KEEYASK GENERATION PROJECT
ENVIRONMENTAL IMPACT STATEMENT

TERRESTRIAL ENVIRONMENT
SUPPORTING VOLUME
AND
RESPONSE TO EIS GUIDELINES

Updated Caribou Sections
Supplemental Filing

July 2013

KEEYASK
Hydropower Limited Partnership

The following supplemental filing contains updated caribou information for the Terrestrial Environment Supporting Volume and Response to EIS Guidelines for the Keeyask Generation Project. The updated information stems from surveys undertaken in January and February 2013 of an unusually high number of caribou present in the Keeyask region. Note that the conclusions drawn in the earlier assessment process do not change as a result of this supplemental information. For ease of reference, additions to the previous text have been highlighted.

This update should replace the following sections of the Keeyask Generation Project Environmental Impact Statements (EIS) filed in July 2012:

Terrestrial Environment Supporting Volume:

Mammals section:

- Section 7.2.5.2, pp. 7-8 [environmental impact assessment study methods]
- Section 7.3.6.3, pp. 7-60 to 7-72 [existing environment]
- Section 7.4.6.2, pp. 7-112 to 7-124 [effects assessment]
- Appendix 7A, Section 7.5.3, pp. 7A-12 to 7A-14 [methods appendix]

Response to EIS Guidelines:

- Section 6.2.3.4.7 Caribou, pp. 6-127 to 6-133 only [existing environment]
- Section 6.5.8.1, pp. 6-368 to 6-377 [effects assessment]

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UPDATES TO TERRESTRIAL ENVIRONMENT SUPPORTING VOLUME

KEEYASK
Hydropower Limited Partnership

1.0 UPDATES TO TERRESTRIAL ENVIRONMENT SUPPORTING VOLUME

1.1 AERIAL SURVEYS (SECTION 7.2.5.2)

Aerial surveys for aquatic furbearers (beaver and muskrat) were conducted along watercourses and waterbodies in Zones 3, 4, and 5 in spring 2001, 2003, and 2006 (Map 7-5), and in fall 2001 and 2003 (Map 7-6). The number of beaver lodges and muskrat push-ups along waterbodies of varying sizes was counted, they were classes as either active or inactive, and their positions were marked using a GPS. An aerial survey was conducted in fall 2001 (Map 7-7) to determine the number of active and inactive beaver colonies in Zone 1, which will be directly affected by the Project.

Aerial surveys for ungulates (moose and caribou) were conducted in Zone 5 in winter 2002 to 2006 (Map 7-8). Ungulate counts included observations of individuals as well as signs of their presence (*e.g.*, tracks and feeding craters). Signs of gray wolf were recorded opportunistically.

Aerial surveys for moose were conducted in the SLRMA in March 2009 and January–February 2010 (Map 7-9). Moose counts included observation of individuals, age, and sex as well as signs of their presence (*e.g.*, tracks). Detailed methods can be found in the Moose Harvest Sustainability Plan.

Aerial surveys were conducted in the eastern portion of Zone 5 in the winter of 2011–2012 (Map 7-10) to document recent observations of caribou in the region. Observations of other large mammals and their signs were also recorded. These surveys were conducted at the request of the KCNs to improve data collection on the north side of the Nelson River and were repeated in the winter of 2012–2013, when a large group of caribou migrated into the Caribou Regional Study Area.

1.2 ENVIRONMENTAL SETTING (SECTION 7.3.6.3)

1.2.1 Caribou

Three groupings of caribou are described for the Caribou Local and Regional Study Areas (Zones 4 and 6 in Map 7-1, respectively): barren-ground caribou (*Rangifer tarandus groenlandicus*); coastal caribou (*R.t. caribou*), which is a forest-tundra migratory woodland caribou ecotype; and summer resident caribou (summer residents), a type of woodland caribou whose exact range and herd association is uncertain.

- Barren-ground caribou from the Qamanirjuaq herd migrate from Nunavut in autumn to overwinter in Manitoba's northern forests and then leave the Regional Study Area in spring to calve. On occasion, a small fraction of the Qamanirjuaq herd may reach the Regional Study Area – about 10,000 animals migrated this far south once in the last 10 years, of the total population of 348,000 estimated in 2008.
- Coastal caribou from the Cape Churchill and Pen Islands herds migrate from northern Manitoba and northern Ontario into parts of the Regional Study Area in winter and leave the area in spring to

calve. Larger groups of Pen Islands coastal caribou, numbering in the hundreds or thousands, have been observed in the Regional Study Area on occasion, but there are generally fewer than about 20 individuals counted in the Caribou Local Study Area during a typical winter.

- Summer resident caribou likely move within and beyond the Regional Study Area, but the extent of their core range is unknown. These caribou remain in the Regional Study Area to calve, but it is unclear whether the same individuals calve in the area year after year. Summer residents are conservatively estimated to number 20 to 50 individuals.

Caribou select habitat for a variety of reasons, particularly food availability, predator avoidance (Hirai 1998; Rettie and Messier 2000; Dyke 2008), and the level of disturbance present, as human-caused or natural alteration and fragmentation may attract moose, which in turn attract gray wolves, increasing the predation risk for caribou (Rettie and Messier 2000). Winter habitat for all caribou groups consists of undisturbed mature coniferous forest composed of black spruce, jack pine, or tamarack-dominated peatland, with a ground cover of lichens. Areas with abundant arboreal and terrestrial lichens (Hirai 1998; Rettie and Messier 2000) and relatively shallow snow (Johnson *et al.* 2001) are preferred. As these lichens are found in older successional stages of forest, mature forests constitute important caribou habitat (Rettie and Messier 2000). Green forage such as horsetails, graminoids, and forbs are commonly consumed by caribou in spring (Rettie *et al.* 1997; Rettie and Messier 2000). Summer and autumn forage consists of horsetails, graminoids, forbs, sedges, deciduous shrubs, and fungi (Rettie *et al.* 1997).

Summer habitat applies only to summer resident caribou, as the other caribou groups do not occupy the region at this time. When calving, female caribou tend to select areas that decrease the risk of predation, such as higher islands surrounded by marsh, bog, or water (Hirai 1998; Dyke 2008). Summer calving and rearing habitats in the Regional Study Area consist of relatively undisturbed islands in lakes or black spruce surrounded by expansive wetlands or treeless areas (peatland complexes). Potential calving habitats are common in the Regional Study Area, and habitat does not appear to be limiting to the summer resident cows and calves.

While golden eagles, lynx, wolverine, and bears are all predators of caribou, particularly calves (Banfield 1987), gray wolves are major predators of adult caribou during winter (Cumming 1992). Caribou could avoid areas populated by moose as a way to avoid predation (Hirai 1998; Rettie and Messier 2000; Dyke 2008). In central Manitoba, caribou occupy peatlands surrounded by upland forest communities and smaller peatlands in summer and winter (Brown *et al.* 2000). Winter range tends to be smaller, a fraction of that occupied in summer (Brown *et al.* 2000).

1.2.1.1 Barren-ground Caribou

Barren-ground caribou (Photo 7-1) spend much of the summer in the tundra, beyond the tree line, and overwinter in the boreal forest (Kelsall 1968), where they select mature spruce stands with an abundance of lichens to consume (Rupp *et al.* 2006), as do all caribou in the Regional Study Area. Barren-ground caribou form large herds during the calving season and tend to calve *en masse*, forming nursery groups (Kelsall 1968). The rut is in late October, and occurs in Nunavut (Beverly and Qamanirjuaq Caribou Management Board 1999).

In the Keeyask region, barren-ground caribou migrate to the area north of the Nelson River (FLCN 2010 Draft). Previous studies indicated that barren-ground caribou from the Qamanirjuaq herd ranged as far south as Split Lake and as far east as the Hudson Bay railway track running between Ilford and Churchill (Miller and Robertson 1967; Split Lake Cree 1996a). Caribou migration began to diminish in the 1950s, reducing hunting activity (Split Lake Cree 1996a). A substantial decline in barren-ground caribou numbers began in the 1950s, and after construction of the Kettle GS, there were virtually none south of the Nelson River (FLCN 2010 Draft). In the 1990s, there was a limited return of caribou (Split Lake Cree 1996a) while recently, in the winter of 2004–2005, a large number of barren-ground caribou returned to the Keeyask region (FLCN 2010 Draft). Current range data (Map 7-21) for the herd supports this distributional extent, where the southeastern limit is now near Stephens Lake. The Qamanirjuaq population was estimated at 348,000 individuals in 2008. Few were observed in Manitoba in 2011, and the Qamanirjuaq herd may be in decline (Beverly and Qamanirjuaq Caribou Management Board 2011). The potential decline is mainly attributed to climate change, human activities, loss of winter habitat due to forest fires, harvesting, and predation. Although the herd may by shrinking and/or has been redistributed, recent reports indicate that Qamanirjuaq caribou are still plentiful (Beverly and Qamanirjuaq Caribou Management Board 2011). About 10,000 Qamanirjuaq caribou have been estimated to reach the Regional Study Area, although this type of occurrence is infrequent.

Source: WRCS, 2010

Photo 7-1: Barren-ground Caribou Herd North of the Churchill River 2010

The Nelson River generally serves as an extralimital boundary for Qamanirjuaq barren-ground caribou in the Keeyask region (Map 7-21). River crossing locations have been reported in the Regional Study Area and on the lower Nelson River (FLCN 2010 Draft; Map 7-22). Few river crossing sites are reported from field studies. Genetic studies indicated that most barren-ground caribou genotypes were found north of the Nelson River from 2004 to 2006 (Ball and Wilson 2007).

1.2.1.2 Coastal Caribou

Coastal caribou behaviour (Photo 7-2) is similar to that of barren-ground caribou, particularly during calving and migration (Thomas and Gray 2002). Coastal caribou from the Cape Churchill and Pen Islands herds occur within the Regional Study Area in winter and leave in spring to calve near the Hudson Bay coast. The Pen Islands coastal caribou herd migrates from Ontario to the area south of the Nelson River (FLCN 2010 Draft), through Shamattawa to the Atkinson Lake area (WLFN 2002), as far west as the Nelson River at York Landing and as far south as Oxford House (see Map 7-21). Animals from the Pen Islands herd were first reported in the Keeyask region in the 1990s (Thompson 1994; Thompson and Abraham 1998; Abraham *et al.* 2012). In the mid-1990s, the herd size peaked and was estimated at 10,800 individuals (Abraham and Thompson 1998; Abraham *et al.* 2012). Less than 300 animals believed to be Pen Islands caribou are observed in the Regional Study Area in most winters. In the winter of 2011–2012, less than 30 caribou/survey were observed during field studies. However, larger migrations into the Regional Study Area were observed periodically in the winters between 2001 and 2005, and in 2013.

Large numbers of caribou were reported during a late January 2013 reconnaissance survey in the order of several thousand animals. About 7,500 observed animals (WRCS unpubl. data) were located on the north side of the Nelson River near the proposed Keeyask Generating Station. In February 2013, 4,169 caribou thought to be from the Pen Islands herd were observed in Zone 5 between Split Lake and Long Spruce GS. It was estimated that 13,985 (± 18.17%, 95% CI) caribou were in the area (LaPorte *et al.* 2013[1]). The rutting period of Pen Islands caribou is from mid-September to mid-October, when most of the herd is near the Hudson Bay coast (Abraham and Thompson 1998).

The Cape Churchill coastal caribou herd is currently estimated at 3,500 to 5,000 individuals and indications are that the population is likely stable. Although a large migration into the Regional Study Area was observed in winter 2010 (Manitoba Hydro 2011b), there are generally fewer than 50 animals in most winters. Based on radio-collaring data coinciding with the February 2013 survey (V. Trim, pers. comm.), none of the 4,169 caribou observed were thought to be Cape Churchill coastal caribou.

While the Nelson River serves as a physical boundary for both Pen Islands and Cape Churchill coastal caribou in the Keeyask region, river crossing locations have been reported in the Regional Study Area and on the lower Nelson River (FLCN 2010 Draft; see Map 7-22 and Caribou River Crossings Winter 2013 map). Genetic studies indicated that coastal caribou genotypes were found north and south of the Nelson

[1] LaPorte, N., R. Berger and P. Hettinga. 2013. Keeyask Caribou Aerial Survey Winter 2013. Keeyask Project Environmental Studies Program. Report prepared by Wildlife Resource Consulting Services MB Inc. for Manitoba Hydro, Winnipeg. 27pp.

River between 2004-2006. Recent radio-collaring data indicate that most of the Cape Churchill coastal caribou activity is north of the Nelson River while Pen Islands coastal caribou activity is south of the river (Manitoba Conservation unpubl. data; Manitoba Hydro 2011b). Slightly more radio-collared Pen Islands coastal caribou use habitat north of the Nelson River than Cape Churchill coastal caribou use habitat on the south side of the Nelson River (Manitoba Conservation unpubl. data; Manitoba Hydro 2011b).

Aerial surveys of known calving grounds along Manitoba's Hudson Bay coastline indicate that summer residency has declined in the province, and some animals may have moved inland (Abraham *et al.* 2012). Photo 7-2 shows the largest grouping of coastal caribou observed inland, and in proximity to the Keeyask area. Possible causes of the shift in distribution from the Hudson Bay coast in Manitoba east to Cape Henrietta Maria in Ontario include habitat change, disturbance, nutritional stress due to range deterioration, and increased mortality due to differences in hunting and predation pressure across the range (Abrahams *et al.* 2012). Summer use of the Keeyask region is described below, including cases where Pen Islands caribou appeared to be calving in the Stephens Lake area.

Source: WRCS, 2010

Photo 7-2: Coastal Caribou Herd with Calves Observed Inland along the Hayes River Near the Hudson Bay Coastline, June 2010

1.2.1.3 Summer Resident Caribou

In addition to barren-ground and Pen Islands caribou, some KCNs have identified a third variety of caribou common to the Keeyask region: woodland caribou, which are present year-round and can be distinguished from migratory caribou based on their appearance (FLCN 2010 Draft; Fox Lake Aski Keskentamowin Keeyask Powistik 2012; YFFN Evaluation Report (*Kipekiskwaywinan*)). This group of caribou has recently been described as migratory woodland caribou (Mammals Working Group 2012, January 24; Fox Lake Aski Keskentamowin Keeyask Powistik 2012). The exact core range, long-term calving frequency, and herd association of the caribou that remain in the Keeyask region year-round cannot be clearly determined. This group could be coastal caribou, woodland caribou, or a mixture of both, and are referred to as summer resident caribou.

Boreal woodland caribou (*R. t. caribou*), a forest-dwelling woodland caribou ecotype, are listed as threatened under SARA and MESA and occurred historically in the Keeyask region (Manitoba Conservation 2005a). They do not tend to form large herds when calving and calve on islands when possible (Thomas and Gray 2002). The Nelson-Hayes boreal woodland caribou herd that once occurred within the Keeyask region blended with the coastal Pen Islands herd and no longer exists as a discrete population (Manitoba Conservation 2005a). The current range of boreal woodland caribou (Map 7-23) extends into the southwest corner of the Regional Study Area near Thompson, but threatened boreal woodland caribou are not recognized by Manitoba Conservation and Environment Canada as occurring in the Gull and Stephens lakes area (Manitoba Conservation 2005a; Environment Canada 2011).

The group of summer resident caribou in the Keeyask region (Photo 7-3) has been observed to calve in isolation or make use of island habitat, as is characteristic of boreal woodland caribou in Manitoba and elsewhere (Shoesmith and Storey 1977; Bergerud *et al.* 1990; Hirai 1998; Rettie and Messier 2000). Concurrently, recent data showed that a few radio-collared Pen Islands caribou cows occupied summer habitat in the Keeyask region over two years. At least one animal occupied summer habitat in the Keeyask region, but migrated long distances into Ontario the following spring (Manitoba Conservation unpubl. data; Manitoba Hydro 2011b). Winter migration distances for several collared caribou were in the order of hundreds of kilometres, separating winter range from summer range, which is uncharacteristic of forest-dwelling boreal woodland caribou in Manitoba and elsewhere (Manitoba Conservation unpubl. data; Manitoba Hydro 2011b). During the winter, the summer residents most likely interact with migrating coastal caribou, which could make it difficult to differentiate among the mixed populations (Mammals Working Group 2012, January 24). It is unclear whether summer residents are coastal caribou that periodically do not return to traditional calving areas in Ontario or northern Manitoba, boreal woodland caribou beyond their current recognized range, or a mixture of both. For the purposes of the assessment of potential Project effects, the group of summer resident caribou is being treated as an independent population that uses a smaller range than the migratory groups, and is more likely to use calving and rearing habitat that occurs within the Keeyask region. Based on what is known of the area, a conservative estimate for the group of animals residing in the Regional Study Area in summer is 20 to 50 individuals.

Summer habitat is in peatlands and black spruce-dominated stands. Such habitat is selected for the availability of forage and for protection from predators, particularly during the calving season (Rettie and

Messier 2000). When calving, summer residents inhabit calving and rearing complexes, which are clusters of islands in lakes or islands of black spruce surrounded by expansive wetlands or treeless areas (peatland complexes), to avoid predators. Primary calving and rearing habitat is defined as islands in lakes greater than 10 ha in size or peatland complexes greater than 200 ha. Secondary calving and rearing habitat is defined as islands in lakes between 0.5 and 10 ha in size or peatland complexes between 30 and 200 ha. Based on field studies, caribou do not appear to be using all of the habitat available in the Local Study Area, with the possible exception of islands in Stephens Lake, which have become a productive calving and summering area. Approximately 55% of the islands sampled in Stephens Lake and Gull Lake were occupied by adult caribou during at least one summer between 2003 and 2011. Calving and rearing was documented on 10% of the islands in lakes and 5% of the islands in peatland complexes surveyed in 2010 and 2011. The earliest date that calves were detected on islands in lakes was June 8.

Source: WRCS, 2010

Photo 7-3: A Summer Resident Caribou in the Keeyask Region

Little is known about the rutting behaviour of summer residents. Signs of the fall rut were limited during field studies. Potential indications included observations of bulls in pursuit of single cows in peatland

complexes and a harem collected on a large island in Stephens Lake photographed by trail cameras (Map 7-24). Rutting habitat usually consists of unobstructed areas, including open and semi-open bogs (Darby and Pruitt 1984), which are habitats similar to calving and rearing complexes in the Keeyask region. It is unlikely that caribou rut in the Local Study Area, which is composed mainly of secondary peatland complexes that are unsuitable for mating due to their relatively small size.

1.2.1.4 Regional Abundance and Habitat

Mean density of caribou in winter was 0.12 individuals/km² over the five-year study period of 2002 to 2006 (Table 7-22). Based on these years and the locations surveyed, the number of animals observed were attributed mainly to Pen Islands coastal caribou, and possibly, included a small number of summer resident caribou. Observations of caribou and signs are depicted in Map 7-25. Caribou density reached a maximum of 0.26 individuals/km² in 2004. Caribou density was lowest in 2005, the same year in which no caribou were observed in the Nelson River area downstream of the Long Spruce GS. No caribou were observed during reconnaissance flights in this study year. Overall caribou density was lower in the Nelson River area downstream of the Long Spruce GS; however, this is based on two years of data and may not accurately reflect caribou densities in the area over a longer period. Results of aerial surveys are reported as densities because animals were observed and counted, whereas relative abundance is generally reported as an index of abundance, based on the number of signs of a particular species compared with that of others. Seventy-seven caribou were observed during reconnaissance flights in the 2002 study year. In 2003, 98 were observed, 25 were observed in 2004, 23 were observed in 2005, and 45 were observed in 2006. Other observations by workers in the area and KCNs Members have been reported throughout the region (Map 7-26). For maps of annual caribou observations, refer to Appendix 7C.

Table 7-22: Caribou Density in the Caribou Regional Study Area, 2002 to 2006[1]

Study Year	Number Observed	Density (individuals/km²)
2002	24	0.03
2003	347	0.24
2004	146	0.26
2005	8	0.02
2006	16	0.05
Total/*Mean*	541	*0.12*

1. Density estimate based on coverage of township blocks surveyed

Relatively few caribou were observed in the winter of 2011–2012 (Table 7-22a). Caribou density in the Regional Study Area was generally relatively low, but periodic migrations of caribou into the region were occasionally observed.

Table 7-22a: Caribou Density in the Regional Study Area, 2011 to 2013[1]

Study Year	Number Observed	Density (individuals/km²)
December 2011	0	NA[2]
January 2012	27	NA
March 2012	26	NA
February 2013	3,486 (population estimate 13,985 ± 18.17%, 95% CI)	1.66

1. Differences in survey methods, total geographic coverage, replication among years and distance correction factors affecting the precision of the density estimates required the separation of data into two tables (7-22 and 7-22a).
2. NA - Not applicable; data too sparse to be applied to the geographic area of coverage

Based on aerial reconnaissance surveys between 2003 and 2008, Pen Islands caribou appear to move west into the Regional Study Area in late December and early January, with the greatest number of caribou occurring in late January and early February. By March, Pen Islands caribou move east of the Regional Study Area and make their way back into Ontario. In late December and early January 2010, the Qamanirjuaq herd was observed as far south as the Limestone Lake area, however most of the herd was seen just south of the Churchill River. In December 2004 and January 2005, barren-ground caribou were observed crossing PR 280 between the north arm of Stephens Lake and the PR 290 junction, some of which also crossed the Nelson River. Presently, barren-ground caribou are rarely observed that far south. Generalized migration movements of caribou into the Keeyask region in early winter are depicted in Map 7-27, and movements out of the Keeyask region in late winter are depicted in Map 7-28.

A large number of caribou was observed between December 2004 and January 2005 and included Qamanirjuaq, Pen Islands, and potentially Cape Churchill caribou. About 10,000 of these animals were observed moving in larger groups between the north arm of Stephens Lake and the town of Bird outside of formal aerial surveys (Manitoba Conservation, unpubl. data).

During the January and March 2009 aerial survey for moose that systematically covered a large portion of the SLRMA, 526 Qamanirjuaq, Pen Islands, and Cape Churchill caribou were recorded incidentally. In January 2010, a similar but more intensive aerial survey for moose was conducted in the same geographic region. High densities of caribou tracks were recorded in some areas, but no caribou observations were reported.

Prior to the winter of 2012–2013, the highest number of caribou counted on a single occasion was on December 12, 2006 from a comparison area near the Limestone GS. The number of animals was estimated at 900 to 1,200. The animals were loosely separated into two herds and were observed moving towards the Regional Study Area. After the Pen Islands caribou migrated from the Regional Study Area in April 2009, potential late winter range was identified for approximately 12 caribou. This range was located 30 to 60 km south of the Nelson River in the Regional Study Area. In December 2009 during a survey conducted by FLCN, 400 to 500 Pen Islands caribou were observed in an area northeast of Fox River near Naismith Camp (FLCN 2010 Draft). Tracks indicated the caribou were moving west. Additional groups of 10 to 20 caribou, as well as solitary caribou, were observed along the flight path

(FLCN 2010 Draft). Caribou signs were observed in the Atkinson Lake area in December 2011 (Map 7-29) and 27 caribou were observed on the eastern edge of Split Lake in January 2010 (Map 7-30). In March, 26 caribou were observed midway between the December and January observations (Map 7-31). These were likely Pen Islands caribou leaving their winter grounds and making their way east or possibly summer resident caribou. About 7,500 animals (WRCS unpubl. data) were observed on the north side of the Nelson River near the proposed Keeyask Generating Station on January 31, 2013. They were travelling in a predominantly northeasterly-to-easterly direction. During the February 2013 survey, most animals were observed south of the Nelson River, but many groups were still located north of the river and Gull and Stephens lakes. Some moved north of the KIP construction zone, and fewer still appeared to have crossed PR 280.

Caribou presence was detected on 78% of islands surveyed in calving and rearing complexes in Zone 5 in 2009, 55% in 2010 and 45% in 2011 (Table 7B-73). Signs of calves were observed on 67% of islands in 2009 and 4% in 2011. No calf signs were observed in 2010. Signs of both caribou and black bear or caribou and gray wolves were observed on 2% of the islands surveyed in 2009. The 2009 study used a different survey method, where intense searches were performed where technicians were able to follow game trails and focus on substrates more likely to hold a track rather than following a predetermined transect as was done in 2010 and 2011. The sample size in 2010 was considerably less than that in 2011, which likely explains why no calves were detected in 2010.

Trail camera studies resulted in caribou adults observed in 33% of the peatland complexes sampled in 2010 and 24% in 2011 (Map 7-32, Table 7B-74). Calves were not photographed in either year on islands in peatland complexes; however, a calf was photographed by cameras mounted between islands in 2011. Gray wolves were photographed on 8% and 24% of complexes in 2010 and 2011, respectively, while black bears were found on 25% and 12% of complexes in 2010 and 2011. In 2010, three distinct cow pairs and five bull caribou were identified by unique features including antler formations and scars. In 2011, four distinct bulls were identified. Islands are important calving areas for caribou, as they allow cows with calves to escape predators. While small islands in lakes are likely important for calving, large islands are more significant for rearing as they provide more forage. Potential calving and rearing habitat increases with the number of large islands in lakes. In Zone 5, 44 islands greater than 10 ha in size were identified as primary calving and rearing habitat, with an additional 187 islands between 0.5 and 10 ha identified as important calving habitat but less important rearing habitat, that is, secondary calving and rearing habitat.

During tracking surveys, caribou were detected on 69% of islands in lakes surveyed in 2003, 46% in 2005, 92% in 2010 and 86% in 2011. There was evidence of calves on 49% of these islands in 2003, 8% in 2005, 29% in 2010 and 10% in 2011 (Table 7B-75). Caribou were detected on the two islands surveyed in 2009; there was evidence of a calf on one island. Gray wolves were only detected in 2010. There were signs of caribou on all three of the islands on which wolf presence was observed; signs of both caribou calves and gray wolves were observed on one. Black bears were recorded on three islands in 2010; signs of caribou adults were found on two and signs of calves were found on one. Black bear and caribou signs were observed on a single island in 2011.

Trail camera studies resulted in caribou adults observed on 64% of islands in lakes in 2010 and 36% in 2011 (Map 7-32, Table 7B-76). Calves were observed on 64% and 17% in 2010 and 2011, respectively. No predators were photographed on these islands. In 2010, nine distinct cow-calf pairs and several bull caribou were also identified by unique features including antler formations and scars. In 2011, two distinct cow-calf pairs were identified along with 12 bulls. It is likely the number of distinct animals using the islands is higher; however, a lack of unique features makes identifying individuals problematic.

1.2.1.4.1 Summer Resident Caribou Habitat Models

Primary calving and rearing habitat is defined as islands in lakes greater than 10 ha in size or peatland complexes greater than 2,000 ha. Secondary calving and rearing habitat is defined as islands in lakes between 0.5 and 10 ha in size or peatland complexes between 30 and 200 ha. Zone 5 (Map 7-1) contains at least 96 potential peatland complexes and at least 230 islands in lakes that are suitable for calving (Map 7-33). Many more peatland complexes and islands in lakes extend outside the area displayed in Map 7-33 and into the Regional Study Area.

Winter habitat is in black spruce, jack pine, or tamarack-dominated peatland, and is not divided into primary or secondary types (Table 7-23). Habitat is selected at multiple spatial scales and based on its level of disturbance, as human-caused or natural alteration and fragmentation could attract moose, which in turn attract wolves, increasing the predation risk for caribou (Rettie and Messier 2000).

Table 7-23: Winter Habitat Types in the Caribou Regional Study Area

Coarse Habitat Type
Black spruce treed on mineral soil
Black spruce treed on shallow peatland
Black spruce treed on wet peatland
Black spruce treed on thin peatland
Jack pine treed on mineral and thin peatland
Jack pine treed on shallow peatland
Tamarack-black spruce mixture on wet peatland
Tamarack treed on shallow peatland
Tamarack treed on wet peatland

1.2.1.5 Local Abundance and Habitat

Few of the caribou observed during aerial surveys from 2002 to 2006 were observed in the Local Study Area. Observations were only made in 2002, where density was 0.05 individuals/km² (Table 7-24). Mean density was 0.01 individuals/km² over a four-year period. None of the blocks surveyed in 2006 were in the Local Study Area. During the 2011–2012 aerial survey a limited number of caribou tracks were observed in the Local Study Area. Approximately 7,500 animals were observed on the north side of the Nelson River near the proposed GS in the Local Study Area during the 2012–2013 winter aerial survey.

In the Local Study Area, signs of caribou were observed on 76% of islands sampled in peatland complexes in 2009, 57% in 2010, and 44% in 2011 during tracking studies in calving habitat (Map 7-34). Calves were found on 65% of islands surveyed in 2009 and 5% in 2011, with no signs of calves

in 2010 (Table 7B-77). Signs of caribou and black bear or caribou and gray wolves were found on 2% of the islands surveyed in 2009.

Table 7-24: Caribou Density in the Caribou Local Study Area, 2002 to 2006

Study Year	Number Observed	Density (individuals/km²)
2002	21	0.05
2003	0	0
2004	0	0
2005	0	0
2006	-	-
Total/*Mean*	21	*0.01*

Caribou signs were very common along lake perimeter transects in the Local and Regional Study Areas in summer (Table 7-25). Signs were abundant (0.21 signs/100 m²) and were found on all transects. No lake perimeters were surveyed in winter. Signs were abundant at lakes north of Gull Lake (0.22 signs/100 m²) and sporadic at lakes south of Gull Lake (0.19 signs/100 m²; Table 7B-78). Mean frequency of caribou signs was similar inside (0.20 signs/100 m²) and outside (0.21 signs/100 m²) Zone 1. Signs of caribou activity were observed in all six habitats surveyed. Mean frequency of caribou signs ranged from 0.07 signs/100 m² in black spruce treed on mineral and thin peatland or shallow peatland to 0.29 signs/100 m² in low vegetation or tall shrub on wet peatland habitat. Signs were also abundant in young regeneration on mineral and thin peatland or shallow peatland (0.28 signs/100 m²) and black spruce treed on shallow peatland (0.25 signs/100 m²).

Table 7-25: Mean Frequency of Caribou Signs (signs/100 m²) in the Caribou Local Study Area

Transect Type	Mean	S.E.	Abundance	Proportion of Transects	Distribution	Species Rarity
Lake perimeters	0.21	0.03	abundant	1.00	very widespread	very common
Coarse habitat mosaics	0.36	0.07	abundant	0.84	very widespread	very common
Coarse habitat mosaics (winter)	0.08	0.05	scarce	0.11	scattered	sparse
Riparian shorelines	0.72	0.21	very abundant	0.72	very widespread	very common

Signs of caribou activity were very common on coarse habitat mosaic transects in summer. Signs were abundant (Table 7-25) and observed on all transects. Caribou signs were very abundant on islands (Table 7B-79) over the three-year study period. Signs were abundant on transects north (0.33 signs / 100 m²) and south (0.37 signs / 100 m²) of Gull and Stephens lakes. Mean frequency of caribou signs was similar in riparian (0.35 signs / 100 m²) and terrestrial (0.37 signs / 100 m²) areas, and inside (0.38 signs / 100 m²) and outside (0.34 signs / 100 m²) Zone 1. Signs of caribou activity were observed in all thirteen habitats surveyed. Mean sign frequency ranged from 0.04 signs / 100 m² in black spruce mixedwood on mineral and thin peatland to 0.50 in black spruce treed on mineral and thin peatland or shallow peatland.

Signs of caribou activity were sparse on coarse habitat mosaic transects in winter. Sign abundance was scarce and distribution was scattered (Table 7-25). Signs were scarce (0.03 signs / 100 m²) on transects north of Gull and Stephens lakes and sporadic on transects south of the lakes (0.12 signs / 100 m²; Table 7B-80). Mean frequency of caribou signs was greater on transects inside Zone 1 (0.21 signs / 100 m²) than outside (0.16 signs / 100 m²). Caribou signs were observed in four of the nine habitats surveyed. No signs were observed in black spruce treed on mineral and thin peatland or shallow peatland, young regeneration on mineral and thin peatland, young regeneration on mineral and thin peatland or shallow peatland, low vegetation or tall shrub on wetland, or on black spruce treed on wet peatland habitat. Where signs were observed, they ranged from 0.07 signs / 100 m² in black spruce treed and young regeneration on mineral and thin peatland and in black spruce treed on shallow peatland, to 0.13 signs / 100 m² on black spruce treed on mineral and thin peatland and in broadleaf mixedwood on mineral and thin peatland.

Caribou signs were very common along riparian transects in the local study area in the summer. Signs were very abundant and very widespread (Table 7-25). No riparian transects were surveyed in winter. Caribou signs were very abundant on the north and south shores of Gull Lake, and on island shorelines over the three-year study period (Table 7B-81). Mean sign frequency was greatest on the south shore of the lake (1.06 signs / 100 m²). Caribou signs were very abundant on transects in all widths of riparian zones, and on all slopes. Signs were observed in all but one of the seven habitats surveyed. None were found in broadleaf treed on all ecosites habitat. Where signs were observed, mean frequency ranged from 0.25 signs / 100 m² in black spruce mixedwood on mineral and thin peatland to 2.83 signs / 100 m² broadleaf mixedwood on mineral and thin peatland.

Signs of caribou activity ranged from scarce to abundant on the north and south access road routes (Table 7B-82). Signs were observed during all study years.

Caribou were active in the Local Study Area in summer, and were scarce in winter. However, caribou density was greater in the Regional Study Area in winter. Seasonal variation in caribou density was expected, as several caribou populations migrate through the Keeyask region. The timing of movements and the habitats used may vary among caribou types and from year to year for each type of caribou. Variations in caribou densities are further explained by habitat quality, habitat availability, and the spatial distribution of habitats in the study areas (Thompson and Abraham 1994; Abraham and Thompson 1998).

1.3 PROJECT EFFECTS, MITIGATION, AND MONITORING (SECTION 7.4.6.2)

1.3.1 Caribou

1.3.1.1 Construction

1.3.1.1.1 Habitat Loss, Gain, and Alteration

Potential Project effects on caribou, including summer residents, during construction include habitat loss and alteration from land clearing in Zone 2 and changes in caribou distribution within the Caribou Local Study Area. Physical habitat losses include the reduction of food and cover available to caribou. About 6% (6,825 ha) of the physical caribou winter habitat in the Local Study Area will be affected (Map 7-44). In comparison, approximately 1% of caribou winter habitat in the Zone 5, the study zone in which intactness was assessed (see the Habitat and Ecosystems section of the TE SV) will be affected. By extrapolation, less than 1% of the winter habitat in the Caribou Regional Study Area will be affected As less than 1% of the vast winter range of the Qamanirjuaq, Cape Churchill, and Pen Islands herds will be affected, the effect of winter habitat loss on migratory caribou will likely be negligible to small (Table 7-32). Although it is unclear whether summer resident caribou use the Regional Study Area in winter, if they do, the effect of habitat loss is also expected to be negligible to small, especially if summer resident caribou travel with the migratory herds and range outside the Caribou Regional Study Area (Manitoba Conservation, unpubl. data).

Summer resident caribou calving and rearing habitat will be lost in the Local Study Area. The loss of these habitats could cause caribou to refrain from using high-quality calving grounds and use marginal habitats instead (Johnson *et al.* 2005). High-quality calving grounds are selected for predator avoidance (Rettie and Messier 2000), and mortality due to predation is a potential outcome of selection of lower-quality calving habitat. A lack of nearby forage could affect the nutrition of lactating females, leading to worsened body condition and potential reduction of future reproductive success (Nellemann and Cameron 1995). Evidence of calving was documented on approximately 10% of the islands in Gull and Stephens lakes and only 5% of the peatland complexes surveyed in 2010 and 2011, indicating that there is likely more habitat available than caribou are currently using. Two islands will be lost at the GS site, which comprise less than 1% of the primary calving and rearing habitat in the Regional Study Area. One of these islands was occupied by caribou with calves during field studies. No suitable primary and secondary calving and rearing complexes will be directly affected by the Project during construction. The initial loss of the islands at the GS site will likely be negligible.

Table 7-32: Benchmarks for Caribou Determination of Magnitude of Effects

Threat to Population Persistence	Range of Values Relative to Magnitude of Effect	
Physical habitat loss	Low	<1% of the region
	Moderate	1–10% of the region
	High	>10% of the region
Intactness	Low	<35% of the region
	Moderate	35–45% of the region
	High	>45% of the region
Linear feature density	Low	<0.6 km/km²
	Moderate	0.6–1.2 km/km²
	High	>1.2 km/km²
Gray wolf density	Low	<4 wolves/1,000 km²
	Moderate	4–6 wolves/1,000 km²
	High	>6 wolves/1,000 km²

1.3.1.1.2 Project-Related Disturbances

Potential Project-related disturbances include sensory disturbances and mortality due to wildlife-vehicle collisions on the south access road. Sensory disturbances, including heavy machinery associated with construction activities, blasting, heavy traffic, and other human activity, can reduce effective habitat for caribou. Factors that influence caribou response to disturbance include distance from the stimulus, visibility of the stimulus, reproductive condition, sex and age class, habitat type, and previous experience. Unlike moose, caribou do not experience a substantial increase in energy costs while running (Murphy and Curatolo 1987).

Habitat avoidance or temporary abandonment could result near construction activity. Although a few caribou may habituate to small levels of noise disturbances and not all will be affected, blasting is unpredictable and could scare away most animals from the blasting zone. In heavy construction areas, some summer resident caribou activity will likely decline within 2 km of the south access road and up to at least 4 km from the GS, which will most likely result in a loss of effective habitat (Manitoba Hydro 2011c). Caribou could choose less favourable areas where they may be susceptible to increased predation or environmental stress (James and Stuart-Smith 2000; Dyer *et al.* 2002; Schindler *et al.* 2007). Wapisu woodland caribou activity decreased approximately 80% within 4 km of the Wuskwatim generating station site after construction began (WRCS unpubl. data). Similar effects could be expected for caribou in the Local Study Area, as caribou activity is reported to decrease within 1 to 10 km of industrial developments (*e.g.*, Vors *et al.* 2007).

In winter, construction could have an effect on the Cape Churchill, Pen Islands, and occasionally Qamanirjuaq herds if these animals enter the Local Study Area during their migration. Sensory

disturbances will likely result in a temporary 12% loss of effective winter habitat in the Local Study Area. It is predicted that 2% of winter habitat will be affected in Zone 5, and by extrapolation, less than 1% of winter habitat in the Regional Study Area will be affected. The level of disturbance expected during construction could change animal distributions and influence migration routes. If the Qamanirjuaq caribou reach the Local Study Area, traditional movement patterns to the south would most likely be deflected east or west of the Local Study Area to avoid construction zones. However, there is typically little caribou activity in the Local Study Area in winter, and caribou that move away from affected winter habitat are expected to find suitable habitat elsewhere in the Local or Regional Study Areas. As less than a 1% loss of effective winter habitat is anticipated in the Regional Study Area, the overall effect of sensory disturbance on caribou will likely be negligible to small.

Sensory disturbance could result in a temporary loss of effective calving and rearing habitat and altered movements (Mahoney and Schaefer 2002) in the Local Study Area. About 510 ha (5%) of the primary calving and rearing habitat in the Local Study Area is expected to be affected by sensory disturbance, all on islands in Gull Lake. Additionally, 695 ha (24%) of secondary calving and rearing habitat in the Local Study Area will likely be affected, including 23% of peatland complexes and less than 1% of islands in Gull Lake. In all, 1,205 ha (9%) of primary and secondary calving and rearing habitat will be affected in the Local Study Area. Of this, 5% will be in peatland complexes and 4% will be on islands in lakes. Given the large amount of calving and rearing habitat, particularly peatland complexes, available on the landscape (Map 7-45), less than 1% of effective primary and secondary calving and rearing habitat in the Regional Study Area is expected to be affected by sensory disturbance. Caribou that encounter sensory disturbances prior to calving will likely move to unoccupied calving and rearing habitats elsewhere in the Local or Regional Study Areas. Sensory disturbance during the summer resident calving period could result in a very small number of cows and calves abandoning protective habitat in order to escape the disturbance, increasing the predation risk and, consequently, mortality.

Caribou could avoid the Local Study Area due to construction noise, but the disturbance will be local and temporary, and no interruption of long-distance seasonal migration is anticipated. Caribou show a high level of site fidelity and do not readily abandon suitable areas due to disturbance useless they are actively pursued (Tucker and Mahoney 1990; Dyke 2008). They will often return to disturbed areas once the disturbance ends (Tucker and Mahoney 1990). As less than 1% of the available calving and rearing habitat in the Regional Study Area will be affected, the overall effects on caribou will likely be negligible to small.

Accidental spills would affect site-specific areas over a short period and have a small, negative effect on caribou or caribou habitat. Given the low probability of occurrence and the regulation requirements for storing, handling, and transporting fuels, oils, and other hazardous materials under the *Dangerous Goods Handling and Transportation Act*, there will likely be no effect on the caribou population.

Heavy construction activity and increased human presence could increase the likelihood of accidental fire in the region. Fire can quickly alter habitat, making it unfavourable for caribou, as lichens and other browse are destroyed. Over 100 years or more, fire plays an important role in maintaining caribou habitat (Klein 1982; Joly *et al.* 2003). In addition to destroying browse, fires can change the structure, composition, and connectivity of quality caribou habitat in the region. This could result in limitations to

caribou movement and distribution as animals would likely avoid burned areas. Increases in fire frequency, severity and/or total area burned could create long-term effects on habitat composition and many ecosystem patterns and processes (*e.g.*, ecosystem diversity, species distributions and abundances, carbon storage; see the Habitat and Ecosystems section of the TE SV) in the Regional Study Area, including a potential change in food, cover, and habitat suitability for caribou in the Region.

Potential Project effects on the caribou populations in Local Study Area include mortality due to collisions with vehicles. Both traffic volume and vehicle speed have been positively linked to the number of caribou accidents (Brown and Ross 1994). Collisions with vehicles are not typically listed as an important source of caribou mortality (Jalkotzy *et al.* 1997; Environment Canada 2011) and would likely be limited to caribou movement corridors and high-quality habitats between Thompson and the GS. With mitigation, effects of mortality due to increased wildlife-vehicle collisions in the Regional Study Area will likely be small and with mitigation are expected to be negligible.

1.3.1.1.3 Access

Increased access to the Local Study Area during construction could result in increased mortality due to predation and hunting. Predators, particularly gray wolves, often use linear features to travel and to hunt (James and Stuart-Smith 2000); wolves have been observed using transmission lines to move (Mammals Working Group 2010, December 9). Greater hunting efficiency and a potential influx of predators could increase predation on caribou, which is among the threats to some populations (Environment Canada 2011). Predators could interrupt breeding and reduce the number of calves in the population (Bergerud and Ballard 1988). Habitat changes could result in the displacement of moose into areas occupied by caribou, increasing predation on caribou as predators follow (Kinley and Apps 2001). Both resident and transient wolves occur in the Regional Study Area. Most transient wolves are habitually wandering wolves that follow migratory caribou into the region. Resident wolves require moose as their primary prey base because there is not enough caribou and other alternate food biomass to sustain a wolf population with small or medium-sized territories in the Regional Study Area year-round (Moose Harvest Sustainability Plan). When migratory caribou move into the territories of resident wolf packs for part of the year; however, wolves usually hunt them while they are available. Limited prey switching can also occur if transient wolves opportunistically prey on moose. When the migratory prey leave, so do the transient wolves; the resident wolves remain and live off the regional population of moose.

Because the number and distribution of moose is not expected to change or shift substantially during construction (see Section 7.4.6.2), resident wolf density will not likely increase and distribution will not likely change. Mortality above the current rate for caribou as an alternative prey source is therefore highly unlikely during construction. Resident and transient gray wolf density in the Regional Study Area is low (estimated at less than 1.4/1,000 km² in the SLRMA) and is not expected to change with the Project; therefore, predation effects on summer resident caribou are predicted to remain small (see Table 7-32). As the density of linear features is predicted to decline in the Local Study Area during construction, predation efficacy will not likely change, thus the overall effect of predation on all caribou should remain small.

Effects of improved access to the Local Study Area could also include increased mortality due to hunting. Opportunistic harvest of caribou by workers and other resource users could increase during construction

due to improved access to the Local Study Area, also increasing caribou mortality. FLCN Members are particularly concerned that increased access will increase hunting pressure (FLCN Environment Evaluation Report (Draft)). However, GHA 3, the area where caribou hunting is permitted, overlaps only a small portion of the Local Study Area near Gillam (Map 7-46), and the small number of resident licences available for caribou harvest is managed by the Province (SE SV). The potential increase in caribou mortality due to workers hunting will be managed (see Mitigation) and the overall effect will likely be neutral. In addition, as the north access road will be the main access route to the GS during construction (PD SV), effects are expected to be neutral on the south access road during construction.

As access to the Local Study Area will increase during the construction phase, ungulates could migrate into the region, potentially bringing parasites and diseases. During construction, the potential risk will be very small, as sensory disturbances will encourage individuals to avoid the area. Additionally, there are no recognized diseases prevalent in the surrounding source populations that could be distributed very far given the relatively small area of the Project. The spread of parasites within the regional caribou population, and the transfer or spread of parasites or disease from other ungulates (*e.g.*, white-tailed deer or moose) to caribou could increase if these species use linear corridors and interact more often. Currently, white-tailed deer range extends as far north as Flin Flon (Manitoba Conservation n.d.*f*), which is well outside of the Regional Study Area. As the climate and habitat in the Regional Study Area is unsuitable for white-tailed deer and will likely remain so for the foreseeable future, range expansion into the Keeyask region is unlikely. As brainworm (*Parelaphostrongylus tenuis*) is not found in northern Manitoba, no Project effects on the spread of this parasite are expected. While similar parasites occur in the regional caribou population (Crichton *pers. comm.* 2010), creation of the access road is not expected to contribute to their spread (Mammals Working Group 2010, April 15).

Fragmentation, a landscape-level process in which human features progressively subdivide habitat blocks into smaller and more isolated fragments, is described in the Habitat and Ecosystems section of the TE SV. The potential for the access roads to fragment the surrounding habitat, compounded by increases in traffic (Laurian *et al.* 2008), could influence caribou by acting as a barrier to movement, contribute to mortality from predation and hunting access, and reduce core area size. Including the Thompson area, the density of existing linear features in Zone 5 (0.45 km/km²) is low (see Table 7-32). The density of existing linear features in Zone 5 decreases when the area around Thompson is excluded (0.32 km/km²), and the current magnitude of the effect of existing features is small. A small net decrease (less than 1%) in linear feature density is anticipated with the construction of the Project, as some existing linear features will be removed during clearing of borrow areas and camps, and some cutlines will be converted into a main access road. For caribou, the overall effect of a reduction in linear feature density will be negligible to small and positive. The number of core areas larger than 200 ha or 1,000 ha that caribou most likely use is expected to decrease by only 1% in Zone 5. As 82% of the largest core areas will remain intact, the overall effect of habitat fragmentation will likely be small.

The federal government outlines draft criteria to assess boreal woodland caribou ranges to measure the long-term viability of a caribou population. Habitat disturbance considers the effects of fire in addition to human features. A minimum of 65% of habitat should remain undisturbed in order to sustain a population (Environment Canada 2011). Currently, 48% of the estimated range for caribou in Zone 5 is intact (Map 7-47). Fire has the largest effect on caribou habitat in the Keeyask region, and currently

affects 36% of Zone 5, where the age class of forest is less than 40 years old (Map 7-48). Consequently, the Keeyask region is unlikely to support a sustainable sedentary boreal woodland caribou population if undisturbed habitat is the only factor to consider. The current range of the summer resident caribou population is thus not considered self-sustaining, especially where a local group ranges from 20–50 animals. Other factors to consider in the overall analysis include range, type of caribou, other habitat factors, and gray wolf density. Recent radio-collaring data have shown some caribou spent a summer in the Keeyask region and migrated to the coast the following year (Manitoba Conservation unpubl. data). As such, at least some of the summer residents are likely coastal caribou that have switched to solitary calving behaviours. Radio-collaring data have also shown large migratory movements nearing Shamattawa, which are not consistent with the shorter migratory movements of forest-dwelling woodland caribou populations found elsewhere in Manitoba. These movements indicate the actual range use of collared caribou extends beyond the Regional Study Area, and the undisturbed portion of their overall range is likely greater than in the Regional Study Area (Manitoba Hydro 2011b). The islands in Stephens Lake are frequently used for calving, and this area should be recognized as suitable habitat. Finally, recognized boreal woodland caribou populations in Manitoba have persisted on landscapes with less than the recommended 65% undisturbed habitat benchmark; however, the long-term viability of these populations is uncertain (Environment Canada 2011). Because some of the summer resident caribou are likely coastal caribou, caribou are not using all of the calving and rearing habitat currently available in the Regional Study Area, and the proportion of undisturbed habitat is greater beyond the Regional Study Area, the effect of habitat disturbance on summer resident caribou is predicted to be small.

1.3.1.1.4 Mitigation

Use of the access roads by resource users will be addressed in the Construction Access Management Plan. Mitigation for accidents and malfunctions includes planned measures such as training in fire response protocols and the presence of fire suppression equipment at the GS site will reduce the extent of fire damage. Additionally, the removal or disposal of vegetation cleared for the reservoir, camp areas and other sites will prevent the creation of barriers to wildlife movement and will reduce the availability of fuel for a fire (Manitoba Hydro 2006). Spill response programs and equipment will be in place for spillage or leaks of any oils or contaminants. All material will be stored and handled in accordance with established policies and regulations. Legislation and regulations will be followed for the transportation of dangerous goods, and on-site emergency response teams will receive training with respect to fuel spill containment, clean up and other emergency measures.

Other mitigation measures include:

- The excavated material placement areas were sited to avoid caribou calving complexes and reduce habitat loss;
- Future calving islands greater than 0.5 ha in the reservoir area will be flagged and left undisturbed to protect the vegetation that will remain on these islands from clearing disturbances;
- The access roads were routed to avoid caribou calving complexes and reduce loss of effective habitat;

- Blasting will be minimized to the extent practicable from May 15 to June 30, to reduce the effects on calving females and their young;
- A Construction Access Management Plan will be implemented to reduce the effects of increased access to the Local Study Area;
- Gates will be added to the north and south dykes, to be kept closed and locked from May 15 to June 30 and during other sensitive periods as may be determined by monitoring (*e.g.*, the arrival of migratory caribou) to minimize disturbances by humans;
- Firearms will be prohibited in camps and at work sites to reduce mortality due to hunting during construction;
- Roadside ditches will be rehabilitated with native plants with low quality food value for caribou where practicable, to minimize attraction and the risk of collisions and harvest opportunities;
- Fire prevention measures will be employed in remote working environments to minimize the risk of habitat loss for caribou; and
- Staff working on-site will attend wildlife awareness training;
- To reduce the possibility of vehicle and wildlife collisions, posted speed limits will not be exceeded;
- Wildlife crossing signs will be posted along the access road in areas of high-quality caribou habitat and travel corridors and are to be respected;
- No person on-site will feed or harass wildlife. Failure to comply could lead to dismissal from the Project;
- When large numbers of caribou are known to be moving through the Project area, daily safety briefings will be used to advise workers about caribou movements in the area; and
- Traffic control measures (crossing signs and stop signs) will be used in the event large numbers of migratory caribou are located near the construction site to prevent the harassment of caribou on roads, and to minimize the likelihood of caribou-vehicle collisions. If caribou are crossing or attempting to cross the access roads or construction areas, then traffic will stop and wait for them to cross without harassment.

1.3.1.1.5 Summary of Construction Effects

Project effects on caribou during construction, including summer residents, include habitat loss and alteration from land clearing in Zone 2 and changes in caribou distribution within the Caribou Local Study Area. About 6% or 6,825 ha of the physical caribou winter habitat in the Local Study Area will be affected, compared with 1% of winter habitat in Zone 5 and, by extension, less than 1% of the habitat in the Regional Study Area. Summer resident caribou calving habitat will also be lost in the Local Study Area. These losses comprise less than 1% of the calving and rearing habitat available in the Regional Study Area. The effects of habitat loss on caribou will be negligible to small.

Project-related disturbances include sensory disturbances and mortality due to wildlife-vehicle collisions on the access roads. Sensory disturbances from blasting, machinery, and people will most likely influence a few caribou to avoid some winter habitat. In addition to physical winter habitat loss, sensory disturbance will likely result in an additional 12% loss of effective habitat in the Local Study Area. Approximately 2% of winter habitat will be affected in Zone 5, and by extrapolation, less than 1% of the winter habitat in the Regional Study Area will likely be affected. Caribou that move away from affected winter habitat will most likely find suitable habitat elsewhere in both the Local and Regional Study Areas, and the overall effect of winter habitat loss during construction will be negligible to small.

In addition to effects on winter habitat, sensory disturbance could result in a loss of effective calving and rearing habitat. In total, about 9% of primary and secondary calving and rearing habitat will be affected in the Local Study Area, and less than 1% is expected to be affected in the Regional Study Area. Caribou that encounter sensory disturbances prior to calving will likely move to unoccupied calving and rearing habitats elsewhere in the Local or Regional Study Areas. Sensory disturbances during the summer resident calving period could result in a very small number of cows and calves abandoning protective habitat in order to escape the disturbance. This could result in increased mortality through predation, as calves could leave protective habitat, resulting in increased predation risk. As less than 1% of the available calving and rearing habitat in the Caribou Regional Study Area will be affected, the overall effects will likely be negligible to small.

Effects of improved access to the Local Study Area include increased mortality due to predation. Predators, particularly gray wolves, often use linear features to travel and to hunt; wolves have been observed using transmission lines to move. Greater hunting efficiency and a potential influx of predators could increase caribou mortality, which is among the threats to some caribou populations. Habitat changes could result in the displacement of moose into areas occupied by caribou, increasing predation on caribou as predators follow. Because the number and distribution of moose is not expected to change or shift substantially during construction, resident wolf density will not likely increase and distribution will not likely change. Mortality above the current rate for caribou as an alternative prey source is therefore highly unlikely during construction, and the overall effect of predation on all caribou should be small.

Effects of improved access to the Local Study Area also include increased mortality due to hunting. As licensed hunting is only permitted in a small portion of the Local Study Area, the increase in caribou mortality due to workers hunting will be managed, and use of the south access road will be restricted during construction, no change in hunting mortality is expected, and effects are expected to be neutral.

Project-related changes in the intactness of caribou habitat and linear feature density could affect caribou habitat and movements in the Local Study Area. Linear feature density in Zone 5 is expected to decrease, and the overall effect on caribou will be small and positive. As 82% of the largest core areas will remain intact, the effect on caribou will likely be small.

1.3.1.1.6 Residual Effects of Construction

Residual effects on caribou that are expected and likely once the appropriate mitigation measures are applied will be localized altered movements due to sensory disturbance, distributional changes, decreased

abundance due to reduced habitat available in the Local Study Area, and increased mortality. Most Project effects will be negligible to small, particularly since habitat currently appears to be under-utilized, limited mainly to the Local Study Area, and affect two or more generations. Regional effects could include any indirect caribou mortality associated with the Project, but these are also expected to be negligible to small.

Using the criteria established to determine the significance of Project effects for regulatory purposes, the likely residual effects of Project construction on caribou are expected to be adverse, small in extent, long-term in duration, and small in magnitude.

1.3.1.2 Operation

1.3.1.2.1 Habitat Loss, Gain, and Alteration

During operation, effects on caribou, including summer resident caribou, will include additional habitat loss and alteration. Long-term habitat losses are associated with reservoir impoundment, erosion, peatland disintegration, and reservoir-related groundwater and edge effects (see the Habitat and Ecosystems section of the TE SV). No additional loss of winter habitat is expected above construction losses, although with flooding, habitat loss will be permanent. As no additional loss of winter habitat is anticipated, effects are expected to be negligible to small.

Approximately 257 ha, or less than 2%, of primary calving and rearing habitat will be affected in the reservoir by year 30 of operation in the Local Study Area. A 65% increase in the area of islands in lakes between 0.5 and 10 ha is anticipated. Ground water effects on vegetation could reduce the quality of potential caribou habitat on new islands formed in the reservoir and on existing islands such as Caribou Island. In a worst-case scenario, all islands in the reservoir could change from primary to secondary calving and rearing habitat, predicted with a moderate level of uncertainty. In total, less than 1% of all calving habitat in the Regional Study Area is expected to be affected by the Project during operation. As such, the effects of the loss or alteration of calving and rearing habitat will likely be small.

1.3.1.2.2 Project-related Disturbances

Project-related disturbances to caribou during operation include sensory disturbance from traffic on the access roads and from noise and workers at the GS site. Sensory disturbance from traffic on the access roads could result in avoidance of the area by some caribou (Dyer *et al.* 2002), particularly Pen Islands animals and summer residents on the south side of Stephens Lake in the Local Study Area. Caribou avoid roads at a minimum of 250 m in open coniferous forest, and at smaller distances in closed coniferous forest (Dyer *et al.* 2001). The degree of avoidance will likely depend on the volume of traffic on the access roads (Jalkotzy *et al.* 1997; Dyer *et al.* 2001). It is predicted that primary calving and rearing habitat within 2 km of the GS will be less suitable for calving, and will be more likely to be used by adults without calves. Summer resident caribou with fidelity to existing calving sites will very likely cross the highway to gain access to high quality calving habitat on Stephens Lake. Early in the operation phase, caribou will likely re-occupy most habitats avoided during construction, but some loss of effective habitat, up to 500 m from the road and less for cutlines, will continue over the long term. Less than 1% of the available calving and rearing habitat in the Regional Study Area is expected to be affected, thus effects will likely be

negligible to small. As less than 1% of the available calving and rearing habitat in the Regional Study Area will be affected, overall, these effects will likely be negligible to small (see Table 7-32).

Several river crossing sites between Birthday Rapids and Hidden Creek were observed in late January and early February 2013 (Map: Caribou River Crossings Winter 2013), in addition to those indicated in Map 7-22. Resource users from the KCNs have observed caribou crossing the Nelson River just downstream of Gull Rapids (FLCN 2010 Draft). Based on experience with past hydroelectric projects, the KCNs raised concerns about caribou drowning as a potential Project effect due to an altered ice regime. Although no increase in caribou drowning as a direct result of the Project is anticipated, there is uncertainty associated with the conditions under which the risk of mortality can change. The earlier formation of thin ice across the reservoir, which could occasionally coincide with the arrival of caribou in the Local Study Area, could increase the risk of drowning mortality. However, once the ice has formed, an increase in caribou drowning is unlikely on the reservoir because post-Project conditions include the formation of a stable ice cover on the reservoir (*i.e.*, smoother and more consistent than the existing environment), including maintaining a steady reservoir level during freeze-up and monitoring ice thickness (Project Description Supporting Volume), and less variation in water levels once the reservoir is established relative to current conditions (Mammals Working Group 2011, June 28). Monitoring will be required.

Other potential Project-related disturbances could include reduced local movements by caribou along shorelines due to woody debris. Past flooding has resulted in debris accumulating on shorelines, making them difficult to access by wildlife (FLCN Environment Evaluation Report (Draft)). However, the area flooded during the creation of the Kettle reservoir (*i.e.*, Stephens Lake) was not cleared prior to inundation, submerging trees and other vegetation that periodically float to the surface and collect on the shorelines. A negligible to small effect is anticipated because the Forebay Clearing Plan and Waterways Management Plan will reduce these effects.

The risk of accidental fire will likely be reduced during the operation phase, as there will be considerably fewer workers and heavy machinery operating in the area. Fire plays an important role in maintaining caribou habitat (Klein 1982; Joly *et al.* 2003). Fire suppression may be limited to areas in proximity to infrastructure, and would not affect large tracts of forest. The risk of spills and other environmental events will also be reduced.

Collisions with vehicles are generally not listed as an important source of caribou mortality (Environment Canada 2011). As the risk of wildlife-vehicle collisions is unlikely to change during operation, the effects of mortality due to collisions with vehicles in the Regional Study Area are expected to remain negligible to small.

1.3.1.2.3 Access

Effects of improved access to the Local Study Area include increased mortality due to predation and hunting. During operation, the number and length of linear features in the Local Study Area is not expected to change, nor will the overall numbers of gray wolves or moose. As a result, the overall effect of predation on caribou is not expected to change and the effect will remain small during operation.

Effects of improved access also include increased caribou mortality due to hunting (Bergerud *et al.* 1984). With their low reproductive rate, caribou cannot sustain high losses due to hunting, which could increase as new access to the Local Study Area becomes available via the north and south access roads. There is no licensed harvest of caribou in GHA 9, which overlaps the Local Study Area, and there is no licensed hunting of boreal woodland caribou in Manitoba (Manitoba Conservation 2011b). Access to the area already includes waterbodies and watercourses, the existing PR 280, cutlines and trails, railways, and transmission lines, whose use as transportation routes to support the sustainable domestic harvest in the Regional Study Area varies seasonally. Once the Project is commissioned, PR 280 will be re-routed to include the north access road, the GS facility over the Nelson River and the south access road to Gillam. This new section of PR 280 could increase local caribou hunting activity by domestic resource users. Increased access is also expected due to the provision of boat launches above and below the GS. The traditional harvest of caribou by the KCNs usually occurs in winter and focuses on migratory caribou populations. With the exception of one large harvest of migratory caribou in the last 10 years (Manitoba Hydro 2011b), few caribou are harvested from the Local Study Area (CNP Keeyask Environmental Evaluation Report; YFFN Evaluation Report *(Kipekiskwaywinan)*; FLCN 2010 Draft). However, many caribou are harvested from the Regional Study Area, from the surrounding GHAs, and into Ontario and Nunavut by all resource users. Including considerations for sustainable caribou management by the province (mainly via regulation of licensed hunting in Manitoba), the effects of harvest on caribou populations in the Local Study Area are not expected to contribute substantially to the effects of the broader regional harvest, thus the effect is expected to be small during operation.

AEA offsetting programs will, among other purposes, provide alternate harvesting opportunities in the SLRMA to replace the loss of traditional resource use areas due to the Project. These programs are expected to disperse existing harvest pressures in the Local Study Area. For waterfowl and moose, traditional wildlife harvests happen in the spring and fall respectively. The traditional harvest of caribou occurs in winter, and because there is no overlap with other hunting seasons, the harvest of caribou is not expected to increase in the SLRMA and effects of AEA offsetting programs on caribou will likely be neutral.

Increased access could also allow caribou and other ungulates to move into the region from other locations. While this may improve genetic diversity, it comes with the potential risk of introducing parasites and disease into the area (Fitzgibbon *et al.* 2005). The spread of brainworm is of concern. The spread of parasites within the regional caribou population, and the transfer or spread of parasites or disease from other ungulates, such as white-tailed deer or moose, to caribou may increase if these species use linear corridors and interact more often. Currently, white-tailed deer range extends as far north as Flin Flon (Manitoba Conservation n.d.*f*), which is well outside of the Regional Study Area. As brainworm is not found in northern Manitoba, the Project is expected to have no effect on the spread of this parasite. While similar parasites occur in the regional caribou population (Crichton *pers. comm*. 2010), the access road is not expected to contribute to their spread, and no effect on the caribou population is anticipated.

No additional change in the density of linear features is expected in Zone 5 during operation, therefore effects of habitat fragmentation on caribou during operation will likely be neutral.

1.3.1.2.4 Mitigation

The PD SV includes measures to be taken to reduce the effects of accidents and malfunctions. A spill response plan for all activities during operation and maintenance will be kept at various locations, including the control room and with emergency response crews. Petroleum products will be stored in the powerhouse with spill containment equipment; and inventory will be monitored and documented. Firebreaks will be maintained to minimize the extent of accidental fires. There is no mitigation for dam failure.

Other mitigation measures include:

- Except for the existing resource-use trails (see Construction Access Management Plan), Project-related cutlines and trails will be blocked where they intersect Zone 1, and the portions of these features within 100 m of Zone 1 will be re-vegetated to minimize the risk of habitat disturbance, invasive plant spreading, accidental fires and access-related effects;
- Temporarily cleared areas and excavated materials placement areas (see the Habitat and Ecosystems section of the TE SV) will be rehabilitated to native habitat types where feasible to improve caribou habitat;
- Warning signs should be maintained in areas along the access roads with caribou activity to caution motorists; and
- A plan is being developed to coordinate caribou mitigation and monitoring activities among Manitoba Hydro's northern developments, as well as with government authorities and existing caribou committees and management boards.

1.3.1.2.5 Summary of Operation Effects

During operation, effects on caribou, including summer resident caribou, will include additional habitat loss and alteration. Long-term habitat losses are associated with reservoir impoundment, erosion, peatland disintegration, and reservoir-related groundwater and edge effects. No additional loss of winter habitat is expected above construction losses, and the effect of alteration of winter habitat is expected to be negligible to small. Less than 2% of primary calving and rearing habitat will be affected in the reservoir by year 30 of operation. While some primary calving habitat will be lost, the availability of secondary calving and rearing habitat will increase. The overall Project effects on caribou habitat during operation will likely be small.

Potential effects include Project-related disturbances from the access roads and from noise and workers at the GS site, and mortality due to collisions with vehicles on access roads. Early in the operation phase, caribou are expected to re-occupy most habitats that were avoided during construction, but some loss of effective habitat will be long-term. Effects of sensory disturbances are expected to be negligible to small. Collisions with vehicles are not an important source of caribou mortality, thus a negligible to small effect is anticipated.

Effects of improved access to the Local Study Area include increased mortality due to predation and hunting. During operation, the number and length of linear features in the Local Study Area is not

expected to change, nor will the overall numbers of gray wolves or moose. As a result, the overall effect of predation on caribou is not expected to change and the effect will remain small during operation. With their low reproductive rate, caribou cannot sustain high losses due to hunting, which could increase as new access to the Local Study Area becomes available via the north and south access roads. The effects of harvest on caribou populations in the Local Study Area are not expected to contribute substantially to the effects of the broader regional harvest, thus the effect is expected to be small during operation. No additional change in the density of linear features or intactness is expected in Zone 5 during operation, therefore effects on caribou will likely be neutral.

1.3.1.2.6 Residual Effects of Operation

Residual effects on caribou that are expected and likely once the appropriate mitigation measures are applied will be altered movements due to reduced intactness and sensory disturbance, and decreased populations due to reduced habitat and increased mortality. Effects will be small, extend towards the Regional Study Area, and affect two or more generations.

Using the criteria established to determine the significance of Project effects for regulatory purposes, the most likely residual effects of Project operation on caribou are expected to be adverse, medium in extent, long-term in duration, and small in magnitude.

1.3.1.3 Conclusion About Residual Effects on Caribou

Residual effects on caribou are expected to be adverse, small to medium in extent, long-term in duration, and small in magnitude. There is a moderate to high degree of certainty in the assessment because of some unpredictability regarding the long-term frequency and variability of habitat use and movements, but high confidence in habitat availability, existing core areas, and regional intactness estimates, and in the ability to mitigate and manage potential Project effects. The adverse residual effects of the Project on caribou will overlap spatially and temporally with effects from the following future projects: Bipole III Transmission Project, Keeyask Transmission Project, Conawapa Generation Project, and Gillam redevelopment. These projects will increase habitat loss, reduce intactness, increase fragmentation and increase mortality due to increased human presence and access effects. The cumulative effects are discussed in more detail in Section7.4.8.2. Monitoring plans are being developed to address uncertainties.

1.4 APPENDIX 7A – MAMMAL SURVEY METHODS

1.5 UNGULATE STUDIES (SECTION 7.5.3)

Aerial Surveys

Aerial surveys for ungulates (moose and caribou) were conducted in winter 2002 to 2006, and in the winters of 2011 to 2013. For the 2002 to 2006 surveys, two or three observers and a pilot flew in a fixed wing aircraft at approximately 100 m altitude. Ungulate counts included actual observation of individuals as well as signs of their presence (*e.g.*, tracks and feeding craters). Surveys typically consisted of both

reconnaissance trajectories and township flight blocks (Table 7A-11, Table 7A-12). Reconnaissance trajectories were designed to locate ungulate populations, particularly caribou, and followed coverage patterns recommended from local knowledge and expert information. The township flight blocks were selected by incorporating habitat (*i.e.*, common habitat types, burns, and linear feature replicates) into the design, and determined ungulate densities throughout the surveyed areas. Flights consisted of linear transects flown from north to south, and covered 15% to 100% of the block. The line of sight was estimated at 200 m on either side of the aircraft.

Table 7A-1: Survey Effort for Aerial Ungulate Surveys in the Caribou Regional Study Area, 2002 to 2006

		Township Blocks			Reconnaissance	All
Study Year	**Survey Period**	**Townships[1]**	**Distance (km)**	**Area (km²)**	**Distance (km)**	**Total Distance (km)**
2002	February 22-23, 2003	3	258	103	737	995
	March 16-20, 2003	8	1,671	668	165	1,836
	Total	8	1,929	771	902	2,831
2003	November 7, 2003	-	-	-	540	540
	November 19-22, 2003	18	973	390	458	1,431
	December 12, 2003	10	410	164	128	538
	December 16-17, 2003	8	545	218	147	692
	February 5-9, 2004	29	1,722	690	459	2,181
	Total	27	3,650	1,462	1,732	5,382
2004	December 6, 9, 2004	-	-	-	1,579	1,579
	January 18-20, 2005	22	1,397	559	0	1,397
	Total	21	1,397	559	1,579	3,516
2005	December 6, 2005	-	-	-	408	408
	January 12-15, 2006	20	829	332	77	906

Table 7A-1: Survey Effort for Aerial Ungulate Surveys in the Caribou Regional Study Area, 2002 to 2006

		Township Blocks			Reconnaissance	All
Study Year	Survey Period	Townships[1]	Distance (km)	Area (km²)	Distance (km)	Total Distance (km)
	March 30, 2006	19	619	181	0	619
	Total	20	1,448	513	485	1,933
2006	January 21-23, 2007	19	838	336	-	838

1. Some townships were surveyed more than once in a survey period.

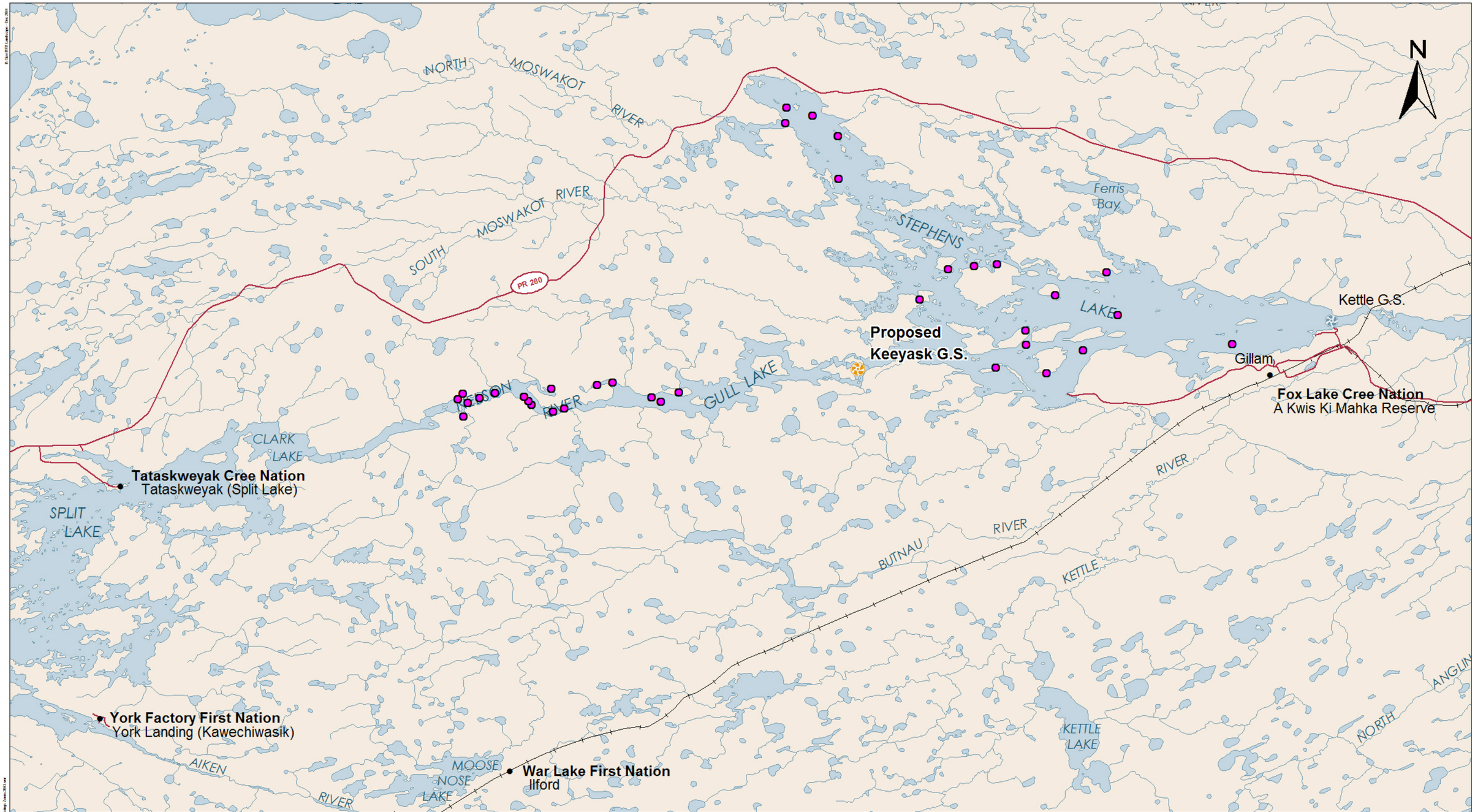
Table 7A-2: Survey Effort for Aerial Ungulate Surveys in Township Blocks in the Caribou Local Study Area, 2002 to 2006

Study Year	Survey Period	Townships[1]	Distance (km)	Area (km²)
2002	February 22-23, 2003	1	178	71
	March 16-20, 2003	4	940	376
	Total	4	1,118	447
2003	November 19-22, 2003	3	193	77
	February 5-9, 2004	5	324	130
	Total	5	517	207
2004	January 18-20, 2005	3	182	73
2005	March 30, 2006	2	143	57

1. Some townships were surveyed more than once in a survey period

Densities were calculated for township blocks in the Caribou Local and Regional Study Areas as individuals/km². Overall density was calculated as the mean of caribou densities over the survey period.

In the winter of 2011–2012, three observers and a pilot flew in a fixed wing aircraft at approximately 80 m above ground level (AGL). Flights consisted of linear transects flown from north to south, 2 km apart. Similar methods were employed in the winter of 2012–2013, but two aircraft were used, one surveying each side of the Nelson River. The area surveyed was 8,738 km² in 2011–2012 and 8,400 km² in 2012–2013. The location of all observations was marked with a GPS unit.



KEEYASK
Hydropower Limited Partnership

DATA SOURCE:
Caribou crossings - WRCS; Water - NTS; Roads and rail - Manitoba Conservation

CREATED BY:
ECOSTEM Ltd.

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	22-MAY-13	22-MAY-13
0 2 4 8 Kilometres / 0 2 4 Miles	VERSION NO: 1.0	QA/QC: RPB/YYY/ZZZ

Legend

Caribou River Crossings by Season

- Winter

Infrastructure

- Highway
- Rail

Caribou River Crossings

Winter 2013

UPDATES TO RESPONSE TO EIS GUIDELINES

2.0 UPDATES TO RESPONSE TO EIS GUIDELINES

2.1 EXISTING ENVIRONMENT (SECTION 6.2.3.4.7)

2.1.1 Caribou

Caribou are important to resource users, especially the KCNs, and are harvested by KCNs Members (although to a much lesser extent than moose) and other resource users (Section 6.2.3.6). The caribou hunt usually follows the autumn moose, duck, and goose hunt and occurs with the winter arrival of caribou (Section 6.2.6.2). Caribou are also important prey for large carnivores. The Caribou Local Study Area was Zone 4, and the Caribou Regional Study Area was Zone 6 in Map 6-28.

Three groupings of caribou are described for the Regional Study Area: barren-ground caribou (*Rangifer tarandus groenlandicus*), coastal caribou (*R. t. caribou*), which is a forest-tundra migratory woodland caribou ecotype, and summer resident caribou (summer residents), a type of woodland caribou whose exact range and herd association is uncertain.

- Barren-ground caribou from the Qamanirjuaq herd migrate from Nunavut in autumn to overwinter in Manitoba's northern forests and then leave the Regional Study Area in spring to calve. On occasion, a small fraction of the Qamanirjuaq herd may reach the Regional Study Area – about 10,000 animals migrated this far south once in the last 10 years, of the total 348,000 animals estimated for the population in 2008.
- Coastal caribou from the Cape Churchill and Pen Islands herds migrate from northern Manitoba and northern Ontario into parts of the Regional Study Area in winter. Historically, they leave the area in spring to calve. Larger groups of Pen Islands coastal caribou, numbering in the hundreds or thousands, have been observed in the Regional Study Area on occasion, but there are generally fewer than about 20 individuals counted in the Caribou Local Study Area during a typical winter.
- Summer resident caribou likely move within and beyond the Regional Study Area, but their core range is uncertain. These caribou remain in the Regional Study Area to calve, but the long-term frequency of calving is uncertain. Summer residents are conservatively estimated to number 20 to 50 individuals.

Habitat is selected by caribou at multiple spatial scales and is based on the level of disturbance present, as human-caused or natural alteration and fragmentation may attract moose, which in turn attract wolves, increasing the predation risk for caribou (Rettie and Messier 2000). Winter habitat for all caribou groups consists of undisturbed mature coniferous forest composed of black spruce, jack pine, or tamarack-dominated peatland, with a ground cover of lichens. Summer habitat applies only to summer resident caribou, as the other caribou groups do not occupy the region at this time. Summer calving and rearing habitats consist of relatively undisturbed islands in lakes or raised black spruce surrounded by expansive wetlands or treeless areas (peatland complexes). Potential calving habitats are common in the Regional Study Area, and habitat does not appear to be limiting to the summer resident cows and calves (TE SV).

2.1.1.1 Barren-ground Caribou

In the Keeyask region, barren-ground caribou migrate to the area north of the Nelson River (FLCN 2010). Previous studies indicated that barren-ground caribou from the Qamanirjuaq herd ranged as far south as Split Lake and as far east as the Hudson Bay railway track running between Ilford and Churchill (Miller and Robertson 1967; Split Lake Cree – Manitoba Hydro Joint Study Group 1996a). Caribou migration began to diminish in the 1950s, reducing hunting activity (Split Lake Cree – Manitoba Hydro Joint Study Group 1996). According to a FLCN resource harvester, a substantial decline in barren-ground caribou numbers began in the 1950s, and after construction of the Kettle GS, there were virtually none south of the Nelson River (FLCN 2010). In the 1990s, there was a limited return of caribou (Split Lake Cree – Manitoba Hydro Joint Study Group 1996) while recently, in the winter of 2004–2005, a large number of barren-ground caribou returned to the Keeyask region (FLCN 2010; TE SV). Current range data (Map 6-38) for the herd supports this distributional extent, where the southeastern limit is now near Stephens Lake (TE SV). The Qamanirjuaq population was estimated at 348,000 individuals in 2008. Few were observed in Manitoba in 2011, and the population may be in decline (Beverly and Qamanirjuaq Caribou Management Board 2011). About 10,000 Qamanirjuaq caribou have been estimated to reach the Regional Study Area, although this type of occurrence is infrequent (TE SV). The Nelson River generally serves as an extralimital boundary for Qamanirjuaq barren-ground caribou in the Keeyask region (Map 6-38). River crossing locations have been reported in the Regional Study Area and on the lower Nelson River (FLCN 2010). Few river crossing sites are reported from field studies. Genetic studies indicated that most barren-ground caribou genotypes were found north of the Nelson River between 2004 and 2006.

2.1.1.2 Coastal Caribou

Coastal caribou behaviour is similar to that of barren-ground caribou, particularly during calving and migration (Thomas and Gray 2002). Coastal caribou from the Cape Churchill and Pen Islands herds historically occur within the Regional Study Area in winter and leave in spring. The Pen Islands coastal caribou herd migrates from Ontario to the area south of the Nelson River (FLCN 2010 Draft), through Shamattawa to the Atkinson Lake area (WLFN 2002), as far west as the Nelson River at York Landing and as far south as Oxford House (Map 6-38). Animals from the Pen Islands herd were first reported in the Keeyask region in the 1990s (Thompson and Abraham 1994; Abraham and Thompson 1998; Abraham *et al.* 2012). In the mid-1990s, the herd size peaked and was estimated at 10,800 individuals (Abraham and Thompson 1998; Abraham *et al.* 2012). Less than 300 animals believed to be Pen Islands caribou are observed in the Regional Study Area in most winters. In the winter of 2011–2012, less than 30 caribou/survey were observed during field studies. However, larger migrations into the Regional Study Area were observed periodically in the winters between 2001 and 2005, and in 2013.

Large numbers of caribou were reported during a late January 2013 reconnaissance survey in the order of several thousand animals. Many observed animals were located near the proposed Keeyask Generating Station on the north side of the Nelson River. In early February 2013, 4,169 caribou thought to be from the Pen Islands herd were observed in Zone 5 between Split Lake and Long Spruce GS. From the

February data, it was estimated that 13,985 (± 18.17%, 95% CI) caribou were in the area (LaPorte *et al.* 2013[2]).

The Cape Churchill coastal caribou herd is currently estimated at 3,500 to 5,000 individuals and indications are that the population is likely stable. Although a large migration into the Regional Study Area was observed in winter 2010 (Manitoba Hydro 2011a), there are generally fewer than 50 animals in most winters. Based on radio-collaring data coinciding with the February 2013 survey (V. Trim, pers. comm.), none of the 4,169 caribou observed were thought to be Cape Churchill coastal caribou.

While the Nelson River serves as a physical boundary for both Pen Islands and Cape Churchill coastal caribou in the Keeyask region, river crossing locations have been reported in the Regional Study Area and on the lower Nelson River (FLCN 2010 Draft). Genetic studies indicated that coastal caribou genotypes were found north and south of the Nelson River between 2004 and 2006. Recent radio-collaring data indicate that most of the sampled Cape Churchill coastal caribou yearly activity is located north of the Nelson River while Pen Islands coastal caribou activity remains south of the river (Manitoba Conservation unpubl. data; Manitoba Hydro 2011a). Slightly more Pen Islands coastal caribou habitat use is found north of the Nelson River than Cape Churchill coastal caribou (Manitoba Conservation unpubl. data; Manitoba Hydro 2011a).

Aerial surveys of known calving grounds along Manitoba's Hudson Bay coastline indicate that summer residency has declined in the province, and some animals may have moved inland (Abraham *et al.* 2012). Summer use of the Keeyask region is described below, including cases where Pen Islands caribou appeared to be calving in the Stephens Lake area.

2.1.1.3 Summer Resident Caribou

In addition to barren-ground and Pen Islands caribou, some KCNs have identified a third variety of caribou common to the Keeyask region: woodland caribou, which are present year-round and can be distinguished from migratory caribou based on their appearance (FLCN 2010; FLCN 2012 Draft; YFFN Evaluation Report (*Kipekiskwaywinan*)). This group of caribou has recently been described as migratory woodland caribou (Mammals Working Group 2012; FLCN Environment Evaluation Report (Draft); Fox 2012 Draft). The exact core range, long-term calving frequency, and herd association of the caribou that remain in the Keeyask region year-round cannot be clearly determined. This group could be coastal caribou, woodland caribou, or a mixture of both, and are referred to as summer resident caribou.

Boreal woodland caribou (*R. t. caribou*), a forest-dwelling woodland caribou ecotype, are listed as threatened under SARA and MESA and occurred historically in the Keeyask region (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2005a). They do not tend to form large herds when calving and calve on islands when possible (Thomas and Gray 2002). The Nelson-Hayes boreal woodland caribou herd that once occurred within the Keeyask region blended with the coastal Pen

[2] LaPorte, N., R. Berger and P. Hettinga. 2013. Keeyask Caribou Aerial Survey Winter 2013. Keeyask Project Environmental Studies Program. Report prepared by Wildlife Resource Consulting Services MB Inc. for Manitoba Hydro, Winnipeg. 27pp.

Islands herd and no longer exists as a discrete population (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2005a). The current range of boreal woodland caribou (Map 6-38) extends into the southwest corner of the Regional Study Area near Thompson, but not as far as the Local Study Area (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2005a 05a; Environment Canada 2011).

The group of summer resident caribou in the Keeyask region (Photo 6-14) has been observed to calve in isolation or make use of island habitat, as is characteristic of boreal woodland caribou in Manitoba and elsewhere (Shoesmith and Storey 1977; Hirai 1998; Rettie and Messier 2000). Concurrently, recent data showed that a few radio-collared Pen Islands caribou cows occupied summer habitat in the Keeyask region over two years. At least one animal occupied summer habitat in the Keeyask region, but migrated long distances into Ontario the following spring (Manitoba Conservation unpubl. data; Manitoba Hydro 2011a).

Winter migration distances for several collared caribou were in the order of hundreds of kilometres, separating winter range from summer range, which is uncharacteristic of forest-dwelling boreal woodland caribou in Manitoba and elsewhere (Manitoba Conservation unpubl. data; Manitoba Hydro 2011a). During the winter, the summer residents most likely interact with migrating coastal caribou, which could make it difficult to differentiate among the mixed populations (Mammals Working Group 2012).

It is unclear whether summer residents are coastal caribou that periodically do not return to traditional calving areas in Ontario or northern Manitoba, boreal woodland caribou beyond their current recognized range, or a mixture of both. For the purposes of the assessment of potential Project effects, the group of summer resident caribou is being treated as an independent population that uses a smaller range than the migratory groups and is more likely to use calving and rearing habitat that occurs within the Keeyask region. Based on what is known of the area, a conservative estimate for the group of animals residing in the Regional Study Area in summer is 20 to 50 individuals.

Summer habitat is in peatlands and black spruce-dominated stands. Such habitat is selected for the availability of forage and for protection from predators, particularly during the calving season (Rettie and Messier 2000). When calving, summer residents inhabit calving and rearing complexes, which are clusters of islands in lakes or islands of black spruce surrounded by expansive wetlands or treeless areas (peatland complexes), to avoid predators. Primary calving and rearing habitat is defined as islands in lakes greater than 10 hectares (ha) in size or peatland complexes greater than 200 ha. Secondary calving and rearing habitat is defined as islands in lakes between 0.5 and 10 ha in size or peatland complexes between 30 and 200 ha. Based on field studies, caribou do not appear to be using all of the habitat available in the Local Study Area, with the possible exception of islands in Stephens Lake, which have become a productive calving and summering area for caribou. Approximately 55% of the islands sampled in Stephens Lake and Gull Lake were occupied by adult caribou during at least one summer between 2003 and 2011. Calving and rearing was documented on 10% of the islands in lakes and 5% of the islands in peatland complexes surveyed in 2010 and 2011. The earliest date that calves were detected on islands in lakes was June 8.

Source: WRCS, 2011 Caribou Calving Island Studies.

Photo 6-14: A Summer Resident Caribou in the Keeyask Region

Signs of the fall rut included observations of bulls in pursuit of single cows and harem collections on four large islands in Stephens Lake and in one peatland complex. Rutting habitat usually consists of open habitats, including open and semi-open bogs (Darcy and Pruitt 1984), which are habitats similar to calving and rearing complexes in the Keeyask region.

2.1.1.4 Historical Change and Future Trends

While caribou have been affected by previous hydroelectric development (YFFN Evaluation Report (*Kipekiskwaywinan*); FLCN Environment Evaluation Report (Draft)), including herd size, migration routes, and river crossings (FLCN 2010 Draft), signs of caribou activity were very common in the Local Study Area in summer, and usually sparse in winter. Large numbers of caribou occur infrequently in the Local Study Area (*e.g.*, the winters of 2004–2005 and 2012–2013), but they are more common in the Regional Study Area. Extreme annual variability in the number of animals was observed from 2001 to 2013 by the

technical study team, likely due to differences in the timing of movements and use of alternate migration routes and winter range. Caribou do not use the same migration routes each year because they use different portions of their winter range, which reduces the possibility of consuming all available food in a localized area. The timing of movements is influenced by snow fall and snow melt patterns, the timing and location of plant growth on the calving grounds, and long-term cycles, among other factors.

Past and existing human impacts and past climate change could influence future habitat for caribou in the Regional Study Area even if the Project does not proceed. Habitat composition, predation, and harvest will continue to be important caribou population drivers. Predicted trends in habitat composition include the future disappearance of the ground ice peatland types, which will be replaced by wetland peatland types and open water. The predicted habitat composition trends for caribou would likely be both positive and negative. Ground ice peatland forms some of the treed calving islands in peatland complexes. Lost calving islands will likely be replaced by wet habitat that provides caribou with protection against predators. Although both habitat components have value as caribou habitat, the net effect is uncertain. Finally, on-going changes in erosion resulting from past and existing projects will continue to reduce the size of future caribou calving islands. Because erosion will also contribute to formation of future islands, the net effect on caribou calving habitat is uncertain.

Recently, population declines have been detected for both barren-ground and coastal caribou, and management actions are being taken to reverse these trends. Qamanirjuaq barren-ground caribou are managed by the Beverly and Qamanirjuaq Caribou Management Board, while Manitoba Conservation and the Ontario Ministry of Natural Resources co-operatively manage and monitor the population of coastal caribou. With appropriate management, no changes to these caribou populations are anticipated due to predation and harvest, and long-term recovery efforts for boreal woodland caribou are also being implemented (Environment Canada 2011).

2.2 EFFECTS AND MITIGATON (SECTION 6.5.8.1)

2.2.1 Construction Effects and Mitigation

Through the following pathways, the Project has the potential to affect caribou during construction:

- Habitat loss, alteration of food and cover, and fragmentation due to physical removal of vegetation from the principal structures, south access road, dykes, camps, borrow areas, clearing of the reservoir, other supporting infrastructure, and changes in vegetation in Zone 2;
- Project-related disturbances from sensory disturbances (blasting, machinery, and people) and potential wildlife-vehicle collisions due to increased traffic on the access roads; and
- Access effects from potential increases in predation and in harvest by the workforce.

Potential Project effects on caribou, including summer residents, during construction include habitat loss and alteration from land clearing in Zone 2 and changes in caribou distribution within the Caribou Local Study Area. Physical habitat losses will include the reduction of food and cover available to caribou in the Local Study Area. About 6% or 6,825 ha (26 square miles) of the physical caribou winter habitat in the

Local Study Area is expected to be affected (Map 6-66). Approximately 1% of caribou winter habitat in Zone 5, the study zone in which intactness was assessed (see Section 6.2.3.4), will be affected. By extrapolation, less than 1% of the winter habitat in the Caribou Regional Study Area will likely be affected. As less than 1% of the vast winter range of the Qamanirjuaq, Cape Churchill, and Pen Islands herds will be affected, the effect of winter habitat loss on migratory caribou will be negligible to small. Although it is uncertain whether summer resident caribou use the Regional Study Area in winter, if they do, the effect of habitat loss is also expected to be negligible to small, especially if summer resident caribou travel with the migratory herds and range outside the Regional Study Area (Thompson and Abraham 1994; Manitoba Conservation, unpubl. data).

Summer resident caribou calving and rearing habitat will be lost in the Local Study Area. Evidence of calving was documented on approximately 10% of the islands in Gull and Stephens lakes and only 5% of the peatland complexes surveyed in 2010 and 2011, indicating that there is likely more habitat available than caribou are currently using. No suitable primary and secondary peatland complexes will be directly affected by the Project during construction. Two islands in Gull Lake will be lost at the GS site, only one of which was occupied by caribou with calves during field studies. As these islands comprise less than 1% of the primary calving and rearing habitat in the Regional Study Area, the initial loss of the islands at the GS site will likely be negligible.

Potential Project-related disturbances include sensory disturbances and mortality due to wildlife-vehicle collisions on the access roads. Sensory disturbances from blasting, machinery, and people will most likely cause caribou to avoid some winter habitat. Although a few caribou may habituate to small levels of noise disturbances and not all will be affected, blasting is unpredictable and could scare away most animals from the blasting zone of influence. Sensory disturbances in fall could affect rutting behaviour near the construction zone. It is unlikely that many caribou rut in Local Study Area, as the habitat is dominated by smaller peatland complexes that are generally unsuitable. Pre-rut behaviours observed on four large islands in Stephens Lake will not be affected. In the event that a few caribou rut near the construction zone, they are expected to find alternate areas in which to breed, and the effect of sensory disturbance on the rut are expected to be negligible to small.

In heavy construction areas, some summer resident caribou activity will likely decline within 2 km (1.2 miles) of the south access road and up to at least 4 km (2.5 miles) from the GS, which will most likely result in a loss of effective habitat (Manitoba Hydro 2011b). In addition to the loss of physical winter habitat, sensory disturbances will likely result in a 12% loss of effective habitat in the Local Study Area. Approximately 2% of winter habitat is expected to be affected in Zone 5, and by extrapolation, less than 1% of the winter habitat in the Regional Study Area will likely be affected. Caribou that move away from affected winter habitat will most likely find suitable habitat elsewhere in the Local and Regional Study Areas. As less than a 1% loss of effective winter habitat is anticipated in the Regional Study Area, the overall effect will likely be negligible to small (TE SV Section 7.4.7.2).

Sensory disturbances could result in a temporary loss of effective calving and rearing habitat and altered movements in the Local Study Area. About 510 ha (2.0 square miles), or 5% of the primary calving and rearing habitat in the Local Study Area is expected to be affected by sensory disturbance, all on islands in Gull Lake. Additionally, 695 ha (2.7 square miles) or 24% of secondary calving and rearing habitat in the

Local Study Area will likely be affected, including 23% of peatland complexes and less than 1% of islands in Gull Lake. In all, 1,205 ha (4.7 square miles) or 9% of primary and secondary calving and rearing habitat will be affected in the Local Study Area. Of this, 5% will be in peatland complexes and 4% will be on islands in lakes. Given the large amount of calving and rearing habitat, particularly peatland complexes, available on the landscape, less than 1% of effective primary and secondary calving and rearing habitat in the Regional Study Area is expected to be affected by sensory disturbance.

Caribou that encounter sensory disturbances prior to calving will likely move to unoccupied calving and rearing habitats elsewhere in the Local or Regional Study Areas. Sensory disturbances during the summer resident calving period could result in a very small number of cows and calves abandoning protective habitat in order to escape the disturbance. This could result in increased mortality through predation, as calves could leave protective habitat, resulting in increased predation risk. Caribou may avoid the Local Study Area due to construction noise, but the disturbance will be small in geographic extent and temporary, and no interruption of long-distance seasonal migration is anticipated. As sensory disturbance during construction will result in less than a 1% loss of calving and rearing habitat in the Regional Study Area and will not affect long-distance movements of migratory caribou, the overall effects will likely be negligible to small.

Collisions with vehicles are generally not listed as an important source of caribou mortality (Jalkotzy *et al.* 1997; Environment Canada 2011; Festa-Bianchet *et al.* 2011) and would likely be limited to caribou movement corridors and high-quality habitats between Thompson and the GS. Effects of mortality due to increased wildlife-vehicle collisions on caribou populations in the Regional Study Area will likely be small and should be negligible with mitigation.

Effects of improved access to the Local Study Area could include increased mortality due to predation. Predators, particularly gray wolves, often use linear features to travel and to hunt (James and Stuart-Smith 2000); wolves have been observed using transmission lines to move (Mammals Working Group 2010). Greater hunting efficiency and a potential influx of predators could increase caribou mortality, which is among the threats to some caribou populations (Environment Canada 2011; Festa-Bianchet *et al.* 2011). Habitat changes could result in the displacement of moose into areas occupied by caribou, increasing predation on caribou as predators follow (Kinley and Apps 2001). Both resident and transient gray wolves occur in the Regional Study Area. Most transient wolves are habitually wandering wolves that follow migratory caribou into the region. Resident wolves require moose as their primary prey base because there is not enough caribou and other alternate food biomass to sustain a wolf population with small or medium-sized territories in the Regional Study Area year-round (TE SV). When migratory caribou move into the territories of resident wolf packs for part of the year however, wolves usually hunt them while they are available. Limited prey switching can also occur if transient wolves opportunistically prey on moose. When the migratory prey leave, so do the transient wolves; the resident wolves remain and live off the regional population of moose.

Because the number and distribution of moose is not expected to change during construction (see moose section below), resident wolf density and distribution will not likely change. Mortality above the current rate for caribou as an alternative prey source is therefore highly unlikely during construction. Resident and transient gray wolf density in the Regional Study Area is low (estimated at less than 4/1,000 km²; TE

SV) and is not expected to change with the Project; therefore, predation effects on summer resident caribou will likely be small. As no net increase in the density of linear features is predicted in the Local Study Area (see below) during construction, predation efficacy will not likely change, thus the overall effect of predation will likely be neutral.

Effects of improved access to the Local Study Area could also include increased mortality due to hunting. Opportunistic harvest of caribou by workers (Section 6.7.3.1) and other resource users could increase during construction due to improved access to the Local Study Area, also increasing caribou mortality. FLCN Members are particularly concerned that increased access will increase hunting pressure (FLCN Environment Evaluation Report (Draft)). However, Game Hunting Area (GHA) 3, the area where caribou hunting is permitted, overlaps only a small portion of the Local Study Area near Gillam, and the low number of resident licences available for caribou harvest is managed by the Province (Section 6.2.3.6; TE SV). The potential increase in caribou mortality due to workers hunting will be managed (see Mitigation) and the overall effect will be neutral. In addition, as the north access road will be the main access route to the GS during construction (Chapter 4), effects are expected to be neutral on the south access road during construction.

Fragmentation, a landscape-level process in which human features progressively subdivide habitat blocks into smaller and more isolated fragments, is described in Section 6.2.3.4. The potential for the access roads to fragment habitat, compounded by increases in traffic (Laurian *et al.* 2008), could influence caribou by acting as a barrier to movement, contribute to mortality from predation and hunting access, and reduce core area size. Including the Thompson area, the current density of existing linear features in Zone 5 (0.45 km/km²; Section 6.5.3.3) is at the low end of the moderate magnitude range. The density of existing linear features in Zone 5 decreases when the area around Thompson is excluded (0.32 km/km²), and the magnitude of the effect of existing features on caribou is small. A small net decrease (less than 1%) in linear feature density is anticipated with the construction of the Project, as some existing linear features will be removed during clearing of borrow areas and camps, and some cutlines will be converted into the main access roads. For caribou, the overall effect of a reduction in linear feature density will be negligible to small and positive. The number of core areas larger than 200 ha (0.8 square miles) or 1,000 ha (3.9 square miles) that caribou most likely use is expected to decrease by only 1% in Zone 5. Eighty-two percent of the largest core areas will remain intact, and the overall effect of habitat fragmentation will likely be small.

The federal government outlines criteria to assess boreal woodland caribou ranges to measure the long-term viability of a caribou population. Habitat disturbance considers the effects of fire in addition to human features. A minimum of 65% of habitat should remain undisturbed in order to sustain a population (Environment Canada 2011). Currently, 48% of the estimated range for caribou in Zone 5 is undisturbed (Map 6-67). Fire has the largest effect on caribou habitat in the Keeyask region; 36% of Zone 5 is less than 40 years old. Based solely on this criterion, the Keeyask region is unsuitable for a sustainable boreal woodland caribou population, especially a small one that ranges from 20–50 animals. Because changes to intactness will be negligible, effects on caribou will likely be negligible. The Project will not contribute to measurable changes in caribou habitat intactness of the Regional Study Area.

While the level of natural and human-caused disturbance is an important factor in the assessment of the effects of habitat disturbance, others factors to consider include the types of caribou in the area, their ranges, and the availability of suitable calving habitat. In addition to the habitat requirements of those summer resident caribou represented in Zone 5, recent radio-collaring data have shown that at least one caribou spent a summer in the Keeyask region and migrated to the coast the following year (Manitoba Conservation, unpubl. data). Other caribou from the same study have shown large migratory movements nearing Shamattawa and large annual ranges, which are not consistent with the shorter migratory movements and small annual ranges of forest-dwelling woodland caribou populations found elsewhere in Manitoba (Manitoba Hydro 2011a). These movements indicate the actual range use of collared caribou extends beyond the Regional Study Area, and the undisturbed portion of their overall range is likely greater than in the Regional Study Area (Manitoba Hydro 2011a). The islands in Stephens Lake are frequently used for calving, and this area should be recognized as suitable habitat. Finally, recognized boreal woodland caribou populations in Manitoba have persisted on landscapes with less than the recommended 65% undisturbed habitat benchmark; however, the long-term viability of these populations is uncertain (Environment Canada 2011). Because some of the summer resident caribou are likely coastal caribou, caribou are not using all of the calving and rearing habitat currently available in the Regional Study Area, and the proportion of undisturbed habitat is greater beyond the Regional Study Area, the effect of habitat disturbance on summer resident caribou is predicted to be small.

Mitigation measures for caribou will include the following:

- The excavated material placement areas were sited to avoid caribou calving complexes and reduce habitat loss;
- The access roads were routed to avoid caribou calving complexes and reduce loss of effective habitat;
- Future calving islands greater than 0.5 ha in the reservoir area will be flagged and left undisturbed to protect the vegetation that will remain on these islands from clearing disturbances;
- Blasting will be minimized to the extent practicable from May 15 to June 30, to reduce the effects on calving females and their young;
- A Construction Access Management Plan will be implemented to reduce the effects of increased access to the Local Study Area;
- Gates will be added to the north and south dykes, to be kept closed and locked from May 15 to June 30 and during other sensitive periods as may be determined by monitoring (*e.g.*, the arrival of migratory caribou) to minimize disturbances by humans;
- Firearms will be prohibited in camps and at work sites to reduce mortality due to hunting during construction;
- Roadside ditches will be rehabilitated with native plants with low quality food value for caribou where practicable, to minimize attraction and the risk of collisions and harvest opportunities;
- Fire prevention measures will be employed in remote working environments to minimize the risk of habitat loss for caribou;

- Staff working on-site will attend wildlife awareness training;
- To reduce the possibility of vehicle and wildlife collisions, posted speed limits will not be exceeded;
- Wildlife crossing signs will be posted along the access road in areas of high-quality caribou habitat and travel corridors and are to be respected;
- No person on-site will feed or harass wildlife. Failure to comply could lead to dismissal from the Project;
- When large numbers of caribou are known to be moving through the Project area, daily safety briefings will be used to advise workers about caribou movements in the area; and
- Traffic control measures (crossing signs and stop signs) will be used in the event large numbers of migratory caribou are located near the construction site to prevent the harassment of caribou on roads, and to minimize the likelihood of caribou-vehicle collisions. If caribou are attempting to cross or crossing the access roads or construction areas, then traffic will stop and wait for them to cross without harassment.

2.2.2 Residual Effects of Construction

Residual effects on caribou that are expected and likely once the appropriate mitigation measures are applied will be localized altered movements and distributional changes due to sensory disturbance; and decreased abundance due to reduced habitat and increased mortality. Most Project effects will be negligible to small, particularly since habitat currently appears to be under-utilized, limited mainly to the Local Study Area, and affect two or more generations. Regional effects could include any indirect caribou mortality associated with the Project, but these are also expected to be negligible.

Using the criteria established to determine the significance of Project effects for regulatory purposes (described in Chapter 5), the likely residual effects of Project construction on caribou are expected to be adverse, small in geographic extent, long-term in duration, and small in magnitude. Step 2 analysis is screened out based on Step 1 analysis.

2.2.3 Operation Effects and Mitigation

Through the following pathways, the Project has the potential to affect caribou during operation:

- Habitat loss and alteration due to flooding, shoreline erosion, peatland disintegration, and reservoir-related groundwater and edge effects;
- Project-related disturbances due to sensory disturbances from traffic, potential changes in river crossings due to altered ice conditions, reduced movements along shorelines due to woody debris, and mortality from potential wildlife-vehicle collisions due to increased traffic on the access roads; and
- Access effects from potential increases in predation and in harvest by resource users.

During operation, effects on caribou, including summer resident caribou, will include additional habitat loss and alteration. Long-term effects are associated with flooding, shoreline erosion, peatland disintegration, and reservoir-related groundwater and edge effects; these are discussed in Section 6.5.3.1 and below. No additional loss of winter habitat is expected above construction losses, although with flooding, habitat loss will be permanent. As no additional loss of winter habitat is anticipated, effects are expected to be negligible to small.

Approximately 257 ha (1.2 square miles), or less than 2%, of primary calving and rearing habitat in the Local Study Area will be affected in the reservoir by year 30 of operation. A 65% increase in the area of islands in lakes between 0.5 and 10 ha is anticipated. Groundwater effects on vegetation could reduce the quality of potential caribou habitat on new islands formed in the reservoir and on existing islands such as Caribou Island. In a worst-case scenario, all islands in the reservoir could change from primary to secondary calving and rearing habitat, predicted with a moderate level of uncertainty. In total, less than 1% of all calving habitat in the Regional Study Area is predicted to be affected by the Project during operation. Thus, the effects of the loss or alteration of calving and rearing habitat will likely be small.

Project-related disturbances to caribou during operation could include sensory disturbances from traffic on the access roads and from noise and workers at the GS site, and mortality due to wildlife-vehicle collisions on the access roads and at river crossing sites. Sensory disturbance from traffic on the access roads could result in avoidance of the area by some caribou, particularly Pen Islands animals and summer residents on the south side of Stephens Lake in the Local Study Area. The degree of avoidance will likely depend on the volume of traffic on the access roads (Jalkotzy *et al.* 1997). It is predicted that primary calving and rearing habitat within 2 km (1.2 miles) of the GS will be less suitable for calving, and will be more likely to be used by adults without calves. Summer resident caribou with fidelity to existing calving sites will highly likely cross the highway to gain access to high quality calving habitat on Stephens Lake. Early in the operation phase, caribou will likely re-occupy most habitats that were avoided during construction, but some loss of effective habitat, up to 500 m from the road and less for cutlines, will continue over the long term. Less than 1% of the available calving and rearing habitat in the Regional Study Area is expected to be affected, thus effects will likely be negligible to small. Based on past experience by some of the KCNs, it will take decades before caribou return to the Project area (YFFN Evaluation Report (*Kipekiskwaywinan*)), or they may not return to the area (FLCN Environment Evaluation Report). Monitoring will be required (see Chapter 8).

Collisions with vehicles are generally not listed as an important source of caribou mortality (Environment Canada 2011). As the risk of wildlife-vehicle collisions is unlikely to change during operation, the effects of mortality due to collisions with vehicles on caribou populations in the Regional Study Area are expected to remain negligible to small.

Several river crossing sites between Birthday Rapids and Hidden Creek were observed in February 2013 (Map: Caribou River Crossings Winter 2013). Resource users from the KCNs have observed caribou crossing the Nelson River just downstream of Gull Rapids (FLCN 2010 Draft). Based on experience with past hydroelectric projects, the KCNs raised concerns about caribou drowning as a potential Project effect due to an altered ice regime. Although no increase in caribou drowning as a direct result of the Project is anticipated, there is uncertainty associated with the conditions under which the risk of mortality

can change. The earlier formation of thin ice across the reservoir, which could occasionally coincide with the arrival of caribou in the Local Study Area, could increase the risk of drowning mortality. However, once the ice has formed, an increase in caribou drowning is unlikely on the reservoir because post-Project conditions include the formation of a stable ice cover on the reservoir (*i.e.*, smoother and more consistent than the existing environment), including maintaining a steady reservoir level during freeze-up and monitoring ice thickness (Project Description Supporting Volume), and less variation in water levels once the reservoir is established relative to current conditions (Mammals Working Group 2011). Monitoring will be required (see Chapter 8).

Other Project-related disturbances could include reduced local movements by caribou along shorelines due to debris. A negligible to small effect is anticipated because the Reservoir Clearing Plan (Chapter 4 Appendix 4A) and Waterways Management Program (Chapter 4 Appendix 4B) will mitigate these effects.

Effects of improved access to the Local Study Area could include increased mortality due to predation and hunting. During operation, the number and length of linear features in the Local Study Area is not expected to change (see Section 6.5.8.2), nor will the overall numbers of gray wolves or moose. As a result, the overall effect of predation on caribou is not expected to change and the effect will remain small during operation.

Effects of improved access also include increased caribou mortality due to hunting. With their low reproductive rate, caribou cannot sustain high losses due to hunting, which could increase as access to the Local Study Area by the public becomes available via the north and south access roads. Access to the area already includes waterbodies and watercourses, the existing Provincial Road 280, cutlines and trails, railways, and transmission lines, whose use as transportation routes to support the sustainable domestic harvest in the Regional Study Area varies seasonally. Once the Project is commissioned, PR 280 will be re-routed to include the north access road, the GS facility over the Nelson River and the south access road to Gillam (Chapter 4, Appendix 4B). This new section of PR 280 could increase local caribou hunting activity by domestic resource users. Increased access is also expected with the provision of boat launches above and below the GS (see Section 6.7.3.2). The traditional harvest of caribou by the KCNs usually occurs in late fall and winter and focuses on migratory caribou populations. With the exception of two large harvests of migratory caribou in the last 10 years (TE SV; Manitoba Hydro 2011a), only a small number of caribou have been harvested from the Local Study Area (CNP Keeyask Evaluation Report; YFFN Evaluation Report (*Kipekiskwaywinan*); FLCN 2010 Draft). However, many caribou are harvested from the Regional Study Area, from the surrounding GHAs, and into Ontario and Nunavut by all resource users. Including considerations for sustainable caribou management by the Province (mainly via regulation of licensed hunting in Manitoba), the effects of harvest on caribou populations in the Local Study Area are not expected to contribute to a large degree to the effects of the broader regional harvest, thus the effect is expected to be small during operation.

AEA offsetting programs will, among other purposes, provide alternative harvesting opportunities in the Split Lake Resource Management Area (SLRMA) to replace the loss of traditional resource use areas due to the Project. These programs are expected to disperse existing harvest pressures in the Local Study Area. For waterfowl and moose, traditional wildlife harvest land-use activities happen in the spring and fall respectively. The traditional harvest of caribou occurs in winter, and because there is no overlap with

other hunting seasons, the harvest of caribou is not expected to increase in the SLRMA (Section 6.7.3.2) and effects of access programs on caribou will likely be neutral.

No additional change in the density of linear features is expected in Study Zone 5 during operation, therefore effects of habitat fragmentation on caribou during operation will be neutral.

Mitigation measures for caribou will include the following:

- Except for the existing resource-use trails (see Construction Access Management Plan), Project-related cutlines and trails will be blocked where they intersect the Project Footprint, and the portions of these features within 100 m of the Project Footprint will be revegetated to minimize the risk of effects related to predation and human access;
- Temporarily cleared areas and excavated materials placement areas (Section 6.5.3.2) will be rehabilitated to native habitat types where feasible to improve caribou habitat;
- Warning signs should be maintained in areas along the access roads with caribou activity to caution motorists; and
- A plan is being developed to coordinate caribou mitigation and monitoring activities among Manitoba Hydro's northern developments, as well as with government authorities and existing caribou committees and management boards.

2.2.4Residual Effects of Operation

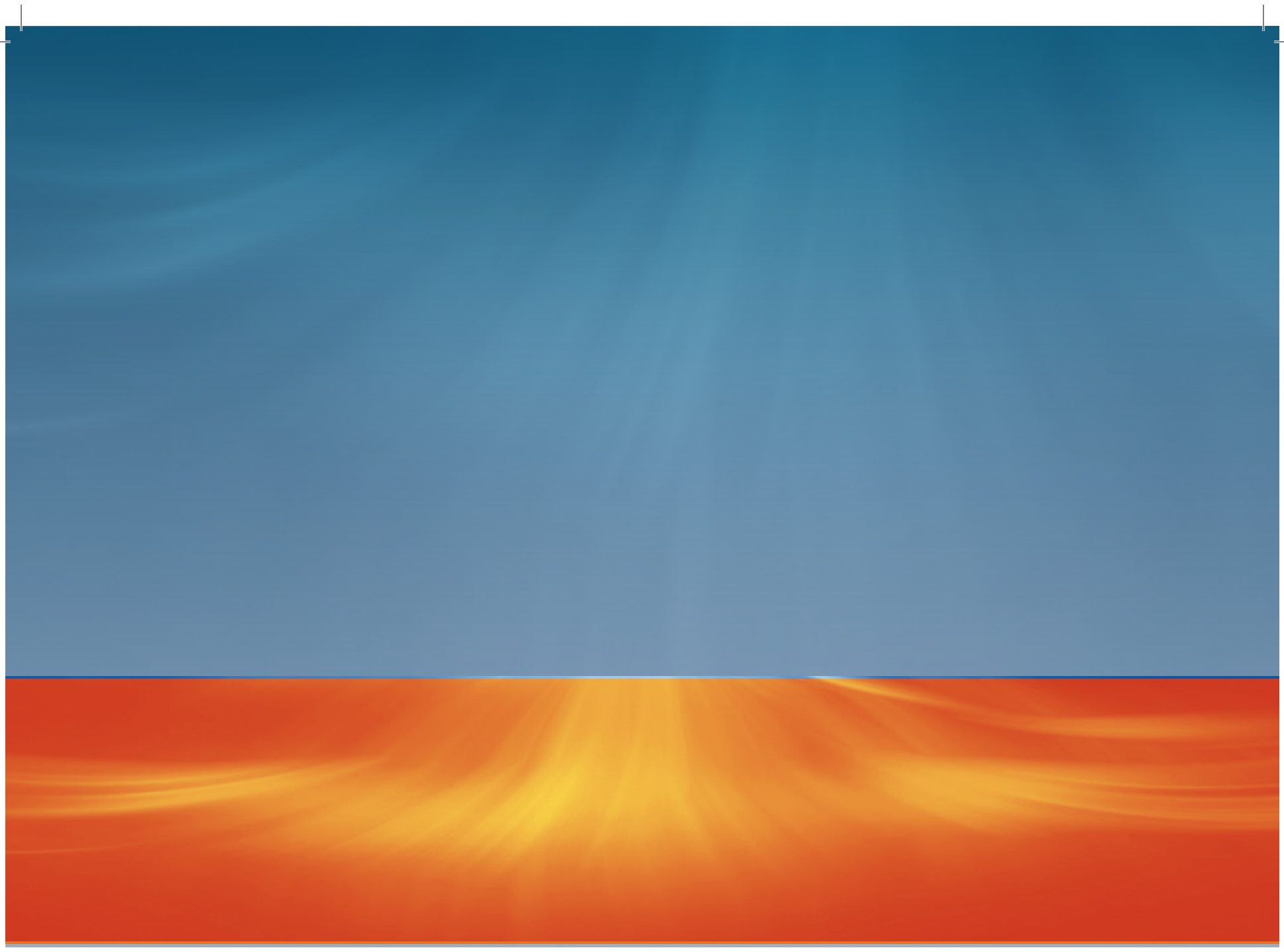
Residual effects on caribou that are expected and likely once the appropriate mitigation measures are applied will be altered movements due to reduced intactness and sensory disturbance, and decreased populations due to reduced habitat and increased mortality. Effects will be small, extending towards the Regional Study Area due to the possible effects of harvest, and affect two or more generations.

Using the criteria established to determine the significance of Project effects for regulatory purposes (see Chapter 5), the most likely residual effects of Project operation on caribou are expected to be adverse, medium in geographic extent, long-term in duration, and small in magnitude. Step 2 analysis is screened out based on Step 1 analysis.

2.2.5Conclusion About Residual Effects on Caribou

Overall, the likely Project residual effects on caribou are expected to be adverse but regionally acceptable because: less than 1% of the region's under-utilized calving and rearing habitat and winter habitat will be lost; only a negligible change in intactness is expected in Zone 5; additive residual Project effects on caribou mortality will likely remain small and below established benchmarks; and, because altered movements and distributional shifts are most likely limited only to habitat near the Project infrastructure, these are unlikely to affect the landscape-level movements and distribution of caribou in the region. There is a moderate to high degree of certainty for caribou in the assessment because of some unpredictability regarding the long-term frequency and variability of habitat use and movements, but high confidence in habitat availability, and existing summer core areas and regional intactness estimates.

The adverse residual effects of the Project on caribou will overlap spatially and temporally with effects from the following future projects: Bipole III Transmission Project, Keeyask Transmission Project, Conawapa Generation Project, and Gillam Redevelopment. These projects will increase habitat loss, reduce intactness, increase fragmentation and increase mortality due to increased human presence and access effects. The cumulative effects are discussed in more detail in Chapter 7. The KCNs are concerned about cumulative effects with other future projects, and with the uncertainty associated with the presence of woodland caribou in the Regional Study Area. Monitoring plans are being developed to address uncertainties. These are discussed in Chapter 8.



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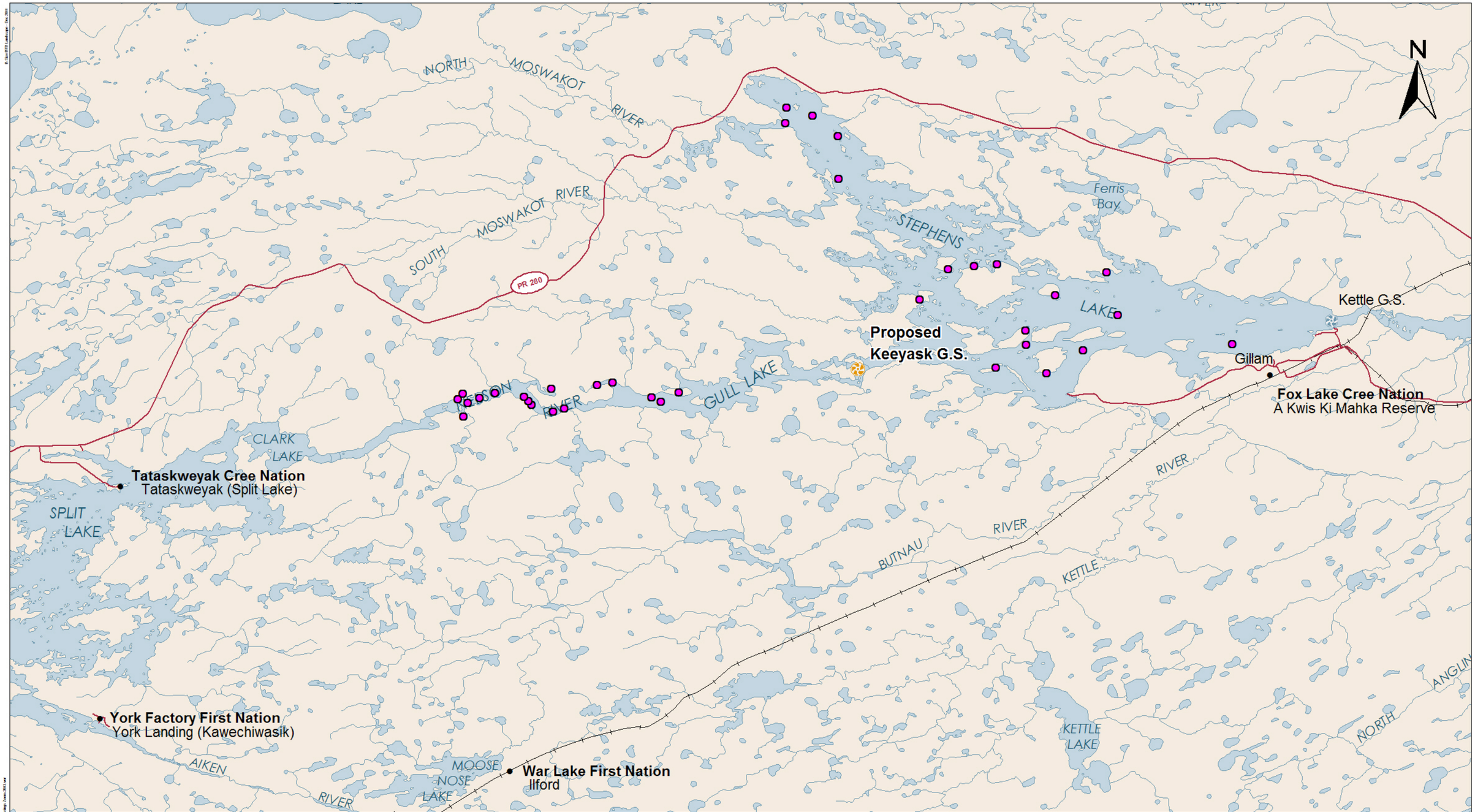

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DATA SOURCE:
Caribou crossings - WRCS; Water - NTS; Roads and rail - Manitoba Conservation

CREATED BY:
ECOSTEM Ltd.

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	22-MAY-13	22-MAY-13
0 2 4 8 Kilometres / 0 2 4 Miles	VERSION NO: 1.0	QA/QC: RPB/YYY/ZZZ

Legend

Caribou River Crossings by Season

- Winter

Infrastructure

- Highway
- Rail

Caribou River Crossings

Winter 2013