



Keeyask Generation Project
Terrestrial Effects Monitoring Plan

Caribou Summer Resident Range Monitoring Report

TEMP-2018-16



KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2018-16

CARIBOU SUMMER RESIDENT RANGE MONITORING

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Services MB Inc.

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SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014. The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the generating station on the terrestrial environment. Monitoring results will help the KHLP, government regulators, members of local First Nation communities, and the general public understand how construction and operation of the generating station will affect the environment, and whether or not more needs to be done to reduce harmful effects.

The objective of this study was to identify the winter distribution and range of the caribou (*Rangifer tarandus*) that occupy the Keeyask region in summer (referred to as summer resident caribou). This report describes the results of an aerial survey conducted in early winter 2017 and of genetic analyses of caribou fecal pellet samples that have been collected in the region since 2014. The aerial survey occurred between Split Lake and Stephens Lake, and replicated surveys conducted in the winters of 2015 and 2016 for the same purpose.

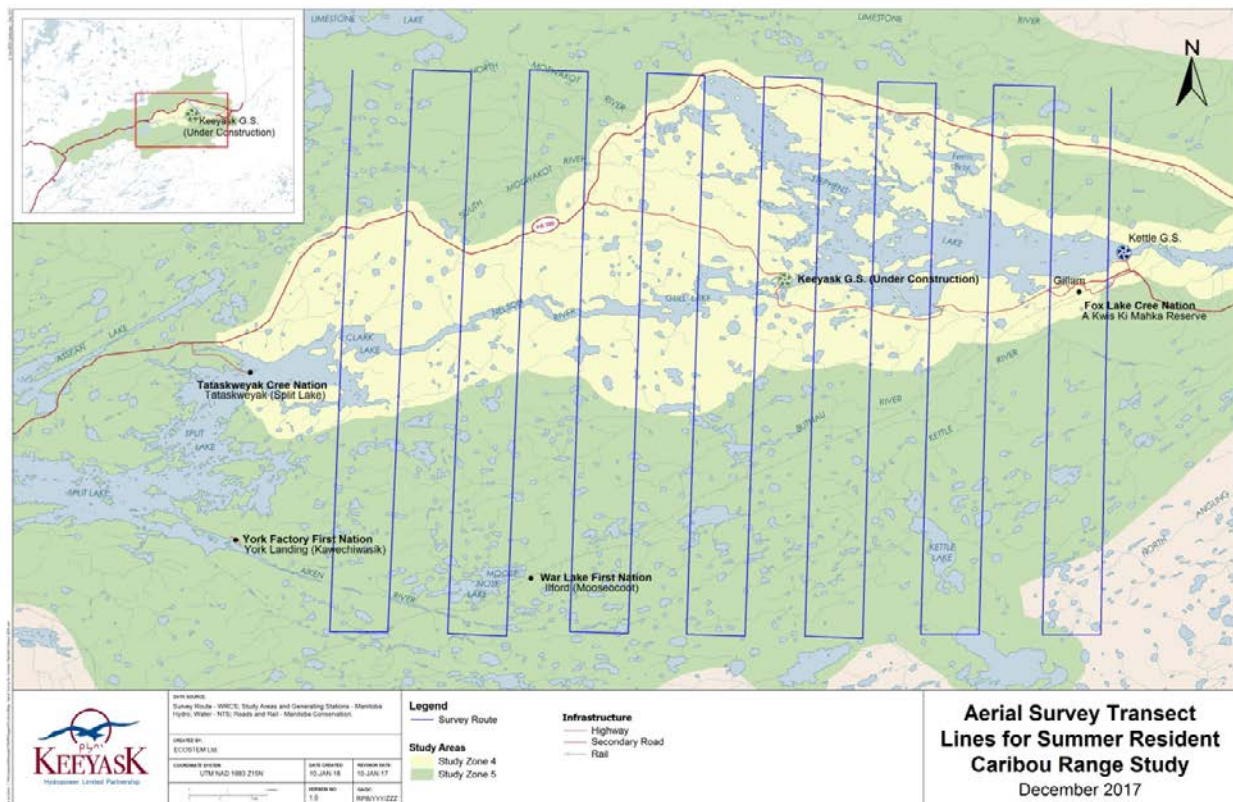
Why is the study being done?

Three groups of migratory caribou occasionally occupy the Keeyask region in winter. These caribou then depart for their calving grounds in spring, where they congregate in large numbers to calve. A small group of caribou stay in the Keeyask region in the summer, and most calve solitarily in the Gull and Stephens lakes area. Their herd association and core range have not been defined, and there is uncertainty about their winter distribution and range. While Project effects on their calving habitat and summer distribution were predicted in the environmental assessment, there was concern that effects could be greater on caribou that are present in the Project area year-round.

What was done?

An aerial survey for summer resident caribou was conducted on pre-defined survey transects from December 4 to 7, 2017. The survey took place before any of the three groups of migratory caribou typically move back into the Keeyask region. Observers searched for signs of caribou presence, such as tracks or scat in the snow, to identify the distance that summer resident caribou travel from their known summer range at Gull and Stephens lakes, as identified during environmental assessment studies for the Project (2011 to 2014). When caribou were observed, group size, age (calf or adult), and sex (where possible) were recorded. The winter locations of the summer resident caribou and their tracks, if any, were mapped and compared with their summer distribution by measuring the distance between previously identified calving areas at Gull and Stephens lakes and their winter locations.

Fecal samples were to be collected during the aerial survey in December 2017 and genetically tested. Results were to be compared with those from samples collected opportunistically in the Gull and Stephens lakes area during other terrestrial fieldwork in summer and early fall 2014, summer 2015, summer and early fall 2017, and during the previous two summer resident caribou winter range aerial surveys, to determine whether individuals that remain in the region in summer also remain in winter, and what area they may occupy.



Area surveyed in 2017 for the summer resident caribou winter range study

What was found?

No caribou or their signs were found in the survey area in 2017, but eight caribou were counted in three small groups about 60 km southeast of the Project site. These groups of caribou were likely from the Southern Hudson Bay subpopulation (formerly known as the Pen Islands herd). A male and female, a female and calf, and a male and three females were observed, and tracks were found at one location. The observations were further southeast than the summer resident caribou's known calving range, and approximately 100 km further east than the caribou observed during this same study in November 2015 and December 2016.

No fecal pellet samples were collected during the 2017 survey because no caribou were found in the survey area. Samples collected from summer 2014 to summer 2017 were analyzed and 25 unique caribou were identified. Two individuals identified in summer were also identified in winter, confirming that the winter range of some summer resident caribou includes the Keeyask

region. Two females were each identified on islands in Stephens Lake during more than one summer.



Caribou Observed in December 2017, Southeast of the Survey Area

What does it mean?

Genetic analysis of fecal pellet samples confirmed that at least two summer resident caribou also occupy the Keeyask region in winter. Their winter locations, up to 40 km from the Project area, suggest that there is likely suitable winter habitat in the survey area that is unaffected by Project disturbance. The winter range of summer resident caribou likely extends beyond the area surveyed in summer and winter, as suggested by the lack of observations of caribou and their signs during the December 2017 aerial survey.

What will be done next?

This was the third and final year for summer resident caribou winter range surveys and fecal pellet collection. Information from radio-collared caribou (a program being led by Manitoba Sustainable Development in partnership with Resource Management Boards and Manitoba Hydro) may also be used to help identify the winter range of individuals that remain in the Keeyask region in the summer. A synthesis report will be produced after the first five years of field studies, after construction completion.

STUDY TEAM

We would like to thank Sherrie Mason and Rachel Boone of Manitoba Hydro, Ron Bretecher of North/South Consultants Inc., and Custom Helicopters for logistical assistance in the field. We would also like to thank James Ehnes of ECOSTEM Ltd. for GIS support and mapping, Samantha McFarlane for her contribution to the collection and genetic analysis of fecal pellet samples in 2014, Dr. Micheline Manseau for her guidance on materials collection, and Dr. Paul Wilson and staff at Trent University for processing DNA, analyses, and interpretation.

Biologists, technicians, and other personnel who designed, participated in, and drafted the aerial survey results included:

- Robert Berger, (M.N.R.M.) – Design, analysis, and reporting
- Andrea Ambrose (B.Sc.) – Reporting
- Nicholas LaPorte (M.N.R.M.) – Crew leader
- Kaitlyn McCormick (B.Sc. Hons.) – Survey personnel
- Jeff Laliberty (War Lake First Nation) – Survey personnel

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1.0 INTRODUCTION

Construction of the Keeyask Generation Project (the Project), a 695-megawatt hydroelectric generating station (GS) and associated facilities, began in July 2014. The Project is located at Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake, 35 km upstream of the existing Kettle GS.

The *Keeyask Generation Project Response to EIS Guidelines* (the EIS), completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the terrestrial environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement Terrestrial Supporting Volume* (TE SV). The *Terrestrial Effects Monitoring Plan* (TEMP) was developed as part of the licensing process for the Project. Monitoring activities for various components of the terrestrial environment were described, including the focus of this report, "summer resident" caribou (*Rangifer tarandus*) winter range.

The ranges of three migratory caribou herds extend into the Keeyask region: barren-ground caribou from the Qamanirjuaq herd, and forest-tundra woodland caribou from the Pen Islands and Cape Churchill coastal caribou herds. Small groups from the Qamanirjuaq herd of barren-ground caribou will occasionally migrate from Nunavut into the Keeyask region in winter, although large numbers (10,000) have been recorded infrequently (KHLP 2012). Caribou from the Cape Churchill and Pen Islands herds migrate from northern Manitoba and northern Ontario into parts of the Keeyask region in winter and return to the Hudson Bay coast in spring to calve. Larger groups of Pen Islands caribou, numbering in the hundreds, have been observed in the Keeyask region on occasion, but there are generally fewer than about 50 individuals in a typical winter (KHLP 2012).

Forest-tundra caribou have most recently been referred to as the Eastern Migratory population, and the Pen Islands herd is called the Southern Hudson Bay subpopulation (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2017). In April 2017, the Eastern Migratory population, which includes the Southern Hudson Bay and Cape Churchill subpopulations, was designated as Endangered by COSEWIC, mainly due to the large decline in two subpopulations in Quebec and Labrador (COSEWIC 2017). The Barren-ground population was designated as Threatened by COSEWIC in 2016, as many of its subpopulations are in decline, including the Qamanirjuaq (COSEWIC 2016). Neither caribou population is currently protected under the federal *Species at Risk Act* or *The Endangered Species and Ecosystems Act* of Manitoba.

In addition to the large migratory Barren-ground and Eastern Migratory caribou herds that may be present in winter, a small group of caribou occupies the Keeyask region in spring and summer. They are similar in appearance to Eastern Migratory caribou, but most disperse and calve solitarily in the Keeyask region in spring. Their herd association and core range have not been identified, and they are referred to as summer resident caribou in the Project's

assessment and monitoring. While they are known to occupy the Gull and Stephens lakes area in spring and summer, the summer resident caribou's winter distribution and range are uncertain. Such information could provide a means of assessing Project effects on summer resident caribou beyond those expected to occur in their calving habitat. As such, the objectives of the summer resident caribou winter range studies, outlined in Section 6.2.3 of the TEMP, were to evaluate their winter distribution via aerial survey and to provide an indication of their home range through genetic sampling, in order to verify potential Project effects on this group in the winter, in addition to those anticipated during the calving and calf-rearing season.

2.0 METHODS

2.1 AERIAL SURVEY

An aerial survey focused on the summer resident caribou was conducted in a portion of Study Zone 5 (Map 1) from December 4 to 7, 2017. Fourteen transects, 60 km in length and spaced 6 km apart, were flown in a Bell Jet Ranger helicopter. Three observers and a pilot searched for signs of caribou presence such as tracks or scat in the snow to identify the distance summer resident caribou had travelled from their known summer range (as identified during the environmental assessment studies from 2011 to 2014) at Gull and Stephens lakes. Tracks were to be followed until they were no longer visible or until caribou were located. Group size and demographics were to be recorded where possible; then, surveying along the transect was to be resumed. No large groups of Eastern Migratory caribou were known to be in the area at the time of the survey, and it is believed that all observations within it would be of summer resident caribou or their signs.

Following the winter aerial survey, the observed locations of caribou and their tracks were to be mapped. The winter distribution of the summer resident caribou was to be compared with their summer distribution by measuring the distance between the previously identified calving areas at Gull and Stephens lakes and their locations in winter 2015, 2016, and 2017.

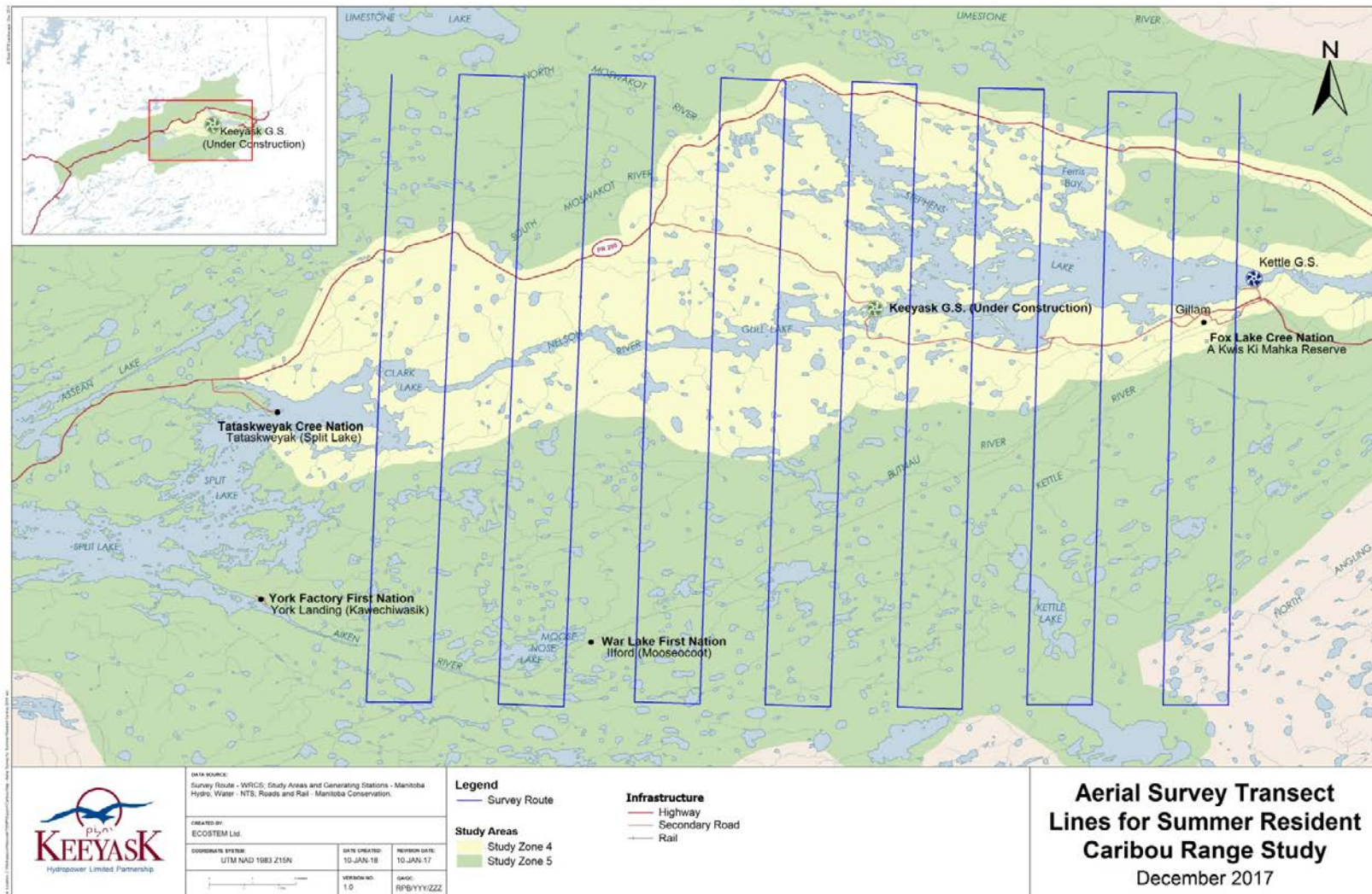
2.2 FECAL PELLET SAMPLE COLLECTION

Fresh (very recently deposited) fecal samples were collected from the Keeyask region, with a focus on islands in Gull and Stephens lakes, in July and September 2014, in July and August 2015, and in August and September 2017 to evaluate the home range of summer resident caribou based on genetics. As large numbers of migratory caribou are generally absent from the Keeyask region in spring and summer, fresh fecal samples would be from caribou that remained in the area for the calving season. Fecal samples were also to be collected during the winter aerial surveys in December 2017, and had been collected under the same study in November 2015 and December 2016. All fecal samples were placed in sterile bags, frozen, and shipped to Trent University in Ontario for genetic analysis to provide an indication of their home range.

DNA extraction occurred by removing the mucosal layer of epithelial cells that coats the fecal pellets, as described by Ball *et al.* (2007). Nine polymorphic microsatellite loci were used (RT5, RT6, RT9, RT24, RT30, BM888, Map2C, BM848 and RT7; Bishop *et al.* 1994; Wilson *et al.* 1997; Cronin *et al.* 2005) along with caribou-specific Zfx/Zfy primers for sex identification. All samples were independently scored by two scorers to ensure high quality of allele scores.

Samples were reamplified if they failed or showed ambiguous scores. Samples were discarded from the analysis if too few loci amplified due to degraded DNA.

ALLELEMATCH, a computer program that identifies unique genotypes by clustering multilocus genotypic data from multiple samples (Galpern *et al.* 2012), was run on the samples to identify those with identical genotypes, indicating that they came from the same individual. Each sample was given an identification number and each individual identified was assigned a unique number in ascending order, which was also assigned to subsequent genetic matches, if any. Individuals and their locations were mapped using ArcGIS.



Map 1: Aerial Survey Transect Lines for Summer Resident Caribou Range Study, December 2017

3.0 RESULTS

3.1 AERIAL SURVEY

No caribou or their signs were observed in the survey area in December 2017. Eight caribou were counted in three small groups outside of the survey area, about 60 km southeast of the Project site (Map 2). These groups of caribou were likely from the Southern Hudson Bay subpopulation, and were likely just moving into the Keeyask region. A male and female, a female and calf, and a male and three females were observed (Photo 1 to Photo 3). No radio-collars were observed on the females. Tracks were also found at one location. All observations of caribou or their signs were in the same general area, southeast of the summer resident caribou's known calving range, and approximately 100 km further east than the caribou observed under the same study in November 2015 and December 2016 (Map 3).



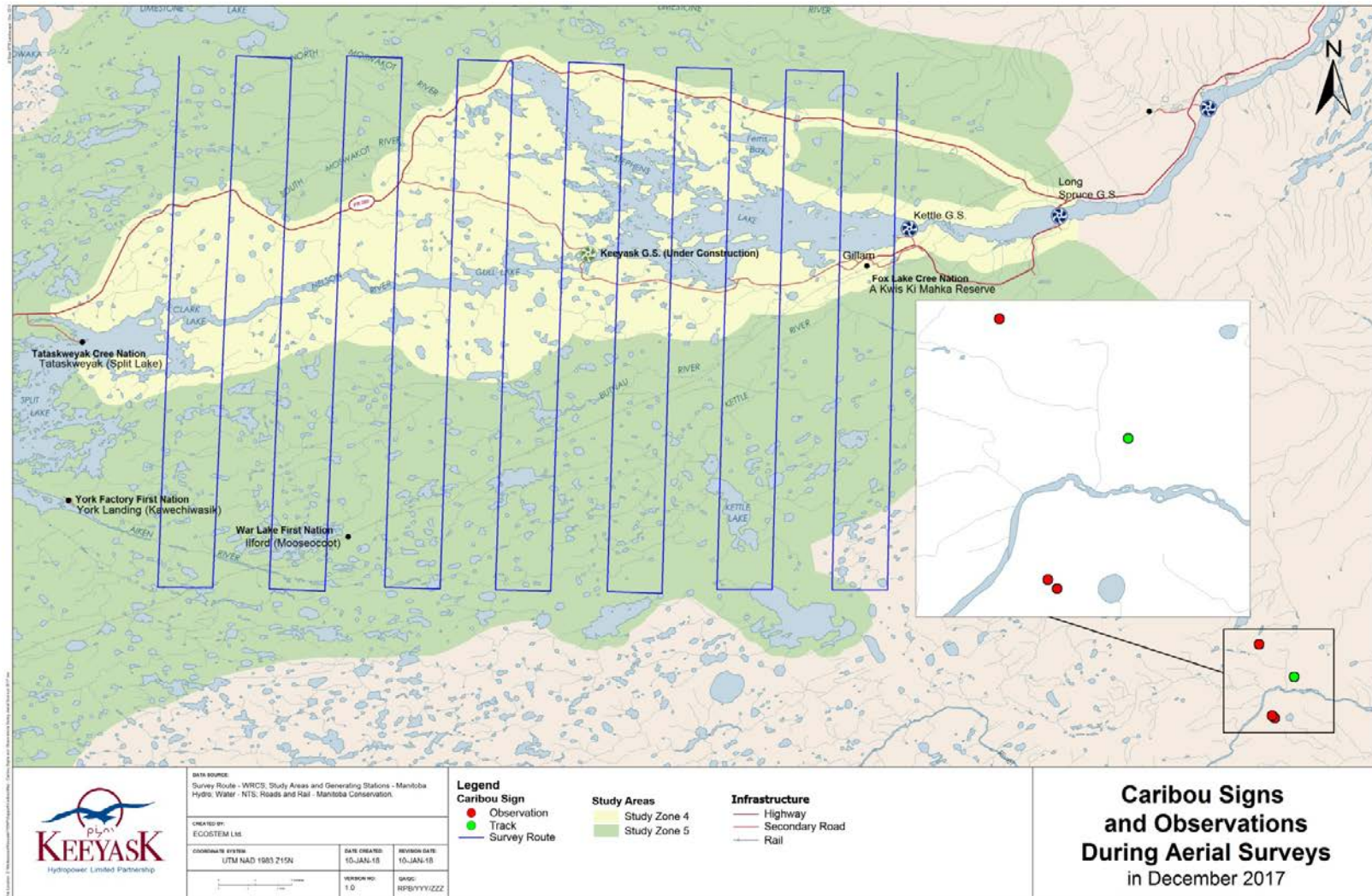
Photo 1: Male Caribou Observed in December 2017



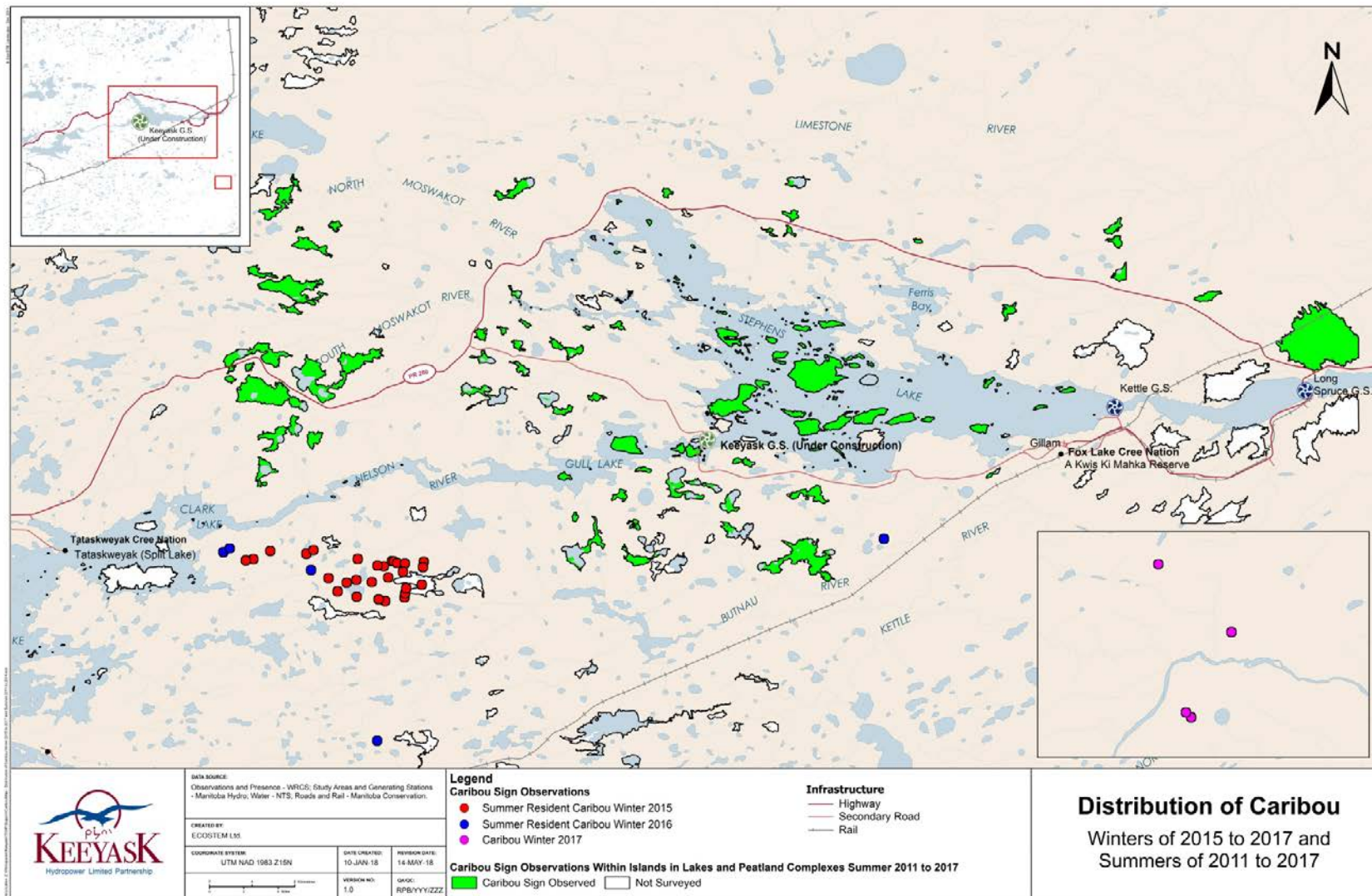
Photo 2: Female Caribou and Calf Observed in December 2017



Photo 3: Three Caribou Observed in December 2017



Map 2: Caribou Signs and Observations Outside of Survey Area in December 2017



Map 3: Distribution of Caribou in Winters of 2015 and 2016 and Summers of 2011 to 2017

3.2 FECAL PELLET SAMPLE COLLECTION

No fecal pellet samples were collected during the aerial survey in December 2017 because no caribou were found in the survey area (Table 1). Eight samples were previously collected at two locations during the aerial survey in December 2016 and 29 samples were collected at four locations during the aerial survey in November 2015 (Map 4). Sixteen fecal pellet samples were collected opportunistically during other terrestrial fieldwork from July 18 to September 16, 2017; 70 samples were collected between July 11 and August 12, 2015; 51 were collected from July 7 to 11, 2014 and 12 were collected on September 30 and 31, 2014 (Map 5).

Table 1: Fecal Pellet Samples Collected and Results of DNA Analysis, 2014 to 2017

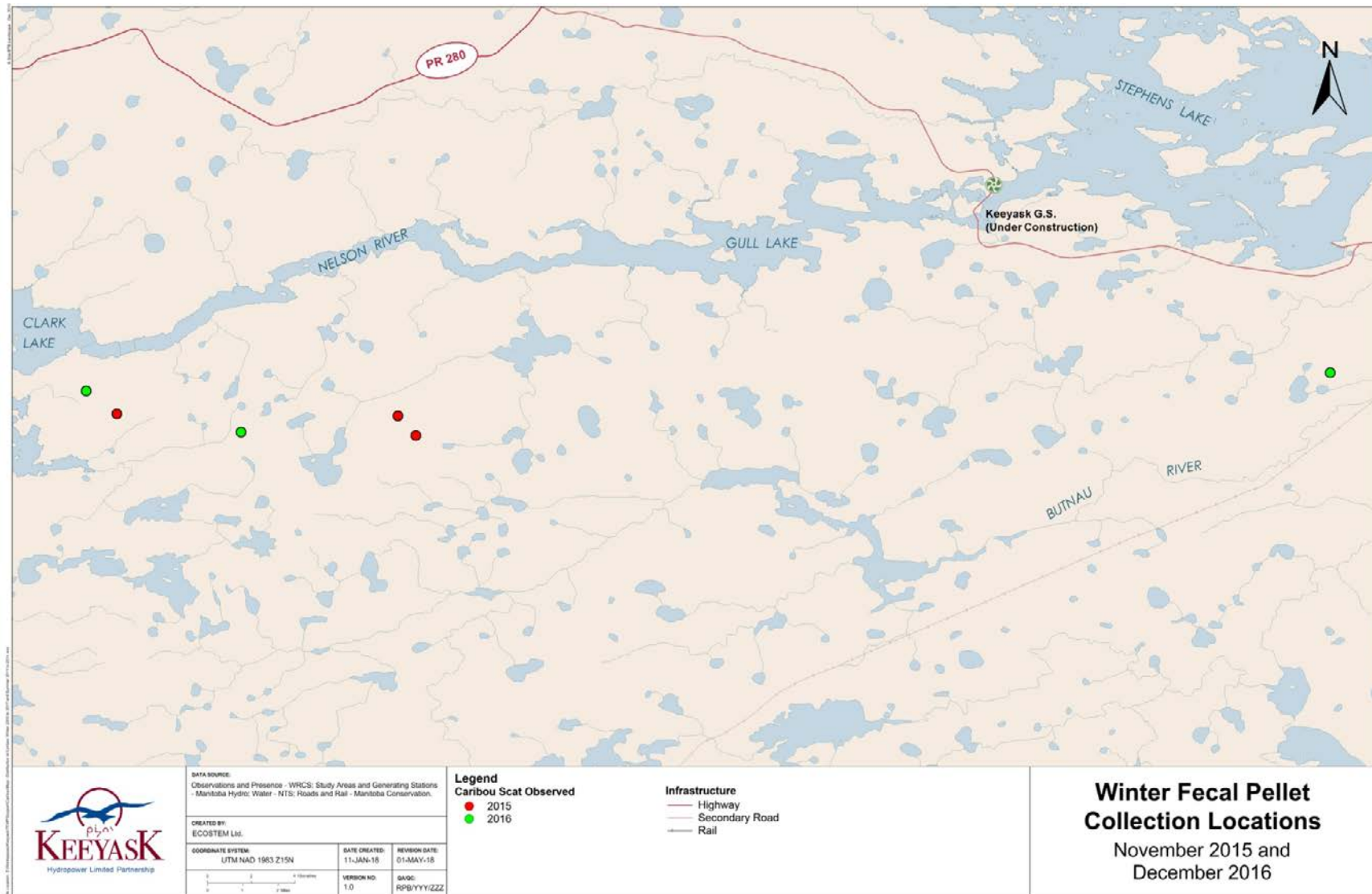
Period	Number of Samples Collected	Number of Samples Successfully Analyzed	Number of Individuals Identified Each Year	Number of Females	Number of Males
Winter 2017	0	-	-	-	-
Winter 2016	8	8	4	2	2
Winter 2015	29	25	14	6	8
Summer 2017	16	4	3	2	11
Summer 2015	70	6	5	3	2
Summer 2014	63	7	3	2	1
Total	186	50	29	15	14

1. Sex could not be determined during the DNA analysis, but the same individual was identified as male in July 2015.

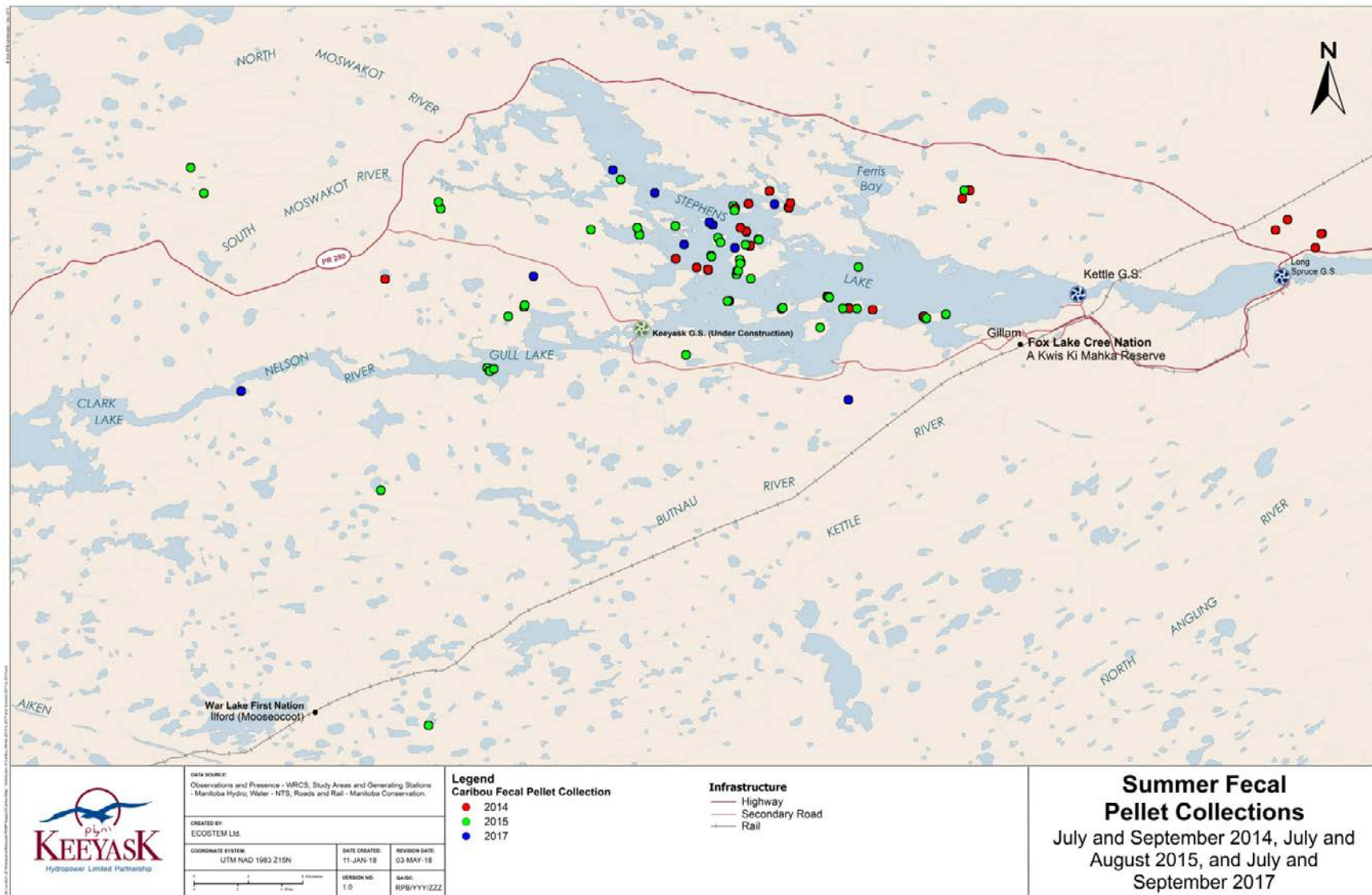
Fewer than half of the fecal pellet samples collected were successfully analyzed in the lab. Successfully amplified DNA results were produced for more winter than summer samples. None of the samples collected in September 2014 were successfully analyzed. In all, 25 unique caribou were identified, 13 females and 12 males (Appendix 1). Two individuals identified in summer were also identified in winter, confirming that the winter range of some summer resident caribou includes the survey area. A male (#6) identified on an island in Gull Lake in summer 2015 had moved approximately 28 km southwest by November of the same year, near Clark Lake (Map 6). A second male (#22) identified on an island in Stephens Lake in summer 2017 had occupied the area south of Stephens Lake, approximately 17 km southwest of the town of Gillam, in December 2016. Approximately 30 km separated the summer and winter locations of each individual. The winter range of these summer resident caribou extends at least 40 km southwest and 17 km southeast of the Project site and the nearby calving and calf-rearing habitat.

Two caribou were each identified on islands in Stephens Lake during more than one summer (Map 6). One female (#1) was identified on an island in 2014 and on three other islands in 2015. A male (#5) was identified on an island in Stephens Lake in summer 2015 and on a different island in summer 2017.

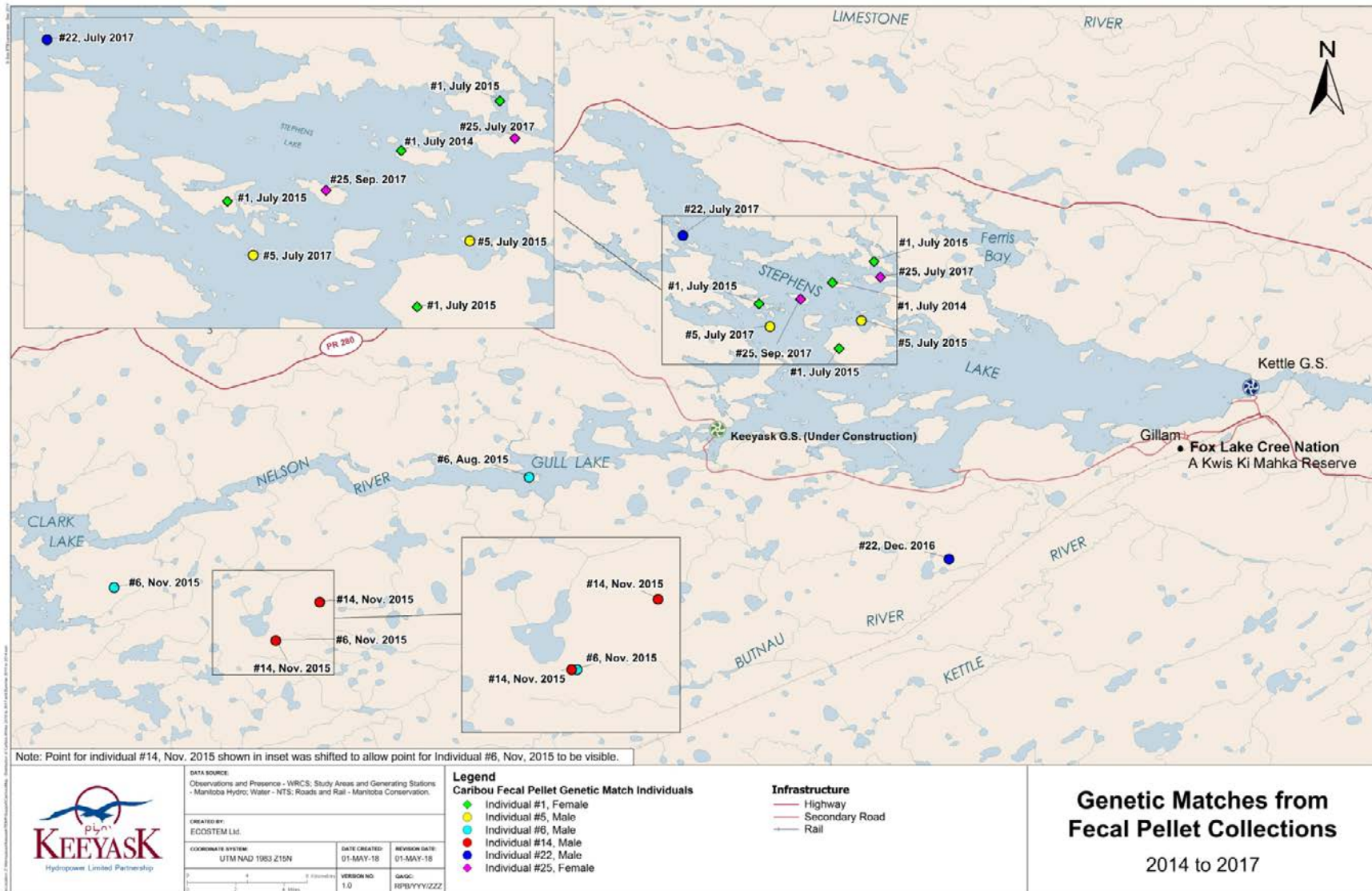
Two individuals were identified at more than one location during the same period. A male (#14) was identified at two locations south of the Nelson River between Gull Lake and Clark Lake with samples collected in November 2015 (Map 6). A female (#25) was identified on two islands in Stephens Lake from samples collected in July 2017 and September 2017.



Map 4: Winter Fecal Pellet Collection Locations in November 2015 and December 2016



Map 5: Summer Fecal Pellet Collections in July and September 2014, July and August 2015, and July and September 2017



Map 6: Genetic Matches from Caribou Fecal Pellet Collections, 2014 to 2017

4.0 DISCUSSION

The lack of observations of caribou and their signs during the December 2017 aerial survey likely indicates that summer resident caribou winter range includes areas beyond those surveyed. No large groups of migratory caribou were known to be in the Keeyask region at the time of the survey; however, pilots flying in the area and local resource users reported caribou east of the survey area and further east of the area where the eight caribou were observed. Thousands of caribou were observed in the Split Lake area in late December 2017 and in January 2018. Based on movement profiles from Manitoba Sustainable Development, these caribou were associated with the Southern Hudson Bay subpopulation (V. Trim, pers. comm.). However, summer resident caribou could have travelled with this larger herd; it is unknown if the caribou observed in December 2017 were summer residents and if the region east of the survey area therefore comprises a portion of their winter range.

Although a large number of summer and winter samples were collected over three years, unsuccessful DNA amplification of summer collections resulted in a low sample size, reducing the likelihood of cross-matching animals that occupied both summer and winter range in the Keeyask region. Successful cross-matching of individuals could also have been affected by a very large winter range (i.e., larger than the approximately 4,500 km² surveyed), part of which was not sampled. The largest number of summer resident caribou identified from genetic analysis in summer was five, in 2015. The largest number of caribou, most likely summer residents, identified from genetic analysis in winter was 14, also in 2015.

Genetic analysis of fecal pellet samples confirmed that at least two summer resident caribou occupied the survey area in summer and winter. Female caribou migrate from winter range to calving habitat in spring (Bergerud 1992). For caribou that calve in isolation, this distance is relatively small. Approximately 30 km separated the known summer and winter locations of each of two male summer resident caribou. While female caribou typically return to the same general area to calve year after year (e.g., Faillie et al. 2010; Abraham et al. 2012), overwintering locations for caribou can vary depending on food availability, food accessibility due to snow, and the effects of forest fires on these conditions (Schaefer and Pruitt 1991).

The winter range of some summer resident caribou appears to include the Clark Lake area, as small groups of caribou or signs of their activity were observed over two consecutive winters (2015 and 2016), when no large groups from the Southern Hudson Bay subpopulation were reported in the region. Caribou activity was also observed south of Stephens Lake in winter 2016, where an individual was identified via genetic analysis. Because this caribou was also identified on an island in Stephens Lake in summer 2017, it was identified as a summer resident whose winter range includes the area south of Stephens Lake. The presence of an individual on an island in Gull Lake in summer 2015 and near Clark Lake in the same winter suggests that some individuals may remain in the region year-round, but it is unclear whether they remain in consecutive years.

Since summer resident caribou have occupied some of the calving habitat expected to be affected by the Project throughout the construction period, some individuals may be less affected by human disturbance than others (see Wildlife Resource Consulting Services MB Inc. 2018). The two summer resident caribou identified in the Keeyask region in winter were found beyond the range of expected habitat loss and sensory disturbance from the Project, indicating that there is likely suitable winter habitat in the surrounding region that remains unaffected by the Project and possibly by fire.

5.0 SUMMARY AND CONCLUSIONS

Early in the winter of 2017/18, caribou activity was concentrated in a relatively small area and not scattered throughout the survey area, similar to the winters of 2015/16 and 2016/17. However, the activity observed during the 2017 survey was considerably farther east than in previous years, and was outside of the survey area. Given that these observations preceded a large southwestward migration of the Southern Hudson Bay subpopulation into the Split Lake area, it is unclear if the caribou observed in December 2017 were summer residents and if their winter range includes the region east of the survey area.

Genetic analysis of fecal pellet samples confirmed that at least two summer resident caribou also occupied the survey area in winter, and that winter range for these animals extends at least 40 km southwest and 17 km southeast of the Project site and nearby calving and rearing habitat. There is likely suitable winter habitat in the surrounding region that is unaffected by Project disturbance, and the winter range of summer resident caribou most likely extends beyond the area surveyed.

Winter surveys and fecal pellet sample collection for summer resident caribou have concluded. Data from these surveys will contribute to winter range mapping for the summer resident caribou. Information from radio-collared caribou (a program being led by Manitoba Sustainable Development in partnership with Resource Management Boards and Manitoba Hydro) may also be used to help delineate the winter range of individuals that remain in the Keeyask region in the summer. A synthesis report will be produced after the first five years of field studies, after construction completion. The report will consolidate, analyze, and evaluate all monitoring information gathered to date, including the genetics information contained in this report.

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APPENDIX 1: RESULTS OF GENETIC ANALYSES OF CARIBOU FECAL PELLET SAMPLES, 2014 TO 2017

Sample Identification Number	Collection Date	Collection Location	Sex	Individual Number
28277	1-Jul-14	15N 374193 6258357	Female	1
28279	7-Jul-14	15N 371456 6256975	Female	1
28280	7-Jul-14	15N 371446 6256973	Female	1
28281	7-Jul-14	15N 371448 6256976	Female	1
28295	9-Jul-14	15N 371858 6255424	Female	2
28296	9-Jul-14	15N 371852 6255418	Female	2
28300	10-Jul-14	15N 369255 6252069	Male	3
34109	21-Jul-15	15N 371894 6252633	Female	1
34131	4-Aug-15	15N 388386 6248451	Female	4
34132	21-Jul-15	15N 373353 6254469	Male	5
34138	6-Aug-15	15N 351480 6244156	Male	6
34142	14-Jul-15	15N 366619 6255567	Female	1
34151	7-Jul-15	15N 371584 6251933	Female	7
34646	28-Nov-15	15N 336889 6236808	Female	8
34647	28-Nov-15	15N 336889 6236808	Female	9
34648	28-Nov-15	15N 336889 6236808	Female	8
34649	28-Nov-15	15N 336889 6236808	Male	10
34650	28-Nov-15	15N 336889 6236808	Female	11
34651	28-Nov-15	15N 336889 6236808	Female	8
34652	28-Nov-15	15N 337692 6235917	Male	12
34654	28-Nov-15	15N 337692 6235917	Male	13
34655	28-Nov-15	15N 337692 6235917	Male	14
34656	28-Nov-15	15N 337692 6235917	Male	14
34657	28-Nov-15	15N 337692 6235917	Male	14
34658	29-Nov-15	15N 334791 6233397	Male	6
34659	29-Nov-15	15N 334791 6233397	Female	15
34660	29-Nov-15	15N 334791 6233397	Female	16
34661	29-Nov-15	15N 334791 6233397	Female	17
34662	29-Nov-15	15N 334791 6233397	Male	14
34663	29-Nov-15	15N 334791 6233397	Male	14
34665	29-Nov-15	15N 334791 6233397	Male	14
34666	29-Nov-15	15N 334791 6233397	Female	16
34667	29-Nov-15	15N 334791 6233397	Male	18
34668	29-Nov-15	15N 334791 6233397	Female	15
34670	29-Nov-15	15N 324146 6236897	Male	19
34671	29-Nov-15	15N 324146 6236897	Male	6
34672	29-Nov-15	15N 324146 6236897	Male	20
34673	29-Nov-15	15N 324146 6236897	Male	20
37650	8-Dec-16	15V 379126 6238764	Male	21

Sample Identification Number	Collection Date	Collection Location	Sex	Individual Number
37651	8-Dec-16	15V 379126 6238764	Male	21
37652	8-Dec-16	15V 379126 6238764	Male	22
37653	8-Dec-16	15V 379126 6238764	Male	22
37654	8-Dec-16	15V 379126 6238764	Male	21
37655	9-Dec-16	15V 329769 6236067	Female	23
37656	9-Dec-16	15V 329769 6236067	Female	24
37657	9-Dec-16	15V 329769 6236067	Female	24
39634	13-Sep-17	15V 369359 6255871	Female	25
39635	7-Sep-17	15V 361596 6260062	Male	22
39642	19-Jul-17	15 367328 6254072	Unknown ¹	5
39643	18-Jul-17	15V 374606 6257319	Female	25

1. Genetic match with Sample Identification Number 34132, a male.