Keeyask Transmission Project
Avian Technical Report

OCTOBER 2012

KEEYASK TRANSMISSION PROJECT

AVIAN TECHNICAL REPORT

PREFACE

The following is one of several technical reports for Manitoba Hydro's application for environmental licensing of the Keeyask Transmission Project. This technical report has been prepared by an independent technical discipline specialist who is a member of the Environmental Assessment Study Team retained to assist in the environmental assessment of the Project. This report provides detailed information and analyses on the related area of study. The key findings outlined in this technical report are integrated into the Keeyask Transmission Environmental Assessment Report.

Each technical report focuses on a particular biophysical or socio-economic subject area and does not attempt to incorporate information or perspectives from other subject areas with the exception of Aboriginal Traditional Knowledge (ATK). Applicable ATK is incorporated where available at time of submission. Most potentially significant issues identified in the various technical reports are generally avoided through the Site Selection and Environmental Assessment (SSEA) process. Any potentially significant effects not avoided in this process are identified in the Environmental Assessment Report along with various mitigation options that would address those potential effects.

While the format of the technical reports varies between each discipline, the reports generally contain the following:

- Methods and procedures.
- Study Area characterization.
- Description and evaluation of alternative routes and infrastructure sites.
- Review of potential effects associated with the preferred transmission routes and station sites.

Following receipt of the required environmental approvals, an Environmental Protection Plan (EnvPP) will be completed and will outline specific mitigation measures to be applied during construction, operation and maintenance of the proposed Keeyask Transmission Project. An EnvPP is typically developed from a balance of each specialist's recommendations and external input.

Each of the technical reports is based on fieldwork and analysis undertaken throughout the various stages of the SSEA process for the Project. The technical reports are as follows:

- Technical Report 1: Aquatics Environment
- Technical Report 2: Terrestrial Habitat, Ecosystems and Plants
- Technical Report 3: Amphibians
- Technical Report 4: Avian

- Technical Report 5: Mammals
- Technical Report 6: Forestry
- Technical Report 7: Socio-economic Environment
- Technical Report 8: Heritage Resources
- Technical Report 9: Tataskweyak Cree Nation Report on Keeyask Transmission Project

The technical reports contain more detail on individual subject areas than is provided in the Environmental Assessment Report. The technical reports have been reviewed by Manitoba Hydro, but the content reflects the opinions of the author. They have not been edited for consistency in format, style and wording with either the Environmental Assessment Report or other technical reports.

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EXECUTIVE SUMMARY

Keeyask HydroPower Limited Partnership is currently proposing to develop a generation station, the Keeyask Generation Project, along the Nelson River at Gull Rapids. As a related component of this potential project, Manitoba Hydro, "the Proponent," is proposing construction of the Keeyask Transmission Project (the Project). This Project includes the development of a Construction Power line that would convey power between an existing transmission line (KN36) and the site where the Keeyask Generation Station would be built, and separate Generation Outlet Transmission lines that would transfer power generated by the Generation Station to the Radisson Converter Station.

Site Selection and Environmental Assessment (SSEA) studies were conducted to gather information on a variety of wildlife groups, including birds, using the habitats within areas where the proposed transmission line routes are located. Information gained through these bird studies, together with other environmental study results, was used to assist in the route selection process for both the Construction Power and Generation Outlet Transmission Lines.

Three years of field studies were conducted for the Keeyask Transmission Project (2009-2011). Data was collected along the Construction Power and Generation Outlet Transmission Lines alternative routes and in the vicinity of the Radisson Converter and Keeyask Switching Stations. Local knowledge was sought while conducting field surveys and was gathered opportunistically throughout the field and reporting processes. Results of field studies were augmented by information collected during Generation Station studies.

Within the Region, the diverse terrestrial habitats and abundant food sources (e.g., insects, seeds) support several landbird species (i.e., songbirds, woodpeckers, upland game birds, raptors, nighthawks), including resident species (e.g., gray jay (*Perisoreus canadensis*), ruffed grouse (*Bonasa umbellus*), boreal owl (*Aegolius funereus*) that inhabit the Region year-round. Inland lakes, creeks and wetlands provide key breeding habitats for many waterbirds including ducks, shorebirds and sandhill cranes (*Grus canadensis*).

Three species at risk, as designated by the Committee on the Status of Endangered Species in Canada (COSEWIC) and the *Species at Risk Act* (SARA) were observed during field studies for the Project. These were olive-sided flycatcher, rusty blackbird and common nighthawk. As well, four other species (yellow rail, short-eared owl, red knot and peregrine falcon) have the potential to occur in the Study Area.

The two alternative Construction Power Transmission Line routes and the four Generation Outlet Transmission Line routes were surveyed and compared with regard to their potential for effects for all environmental components. The route options with the least potential for negative effects were identified for each component (e.g., birds, mammals, terrestrial habitat, etc.).

The sites for the Construction Power and Switching Stations were selected more for technical consideration, but they had been determined to be similar regarding their potential for effects on birds and other environmental components.

Potential negative effects of the Project were mitigated to the extent feasible by route selection decision making. Where negative effects were still possible, these will be were minimized or eliminated through various mitigation measures. Mitigation measures to be employed included:

- Winter clearing of rights-of-way and station sites to reduce potential for impacts on nesting birds.
- Allowing some regrowth of vegetation along the rights-of-way to provide bird habitat.
- Restriction of hunting by Project workers to reduce negative impacts on migratory and upland gamebirds.
- Avoidance and buffering of large stick nests found in construction areas.

Effects of the Keeyask Transmission Project on bird communities will exist for the life of the Project. These effects will include minor habitat loss at station sites and transmission tower footprints, sensory disturbance during construction activities, a potential for increased foraging and/or nesting opportunities for species which prefer open areas, mortality and increased hunting pressure. However, these effects are expected to be small, and likely not measurable within the range of natural variation of bird populations.

1.0 INTRODUCTION

The Keeyask Transmission Project is required to transmit power, created by the proposed Keeyask Generation Project. Keeyask HydroPower Limited Partnership is currently proposing to develop a generation station, the Keeyask Generation Project, along the Nelson River at Gull Rapids. As a related component of this potential project, Manitoba Hydro, "the Proponent," is proposing construction of the Keeyask Transmission Project ('the Project'). This project includes the development of a Construction Power Transmission Line that would convey power between an existing transmission line (KN36) and the site where the Keeyask Generating Station would be built, and separate generation outlet lines that would transfer power generated by the Generation Station to the Radisson Converter Station (Map 1-1).

In 2009 and through 2011, Site Selection and Environmental Assessment (SSEA) studies were conducted to gather information on a variety of wildlife groups, including birds, using the habitats within areas where the proposed transmission line routes are located. Information gained through these avian studies, together with other environmental study results, was used to assist in the route selection process for both the Construction Power Transmission Line and Generation Outlet Transmission Lines. Ultimately this information will be used in the development of the standalone Keeyask Transmission Project Environmental Assessment Report that will be submitted to Manitoba Conservation and Water Stewardship for licensing approval.

This report provides information gathered in June 2009, 2010 and 2011 on avian communities utilizing various habitats located throughout the areas proposed for transmission line development. Avian abundance and diversity was described for the various habitat types potentially affected by the Project. A route analysis based on habitat data and avian community data was conducted to determine if Construction Power Transmission Line routes and/or Generation Outlet Transmission Line routes differed in terms of their potential to impact high-quality avian habitat.

1.1 PROJECT COMPONENT OVERVIEW

1.1.1 Construction Power Transmission Line and Station

A new Construction Power Transmission Line (138-kV and approximately 22 km long) from the existing 138-kV KN36 transmission line to a new 138-kV to 12.47-kV Construction Power Station to be located north of the proposed Keeyask Generation Station.

The purpose of the Construction Power Transmission Line and Station is to provide power for the construction activities of the Generation Station. After operation, the Construction Power Station will be left in place, as will a portion of the Construction Power Transmission Line, to

provide a contingency function for a "black start"[1] emergency backup to diesel generation units at the Generation Station (Figure 1-1).

1.1.2 Unit Transmission Lines

Four 138-kV AC Unit Transmission lines (KE1 to 4) will transmit power from the seven generators located at the Keeyask Generation Station to the new Keeyask Switching Station. Three lines will be double circuit and one line single circuit to accept power from the seven Generation Station turbines. The four lines, each approximately 4 km long, will be located in a single corridor.

1.1.3 Keeyask Switching Station

A new Keeyask Switching Station will accept power from Generation Station via the four Unit Transmission lines from the Generation Station transformers and transfer that power to three Generation Outlet Transmission lines. The Switching Station will be located on the south side of the Nelson River. The purpose of the Switching Station is to provide the terminal facilities for the electrical connection to the Generation Station, and to provide flexibility for accommodating power transmission from the Generation Station to the Radisson Converter Station (Figure 1-2).

1.1.4 Generation Outlet Transmission Lines

Three 138-kV AC Generation Outlet Transmission (GOT) lines will transmit power from the Keeyask Switching Station to the existing Radisson Converter Station 138-kV AC switchyard. The three lines, each approximately 38 km long, will be located in a single corridor. Manitoba Hydro plans to build one of these Generation Outlet Transmission lines to serve as a backup construction power line during construction and the line will be partially salvaged back to the Keeyask Switching Station and utilized as a Generation Outlet Transmission Line.

1.1.5 Radisson Converter Station Upgrades

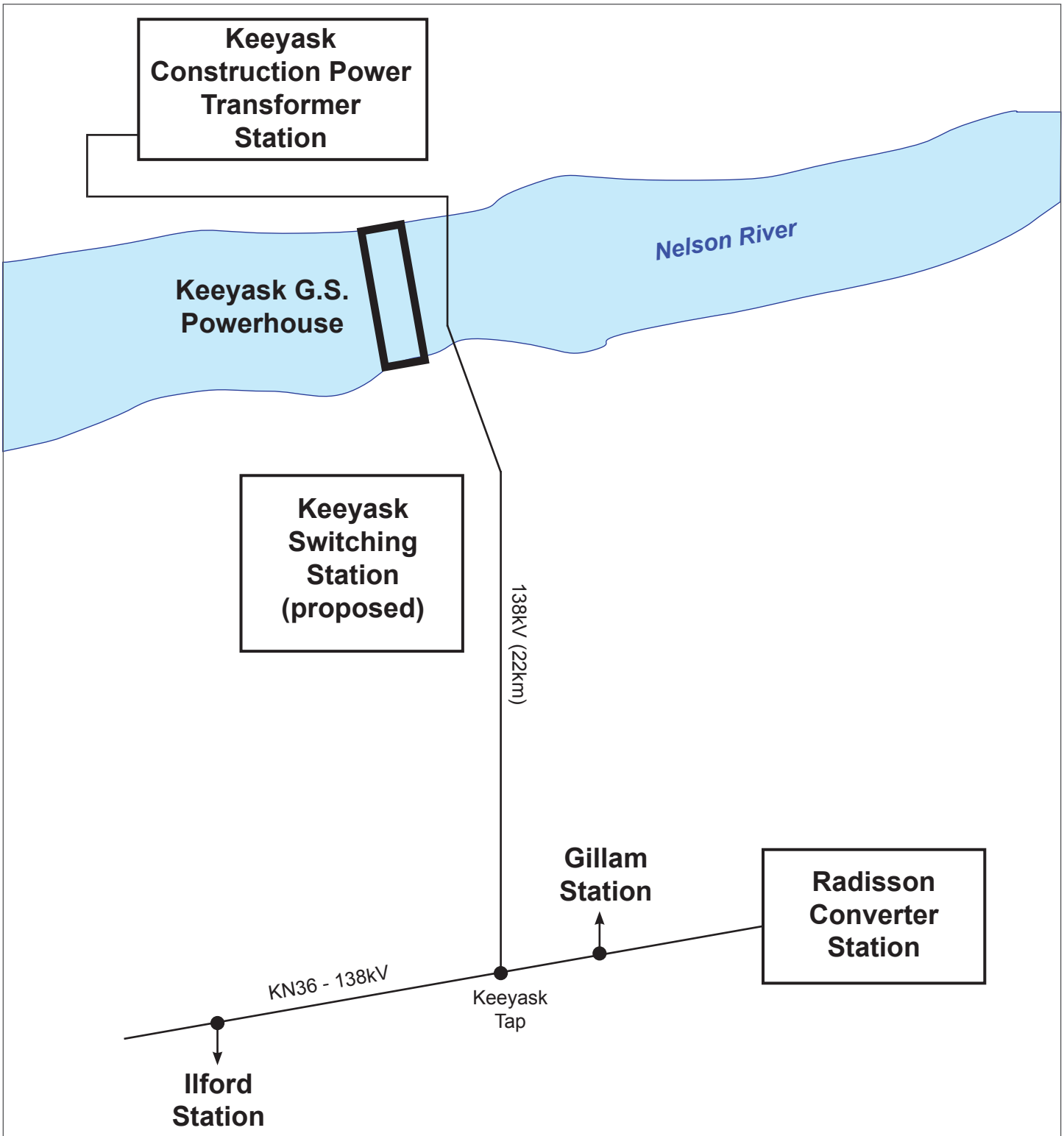
The existing Radisson Converter Station will be upgraded in two stages, as follows:

1. Stage I: Radisson Converter Station will require the addition of a 138-kV breaker to accommodate the initial new 138-kV transmission line KR1 from Keeyask Switching Station.

2. Stage II: Station equipment will include the addition of a 138-kV bay (Bay 1) complete with four 138-kV breakers and associated equipment for the termination of two additional lines (KR2 and KR3) from Keeyask Switching Station. KR2 and KR3 will enter the west side of the station utilizing dead-ended steel structure with line switches. The KR2 and KR3 lines will

[1] Black start is the process of restoring a power station to operation without relying on the external electric power transmission network or grid.

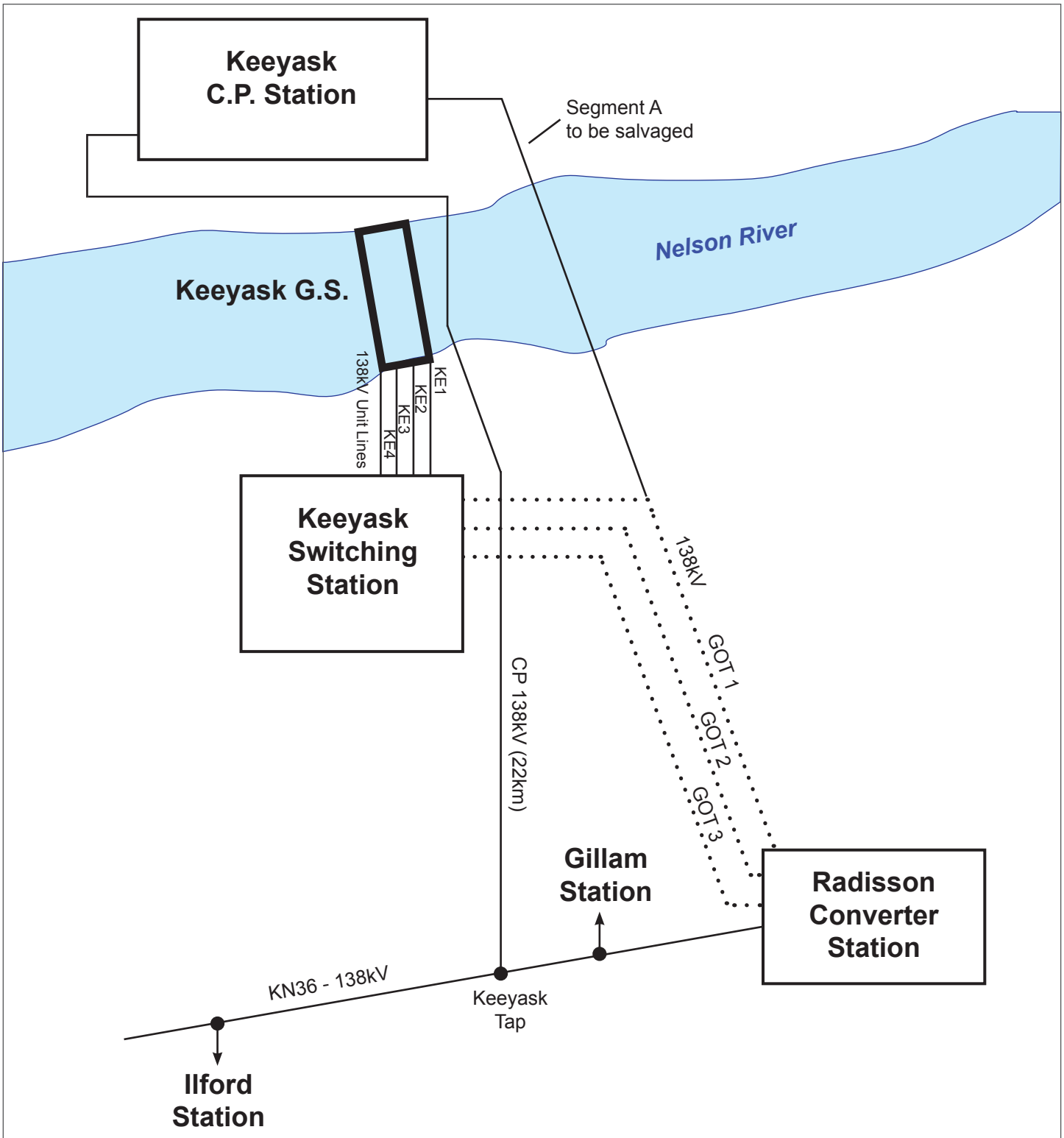
proceed underground around the station and finally terminate to Bay 1. This is done to avoid complex line crossings into the station. Thirty-one 138-kV AC breakers will also need to be replaced due to fault levels exceeding existing breaker ratings.



Notes:

- Construction power line & transformer station required to provide power to construction site.
- Construction power line remains in service to serve as “black start” during operations.
- Part of transformer station is decommissioned after construction.

Figure 1-1. Schematic of Proposed Construction Power (CP)



Notes:

- Generation outlet transmission lines & switching station are required to deliver power from Keeyask to Radisson Converter Station.
- GOT 1 is built at start of construction to act as backup to CP line.
- A segment of GOT 1 (Segment A) is salvaged after construction & GOT 1 is re-terminated at SS.

G:_GIS_Project_Folder\00_Hydro\111420007_Kysk_Outlet_Transmission\InDesign\Construction_Pwr_Schematic

Figure 1-2. Schematic of Proposed Generation Outlet Transmission (GOT)

Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- Construction Power Line (Temporary)
- Unit Lines
- Construction Power Station
- Switching Station
- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- North Access Road
- Proposed Access Road

Landbase

- Community
- Provincial Road
- Municipal Road
- Active Railway
- Abandoned Railway
- Watercourse
- Waterbody
- First Nation

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: Monday, September 24, 2012

N

0 2 4 Kilometres
0 2 4 Miles

1:150,000

Project Infrastructure

Alternative Transmission Line Routes

Map 1-1

2.0 METHODS AND PROCEDURES

2.1 STUDY AREA DEFINITION

The Project Study Area (illustrated in Map 1-1) is located in northern Manitoba, extending from the Radisson Converter Station (about 6 km northeast of the town of Gillam), along the south shore of Stephens Lake, to the proposed Keeyask Generation Project. From this juncture, the Project Study Area extends north across the Nelson River approximately 4 km, and southward to a point about 3 km south of Manitoba Hydro transmission line KN36 – 138-kV. The southern boundary extends east back to the Radisson Converter Station and parallel to KN36.

The Project is located in the Split Lake Resource Management Area, which includes the town of Gillam, about 300 km northeast of Thompson, Manitoba. The area is utilized by resources users from Tataskweyak Cree Nation (Split Lake) and Fox Lake Cree Nation (Gillam/Bird).

The Project Study Area occurs within a Region shown in Map 2-1. Descriptions of the Region in the EA Report are intended to put into context the potential effects and characteristic of the Study Area. The region for the Keeyask Transmission Project coincides with the regional study area defined in the terrestrial environment assessed for the Keeyask Generation Project data collection.

2.2 DATA COLLECTION AND ANALYSIS

2.2.1 Overview of Information Sources and Data

A review of pertinent literature, including field reports from Keeyask Generation Project studies was conducted to guide field studies and interpret information gathered during the three years of surveys. Local knowledge was sought while conducting field surveys and was gathered opportunistically throughout the field and reporting processes.

Three years of field studies conducted for the Keeyask Transmission Project (2009-2011). Data was collected along the Construction Power and Generation Outlet Transmission lines proposed routes and in the vicinity of the converter and switching stations. While studies were not undertaken along the Unit Transmission Line routes, this area had been previously surveyed during studies for the Keeyask Generation Project.

In addition to the data collected for the Keeyask Transmission Project, the study team utilized data collected for the Keeyask Generation Project and Keeyask Infrastructure Project as a comparison/confirmation dataset.

2.2.2 Breeding-Bird Surveys

Breeding-bird surveys were initially conducted in the Project Study Area from June 14 to June 23, 2009. Survey efforts included investigations of 20 transects, containing a total of 193 stops situated among various habitat types located along the Construction Power and Generation Outlet Transmission Line route options (Map 2-2). To strengthen the understanding of bird communities observed in the Project Study Area in 2009, a second year of surveys was conducted between June 9 and 20, 2010. With the exception of one survey stop, all 20 transects surveyed in 2009 (total of 192 stops) were resurveyed during this period. In 2011, additional surveys were conducted from June 13 to 16 to investigate bird utilization of habitat at recently selected preliminary switching station locations and to further contribute to the overall bird survey dataset for the Project Study Area. Seventeen transects, totaling 105 point-count stops, were surveyed in 2011 (Map 2-2).

At the time of the 2009 to 2011 bird surveys, Manitoba Hydro had identified two route options (Routes 1 and 2) for the Construction Power Transmission Line, and three alternative route options (Routes A, B, and C) for the Generation Outlet Transmission lines (Map 2-2). In 2009 and 2010, 11 transects totaling 108 point-count stops were surveyed along and adjacent to the two Construction Power Transmission Line route options (Map 2-2). Nine transects totaling 85 point-count stops (84 point-count stops in 2010) were surveyed along and adjacent to the three Generation Outlet Transmission Line route options (Map 2-2). In 2011, surveys took place on 14 transects along and adjacent to the Generation Outlet Transmission Line route options (8 transects; 48 point-count stops) and Construction Power Transmission Line (6 transects; 48 point-count stops) route options. Additionally, three new transects (totaling 9 point-count stops) associated with the preliminary switching station locations were also surveyed in 2011. Generation Outlet Transmission Line Route D was added as an option after all field studies occurred. However, this route is expected to be similar to Route A with respect to bird habitat and bird populations as they are both well removed from Stephens Lake and traverse similar habitats.

Transect locations were selected using a combination of topographic mapping, ECOSTEM Ltd. habitat classification mapping (ECOSTEM Ltd. 2009) and pre-survey aerial flights of the proposed routes. An integrated evaluation of this information helped to identify locations of representative cover types for sampling. While this information assisted in determining location of sampling efforts, further classification of breeding bird habitat was conducted at each survey stop visited (Table 2-1).

Surveys for breeding terrestrial birds (e.g., songbirds) coincided with their peak breeding season in early to mid-June. Methods utilized for breeding-bird surveys were consistent with Canadian and US standard procedures for conducting population surveys using the Point Count Method (Ralph *et al.* 1993; Welsh 1993). Breeding-bird surveys occurred during the peak bird singing

hours of 05:00-10:00h. Point-count survey stops were located at 150-m intervals along a set transect of variable length. At each survey stop, biologists and a First Nations assistant allowed a few minutes to pass prior to proceeding with the three-minute sample period; this allowed birds to return to normal behaviour prior to sampling beginning. One biologist recorded the number and species of all birds heard or seen within and outside of each 75-m radius (1.77-ha) stop or 'plot.' Birds flying over the stop were recorded but excluded from analysis, and care was taken to avoid double-counting birds at each stop. A second biologist recorded a description of habitat, including canopy cover, understory and ground cover at each survey stop. All other wildlife observed during surveys was recorded as reconnaissance observations. First Nations assistants were from Keeyask Cree Nation communities and provided valuable local knowledge to the biologists.

Analysis of bird survey data was carried out for each habitat/broad vegetation type surveyed (Map 2-3). Broad vegetation type classifications are defined by the leading tree species present and the degree of mixture of that species with other vegetation types. Habitat types comprising the Project Study Area were classified by ECOSTEM Ltd. (Terrestrial Habitat, Ecosystems and Plants Technical Report 2012) and descriptions of each habitat classification is provided in Tables 2-1 and 2-2. For each broad vegetation type, bird diversity was determined by averaging the number of species observed per stop while bird density was determined using the total number of birds observed divided by total area surveyed (in hectares). When Generation Outlet Transmission Line Route D was added to the options being considered, habitat data was not available for much of Option D. As a result, Route D is not included in Table 2-2. In order to characterize Route D in relation to the other Generation Outlet Transmission Line options, recent data from the Habitat Technical Report (Terrestrial Habitat, Ecosystems and Plants Technical Report 2012) was added (Table 2-3). This data demonstrates that Generation Outlet Transmission options A and D are similar with respect to terrestrial habitats traversed.

Results of breeding bird surveys conducted in the Keeyask Generation Project Study Area between 2001 and 2007 were used as regional comparative values for the survey data collected in the Project Study Area between 2009 and 2011.

Table 2-1: Dominant Broad Vegetation Types Along Construction Power Transmission Line Route Options

Broad Vegetation Type	Route 1		Route 2	
	Area (ha) of a 60-m ROW	% of Total Area	Area (ha) of a 60-m ROW	% of Total Area
Black Spruce Pure	79.5	68.0%	66.9	54.0%
Low Vegetation	18.0	15.4%	36.7	29.6%

Table 2-1: Dominant Broad Vegetation Types Along Construction Power Transmission Line Route Options

Broad Vegetation Type	Route 1		Route 2	
	Area (ha) of a 60-m ROW	% of Total Area	Area (ha) of a 60-m ROW	% of Total Area
Young Regeneration	3.5	3.0%	6.8	5.5%
Tamarack Mixture	3.4	2.9%	3.2	2.5%
Black Spruce Mixture	2.6	2.2%	2.8	2.3%
Tamarack Pure	2.3	1.9%	-	-
Other (Including Water)	7.6	6.5%	762.8%	6.2%
Total	**117**	**100%**	**124**	**100%**

Table 2-2: Dominant Broad Vegetation Types Along Generation Outlet Transmission Line Route Options

Broad Vegetation Type	Route A		Route B		Route C	
	Area (ha) of a 60-m ROW	% of Total Area	Area (ha) of a 60-m ROW	% of Total Area	Area (ha) of a 60-m ROW	% of Total Area
Black Spruce Pure	380.64	56.7%	353.90	54.0%	433.45	66.8%
Low Vegetation	126.46	18.8%	128.49	19.6%	47.90	7.4%
Tamarack Mixture	14.55	2.2%	20.39	3.1%	19.38	3.0%
Black Spruce Mixture	9.78	1.5%	16.92	2.6%	17.44	2.7%
Jack Pine Mixture	8.90	1.3%	3.58	0.5%	7.47	1.2%
Young Regeneration	8.64	1.3%	8.64	1.3%	8.64	1.3%
Human	4.67	0.7%	4.40	0.7%	8.81	1.4%
Tall Shrub	4.58	0.7%	3.45	0.5%	2.54	0.4%
Other (Including Water)	113.2	16.9%	115.4	17.6%	103.0	15.9%
Total	**671**	**100%**	**655**	**100%**	**649**	**100%**

Table 2-3: Habitat Compositions of the Alternative Generation Outlet Route Options

Habitat Type*	Option A		Option B		Option C		Option D**	
	Total Area (ha)	% of Total Area	Total Area (ha)	% of Total Area	Total Area (ha)	% of Total Area	Total Area (ha)	% of Total Area
Black Spruce Dominant	995	64.9	923	62.2	1110	77.1	634	68.7
Black Spruce Mixedwood	47	3.1	56	3.8	77	5.3	49	5.3
Jack Pine Dominant	42	2.7	34	2.3	35	2.4	56	6.1
Jack Pine Mixedwood	17	1.1	12	0.8	15	1.0	9	1.0
Low Vegetation	336	21.9	352	23.7	129	9.0	107	11.6
Tall Shrub	12	0.8	12	0.8	7	0.5	6	0.7
Tamarack Dominant	10	0.7	12	0.8	4	0.3	5	0.5
Tamarack Mixedwood	62	4.0	68	4.6	54	3.8	33	3.6
Trembling Aspen Dominant	11	0.7	11	0.7	6	0.4	11	1.2
Trembling Aspen Mixedwood	2	0.1	3	0.2	3	0.2	13	1.4
Total area (ha)	*1534*		*1483*		*1440*		*923***	

**See Keeyask Hydropower Limited Partnership (2012b) for a description of the land cover and habitat types.*

***Based on terrestrial habitat mapping for 52% of the area in corridor for Option D, plus 11 ha of priority habitat identified in the unmapped areas.*

2.2.3 Aerial Surveys

Reconnaissance-based helicopter bird surveys were conducted during spring, summer and fall of 2009, to gain a general understanding of waterbird usage of inland lakes, rivers and creeks in the Project Study Area. Helicopter surveys of the two alternative Construction Power Transmission Line route options were conducted on May 25, June 20, and September 21, 2009. A predetermined flight path was followed for May and June surveys (Map 2-4). This flight path consisted of four survey routes that covered the proposed Construction Power Transmission Line route options and adjacent areas (Map 2-4). In September, a reconnaissance helicopter survey focused on determining the degree to which waterbirds used small inland lakes as staging areas during fall migration. In May 2009, at the time of the first Construction Power helicopter survey, alternative route options for the Generation Outlet Transmission lines had not yet been established by Manitoba Hydro and therefore, May helicopter surveys of this area were not conducted. June aerial surveys of the alternative Generation Outlet Transmission Line routes were carried out on June 24, 2009. The flight path of this survey generally followed the route options initially proposed in June 2009, as shown in Map 2-4.

The helicopter-based bird survey procedures for both Construction Power and Generation Outlet Transmission Line surveys were as follows:

- Flights were conducted at approximately 80 km/hr at an altitude of approximately 60 m.
- Two primary observers were positioned on opposite sides of the helicopter and recorded all large-bodied birds (e.g., waterbirds and raptors), and other wildlife, within 200 m of the helicopter.
- A third person served as a secondary observer and informed primary observers of any additional wildlife sightings.
- A GPS-time stamped track was recorded for the duration of each survey. Times (including hour, minute, second) of all bird and other wildlife observations were manually recorded by one observer; this allowed for later retrieval of UTM coordinates for each observation made during the aerial survey.
- Large inland lakes encountered along the survey routes were fully circled by the helicopter to observe all areas of the waterbody.
- Number and species of birds along with other observed wildlife were recorded on data sheets.
- Acronyms were used for birds to abbreviate writing time and optimize observation time.
- Unidentifiable shorebirds were categorized as small, medium or large.

- Pertinent observations regarding habitat features (e.g., small eskers, burns) along the survey route were also recorded.

2.3 VALUED ENVIRONMENTAL COMPONENT SELECTION

Valued Environmental Components (VECs) are components of the biological or socio-economic environment that may be affected by the Project. VECs are species and/or environmental components that are used to highlight or focus an environmental assessment. Defined as elements of the environment having scientific, social, cultural, economic, historical, archaeological or aesthetic importance, VECs are proposed and identified and described under each environmental component. VECs are typically selected on the basis of their importance or relevance to stakeholders (e.g., species such as moose that are hunted) and/or as indicators of environmental effects to a broader range of animals. VECs are typically determined with the input from regulators and stakeholders, Aboriginal people and discipline experts, as well as literature reviews and experience with other projects. Environmental indicators and measurable parameters or variables are identified and described for each VEC. The same indicators and parameters/variables are used to describe environmental effects and residual environmental effects, and to monitor changes or trends over time during the Project construction and operation/maintenance phases.

The Keeyask Transmission Project selected VECs that were identified as being important or valued by members of the study team (e.g., species that are protected) and/or by the public and by other elements of the SSEA process. The identified VECs facilitated assessment of the interactions between the Project components and specific valued components of the environment.

The selection and use of VECs are intended to permit the analyses to be fairly consistent with the Bipole III Transmission Project and Keeyask Generation Project. Since the Keeyask Transmission and Generation Projects are occurring in the same region, factors influencing the different components are similar and therefore it is likely feasible to use many of the same VECs, particularly those that are potentially affected by transmission projects.

Raptors, a bird group, olive-sided flycatcher, rusty blackbird and common nighthawk were selected as bird VECs for the Keeyask Transmission Project. They are discussed in Section 3.2.5.

2.4 METHODOLOGY FOR EVALUATING ALTERNATIVE ROUTES AND INFRASTRUCTURE

2.4.1 Construction Power Transmission Lines

Factors considered when evaluating the Construction Power Transmission lines with respect to avian communities and their habitat included:

- Line length: Generally it is considered that the shorter the line, the less potential that impacts will occur.
- Number of stream crossings: In the study area, stream crossings are usually more sensitive sites that support higher-quality habitat for birds and other wildlife therefore reducing the number of stream crossings is desirable.
- Proximity to wetlands and lakes: Wetlands and lakes provide habitat for waterbirds, shorebirds and other wildlife. Generally, it is ideal to minimize the number of wetlands and lakes crossed by or in proximity to transmission lines.
- Presence of terrestrial avian habitat: Forest habitat along the two routes was compared to determine if any significant differences occurred, e.g., the presence of a contiguously treed upland ridge (which is not common in the area). The bird habitats traversed by both lines were calculated and used in comparing the two routes (Tables 2-1 to 2-3).
- Habitat structure/fragmentation: The presence of transmission lines will contribute to habitat fragmentation in the Project Study Area. Alignment of the Construction Power Transmission lines need to consider other features in the area that already contribute to habitat fragmentation.

Utilizing these factors, Route Options 1 and 2 were evaluated with information from a desktop aerial photo interpretation analysis, results from Project field surveys and data collected for Keeyask Generation Project studies.

2.4.2 Construction Power Station

Factors considered when siting the Construction Power Station a primarily technical in nature. A preliminary environmental assessment of siting options was done prior to the determination of the preferred site.

Within the Study Area, five alternative Construction Power Station sites (CP Sites 2-6) were identified. Due to the new access road alignment from PR 280 to the Keeyask Generation Station site, four of the five sites (CP Sites 2, 3, 4 and 5) were ruled out as the access road would go through the center of these proposed sites.

A desktop photo analysis and examination of data collected for Keeyask Generation Project studies was undertaken, to assess all optional sites with regards to the potential for substantive negative effects on birds.

2.4.3 Generation Outlet Transmission Line

The factors considered with respect to birds when siting the Generation Outlet Transmission included:

- Line length: Generally it was considered that the shorter the line length, the better, as there would be less potential for negative impacts to occur.

- Number of stream crossings: In the Project Study Area, stream crossings are usually more sensitive sites that support higher-quality habitat for birds and other wildlife. Reducing the number of stream crossings is desirable.

- Proximity to wetlands and lakes: Wetlands and lakes provide habitat for waterbirds, shorebirds and other wildlife. Generally, it is more desirable to have transmission lines pass close to as few of these features as possible.

- Proximity to Stephens Lake: Generally, from a bird-habitat perspective, riparian habitat is judged to be of high quality compared with habitat located further away from a lake, stream or wetland. In the Project Study Area, riparian habitat along Stephens Lake is a notable feature. Generation Outlet Transmission Line routes need to consider proximity to Stephen's Lake as there is potential for staging waterfowl to utilize Stephens Lake, which could result in increased bird/line collision risk.

- Presence of terrestrial avian habitat: The forest habitat along the four routes was compared to determine if any significant differences occurred, e.g., the presence of a contiguously treed upland ridge (which is not common in the area). The habitats traversed by Generation Outlet Transmission lines were calculated and used in comparing the two routes (Tables 2-1 to 2-3).

- Habitat structure/fragmentation: The presence of transmission lines will contribute to habitat fragmentation in the area. The alignment of the Generation Outlet Transmission Lines needs to consider other features in the area that already contribute to habitat fragmentation. Of particular importance in the Project Study Area are the proposed South Access Road route, the Butnau Road and the right-of-way for the KN36 transmission line. The Hudson Bay Railway and the Bipole I and II transmission line rights-of-way also traverse the Project Study Area. Siting of the Generation Outlet Transmission right-of-way in combination with features already present on the landscape to increase habitat fragmentation needs to be considered.

Generation Outlet Transmission Line route options were evaluated in reference to these factors utilizing results from Project breeding bird and reconnaissance based helicopter surveys,

desktop aerial photo interpretation and examination of data collected for Keeyask Generation Project studies in the region.

2.4.4 Unit Transmission Lines

Factors utilized for evaluating the Unit Transmission Line routes were terrestrial habitat types crossed and the presence of significant wetland areas adjacent to the routes. Consideration of the potential for negative effects on birds was undertaken utilizing aerial photography and habitat classifications provided by ECOSTEM (Terrestrial Habitat, Ecosystems and Plants Technical Report 2012).

2.4.5 Keeyask Switching Station

The factors considered from a bird perspective when siting the Keeyask Switching Station included:

- Length of transmission lines required.
- Proximity to/conflicts with Keeyask Generation Station components.
- Technical considerations.

These factors were incorporated into Switching Station siting utilizing results from Project breeding bird surveys, desktop aerial photo interpretation and examination of data collected for Keeyask Generation Project studies in the region.

2.4.6 Radisson Converter Station Upgrade

Proposed upgrades to the Radisson Converter Station necessary to accommodate the power delivered from the Keeyask Generation Project will be confined to the existing footprint of the Radisson Converter Station. Consequently, there are no specific siting evaluations necessary for this Project component.

2.5 EFFECTS ASSESSMENT AND MITIGATION MEASURES

The environmental assessment involved identifying and analyzing potential effects associated with the preferred routes that could not be avoided during the route selection process. During the route selection process, detailed socio-economic and biophysical studies were conducted to determine potential effects more precisely. Potential effects and mitigation measures are detailed in Chapter 7 of the Environmental Assessment Report. Appropriate mitigation

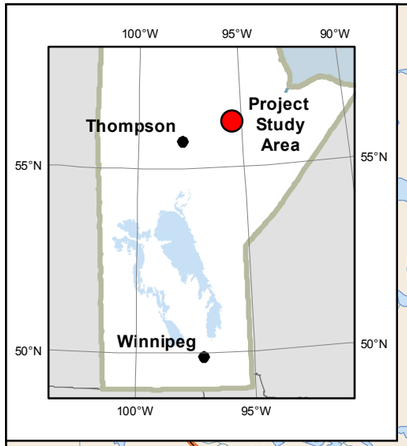
measures have been identified to reduce potential negative effects during all phases of Project development.

2.5.1 Residual Effects Significance Evaluation

Residual effects are the actual or anticipated Project effects that remain after considering mitigation and the combined effects of other past and existing developments and activities. Each potential effect on a VEC is initially evaluated using the following criteria:

- Direction or nature (i.e., positive, neutral or adverse) of the effect.
- Magnitude (i.e., severity) of the effect.
- Duration (temporal boundaries).
- Geographic Extent (spatial boundaries).

The definitions for the above are provided in Chapter 3 of the Environmental Assessment Report.



Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure

- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line

Landbase

- Community
- Provincial Highway
- Provincial Road
- Active Railway
- Abandoned Railway
- Resource Management Area
- First Nation
- Watercourse
- Waterbody

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, Stantec, ProvMB, NRCAN
Date Created: September 26, 2012

N

0 10 20 Kilometres
0 10 20 Miles

1:1,000,000

Project Study Area in Northern Manitoba

Map 2-1

Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- Unit Lines
- Construction Power Station
- Switching Station
- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- North Access Road
- Proposed Access Road

Avian

- Breeding Bird Survey Stops

Landbase

- Community
- Provincial Road
- Municipal Road
- Active Railway
- Abandoned Railway
- Watercourse
- Waterbody

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: Tuesday, October 09, 2012

N

0 2 4 Kilometres
0 2 4 Miles

1:150,000

Breeding Bird Survey Location in Project Study Area 2009 - 2011

Map 2-2

Kaiser Island
Callan Island
Stephens Lake
Mary Miller Island
John Taylor Island
Stratford Island
Kettle G.S.
Radisson C.S.
Fox Lake Cree Nation
A Kwis Ki Mahka Reserve
Gillam
280
North Access Road
Construction Power Station
Keeyask G.S.
Howe Island
Nelson River
Gull Rapids
Switching Station
Proposed South Access Road
Route Alternative Option C
Route Alternative Option B
Route Alternative Option A
Cache Lake
Gillrat Lake
Joslin Lake
KN 36 Construction Power Tap Route Option 1
KN 36 Construction Power Tap Route Option 2
Ethel lake
Butnau River
Willbeach
Route Alternative Option D
Kettle River
KN36
Bipole I and II (Existing 500 kV DC Line)
Butnau Lake
Wivenhoe
Little Kettle Lake
Kettle Lake

Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- Unit Lines
- Construction Power Station
- Switching Station
- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- North Access Road
- Proposed Access Road

Broad Vegetation Types

- BS Mixedwood
- BS Mixture
- BS Pure
- Human
- JP Mixture
- JP Pure
- Low Vegetation
- TL Mixture
- Tall Shrub
- Young Regeneration
- Other Vegetation Types
- Water

Landbase

- Community
- Provincial Road
- Municipal Road
- Active Railway
- Abandoned Railway
- Watercourse
- Waterbody

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: Tuesday, October 09, 2012

N

0 2 4 Kilometres
0 2 4 Miles

1:150,000

Habitat Types in the Project Study Area

Map 2-3

Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- Unit Lines
- C — Construction Power Station
- S — Switching Station
- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- North Access Road
- Proposed Access Road

Generalized Helicopter Flight Path

- Construction Power
- Collector Lines

Landbase

- Community
- Provincial Road
- Municipal Road
- Active Railway
- Abandoned Railway
- Watercourse
- Waterbody

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: Tuesday, October 09, 2012

N

0 2 4 Kilometres
0 2 4 Miles

1:150,000

Aerial Survey Routes in the Project Study Area June 2009

Map 2-4

3.0 STUDY AREA CHARACTERIZATION

3.1 STUDY AREA OVERVIEW

The Project Study Area (Map 1-1) is located in the Knee Lake Ecodistrict of the High Boreal Ecoclimate Region in northern Manitoba (Smith *et al.* 1998).

The Study Area is characterized by forest stands that are generally less than medium height, and are often more open than stands farther south. Black spruce (*Picea mariana*) is the dominant tree species in the Project Study Area with black spruce muskeg being the prominent form of plant community observed (Smith *et al.* 1998).

3.1.1 Climate

The climate of the Knee Lake ecodistrict is marked by short, cool summers and long, very cold winters. The mean annual temperature is approximately –4.1°C and the area has an average growing season of 131 days (Smith *et al.* 1998).

The average annual precipitation is approximately 500 mm, of which slightly more than one-third falls as snow. Precipitation is highest during the summer months with significant yearly variation. The district has a very cold, humid, Cryoboreal soil climate.

3.1.2 Physiography and Drainage

The Knee Lake ecodistrict is an undulating to ridged loamy, morainal plain, ranging in elevation from 213 m above-sea-level (asl) at its southern edge to about 150 m asl in the north (Smith *et al.* 1998). Drumlins, or elongated hills formed from glacial activity, provide some of the undulating terrain characteristic of this ecodistrict. Patterned fens and peat plateau bogs occupy large areas of low-lying terrain, while eskers and esker aprons create a rise in some areas. Slopes in this ecodistrict range from level in peat-filled depressions, to 10-30% on drumlin ridges (Smith *et al.* 1998). The Nelson River drainage system occupies the northwestern part of the ecodistrict while the southwestern and eastern sections are within the Hayes River system. Lakes of various sizes are distributed throughout the region. Drainage is generally northeast towards the coast (Smith *et al.* 1998).

3.1.3 Terrestrial Habitat

Land cover in 2010 was dominated by sparsely to densely treed needleleaf vegetation on thin or shallow peatlands (about 80% of the land area; Keeyask Hydropower Limited Partnership 2012). Broadleaf treed land cover accounted for approximately 1% of the land area, typically occurring on upland mineral soils, in richer riparian areas and near the Nelson River. Tall shrub

and low vegetation on mineral or peatland ecosites covered 16% of land area, primarily occurring along streams and rivers, other wet areas and poorly regenerating burned areas (a substantial proportion of the low vegetation on mineral, thin peatland and shallow peatland was treed vegetation prior to burning in wildfires during the 1980s and 1990s). Shoreline wetlands other than shallow water wetlands accounted for less than 1% of land area. Human infrastructure comprised approximately 2% of the existing land area. (Terrestrial Habitat, Ecosystems and Plants Technical Report 2012 2012).

3.2 ENVIRONMENTAL SETTING

3.2.1 Bird Overview

Approximately 178 bird species potentially breed within or migrate through the Bird Regional Study Area for the Keeyask Generation Project, which includes the Project Study Area. Of these 178 species, 155 are migratory, overwintering in southern areas and breeding in the Region and/or in areas further north. The remaining 23 species are residents which breed and overwinter within the Region. Between 2001 and 2011, 124 different species were observed during the ground-based, boat-based and helicopter-based bird surveys.

Within the Region, the diverse terrestrial habitats and abundant food sources (e.g., insects, seeds) support several landbird species (i.e., songbirds, woodpeckers, upland game birds, raptors, nighthawks), including resident species (e.g., gray jay (*Perisoreus canadensis*), ruffed grouse (*Bonasa umbellus*), boreal owl (*Aegolius funereus*) that inhabit the Region year-round. Inland lakes, creeks and wetlands provide key breeding habitats for many waterbirds including ducks, shorebirds and sandhill cranes (*Grus canadensis*).

Birds are a key food source for the Keeyask Cree Nations, with spring and fall hunts important community events. For FLCN, the spring goose hunt has become increasingly important, both for the food harvested and as a tradition that welcomes and celebrates the spring season (FLCN 2012). YFFN Community Members travel to the coastal area for their spring goose hunt (YFFN 2012). TCN members indicated that harvesting traditions were an essential ingredient of member's identity as Cree people. Further, spring and fall hunts were an annual rite binding the community together (Split Lake Cree 1996).

A number of factors, including fire, weather, disease, insect populations, human development, hunting and climate change, affect bird communities inhabiting the area. Some of the bird species at risk (e.g., rusty blackbird [*Euphagus carolinus*]) have been and will likely continue to experience population declines due to loss of overwintering habitats (COSEWIC 2006, 2007a, 2007b). Other species (e.g., turkey vulture [*Cathartes aura*]) have increased in abundance and have been expanding their range into northern areas because of climate change, increased availability of food sources and loss of habitat in their current range (Cox 2010).

3.2.2 Passerines

Of the 41 passerine species recorded in the Project Study Area during the 2009 to 2011 breeding-bird surveys, 36 were found within black spruce pure habitats (n= 140 stops; Appendix A, Table A-1) and 31 within low vegetation habitats (n= 37; Appendix A, Table A-1). Areas of tamarack mixture habitat also supported high passerine species richness (27 species; n = 16 stops) relative to other habitat types surveyed.

Blackpoll warbler (*Setophaga striata*) was the most abundant and frequently noted species occurring within all surveyed habitat types and at over half of all stops surveyed (n=279 of 490 survey stops; overall average density of 0.32 birds/ha; Appendix A, Table A-1). Common to Manitoba's northern boreal forests, this ground-nesting species has a preference for coniferous breeding habitats (Carey *et al.* 2003). Highest observed densities of blackpoll warbler occurred in pure tamarack mixture (0.94 birds/ha; Appendix A, Table A-1).

Ruby-crowned kinglet (*Regulus calendula*; occurred at nearly 33% of all stops) and northern waterthrush (*Parkesia noveboracensis*; 37% of stops) were also among the most common species observed during surveys (Appendix A, Table A-2). Ruby-crowned kinglet, a common breeder in the boreal forest that nests in coniferous tree tops, was also recorded in all surveyed habitat types. This species was most abundant in areas of black spruce mixedwood and pure jack pine vegetation (0.28 birds/ha, Appendix A, Table A-1). Northern waterthrush is a species regularly found in wet habitats supporting shrubs, such as bogs, creeks and other low-lying wet areas which are common throughout the Project Study Area.

Other bird species widespread throughout most habitat types surveyed included fox sparrow (*Passerella iliaca*; 0.18 birds/ha, 32% of n=490 stops), white-throated sparrow (*Zonotrichia albicollis*; 0.18 birds/ha, 33% of n=490 stops]), yellow-bellied flycatcher (*Empidonax flaviventris*; 0.18 birds/ha, 31% of n=490 stops), and dark-eyed junco (*Junco hyemalis*; 0.18 birds/ha, 31% of n=490 stops; Appendix A, Table A-2). These passerine species are common inhabitants of Manitoba's northern boreal forests (Carey *et al.* 2003).

Alder flycatcher (*Empidonax alnorum*), Wilson's warbler (*Wilsonia pusilla*), magnolia warbler (*Dendroica magnolia*) and winter wren (*Troglodytes hiemalis*), all low to ground nesting species, were among several bird species less commonly observed during breeding-bird surveys. Typical of moist deciduous shrub and mixedwood habitats along slow-moving creeks, alder flycatcher was observed at an average density of 0.09 birds/ha (Appendix A, Table A-1). Wilson's warbler, also known to frequent low lying wet shrubby areas, especially among young regenerating forest and along forest-edge habitats, was recorded at an average density of 0.4 birds/ha. Known to occur among mixedwood and coniferous forests, magnolia warbler and winter wren were observed at an average density of 0.04 and 0.03 birds/ha respectively (Appendix A, Table A-1).

White-winged crossbill (*Loxia leucoptera leucoptera*), red crossbill (*Loxia curvirostra*) and common redpoll (*Carduelis flammea*) are three passerine species infrequently encountered during 2009-2011 bird surveys. Considered to be cone and seed specialists, observed numbers of these three species are known to fluctuate annually with food availability (Carey *et al.* 2003). Both crossbill species are known to have sporadic occurrences throughout the province, but in Manitoba are considered to be more common to the central boreal forest south of the Project Study Area. Common redpolls are considered to be a common breeder near the treeline and as such, the Project Study Area is likely near the southern extents of this species breeding range (Carey *et al.* 2003).

Three passerine species, rusty blackbird (*Euphagus carolinus*), olive-sided flycatcher (*Contopus cooperi*) and common nighthawk (*Chordeiles minor*) were recorded during Project breeding-bird surveys conducted from 2009 through 2011, are listed as being 'at risk' by the Committee on Endangered Wildlife in Canada (COSEWIC 2009) and the federal *Species at Risk Act* (Government of Canada 2009)[2]. Details of these observations are further discussed in Section 4.1.5. All species recorded during 2009-2011 surveys were also encountered during the Keeyask Generation Project 2001-2010 breeding-bird surveys. No bird species observed were considered unique to the Project Study Area.

3.2.3 Waterbirds and Shorebirds

Observations of waterfowl and other waterbirds (cranes, gulls and shorebirds) were generally uncommon during land-based surveys, (2% of 2449 birds; Appendix A, Table A-2) and occurred primarily at survey stops that coincided with riparian habitat adjacent to creeks or lakes. Canada goose (*Branta canadensis*) was occasionally observed flying, in flocks and as individuals, over breeding-bird transects during both 2009 and 2010 surveys. In 2011, flights of geese were exempt from being counted during surveys. As these birds were in transit to other habitat types, these flight observations were recorded but excluded from further analysis of bird survey data.

Reconnaissance-based, helicopter waterbird surveys in 2009 examined inland waterbodies present in the Project Study Area. Several inland lakes, creeks and rivers are present in the area, many of which possess well-vegetated shorelines that provide suitable cover and nesting habitat for some species of waterbirds (e.g., green-winged teal [*Anas carolinensis*], ring-necked duck [*Aythya collaris*]). Helicopter-based bird surveys confirmed occasional, although not abundant, waterbird utilization of inland lakes and rivers in the Project Study Area. Surveyed lakes and rivers in general, and specifically those within and along the proposed Construction Power and Generation Outlet Transmission Line routes did not appear to support any large concentrations of waterbirds during the breeding, staging or migration periods. No inland waterbodies were identified as possessing bird habitat rare or unique to the region.

[2] It should be noted that common nighthawk is also listed by Manitoba's *Endangered Species Act*.

June surveys of the Construction Power and Generation Outlet Transmission Line alternative route options in 2009 revealed a minimum of 15 species of waterbirds utilizing surveyed inland waterbodies. Species such as black scoter (*Melanitta americana*), mallard (*Anas platyrhynchos*), ring-billed gull (*Larus delawarensis*), common merganser (*Mergus merganser*), ring-necked duck, common loon (*Gavia immer*) and Canada goose were regularly encountered in the area. Several pairs of waterbirds were observed on many waterbodies in the area indicating that the breeding season was well underway at this time.

August surveys revealed notably fewer waterbirds utilizing surveyed inland waterbodies than was observed in June, suggesting that many birds had moved on to other habitats at this time. During aerial surveys in late September, larger groups (20-50 birds) were more commonly observed relative to other months, indicating that a small population of birds use inland lakes for staging during migration. The degree of waterbird use of inland lakes is consistent with observations made during fall overflights in the Region. Most species of waterbirds tended to leave smaller lakes in favour of larger waterbodies (e.g., Gull Lake) during the fall migration season.

3.2.4 Upland Game Birds

Two upland game bird species, spruce grouse (*Falcipennis canadensis*) and ruffed grouse (*Bonasa umbellus*), were recorded during Project bird surveys (2009-2011; 0.3% of 2449 birds; Appendix A, Table A-2). The presence of grouse scat at many survey stops, as well as one identified ptarmigan (*Lagopus spp.*) kill along a survey transect, confirms the presence of at least three upland game bird species using the Project Study Area. Although not observed during surveys, sharp-tailed grouse (*Tympanuchus phasianellus*) is one other upland game bird species likely using the Project Study Area. Three of the four upland game birds (excluding ptarmigan) were observed during bird surveys in the Keeyask Generation Station Study Area between 2001-2007 (Tetr*ES* 2004a,b; 2005, 2007, 2008).

The distribution of grouse and ptarmigan is widespread throughout the Keeyask area, with these species inhabiting different vegetation communities that meet their specific diet requirements. For example, spruce grouse generally inhabit coniferous stands, as well as muskeg and bogs. Berries, leaves and insects are consumed in the summer, while conifer needles make up their winter diet (Boag and Schroeder 1992). Sharp-tailed grouse (*Lasopus lagopus*) and willow ptarmigan prefer more open habitats. Sharp-tailed grouse forage in shrub cover during the winter, switching to coniferous forest clearings, recent burns and other edges and openings during the summer. Willow ptarmigan breed in regions north of the Study Area (i.e., in tundra), and over-winter in forested habitat such as that located in the Project Study Area and the Region. Both sharp-tailed grouse and ptarmigan feed primarily on willow and birch seeds, buds, berries, leaves and insects in open areas including along cut-lines and roadways (Connelly *et al.* 1998).

3.2.5 Raptors

Raptors are comprised of three groupings: piscivorous (fish-eating) raptors, owls and other raptors (e.g., hawks and falcons, etc.). In the Project Study Area, raptor observations were relatively uncommon. During breeding-bird surveys in 2009 and 2010, bald eagles (*Haliaeetus leucocephalus*), merlins (*Falco columbarius*) and hawks were observed. Reconnaissance observations of osprey (*Pandion haliaetus*) and great-horned owl indicate that suitable habitat for these species exists in the Project Study Area. The Region has the potential to support 19 species of raptors, of which 15 are expected to breed, with the remaining four utilizing the region during migration seasons (Keeyask Limited Partnership 2012).

Tending to take vertebrate prey as food sources, piscivorous raptors build large stick nests which are often used annually atop tall trees or utility poles in proximity to wetland, flooded areas (i.e., osprey) and high in trees or along shorelines in sight of water (i.e., bald eagles). Owls prefer moist areas and mixed-wood boreal forest; hawks frequently hunt small mammals and birds in open terrain where herbaceous cover is intermixed with woody growth similar to that experienced in recently burned areas of the boreal forest (Manitoba Naturalist Society 2003). Nesting usually occurs fairly high above the ground in the lower crowns of deciduous trees or near the top of isolated conifer trees

3.2.6 Woodpeckers

While the Region has the potential to support six species of woodpeckers, observations of woodpeckers were infrequent during breeding-bird surveys in the Project Study Area. Three species were identified during 2009 and 2010 surveys including a black-backed woodpecker (*Picoides arcticus*), a hairy woodpecker (*Picoides villosus*), and a northern flicker (*Colaptes auratus*).

Black-backed woodpecker is a common year-round resident in some northern locations while the hairy woodpecker is rare to uncommon permanent residents of Manitoba (Keeyask Hydropower Limited Partnership 2012). As cavity nesters, hairy woodpeckers tend to reside in mature, deciduous and mixed-wood forests and woodlands and are much less common in coniferous forests (Manitoba Naturalist Society 2003). These bark foragers rely on heavily on insects for food sources, but have also been known to consume fruits, berries, nuts, and sometimes tree sap (Jackson et al. 2002). Black-backed woodpeckers on the other hand, prefer recently burned coniferous stands utilizing the burned tree trunks to forage for insect larvae (Manitoba Naturalists Society 2003).

Northern flickers are migrant breeders in the Region frequently feed on the ground. Although fruits, berries, seeds and nuts make up part of their diet, their primary food is insects. Flickers prefer open habitats near trees, including woodlands and edges and generally nest in holes in trees like other woodpeckers. Occasionally, they have been found nesting in old, earthen

burrows vacated by belted kingfishers or bank swallows, species both known to reside in the Region (Wiebe et al. 2008).

3.2.7 Valued Environmental Components

3.2.7.1 Common Nighthawks

A single common nighthawk was recorded during both 2010 and 2011 bird surveys in the Project Study Area. In 2010, surveys associated with the Generation Outlet Transmission Line route options identified this species along a raised esker dominated by jack pine pure vegetation adjacent to black spruce pure and low vegetation habitats (Map 3-1). In 2011, surveys associated with the Construction Power Transmission Line route options identified a common nighthawk among low, sparsely vegetated black spruce habitats (Map 3-1).

Common nighthawks have the potential to be affected by transmission line development in the boreal forest. The cleared right-of-way may create foraging opportunities for common nighthawks and development of associated infrastructure could create areas of bare ground which may be utilized for nesting.

As the common nighthawk has been observed in the Project Study Area, has the potential to be affected by the Project and is a species of regulatory interest (listed by the Committee on the Status of Endangered Wildlife in Canada [COSEWIC], the Manitoba *Endangered Species Act* [MESA], and *Species at Risk Act* [SARA], it has been selected as a bird VEC.

3.2.7.2 Raptors

Raptor observations were uncommon during terrestrial breeding bird surveys (<0.1% of 2449 birds; Appendix A, Table A-2). Bald eagle, merlin and one unidentified hawk species were the only raptors observed during surveys.

Reconnaissance observations identified two osprey that were nesting on an existing transmission tower, adjacent to Generation Outlet Transmission Line Route Option A (Map 3-1). Two osprey were observed nesting at this site in 2009, 2010 and 2011. Additional reconnaissance observations by a field team conducting mammal studies in the Keeyask Transmission area in June 2009 identified the location of a great-horned owl nest along Construction Power Transmission Line Route Option 1 (Map 3-1). Investigations by the bird survey team on June 24, 2009, confirmed that the nest was active and one owl was observed flying out of the nest.

Potential for Project effects on raptors are quite variable. Some interior forest species will be mainly unaffected by transmission line development. Other species, which forage in boreal forest openings could be attracted to cleared rights-of-way associated with transmission lines and access routes to station infrastructure. These species will have potential for Project-related

effects (increased foraging opportunities, line strikes, etc.). Due to the potential for effects on some of the members of the raptor group and the broad-based habitat utilization of the group as a whole, raptors were selected as a VEC for the Project.

Rusty blackbird and Olive-sided flycatcher were also selected as VECs for the Project. They are discussed below.

3.2.8 Species at Risk

Three species listed as 'at risk' by the COSEWIC, *SARA* and/or *MESA* were observed during 2009 through 2011 breeding-bird studies in the Keeyask Transmission Study Area, including: rusty blackbird (special concern status by COSEWIC [2012] and SARA [Government of Canada 2009]), olive-sided flycatcher (threatened status by COSEWIC [2012] and SARA [Government of Canada 2009]) and common nighthawk (threatened status by COSEWIC, schedule 1 of *SARA* and *MESA*). These three species were all selected as Project VECs.

In addition to the species observed, yellow rail (*Coturnicops noveboracensis*), short-eared owl (*Asio flammeus*), red knot (*Calidris canutus*) and peregrine falcon (*Falco peregrinus*) have the potential to range in or through the study area. Due to the transient nature of these species potential occurrence in the study area, Project-related effects are expected to be not significant.

Rusty blackbird observations occurred at several stops throughout the Project Study Area (Map 3-1) situated among immature, coniferous forest within or adjacent to riparian or low-lying, wet areas. Olive-sided flycatcher were also distributed throughout the Project Study Area (Map 3-1) within mature, coniferous forest, generally with low crown closure (20-50%) located adjacent to riparian habitat (i.e., the Nelson River, Butnau River, and wetlands; Map 3-1). Common nighthawk is discussed in Section 3.2.7.1 above.

Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- Unit Lines
- C — Construction Power Station
- S — Switching Station
- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- North Access Road
- Proposed Access Road

Species Observations

- Osprey Nest (Active - 2009-2011)
- Great-horned Owl Nest (Active 2010)
- Common Nighthawk
- Olive-sided Flycatcher
- Rusty Blackbird

Landbase

- Community
- Provincial Road
- Municipal Road
- Active Railway
- Abandoned Railway
- Watercourse
- Waterbody

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: Tuesday, October 09, 2012

N

0 2 4 Kilometres
0 2 4 Miles

1:150,000

Species at Risk and Active Raptor Nests Observed during Breeding Bird Surveys 2009 - 2011

Map 3-1

4.0 EVALUATION OF ALTERNATIVE ROUTES AND OTHER INFRASTRUCTURE

4.1.1 Construction Power Transmission Line and Station

Transmission Line rights-of-way contribute to habitat fragmentation in the area, the two route options for the Construction Power Transmission lines were compared to determine habitat use, species composition, diversity and the degree of fragmentation along each route with respect to Project effects on avian communities.

Breeding-bird surveys in the Keeyask Transmission Study Area revealed that pure black spruce vegetation, through which approximately two-thirds of Construction Power Transmission Line Route Option 1 (with a 60-m right-of-way) and over one-half of Construction Power Transmission Line Route Option 2 (with a 60-m right-of-way) bisect (Table 4-1), supported lower bird densities than most other surveyed habitat types. Low vegetation, the second most dominant habitat type along the Construction Power Transmission Line Route Options, supported a higher bird density relative to the pure black spruce vegetation communities (Table 4-1). Areas classified as low vegetation are generally open, sparsely treed habitats with a greater diversity of shrub and understory species than is present in pure black spruce habitats. Due to the diverse vegetative structure, low vegetation habitats are able to support a variety of species, particularly those that nest on the ground or in shrubs (e.g., dark-eyed junco, white-throated sparrow, and blackpoll warbler). The third most abundant habitat type was young regeneration, which supported the lowest abundance of birds of all vegetation types surveyed (Table 4-1). Vegetative communities present in these areas are in relatively early stages of succession as they represent regeneration from recent burns (approximately 20 years ago). As a result, vegetation in these areas lack structural diversity and therefore provide minimal quality bird habitat. As time passes however, these communities will regenerate to mature forest, passing through ecologically productive successional stages in the process.

Table 4-1: Breeding-Bird Mean Density and Diversity in the Keeyask Transmission Area (2009 through 2011)

Broad Vegetation Type	Average Density*	Average Diversity**
Black Spruce Pure	2.7 ± 1.6	4.6 ± 2.4
Low Vegetation	2.9 ± 1.6	4.8 ± 2.4
Tamarack Mixture	3.2 ± 1.2	5.2 ± 2.0
Black Spruce Mixture	2.6 ± 1.4	4.4 ± 2.1

Table 4-1: Breeding-Bird Mean Density and Diversity in the Keeyask Transmission Area (2009 through 2011)

Broad Vegetation Type	Average Density*	Average Diversity**
Young Regeneration	1.8 ± 1.0	3.9 ± 1.3
Jack Pine Mixture	2.6 ± 1.0	4.4 ± 1.8
Jack Pine Mixedwood	2.3	4
Tamarack Pure	3.5 ± 1.3	5.7 ± 1.9
Jack Pine Pure	3.9 ± 1.5	6.0 ± 1.7
Human	4.2 ± 2.9	6.8 ± 4.3
Black Spruce Mixture/Tall Shrub	3.4 ± 2.4	5.5 ± 3.5
Black Spruce Mixedwood	2.3 ± 0.8	4.0 ± 1.4
Total	***2.8 ± 1.6***	***4.9 ± 2.5***

* Density reported as number of birds per hectare ± st.dev.

* Diversity reported as number of species per stop ± st.dev.

4.1.1.1 Passerines

Abrupt habitat edges created by the clearing of forest vegetation associated with transmission line corridor development, have the potential to influence a variety of bird community dynamics including changes to territory boundary establishment and shifts in bird community composition (Kroodsma 1984; Rail *et al.* 1997). Studies have shown that sizeable forest clearings may also affect the movement of birds across newly developed openings as some bird species, especially those characteristic of the forest interior such as yellow-rumped warbler, Swainson's thrush, and red-breasted nuthatch, have a tendency to avoid crossing sizeable habitat gaps (i.e., greater than 50 m; Rail *et al.* 1997; Desrochers and Hannon 1997).

Both proposed Route Options for the Construction Power Transmission Line are similar in length and bisect similar habitat types. As a result, the average number of breeding-bird pairs that could potentially be displaced as a result of habitat clearing along a 60-m right-of-way for the two Route Options is similar, but higher for Route Option 2. Using average bird densities observed in each surveyed vegetation type and assuming complete abandonment of cleared habitat, approximately 300 pairs of breeding birds would be displaced resulting from land clearing along a 60-m right-of-way for Route Option 1 and approximately 331 pairs would be displaced along a 60-m right-of-way for Route Option 2 (Appendix A, Table A-3), making Route Option 1 the preferred option with respect to overall Project impacts to passerine communities.

4.1.1.2 Waterbirds and Shorebirds

Natural riparian edges create diverse vegetative communities that are known to support high bird abundance and diversity (Larue *et al.* 1995, Whitaker and Montevecchi 1997). Breeding-bird surveys in the Project Study Area occasionally revealed a higher diversity of waterbirds at survey stops within or adjacent to riparian edge habitats. Helicopter-based waterbird surveys also confirmed waterbird utilization of inland lakes and creeks in the Project Study Area. Stream or waterbody crossings by the proposed Construction Power Transmission Line Route Options increase the potential for disturbance to riparian edge habitats, and the bird communities they support. A minimum of nine streams/waterbodies are crossed by Construction Power Transmission Line Route Option 1, including one crossing of the Nelson River. Route Option 2 crosses a minimum of 11 streams/waterbodies, including one crossing of the Nelson Riverin which placement of a transmission tower on William Smith Island would be required (Appendix A, Table A-3).

The higher number of stream/waterbody crossings through riparian edge habitat required for Route Option 2, in addition to the potential for displacement of a slightly larger number of birds, suggests this option may have a greater potential impact bird habitat quality and therefore bird populations utilizing these habitats. As a result, the recommended Route Option for the proposed Construction Power Transmission Line, relative to the overall impact to bird habitat quality in the Project Study Area, is Route Option 1.

4.1.1.3 Raptors

As discussed in Section 3.2.7.2, an active great-horned owl nest was identified along Route Option 1 (Map 3-1). Great-horned owls are fairly common residents of Manitoba, occurring almost province-wide (Carey *et al.* 2003). Rarely known to construct or repair their own nest, this owl species generally occupies nests previously used by other large raptors. Most nests are used for only one season, as a lack of nest maintenance, in combination with trampling of nests by owlets, often cause nests to deteriorate (Houston *et.al* 1998). Therefore, it is unlikely that the nest identified along Route Option1 will be reused as nests of other raptor species often are.

While raptors surveys were conducted in the general vicinity of the Keeyask Transmission Study Area, no further raptor species were observed. There is little difference in the two Route Options regarding potential for effects on raptors.

4.1.1.4 Species at Risk

The following three species observed in the Project Study Area are listed as ‘Species at Risk’ by COSEWIC *SARA* and *MESA:* rusty blackbird (special concern), common nighthawk (threatened) and olive-sided flycatcher (threatened).

Olive-sided flycatcher preferential habitat was identified along both Construction Power Transmission Line Route Options. Habitat loss and alteration have been identified as causes in the current decline of olive-sided flycatcher populations, An examination of Olive-sided Flycatcher habitat in the Project Study Area (Map 4-1) showed that there is scattered high quality habitat along both routes. Due to the sparse and scattered availability of the habitat there is no preference for either Construction Power Route Option regarding Olive-sided Flycatcher habitat.

Rusty blackbird favoured habitats of forested riparian edges, such as that along the margins of treed muskeg, swamps and slow moving streams, bogs and marshes. Rusty blackbirds nest along riparian edges, usually in wetland vegetation (e.g., cattails), or shrubs (COSEWIC 2006) which occurs along both Route Options and throughout the Project Study Area. An examination of Rusty Blackbird habitat in the Project Study Area (Map 4-2) showed that there is very little high quality habitat available along either Construction Power Route Option. Although there is slightly more medium quality habitat available along Construction Power Route Option 1, the difference is not substantial. There is no preference for either Construction Power Route Option regarding Rusty Blackbird habitat.

Due to their crepuscular nature, or tendency to be more active at twilight, common nighthawk is rarely encountered during daylight hours (Carey *et al.* 2003). Because no observations of common nighthawk occurred along either Construction Power Transmission Line Route Option during Breeding-bird surveys in the Project Area, common nighthawk use of this portion of the Project Study cannot accurately be determined.

An examination of Common Nighthawk habitat in the Project Study Area (Map 4-3) showed that there is high-quality habitat available along both Construction Power Route Options. There is slightly more high quality habitat along Construction Power Route Option 1, particularly near the Keeyask Switching Station site. For this reason, there is a slight preference for Construction Power Route Option 2 regarding Common Nighthawk habitat, but this would not be a strong preference.

4.1.2 Construction Power Station

Within the Project Study Area, five alternative Construction Power Station sites (CP Sites 2-6) were identified. All five sites, evaluated for the potential of negative effects on birds, were determined to similar in nature and that negative effects on bird communities would be minimal. Technical issues arising from the new access road alignment from PR 280 to the Keeyask Generation Project site determined that four of the five sites (CP Sites 2, 3, 4 and 5) were undesirable leaving Site 6 the preferred siting choice.

4.1.3 Generation Outlet Transmission Lines

Within the Project Study Area, four alternate Generation Outlet Transmission Line Route Options were identified (Map 4-4). All four Route Options were evaluated for line length, number of stream crossings, proximity to wetlands and Stephen's Lake, presence of terrestrial habitat and potential for fragmentation.

Evaluations determined Generation Outlet Transmission Line Route Option A is the best alternative with respect to birds because the potential for line strikes by birds which utilize Stephens, Gillrat, Cache or Joslin lakes is minimized. Generation Outlet Transmission Line Route Option A also places the transmission line in a habitat type that appears to support lower forest bird abundance and diversity.

Generation Outlet Transmission Line Route Option B is in close proximity to Stephen's Lake at its western end and also traverses between two lakes just north of Gillrat Lake. This increases the potential for bird strikes during migration periods. Further east, Route Option B shifts to the south into habitat which is generally less productive for passerine bird communities. It passes in relatively close proximity to Cache Lake, which may result in an additional risk of bird-line collisions.

Generation Outlet Transmission Line Route Option C (the northernmost route) is in closer proximity to Stephen's Lake for a longer length than any other route. Much of this route follows either the existing road extending from Gillam to the Butnau Dam or the proposed South Access Road. Despite riparian habitat being generally more productive for bird communities than any other habitat type, both breeding-bird surveys and aerial reconnaissance flights indicated the southern shores and bays of Stephens Lake tend not to contain large concentrations of birds. Previous Keeyask Generation Project field studies have indicated that the potential for birds nesting on inland lakes such as Cache Lake and Gillrat Lake to collide with transmission lines, guy wires and towers situated close to Stephens Lake exists. More importantly, there is increased potential for transmission line collisions during fall migration, when birds use major waterbodies such as Stephens Lake as both staging areas and as southward flight corridors. With respect to fragmentation, aligning the Generation Outlet Transmission Line alongside the proposed South Access Road has some advantage over developing more contiguous habitat further south.

While Generation Outlet Transmission Line Route Option D traverses very similar habitat to Route Option A and is well removed from the other large lakes mentioned above, it was not chosen as a preferred Route Option. Route Option D line would be routed adjacent to transmission line KN36 for much of its length resulting in a very wide right-of-way which has the potential to be an impediment for utilization by some interior forest bird species.

Evaluations of all Generation Outlet Route Options indicated that based on the potential for avian community effects (particularly with respect to waterbirds), Route Option A is the preferred choice. However, given the potential for fragmentation effects on forest bird communities from the development of Option A, it is not a strong preference.

4.1.3.1 Passerines

Black spruce pure habitats were the dominant vegetation type within the right-of-way of each Generation Outlet Transmission Line, and supported low bird densities relative to other habitat types surveyed (Table 2-2; Appendix A, Table A-4). Low vegetation, the second most abundant vegetation type affected by proposed Route Options A, B, C and D, supported higher bird densities compared to the black spruce vegetated areas (Table 2-2; Appendix A, Table A-4). Parcels of jack pine dominated vegetation along a raised esker between Generation Outlet Transmission Line Route Options B and C were a relatively unique vegetative community within the Project Study Area. Uncommon occurrences and small areas of this vegetative type however, provided limited opportunities to sample sizeable, contiguous stands for breeding birds. Although Project Study Area bird surveys suggest that these areas support a high diversity and density of birds in comparison to other habitats surveyed in the Project Study Area, these results are based on a relatively small sample size (3 stops or less) and are contrary to that observed in similar habitat types in the Region. Survey results, based on larger sample sizes, in similar inland, jack-pine dominated habitats, in the Region between 2001 and 2011 suggest that areas of this vegetation type generally support less abundant and diverse bird communities than other surveyed habitat types.

The four Route Options for the Keeyask Generation Outlet Lines bisect comparable habitat types with respect to use by forest birds. Routes A, B and C are similar in length while Route D is approximately 11% longer. As a result, the average number of breeding-bird pairs that could potentially be displaced from habitat clearing operations along a 230-m right-of-way for each Route Option is comparable, although highest for Route Option D.

Route Option A has experienced minimal fragmentation of bird habitat as a result of infrastructure development, nor is any development other than, potentially, the proposed Generation Outlet Transmission lines, proposed for the area at the time of this report. Transmission Line development along Route Option A would increase fragmentation effects.

In comparison, Route Option B, jointly shared with Route Option C along the western portion of the route, parallels a forested area that is bisected by several existing cutlines which were made during site feasibility studies for the proposed development of the Keeyask Generation Project South Access Road. A longer distance routed alongside existing and proposed infrastructure for Route Option C suggests that the latter route may have a lower potential effect on bird habitat quality and therefore on bird populations utilizing these habitats than Route Option B.

As Route Option D parallels the KN36 transmission line right-of-way for the east-west portion of its route, it is also sited in a previously fragmented landscape. However, as stated previously, the fragmentation effects associated with Route Option D may be greater due to the very wide right-of-way that result from siting the Generation Outlet Transmission lines alongside the KN36 line.

While it is recognized that habitat fragmentation is an issue when considering Route Option A, it is not judged to be as important as some of the factors affecting the more northern options. Route Options B and C pass between two relatively unnamed large lakes just north of Gillrat Lake. The potential for bird collisions in this area by birds transferring back and forth between these lakes exists. In addition to potential bird collisions, Route Options B and C pass in close proximity to Stephens Lake and although Stephens Lake has not been observed to support large numbers of staging waterfowl, there is potential for it to be utilized as a staging area, particularly in the fall.

4.1.3.2 Waterbirds and Shorebirds

Natural riparian edges create diverse vegetative communities that are known to support high bird abundance and diversity (Larue *et al.* 1995, Whitaker and Montevecchi 1997). Breeding-bird surveys in the Project Study Area occasionally revealed a higher diversity of waterbirds at survey stops within or adjacent to riparian edge habitats. Helicopter surveys also confirmed waterbird utilization of inland lakes and creeks in the Project Study Area. Stream crossings by any of the proposed Generation Outlet Transmission Line Route Options increase the potential for disturbance to riparian edge habitats and the bird communities they support. The four proposed Generation Outlet Transmission Line Route Options differ in the number of potential stream crossings required, and therefore, in the potential of each route to affect the quality of bird habitat along riparian edges. A minimum of 10 streams are crossed by Route Option A, Route Option B crosses a minimum of 14, Route Option C crosses at least 17 streams and Route Option D crosses 8 streams (Aquatics Technical Report 2012).

4.1.3.3 Raptors

Generation Outlet Transmission Line Options B and C are located in closer proximity to the Stephens Lake shoreline than Route Options A or D. For this reason, there is increased potential for bald eagles to be in proximity to these lines. However, for most of the route the separation from the lake is sufficient that eagles will likely not utilize the route more frequently than they would Options A or D. All four routes have potential for utilization by foraging raptors and an associated risk of line collisions; however, it is unlikely there will be a measurable difference in level of risk between the options.

4.1.3.4 Species at Risk

Common Nighthawks

Route Option A is located in an area with less fragmented habitat than exists near Options B and C which are located near the Keeyask Generation Project South Access Road and Butnau Road. Route Option D is sited along the KN36 transmission line. As such, clearing land along Option A may have potential to affect common nighthawks more than similar activities at Options B, C or D since Options B, C and D already have more open areas which may be frequented by foraging or nesting common nighthawks. Due to their low densities and broad distribution, effects on common nighthawks are expected to be low for all Route Options.

Olive-sided Flycatcher

Along the Generation Outlet Transmission Line options, olive-sided flycatcher habitat was found in the area to the east of Gillrat Lake, in the Cache Creek/Cache Lake area and along the Kettle River in the Gillam area (Map 4-2). Olive-sided flycatcher preferred habitat evaluations revealed that Route Option C would potentially traverse the most habitat followed by Route Options B and A, respectively. Habitat mapping for Option D was unavailable.

Rusty Blackbird

Along the Generation Outlet Transmission Line Route Options, rusty blackbird habitat was found around Gillrat Lake and just to the east of Gillrat Lake, north of Cache Lake near Stephens Lake, and in the area to the south of the Butnau dam (Map 4-3). Rusty blackbird preferred habitat evaluations revealed that Route Option C would potentially traverse the most habitat and has the potential to affect rusty blackbird habitat followed by Route Options B and A, respectively. Habitat mapping for Option D was unavailable.

Table 4-2 illustrates the ratings of the Generation Outlet Transmission Line Options for the various bird groups.

Table 4-2: Generation Outlet Transmission Line Options Ratings for Bird Groups

Bird Group	Option A	Option B	Option C	Option D
Passerines	p			
Waterbirds/Shorebirds	**P**			
Raptors	n	n	n	n
Common Nighthawk	N	n	n	n
Olive-sided Flycatcher	p			
Rusty Blackbird				

P = preferred route
p = preferred route (slight preference)
n = no preference

4.1.4 Keeyask Switching Station

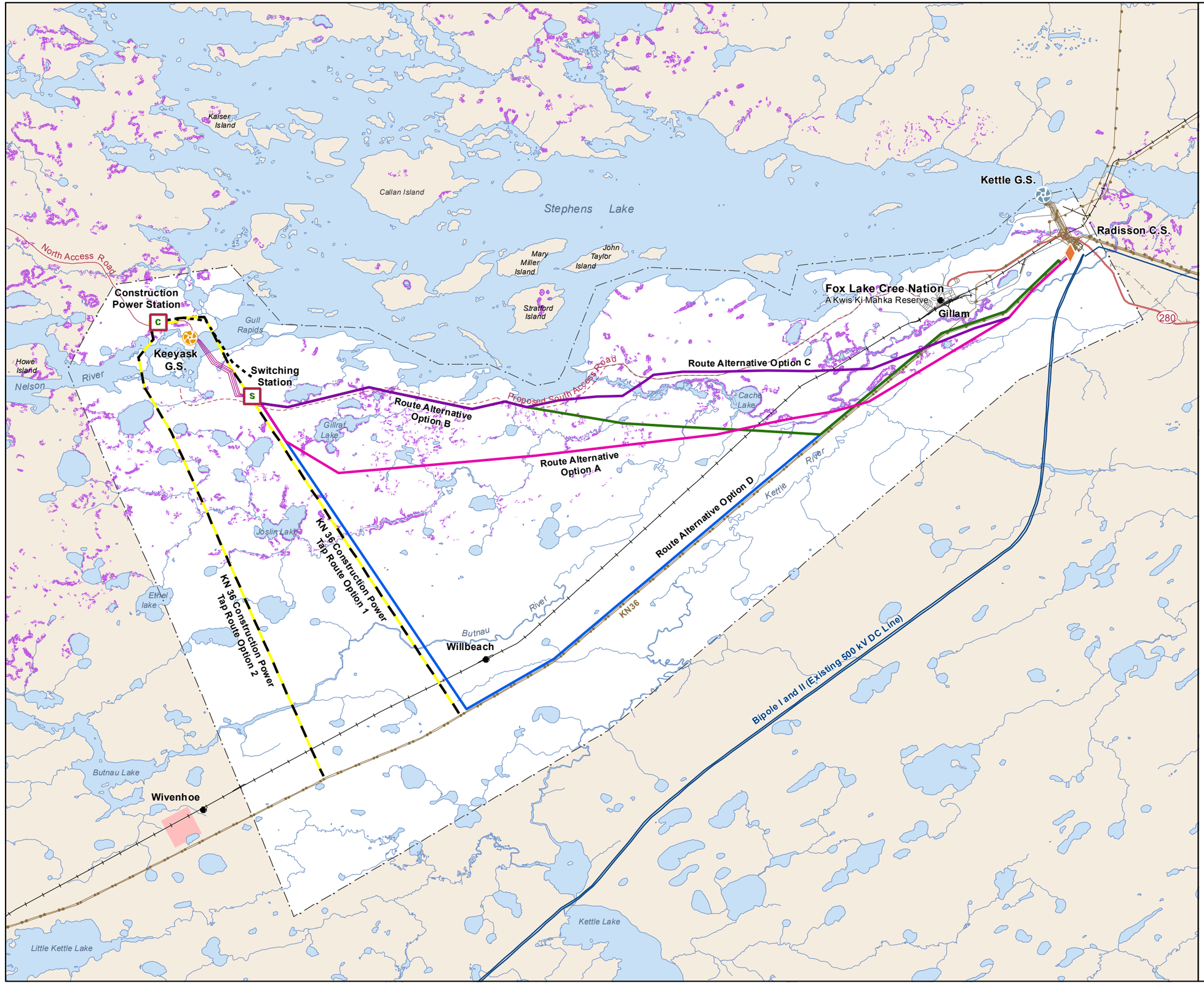
Within the Project Study Area, seven alternative station sites were identified. Three sites (Sites 5, 6 and 7) on the north side and four sites (Sites 1 through 4) on the south side of the Nelson River (Map 4-4). Sites 5 through 7 were ruled out as technically not feasible due to doubling the distance of transmission lines and the need for approximately four to 16 electrical crossovers. Site 1 was ruled out due to its location within the flooded area of the proposed Keeyask Generation Project and Site 2 is located on a rock quarry making construction unfeasible. Technically, Site 3 on the south side of the Nelson River is the preferred site with Site 4 serving as the alternative location.

A desktop photo analysis and examination of data collected for Keeyask Generation Project studies was undertaken to assess Sites 3 and 4 to identify the potential for substantive negative effects on birds. Results from this analysis verified that should any significant constraints be identified with respect to unanticipated negative effects on birds at Site 3, Site 4 would be developed as the alternative (Map 4-4).

4.1.5 Radisson Converter Station Upgrade

Evaluations with respect to birds did not identify any significant environmental effects associated with the proposed changes to the Radisson Converter Station.

Upgrades to the Radisson Converter Station will occur within the existing footprint of the station. These upgrades will not adversely affect bird species in the area as they have been acclimated to the existence of the station for many years.



Keeyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- Construction Power Line (Temporary)
- Unit Lines
- Construction Power Station
- Switching Station
- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- North Access Road
- Proposed Access Road

Olive-sided Flycatcher Habitat

- High
- Moderate

Landbase

- Community
- Provincial Road
- Municipal Road
- Active Railway
- Abandoned Railway
- Watercourse
- Waterbody

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: Monday, September 24, 2012

N

0 2 4 Kilometres
0 2 4 Miles

1:150,000

Olive-sided Flycatcher Habitat within the Project Study Area

Map 4-1

Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- Construction Power Line (Temporary)
- Unit Lines
- Construction Power Station
- Switching Station
- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- North Access Road
- Proposed Access Road

Rusty Blackbird Habitat

- High
- Medium

Landbase

- Community
- Provincial Road
- Municipal Road
- Active Railway
- Abandoned Railway
- Watercourse
- Waterbody

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: Monday, September 24, 2012

N

0 2 4 Kilometres
0 2 4 Miles

1:150,000

Rusty Blackbird Habitat within the Project Study Area

Map 4-2

Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- Construction Power Line (Temporary)
- Unit Lines
- Construction Power Station
- Switching Station
- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- North Access Road
- Proposed Access Road

Common Nighthawk Habitat

- High
- Moderate

Landbase

- Community
- Provincial Road
- Municipal Road
- Active Railway
- Abandoned Railway
- Watercourse
- Waterbody

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: Monday, September 24, 2012

N

0 2 4 Kilometres
0 2 4 Miles

1:150,000

Common Nighthawk Habitat within the Project Study Area

Map 4-3

Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure

- Alternative Construction Power Station Site
- Alternative Switching Station Site

Infrastructure

- Keeyask Generation Infrastructure (Proposed)
- South Access Road (Proposed)
- North Access Road

Coordinate System: UTM Zone 15N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: September 24, 2012

N

0 250 500 Metres

1:20,000

Alternative Construction Power and Switching Station Sites

Map 4-4

5.0 EFFECTS AND MITIGATION

5.1 BIRD OVERVIEW

Manitoba Hydro is committed to responsible environmental stewardship, which aims to minimize the environmental effects of the Project components on bird species (Manitoba Hydro 2011). By conducting a detailed effects assessment, Manitoba Hydro is committed to developing the Project while mitigating any potential Project effects on migratory and resident bird species where possible.

Potential effects are expected when bird ranges overlap spatially and temporally with the Project. Most species are migratory in Manitoba, generally migrating northward in spring, nesting in suitable habitats in spring and summer, and migrating south in fall to over-winter in the southern United States and in Central and South America. In Manitoba, few bird species are year-round residents (Carey *et al.* 2003).

Clearing, construction, operation, and maintenance of the infrastructure associated with the Project are expected to affect birds and bird communities in several ways. Effects can be positive, negative, or neutral, depending upon the affected species. Potential effects include increased mortality, habitat alteration and fragmentation, sensory disturbance, and disruption of movements.

5.1.1 Potential Effects

The completed effects assessment identifies potential effects of the Project components on bird species during the operation and construction phases of the Project; this includes evaluation of: Construction Power Transmission lines, Unit Transmission lines and Generation Outlet Transmission lines, as well as the Construction Power Station, Keeyask Switching Station and Radisson Converter Station Upgrades. Proposed mitigation measures were derived based on public domain literature and environmental assessments. The potential effects of Project-related construction, operation and maintenance on bird species and communities are as follows:

- Increased Mortality:
    - Due to collisions with vehicles or machinery, and collisions with transmission wires.
    - Of waterfowl, other waterbirds, and upland game birds due to increased hunting.
    - Mortality or nest loss due to construction or maintenance during the spring nesting season.
    - Increased susceptibility to terrestrial predators.

- Habitat Alteration:
    - Loss or alteration of habitat on Project rights-of-way
    - Loss or alteration of habitat in Project infrastructure component footprints.
- Sensory Disturbance:
    - And/or habitat avoidance due to clearing or maintenance activities.
    - Disruption of daily movements due to the physical presence of humans, machinery, or Project structures.

5.1.1.1 Mortality

Increases in bird mortality can occur in a variety of forms, including collisions with transmission wires and vehicles, electrocutions, increased predation and hunting. Bird-wire strikes are one of the most common causes of non-hunter related mortality for birds, particularly birds with short wings and large body masses (Avery *et al.* 1980; Malcolm 1982; Rusz *et al.* 1986; Faanes 1987; Morkill and Anderson 1991; Brown and Drewien 1995; Bevanger 1998; Training Unlimited Inc. 2000). Other factors influencing a bird's likelihood of colliding with a transmission wire include visibility (e.g., weather conditions, time of day), age of the bird (i.e., younger birds are more prone to collisions), location of the wire (e.g., wires crossing migration corridors can cause more collisions), and surrounding environment (Bevanger 1994; Brown and Drewien 1995; Bevanger 1998). While the possibility for any bird species to collide with a vehicle exists, the likelihood of such an event is considered to be remote while travelling on a transmission line right-of-way.

Clearing and maintenance associated with the right-of-way and other Project components may result in the destruction of some nests, consequently decreasing nest success or increasing mortality rates of hatchlings. With the exception of a few irregular nesting species such as gray jay (*Perisoreus canadensis*) that nest in late winter, the risk of nest disturbance from maintenance and clearing is reduced and nearly eliminated by limiting these activities to winter months.

The introduction of new transmission lines on the landscape could contribute to increased predation on some bird species located near the right-of-way, by raptors. Artificial perching and roosting structures such as transmission towers are used by some raptors in habitats with few natural perches; these perches provide an elevated viewpoint to aid in locating prey (Boeker and Nickerson 1975; Knight and Kawashima 1993). Raptors often utilize transmission towers even in habitats containing natural perch sites as the great height of transmission towers offer the highest vantage point (Lammers and Collopy 2007).

In addition, nests located near the forest edge are under greater predatory pressures from small mammals such as chipmunks and red squirrels that may not utilize the central portion of transmission line rights-of-way (Chasko and Gates 1982). In addition to increased predation as the right-of-way is cleared and access trails are created, opportunities for harvest of upland game birds and waterfowl may increase. In some cases, access could be limited by physical barriers (e.g., terrain, water). Provincial harvest management strategies and regulations are an important consideration in ensuring that sustainable upland game bird and waterfowl population goals are met.

5.1.1.2 Habitat Alteration

The loss of individuals and a decline in a species' population is strongly associated with habitat loss (Schmiegelow and Mönkkönen 2002). The vulnerability of bird species to habitat loss is dependent on their degree of habitat specialization; birds with broad-ranging habitat requirements are less likely to be affected (Hockey and Curtis 2008). Conversely, species that are highly specialized for small, rare habitat features are extremely vulnerable to any habitat loss (Hockey and Curtis 2008). Generally, habitat types that occur in the Project Study Area are common in the Region.

Fragmentation of habitat involves the removal of existing habitat that results in smaller isolated patches of remaining habitat where there was previously continuous habitat (Bender *et al.* 1998). Stable species abundance in fragmented landscapes may mask changes in bird communities due to replacement of locally extirpated species by immigration of species that favour fragmented habitats (Schmiegelow *et al.* 1997). Population declines observed in some birds may be attributed to their habitat requirements, as species that favour interior habitat will experience declines as the habitat becomes fragmented into smaller and smaller patches (Bender *et al.* 1998). This high degree of habitat specialization increases bird species' susceptibility to habitat loss and fragmentation. Increasing fragmentation of a landscape may not lead to declines in bird populations when remaining patches of habitat are large enough to provide suitable breeding habitat to allow for stable populations (Schmiegelow *et al.* 1997). It was observed during field studies, that other bird species may be positively affected by the creation of openings in a previously contiguous forest stand. Consequently, fragmentation of habitat has the potential to affect many bird species, both positively and negatively.

The effects of fragmentation on bird groups may be somewhat mitigated by allowing vegetation regrowth to occur; however vegetation management will generally maintain the right-of-way at an early stage of succession, which may be of limited use to species favouring interior forest habitat. The habitat of rights-of-way is expected to benefit edge-favouring species, and potentially shrubland birds.

The effects of habitat alteration due to clearing and maintenance activities, as well as construction activities would be mitigated in part, by limiting these activities to winter months.

Year-round construction disturbances associated with the Project are associated with point-source disturbances at the station sites and borrow areas.

5.1.1.3 Sensory Disturbance

Birds occurring along transmission lines that are affected by sensory disturbance may react by nest or territory abandonment, particularly those birds that rely on songs and calls for communication and territory establishment and defence (Bayne *et al.* 2008; Francis *et al.* 2009). Additionally, noise disturbance (i.e., construction equipment noise) may result in increased and decreased predation rates, as noise interferes with the ability of some birds to pick up on audio cues to the presence of a predator (e.g., warning calls from other birds) while interfering with the ability of predators to pick up on audio cues regarding the presence of prey species (Slabbekoorn and Ripmeester 2007).

The physical presence of humans, towers, and machinery in the Project Study Area during Project construction and operation and during maintenance operations could affect seasonal and daily movements of some species or individuals as they alter their pathways to avoid disturbance. Limited movement can prevent individuals from accessing resources and can hamper their ability to avoid predators (AltaLink Management Ltd. 2006). Daily movements could be altered on a local scale. Most transmission line projects likely have little effect on seasonal movements such as the spring and fall migrations of larger bird species, as most fly considerably higher than the height of transmission lines and any related construction activities on the ground (Gauthreaux 1972). The effects of disruption of movements due to clearing and maintenance activities, as well as construction activities, are mitigated by limiting these activities to winter months.

5.1.2 Summary of Mitigation Measures

The following mitigation measures are proposed to minimize and mitigate effects of the transmission lines during the clearing and construction phase:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods;
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods (300 m for olive-sided flycatcher and 100 m for rusty blackbirds).
- Night-time activities will be avoided during the nesting season to minimize disturbance to common nighthawk.

- Shrubby vegetation will be maintained on the rights-of-way where possible.
- Shrubby vegetation will be maintained on the right-of-way where possible as potential olive-sided flycatcher habitat.
- Vegetation management will be limited in areas where common nighthawk could occur from April 1 to July 31 to minimize the risk of nest destruction.
- Bird diverters may be installed if sensitive sites are identified during Project Monitoring. These have been demonstrated to be effective in other locations (Manitoba Hydro 2012).

Although individuals of a population may collide with transmission lines, there is not expected to be a population level effect; however, the use of deflectors on the lines could potentially reduce the collision risk if an area of high occurrence was found.

5.2 VALUED ENVIRONMENTAL COMPONENTS

5.2.1 Bird Valued Environmental Components

Bird Valued Environmental Components (VECs) for the Project consisted of one bird group (raptors) and three Species at Risk (common nighthawk, olive-sided flycatcher and rusty blackbird).

As a group, raptors have several species that may utilize transmission line corridors for hunting, perching or nesting (certain hawks, some owls, bald eagles and osprey). Consequently, they have the potential to be affected by the Project. Effects of Project construction and operation on raptors include: mortality, habitat alternation and sensory disturbance.

The common nighthawk is listed as “threatened” by Schedule 1 of *SARA* and *MESA*. Because common nighthawks lay eggs directly on the ground in open areas and frequently roost on bare patches on the ground they have the potential to be affected by clearing activities related to the Project (Taylor 2003a). Effects of Project construction and operation on common nighthawks include mortality and habitat alteration.

Rusty blackbird and olive-sided flycatcher both nest in the forested area which will be affected by Project development. They have the potential to be affected by habitat loss and alteration along the transmission line right-of-way and at station sites. They could similarly be affected by vegetation management along the right-of-way and at station sites depending on the timing of these activities.

5.2.2 Construction Effects on Raptors

5.2.2.1 Mortality

Few direct causes of mortality of raptors such as bald eagle are expected during clearing and construction phases of the Project. Birds of prey are somewhat susceptible to collisions with vehicles (Harness and Wilson 2001; AltaLink Management Ltd. 2006; Stinson *et al.* 2007). Limited increases in local traffic to and from construction sites, and low vehicle speeds along transmission line rights-of-way are expected to result in very few accidental raptor injuries or mortalities. Ground nesting raptors are at increased potential for nest and egg destruction by machinery during the construction phase.

5.2.2.2 Habitat Alteration

Clearing of the rights-of-way and at the station sites will result in the disruption, alteration, and improvement of some raptor nesting and foraging habitat. Loss of mature and dead standing trees from clearing will have an adverse effect on the local population of raptors that return each year to breed within the Project Study Area (e.g., northern hawk owl, great gray owl, osprey, and red-tailed hawk [*Buteo jamaicensis*]).

With the exception of short-eared owl (*Asio flammeus*) and northern harrier (*Circus cyaneus*), ground-nesting species that use open habitats, loss of tree cover will have long-term adverse effects on all raptor species that utilize the Project Study Area (Holt and Leasure 1993; Marks *et al.* 1994; Houston *et al.* 1998). Species potentially affected include merlin, northern hawk owl (*Surnia ulula*) and long-eared owl.

The removal of forest cover will not only affect breeding and foraging habitat but it will also lower the abundance of thermal cover required by raptor species that overwinter within the Project Study Area (e.g., northern hawk owl and great gray owl [*Strix nebulosa*]).

Some raptor species, including members of the hawk (*Accipteridae*), falcon (*Falconidae*), and owl (*Strigidae*) families, may benefit from the creation of edge habitats associated with forest clearing along rights-of-way and at station sites. For some raptors, foraging efficiency is often greater along forest edges due to the presence of perches (e.g., trees), visibility of prey and abundance of prey (Widen 1994). For other species, fragmentation of contiguous forest will have an adverse effect on their abundance and distribution. Great gray owls can be adversely affected by forest clearing activities through increased competition with great horned owls, which benefit from the creation of edge habitats (Bull and Duncan 1993).

5.2.2.3 Sensory Disturbance

During construction, noise from heavy equipment and human activity may cause short-term disturbance to some raptors breeding and/or overwintering in the Project Study Area. However,

raptors are quite tolerant of disturbance and may acclimate to the noise quite readily (Becker 2002).

5.2.3 Operation Effects on Raptors

5.2.3.1 Mortality

Electrocution can be a significant source of raptor mortality (Lehman *et al.* 2007). As large raptors such as bald eagle are susceptible to electrocution (Harness and Wilson 2001; Millsap *et al.* 2004), mortality could increase where they are attracted to the transmission line and structures. Collisions with wires are a potential source of mortality, and species that fly at high speeds in pursuit of prey, such as northern goshawk, are most prone to collisions (Bevanger 1994). Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires. While individual birds may occasionally collide with transmission wires, otherwise healthy populations should not be affected by such incidents. Mortality of a few individuals would result in negligibly reduced local populations of birds of prey.

Northern harriers and short-eared owls which nest on the ground in open areas (Holland and Taylor 2003) could have their nests destroyed or damaged by vegetation management during the spring nesting season.

5.2.4 Construction Effects on Common Nighthawk

5.2.4.1 Mortality

Common nighthawk range extends throughout the Project Study Area. No effects on this migratory species' mortality are anticipated during winter clearing. This species lays eggs directly on the ground in open areas (Taylor 2003b), and eggs or hatchlings could be destroyed during construction machinery in the summer. Common nighthawks frequently roost on bare patches on the ground, and are susceptible to collisions with vehicles (COSEWIC 2007b). Local increases in traffic associated with construction activities may temporarily increase the risk of common nighthawk collisions with vehicles. These collisions are generally infrequent. As all sources of mortality are important to species at risk as they can affect local and regional populations, mitigation measures are required to minimize these potential effects. A common nighthawk was found dead on the roadside during 2010 bird surveys, indicating that collisions with vehicles, while unlikely, are possible in the Project Study Area.

5.2.4.2 Habitat Alteration

COSEWIC (2007b) reports that habitat loss or alteration may contribute to the decline of common nighthawk populations in the Prairie Provinces. In some cases, common nighthawk

nesting and foraging habitat may improve slightly where forest is converted to open habitats where nighthawks nest on the ground and often forage in open habitats. This may be true when clearing of the transmission line rights-of-way and at the station sites.

Common nighthawks may be subject to sensory disturbance from construction equipment noise. Also, lighting at the construction camp and work sites may attract insects which could be preyed upon by nighthawks.

5.2.5 Operation Effects on Common Nighthawk

As common nighthawks lay eggs on the ground in clearings (Taylor 2003b), eggs or hatchlings could be damaged or destroyed during vegetation maintenance in spring. As this species is migratory, no effects on mortality are anticipated during the winter. As well, there is potential for some bird-wire collisions by nighthawks foraging along the right-of-way. Permanent lighting at station sites may attract insects which could be preyed upon by common nighthawks.

5.2.6 Construction Effects on Olive-sided Flycatcher

Mortality

No effects on the olive-sided flycatcher's mortality are anticipated during winter clearing. Olive-sided flycatchers are unlikely to nest on the cleared rights-of-way if shrubs are not established. It is anticipated that olive-sided flycatcher will not experience adverse effects during construction activities as this species is not likely to be subject to vehicle collisions.

Habitat Alteration

COSEWIC (2007a) states that habitat loss and alteration are believed to contribute to olive-sided flycatcher population declines. Minor habitat alterations and losses may affect a few individuals where suitable perch trees are removed, but are not expected to have a measurable effect on local populations or to breeding and nesting habitat availability.

5.2.7 Operation Effects on Olive-sided Flycatcher

Minor Project-related effects on olive-sided flycatcher mortality are anticipated during the operation and maintenance phase. As olive-sided flycatchers are associated with semi-open forests, edges, and clear-cuts (Altman and Sallabanks 2000), nests could be destroyed during vegetation management on the right-of-way in spring.

5.2.8 Construction Effects on Rusty Blackbird

Rusty blackbird range extends throughout Manitoba, including the Project Study Area. As this species is migratory, no effects on mortality are anticipated during winter clearing. Rusty blackbirds mainly nest in northern treed muskeg habitat (Nero and Taylor 2003), and are unlikely to nest on the cleared right-of-way if regenerating vegetation is not established. Collisions with vehicles are not reported in the literature reviewed. No Project-related effects are expected during the clearing and construction phase.

COSEWIC (2006) states that alteration of wintering habitat is the most important threat to rusty blackbird populations, and loss of breeding habitat also contributes to this species' decline. Minor habitat alterations and any potential habitat losses may affect a few individuals at Project footprints but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability.

5.2.9 Operations Effects on Rusty Blackbird

Minor effects on rusty blackbirds may occur as a result of right-of-way maintenance activities. Once vegetation becomes re-established along the right-of-way there is potential for rusty blackbirds to utilize the right-of-way for nesting and the nesting birds could be disturbed if vegetation control activities occurred during the nesting season

5.3 RESIDUAL EFFECTS

Manitoba Hydro has sought to avoid adverse impacts and to enhance positive benefits during the site-selection process, whenever possible and practical.

After the mitigation measures are implemented, the potential long-term residual effects remaining may include:

- Minor alteration or loss of habitat and its use by birds along the transmission line rights-of-way and at station sites and borrow sites.
- Sensory disturbances which may result in temporary movements into alternate habitats by local birds.
- Small increases in foraging and nesting opportunities for some birds, while other bird species may experience small decreases in foraging and nesting opportunities.
- Small increase in bird mortality from increased hunting pressure due to increased access along the transmission line rights-of-ways.

These effects can be observed during the construction and operations phases of the Project and mainly reversible based on decommissioning activities. Residual effects are expected to only be of small magnitude after applying the Project mitigation measures. As outlined in Section 2.5.1, residual effects on VECs are discussed below.

5.3.1 Residual Effects on Raptors

Residual effects on raptors will include habitat alteration, habitat loss and habitat avoidance due to sensory disturbance. During construction, habitat alteration will occur along the transmission line rights-of-way and at borrow sites. Habitat loss will occur at the tower footprints and at the station sites. Sensory disturbance from construction activities may discourage use of some habitat in the local area.

During operations, habitat alteration will occur as a result of vegetation-management activities along the rights-of-way. Although infrequent, sensory disturbance as a result of maintenance activities may result in temporary avoidance of the area. However, maintenance activities will occur infrequently. Habitat avoidance due to sensory disturbance from mechanical operations or human activity may occur at the station sites.

5.3.2 Residual Effects on Common Nighthawk

Residual effects on common nighthawk may include habitat loss, alteration and avoidance (and sensory disturbance). Construction activities will cause habitat alteration along the transmission lines rights-of-way and at the borrow sites. Habitat loss will occur at station sites and tower footprints. Sensory disturbance, specifically noise from construction equipment activities may discourage use of some habitat in the Project Study Area.

During operations, habitat alteration will result from vegetation management along the transmission line rights-of-way. It is possible short-term avoidance of the area resulting from sensory disturbance from human and mechanical activities during both maintenance and operations activities of the Project may occur. Maintenance activities will only occur once per year or less, while operation activities will occur for the life of the Project. Additional potential for bird collisions along transmission lines also exists.

A summary of residual effects is provided in Table 5-1.

5.3.3 Residual Effects on Olive-sided Flycatcher and Rusty Blackbird

Residual effects on olive-sided flycatcher and rusty blackbird will be potential for bird-wire collisions along the transmission line rights-of-way and very minor habitat loss at station sites and tower footprints. These effects are expected to be small and not significant.

Table 5-1: Summary of Residual Effects on Birds

Potential Effect	Project Phase	Mitigation	Residual Effect	Assessment Characteristics
Bird Habitat				
Minor habitat loss will occur at station sites and transmission tower footprints	Construction and Operation	Land developed at station sites will be kept to the minimum required and land disturbed during tower construction, but not part of the actual tower foundation, will be returned to a natural state	Some bird habitat will be lost	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term.
Minor habitat alteration will occur along right-of-way	Construction and Operation	Land cleared along the right-of-way will be allowed to regenerate to a height that is considered practical for operations	Some bird habitat will be altered	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term.
Sensory disturbance from construction activities	Construction	Clearing to occur in winter to avoid effecting migratory species, vehicles will be maintained in good working order to limit noise produced	Some disturbance from construction noise	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: short-term.
Mortality due to increased hunting	Construction and Operation	Prohibition of firearms in camp Decommissioning of trails used during construction	Some increased harvest of upland gamebirds and waterfowl	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term.

Table 5-1: Summary of Residual Effects on Birds

Potential Effect	Project Phase	Mitigation	Residual Effect	Assessment Characteristics
Increase in foraging opportunities for species that frequent forest openings	Construction and Operation	none	Potential positive effect on some species	Direction: Positive Magnitude: Small Geographic Extent: Small Duration: Long-term.

5.4 INTERACTIONS WITH FUTURE PROJECTS

Future projects that were considered in evaluating the effects of the Project included:

- Development of the Keeyask Generation Project.
- Development of the Bipole III Transmission Project.
- Development of the Conawapa Generation Project.
- Town of Gillam Redevelopment (including the potential for development of new housing within the Town of Gillam).

The proposed Project is not particularly large. However, has numerous components including transmission lines, a switching station, a transformer station, a construction camp, and the creation of borrow pit areas. Each Project component may have environmental effects that may act cumulatively with effects from other components along with effects from future projects and activities in the Project Study area.

Maintaining bird species and communities is important for maintaining biodiversity and ecosystem function. Bird species play an important role as seed dispersers, pollinators, game species, and insect predators (Sekercioglu 2006). Worldwide, the rate of bird species extinctions is largely unprecedented and is worsened by human activities including habitat loss and alteration (particularly deforestation), climate change, and introduced species (Butchart *et al.* 2006; Pimm *et al.* 2006).

Many environmental factors may play a role in affecting bird species and communities alongside the development of the the Project. These factors could include various anthropogenic practices, specifically forms of landscape development including road building, land clearing and hydroelectric generating station developments such as the Keeyask Generation Project.

Natural changes to bird communities could alternately take place through environmental drivers including forest fires, flooding, insect outbreaks, and climate change. Due to the uncertainty of climate change, it is difficult to predict its role in cumulative effects on bird species and communities. However a number of potential effects can be identified such as changes in predictable climate patterns may result in earlier breeding and egg laying (Price and Glick 2002, BirdLife International 2004). Additional changes in bird behaviour linked to environmental changes include migratory birds responding to cues in the south indicating the onset of migration season when in fact they are returning to the summering grounds too early (Price and Glick 2002, BirdLife International 2004).

The development of infrastructure such as roads, transmission lines, trails, etc., may lead to increased bird-vehicle (Loos and Kerlinger 1993) and bird-wire collisions (Chasko and Gates 1992; Nobel 1995).The potential for forest fires also exists in the region where large tracts of forests can precipitate forest fires which lead to a level of landscape disturbance and alter the suitability of habitat to avian species (Vierling *et al.* 2008).

Increases in global temperatures are also predicted to result in the northern expansion of bird ranges. A warming climate could result in fewer wetlands holding water, and drought could be more frequent and of longer duration, while in the boreal forest, permafrost thawing could cause wetland drying in some regions (Andrews *et al.* 2008), affecting habitat for waterfowl and other waterbirds, while in other areas permafrost thawing may result in an increase in wetlands. Finally, changes in climate may cause disruption of ecological communities resulting in new predators, competitors, and prey to which a species has not adapted to (Price and Glick 2002, BirdLife International 2004). The following assessment examines how the development of the Keeyask transmission line, considered with other development in the area, could affect avian VECs.

5.4.1 Raptors

There are a number of raptor species inhabiting, breeding or staging in the Region. This assessment focuses on the bald eagle and short-eared owl. Raptors have a range of habitat use characteristics but are similar in typically having relatively large hunting grounds and being largely responsive to changes in prey density (Janes 1984). Foraging areas therefore often includes perching areas as well as open ground where raptors can ambush prey (Kirk and Hyslop 1998; Smith *et al.* 2003). The removal of stands through forestry practices and forest fires can therefore possibly remove perch stands, while increasing open areas, and affect raptor distribution (Kirk and Hyslop 1998; Smith *et al.* 2003). Use of chemical deterrents, (i.e., pesticides and herbicides) which cause declines in the abundance of potential prey (i.e., rodents) can also be linked with limiting raptor distribution, fledgling deformations and decreased eggshell thickness (e.g., the impact of DDT) on bald eagles (Buehler 2000). The use

of pesticides in rights-of-way maintenance may also cause bioaccumulation of harmful substances in animals that raptors prey (Buehler 2000; Koonz 2003).

5.4.1.1 Bald Eagle

The Bald eagle range extends over much of Manitoba and they are abundant in the area near where the Project development will occur. Impacts of development on bald eagles are often associated with the removal of large trees potentially used as nesting areas and as perches overlooking hunting areas (Buehler 2000). Previously, pesticide use, specifically DDT, was linked with population declines and was a primary determinant in this species being listed in the United States under the *Endangered Species Act* (Buehler 2000; Koonz 2003).

Specific developments that could affect bald eagle presence include forestry practices and other development projects that reduce the quantity of usable forest stands. Where the consumption of fish species is prevalent, the bioaccumulation of methylmercury can have adverse effects on bald eagles (Bechard *et al.* 2009). The impact of climate change on bald eagles is likely variable and based on the extent of seasonal climatic extremes where changes in the available prey may affect life-history characteristics. Milder winters may benefit this species, as it may become a more frequent year-round resident in Manitoba.

Residual effects of the Project on bald eagles include habitat alteration, habitat loss and potential habitat avoidance due to sensory disturbance. There is minor potential for wire strikes by this species (Buehler 2000); although bald eagles are generally considered agile flyers, therefore wire strikes will likely not affect overall population numbers. Forest clearing and the periodic maintenance of cleared transmission line rights-of-way should be done with caution and according to those guidelines and thresholds set by Manitoba Conservation (2010) where nests are avoided by 50-200 m based on season.

5.4.1.2 Short-eared Owl

The breeding season range of short-eared owl potentially extends over all of Manitoba. The irruptive nature of short-eared owl populations and where they may nest in Manitoba; however, is difficult to predict. Notable threats to short-eared owl include the development of habitat areas for varied development purposes as well as the absence of potential prey species (Holt and Leasure 1993).

The introduction of varying environmental contaminants, i.e. pesticides, fertilizers, herbicides, etc., likely play a role in altering the availability of prey for short-eared owls.

Residual effects of the Project could affect short-eared owl mortality associated with individual bird-wire collisions.

5.4.2 Common Nighthawk

The breeding range of the common nighthawk extends over much of Manitoba, though it is seldom present above the treeline (Taylor 2003a). Threats to common nighthawk are mainly based on habitat loss and alteration and reductions in insect populations that serve as a primary food source (Behrstock 2001; Savignac 2007).

Foraging by nighthawks generally takes place in areas with water (i.e., lakes, rivers and swamps) as well as forested clearings. The creation of gravel roads can serve to attract nighthawks for nesting purposes and have the adverse consequence of increased mortalities through vehicle strikes (Taylor 2003a). Climate-change effects which may serve to potentially alter common nighthawk distribution include the expansion of the breeding range with the northwards expansion of the treeline.

Residual effects of the Project on common nighthawks are expected to include some mortality associated with a few individual bird-wire collisions. The Project may create some usable habitat through the maintenance of cleared rights-of-way.

5.5 MONITORING

In order to determine long-term effects of the Project on birds, a bird-monitoring program will be implemented. The Bird-Monitoring Program is designed to confirm predictions of effects and to determine whether unexpected effects are occurring. Manitoba Hydro is responsible for ensuring that mitigation measures prescribed are implemented and verified through follow-up inspections, monitoring and reporting. Recommended follow-up activities include monitoring of species at risk populations and assessment of bird-wire collisions.

5.5.1 Monitoring During Construction

Potential construction-related activities that would have the most notable effect on birds are primarily associated with:

- The clearing and grubbing of habitat in the Project footprint.
- The presence and noise associated with construction equipment and personnel, which is expected to have potential effects on bird use in habitat adjacent to the Project footprint.

The effects of these Project construction activities on birds will be monitored to test construction-related impact predictions and to measure the effectiveness of the Environmental Protection Plan developed for the Project and to improve it, where necessary.

Bird-monitoring studies during the construction period will focus on areas where bird habitat will be affected most by construction-related activities, i.e., along the transmission route, and at the work camp and station sites.

5.5.1.1 Objectives

The primary objectives of bird monitoring during the construction phase of the Project are to:

- Assess predictions regarding the effects of construction activities on local bird abundance and distribution.
- Determine if any unexpected impacts are occurring as a result of construction activities.
- Determine the effectiveness of mitigation measures and, if appropriate, propose new mitigation options, should unexpected impacts to birds occur as a result of construction-related activities.

5.5.1.2 Project Design

Bird species abundance and diversity will be monitored at sites adjacent to Project construction sites and at sites located at increasing distances from Project construction sites to determine the effects of construction activities on birds. For example, it is expected that bird abundance and diversity at sites immediately adjacent to construction areas may be lower than at less disturbed sites further away from construction activities.

5.5.1.3 Sampling Frequency and Schedule

The bird-monitoring study schedule presently anticipates bird monitoring during the construction period (and for one or two years during operations). Breeding-bird surveys will be conducted during an approximate three-week period during spring (late May to early June) when most birds are singing. Bird monitoring surveys will commence in the first spring following the start of construction. Bird monitoring studies will occur in all areas where construction has been initiated.

5.5.1.4 Methods

The methods for conducting breeding-bird inventories will be consistent with standard procedures for conducting population surveys using the Point-Count Method (Ralph *et al.* 1993; Welsh 1993).These methods have been utilized in all breeding-bird surveys done for the Project. Field investigators conducting the surveys will be familiar with the songs, calls and visual identification of the species encountered. Pre-field training, including listening to bird calls, will add to the integrity of species identification and resulting data.

Surveys will not be conducted when rain or winds interfere with the intensity or audibility of bird songs, or when fog or rain interferes with visibility. Since surveys occur during morning hours, a few species that are more active and sing more frequently in the evening and at night will likely be under-represented during counts (e.g., common nighthawks, owls).

In addition to breeding-bird surveys, an evaluation of other potential construction-related effects, including nesting areas used by raptors (e.g., hawks and eagles) that may be active prior to Project clearing or construction.

5.5.2 Monitoring During Operations

Breeding-bird surveys will be done for one or two years during operations. If analysis of data collected indicates any potential effect on bird communities, additional mitigation measures, such as the installation of bird deflectors, may be necessary.

6.0 CONCLUSIONS

During the routing and site-selection process for the transmission lines and stations associated with the Project, alternative Route Option and Site locations were assessed based on their potential for Project-related effects on bird species and communities.

The two Construction Power Transmission Line Route Options and four Generation Outlet Transmission Line Routes Options were surveyed and evaluated with regard to their environmental effects on bird species and communities. Evaluations were also conducted on sites for the Construction Power and Switching Stations. As areas for these components are similar regarding their potential for effects on bird species and communities, preferred site selection was based on technical considerations.

The Bird Valued Ecosystem Components selected for the Project included three Species at Risk – common nighthawk, olive-sided flycatcher and rusty blackbird as well as one bird group - raptors. These species were utilized to assess residual effects of the Project.

Sensitive sites identified along alternative Route Options included river crossings and routing between two lakes. These sites were judged to have greater potential for negative effects on birds and were identified as less desirable options when considering the potential for effects on bird species and communities.

Potential negative effects of the Project will be mitigated to the extent feasible by route selection decision making. Where the potential for negative effects have been identified, mitigation measures need to be employed. Mitigation measures include:

- Winter clearing of rights-of-way and station sites to reduce potential for effects on nesting birds.
- Allowing some regrowth of vegetation along the rights-of-way to reduce habitat fragmentation effects.
- Restriction of hunting by Project workers to reduce negative impacts on migratory and upland gamebirds.
- Avoidance and buffering of large stick nests.

Effects of the Project on bird communities will exist for the life of the Project. These effects will include minor habitat loss at station sites and transmission tower footprints, sensory disturbance during construction activities, a potential for increased foraging and/or nesting opportunities for species which prefer open areas, and mortality from increased hunting pressure. However,

these effects are expected to be small, and likely not measurable within the range of natural variation of bird populations.

Other developments may occur in the Project Study Area which may affect bird populations. These may include: building of roads, clearing of land and the development of hydroelectric generating stations. Other naturally occurring factors could cause changes in the bird communities. These include: forest fires, insect outbreak or die-offs and climate change.

Monitoring of project-related effects on bird communities has been proposed to occur during the construction period and one or two years after during project operations. Breeding-bird surveys will be conducted to assess bird species abundance and diversity at sites adjacent to Project construction sites.

7.0 GLOSSARY

Biodiversity: The variability among living organisms from all sources, including, without limiting the generality of the foregoing, terrestrial and marine and other aquatic ecosystems and the ecological complexes of which they form a part and includes the diversity within and between species and of ecosystems (Canadian Environmental Assessment Act).

Boreal: Of or relating to the cold, northern, circumpolar area just south of the tundra, dominated by coniferous trees such as spruce, fir, or pine. Also called taiga.

Crepuscular: Appearing or active in twilight.

Cryoboreal: Refers to species characteristic of the colder parts of the Boreal Zone.

Esker: A narrow ridge of sand or gravel, usually deposited by a stream flowing in or under glacial ice.

Fen: Peatland in which the plants receive nutrients from mineral enriched ground and/or surface water. Water chemistry is neutral to alkaline. Sedges, brown mosses and/or Sphagnum mosses are usually the dominant peat forming vegetation.

Forage(ing)[1]: To locate, capture, and eat food.

Fragmentation: Refers to the extent to which an area is broken up into smaller areas by human features and how easy it is for animals, plant propagules and other ecological flows such as surface water to move from one area to another. Fragmentation can isolate habitat and create edges, which reduces habitat for interior species and may reduce habitat effectiveness for other species. *OR* The breaking up of contiguous blocks of habitat into increasingly smaller blocks as a result of direct loss and/or sensory disturbance (*i.e.*, habitat alienation). Eventually, remaining blocks may be too small to provide usable or effective habitat for a species (Cumulative Effects Assessment).

Indicator Species: A species this is closely correlated with a particular environmental condition or habitat type such that its presence, absence, or state of well-being can be used as indicator of environmental conditions. A species whose population size and trend is assumed to reflect the population size and trend of other species associated with the same geographic area and habitats.

Moraine: A mass of rocks, gravel, sand, clay and other materials deposited directly by a glacier.

Riparian: Along the banks of rivers and streams.

Topography: General configuration of a land surface, including its relief and the position of its natural and manmade features.

Transect: A line located between points and then used to investigate changes in attributes along that line.

Umbrella indicator: An indicator that is thought to represent changes for a broad group of species, several ecological pathways and/or an indicator of one or more other topics.

Valued Environmental Component (VEC): Any part of the environment that is considered important by the proponent, public, scientists or government involved in the assessment process. Importance may be determined based on cultural values or scientific concern.

Wildlife: All undomesticated organisms including invertebrates, amphibians, reptiles, birds, and mammals. Excludes people and plants.

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APPENDIX A

SURVEY DATA

Appendix A, Table A-1: Average Density of Birds Observed Within Surveyed Broad Vegetation Types* in the Keeyask Transmission Project Study Area - 2009 to 2011											
Species	**Scientific Name**	**Black Spruce Mixedwood**	**Black Spruce Mixture**	**Black Spruce Pure**	**Human**	**Jack Pine Mixture**	**Jack Pine Pure**	**Low Vegetation**	**Tamarack Pure Mixture**	**Tamarack Pure**	**Young Regeneration**
Passerine											
Alder Flycatcher	*Empidonax alnorum*		0.10	0.08	0.28	0.17		0.14	0.06		
American Crow	*Corvus brachyrhynchos*			<0.01							
American Robin	*Turdus migratorius*		0.02	0.04		0.04		0.05			0.07
Bay-breasted Warbler	*Dendroica castanea*					0.04	0.09				
Blackpoll Warbler	*Dendroica striata*	0.28	0.34	0.31	0.42	0.13	0.19	0.21	0.60	0.94	0.14
Blue-headed Vireo	*Vireo solitaries*					0.04					
Boreal Chickadee	*Parus hudsonicus*			0.01			0.09	0.01			
Brown Creeper	*Certhia Americana*		0.02	0.01							0.07
Chipping Sparrow	*Spizella passerine*		0.07	0.03				0.02	0.05		0.21
Clay-colored Sparrow	*Spizella pallida*				0.14						
Common Raven	*Corvus corax*			0.01					0.05	0.06	0.07
Common Redpoll	*Carduelis flammea*			<0.01							
Dark-eyed Junco	*Junco hyemalis*		0.17	0.17	0.42	0.17	0.09	0.26	0.09		0.07
Fox Sparrow	*Passerella iliaca*	0.28	0.07	0.19		0.13	0.19	0.17	0.27	0.44	
Gray Jay	*Perisoreus canadensis*		0.05	0.08	0.28	0.09	0.56	0.08	0.05		
Hermit Thrush	*Catharus guttatus*		0.14	0.09	0.14	0.13	0.38	0.11	0.09	0.19	
Least Flycatcher	*Empidonax minimus*			0.01				0.01	0.02		
Lincoln's Sparrow	*Melospiza lincolnii*		0.12	0.08	0.14	0.09	0.19	0.14	0.03		
Magnolia Warbler	*Dendroica magnolia*			0.03		0.13	0.09	0.02	0.09	0.25	
Nashville Warbler	Oreothlypis ruficapilla			<0.01	0.14	0.04		0.01	0.02		
Northern Waterthrush	*Seiurus noveboracensis*		0.21	0.21	0.28	0.17	0.09	0.27	0.19		0.21
Olive-sided Flycatcher	*Contopus borealis*		0.07	0.02	0.28			0.01			
Orange-crowned Warbler	*Vermivora celata*		0.02	0.06	0.14	0.04		0.19	0.03	0.19	0.14
Palm Warbler	*Dendroica palmarum*		0.09	0.11	0.28	0.22	0.09	0.18	0.11	0.25	
Pine Grosbeak	*Pinicola enucleator*				0.14						
Red-breasted Nuthatch	*Sitta Canadensis*							0.01			
Red-winged Blackbird	*Agelaius phoeniceus*			0.02							
Ruby-crowned Kinglet	*Regulus calendula*	0.28	0.15	0.20	0.14	0.09	0.28	0.12	0.27	0.31	0.21
Rusty Blackbird	*Euphagus carolinus*		0.02	0.02			0.19	0.02	0.02		
Savannah Sparrow	*Passerculus sandwichensis*			<0.01				0.02			

Appendix A, Table A-1: Average Density of Birds Observed Within Surveyed Broad Vegetation Types* in the Keeyask Transmission Project Study Area - 2009 to 2011											
Species	**Scientific Name**	**Black Spruce Mixedwood**	**Black Spruce Mixture**	**Black Spruce Pure**	**Human**	**Jack Pine Mixture**	**Jack Pine Pure**	**Low Vegetation**	**Tamarack Pure Mixture**	**Tamarack Pure**	**Young Regeneration**
Song Sparrow	*Melospiza melodia*			<0.01				0.01			
Swainson's Thrush	*Catharus ustulatus*	0.28	0.10	0.05				0.04	0.19	0.06	
Swamp Sparrow	*Melospiza georgiana*			0.03				0.08	0.03		
Tennessee Warbler	*Vermivora peregrina*	0.28	0.07	0.13	0.14	0.26	0.38	0.13	0.19	0.06	0.07
White-crowned Sparrow	*Zonotrichia leucophrys*			0.01				0.04	0.02		
White-throated Sparrow	*Zonotrichia albicollis*		0.14	0.20	0.14	0.09	0.28	0.20	0.11	0.19	0.14
Wilson's Warbler	*Wilsonia pusilla*	0.28	0.09	0.03		0.04		0.07	0.05		0.07
Winter Wren	*Troglodytes troglodytes*		0.03	0.02				0.05	0.05	0.13	0.07
Yellow Warbler	*Dendroica petechia*		0.05	0.02					0.05		
Yellow-bellied Flycatcher	*Empidonax flaviventris*	0.28	0.10	0.15	0.56	0.39	0.28	0.20	0.28	0.25	
Yellow-rumped Warbler	*Dendroica coronata*	0.28	0.22	0.18	0.14	0.04	0.19	0.02	0.14		0.14
Crane											
Sandhill Crane	*Grus canadensis*			0.01							
Rail											
Sora	*Grus canadensis*			0.00							
Gull											
Bonaparte's Gull	*Larus philadelphis*										
Kingfisher											
Belted Kingfisher	*Cerlye alcyon*							0.02		0.00	
Nighthawk											
Common Nighthawk	*Chordeiles minor*						0.09				
Raptor											
Merlin	*Falco columbarius*							0.01			
Bald Eagle	*Haliaeetus leucocephalus*							0.01			
Hawk spp.	undetermined								0.02		
Shorebird											
Common Snipe	*Gallinago gallinago*		0.02	0.02				0.02	0.02		
Greater Yellowlegs	*Tringa melanoleuca*		0.02	<0.01				0.01			
Lesser Yellowlegs	*Tringa flavipes*			<0.01							
Yellowlegs spp.	*Tringa sp.*			<0.01							

Appendix A, Table A-1: Average Density of Birds Observed Within Surveyed Broad Vegetation Types* in the Keeyask Transmission Project Study Area - 2009 to 2011											
Species	**Scientific Name**	**Black Spruce Mixedwood**	**Black Spruce Mixture**	**Black Spruce Pure**	**Human**	**Jack Pine Mixture**	**Jack Pine Pure**	**Low Vegetation**	**Tamarack Pure Mixture**	**Tamarack Pure**	**Young Regeneration**
Woodpecker											
Black-backed Woodpecker	*Picoides arcticus*			<0.01							
Hairy Woodpecker	*Picoides villosus*			<0.01							
Northern Flicker	*Colaptes auratus*										0.07
Woodpecker spp.	undertermined			<0.01					0.02		
Waterfowl											
American Wigeon	*Anas americana*			<0.01							
Upland Game Bird											
Ruffed Grouse	*Bonasa umbellus*		0.02	<0.01							
Spruce Grouse	*Dendragapus canadensis*		0.03	<0.01					0.05		

Descriptions of Vegetation Types and Abbreviations:

Black Spruce Pure – BS Pure	Black spruce dominated and representing >90% of tree species present.
Black Spruce Mixedwood – BS Mixedwood	Black spruce dominated and representing >40% of treed species present; broadleaf tree species >=30% and <=40% of treed species present.
Black Spruce Mixture – BS Mixture	Black spruce dominated and representing >40% of treed species present; broadleaf tree species representing <=20% of treed species present.
Human	Habitat is dominated by human disturbance.
Jack Pine Pure – JP Pure	Jack pine dominated and representing >90% of tree species present.
Jack Pine Mixture – JP Mixture	Jack pine dominated and representing >40% of treed species present; broadleaf tree species representing <=20% of treed species present.
Low Vegetation	Habitat comprised of <10% trees, <25% tall shrubs and >10% ground cover.
Tamarack Pure – TL Pure	Tamarack dominated and representing >90% of tree species present.
Tamarack Mixture – TL Mixture	Tamarack larch dominated and representing >40% of treed species present; broadleaf tree species representing <=20% of treed species present.
Young Regeneration	Area burned between 1993 and 2003, vegetation in regeneration.

Appendix A, Table A-2: Bird Species Observed During Terrestrial Breeding-Bird Surveys in the Keeyask Transmission Study Area, 2009 to 2011																
Species	Total Number of Birds Observed				Density of Birds Observed (birds/ha)[1]				Frequency of Observation (%)				Percent of Total			
	2009-2011 (n=490 stops)	2009 (n=193 stops)	2010 (n=192 stops)	2011 (n=105 stops)	Average Density	2009 (n=193 stops)	2010 (n=192 stops)	2011 (n=105 stops)	Average Frequency of Observa-tion	2009 (n=193 stops)	2010 (n=192 stops)	2011 (n=105 stops)	% of Birds Observed in 2009 to 2011 (n=2406 birds)[2]	% of Birds Observed in 2009 (n=1134 birds)[2]	% of Birds Observed in 2010 (n=837 birds)2	% of Birds Observed in 2011 (n=435 birds)[2]
Passerine																
Blackpoll Warbler	279	143	85	51	0.32	0.42	0.25	0.27	56.94%	58.5	43.8	47.6	11.6	12.6	10.2	11.7
Ruby-crowned Kinglet	162	77	63	22	0.19	0.23	0.19	0.12	33.06%	37.8	32.8	21.0	6.7	6.8	7.5	5.1
Northern Waterthrush	181	90	56	35	0.21	0.26	0.16	0.19	36.94%	39.9	28.6	32.4	7.5	7.9	6.7	8.0
Fox Sparrow	156	84	48	24	0.18	0.25	0.14	0.13	31.84%	38.9	24.5	22.9	6.5	7.4	5.7	5.5
Yellow-bellied Flycatcher	154	69	55	30	0.18	0.20	0.16	0.16	31.43%	34.2	28.6	29.5	6.4	6.1	6.6	6.9
White-throated Sparrow	160	76	49	35	0.18	0.22	0.14	0.19	32.65%	36.3	25.0	32.4	6.7	6.7	5.9	8.0
Dark-eyed Junco	154	64	56	34	0.18	0.19	0.16	0.18	31.43%	29.0	28.1	30.5	6.4	5.6	6.7	7.8
Yellow-rumped Warbler	127	72	36	19	0.15	0.21	0.11	0.10	25.92%	32.6	18.8	18.1	5.3	6.3	4.3	4.4
Tennessee Warbler	117	15	74	28	0.13	0.04	0.22	0.15	23.88%	6.2	37.5	24.8	4.9	1.3	8.8	6.4
Palm Warbler	105	49	42	14	0.12	0.14	0.12	0.08	21.43%	21.8	21.9	13.3	4.4	4.3	5.0	3.2
Hermit Thrush	88	55	16	17	0.10	0.16	0.05	0.09	17.96%	25.9	8.3	15.2	3.7	4.9	1.9	3.9
Gray Jay	70	30	38	2	0.08	0.09	0.11	0.01	14.29%	13.5	16.1	1.9	2.9	2.6	4.5	0.5
Alder Flycatcher	81	37	26	18	0.09	0.11	0.08	0.10	16.53%	15.5	13.5	16.2	3.4	3.3	3.1	4.1
Lincoln's Sparrow	76	34	22	20	0.09	0.10	0.06	0.11	15.51%	15.5	11.5	19.0	3.2	3.0	2.6	4.6
Swainson's Thrush	53	22	31	0	0.06	0.06	0.09	0.00	10.82%	9.8	16.1	0.0	2.2	1.9	3.7	0.0
Orange-crowned Warbler	68	28	24	16	0.08	0.08	0.07	0.09	13.88%	12.4	12.5	14.3	2.8	2.5	2.9	3.7
Wilson's Warbler	38	10	26	2	0.04	0.03	0.08	0.01	7.76%	5.2	13.0	1.9	1.6	0.9	3.1	0.5
American Robin	31	13	10	8	0.04	0.04	0.03	0.04	6.33%	6.7	5.2	7.6	1.3	1.1	1.2	1.8
Winter Wren	28	15	8	5	0.03	0.04	0.02	0.03	5.71%	7.8	4.2	4.8	1.2	1.3	1.0	1.1
Chipping Sparrow	30	7	15	8	0.03	0.02	0.04	0.04	6.12%	3.1	7.3	7.6	1.2	0.6	1.8	1.8
Magnolia Warbler	35	12	8	15	0.04	0.04	0.02	0.08	7.14%	5.7	4.2	13.3	1.5	1.1	1.0	3.4
Swamp Sparrow	27	19	3	5	0.03	0.06	0.01	0.03	5.51%	8.3	1.6	4.8	1.1	1.7	0.4	1.1
Olive-sided Flycatcher	16	9	6	1	0.02	0.03	0.02	0.01	3.27%	4.7	3.1	1.0	0.7	0.8	0.7	0.2
Rusty Blackbird	23	6	13	4	0.03	0.02	0.04	0.02	4.69%	2.1	5.2	2.9	0.8	0.5	1.1	0.9
Yellow Warbler	14	8	3	3	0.02	0.02	0.01	0.02	2.86%	3.6	1.6	2.9	0.6	0.7	0.4	0.7
White-crowned Sparrow	11	8	2	1	0.01	0.02	0.01	0.01	2.24%	4.1	1.0	1.0	0.5	0.7	0.2	0.2
Common Raven	13	11	2	0	0.01	0.02	0.01	0.00	2.65%	4.7	0.5	0.0	0.4	0.6	0.2	0.0
Boreal Chickadee	11	6	3	2	0.01	0.02	0.01	0.01	2.24%	3.1	1.6	1.9	0.5	0.5	0.4	0.5

Appendix A, Table A-2: Bird Species Observed During Terrestrial Breeding-Bird Surveys in the Keeyask Transmission Study Area, 2009 to 2011																
Species	**Total Number of Birds Observed**				**Density of Birds Observed (birds/ha)[1]**				**Frequency of Observation (%)**				**Percent of Total**			
	2009-2011 (n=490 stops)	**2009 (n=193 stops)**	**2010 (n=192 stops)**	**2011 (n=105 stops)**	**Average Density**	**2009 (n=193 stops)**	**2010 (n=192 stops)**	**2011 (n=105 stops)**	**Average Frequency of Observa-tion**	**2009 (n=193 stops)**	**2010 (n=192 stops)**	**2011 (n=105 stops)**	**% of Birds Observed in 2009 to 2011 (n=2406 birds)[2]**	**% of Birds Observed in 2009 (n=1134 birds)[2]**	**% of Birds Observed in 2010 (n=837 birds)2**	**% of Birds Observed in 2011 (n=435 birds)[2]**
Least Flycatcher	9	9	0	0	0.01	0.03	0.00	0.00	1.84%	4.7	0.0	0.0	0.4	0.8	0.0	0.0
Brown Creeper	9	3	5	1	0.01	0.01	0.01	0.01	1.84%	1.6	2.6	1.0	0.4	0.3	0.6	0.2
Red-winged Blackbird	11	7	3	1	0.01	0.02	0.01	0.01	2.24%	2.6	1.6	1.0	0.4	0.5	0.4	0.2
Nashville Warbler	6	5	0	1	0.01	0.01	0.00	0.01	1.22%	2.6	0.0	1.0	0.2	0.4	0.0	0.2
*Bank Swallow**	*29*	*6*	*23*	*0*	*0.03*	*0.00*	*0.07*	*0.00*	*5.92%*	*1.0*	*1.0*	0.0	-	-	-	-
Common Redpoll	27	26	1	0	<0.01	0.00	0.00	0.00	5.51%	1.6	0.5	0.0	0.0	0.1	0.0	0.0
Song Sparrow	2	0	2	0	<0.01	0.00	0.01	0.00	0.41%	0.0	1.0	0.0	0.1	0.0	0.2	0.0
Bay-breasted Warbler	2	2	0	0	<0.01	0.01	0.00	0.00	0.41%	1.0	0.0	0.0	0.1	0.2	0.0	0.0
Savannah Sparrow	3	3	0	0	<0.01	0.01	0.00	0.00	0.61%	1.0	0.0	0.0	0.1	0.3	0.0	0.0
Pine Grosbeak	1	0	1	0	<0.01	0.00	0.00	0.00	0.20%	0.0	0.5	0.0	0.0	0.0	0.1	0.0
*Red Crossbill**	*2*	*0*	*1*	*1*	*<0.01*	*0.00*	*0.00*	*0.01*	*0.41%*	*0.0*	*0.5*	1.0	-	-	-	-
American Crow	2	1	0	1	<0.01	0.00	0.00	0.01	0.41%	0.5	0.0	1.0	0.1	0.1	0.0	0.2
Clay-colored Sparrow	1	1	0	0	<0.01	0.00	0.00	0.00	0.20%	0.5	0.0	0.0	0.0	0.1	0.0	0.0
Red-breasted Nuthatch	1	1	0	0	<0.01	0.00	0.00	0.00	0.20%	0.5	0.0	0.0	0.0	0.1	0.0	0.0
*White-winged Crossbill**	*45*	*45*	*0*	*0*	*<0.01*	*0.00*	*0.00*	*0.00*	*9.18%*	*0.5*	*0.0*	3.8	-	-	-	-
Blue-headed Vireo	2	0	0	2	<0.01	0.00	0.00	0.01	0.41%	0.5	0.0	1.9	0.1	0.1	0.0	0.5
Crane																
Sandhill Crane	3	3	0	0	<0.01	0.01	0.00	0.00	0.61%	1.6	0.0	0.0	0.1	0.3	0.0	0.0
Rail																
Sora	1	0	0	1	<0.01	0.01	0.00	0.01	0.20%	1.6	0.0	1.0	0.2	0.3	0.0	0.2
Gull																
*Bonaparte's Gull**	*1*	*1*	*0*	*0*	*<0.01*	*0.00*	*0.00*	*0.00*	*0.20%*	*0.5*	*0.0*	*0.0*	-	-	-	0.0
*Gull sp.**	*5*	*4*	*1*	*0*	*<0.01*	*<0.01*	*<0.01*	*0.00*	*1.02%*	*0.5*	*0.5*	*1.0*	-	-	-	0.0
*Ring-billed Gull**	*2*	*1*	*1*	*0*	*<0.01*	*<0.01*	*<0.01*	*0.00*	*0.41%*	*0.5*	*0.5*	*0.0*	-	-	-	0.0
Kingfisher																
Belted Kingfisher	3	2	1	0	<0.01	0.01	0.00	0.00	0.61%	0.5	0.5	0.0	0.1	0.2	0.0	0.0
Loon																
*Common Loon**	*1*	*1*	*0*	*0*	*<0.01*	*0.00*	*0.00*	*0.00*	*0.20%*	*0.5*	*0.0*	*0.0*	-	-	-	0.0

Appendix A, Table A-2: Bird Species Observed During Terrestrial Breeding-Bird Surveys in the Keeyask Transmission Study Area, 2009 to 2011																
Species	**Total Number of Birds Observed**				**Density of Birds Observed (birds/ha)[1]**				**Frequency of Observation (%)**				**Percent of Total**			
	2009-2011 (n=490 stops)	**2009 (n=193 stops)**	**2010 (n=192 stops)**	**2011 (n=105 stops)**	**Average Density**	**2009 (n=193 stops)**	**2010 (n=192 stops)**	**2011 (n=105 stops)**	**Average Frequency of Observa-tion**	**2009 (n=193 stops)**	**2010 (n=192 stops)**	**2011 (n=105 stops)**	**% of Birds Observed in 2009 to 2011 (n=2406 birds)[2]**	**% of Birds Observed in 2009 (n=1134 birds)[2]**	**% of Birds Observed in 2010 (n=837 birds)2**	**% of Birds Observed in 2011 (n=435 birds)[2]**
Nighthawk																
Common Nighthawk	2	0	1	1	<0.01	0.00	0.00	0.01	0.41%	0.0	0.5	1.0	0.1	0.0	0.1	0.2
Raptor																
Bald Eagle	1	0	1	0	<0.01	0.00	0.00	0.00	0.20%	0.0	0.5	0.0	0.0	0.0	0.1	0.0
Hawk sp.	1	0	1	0	<0.01	0.00	0.00	0.00	0.20%	0.0	0.5	0.0	0.0	0.0	0.1	0.0
Merlin	1	1	0	0	<0.01	0.00	0.00	0.00	0.20%	0.5	0.0	0.0	0.0	0.1	0.0	0.0
Shorebird																
Common Snipe	28	20	6	2	0.03	0.04	0.02	0.01	5.71%	9.3	3.1	1.0	0.7	1.1	0.2	0.5
Greater Yellowlegs	9	3	3	3	0.01	0.01	0.00	0.02	1.84%	1.6	1.6	1.0	0.3	0.3	0.1	0.7
Lesser Yellowlegs	1	0	1	0	<0.01	0.00	0.00	0.00	0.20%	0.0	0.5	0.0	0.0	0.0	0.1	0.0
Yellowlegs sp.	2	2	0	0	<0.01	0.01	0.00	0.00	0.41%	1.0	0.0	0.0	0.1	0.2	0.0	0.0
Upland Game Bird																
Ruffed Grouse	1	0	0	1	0.00	0.01	0.00	0.01	0.20%	1.0	1.0	1.0	0.2	0.2	0.2	0.2
Spruce Grouse	6	2	2	2	0.01	0.01	0.01	0.01	1.22%	1.0	1.0	1.9	0.2	0.2	0.2	0.5
Waterfowl																
American Wigeon	1	1	0	0	<0.01	0.00	0.00	0.00	0.20%	0.5	0.0	0.0	0.0	0.1	0.0	0.0
*Canada Goose**	*158*	*48*	*110*	*0*	*0.00*	*0.00*	*0.00*	*0.00*	*32.24%*	*1.6*	*1.6*	*0.0*	-	-	-	-
Mallard*	1	1	0	0	0.00	0.00	0.00	0.00	0.20%	0.5	0.0	0.0	-	-	-	-
Woodpecker																
Black-backed Woodpecker	1	0	1	0	<0.01	0.00	0.00	0.00	0.20%	0.0	0.5	0.0	0.0	0.0	0.1	0.0
Hairy Woodpecker	1	1	0	0	<0.01	0.00	0.00	0.00	0.20%	0.5	0.0	0.0	0.0	0.1	0.0	0.0
Northern Flicker	1	1	0	0	<0.01	0.00	0.00	0.00	0.20%	0.5	0.0	0.0	0.0	0.1	0.0	0.0
Woodpecker sp.	2	2	0	0	<0.01	0.01	0.00	0.00	0.41%	1.0	0.0	0.0	0.1	0.2	0.0	0.0
Total (including flyovers)	**2708**	**1272**	**985**	**451**												
Total (excluding flyovers)	**2449**	**1166**	**848**	**435**									**100.0**	**100.0**	**100.0**	**100.0**
Density[1]					**2.7 ± 1.6**	**3.3 ± 1.9**	**2.5 + 1.3**	**2.3 ± 1.2**								
Diversity[2]					**4.7 ± 2.4**	**5.3 ± 2.7**	**4.5 + 2.1**	**4.1 ± 1.9**								

* observed as fly-over flocks and thus excluded from overall density and diversity calculations
[1] mean bird density/hectare ± standard deviation
[2] percentages based on totals excluding fly-over flocks

Appendix A, Table A-3: Potential Number of Breeding Pairs of Passerines Displaced and Waterbody Crossings Required Along Construction Power Route Options 1 and 2							
Broad Vegetation Type	**Average Bird Density**	**Route 1**			**Route 2**		
		Area (ha) of a 60-m ROW	**% of Total Area**	**Average Number of Breeding Pairs Displaced**	**Area (ha) of a 60-m ROW**	**% of Total Area**	**Average Number of Breeding Pairs Displaced**
Black Spruce Pure	2.7 + 1.6	79.5	68.0%	214.7	66.9	54.0%	180.7
Low Vegetation	2.9 + 1.6	18.0	0.0%	52.3	36.7	29.6%	106.4
Young Regeneration	1.8 ± 1.0	3.5	3.0%	6.3	6.8	5.5%	12.2
Tamarack Mixture	3.2 + 1.2	3.4	2.9%	11.0	3.2	2.5%	10.1
Black Spruce Mixture	2.6 + 1.4	2.6	0.0%	6.8	2.8	2.3%	7.3
Tamarack Pure	3.5 + 1.3	2.3	1.9%	8.1	-	-	8.1
Other Vegetation Types Not Surveyed for Birds	N/A	2.0	1.7%	N/A	1.7	1.4%	N/A
Water (including Nelson River)	N/A	5.6	4.8%	N/A	5.9	4.8%	N/A
Total		**117**	**100%**	**299**	**124**	**100%**	**331**
Number of Stream/Waterbody Crossings (Minimum)		**9**			**11**		

Appendix A, Table A-4: Potential Number of Breeding Pairs of Passerines Displaced Along Collector Line Route Options A, B and C*										
Broad Vegetation Types	**Average Bird Density**	**Route A**			**Route B**			**Route C**		
		Area (ha) of a 160-m ROW	**% of Total Area**	**Average Number of Breeding Pairs Displaced**	**Area (ha) of a 160-m ROW**	**% of Total Area**	**Average Number of Breeding Pairs Displaced**	**Area (ha) of a 160-m ROW**	**% of Total Area**	**Average Number of Breeding Pairs Displaced**
Black Spruce Pure	2.7 + 1.6	380.64	56.7%	1027.7	353.90	54.0%	955.5	433.45	66.8%	1170.3
Low Vegetation	2.9 + 1.6	126.46	18.8%	366.7	128.49	19.6%	372.6	47.90	7.4%	138.9
Tamarack Mixture	3.2 + 1.2	14.55	2.2%	46.6	20.39	3.1%	65.2	19.38	3.0%	62.0
Black Spruce Mixture	2.6 + 1.4	9.78	1.5%	25.4	16.92	2.6%	44.0	17.44	2.7%	*45.3*
Jack Pine Mixture	2.6 + 1.0	8.90	1.3%	23.1	3.58	0.5%	9.3	7.47	1.2%	19.4
Young Regeneration	1.8 ± 1.0	8.64	1.3%	15.5	8.64	1.3%	15.5	8.64	1.3%	15.5
Human	4.2 ± 2.9	4.67	0.7%	19.6	4.40	0.7%	18.5	8.81	1.4%	37.0
Black Spruce Mixedwood	2.3 ± 0.8	0.01	0.0%	0.0	0.95	0.1%	2.2	1.99	0.3%	4.6
Jack Pine Pure	3.9 ± 1.5	1.43	0.2%	5.6	0.99	0.2%	3.9		0.0%	0.0
Tamarack Pure	3.9 + 1.5	2.03	0.3%	7.9	3.26	0.5%	12.7	0.4	0.1%	1.7
Other Vegetation Types Not Surveyed for Birds:	-	14.4	2.1%	N/A	13.4	2.1%	N/A	11.5	1.8%	N/A
Trembling Aspen Mixture	-	2.55	0.4%	N/A	4.06	0.6%	N/A	2.07	0.3%	N/A
Tall Shrub	-	4.58	0.7%	N/A	3.45	0.5%	N/A	2.54	0.4%	N/A
Jackpine Mixedwood	-	3.74	0.6%	N/A	1.77	0.3%	N/A	3.80	0.6%	N/A
Black Spruce Pure/Tall Shrub	-	2.89	0.4%	N/A	3.56	0.5%	N/A	2.46	0.4%	N/A
Trembling Aspen Mixture/Tall Shrub	-	0.62	0.1%	N/A	0.39	0.1%	N/A	0.62	0.1%	N/A

Appendix A, Table A-4: Potential Number of Breeding Pairs of Passerines Displaced Along Collector Line Route Options A, B and C*										
Broad Vegetation Types	**Average Bird Density**	**Route A**			**Route B**			**Route C**		
		Area (ha) of a 160-m ROW	**% of Total Area**	**Average Number of Breeding Pairs Displaced**	**Area (ha) of a 160-m ROW**	**% of Total Area**	**Average Number of Breeding Pairs Displaced**	**Area (ha) of a 160-m ROW**	**% of Total Area**	**Average Number of Breeding Pairs Displaced**
Trembling Aspen Mixedwood	-	-	-	N/A		0.0%	N/A	-	-	N/A
Trembling Aspen Mixture/Tall Shrub	-	-	-	N/A	-	-	N/A	-	-	N/A
Trembling Aspen Pure	-	0.02	0.0%	N/A	0.21	0.0%	N/A	-	-	N/A
Tamarack Mixture/Tall Shrub	-	-	-	N/A	-	-	N/A	-	-	N/A
Water (including Nelson River)	-	2.52	0.4%	N/A	3.15	0.5%	N/A	2.83	0.4%	N/A
Area Not accounted for by Habitat Data	-	97.38	14.5%	N/A	97.10	14.8%	N/A	88.78	13.7%	N/A
Total		**671**	**100.0 %**	**1538**	**655**	**100.0%**	**1499**	**649**	**100.0%**	**1495**
Number of Stream/Waterbody Crossings (Minimum)		**14**			**19**			**11**		
* Estimates not available for Route D as habitat mapping not completed for this option.										