deployed along the transect for the capture of shrews, which are not always readily captured using snap-traps. The pit-fall traps were equally spaced along the trap-line. Snap traps and pit-falls were left in place for three consecutive trap nights. Snap traps and pit-fall traps were baited with a mixture of peanut butter and rolled oats. Trap-lines were checked once a day and all captures were recorded. Captured animals were collected using zip-lock bags and were marked with the date of capture, species, trap-line, and trap station. Specimens were frozen and sent to the Saskatchewan Research Council (SRC) for homogenization and laboratory analysis. Survey design and field methodologies were completed under Saskatchewan Government Research Permit/Species Detection #18FW031.

7.2.2 Habitat Characterization

Vegetation cover and structure plots (5 m x 2 m) were established at each trapping station to quantify habitat attributes present along each trap-line and at each trap station. The objective was to quantify and describe the micro-habitat characteristics of each ecosite/vegetation cover type. Micro-habitat associations can then be used to help guide future reclamation prescriptions to accommodate small mammal species and the associated predators. At each trap site, measurements/estimates of the following variables were completed:

- percent cover of graminoids;
- percent cover of forbs;
- percent cover of shrubs (<2.5 m);
- percent cover of shrubs (2.5-5 m);
- percent cover of trees (>5 m);
- tree diameter at breast height (dbh);
- tree species composition;
- percent cover of surface litter;
- surface litter depth (cm);
- graminoid height (cm);
- forb height (cm);
- low shrub height (cm);
- tall shrub height (m);
- percent cover of bare soil;
- percent cover of deadfall (0-10 cm);
- percent cover of deadfall (10-25 cm);
- percent cover of deadfall (>25 cm);
- percent cover of rock;
- percent cover of standing water;
- percent cover of sphagnum;
- percent cover of feather moss; and
- percent cover of lichen.

Data for all variables were pooled and summarized by ecosite/vegetation cover type.

7.2.3 Baseline Tissue Analysis – Metals and Radionuclides

All specimens captured during the small mammal trapping program were collected, frozen, and sent to the SRC laboratory for metal and radionuclide analysis and subsets of the specimens were selected for analysis. Red-backed voles (*Myodes gapperi)* were selected as the species to be analyzed because of the species' abundance, spatial location of specimen, and the suitability of this species for follow-up programs in the future. Samples collected from proposed development were combined to provide six composite samples to quantify baseline metal and radionuclide levels. The reference sites were sub-divided into four composited samples. Table 7.2-1 details the composited sample locations and specimen count.

The metals/parameters that were analyzed included:

- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Boron
- Cadmium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Manganese
- Molybdenum
- Nickel
- Selenium
- Silver
- Strontium
- Thallium
- Tin
- Titanium
- Uranium
- Vanadium
- Zinc

The radionuclide parameters that were analyzed included:

- Lead-210
- Polonium-210
- Radium-226
- Thorium-230

The metal parameters were analyzed by inductively coupled plasma – mass spectronomy, and radionuclides were analyzed by extraction and beta counting (Pb-210), or alpha spectroscopy (Po-210, Ra-226, Th-230). All analysis was completed by the Saskatchewan Research Council (SRC) in the fall of 2018.

Table 7.2-1 Small Mammal Composited Sample Locations and Specimen Count.

Lab Sample Grouping	Transect #	Site	Total # of Specimens	Comments
1	1, 2, and 6	Footprint - Exposure	24	Composite includes 8 specimens from all 3 transects
2	3 and 5	Footprint - Exposure	20	Total from both transects
3	8	Exposure	26	Total
4	9	Reference	22	Total
5	11 and 18	Exposure	24	12 specimens from both transects
6	12,13, and 14	Reference	17	Total
7	20 and 21	Exposure	27	Total
8	22, 25, and 26	Exposure	16	Total
9	16	Reference	23	Total
10	10	Reference	26	Total

7.3 Results

7.3.1 Trapping/Inventory and Habitat Characterization

A total of 484 individual small mammals of six species were captured over the 26 trap lines (Figure 7.3-1). Red-backed voles were most abundant with 401 captures (15.7 captures/100 trap nights), followed by deer mice (*Peromyscus maniculatus* - 1.37 captures/100 trap nights), and masked shrews (*Sorex cinerus* - 0.9 captures/100 trap nights). The overall capture rate was 19.0 captures per 100 trap nights.

Red-backed Vole

Red-backed voles were captured along approximately 96% (25/26) of trap-lines and in all ecosites/vegetation cover types sampled. The most productive ecosites/vegetation cover types included white birch/lingonberry –Labrador tea (BS14) (37.9 captures/100 trap nights), black spruce/Labrador tea/feathermoss (BP14) (34.4 captures/100 trap nights), and regeneration – coniferous tree dominated (RF1-C) (28.3 captures/100 trap nights) (Table 7.3-1 and Table 7.3-2).

The three ecosites/vegetation cover types yielding the highest capture rates also had some of the highest percentages of coarse woody debris and average shrub cover as determined during the microsite habitat assessment (Table 7.3-3). Coarse woody debris and shrub cover are two major components of red-backed vole habitat (Carey and Johnson 1995, Sullivan et al. 2011) and could be incorporated into future reclamation considerations.

Meadow Vole

Meadow voles (*Microtus pennsylvanicus*) were captured along approximately 42% (11/26) of trap-lines and in approximately 56% (10/18) ecosites/vegetation cover types (56%) sampled. The most productive ecosites/vegetation cover types were tamarack treed fen (BP23) and graminoid fen (BP26), with capture rates of 6.2 and 3.0 per 100 trap nights respectively (Table 7.3-1 and Table 7.3-2).

The relative abundance of meadow voles was highest in two ecosites/vegetation cover types: tamarack treed fen (BP23); and graminoid fen (BP26). These ecosites/vegetation cover types had the highest percentage of graminoid species ground cover. In addition, these two cover types were wetter, as evidenced by the presence of open water and/or sphagnum moss (Table 7.3-3). Peles and Barrett (1996) found that standing vegetation and litter abundance are key components in habitat selection for meadow voles, while Dehn et al. (2017) found that meadow voles were more active, foraged more, and produced more offspring in vegetation types with a higher density of cover. The results of the current study support the findings of Peles and Barrett (1996) and Dehn et al. (2017) and suggest that providing a well-developed ground cover (shrub or graminoid) with substantial litter cover could be a useful strategy for reclamation objectives focussed on small mammals and important micro-habitat elements.

Masked and Water Shrews

Masked shrews were captured along approximately 42% (11/26) of trap-lines and in 50% (9/18) ecosites/vegetation cover types (50%) sampled. The most productive ecosites/vegetation cover types were willow shrubby rich fen (BP25), white birch/lingonberry – Labrador tea (BS14) and tamarack treed fen (BP23), with capture rates of 4.0, 4.0, and 2.1 per 100 trap nights respectively (Table 7.3-1 and Table 7.3-2).

A single water shrew (*Sorex palustris*) was captured along Transect 14 in the tamarack treed fen (BP23) ecosite (Table 7.3-1 and Table 7.3-2).

Shrews were captured across several ecosites/vegetation cover types, with highest capture rates in wetter ecosite types. The ecosites/vegetation cover types noted above all had high percentages of low shrub cover and willow shrubby rich fen (BP25) and tamarack treed fen (BP23) and had patches of open water and/or extensive cover of sphagnum moss. The white birch/lingonberry – Labrador tea (BS14) is not a high moisture regime ecosite; however, it had the highest percentage of feather moss cover (Table 7.3-3). Whitaker Jr. (1963) found that moss is an important component in shrew habitat, while Wrigley et al. (1979) found hydric habitats dominated by either shrubs or graminoid/sedge were most suitable for shrews. The presence of interspersed wet habitats, such as fens and riparian areas, which include a combination of graminoid cover, shrub cover, and moss, helps provide essential habitat for a variety of shrew species.

Meadow Jumping Mouse

A single meadow jumping mouse (*Zapus hudsonius)* was captured along Transect 1 in the white birch/lingonberry – Labrador tea (BS14) ecosite (Table 7.3-1 and Table 7.3-2).

The white birch/lingonberry – Labrador tea (BS14) ecosite is not representative of typical meadow jumping mouse habitat. Previous small mammal studies have shown the occurrence of meadow jumping mice in shrubby riparian areas with extensive sedge and grass cover, graminoid wetlands, sedge fens, cattail wetlands, and generally, in wet areas with an extensive ground cover herbaceous layer (Banfield 1974). Whitaker (1963) and Getz (1961) both concluded that an adequate herbaceous ground cover layer is necessary for the maintenance of this species. Wetland habitats with abundant shrub and graminoid/herbaceous layers benefit meadow jumping mice.

Deer Mouse

Deer mice were captured along approximately 35% (9/26) trap-lines and in approximately 39% (7/18) ecosites/vegetation cover types sampled. The most productive ecosites/vegetation cover types were disturbed lands – non-vegetated (DL2), rush sandy shore (BS26) and regeneration – coniferous tall shrub dominated (RF2-C), with capture rates of 5.1, 3.7 and 2.8 per 100 trap nights respectively (Table 7.3-1 and Table 7.3-2).

The deer mouse is a generalist species and known to thrive across a variety of habitats (Eder and Gregory 2011); however, evidence suggests a preference for disturbance, anthropogenic, and open habitats (Eder and Gregory 2011, Martell 1983, Baker 1968). The disturbed lands – non-vegetated (DL2) and rush sandy shore (BS26) ecosites/vegetation cover types had the highest percent of bare ground and lowest cover low shrub/graminoid species (Table 7.3-3). No focal reclamation targets are noted for this species.

Baseline Tissue Analysis – Metals and Radionuclides

A total of 225 red-backed vole specimens in 10 composite samples were submitted to the Saskatchewan Research Council (SRC) for metal and radionuclide analysis. The composites were arranged in three groupings: future Project footprint, future exposure, and reference sites. Two composites were submitted from Transects 1, 2, 3, 5, and 6 to represent future footprint/exposure (Figure 7.3-1). Four composites were submitted from Transects 8, 11, 18, 20, 21, 22, 25, and 26 to represent future potential exposure areas (Figure 7.3-1). Four composites were submitted from Transects 9, 10, 12, 13, 14, and 16 to represent reference locations (Figure 7.3-1). A summary of the results of the metals and radionuclide analysis are presented in Table 7.3-4. Adequate sample composites and material was processed to scientifically inform background/baseline conditions.

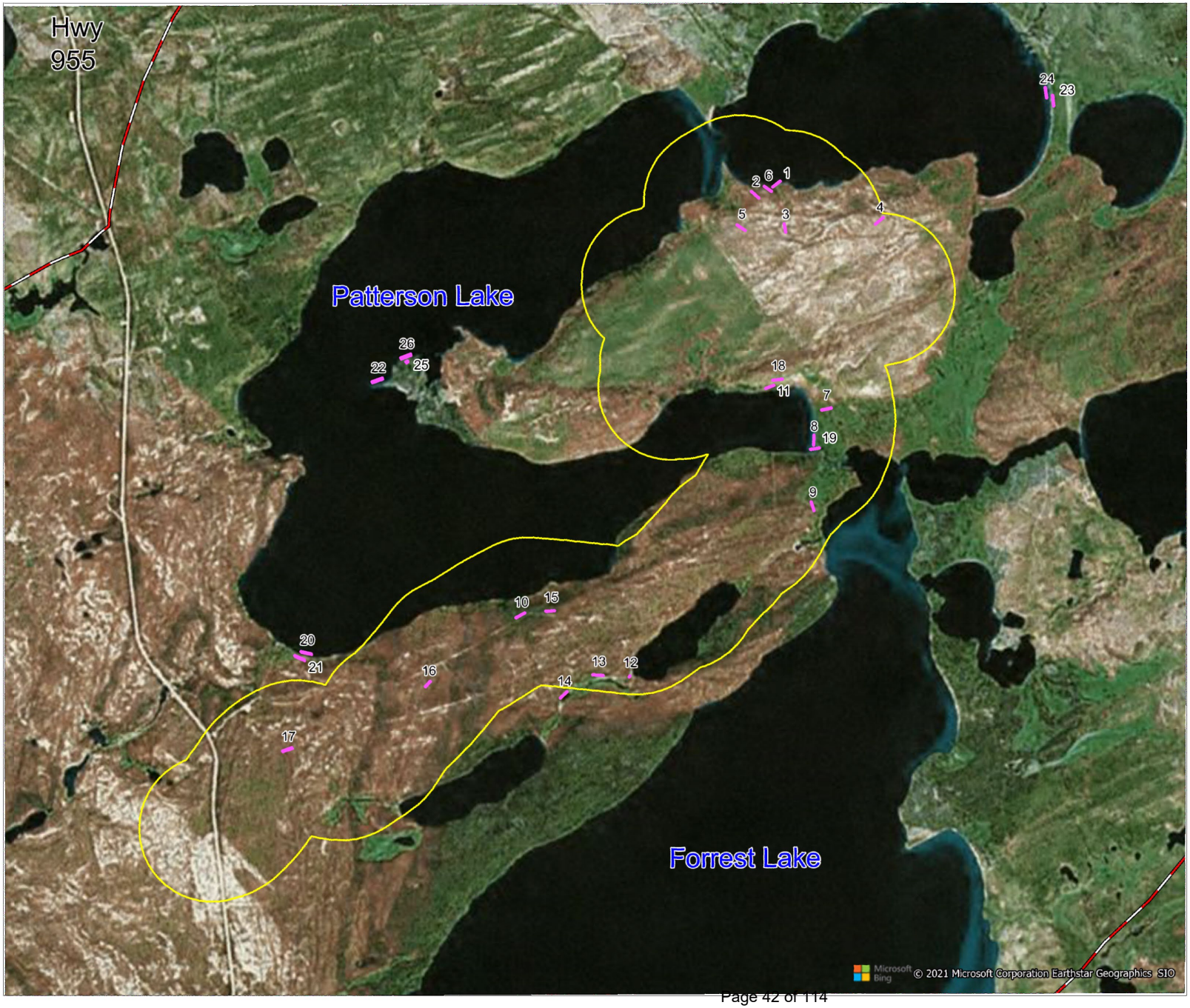

Figure 7.3-1 Small Mammal Trapping Transects

Legend

- Trapping Transect
- Regional Study Area (RSA)
- Local Study Area (LSA)

N
W E
S

0 5 10
kilometers
Scale = 1 : 50,000

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Table 7.3-1 Small Mammal Captures per Transect in the LSA and Reference Sites – September 2018.

Transect	Total Trapping Effort (# of trap nights)	Trapping Success (# of individuals caught per 100 trap nights)						
		Red-Backed Vole	Meadow Vole	Masked Shrew	Water Shrew	Deer Mouse	Meadow Jumping Mouse	Unknown[a]
1	99	61.62	1.01	6.06	0.00	2.02	1.01	0.00
2	99	19.19	1.01	1.01	0.00	7.07	0.00	0.00
3	99	15.15	1.01	0.00	0.00	4.04	0.00	0.00
4	99	3.03	0.00	0.00	0.00	0.00	0.00	0.00
5	99	5.05	0.00	0.00	0.00	10.10	0.00	0.00
6	97	29.90	1.03	1.03	0.00	2.06	0.00	0.00
7	99	19.19	1.01	1.01	0.00	0.00	0.00	0.00
8	99	26.26	1.01	1.01	0.00	0.00	0.00	0.00
9	99	23.23	1.01	2.02	0.00	0.00	0.00	0.00
10	91	27.47	0.00	0.00	0.00	0.00	0.00	0.00
11	98	41.84	0.00	1.02	0.00	1.02	0.00	1.02
12	99	10.10	1.01	0.00	0.00	1.01	0.00	0.00
13	99	3.03	3.03	1.01	0.00	0.00	0.00	0.00
14	97	4.12	6.19	2.06	1.03	0.00	0.00	0.00
15	98	9.18	0.00	0.00	0.00	0.00	0.00	1.02
16	99	24.24	0.00	0.00	0.00	0.00	0.00	0.00
17	99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	99	28.28	0.00	0.00	0.00	1.01	0.00	0.00
19	99	11.11	1.01	4.04	0.00	0.00	0.00	0.00
20	99	14.14	0.00	2.02	0.00	0.00	0.00	0.00
21	99	13.13	0.00	0.00	0.00	0.00	0.00	0.00
22	93	1.08	0.00	0.00	0.00	0.00	0.00	0.00
23	97	1.03	0.00	0.00	0.00	0.00	0.00	0.00
24	99	3.03	0.00	0.00	0.00	7.07	0.00	0.00
25	99	2.02	0.00	0.00	0.00	0.00	0.00	0.00
26	99	13.13	0.00	0.00	0.00	0.00	0.00	0.00
Total/ Average	**2552**	**15.60**	**0.71**	**0.86**	**0.04**	**1.37**	**0.04**	**0.08**

a) Not enough of specimen to ID

Table 7.3-2 Small Mammal Captures by Ecosite in the LSA and Reference Sites – September 2018.

Ecosite Code	Ecosite Name	Total Trapping Effort (# of trap nights)	Trapping Success (# of individuals caught per 100 trap nights)		
			Red-Backed Vole	Meadow Vole	Masked Shrew
BP2	Jack pine / Lichen: Moderately fresh sand	197	11.17	0.00	0.00
BP3	Jack pine / Feathermoss: Moderately fresh loamy sand	91	27.47	0.00	0.00
BP14	Black spruce / Labrador tea / Feathermoss: Very moist sandy clay loam	195	34.36	0.51	1.03
BP15	Balsam poplar - White spruce / Feathermoss: Very moist silty loam	99	10.10	1.01	0.00
BP19	Black spruce treed bog: Moderately wet fibric organic	99	26.26	1.01	1.01
BP20	Labrador tea shrubby bog: Wet fibric organic	99	19.19	1.01	1.01
BP23	Tamarack treed fen: Wet fibric organic	97	4.12	6.19	2.06
BP25	Willow shrubby rich fen: Wet humic organic	99	11.11	1.01	4.04
BP26	Graminoid fen: Wet humic organic	99	3.03	3.03	1.01
BP27	Open fen: Wet fibric organic	99	2.02	0.00	0.00
BS14	White birch / Lingonberry - Labrador Tea: Moderately dry sand	198	37.88	0.51	4.04
BS26	Rush sandy shore: Very moist sand	192	2.08	0.00	0.00
RF1-C	Regeneration - Coniferous tree dominated	99	28.28	0.00	0.00
RF2-B	Regeneration bog - Tall shrub dominated	99	23.23	1.01	2.02
RF2-C	Regeneration - Coniferous tall shrub dominated	396	15.15	0.51	0.25
RF4	Regeneration - Recent burn < 5 years	97	1.03	0.00	0.00
DL1	Disturbed land - Vegetated	99	13.13	0.00	0.00
DL2	Disturbed land - Non-vegetated	198	2.53	0.00	0.00
Total / Average		**2552**	**15.60**	**0.71**	**0.86**

Table 7.3-2 Small Mammal Captures by Ecosite in the LSA and Reference Sites – September 2018– cont.

Ecosite Code	Ecosite Name	Total Trapping Effort (# of trap nights)	Trapping Success (# of individuals caught per 100 trap nights)			
			Water Shrew	Deer Mouse	Meadow Jumping Mouse	Unknown[a]
BP2	Jack pine / Lichen: Moderately fresh sand	197	0.00	0.00	0.00	0.51
BP3	Jack pine / Feathermoss: Moderately fresh loamy sand	91	0.00	0.00	0.00	0.00
BP14	Black spruce / Labrador tea / Feathermoss: Very moist sandy clay loam	195	0.00	1.54	0.00	0.51
BP15	Balsam poplar - White spruce / Feathermoss: Very moist silty loam	99	0.00	1.01	0.00	0.00
BP19	Black spruce treed bog: Moderately wet fibric organic	99	0.00	0.00	0.00	0.00
BP20	Labrador tea shrubby bog: Wet fibric organic	99	0.00	0.00	0.00	0.00
BP23	Tamarack treed fen: Wet fibric organic	97	1.03	0.00	0.00	0.00
BP25	Willow shrubby rich fen: Wet humic organic	99	0.00	0.00	0.00	0.00
BP26	Graminoid fen: Wet humic organic	99	0.00	0.00	0.00	0.00
BP27	Open fen: Wet fibric organic	99	0.00	0.00	0.00	0.00
BS14	White birch / Lingonberry - Labrador Tea: Moderately dry sand	198	0.00	1.01	0.51	0.00
BS26	Rush sandy shore: Very moist sand	192	0.00	3.65	0.00	0.00
RF1-C	Regeneration - Coniferous tree dominated	99	0.00	1.01	0.00	0.00
RF2-B	Regeneration bog - Tall shrub dominated	99	0.00	0.00	0.00	0.00
RF2-C	Regeneration - Coniferous tall shrub dominated	396	0.00	2.78	0.00	0.00
RF4-B	Regeneration bog - Recent burn < 5 years	97	0.00	0.00	0.00	0.00
DL1	Disturbed land - Vegetated	99	0.00	0.00	0.00	0.00
DL2	Disturbed land - Non-vegetated	198	0.00	5.05	0.00	0.00
Total / Average		**2552**	**0.04**	**1.37**	**0.04**	**0.08**

a) Not enough of specimen to ID

Table 7.3-3 Small Mammal Micro-Habitat Assessment– September 2018.

Habitat Attribute	Transect ID / Ecosite																	
	15/26	10	6/11	12	8	7	14	19	13	25	1/20	22/24	18	9	2/3/4/16	23	21	5/17
	BP2	BP3	BP14	BP15	BP19	BP20	BP23	BP25	BP26	BP27	BS14	BS26	RF1-C	RF2-B	RF2-C	RF4	DL1	DL2
Mean % Trees (>5m)	21.00	38.67	26.33	70.33	1.40	0.00	2.00	1.00	0.00	0.00	23.83	0.07	16.00	0.00	0.00	0.00	0.00	0.00
Mean Tree Diameter at breast height (dbh) (cm)	10.60	10.19	14.22	8.78	7.72	-	10.03	11.45	-	-	9.37	5.10	5.63	-	-	-	-	-
Mean Tree Height (m)	7.15	7.79	9.01	7.60	6.56	-	6.10	11.75	-	-	7.67	6.00	5.21	-	-	-	-	-
Mean % Shrubs (<2.5m)	11.43	35.33	35.50	10.33	66.00	76.00	41.67	57.67	19.00	6.50	26.17	4.83	21.67	83.00	49.67	8.20	5.63	0.28
Mean % Shrubs (2.5-5m)	0.37	0.40	5.77	3.47	18.40	0.00	7.67	3.67	0.00	0.00	22.57	0.23	14.00	0.07	9.32	0.00	0.00	0.00
Mean Low Shrub Height (cm)	16.90	87.33	66.00	86.67	76.67	47.00	98.67	121.33	45.33	30.00	100.33	72.73	130.00	109.33	106.75	22.00	29.67	12.55
Mean Tall Shrub Height (m)	2.80	2.50	3.33	3.92	3.04	-	3.47	3.05	-	-	3.32	2.75	3.60	2.50	3.04	-	-	-
Mean % Forbes	0.00	0.00	0.37	7.40	2.07	0.33	0.47	0.30	0.60	0.73	1.88	1.78	0.00	0.83	0.07	0.43	0.07	0.02
Mean Forb Height (cm)	-	-	13.31	8.00	14.36	9.00	6.22	9.11	7.18	5.00	13.78	23.75	-	12.47	6.13	7.08	10.00	10.00
Mean % Graminoids	0.00	0.00	0.03	3.37	0.67	1.50	13.13	15.23	38.87	11.20	0.63	7.40	0.00	0.17	0.00	0.00	5.73	0.22
Mean Graminoid Depth (cm)	-	-	50.00	35.38	30.00	23.40	66.33	65.33	74.00	24.00	40.91	36.00	-	25.00	-	-	22.86	19.00
Mean % Litter	27.97	16.93	5.90	82.67	1.87	0.93	0.83	7.27	0.87	0.00	47.13	1.78	65.33	3.93	39.28	0.40	2.83	1.95
Mean Litter Depth (cm)	2.30	3.73	2.93	3.27	1.80	2.14	1.78	2.73	2.50	-	3.37	2.39	2.80	2.73	2.98	1.13	2.00	3.15
Mean % Bare Soil	0.57	5.87	2.85	0.33	0.93	0.70	0.00	2.33	0.00	0.00	5.65	85.17	6.13	3.47	3.99	45.33	55.67	87.20
Mean % Deadfall (0-10 cm)	8.27	5.80	2.47	3.40	0.30	1.23	2.50	0.17	0.43	0.00	3.95	0.18	12.67	1.10	9.25	2.93	5.37	1.97
Mean % Deadfall (10-25 cm)	4.83	0.40	2.57	2.53	0.00	0.00	0.07	0.00	0.00	0.00	1.57	0.00	2.40	0.00	0.98	0.40	1.00	0.00
Mean % Deadfall (>25cm)	0.00	0.00	0.17	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.02	0.00	0.00	0.00
Overall % Deadfall	9.23	6.20	5.20	6.27	0.30	1.23	2.57	0.17	0.43	0.00	5.12	0.18	15.27	1.10	10.25	3.33	6.37	1.97
Mean % Rock	0.38	0.03	0.87	0.93	0.00	0.00	0.00	0.00	0.00	0.00	4.32	0.00	3.07	0.00	5.89	0.00	0.36	10.77
Mean % Water	0.00	0.00	0.00	0.00	0.00	0.00	18.33	7.47	4.07	29.67	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean % Sphagnum	0.00	0.00	0.00	0.00	54.00	80.60	60.67	20.27	64.67	49.27	2.90	0.00	0.00	56.67	0.00	49.33	0.00	0.00
Mean % Feathermoss	2.83	55.47	77.50	0.27	23.43	0.00	0.00	0.33	0.00	0.00	5.48	2.30	0.00	0.00	0.00	0.00	0.00	0.00
Mean % Terrestrial Lichen	42.50	1.37	1.15	0.00	11.80	5.87	0.00	0.00	0.00	0.00	0.33	0.57	1.53	14.27	20.93	0.03	0.23	0.00

Table 7.3-4 Summary of Red-backed Vole Metals and Radionuclide Analysis– September 2018.

Parameter	Units	Future Project Footprint		Future Exposure				Reference Sites			
Composite Transects		1, 2, 6	3, 5	8	11, 18	20, 21	22, 25, 26	9	12, 13, 14	16	10
Physical Properties											
Moisture	%	74.86	74.81	74.31	74.49	74.63	74.19	73.65	73.51	75.22	74.69
Metals and Trace Elements											
Aluminum	µg/g	19	27	8.6	13	16	8.7	3.0	5.6	52	12
Antimony	µg/g	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/g	0.02	0.03	0.01	0.02	0.01	0.02	<0.01	0.02	0.02	<0.01
Barium	µg/g	9.6	20.2	11.5	23.2	9.9	8.0	22.3	6.6	23.2	34.1
Beryllium	µg/g	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron	µg/g	0.5	0.3	0.4	0.4	0.5	0.3	0.4	0.5	0.2	0.3
Cadmium	µg/g	0.064	0.036	0.033	0.062	0.078	0.13	0.072	0.096	0.11	0.035
Chromium	µg/g	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/g	0.038	0.053	0.060	0.058	0.069	0.045	0.061	0.066	0.070	0.058
Copper	µg/g	2.3	2.5	2.5	3.2	3.5	2.6	2.5	2.9	2.4	2.5
Iron	µg/g	69	78	67	66	77	65	60	78	100	59
Lead	µg/g	0.089	0.048	0.032	0.020	0.039	0.020	0.012	0.015	0.033	0.017
Manganese	µg/g	12	12	12	10	12	13	14	12	6.8	10
Molybdenum	µg/g	0.14	0.13	0.10	0.11	0.12	0.06	0.10	0.13	0.12	0.08
Nickel	µg/g	0.10	0.07	0.10	0.09	0.11	0.09	0.08	0.10	0.08	0.07
Selenium	µg/g	0.56	0.83	0.18	0.56	0.46	0.24	0.50	0.49	0.55	0.41
Silver	µg/g	0.024	0.027	<0.002	0.012	0.005	0.009	0.003	0.004	0.006	0.002
Strontium	µg/g	2.8	4.5	2.7	6.4	3.6	2.2	4.9	3.0	8.3	7.7
Thallium	µg/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Tin	µg/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Titanium	µg/g	0.86	0.77	0.59	0.66	0.62	0.48	0.33	0.33	1.8	0.56
Uranium	µg/g	0.076	0.034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Vanadium	µg/g	0.04	0.04	0.02	<0.02	0.03	<0.02	<0.02	<0.02	0.08	<0.02
Zinc	µg/g	22	24	26	26	22	25	27	26	23	26
Radionuclides											
Lead-210	Bq/g	0.006	0.005	0.019	0.006	0.003	0.007	0.004	0.003	0.005	0.006
Polonium-210	Bq/g	0.014	0.018	0.041	0.017	0.011	0.011	0.010	0.010	0.012	0.017
Radium-226	Bq/g	0.0058	0.0043	0.0003	0.0011	0.0006	0.0008	0.0007	0.0005	0.0005	0.0005
Thorium-230	Bq/g	<0.0003	0.0009	<0.0003	<0.0003	<0.0003	0.0005	<0.0003	<0.0003	<0.0003	<0.0003

8.0 SEMI AQUATIC FURBEARING MAMMAL SHORELINE SURVEY

8.1 Study Objectives

Semi-aquatic furbearing mammals (muskrat (*Ondatra zibethicus*), mink, beaver (*Castor canadensis*), and otter) are important species for fur trapping and traditional lifestyles/traditional land use. In addition, muskrats for example, have a widespread distribution, are generally abundant, are adaptable, and are a good indicator of aquatic ecosystem health (Westworth Associates 2002). Semi-aquatic furbearer shoreline surveys were completed to:

- provide quantitative data on the occurrence and relative abundance of semi-aquatic furbearing mammals;
- provide spatial data on the distribution of semi-aquatic furbearer sign within and across the study area; and
- provide a scientifically defensible baseline for potential follow-up/monitoring requirements.

8.2 Methods

Semi-aquatic furbearer shoreline surveys were completed between 12 September 2018 and 16 September 2018 along the shorelines of select creeks, lakes, and ponds. Two observers paddled the shorelines of pre-selected sites and detailed notes were recorded to document the location and type of semi-aquatic mammal sign including:

- territorial scent stations;
- foraging platforms and/or sign of foraging;
- resting platforms;
- scat; and
- houses/lodges, dams, or runs.

The perimeters of select water bodies were paddled and the survey routes were mapped using the track-log function in a hand-held GPS unit. The locations of all observations, including incidental sightings, were recorded with UTM coordinates. The survey was completed by a Professional Biologist (ASPB) proficient in species use identification and an assistant. The track-log route path data were recorded at five second intervals. All observations were summarized by species and water body. The resultant measure was the number of observations per km of shoreline.

Survey design and field methodologies were guided by existing provincial protocols, where applicable, or peer-reviewed methodology, and were completed under Saskatchewan Government Research Permit/Species Detection #18FW031 and 18SD170.

8.3 Results

A total of 14 water bodies were surveyed (9 lakes/lake sections and 5 creek portions) (Figure 8.3-1). The total distance of shoreline surveyed was 75 km, with approximately 19 km in the LSA and 56 km in the RSA. Signs of three target species, muskrat, beaver, and mink, were observed during the survey.

Muskrat sign was noted in both the LSA and RSA. Muskrat sign was grouped into three types of observations including: burrows/houses; run/feeding sign; and scat. A total of approximately 57% (8/14) of water bodies hosted muskrat sign. The most observed run/feeding sign consisted of sedge clippings, tuber/roots, and various emergent and submergent aquatic vegetation chewing/harvesting and runs along the shore. Muskrat sign averaging 0.41 observations per km for the entire survey, with densities in the LSA

and RSA were 0.36/km and 0.43/km, respectively. Creek 3 (6.8 observations/km), Patterson/Forest Creek (5.9 observations/km), and Creek 2 (4.6 observations/km) had the highest run/feeding sign densities. Scat was observed along the shores of approximately 43% (6/14) of water bodies at a rate of 0.15 observations/km in the LSA and 0.20/km in the RSA. Creek 4 (4.3 observations/km), Patterson/Forest Creek (3.6 observations/km), and Jed Creek (1.9 observations/km) had the highest scat detection rates. One muskrat was observed swimming in Forest Lake; no muskrat houses or burrows were detected (Table 8.3-1).

Beaver sign was grouped into four types of observations including: runs/feeding sign; active houses; old/inactive houses; and dams. Beaver sign was observed in both the LSA and RSA. Run/feeding sign was observed at a rate of 0.46/km in the LSA and 1.5/km in the RSA. Run/feeding sign was observed along the shores of approximately 57% (8/14) of the water bodies surveyed, with the highest concentrations at Creek 2 (21.7/km), Creek 4 (18.8/km), and Lake 1 (10.0/km). Active beaver houses (i.e., those currently occupied by beavers), and old/inactive beaver houses (i.e., classed as such by the dilapidated, overgrown appearance and lack of fresh sign or feed beds), were observed across the LSA and RSA. Active beaver houses were detected at a rate of 0.05/km in the LSA and 0.07/km in the RSA, while old/inactive beaver house were at rates of 0.10/km in the LSA and 0.13/km in the RSA. A total of approximately 29% (4/14) of the water bodies surveyed had active beaver houses present and old/inactive beaver houses were present on approximately 36% (5/14). Creek 2 (1.5/km), Creek 3 (0.5/km), and Jed Lake (0.2/km) had the highest densities of active beaver house. Lake 3 (0.4/km), Lake 1 (0.3/km), and Jed Lake (0.3/km) had the highest densities of old/inactive beaver houses. Beaver dams were observed in both the LSA and RSA, but only on two water bodies, Creek 2 (3.1/km) and Lake 1 (0.3/km) (Table 8.3-1).

Mink sign was detected in the RSA, along two water bodies: Jed Creek (0.6/km); and Lake 4 (0.4/km). Mink sign was only detected in the form of tracks along the shoreline (Table 8.3-1).

Figure 10 presented by the Athabasca Denesųłiné also highlights the importance of the area for semi-aquatic furbearers as “it represents the areas that were identified as small game and furbearing harvesting areas”. Specific species identified were mink, beaver, otter and muskrat. (Ya’thi Nene Lands and Resources 2020, p. 15 & 30).

The Birch Narrows Dene also indicated that the area was important for “food and furs” including semi-aquatic furbearers such as “mink, beaver and muskrat” (Olson and Firelight 2019a, p. 28).

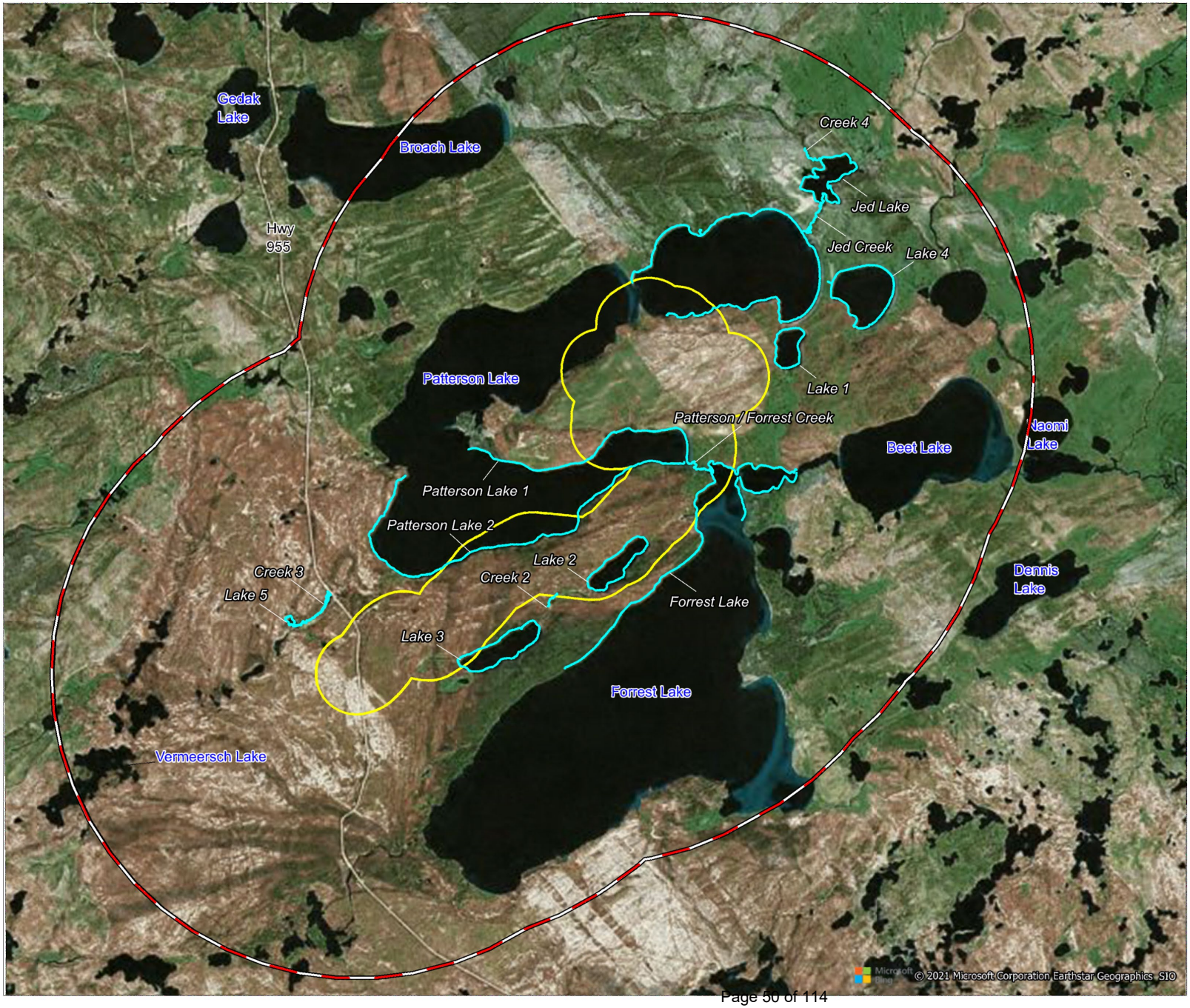

Figure 8.3-1 Semi-aquatic Furbearer Shoreline Survey Locations

Legend

- Shorelines Surveyed
- Regional Study Area (RSA)
- Local Study Area (LSA)

Shorelines Surveyed (table 8.3-1)

- Lake1
- Lake2
- Lake3
- Lake4
- Lake5
- Patterson Lake1
- Patterson Lake2
- Jed Lake
- Forrest Lake
- Patterson/Forrest Creek
- Jed Creek
- Creek2
- Creek3
- Creek4

N W E S

0 5 10

kilometers
Scale = 1 : 90,000

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Table 8.3-1 Semi-Aquatic Furbearer Shoreline Survey Observations– September 2018.

Waterbody ID	Shoreline (km)	Surveyed Length in Study Area (km)	Observations per km							
			Beaver				Muskrat			Mink
			Run/ Feed Sign	Active House	Inactive/ Old House	Dam	Run/ Feed Sign	Scat	Visual	Tracks
Lake 1	3.0	3.0 RSA	10.0	0	0.3	0.3	0	0	0	0
Lake 2	4.5	4.5 LSA	0	0	0.2	0	0	0	0	0
Lake 3	5.2	4.3 RSA 0.9 LSA	0.6	0	0.4	0	0.4	0	0	0
Lake 4	5.3	5.3 RSA	0	0	0	0	0	0	0	0.2
Lake 5	1.0	1.0 RSA	3.1	0	0	0	0	0	0	0
Patterson Lake 1	13	1.5 LSA 11.5RSA	0	0	0	0	0	0	0	0
Patterson Lake 2	18.3	8.8 LSA 9.5 RSA	0	0	0	0	0	0	0	0
Jed Lake	5.8	5.8 RSA	2.2	0.2	0.3	0	0.3	0.3	0	0
Forest Lake	13.7	2.8 LSA 10.9 RSA	0.9	0.1	0.2	0	0.1	0.1	0.1	0
Patterson/Forest Creek	0.8	0.8 LSA	0	0	0	0	5.9	3.6	0	0
Jed Creek	1.6	1.6 RSA	0	0	0	0	2.5	1.9	0	0.6
Creek 2	0.6	0.505 RSA 0.141 LSA	21.7	1.5	0	3.1	4.6	0	0	0
Creek 3	1.9	1.9 RSA	2.6	0.5	0	0	6.8	1.1	0	0
Creek 4	0.7	0.7 RSA	18.8	0	0	0	0	4.3	0	0
LSA (total area and average density of sign)	**19.5**		**0.5**	**0.1**	**0.1**	**0.1**	**0.4**	**0.2**	**0**	**0**
RSA (total area and average density of sign)	**56.0**		**1.5**	**0.1**	**0.1**	**<0.1**	**0.4**	**0.2**	**<0.1**	**<0.1**
Total (total area and average density of sign)	**75.4**		**1.2**	**0.1**	**0.1**	**<0.1**	**0.4**	**0.2**	**<0.1**	**<0.1**

9.0 AERIAL WATERFOWL AND RAPTOR STICK NEST SURVEY

9.1 Study Objectives

The aerial waterfowl and raptor stick nest survey was completed for the RSA to:

- document the presence, diversity, and abundance of waterfowl;
- document the occurrence of active, inactive, and old raptor nests (e.g., bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), red-tailed hawk (*Buteo jamaicensis*));
- document the occurrence of avian species at risk; and
- develop a scientifically defensible baseline to support effect assessments and to allow for potential future follow up/monitoring requirements.

9.2 Methods

Lakes, streams, and wetland areas were surveyed on 4 and 5 July 2018 by helicopter at the maximum altitude that allowed for identification of avian species including waterfowl, shore birds, and raptors. A total of three observers completed the survey, with two observers documenting waterfowl and shore birds and one observer documenting raptor and stick nest observations. Observers were Professional Biologists with the ASPB, proficient in waterfowl and raptor identification. Surveys were completed under appropriate environmental conditions that would not deter waterfowl from being observed in open water (i.e., low wind speed and no precipitation). Weather conditions were recorded at the beginning of each survey and monitored throughout. Survey conditions are listed in Table 9.2-1.

Table 9.2-1 Aerial Waterfowl Survey Timing and Weather Summary

Survey Bout	Survey Section ID #'s	Date	Cloud Cover (%)	Temperature (°C)	Precipitation	Wind
1	1-8	04-July-2018	70.0	15.0	0.0	Calm
2	9-20	04-July-2018	40	15	0.0	4-6 knots
3	21-28	04-July-2018	50.0	15.0	0.0	4-8 knots
4	29-38	05-July-2018	0.0	18.0	0.0	Calm

When possible, all birds observed were identified to species, and total observations by lake/river/wetland complex were recorded. Survey sections varied in area searched (combined area of water bodies) from < 1 ha to 4,246 ha. The number of water bodies per complex also varied (from 1 to 24). Therefore, the abundance (i.e., total number of birds observed) and species richness (i.e., number of unique avian species observed) in each survey complex was divided by area searched to allow comparison between search areas. For each survey complex, factors such as average size of water bodies, density of water bodies, and mapped ecosites within 100 m of each water body were considered when attempting to identify important attributes for avian species within the area of the Project.

Raptor nest locations were recorded using a hand-held GPS unit and nests were classified as active, inactive (i.e., intact but not currently occupied), or old (i.e. broken/damaged). Notes on the species and clutch size/number of eggs/young were recorded for all active nests.

Survey design and field methodologies were guided by Government of British Columbia (1999), and were completed under Saskatchewan Government Research Permit/Species Detection #18FW031 and 18SD170.

9.3 Results

A total of 38 complexes containing 182 water bodies and 20 sections of water courses were surveyed (Figure 9.3-1). The survey recorded 22 confirmed unique species and three species groups, for a total of 799 individual avian species observations (Table 9.3-1). The 10 most observed species were:

- Ring-necked Duck (*Aythya collaris*) – 189 observations;
- California gull (*Larus californicus)* – 99 observations;
- Common Merganser (*Mergus merganser*) – 82 observations;
- Mallard (*Anas platyrhynchos*) – 61 observations;
- Bonaparte's gull (*Chroicocephalus philadelphia*) – 61 observations;
- American white pelican (*Pelecanus erythrorhynchos*) – 44 observations;
- Sandpiper spp. (*Tringa / Actitis spp*.) – 33 observations;
- Bald Eagle – 28 observations;
- Common raven (*Corvus corax*) – 27 observations; and
- Common loon (*Gavia immer*) – 26 observations.

Waterfowl or raptors were observed within approximately 92% (35/ 38) survey sections. The survey sections with the highest species diversity were Section 6 (10 species), Section 1 (9 species), and Section 4 (9 species). The highest individual abundances were recorded in Section 5 (98 individuals), Section 1 (96 individuals), and Section 6 (81 individuals) (Table 9.3-2, Figure 9.3-1). However, based on the amount of area searched, the survey Section with the highest species diversity per hectare were survey Section 7 (3.9 species/ha), survey Section 19 (1.4 species/ha), survey Section 34 (1.3 species/ha), and survey Section 37 (1.2 species/ha). The highest individual abundances (density of birds per ha) were observed in survey Section 7 (30.0 birds/ha), Section 37 (7.9 birds/ha), Section 27 (3.3 birds/ha), and Section 19 (3.3 birds/ha). (Figure 9.3-1, Table 9.3-3).

A likely factor contributing to a high density of birds and species richness appears to be the size of the water body. All survey sections with the highest bird densities and species richness had water body sizes of 10 ha or less, and most were smaller than 5 ha, and the five largest water bodies (#1, #4, #6, #20 and #28) all had low density of birds (on average 0.04 birds birds/ha) and low species diversity (<0.01 species /ha) (Table 9.3-3). However, water courses (streams and rivers) were also important. Water courses only accounted for 17% of the total shoreline surveyed; however, four of eight sections with highest bird densities were water courses. Adjacent ecosite type did not appear to have a large effect on density or diversity, however two of the five survey sections with highest density and/or abundance had a relatively high percentage of adjacent shrubby fen (BP24, BP25) (Table 9.3-3).

A total of seven inactive nests were observed in the area of the Project (Figure 9.3-1, Table 9.3-4). Two of the seven inactive nests had evidence of recent use (e.g., presence of ravens near one and bald eagles near the other). Six active beaver houses and 33 inactive/old houses were also observed in the Project area (Figure 9.3-1, Table 9.3-4).

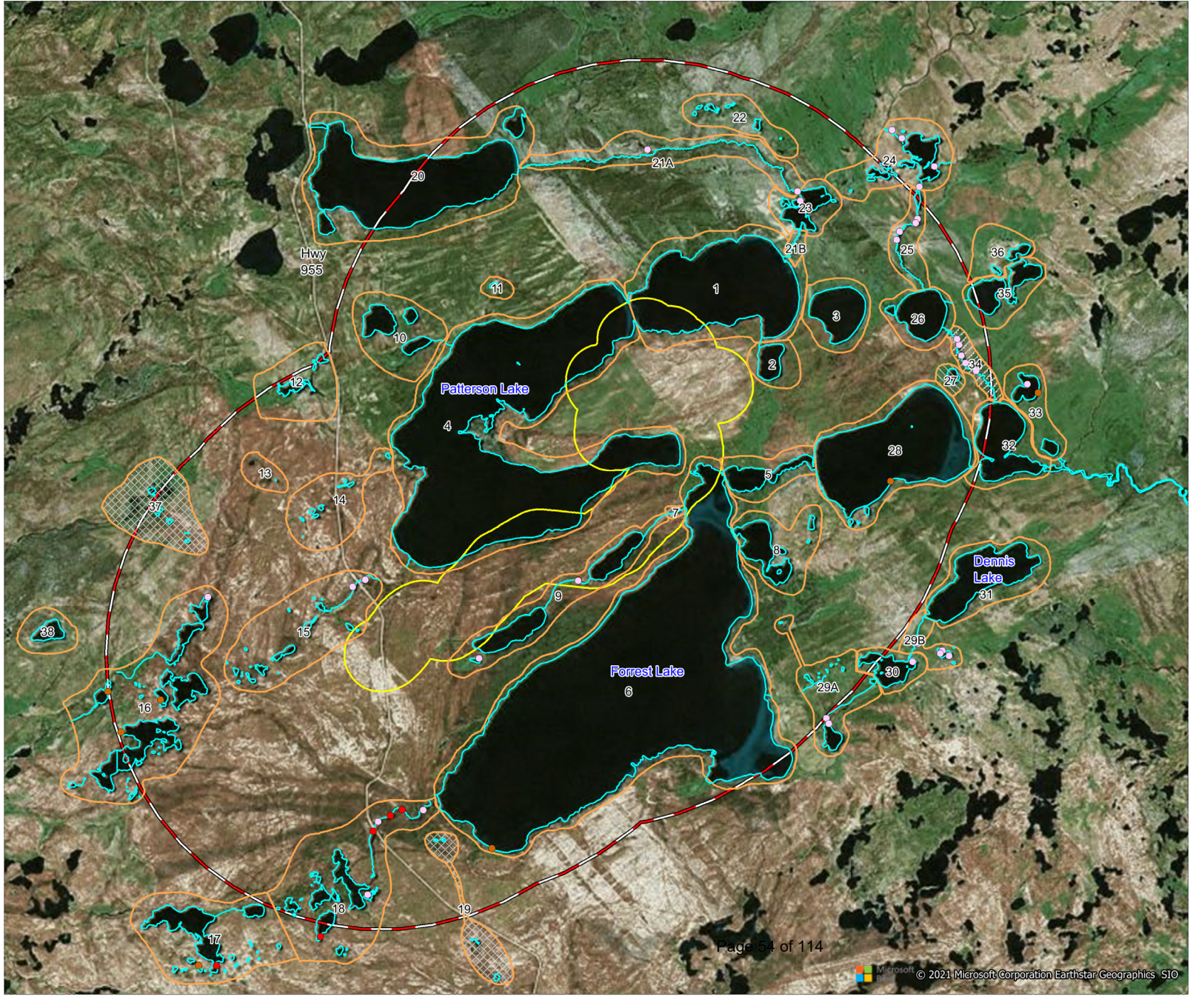

Figure 9.3-1 Aerial Waterfowl Sections, Stick Nest and Beaver Lodge Locations

Legend

- 11 Waterfowl Survey Sections
- 34 High Waterfowl Species Diversity (# species/ha)
- 27 High Waterfowl Abundance (# birds/ha)
- Waterbodies
- Regional Study Area (RSA)
- Local Study Area (LSA)

Observation Type

- Inactive/old stick nest
- Active beaver lodge
- Inactive/old beaver lodge

N
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0 2.5 5
kilometers
Scale = 1 : 100,000

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Table 9.3-1 Aerial Waterfowl Survey Observations in Descending order of Abundance– July 2018.

Common Name	*Scientific Name*	Number of Pairs
Ring-necked Duck	*Aythya collaris*	189
California Gull	*Larus californicus*	99
Common Merganser	*Mergus merganser*	82
Mallard	*Anas platyrhynchos*	61
Bonaparte's Gull	*Chroicocephalus philadelphia*	61
American White Pelican	*Pelecanus erythrorhynchos*	44
Sandpiper Spp.	*Actitus or Tringa spp.*	33
Unknown White-headed Gull	*Larus spp.*	28
Bald Eagle	*Haliaeetus leucocephalus*	28
Common Raven	*Corvus corax*	27
Common Loon	*Gavia immer*	26
Canada Goose	*Branta canadensis*	24
Yellowleg Spp.	*Tringa spp.*	18
Bufflehead	*Bucephala albeola*	13
Unknown Diver	*Aythya, Bucephala, or Mergus spp.*	11
Unknown Gull	*Larus spp.*	10
Herring Gull	*Larus argentatus*	9
Common Goldeneye	*Bucephala clangula*	8
Lesser Scaup	*Aythya affinis*	4
Unknown	*n/a*	4
Sandhill Crane	*Antigone canadensis*	4
Unknown Dabbler	*Anas spp.*	3
Unknown Young	*n/a*	3
Osprey	*Pandion haliaetus*	3
Green-winged Teal	*Anas crecca*	2
American Coot	*Fulica americana*	1
Common Tern	*Sterna hirundo*	1
Red-throated Loon	*Gavia stellata*	1
Red-tailed Hawk	*Buteo jamaicensis*	1
Tundra Swan	*Cygnus columbianus*	1
Total		**799**

Table 9.3-2 Aerial Waterfowl and Stick Nest Survey Results – July 2018.

Species	Survey Section ID																		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
Canada Goose	9		3																
Mallard	2	1			9		5			1		3			1				
Common Merganser	48			2		26													
Ring-necked Duck		4			20		15	3				6		1	10	3	4	4	3
Lesser Scaup				2														2	
Bufflehead	2								7						1	3			
Common Goldeneye												3		1	3				1
American Coot																			
Common Loon	1			3			3	2		1		1				5		2	1
Herring Gull					4	5													
Bonaparte's Gull		1			2			3				1							
California Gull	24			8	56	10													
Common Tern					1														
Green-winged Teal						2													
Bald Eagle	4	1		8		1			1							1			
Red-tailed Hawk										1									
Osprey			1																
Common Raven				5	5	2													
Yellowleg Spp.				1		1									1	4			4
Sandpiper Spp.	1		4	1				1				4		5	1	1		1	3
Tundra Swan																		1	
American White Pelican	5					10									9				
Sandhill Crane																			
Red-throated Loon																			
Unknown white-headed Gull				1	1	23										1			
Unknown Dabbler															2				
Unknown Diver																		8	
Unknown Gull						1						1							
Unknown Young																			
Unknown			2									2							
Total	**96**	**7**	**10**	**31**	**98**	**81**	**23**	**9**	**8**	**3**	**0**	**21**	**0**	**7**	**28**	**18**	**4**	**18**	**12**

Table 9.3-2 Aerial Waterfowl and Stick Nest Survey Results– July 2018 cont.

Species	Survey Section ID																			
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	Total
Canada Goose						6												6		**24**
Mallard	12					3		10		3	6	3			2					**61**
Common Merganser		1							2	2									1	**82**
Ring-necked Duck		2	8	2	2		10			70	2				4			16		**189**
Lesser Scaup																				**4**
Bufflehead																				**13**
Common Goldeneye																				**8**
American Coot						1														**1**
Common Loon			1	2					2				1						1	**26**
Herring Gull																				**9**
Bonaparte's Gull								20	7				4	2				21		**61**
California Gull	1																			**99**
Common Tern																				**1**
Green-winged Teal																				**2**
Bald Eagle	6			1			1		1				3							**28**
Red-tailed Hawk																				**1**
Osprey							2													**3**
Common Raven	2								12								1			**27**
Yellowleg Spp.						1			2	2					1			1		**18**
Sandpiper Spp.						2	1					5						2	1	**33**
Tundra Swan																				**1**
American White Pelican	17												3							**44**
Sandhill Crane																	2	2		**4**
Red-throated Loon			1																	**1**
Unknown white-headed Gull									1									1		**28**
Unknown Dabbler										1										**3**
Unknown Diver			1		1										1					**11**
Unknown Gull									4			4								**10**
Unknown Young																		3		**3**
Unknown																				**4**
Total	**38**	**3**	**11**	**5**	**3**	**13**	**14**	**30**	**31**	**78**	**8**	**12**	**11**	**2**	**8**	**0**	**3**	**52**	**3**	**799**

Table 9.3-3 Information on Water Bodies Within Survey Sections for the Aerial Waterfowl Surveys– July 2018.

Survey Section ID	# Water Bodies			Total Area Searched (ha)	Average Water Body Size (ha)	Density (# birds /ha)	Species diversity (# species /ha)	Dominant Ecosites Within a 100 m Buffer Adjacent to Water Body (Rated by Composition[1])		
	Lakes/ Ponds	Creeks / Rivers	Total					1st	2nd	3rd
1	1	-	1	936.3	936.3	0.10	0.01	RF2-C	RF4	-
2	1	-	1	57.2	57.2	0.12	0.07	RF2-B	RF4	RF2-C
3	1	-	1	167.3	167.3	0.06	0.02	RF4	-	-
4	1	-	1	2832.2	2832.2	0.01	0.00	RF1-D	BP3	RF2-C
5	1	-	1	94.2	94.2	1.04	0.08	RF4	RF2-B	BP3
6	1	-	1	4246.1	4246.1	0.02	0.00	RF2-C	BP2	BP3
7	1	1	2	0.8	0.4	30.02	3.92	RF2-B	BP24	RF2-C
8	4	-	4	131.4	32.8	0.07	0.03	RF4	BP2	-
9	3	2	5	182.6	36.5	0.04	0.01	RF2-D	BP3	BP4
10	3	-	3	92.8	30.9	0.03	0.03	BP2	RF2-C	BP4
11	2	-	2	2.2	1.1	0.00	0.00	RF2-C	BP2	-
12	3	-	3	23.8	7.9	0.88	0.34	BP20	BP2	-
13	1	-	1	2.1	2.1	0.00	0.00	RF2-C	-	-
14	8	-	8	8.6	1.1	0.81	0.35	RF2-C	BP2	-
15	22	2	24	34.9	1.5	0.80	0.23	RF2-C	BP2	-
16	22	1	23	305.8	13.3	0.06	0.02	RF2-C	BP20	BP2
17	17	1	18	159.5	8.9	0.03	0.01	RF2-C	BP3	-
18	20	4	24	127.1	5.3	0.14	0.05	BP3	RF2-C	BP2
19	6	-	6	3.7	0.6	3.28	1.37	RF2-C	BP2	BP3
20	5	-	5	984.6	196.9	0.04	0.01	RF3-C	BP3	RF2-C
21	1	2	3	6.6	2.2	0.45	0.30	RF4	BP20	BP25
22	7	-	7	12.1	1.7	0.91	0.33	RF4	BP20	-
23	3	-	3	82.9	27.6	0.06	0.04	RF4	-	-
24	6	2	8	178.6	22.3	0.02	0.01	RF4	-	-
25	1	1	2	8.8	4.4	1.47	0.57	RF4	BP25	BP26
26	2	-	2	146.7	73.3	0.10	0.03	RF4	-	-
27	1	-	1	9.1	9.1	3.31	0.22	BP20	-	-
28	4	-	4	890.9	222.7	0.03	0.01	RF4	BP20	-
29	16	3	19	35.0	1.8	2.23	0.14	RF4	BP20	-
30	1	-	1	76.7	76.7	0.10	0.03	RF4	-	-
31	1	-	1	302.4	302.4	0.04	0.01	N/A	-	-
32	1	-	1	239.3	239.3	0.05	0.02	BP20	BP2	-
33	2	-	2	53.3	26.7	0.04	0.02	N/A	-	-
34	-	1	1	3.2	3.2	2.52	1.26	BP25	BP20	BP19
35	2	-	2	119.4	59.7	0.00	0.00	BP20	RF4	-
36	2	-	2	18.2	9.1	0.16	0.11	N/A	-	-
37	8	-	8	6.6	0.8	7.93	1.22	RF1-D	RF3-B	-
38	1	-	1	33.6	33.6	0.09	0.09	N/A	-	-

[1]Rated by surface area of specific Ecosite.

Table 9.3-4 Nest Sites & Beaver Lodges Observed During Aerial Waterfowl – July 2018.

Description	Location (NAD 83)
Stick nest, empty but ravens nearby	12 V 600160 6379849
Empty stick nest, bald eagle nearby, active this year	12 V 610928 6390272
Empty stick nest, likely used this year, large	12 V 614937 6392821
Empty stick nest	12 V 590884 6383737
Empty stick nest	12 V 589419 6383932
Empty stick nest	12 V 589809 6382823
Empty stick nest	12 V 592104 6376422
Active beaver lodge	12 V 592593 6376420
Active beaver lodge	12 V 595461 6377292
Active beaver lodge	12 V 596854 6380240
Active beaver lodge	12 V 597320 6380690
Active beaver lodge	12 V 597637 6380852
Active beaver lodge	12 V 602369 6387317
Inactive/old beaver lodge	12 V 599676 6385087
Inactive/old beaver lodge	12 V 602360 6387303
Inactive/old beaver lodge	12 V 596466 6387186
Inactive/old beaver lodge	12 V 596130 6386983
Inactive/old beaver lodge	12 V 592122 6386610
Inactive/old beaver lodge	12 V 596741 6378479
Inactive/old beaver lodge	12 V 596987 6380512
Inactive/old beaver lodge	12 V 598231 6380859
Inactive/old beaver lodge	12 V 603970 6399229
Inactive/old beaver lodge	12 V 608144 6398188
Inactive/old beaver lodge	12 V 608225 6397928
Inactive/old beaver lodge	12 V 611902 6398977
Inactive/old beaver lodge	12 V 610984 6399728
Inactive/old beaver lodge	12 V 610709 6399951
Inactive/old beaver lodge	12 V 611505 6398410
Inactive/old beaver lodge	12 V 611479 6397521
Inactive/old beaver lodge	12 V 611425 6397406
Inactive/old beaver lodge	12 V 610995 6397157
Inactive/old beaver lodge	12 V 610916 6396924
Inactive/old beaver lodge	12 V 609329 6383679
Inactive/old beaver lodge	12 V 609403 6383536
Inactive/old beaver lodge	12 V 612686 6385498
Inactive/old beaver lodge	12 V 612491 6385636
Inactive/old beaver lodge	12 V 612430 6385560
Inactive/old beaver lodge	12 V 611675 6385310
Inactive/old beaver lodge	12 V 611813 6385814
Inactive/old beaver lodge	12 V 611806 6385844
Inactive/old beaver lodge	12 V 614632 6393049
Inactive/old beaver lodge	12 V 613213 6393374
Inactive/old beaver lodge	12 V 612911 6393587
Inactive/old beaver lodge	12 V 612795 6393792
Inactive/old beaver lodge	12 V 612721 6394086
Inactive/old beaver lodge	12 V 612661 6394241

10.0 COVERT CAMERA SURVEY

10.1 Study Objectives

Covert camera surveys are an effective and non-invasive way to gather wildlife observation data. These cameras collect data remotely and continuously for a range of species and can be deployed in the field for months at a time with minimal maintenance. The primary objectives of this survey were to:

- determine the presence and spatial distribution of wildlife species within the Project RSA;
- identify the relative use of linear features (i.e., roads, trails, and hand-cut lines) in the Project RSA by wildlife and humans; and
- develop a scientifically defensible baseline to support effect assessments and to allow for potential future follow up/monitoring requirements.

10.2 Methods

A total of 24 Reconyx XP9 UltraFire Professional Covert Trap cameras were deployed between 26 March 2018 and 31 March 2018 within the area of the Project. Camera locations were determined using a stratified random approach to sample different disturbance feature types and reference sites. Cusack et al. (2015) found that camera placement (i.e., random versus game trail based) was unlikely to affect community level inferences, given adequate sampling effort. The cameras were located on four linear feature types including road, trail, hand-cut line, and undisturbed reference sites. Road sites were further divided into two sub-classes including an all-season road (i.e., plowed during winter) and a seasonal road. The feature types were defined as:

- road – a maintained or seasonally maintained road supporting truck traffic or larger;
- trail / conventional cutline – a cleared disturbance over 2 m in width;
- hand-cut line – a cleared disturbance under 2 m in width; and
- reference site – a site undisturbed by human alteration representing natural conditions.

Originally, the study area was divided into six geographic units to ensure spatial distribution of the covert cameras across the study area. Each unit was further broken into numbered 1-km^2 grid cells to enable random site selection. The grid cells were created only in areas that were safely accessible during both summer and winter seasons. Six cameras were located in each of: trail/conventional cutline, hand-cut line, and undisturbed reference sites within each unit of the study area. The six road cameras were located using a random number generator to select grid cells that coincided with roads. This was necessary since roads were only located in certain portions of the Project area. The initial intention was to place three cameras on all-season roads and three cameras on seasonal roads; however, all roads surveyed were all-season due to ongoing exploration activities by multiple companies in the study area.

Multiple camera thefts were discovered during the first two camera maintenance/data retrieval trips. Due to this ongoing issue, the original stratified random study design was changed. Cameras deemed to be in high theft risk locations were redistributed to areas specifically identified as low risk for theft. In addition, cameras were relocated along linear features with low sampling intensity due to theft. This program shift is not expected to have resulted in substantial changes in the baseline data collected. The camera data were complementary to the full suite of wildlife baseline data collection efforts.

Cameras were mounted on stable trees, 1.5 m above the ground to capture a variety of species and pointed towards the targeted linear feature or towards the most open area in the case of reference locations. All cameras faced north, or as close as feasible, to optimize lighting and avoid sun glare (Dunne 2007). Each

camera was tested at its field location to ensure proper function. Camera settings included: high sensitivity trigger and motion sensors, three photographs per activation, one second photograph intervals, and no quiet period between activations.

Camera photographs were examined by a Professional Biologist (ASPB) to determine the number of individuals of each species captured. Each animal photographed was considered as an individual, since most species present in the study area are not distinguishable by pelage (i.e., fur or hair type). Multiple photographs of the same individual (i.e., standing in front of camera, milling back and forth) were considered one observation event. Anthropogenic presence was also of interest; photographs containing humans/human use (e.g., vehicles, heavy equipment, recreational use) were also examined. The number of captures was divided by the number of camera deployment days to provide a relative abundance of species and human use.

It is noted that detections collected using covert cameras represent the minimum detection rate as cameras can malfunction or be misaligned due to tampering from animals or humans.

Survey design and field methodologies were guided by ABMI (2019) and were completed under Saskatchewan Government Research Permit/Species Detection #18FW031 and 18SD170.

10.3 Results

Twenty-four remote cameras were deployed in the area of the Project (Figure 10.3-1). A total of seven cameras were stolen during the program and six cameras were re-deployed in lower theft risk areas. Results over time were available from 27 camera locations, totaling 12,908 camera days. Across the study area, cameras averaged 3.5 captures per 100 camera days (including all species captured).

All-season roads had the highest frequency of wildlife detection at 5.22 captures per 100 camera days, followed by trails and hand-cut lines, each with and 3.36 captures per 100 camera days. Black bears (0.7/100 camera days), red squirrels (0.5/100 camera days), and snowshoe hare (0.4/100 camera days) were the most photographed species. Table 10.3-1 and Table 10.3-2 detail the wildlife capture results by camera, species, and feature type.

The study area averaged 46.5 human use events per 100 camera days across the study area. The highest frequency of human use occurred on all-season roads (383.3/100 camera days) and trails (10.3/100 camera days). Heavy equipment/passenger vehicles were the most detected human use at 28.9 detections per 100 camera days. Table 10.3-3 and Table 10.3-4 detail human use captures by camera, vehicle group and feature type.

A sample of game camera wildlife photograph captures can be viewed in Appendix D The covert camera survey was completed in September 2021.

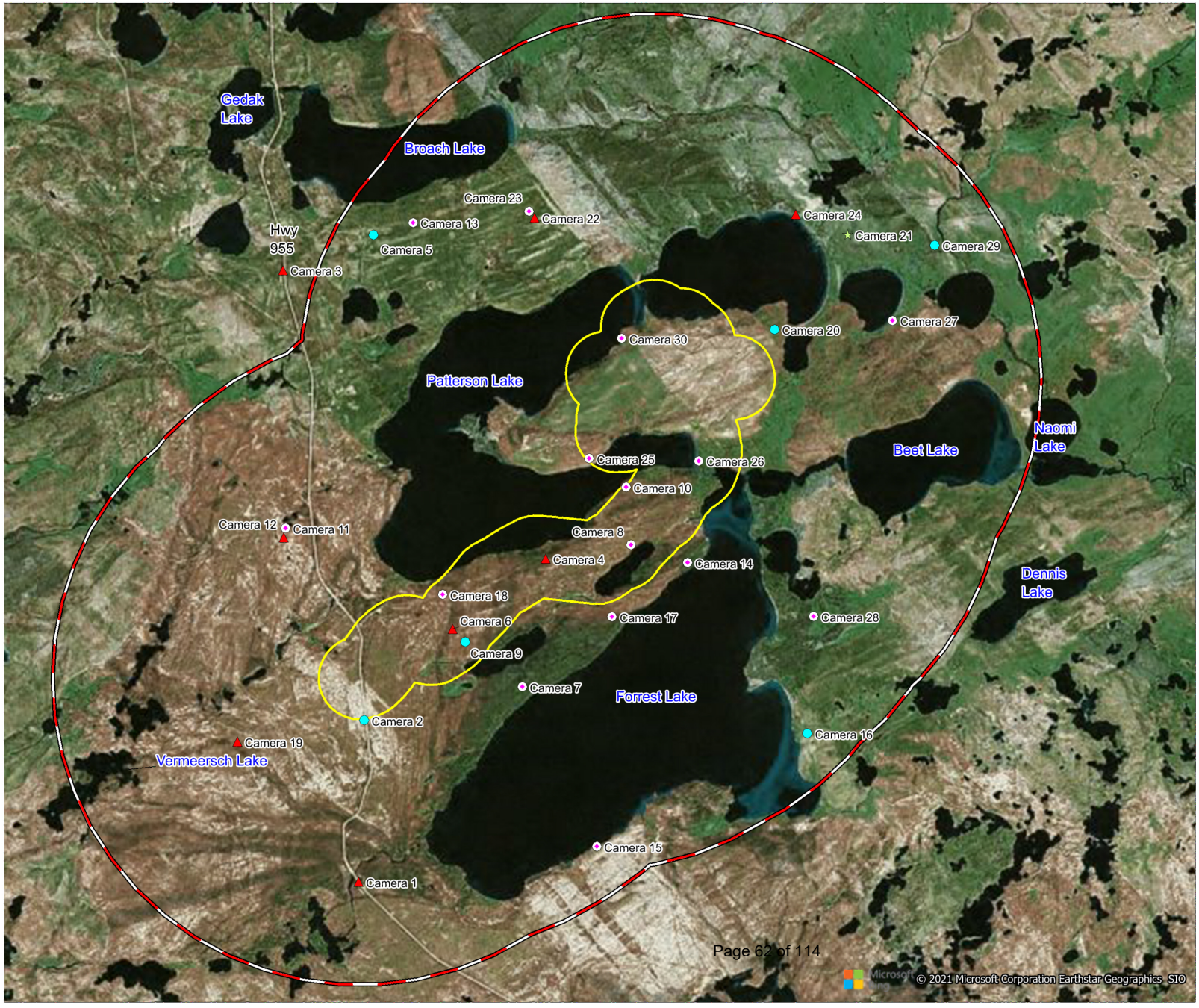

Figure 10.3-1 Covert Camera Locations

Legend

Covert Camera

- Camera Location
- Previous Location (Moved)
- Previous Location (Stolen)
- Previous Location (Taken down)
- Regional Study Area (RSA)
- Local Study Area (LSA)

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kilometers
Scale = 1 : 90,000

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Table 10.3-1 Remote Camera Wildlife Capture Results - 2018 – 2021.

Camera ID	Associated Feature	Zone	Easting	Northing	Camera Days	Species Observations per 100 Camera Days								
						All Species	Bear	Bear Young	Caribou	Caribou Young	White-tailed deer	Moose	Moose Young	Lynx
Camera 1	All-season road	12 V	597048	6380084	315	0.95	0.32	-	0.32	-	-	-	-	-
Camera 2	All-season road	12 V	597096	6384086	242	4.13	0.41	-	0.41	-	-	0.41	-	-
Camera 3	All-season road	12 V	594825	6395153	-	-	-	-	-	-	-	-	-	-
Camera 4	All-season road	12 V	601497	6388190	200	1.50	0.50	1.00	-	-	-	-	-	-
Camera 5	All-season road	12 V	597036	6396071	107	14.95	1.87	-	-	-	-	-	-	1.87
Camera 6	All-season road	12 V	599230	6386391	443	9.26	1.81	2.03	-	-	-	0.23	0.23	0.68
Camera 7	Reference	12 V	600999	6385003	1,276	1.88	0.16	-	-	-	-	0.15	-	-
Camera 8	Hand-cut	12 V	603595	6388583	426	9.62	1.41	0.23	-	-	-	1.17	-	-
Camera 9	Reference	12 V	599553	6386080	125	1.60	0.80	-	-	-	-	-	-	-
Camera 10	Reference	12 V	603439	6390002	721	2.50	0.14	-	-	-	-	0.97	-	-
Camera 11	Hand-cut	12 V	595034	6388784	784	3.57	0.89	-	-	-	-	-	-	0.64
Camera 12	Trail	12 V	594993	6388557	363	4.41	1.38	0.28	-	-	0.28	-	-	1.10
Camera 13	Reference	12 V	598011	6396397	522	0.96	-	-	-	-	-	-	-	-
Camera 14	Trail	12 V	605011	6388177	955	0.84	0.31	-	0.10	-	-	0.35	-	-
Camera 15	Reference	12 V	602938	6381097	1,138	3.60	0.62	-	-	-	0.17	0.17	-	0.33
Camera 16	Trail	12 V	608092	6384032	240	13.75	4.58	-	2.08	-	-	2.08	-	-
Camera 17	Hand-cut	12 V	603178	6386795	1,130	1.33	0.44	-	-	-	-	0.37	-	-
Camera 18	Hand-cut	12 V	598965	6387234	317	9.15	2.84	0.33	-	-	-	1.64	-	-
Camera 19	Trail	12 V	593966	6383478	39	17.95	10.26	2.56	-	-	-	-	-	2.56
Camera 20	Reference	12 V	607012	6393994	363	10.47	1.38	0.28	-	-	-	0.55	-	-
Camera 21	Hand-cut	12 V	608756	6396376	494	3.64	1.01	0.20	1.01	0.20	-	0.40	-	-
Camera 22	Trail	12 V	601007	6396597	-	-	-	-	-	-	-	-	-	-
Camera 23	Hand-cut	12 V	600865	6396756	862	0.46	0.23	-	-	-	-	0.12	-	-
Camera 24	Trail	12 V	607466	6396853	-	-	-	-	-	-	-	-	-	-
Camera 25	Trail	12V	602510	6390690	434	1.61	0.23	-	-	-	-	0.46	-	-
Camera 26	All-season road	12V	605226	6390697	168	2.38	0.60	-	-	-	-	-	-	0.60
Camera 27	Trail	12V	609924	6394290	551	1.09	0.54	0.18	0.18	-	-	0.18	-	-
Camera 28	Trail	12V	608170	6386929	300	3.67	-	-	0.67	-	-	-	-	-
Camera 29	Trail	12V	610921	6396177	142	5.63	2.82	-	0.70	-	-	1.41	-	-
Camera 30	Trail	12V	603241	6393669	251	5.58	-	-	-	-	-	0.40	-	-
Total/ Average					**12,908**	**3.49**	**0.74**	**0.17**	**0.13**	**0.01**	**0.02**	**0.39**	**0.01**	**0.17**

Table 10.3-1 Remote Camera Wildlife Capture Results - 2018 – 2021- cont.

Camera ID	Associated Feature	Zone	Easting	Northing	Camera Days	Species Observations per 100 Camera Days							
						Fox	Hare	Wolf	Coyote/ Wolf	Marten	Porcupine	Squirrel	Unknown / Other
Camera 1	All-season road	12 V	597048	6380084	315	-	-	0.32	-	-	-	-	-
Camera 2	All-season road	12 V	597096	6384086	242	-	0.41	-	-	-	-	-	1.90
Camera 3	All-season road	12 V	594825	6395153	-	-	-	-	-	-	-	-	-
Camera 4	All-season road	12 V	601497	6388190	200	-	-	-	-	-	-	-	-
Camera 5	All-season road	12 V	597036	6396071	107	4.67	2.80	-	-	0.93	0.93	-	1.87
Camera 6	All-season road	12 V	599230	6386391	443	1.13	0.23	1.13	-	-	-	1.13	0.68
Camera 7	Reference	12 V	600999	6385003	1,276	-	-	-	-	0.31	-	1.02	0.31
Camera 8	Hand-cut	12 V	603595	6388583	426	0.23	-	0.23	-	-	-	5.63	0.70
Camera 9	Reference	12 V	599553	6386080	125	-	-	-	-	0.80	-	-	-
Camera 10	Reference	12 V	603439	6390002	721	-	-	0.14	-	0.28	-	0.28	0.69
Camera 11	Hand-cut	12 V	595034	6388784	784	0.13	1.66	-	-	-	-	-	0.26
Camera 12	Trail	12 V	594993	6388557	363	-	0.83	-	0.28	-	-	-	0.28
Camera 13	Reference	12 V	598011	6396397	522	-	0.19	-	-	-	-	-	0.77
Camera 14	Trail	12 V	605011	6388177	955	-	-	-	-	0.21	-	-	-
Camera 15	Reference	12 V	602938	6381097	1,138	-	1.14	-	-	0.26	-	0.97	0.26
Camera 16	Trail	12 V	608092	6384032	240	2.08	0.83	0.42	-	-	-	0.83	0.83
Camera 17	Hand-cut	12 V	603178	6386795	1,130	0.12	-	-	-	0.27	-	-	0.27
Camera 18	Hand-cut	12 V	598965	6387234	317	-	3.15	-	-	0.63	-	0.63	-
Camera 19	Trail	12 V	593966	6383478	39	-	-	2.56	-	-	-	-	-
Camera 20	Reference	12 V	607012	6393994	363	-	1.93	-	-	4.68	-	0.83	0.83
Camera 21	Hand-cut	12 V	608756	6396376	494	-	-	-	-	-	-	0.20	0.61
Camera 22	Trail	12 V	601007	6396597	-	-	-	-	-	-	-	-	-
Camera 23	Hand-cut	12 V	600865	6396756	862	-	0.12	-	-	-	-	-	-
Camera 24	Trail	12 V	607466	6396853	-	-	-	-	-	-	-	-	-
Camera 25	Trail	12V	602510	6390690	434	-	-	-	-	0.23	-	-	0.69
Camera 26	All-season road	12V	605226	6390697	168	0.60	-	-	-	-	-	-	0.60
Camera 27	Trail	12V	609924	6394290	551	-	-	-	-	-	-	-	-
Camera 28	Trail	12V	608170	6386929	300	-	-	-	-	0.67	-	0.33	2.00
Camera 29	Trail	12V	610921	6396177	142	-	-	0.70	-	-	-	-	-
Camera 30	Trail	12V	603241	6393669	251	-	-	-	-	-	-	-	5.18
Total/ Average					**12,908**	**0.17**	**0.43**	**0.10**	**0.01**	**0.29**	**0.01**	**0.50**	**0.52**

Table 10.3-2 Remote Camera Wildlife Capture Results by Feature Type - 2018 – 2021.

Associated Feature	Total Camera Days	Species Observations Per 100 Camera Days																
		All Species	Bear Adult	Bear Young	Caribou Adult	Caribou Young	White-tailed Deer	Moose Adult	Moose Young	Lynx	Fox	Hare	Wolf	Coyote/ Wolf	Marten	Porcupine	Squirrel	Unknown / Other
All-season road	1,475	5.22	0.95	0.75	0.14	0.00	0.00	0.14	0.07	0.41	0.75	0.34	0.41	0.00	0.07	0.07	0.34	0.81
Hand-cut line	4,013	3.36	0.85	0.07	0.12	0.02	0.00	0.40	0.00	0.12	0.07	0.60	0.02	0.00	0.12	0.00	0.67	0.27
Reference	4,145	3.09	0.39	0.02	0.00	0.00	0.02	0.27	0.00	0.05	0.00	0.51	0.02	0.00	0.65	0.00	0.70	0.46
Trail	3,275	3.36	0.95	0.09	0.31	0.00	0.03	0.40	0.00	0.15	0.15	0.15	0.09	0.03	0.15	0.00	0.09	0.76
Total/Average	**12,908**	**3.49**	**0.74**	**0.14**	**0.13**	**0.01**	**0.02**	**0.33**	**0.01**	**0.14**	**0.15**	**0.43**	**0.09**	**0.01**	**0.29**	**0.01**	**0.50**	**0.52**

Table 10.3-3 Remote Camera Anthropogenic Capture Results - 2018 – 2021.

Camera ID	Associated Feature	Zone	Easting	Northing	Camera Days	All Anthropogenic	Vehicles (heavy equipment, passenger)	ATVs / Snowmobiles	Human (non-motorized)	Unknown Vehicle[a]
Camera 1	All-season road	12 V	597048	6380084	315	614.29	362.86	2.54	-	248.89
Camera 2	All-season road	12 V	597096	6384086	242	436.78	307.85	3.31	-	125.62
Camera 3	All-season road	12 V	594825	6395153	-	-	-	-	-	-
Camera 4	All-season road	12 V	601497	6388190	200	140.50	77.50	3.00	-	60.00
Camera 5	All-season road	12 V	597036	6396071	107	25.23	19.63	1.87	-	3.74
Camera 6	All-season road	12 V	599230	6386391	443	524.38	312.42	1.81	0.68	209.48
Camera 7	Reference	12 V	600999	6385003	1,276	0.08	-	-	0.08	-
Camera 8	Hand-cut	12 V	603595	6388583	426	1.64	-	-	1.64	-
Camera 9	Reference	12 V	599553	6386080	125	0.00	-	-	-	-
Camera 10	Reference	12 V	603439	6390002	721	0.28	-	-	0.28	-
Camera 11	Hand-cut	12 V	595034	6388784	784	0.00	-	-	-	-
Camera 12	Trail	12 V	594993	6388557	363	85.67	68.32	1.93	-	15.43
Camera 13	Reference	12 V	598011	6396397	522	0.00	-	-	-	-
Camera 14	Trail	12 V	605011	6388177	955	0.00	-	-	-	-
Camera 15	Reference	12 V	602938	6381097	1,138	0.00	-	-	-	-
Camera 16	Trail	12 V	608092	6384032	240	0.00	-	-	-	-
Camera 17	Hand-cut	12 V	603178	6386795	1,130	0.00	-	-	-	-
Camera 18	Hand-cut	12 V	598965	6387234	317	0.00	-	-	-	-
Camera 19	Trail	12 V	593966	6383478	39	2.56	-	-	-	2.56
Camera 20	Reference	12 V	607012	6393994	363	0.00	-	-	-	-
Camera 21	Hand-cut	12 V	608756	6396376	494	0.00	-	-	-	-
Camera 22	Trail	12 V	601007	6396597	-	-	-	-	-	-
Camera 23	Hand-cut	12 V	600865	6396756	862	0.00	-	-	-	-
Camera 24	Trail	12 V	607466	6396853	-	-	-	-	-	-
Camera 25	Trail	12V	602510	6390690	434	5.99	0.46	0.69	4.84	-
Camera 26	All-season road	12V	605226	6390697	168	17.86	16.67	-	-	1.19
Camera 27	Trail	12V	609924	6394290	551	0.00	-	-	-	-
Camera 28	Trail	12V	608170	6386929	300	0.00	-	-	-	-
Camera 29	Trail	12V	610921	6396177	142	0.00	-	-	-	-
Camera 30	Trail	12V	603241	6393669	251	0.00	-	-	-	-
Total/ Average					**12,908**	**46.49**	**28.87**	**0.33**	**0.26**	**17.04**

a) i.e., dust cloud, headlights, small portion of vehicle preventing more detailed identification.

Table 10.3-4 Remote Camera Anthropogenic Capture Results by Feature Type - 2018 – 2021.

Associated Feature	Total Camera Days	Captures per 100 Camera Days				
		All Human Use	Vehicles (heavy equipment, passenger)	ATVs / Snowmobiles	Human (non-motorized)	Unknown Vehicle
All-season road	1,475	383.25	235.66	2.17	0.20	145.22
Hand-cut line	4,013	0.17	0.00	0.00	0.17	0.00
Reference	4,145	0.07	0.00	0.00	0.07	0.00
Trail	3,275	10.32	7.63	0.31	0.64	1.74
Total/Average	**12,908**	**46.49**	**28.87**	**0.33**	**0.26**	**17.04**

11.0 SPECIES AT RISK AND SENSITIVE SPECIES

In addition to the vegetation and wildlife baseline data collected during formal surveys, species at risk and other sensitive species observations were also collected and compiled from incidental observations.

A total of 28 provincially listed sensitive plant species, tracked by the Saskatchewan Conservation Data Centre, were detected during field surveys in support of the Rook I Project. The list of species detected is provided in Table 11.0-1 and Figure 11.0-1 outlines the respective locations. No federally listed species-at-risk were detected.

Thirteen different sensitive or at-risk wildlife species were observed during field surveys, or incidentally, in support of the Project (Table 11.0-2), including:

- Common Loon (Aerial waterfowl and Incidentally)
- Red-throated Loon (Aerial waterfowl)
- Bald Eagle (Aerial waterfowl and Incidentally)
- Common Nighthawk (Incidentally)
- Barn Swallow (Incidentally)
- Olive-sided Flycatcher (Incidentally)
- Bonaparte's Gull (Aerial waterfowl)
- Herring Gull (Aerial waterfowl)
- Common Tern (Aerial waterfowl)
- American White Pelican (Aerial Waterfowl)
- Osprey (Aerial waterfowl and Incidentally)
- Woodland Caribou (Pellets, Vegetation survey, Covert camera, Backtrailing and Incidentally)
- River Otter (Winter tracking)

Figure 11.0-2 highlights the locations of wildlife species at risk observations and species/features (nests and breeding colonies) observed in the Project area.

Table 11.0-1 Sensitive and at Risk Plant Species Observations.

Common Name	Scientific Name	SKCDC Status	COSEWIC Status	SARA Status
Concentric ring lichen	*Arctoparmelia centrifuga*	S2	-	-
Subarctic ladyfern	*Athyrium filix-femina ssp. Angustatum*	S3	-	-
Low northern sedge	*Carex concinna*	S3	-	-
Iceland lichen	*Cetraria ericetorum*	S3	-	-
True Iceland lichen	*Cetraria islandica*	S3	-	-
Greater sulphur-cup	*Cladonia sulfurina*	S2	-	-
Red-fruited pixie-cup	*Cladonia pleurota*	S2	-	-
Lesser sulphur-cup	*Cladonia deformis*	S3	-	-
Organ-pipe lichen	*Cladonia crispata*	S3	-	-
Powdered funnel lichen	*Cladonia cenotea*	S3	-	-
Boreal pixie-cup	*Cladonia borealis*	S3	-	-
Common powderhorn	*Cladonia coniocraea*	S2	-	-
British soldiers	*Cladonia cristatella*	S3	-	-
Angle-leaved sundew	*Drosera anglica*	S3	-	-
White cotton grass	*Eriophorum scheuchzeri*	S2	-	-
Crinkled snow lichen	*Cetraria nivalis*	S3	-	-
Waldo Lake liverwort	*Jamesoniella autumnalis*	S3	-	-
Northern Labrador tea	*Rhododendron tomentosum*	S3	-	-
Lesser duckweed	*Lemna Minor*	S1	-	-
Creeping Fingerwort	*Lepidozia reptans*	S3	-	-
Lophozia liverwort	*Lophozia ventricosa*	S3	-	-
Anomalous flapwort	*Leiomylia anomala*	S3	-	-
Green starburst lichen	*Parmeliopsis ambigua*	S3	-	-
Gray starburst lichen	*Parmeliopsis hyperopta*	S3	-	-
Common freckle pelt	*Peltigera aphthosa*	S3	-	-
Apple Pelt	*Peltigera aphthosa*	S3	-	-
Naugehyde liverwort	*Ptilidium pulcherrimum*	S3	-	-
Green Map Lichen	*Rhizocarpon geographicum*	S2	-	-

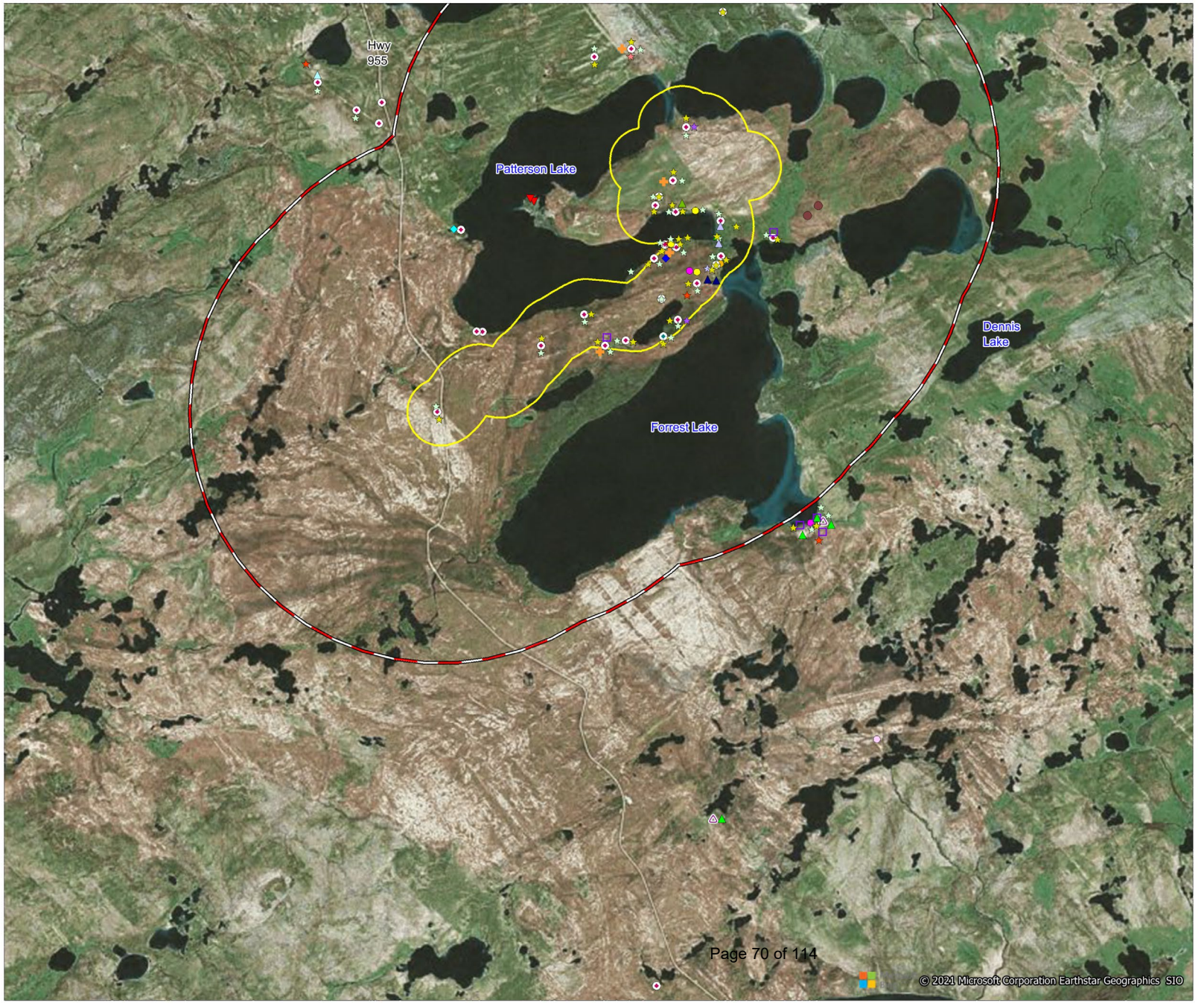

Figure 11.0-1 Plant Species at Risk Observations

Legend

Plant Common Name
- Angle-leaved sundew
- Anomalous flapwort
- Apple Pelt
- Boreal pixie-cup
- British soldiers
- Common freckle pelt
- Common powderhorn
- Concentric ring lichen
- Creeping Fingerwort
- Crinkled snow lichen
- Gray starburst lichen
- Greater sulphur-cup
- Green Map Lichen
- Green starburst lichen
- Iceland lichen
- Lesser duckweed
- Lesser sulphur-cup
- Lophozia liverwort
- Low northern sedge
- Naugehyde liverwort
- Northern Labrador tea
- Organ-pipe lichen
- Powdered funnel lichen
- Red-fruited pixie-cup
- Subarctic ladyfern
- True Iceland lichen
- Waldo Lake liverwort
- White cotton grass

Regional Study Area (RSA)
Local Study Area (LSA)

N
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0 5 10
kilometers
Scale = 1 : 110,000

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Ref# O-F736_12-18

Table 11.0-2 Wildlife Sensitive and Species at Risk Observations.

Common Name	Scientific Name	SKCDC Status	COSEWIC Status	SARA Status
Common Loon[a]	*Gavia immer*	S5B,SUN, S5M	Not at Risk	-
Red-Throated Loon[a]	*Gavia stellata*	S1B, S1M	-	-
Woodland Caribou	*Rangifer tarandus caribou*	S3	Threatened	Threatened
River Otter	*Lontra canadensis*	S3	Not at Risk	Not at Risk
Bald Eagle	*Haliaeetus leucocephalus*	S5B, S5N, S4M	Not at Risk	-
Common Nighthawk	*Chordeiles minor*	S4B, S4M	Special Concern	Threatened
Barn Swallow	*Hirundo rustica*	S5B, S5M	Threatened	Threatened
Olive-sided Flycatcher	*Contopus cooperi*	S4B, S4M	Special Concern	Threatened
Bonaparte's Gull[1]	*Chroicocephalus philadelphia*	S4B, S4M	-	-
Herring Gull[1]	*Larus argentatus*	S5B, S5M	-	-
Common Tern[1]	*Sterna hirundo*	S5B, S5M	Not at Risk	-
American White Pelican[1]	*Pelecanus erythrorhynchos*	S5B, S5M	Not at Risk	-
Osprey	*Pandion haliaetus*	S2B, S2M	-	-

Note: SKCDC Rankings:
2 = Imperiled/Very rare
3 = Vulnerable/Rare to uncommon
4 = Apparently Secure
5 = Secure/Common

M = for a migratory species, rank applies to the transient (migrant) population
B = for a migratory species, applies to the breeding population in the province
N= for a migratory species, applies to the non-breeding population in the province
U= status is uncertain in Saskatchewan because of limited or conflicting information (unrankable)

a) Birds observed but no specific nests.

SARGSS: Saskatchewan Activity Restriction Guidelines for Sensitive Species.

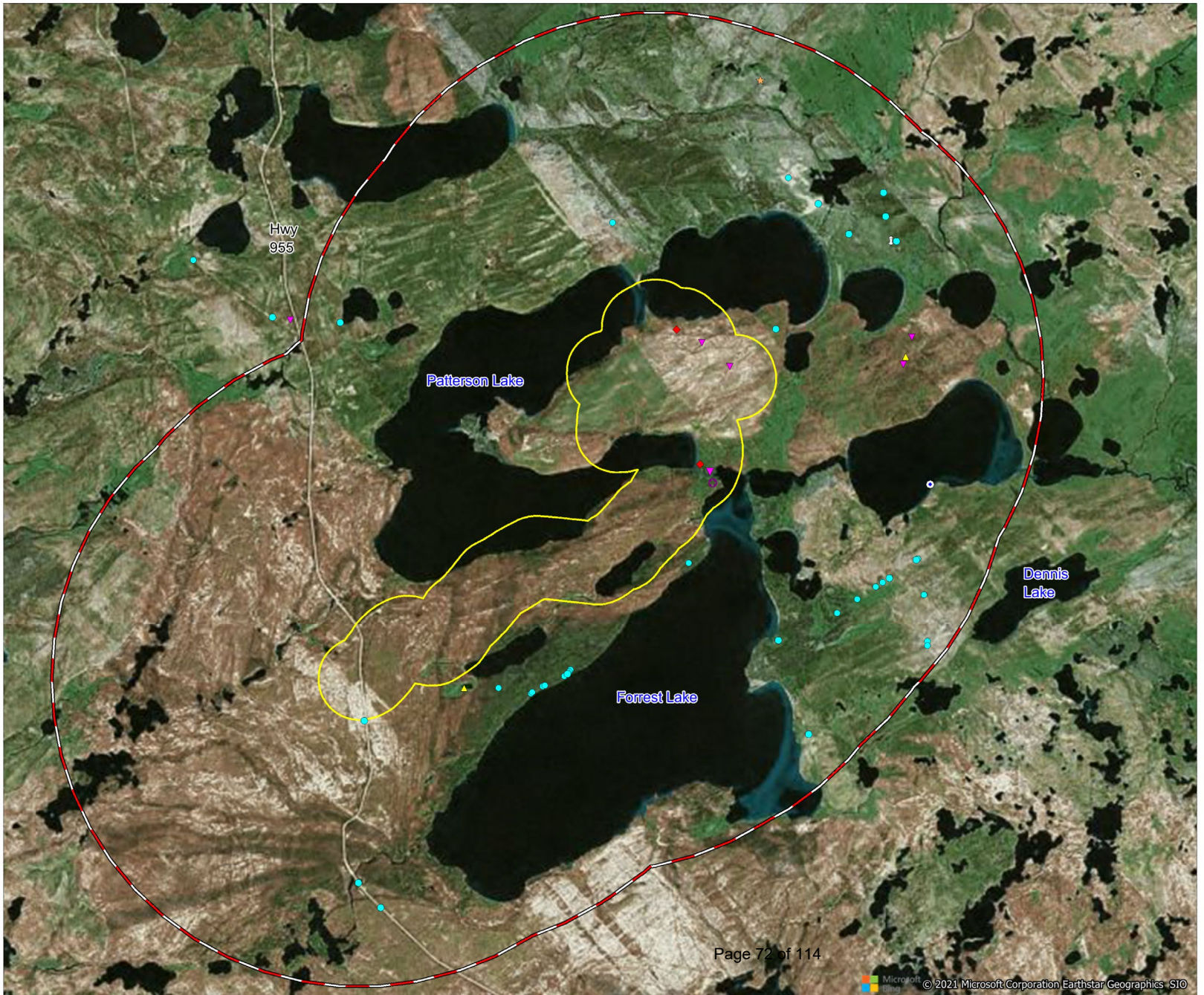

Figure 11.0-2 Wildlife Species at Risk Observations

Legend

Observation

- Woodland Caribou
- Common Nighthawk
- Olive-sided Flycatcher
- Barn Swallow
- Bald Eagle Nest
- Red-throated Loon
- River Otter
- Osprey Nest
- Regional Study Area (RSA)
- Local Study Area (LSA)

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kilometers
Scale = 1 : 90,000

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12.0 Regional Fur Harvest Data

12.1 Study Objectives

The objectives of the compilation and description of regional fur trapping data were to:

- utilize existing publicly available data to further characterize the potential wildlife assemblages in the Fur Conservation Area (FCA) N-19; and
- utilize all possible data sources to complement and enhance Project-specific data collection efforts to support the development of a scientifically defensible baseline.

12.2 Methods

Fur harvest return information for the 1985/1986 to 2017/2018 (33 years) was obtained from Lois Koback, Fur and Problem Wildlife Support with the Ministry of Environment Fish, Wildlife and Lands Branch. Data were obtained and summarized for all species for Fur Conservation Area (FCA) N-19 (La Loche), which incorporated the entire study area. A summary of the total and average (plus minimum and maximum) annual number of furbearers harvested for FCA N-19 per year is provided (Table 12.2-1).

12.3 Results

From the period 1985/1986 to 2017/2018, fur returns for 18 different species/species groups in FCA N-19 were reported. These included, in descending order of total captures, red squirrel (43,723), muskrat (37,930), marten (8,355), weasel spp. (5,037), beaver (4,456), mink (3,158), fisher (2,539), lynx (1,516), fox spp. (1,345), badger (*Taxidea taxus*) (870), otter (621), coyote (121), wolf (88), black bear (32), and wolverine (8) (Table 12.2-1). The three species with the highest average capture rates per year over the 33-year period included red squirrel (1,324.9), muskrat (1,149.4), and marten (253.2).

Caution must be used when interpreting these data. Capture rates can vary widely and may reflect trapper effort and fur prices as much as animal abundance. It also relies on public reporting of annual catch.

The importance of the area was highlighted by traditional land use study findings and during joint working group stakeholder engagements. Each group highlighted the importance of the area and the degree of reliance. According to each document, the importance was listed as the following:

- the Métis Nation-Saskatchewan Northern Region II indicated that on “average 70% of their food comes from hunting, trapping, fishing, and gathering" (WD Lewis 2020, p. 17).
- The Clearwater River Dene Nation have also indicated that “the area which encompasses Patterson Lake (Upper and Lower Peilican Lake) is historically and currently recognized as a *good for everything* harvesting area which has sustained CRDN members through time beyond living memory” (McCullough 2020, p.10).
- For the Birch Narrows Dene Nation, it was indicated that “hunting and trapping have long been at the heart of Dene culture, and they remain central to the subsistence lifeways of members of the Birch Narrows Dene Nation. Members hunt for large and small game throughout BNDN territory, with locations depending on the seasonal availability of certain species” (Olson and Firelight 2019a, p. 23, 25, 28 and 32).
- The Buffalo Narrows Dene Nation indicated that “the Study Area and Patterson Lake also support BRDN trapping activities. Study participants recalled trapping and travelling in the Study Area, as well as stories of others trapping in the region.” (Olson and Firelight 2019b, p.21).

Table 12.2-1 Trapping Capture Rates per Year by Species for FCA N-19 (La Loche).

Year	N-19 La Loche																	
	1985-1986	1986-1987	1987-1988	1988-1989	1989-1990	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Badger	0	1	1	0	864	0	0	0	0	0	0	0	0	0	0	0	0	4
Beaver	491	668	624	250	254	89	130	28	112	158	160	179	233	44	21	23	171	42
Coyote	9	5	4	3	5	5	7	1	4	2	2	4	1	4	1	0	9	10
Fisher	151	123	107	142	122	159	337	196	173	117	37	93	53	35	58	27	102	82
Red Fox	52	56	57	47	29	15	66	22	14	16	3	14	6	6	8	15	25	14
Cross Fox	13	31	16	18	9	3	34	10	8	6	4	13	6	2	3	4	6	0
Silver Fox	0	2	408	1	0	1	1	0	2	1	1	1	8	0	1	2	0	0
Arctic Fox	0	9	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Fox	65	98	481	66	63	19	101	32	24	23	8	28	20	8	12	21	31	14
Lynx	49	47	15	0	44	49	93	61	29	23	9	63	64	49	40	52	153	77
Marten	165	218	307	506	452	284	460	410	226	190	120	288	258	299	140	326	204	120
Mink	199	295	480	270	163	127	171	139	75	122	72	131	176	102	68	71	27	22
Muskrat	5,844	6,421	6,582	1,614	1,123	3,571	757	58	307	507	1,283	166	616	261	12	5	747	104
Otter	52	49	52	28	33	10	29	27	16	43	29	19	37	23	7	20	26	5
Squirrel	4,509	4,241	17,581	1,817	863	931	1,309	984	1,442	1,294	532	1,172	2,943	275	141	154	280	216
Weasel	144	210	637	457	127	70	256	282	147	391	138	202	93	66	61	24	7	37
Wolf	8	6	6	4	1	5	3	4	1	4	0	3	2	4	0	0	0	3
Black Bear	3	8	0	4	4	0	3	1	2	0	0	0	1	2	1	0	1	0
Wolverine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**11,689**	**12,390**	**26,877**	**5,161**	**4,118**	**5,319**	**3,656**	**2,223**	**2,558**	**2,874**	**2,390**	**2,348**	**4,497**	**1,172**	**562**	**723**	**1,758**	**736**

Table 12.2-1 Trapping Capture Rates per Year by Species for FCA N-19 (La Loche)- cont.

Year	N-19 La Loche																
	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	Total	Mean Annual (Min, Max)[a]
Badger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**870**	**217.5 (1, 864)**
Beaver	54	116	194	53	103	112	13	11	7	46	42	10	0	5	13	**4,456**	**139.3 (5, 668)**
Coyote	3	1	1	8	3	1	2	0	1	9	2	2	1	0	11	**121**	**4.0 (1, 11)**
Fisher	32	29	26	53	26	33	18	25	19	38	49	33	16	10	18	**2,539**	**76.9 (10, 337)**
Red Fox	10	7	6	17	12	11	2	6	14	48	18	13	4	3	15	**651**	**19.7 (2, 66)**
Cross Fox	6	0	2	2	3	4	0	1	5	8	2	6	1	0	1	**227**	**7.8 (1, 34)**
Silver Fox	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	**432**	**28.8 (1, 408)**
Arctic Fox	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**35**	**11.7 (1, 25)**
Total Fox	16	9	8	19	16	15	2	7	19	56	20	19	5	3	17	**1,345**	**40.8 (2, 481)**
Lynx	34	17	13	34	12	24	16	37	86	137	89	31	25	17	27	**1,516**	**45.9 (9, 153)**
Marten	90	145	199	345	330	256	172	198	270	337	404	193	147	127	169	**8,355**	**253.2 (90, 506)**
Mink	12	19	16	95	86	11	18	33	44	29	36	28	9	6	6	**3,158**	**95.7 (6, 480)**
Muskrat	969	1,745	2,142	917	58	133	645	54	90	187	518	254	74	56	110	**37,930**	**1,149.4 (5, 6582)**
Otter	18	12	25	7	3	9	4	7	4	5	6	7	3	2	4	**621**	**18.8 (2, 52)**
Squirrel	121	441	367	473	122	227	268	218	173	209	193	99	121	0	7	**43,723**	**1,366.3 (7, 17581)**
Weasel	59	36	86	393	309	107	86	94	100	114	172	86	39	6	1	**5,037**	**152.6 (1, 637)**
Wolf	2	3	2	1	1	3	2	1	2	5	3	5	0	1	3	**88**	**3.1 (1, 8)**
Black Bear	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**32**	**2.7 (1, 8)**
Wolverine	2	0	0	0	0	1	0	1	0	1	0	2	0	1	0	**8**	**1.3 (1, 2)**
Total	**1,412**	**2,575**	**3,079**	**2,398**	**1,069**	**932**	**1,246**	**686**	**815**	**1,173**	**1,534**	**769**	**440**	**234**	**387**	**109,800**	**3,327.3 (234, 26877)**

Source: Lois Koback, Fur and Problem Wildlife Support with the Ministry of Environment Fish, Wildlife and Lands Branch.
a) Calculated when captures present.

13.0 Saskatchewan ENV Caribou Habitat Mapping

13.1 Study Objectives

The objectives of the use of this mapping include:

- utilize existing government data to highlight woodland caribou habitat potential for the area of the Project;
- utilize existing government data to map woodland caribou habitat suitability for the area of the Project; and
- utilize all possible data sources to complement and enhance Project specific data collection efforts to support the development of a scientifically defensible baseline.

13.2 Methods

Analyze and compile the existing provincial government data sources and data sets. This involved a download, clip, and display of existing government mapping (ENV 2017a).

13.3 Results

Woodland caribou habitat potential within the provincial forest of central and northern Saskatchewan has been identified by ENV using a forest ecosite geographic information system layer, which has been mapped for SK2 (ENV 2017a). Forest ecosites represent information about a site's tree species, plant-abundance, and soil and site characteristics (McLaughlan et al. 2010). According to ENV (2017a), forest ecosite habitat potential ranks were assigned by individually evaluating the ecosite's potential to provide forage, refuge, and calving habitat. The ecosite rankings were completed by a panel of biologists with expertise on woodland caribou habitat use in Saskatchewan (ENV 2017b). These data are currently only available for the SK2 region. Therefore, the analysis has only been completed for the Project RSA and LSA where mapping is available. Currently, no detailed mapping is available for the CRSA.

Habitat potential refers to the capability of a habitat type (excluding water/lake ice) to support a wildlife species for its various life requirements and potential, and does not consider the current state of the habitat (e.g., recently burned or harvested), but rather its potential optimal state (ENV 2017a). The woodland caribou habitat potential for the LSA, RSA and CRSA are provided in Figure 3.1-1. Within the LSA, 777.1 ha (23.3%) is mapped as having high potential; 2,530.4 ha (80%) as having moderate potential; and 22.5 ha (0.7%) as having low potential for providing woodland caribou habitat. Within the parts of the RSA where data are available, the corresponding values are 6,475.9 ha (24.6%), 19,641.8 ha (74.6%), and 253.3 ha (1%), for high, moderate, and low potential, respectively (Table 13.3-1).

Table 13.3-1 Overview of Potential Versus Suitable Woodland Caribou Habitat in the Parts of the LSA and RSA Where Data are Available

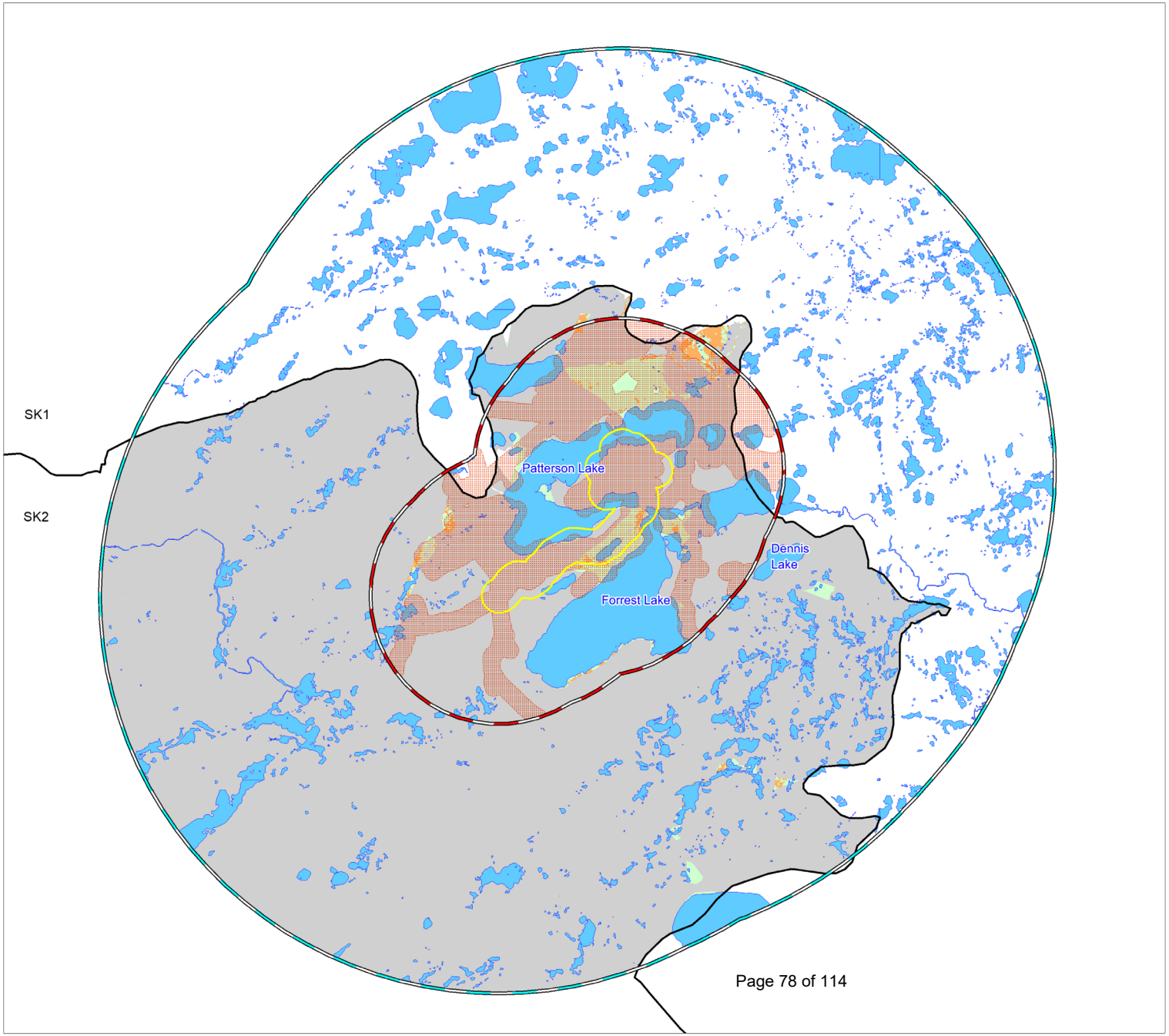
Study Area	Rating	Potential Habitat (ha)	Suitable Habitat (ha)	Area Reduced (ha)
LSA	High	777.1	0.0	-777.1
	Moderate	2,530.4	2.9	-2,527.5
	Low	22.5	0.6	-21.9
RSA	High	6,475.9	58.0	-6,417.9
	Moderate	19,641.8	446.5	-19,195.3
	Low	253.3	173.9	-79.5

Source: HabiSask 2018.

In comparison, habitat suitability reflects the status of the habitat and includes the effects of fire or forest harvesting on seral stage (i.e., sequence of vegetation development over time), habitat loss, reduced use of a habitat by caribou resulting from sensory disturbance adjacent to human land use features, increased risk of mortality, and other factors (ENV 2017a). The status of the habitat is therefore the habitat potential layer as discussed above, with the disturbance (plus buffer) removed (Gigi Pittoello, pers. comm.). By removing the layers covered by fires younger than 40 years and mapped anthropogenic disturbance, including the 500-m buffer, the current suitability is reduced to a few fragmented patches of suitable habitat (Figure 13.3-1). The current areas of suitable habitat in the LSA are <0.1 ha (high suitability), 2.9 ha (moderate suitability), and 0.6 ha (low suitability). In the RSA the suitable areas are 58.0 ha (high suitability), 446.5 ha (moderate suitability), and 173.9 ha (low suitability).

The CRSA straddles both the Boreal Plain (59%) and the Boreal Shield (41%) Ecozones relatively evenly (Figure 13.3-1). Population and species distribution objectives differ between the Boreal Shield and the Boreal Plain in Saskatchewan (ECCC 2020). In the Boreal Plain, the published goal is to achieve at least 65% undisturbed habitat, and in the Boreal Shield (SK1) the published goal is to achieve at least 40% undisturbed habitat. Because the Landscape Areas in this portion of the Boreal Plain are more representative of the Boreal Shield, and because land uses (e.g., lack of commercial logging) in the CRSA are also more like those in the Boreal Shield, it may be appropriate, from a woodland caribou perspective, to manage woodland caribou using Boreal Shield criteria and objectives.

Figure 13.3-1 Woodland Caribou Habitat Potential



Legend

Habitat Rating

- Low
- Moderate
- High
- Data N/A
- Waterbody
- 500m Anthropogenic Linear Buffer
- Wildfire from 1978 - 2018
- Caribou Regional Study Area (CRSA)
- Regional Study Area (RSA)
- Local Study Area (LSA)

source: HabiSask

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0 5 10
kilometers
Scale = 1 : 210,000

OMNIA ECOLOGICAL SERVICES

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14.0 SUMMARY

This report documents and summarizes baseline conditions for wildlife elements including: waterfowl, terrestrial and semi-aquatic furbearers and baseline chemistry of small mammals obtained during field programs completed in 2018, 2019 and 2020. This wildlife baseline data will be used to support future pre-feasibility studies, technical assessments, Project layout, and environmental effects assessments related to the to the mining of the Arrow deposit and the development of associated Project infrastructure.

The objectives of the wildlife baseline surveys were to:

- characterize the existing terrestrial environment in the area of the Project (natural and anthropogenic elements);
- inform environmental effects and technical assessments;
- ensure the baseline studies meet all provincial and federal regulatory requirements for the effects assessment;
- inventory wildlife species occurrence;
- capture information from community engagements and stakeholder considerations;
- establish a framework to facilitate future environmental effects monitoring; and
- support the development of Project specific mitigation strategies.

All field work was completed under approved Government of Saskatchewan Species Detection and Research Permits.

The terrestrial baseline surveys were established using three nested study areas to guide impact assessments of Project-specific and cumulative impacts on potential wildlife valued components. Several baseline field investigations were undertaken including:

- winter track counts;
- winter backtrailing;
- ungulate pellet group/carnivore scat and browse surveys;
- small mammal trapping and habitat assessments;
- small mammal tissue collection and chemistry analysis;
- semi-aquatic furbearer surveys;
- waterfowl and raptor surveys; and
- covert camera surveys.

Relevant mapping and database searches were also completed to complement data collected specifically for the Rook I Project. A desktop assessment and evaluation indicated that there was the potential for 194 different species of wildlife to occur within our study area. Field investigations were comprehensive and documented 73 different wildlife species. Of these, 13 sensitive or at risk vertebrate species were documented including: common loon, red-throated loon, woodland caribou, river otter, bald eagle, common nighthawk, barn swallow, olive-sided flycatcher, Bonaparte's gull, hearing gull, common tern, American white pelican and osprey.

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16.0 APPENDICES

Appendix A.

Appendix A. List of Vertebrates Known or With Potential to Occur in the Area of the Project.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
BIRDS					
Greater White-fronted	*Anser albifrons*				Not detected
Snow Goose	*Anser caerulescens*				Incidental
Canada Goose	*Branta canadensis*	S2N			Aerial Waterfowl, Incidental
Cackling Goose	*Branta hutchinsii*				Not detected
Ross' Goose	*Anser rossii*				Not detected
Tundra Swan	*Cygnus columbianus*				Aerial Waterfowl
American Black Duck	*Anas rubripes*				Not detected
American Wigeon	*Mareca americana*				Not detected
Mallard	*Anas platyrhynchos*				Aerial Waterfowl
Gadwall	*Mareca strepera*				Not detected
Canvasback	*Aythya valisineria*	S2N			Not detected
Ruddy Duck	*Oxyura jamaicensis*				Not detected
Blue-winged Teal	*Spatula discors*				Not detected
Northern Shoveler	*Anas clypeata*				Not detected
Northern Pintail	*Anas acuta*				Not detected
Green-winged Teal	*Anas crecca*				Aerial Waterfowl
Redhead	*Aythya american*	S2N			Not detected
Ring-necked Duck	*Aythya collaris*				Aerial Waterfowl
Greater Scaup	*Aythya marila*				Not detected
Lesser Scaup	*Aythya affinis*	S3N			Aerial Waterfowl
Surf Scoter	*Melanitta perspicillata*	S3M			Not detected
White-winged Scoter	*Melanitta fusca*	S3M			Not detected
Long-tailed Duck	*Clangula hyemalis*				Not detected
Bufflehead	*Bucephala albeola*	S1N,S3M			Aerial Waterfowl, Incidental
Common Goldeneye	*Bucephala clangula*	S3N,S3M			Aerial Waterfowl
Common Merganser	*Mergus merganser*	S2N			Aerial Waterfowl

Appendix A cont.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
Red-breasted Merganser	*Mergus serrator*				Not detected
Ruffed Grouse	*Bonasa umbellus*				Not detected
Spruce Grouse	*Falcipennis canadensis*				Incidental
Willow Ptarmigan	*Lagopus lagopus*				Game Camera
Sharp-tailed Grouse	*Tympanuchus*				Not detected
Red-throated Loon	*Gavia stellata*	S1B, S1M			Aerial Waterfowl
Common Loon	*Gavia immer*		Not at Risk		Aerial Waterfowl, Incidental
Red-necked Grebe	*Podiceps grisegena*		Not at Risk		Not detected
Horned Grebe	*Podiceps auritus*	S5B, S5M	Special	Special	Not detected
Pied-billed Grebe	*Podilymbus podiceps*				Not detected
American Bittern	*Botaurus lentigenosis*				Not detected
Black-crowned Night-	*Nycticoraz nycticorax*				Not detected
American White Pelican	*Pelecanus*		Not at Risk		Aerial Waterfowl
Double-crested	*Phalacrocorax auritus*		Not at Risk		Not detected
Osprey	*Pandion haliaetus*	S2B, S2M			Aerial Waterfowl, Incidental
Bald Eagle	*Haliaeetus leucocephalus*		Not at Risk		Aerial Waterfowl, Incidental
Northern Harrier	*Circus hudsonius*		Not at Risk		Not detected
Golden Eagle	*Aquila chrysaetos*	S3B,S3N,S4M	Not at Risk		Not detected
Sharp-shinned Hawk	*Accipiter striatus*	S2N	Not at Risk		Not detected
Northern Goshawk	*Accipiter gentilis*	S3N	Not at Risk		Not detected
Broad-winged Hawk	*Buteo platypterus*	S3M			Not detected
Red-tailed Hawk	*Buteo jamaicensis*	S1N	Not at Risk		Aerial Waterfowl, Incidental
Rough-legged Hawk	*Buteo lagopus*		Not at Risk		Not detected
American Kestrel	*Falco sparverius*	S1N			Not detected
Merlin	*Falco columbarius*		Not at Risk		Not detected
Gyrfalcon	*Falco rusticolus*		Not at Risk		Not detected
Peregrine Falcon	*Falco peregrinus*	S1B,SNRM	Not at Risk	Special	Not detected

Appendix A cont.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
Sora	*Porzan carolina*				Not detected
Yellow Rail	*Coturnicops*	S3B, S3M	Special Concern	Special	Not detected
American Coot	*Fulica americana*		Not at Risk		Aerial Waterfowl
Sandhill Crane	*Antigone canadensis*				Aerial Waterfowl, Incidental
Whooping Crane	*Grus americana*	SXB, S1M	Endangered	Endangered	Not detected
Black-bellied Plover	*Pluvialis squatarola*				Not detected
American Golden-Plover	*Pluvialis dominica*				Not detected
Semipalmated Plover	*Charadrius sempalmatus*				Not detected
Killdeer	*Charadrius vociferus*				Not detected
Spotted Sandpiper	*Actitis macularia*				Not detected
Solitary Sandpiper	*Tringa solitaria*				Not detected
Greater Yellowlegs	*Tringa melanoleuca*				Not detected
Lesser Yellowlegs	*Tringa flavipes*				Not detected
Hudsonian Godwit	*Limosa haemastica*	S4M	Threatened		Not detected
Ruddy Turnstone	*Arenaria interpres*				Not detected
Sanderling	*Calidris alba*				Not detected
Semipalmated Sandpiper	*Calidris pusilla*				Not detected
Least Sandpiper	*Calidris minutilla*				Not detected
White-rumped Sandpiper	*Calidris fuscicollis*				Not detected
Baird's Sandpiper	*Calidris bairdii*				Not detected
Pectoral Sandpiper	*Calidris melanotos*				Not detected
Stilt Sandpiper	*Calidris himantopus*				Not detected
Buff-breasted Sandpiper	*Calidris subruficollis*	S4M	Special Concern	Special	Not detected
Eskimo Curlew	*Numenius borealis*	SXB,SXM	Endangered	Endangered	Not detected
Short-billed Dowitcher	*Limnodromus griseus*				Not detected
Long-billed Dowitcher	*Limnodramus scolopaceus*				Not detected
Wilson's Snipe	*Gallinago delicata*				Incidental

Appendix A cont.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
Red-necked Phalarope	*Phalaropus lobatus*	S4B, S3M	Special	Special	Not detected
Franklin's Gull	*Leucophaeus pipixcan*				Not detected
Bonaparte's Gull	*Chroicocephalus philadelphia*				Aerial Waterfowl
Ring-billed Gull	*Larus delawarensis*				Not detected
California Gull	*Larus californicus*				Aerial Waterfowl
Herring Gull	*Larus argentatus*				Aerial Waterfowl
Sabine's Gull	*Xema sabini*				Not detected
Thayer's Gull	*Larus thayeri*				Not detected
Caspian Tern	*Hydroprogne caspia*	S2B, S2M	Not at Risk		Not detected
Black Tern	*Chlidonias niger*		Not at Risk		Not detected
Common Tern	*Sterna hirundo*		Not at Risk		Aerial Waterfowl
Arctic Tern	*Sterna paradisaea*	S3B, S3M			Not detected
Great Horned Owl	*Bubo virginianus*				Not detected
Snowy Owl	*Bubo scandiacus*		Not at Risk		Not detected
Northern Hawk Owl	*Surnia ulula*	S3B, S5N	Not at Risk		Not detected
Short-eared Owl	*Asio flammeus*	S3B, S2N,	Special	Special	Not detected
Barred Owl	*Strix varia*	S3			Not detected
Great Grey Owl	*Strix nebulosa*	S3	Not at Risk		Not detected
Boreal Owl	*Aegolius funereus*	S3	Not at Risk		Not detected
Common Nighthawk	*Chordeiles minor*	S4B, S4M	Special	Threatened	Incidental
Belted Kingfisher	*Megaceryle alcyon*				Incidental
Yellow-bellied	*Sphyrapicus varius*				Game Camera
Downy Woodpecker	*Picoides pubescens*				Not detected
Hairy Woodpecker	*Picoides villosus*				Not detected
Three-toed Woodpecker	*Picoides dorsalis*				Incidental
Black-backed	*Picoides arcticus*				Incidental
Northern Flicker	*Colaptes auratus*				Not detected

Appendix A cont.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
Pileated Woodpecker	*Dryocopus pileatus*	S3			Not detected
Olive-sided Flycatcher	*Contopus cooperi*	S4B, S4M	Special	Threatened	Incidental
Western Wood-Pewee	*Contopus sordidulus*				Not detected
Yellow-bellied Flycatcher	*Empidonax flaviventris*				Not detected
Alder Flycatcher	*Empidonax alnorum*				Incidental
Least Flycatcher	*Empidonax minimus*				Incidental
Eastern Phoebe	*Sayornis phoebe*				Not detected
Eastern Kingbird	*Tyrannus tyrannus*				Not detected
Northern Shrike	*Lanius borealis*	S1B, S4N, S4M			Not detected
Blue-headed Vireo	*Vireo solitarius*				Not detected
Warbling Vireo	*Vireo gilvus*				Incidental
Philadelphia Vireo	*Vireo philadelphicus*				Not detected
Red-eyed Vireo	*Vireo olivaceus*				Incidental
Blue Jay	*Cynocitta cristata*				Not detected
Canada Jay	*Perisoreus canadensis*				Pellet, Game Camera, Incidental
American Crow	*Corvus brachyrhynchos*				Not detected
Common Raven	*Corvus corax*				Aerial Waterfowl
Horned Lark	*Eremophila alpestris*	S3N			Not detected
Tree Swallow	*Tachycineta bicolor*				Not detected
Bank Swallow	*Riparia riparia*	S4B, S5M	Threatened	Threatened	Not detected
Cliff Swallow	*Petrochelidon pyrrhonota*				Not detected
Barn Swallow	*Hirundo rustica*	S5B, S5M	Threatened	Threatened	Incidental
Black-capped Chickadee	*Poecile atricapillus*				Not detected
Boreal Chickadee	*Poecile hudsonicus*				Not detected
Red-breasted Nuthatch	*Sitta canadensis*				Incidental
Winter Wren	*Troglodytes troglodytes*				Not detected
Marsh Wren	*Cistothorus palustris*				Not detected

Appendix A cont.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
Ruby-crowned Kinglet	*Regulus calendula*				Incidental
Golden-crowned Kinglet	*Regulus satrapa*				Incidental
Gray-cheeked Thrush	*Catharus minimus*				Not detected
Swainson's Thrush	*Catharus ustulatus*				Incidental
Hermit Thrush	*Catharus guttatus*				Incidental
Mountain Bluebird	*Sialia currocoides*				Not detected
American Robin	*Turdus migratorius*				Incidental
European Starling	*Sturnus vulgaris*				Not detected
American Pipit	*Anthus rubescens*				Not detected
Bohemian Waxwing	*Bombycilla garrulus*				Not detected
Cedar Waxwing	*Bombycilla garrulus*				Not detected
Tennessee Warbler	*Oreothlypis peregrina*				Not detected
Orange-crowned Warbler	*Oreothlypis celata*				Not detected
Yellow Warbler	*Setophaga petechia*				Not detected
Magnolia Warbler	*Setophaga magnolia*				Not detected
Black-and-white Warbler	*Mniotilta varia*				Not detected
Black-throated Green Warbler	*Setophaga virens*				Not detected
Canada Warbler	*Cardellina canadensis*	S4B, S3M	Threatened	Threatened	Not detected
Cape May Warbler	*Setophaga tigrina*				Not detected
Yellow-rumped Warbler	*Setophaga coronata*				Incidental
Palm Warbler	*Setophaga palmarum*				Not detected
Bay-breasted Warbler	*Setophaga castanea*				Not detected
Blackpoll Warbler	*Setophaga striata*				Not detected
Connecticut Warbler	*Oporornis agilis*	S2B, S2M			Not detected
Mourning Warbler	*Geothlypis philadelphia*				Not detected
Ovenbird	*Seiurus aurocapillus*				Not detected
Northern Waterthrush	*Parkesia noveboracensis*				Not detected

Appendix A cont.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
Common Yellowthroat	*Geothlypis trichas*				Not detected
Wilson's Warbler	*Cardellina pusilla*				Not detected
American Redstart	*Setophaga ruticilla*				Not detected
Western Tanager	*Piranga ludoviciana*				Not detected
American Tree Sparrow	*Spizella arborea*				Not detected
Chipping Sparrow	*Spizella passerina*				Not detected
Clay-colored Sparrow	*Spizella pallida*				Not detected
House Sparrow	*Passer domesticus*				Not detected
Vesper Sparrow	*Pooecetes gramineus*				Not detected
Savannah Sparrow	*Passerculus sandwichensis*				Not detected
Le Conte's Sparrow	*Ammodramus leconteii*				Incidental
Fox Sparrow	*Passerella iliaca*				Incidental
Song Sparrow	*Melospiza melodia*				Not detected
Lincoln's Sparrow	*Melospiza lincolnii*				Not detected
Swamp Sparrow	*Melospiza georgiana*				Not detected
White-throated Sparrow	*Zonotrichia albicollis*				Incidental
Harris' Sparrow	*Zonotrichia querula*	SUB, S5M	Special		Not detected
White-crowned Sparrow	*Zonotrichia leucophrys*				Not detected
Dark-eyed Junco	*Junco hyemalis*				Incidental, Game Camera
Lapland Longspur	*Calcarius lapponicus*				Not detected
Smith's Longspur	*Calcarius pictus*				Not detected
Snow Bunting	*Plectrophenax nivalis*				Not detected
Red-winged Blackbird	*Agelaius phoeniceus*				Not detected
Yellow-headed Blackbird	*Xanthocephalus*				Not detected
Rusty Blackbird	*Euphagus carolinus*	S3B,SUN,S3M	Special	Special	Not detected
Common Grackle	*Quiscalus quiscula*				Not detected
Brewer's Blackbird	*Euphagus cyanocephalus*				Not detected

Appendix A cont.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
Brown-headed Cowbird	*Molothrus ater*				Not detected
Pine Grosbeak	*Pinicola enucleator*	S2B, S4N			Not detected
Rose-breasted Grosbeak	*Pheucticus*				Not detected
Purple Finch	*Haemorhous purpureus*				Not detected
Red Crossbill	*Loxia curvirostra*				Not detected
White-winged Crossbill	*Loxia leucoptera*	S3N			Not detected
Common Redpoll	*Acanthis flammea*				Not detected
Hoary Redpoll	*Acanthis hornemanni*				Not detected
Pine Siskin	*Spinus pinus*				Incidental
Mammals					
Masked Shrew	*Sorex cinereus*				Small Mammal Trapping
Dusky Shrew	*Sorex monticolus*				Not detected
Common Water Shrew	*Sorex palustris*				Small Mammal Trapping
Arctic Shrew	*Sorex arcticus*				Not detected
Pygmy Shrew	*Sorex hoyi*				Not detected
Little Brown Bat	*Myotis lucifugus*	S4B, S4N	Endangered	Endangere	Not detected
Northern Bat	*Myotis septentrionalis*	S3	Endangered	Endangere	Not detected
Silver-haired Bat	*Lasionycteris noctivagans*				Not detected
Big Brown Bat	*Eptesicus fuscus*				Not detected
Hoary Bat	*Lasiuris cinereus*				Not detected
Snowshoe Hare	*Lepus americanus*				Winter Tracking, Game Camera
Least Chipmunk	*Tamias minimus*				Not detected
Woodchuck	*Marmota monax*				Not detected
Red Squirrel	*Tamiasciurus hudsonicus*				Pellet, Winter Tracking, Game Camera,
Northern Flying Squirrel	*Glaucomys sabrinus*				Not detected
North American Beaver	*Castor canadensis*				Aerial Waterfowl, Shoreline
Deer Mouse	*Peromyscus maniculatus*				Small Mammal Trapping

Appendix A cont.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
Southern Red-backed	*Myodes gapperi*				Small Mammal Trapping
Eastern Heather Vole	*Phenacomys ungava*				Not detected
Meadow Vole	*Microtus pennsylvanicus*				Small Mammal Trapping
Yellow-cheeked Vole	*Microtus xanthognathus*				Not detected
Muskrat	*Ondatra zibethicus*				Shoreline
Northern Bog Lemming	*Synaptomys borealis*				Not detected
Meadow Jumping Mouse	*Zapus hudsonius*				Small Mammal Trapping
North American Porcupine	*Erethizon dorsatum*				Not detected
Coyote	*Canis latrans*				Winter Tracking
Grey Wolf	*Canis lupus*				Incidental, Game Camera
Red Fox	*Vulpes vulpes*				Winter Tracking, Incidental
Black Bear	*Ursus americanus*		Not at Risk		Aerial Waterfowl, Pellet, Game Camera, Incidental
American Marten	*Martes americana*				Winter Tracking, Game Camera
Fisher	*Pekania pennanti*				Winter Tracking
Short-tailed Weasel	*Mustela erminea*				Winter Tracking
Least Weasel	*Mustela nivalis*				Not detected
American Mink	*Neovison vison*				Pellet, Winter Tracking, Shoreline
Wolverine	*Gulo gulo*	S2	Special	Special	Not detected
Striped Skunk	*Mephitis mephitis*				Not detected
River Otter	*Lontra canadensis*	S3			Winter Tracking
White-tailed Deer	*Odocoileus virginianus*				Game Camera
Canada Lynx	*Lynx canadensis*		Not at Risk		Winter Tracking, Game Camera
Moose	*Alces alces*				Aerial Waterfowl, Pellet, Winter Tracking, Game Camera Tracking, Incidental
Woodland Caribou	*Rangifer tarandus*	S3	Threatened	Threatened	Pellet, Vegetation Survey, Game Camera, Incidental

Appendix A cont.

Common Name	Scientific Name	At Risk Designation			Detected/Program*
		SKCDC	COSEWIC	SARA	
Amphibians/ Reptiles					
Canadian Toad	*Anaxyrus hemiophrys*		Not at Risk		Not detected
Boreal Chorus Frog	*Pseudacris triseriata*		Not at Risk		Not detected
Wood Frog	*Lithobates sylvaticus*				Not detected
Northern Leopard Frog	*Lithobates pipiens*	S3	Special	Special Concern	Not detected
Red-sided Garter Snake	*Thamnophis sirtalis*				Not detected

* Species detections included visual/auditory observations, scat/pellet groups, winter tracking trails and general sign.

B: for a migratory species, applies to the breeding population in the province.

N: for a migratory species, applies to the non-breeding population in the province.

M: for a migratory species, rank applies to the transient (migrant) population.

U: status is uncertain in Saskatchewan because of limited or conflicting information (unrankable).

X: believed to be extinct or extirpated from the province.

NR: rank is not yet assigned or species has not yet been assessed (not ranked).

1: Critically Imperiled/ Extremely rare.

2: Imperiled/Very rare.

3: Vulnerable/Rare to uncommon.

4: Apparently Secure.

5: Secure/Common.

Saskatchewan Conservation Data Centre (SK CDC) go to: http://www.biodiversity.sk.ca.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and its recommendations for listing, go to: http://www.cosewic.gc.ca.

Species at Risk Act (SARA) and its registry of protected species go to: http://www.sararegistry.gc.ca.

Appendix B.

Appendix B. Terrestrial and Arboreal Lichen Occurrence by Ecosite Type in the Area of the Project- 2018/2019.

Ecosite Type	Total Sampling Area (ha)	n	Arboreal Lichen							Terrestrial Lichen		
			% Frequency Occurrence	Frequency by Cover Class						% Frequency Occurrence	Mean % Cover[a]	Importance Value
				1	2	3	4	5	Mean Cover Class[1]			
BP2	3.55	347	98.27	1.17	20.23	34.31	32.55	11.73	3.33	96.85	59.00	5714.04
BP3	2.38	233	96.14	0.89	23.66	45.98	26.79	2.68	3.07	68.67	10.32	708.67
BP4	0.18	18	61.11	27.27	9.09	45.45	18.18	0.00	2.55	77.78	6.36	494.67
BP11	0.09	9	33.33	0.00	33.33	33.33	0.00	33.33	3.33	11.11	3.00	33.33
BP12	1.19	116	66.27	11.82	42.73	31.82	11.82	1.82	2.49	75.00	21.86	1639.50
BP14	0.96	94	97.87	0.00	16.30	29.35	34.78	19.57	3.58	54.26	16.14	875.68
BP18	0.03	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BP19	0.47	45	91.11	0.00	7.32	9.76	41.46	41.46	4.17	37.78	9.12	344.53
BP20	1.01	93	34.41	0.00	6.25	40.63	34.38	18.75	3.66	53.76	16.46	884.95
BP21	0.04	4	25.00	0.00	0.00	0.00	100.00	0.00	4.00	0.00	0.00	0.00
BP22	0.02	2	50.00	0.00	0.00	0.00	100.00	0.00	4.00	0.00	0.00	0.00
BP23	0.31	34	85.29	0.00	34.48	27.59	10.34	27.59	3.31	11.76	33.75	397.06
BP24	0.05	5	80.00	0.00	0.00	25.00	50.00	25.00	4.00	20.00	3.00	60.00
BP25	0.01	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BP26	0.01	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DL1	0.01	1	100.00	0.00	0.00	100.00	0.00	0.00	3.00	100.00	70.00	7000.00
DL2	0.09	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.44	16.00	711.11
RF1c	0.49	46	82.61	44.74	36.84	15.79	0.00	2.63	1.79	82.61	37.95	3135.00
RF1d	0.06	6	16.67	0.00	100.00	0.00	0.00	0.00	2.00	33.33	2.00	66.67
RF2c	12.20	1202	10.82	25.38	47.69	21.54	4.62	0.77	2.08	93.09	21.46	1997.82
RF2d	0.17	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.89	4.07	158.28
RF2b	0.15	15	20.00	0.00	66.67	33.33	0.00	0.00	2.33	93.33	28.57	2666.53
RF3c	0.77	77	5.19	25.00	50.00	25.00	0.00	0.00	2.00	81.82	10.94	895.09
RF4	6.36	625	8.80	20.00	29.09	29.09	18.18	3.64	2.56	22.40	10.76	241.02
Total	**30.62**	**3004**	**37.32**	**7.49**	**26.58**	**32.74**	**24.00**	**9.19**	**3.01**	**70.27**	**25.46**	**1789.15**

a) when lichen is present.

Appendix C.

Appendix C. Woody Browse Availability and Use Summary by Ecosite in the Area of the Project- 2018/2019.

Ecosite Phase	n	Alder Spp. (*Alnus spp.*)						Prickly Rose (*Rosa acicularis*)				
		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value
BP2	347	48.99	9.15	448.27	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP3	233	91.42	22.85	2088.86	0.01	0.91		0.43	2.50	1.07	0.00	0.00
BP4	18	72.22	18.27	1319.50	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP11	9	33.33	22.83	761.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP12	116	73.28	10.94	801.64	0.00	0.00		0.86	2.50	2.16	0.00	0.00
BP14	94	71.28	7.75	552.39	0.04	2.85		0.00	0.00	0.00	0.00	0.00
BP18	3	100.00	22.83	2283.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP19	45	2.22	2.50	5.56	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP20	93	13.98	12.88	180.04	0.19	2.66		0.00	0.00	0.00	0.00	0.00
BP21	4	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP22	2	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP23	34	41.18	16.68	686.82	0.36	14.82		0.00	0.00	0.00	0.00	0.00
BP24	5	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP25	1	100.00	2.50	250.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP26	1	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL1	1	100.00	2.50	250.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL2	9	11.11	2.50	27.78	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF1c	46	89.13	11.84	1055.30	0.38	33.87		0.00	0.00	0.00	0.00	0.00
RF1d	6	83.33	17.30	1441.67	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF2c	1202	44.93	10.57	474.86	0.08	3.59		0.00	0.00	0.00	0.00	0.00
RF2d	18	77.78	9.64	749.78	0.18	14.00		0.00	0.00	0.00	0.00	0.00
RF2b	15	40.00	13.33	533.20	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF3c	77	49.35	13.80	681.04	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF4	625	16.80	2.75	46.20	0.36	6.05		0.00	0.00	0.00	0.00	0.00
Total	**3004**	**44.41**	**11.97**	**531.56**	**0.09**	**4.00**		**0.07**	**2.50**	**0.17**	**0.00**	**0.00**

a) Calculated using percent cover/browse only where species/browse is present.

Appendix C cont.

Ecosite Phase	n	Willow Spp. (*Salix spp.*)						Tamarack (*Larix laricina*)				
		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value
BP2	347	2.02	2.50	5.04	2.93	5.91		0.00	0.00	0.00	0.00	0.00
BP3	233	3.00	2.50	7.51	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP4	18	27.78	7.70	213.89	6.70	186.11		0.00	0.00	0.00	0.00	0.00
BP11	9	22.22	15.50	344.44	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP12	116	6.90	2.50	17.24	1.94	13.38		0.00	0.00	0.00	0.00	0.00
BP14	94	31.91	7.38	235.53	1.33	42.45		1.06	2.50	2.66	0.00	0.00
BP18	3	33.33	37.50	1250.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP19	45	11.11	10.30	114.44	3.60	40.00		8.89	2.50	22.22	0.00	0.00
BP20	93	8.60	9.00	77.42	2.88	24.77		16.13	3.37	54.35	0.00	0.00
BP21	4	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP22	2	0.00	0.00	0.00	0.00	0.00		50.00	2.50	125.00	0.00	0.00
BP23	34	85.29	26.28	2241.53	7.60	648.24		47.06	6.31	296.94	0.00	0.00
BP24	5	0.00	0.00	0.00	0.00	0.00		80.00	5.75	460.00	0.00	0.00
BP25	1	100.00	37.50	3750.00	15.50	1550.00		0.00	0.00	0.00	0.00	0.00
BP26	1	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL1	1	100.00	2.50	250.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL2	9	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF1c	46	13.04	2.50	32.61	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF1d	6	33.33	6.00	200.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF2c	1202	4.83	3.62	17.47	3.75	18.09		0.00	0.00	0.00	0.00	0.00
RF2d	18	33.33	12.67	422.33	15.08	502.67		0.00	0.00	0.00	0.00	0.00
RF2b	15	33.33	7.70	256.67	6.20	206.67		0.00	0.00	0.00	0.00	0.00
RF3c	77	7.79	4.67	36.39	2.58	20.10		0.00	0.00	0.00	0.00	0.00
RF4	625	1.92	2.50	4.80	6.88	13.21		0.32	2.50	0.80	0.00	0.00
Total	**3004**	**6.62**	**8.67**	**57.43**	**4.14**	**27.43**		**1.43**	**4.52**	**6.47**	**0.00**	**0.00**

a) Calculated using percent cover/browse only where species/browse is present.

Appendix C cont.

Ecosite Phase	n	Trembling Aspen (*Populus tremuloides*)						Paper Birch (*Betula papyrifer)*				
		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value
BP2	347	0.86	2.50	2.16	0.00	0.00		10.37	3.58	37.14	0.14	1.45
BP3	233	1.72	2.50	4.29	0.00	0.00		11.16	4.85	54.12	0.19	2.12
BP4	18	5.56	2.50	13.89	0.00	0.00		72.22	24.54	1772.33	0.00	0.00
BP11	9	0.00	0.00	0.00	0.00	0.00		88.89	19.69	1750.22	0.00	0.00
BP12	116	0.00	0.00	0.00	0.00	0.00		31.90	4.50	143.53	0.07	2.23
BP14	94	0.00	0.00	0.00	0.00	0.00		67.02	3.33	223.18	0.00	0.00
BP18	3	0.00	0.00	0.00	0.00	0.00		66.67	9.00	600.00	0.00	0.00
BP19	45	0.00	0.00	0.00	0.00	0.00		8.89	5.75	51.11	0.63	5.60
BP20	93	0.00	0.00	0.00	0.00	0.00		10.75	7.70	82.80	0.25	2.69
BP21	4	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP22	2	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP23	34	0.00	0.00	0.00	0.00	0.00		20.59	8.07	166.15	0.36	7.41
BP24	5	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP25	1	0.00	0.00	0.00	0.00	0.00		100.00	2.50	250.00	0.00	0.00
BP26	1	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL1	1	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL2	9	0.00	0.00	0.00	0.00	0.00		11.11	2.50	27.78	0.00	0.00
RF1c	46	2.17	2.50	5.43	0.00	0.00		36.96	2.50	92.39	0.15	5.54
RF1d	6	0.00	0.00	0.00	0.00	0.00		100.00	20.42	2042.00	3.00	300.00
RF2c	1202	0.58	2.50	1.46	0.00	0.00		5.91	6.91	40.82	2.14	12.64
RF2d	18	0.00	0.00	0.00	0.00	0.00		94.44	44.65	4216.94	3.62	341.89
RF2b	15	0.00	0.00	0.00	0.00	0.00		40.00	10.50	420.00	3.00	120.00
RF3c	77	5.19	2.50	12.99	0.00	0.00		6.49	2.50	16.23	0.00	0.00
RF4	625	0.00	0.00	0.00	0.00	0.00		2.88	3.94	11.35	2.97	8.55
Total	**3004**	**0.67**	**2.50**	**1.66**	**0.00**	**0.00**		**11.58**	**8.18**	**94.76**	**0.94**	**10.89**

a) = Calculated using percent cover/browse only where species/browse is present.

Appendix C cont.

Ecosite Phase	n	Wild Red Raspberry (*Rubus idaeus*)						Birch Spp. (*Betula spp.*)				
		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value
BP2	347	0.00	0.00	0.00	0.00	0.00		1.44	2.50	3.60	0.00	0.00
BP3	233	0.00	0.00	0.00	0.00	0.00		0.43	2.50	1.07	0.00	0.00
BP4	18	0.00	0.00	0.00	0.00	0.00		5.56	15.50	86.11	0.00	0.00
BP11	9	22.22	2.50	55.56	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP12	116	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP14	94	0.00	0.00	0.00	0.00	0.00		1.06	2.50	2.66	0.00	0.00
BP18	3	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP19	45	0.00	0.00	0.00	0.00	0.00		15.56	8.07	125.53	0.36	5.60
BP20	93	0.00	0.00	0.00	0.00	0.00		6.45	4.67	30.13	0.00	0.00
BP21	4	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP22	2	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP23	34	0.00	0.00	0.00	0.00	0.00		64.71	27.18	1758.71	0.00	0.00
BP24	5	0.00	0.00	0.00	0.00	0.00		60.00	2.50	150.00	0.00	0.00
BP25	1	0.00	0.00	0.00	0.00	0.00		100.00	37.50	3750.00	15.50	1550.00
BP26	1	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL1	1	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL2	9	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF1c	46	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF1d	6	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF2c	1202	0.00	0.00	0.00	0.00	0.00		0.17	2.50	0.42	1.25	0.21
RF2d	18	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF2b	15	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF3c	77	0.00	0.00	0.00	0.00	0.00		6.49	5.10	33.12	0.00	0.00
RF4	625	0.00	0.00	0.00	0.00	0.00		2.88	3.22	9.27	0.42	1.21
Total	**3004**	**0.07**	**2.50**	**0.17**	**0.00**	**0.00**		**2.40**	**11.79**	**28.26**	**0.39**	**0.93**

a) Calculated using percent cover/browse only where species/browse is present.

Appendix C cont.

Ecosite Phase	n	Currant Spp. (*Ribes spp.*)						Sweet Gale (*Myrica gale)*				
		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value		Frequency %	Mean PC[1]	Importance Value	% Browsed[a]	Importance Value
BP2	347	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP3	233	0.00	0.00	0.00	0.00	0.00		0.43	2.50	1.07	0.00	0.00
BP4	18	0.00	0.00	0.00	0.00	0.00		11.11	15.50	172.22	0.00	0.00
BP11	9	0.00	0.00	0.00	0.00	0.00		11.11	15.50	172.22	0.00	0.00
BP12	116	0.00	0.00	0.00	0.00	0.00		3.45	5.75	19.83	0.00	0.00
BP14	94	0.00	0.00	0.00	0.00	0.00		26.60	4.58	121.81	0.00	0.00
BP18	3	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP19	45	0.00	0.00	0.00	0.00	0.00		35.56	7.13	253.51	0.00	0.00
BP20	93	0.00	0.00	0.00	0.00	0.00		3.23	2.50	8.06	0.00	0.00
BP21	4	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP22	2	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP23	34	2.94	2.50	7.35	0.00	0.00		70.59	6.29	444.00	0.00	0.00
BP24	5	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP25	1	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
BP26	1	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL1	1	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
DL2	9	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF1c	46	0.00	0.00	0.00	0.00	0.00		2.17	2.50	5.43	0.00	0.00
RF1d	6	0.00	0.00	0.00	0.00	0.00		16.67	15.50	258.33	0.00	0.00
RF2c	1202	0.00	0.00	0.00	0.00	0.00		0.33	2.50	0.83	0.00	0.00
RF2d	18	0.00	0.00	0.00	0.00	0.00		22.22	2.50	55.56	0.00	0.00
RF2b	15	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF3c	77	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
RF4	625	0.00	0.00	0.00	0.00	0.00		3.20	3.80	12.16	0.38	1.22
Total	**3004**	**0.03**	**2.50**	**0.08**	**0.00**	**0.00**		**3.53**	**5.41**	**19.09**	**0.07**	**0.25**

a) = Calculated using percent cover/browse only where species/browse is present.

Appendix D.

Appendix D. Sample of Game Camera Wildlife Photo Captures in the Area of the Project.

Camera 6 (All-season Road) – Black Bear with cubs

Appendix D cont.

Camera 12 (Trail) White-tailed Deer

Appendix D cont.

Camera 15 (Reference) - Moose

Appendix D cont.

Camera 7 (Reference) - Marten

Appendix D cont.

Camera 15 (Reference) - Red Squirrel

Appendix D cont.

Camera 15 (Reference) - Snowshoe Hare

Appendix D cont.

Camera 19 (Trail) - Grey Wolf

Appendix D cont.

Camera 17 (Conventional Cutline) – Moose

Appendix D cont.

Camera 21 (Hand-cut Line) – Woodland Caribou

Appendix D cont.

Camera 16 (Trail) - Red Fox

Appendix D cont.

Camera 12 (Trail) - Canada Lynx