Keeyask Transmission Project
Amphibian Technical Report

SEPTEMBER 2012

KEEYASK TRANSMISSION PROJECT

AMPHIBIAN TECHNICAL REPORT

SEPTEMBER 2012

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 Transmisson lines that would transfer power generated by the Generating 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 amphibians, using the habitats within areas where the proposed transmission line routes are located. Information gained through these amphibian studies, together with other environmental study results, was used to assist in the route selection process for both the Construction Power and Generation Outlet 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 proposed 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.

The findings of field studies indicate that amphibians, particularly boreal chorus frogs and wood frogs, are widely dispersed and relatively abundant throughout the regional study area. Frog populations in boreal regions are generally lower than those observed in southern Manitoba.

During the routing and site-selection process for the transmission lines and stations for the Keeyask Transmission Project, alternatives were assessed based on their potential for effects on amphibians and their habitat.

The two alternative Construction Power 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., amphibians, 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 amphibians 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 were minimized through various mitigation measures. Potential effects of the Keeyask Transmission Project on amphibian communities will exist for the life of the Project. The key potential effects of the Keeyask Transmission Line on amphibians is from habitat loss along the transmission line rights-of-way and at station sites. However, these effects are expected to be small, and likely not measurable within the range of natural variation of amphibian populations.

1.0 INTRODUCTION

The Keeyask Transmission Project is required to transmit power, created by the proposed Keeyask Generation Project (Map 1-1). 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 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 1-2).

In 2009 and through 2011, Site Selection and Environmental Assessment (SSEA) studies were conducted to gather information on a variety of **wildlife** groups, including **amphibians**, using the habitats within areas where the proposed transmission line routes are located. Information gained through these amphibian studies, together with other environmental study results, was used to assist in the route selection process for both the construction power line and generation outlet 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.

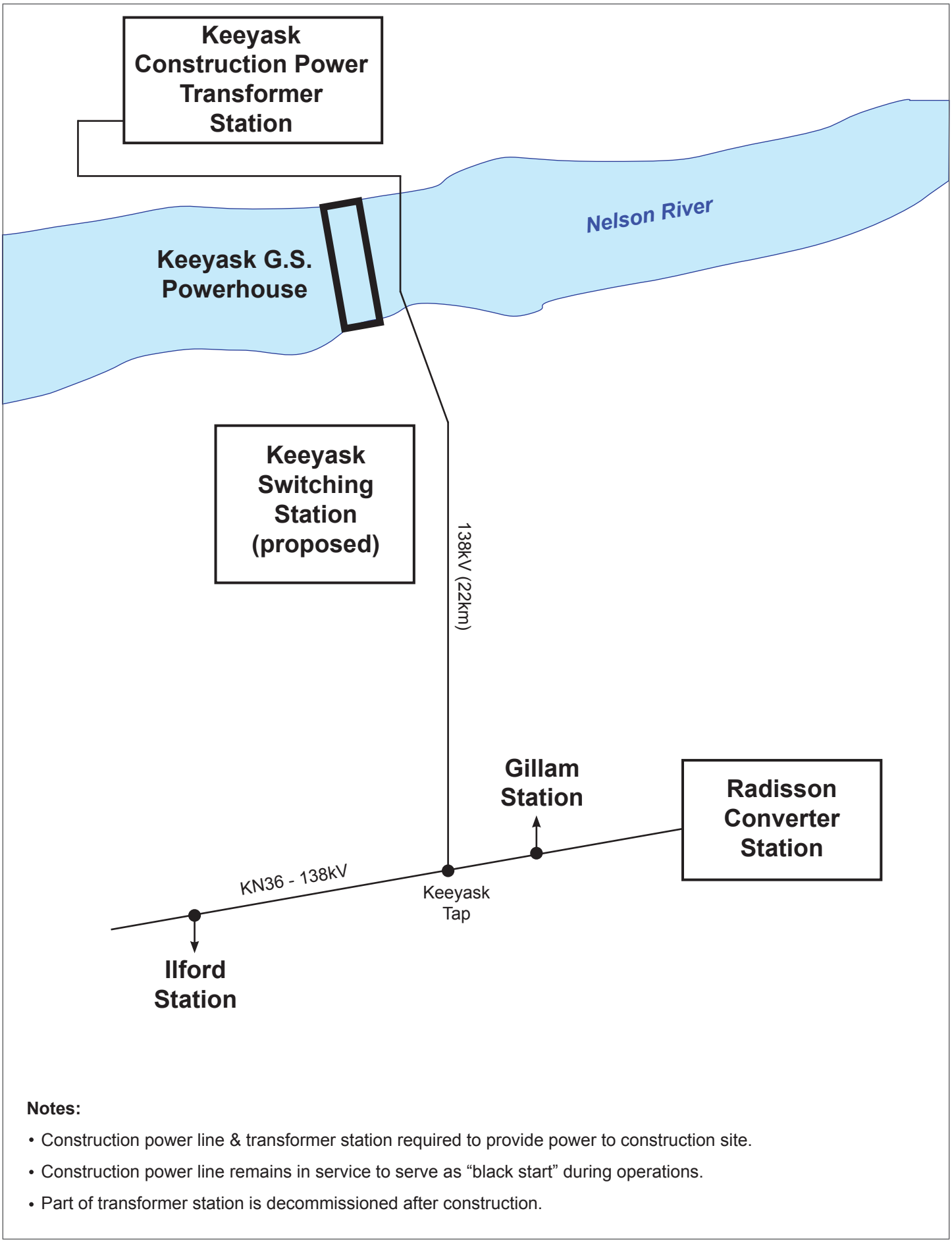
This report provides information gathered in June 2009, 2010 and 2011 on amphibian communities utilizing various habitats located throughout the areas proposed for transmission line development. Amphibian abundance and diversity was described for the various habitat types potentially affected by the Project. A route analysis based on habitat data and amphibian community data was conducted to determine if construction power line routes and/or generation outlet line routes differed in terms of their potential to impact high-quality amphibian 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 KN 36 transmission line to a new 138-kV to 12.47-kV Construction Power Station to be located north of the proposed Keeyask Generating Station.

The purpose of the Construction PowerTransmission Line and Station is to provide power for the construction activities of the Generation Station (Figure 1-1). After operation, the Construction Power Transmission Line will be left in place, as will a portion of the Station, to



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 Transmission Line & Transformer Station

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

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 the Generation Station via 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 (GOT)

Three 138-kV ac Generation Outlet Transmission 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 along a single route. Manitoba Hydro plans to build one of these GOT 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.

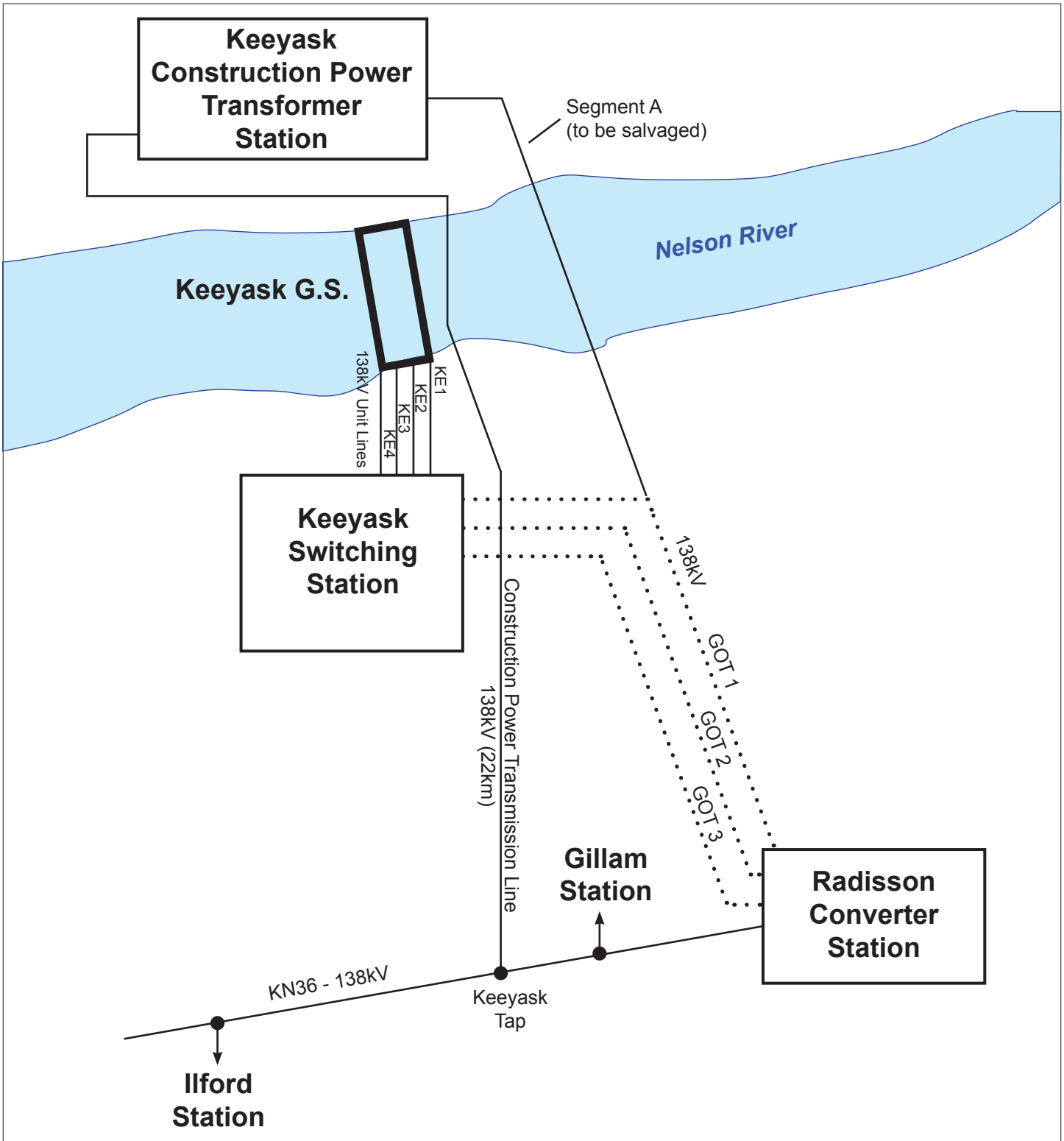
1.1.5 Radisson Converter Station Upgrades

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. 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.



Notes:

- Generation Outlet Transmission (GOT) lines & Keeyask switching station are required to deliver power from Keeyask GS Powerhouse to Radisson Converter Station.
- GOT 1 is built at start of construction to act as backup to Construction Power Transmission Line.
- A segment of GOT 1 (Segment A) is salvaged after construction & GOT 1 is re-terminated at the Keeyask Switching Station.

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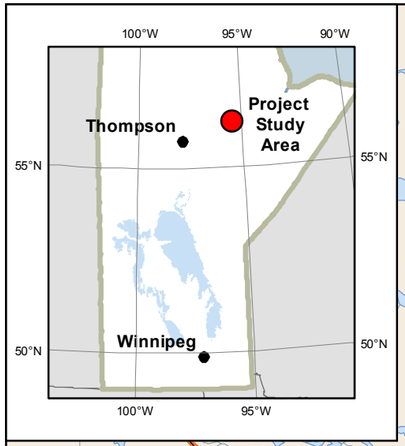
Figure 1-2. Schematic of Proposed Generation Outlet Transmission Lines

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.



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

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Project Study Area in Northern Manitoba

Map 1-1

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
- 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

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: September 24, 2012

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0 2 4 Miles

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Project Infrastructure

Alternative Transmission Line Routes

Map 1-2

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 Station. From this juncture, the 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 Radisson and parallel to KN36.

The Project is located in the Split Lake Resource Management Area, and 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.

2.1.1 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 were conducted for the Keeyask Transmission Project (2009-2011). Data was collected along the Construction Power and Generation Outlet Transmission (GOT) Lines proposed routes and in the vicinity of the converter and switching stations.

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 (Keeyask Hydropower Limited Partnership 2009, 2012).

2.1.2 Point-count Amphibian Surveys

Ground-based amphibian point-count surveys were initially conducted in the Keeyask Transmission Study Area from June 14 to June 23, 2009. Survey efforts included investigations of 20 **transect**s, containing a total of 193 stops, located along the potential Construction Power

and GOT line route options (Map 2-2). 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 amphibian utilization of recently selected potential switching station locations, and to further contribute to the overall dataset for the Project Area. Seventeen transects, totaling 105 point-count stops, were surveyed in 2011 (Map 2-2).

At the time of amphibian surveys, Manitoba Hydro had identified two potential route options (Routes 1 and 2) for the Keeyask Construction Power Transmission Line, and three potential route options (Routes A, B, and C) for the GOT lines (Map 2-2).An additional GOT line option (Option D) was added subsequent to amphibian surveys being conducted.In 2009 and 2010, 11 transects totaling 108 point-count stops were surveyed along and adjacent to the two proposed Construction Power Transmission Line routes (Map 2-2). Nine transects totaling 85 point-count stops (84 point-count stops in 2010) were surveyed along and adjacent to the three proposed Generation Outlet line transmission route options (Map 2-2). In 2011, surveys took place on 14 transects along and adjacent to the proposed Generation Outlet line (8 transects; 48 point-count stops) and Construction Power (6 transects; 48 point-count stops) route options. Additionally, three new transects (totaling 9 point-count stops) associated with the proposed switching station locations were also surveyed in 2011.

The amphibian transect locations were selected using an evaluation process that involved examining: topographic mapping, air photos, Biological Land Classification data (Westernland Resource Group 2001), habitat classification data (ECOSTEM 2005), as well as data and mapping from prior years. This information was used collectively to identify the location of wetlands (e.g., ponds, fens, borrow pits, bogs) that may or may not be affected by the Project. While these maps and data sets assisted in determining the location of sampling efforts, detailed classification of habitat was also conducted for each site during surveys.

Since frogs communicate by calling during the spring breeding season, auditory surveys were deemed most suitable for identifying amphibian use of, and abundance within, the study area. The following standard coding system was used at each survey stop to describe amphibian presence (types of species) and relative abundance on the basis of number of amphibians heard within a three-minute observation period (Badzinski et al. 2008):

- 0 = no amphibians can be heard.
- 1 = visual identification of frog(s).
- 2 = individuals can be counted, no overlapping calls.
- 3 = individual calls are distinguishable but overlapping.

- 4 = full chorus, calls are continuous and overlapping (number cannot be estimated with precision).

Time spent at point-count stops also involved attempts to visually observe **reptile**s and other amphibians not calling (e.g., females or other amphibian species) residing within the Project Study Area. Visual efforts focused on observing:

- Individual adults or earlier life stages (i.e., tadpoles or froglets).
- Tracks (where applicable).
- Eggs or egg masses.

In addition to recording amphibian calls and amphibian/reptile sightings (or sign), the following were recorded during surveys:

- Location of transect and survey point.
- Time of day.
- Weather information (temperature, wind direction and speed, cloud cover and precipitation).
- Habitat description (dominant plant species, crown cover, understory, and ground cover).

2.1.3 Remote Audio Recorder Surveys

Throughout June 2011, automated recording units were placed in 14 sites within aquatic habitats within or adjacent to the Keeyask Transmission Line Region in areas that had the potential to support amphibians (Map 2-3). Units were set to remotely record amphibian calls between 22:00h-midnight and 05:00h-06:00h for the greatest chance of recording both diurnally and nocturnally active species.

2.2 VALUED ENVIRONMENTAL COMPONENT SELECTION

Valued Environmental Components (VECs) are parameters 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. VECs are defined as elements of the environment having scientific, social, cultural, economic, historical, archaeological or aesthetic importance and 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 based on consultations with 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.

VEC selection criteria are:

- Overall importance/value to people.
- Regulatory requirements.
- Potential for substantial Project effects.
- Key for **ecosystem function**.
- Umbrella indicator.
- **Indicator species**.
- Amenable to scientific study in terms of the analysis of existing and post-construction conditions.

The potential use of VECs in the Keeyask Transmission Project was evaluated by the Keeyask Transmission Study Team. The Keeyask Transmission EA Report should consider the construction and operational effects of the Project on a broad range of environmental parameters. The study team concluded that VECs are feasible for use in the Keeyask Transmission Project. The analysis of VECs was facilitated by compilation and analysis of information previously gathered for several potential VEC species during the Keeyask Transmission and Generation projects.

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 projects. Since the Keeyask Transmission and Generation projects are occurring in the same region, the factors influencing the different components are similar and therefore it may be feasible to use many of the same VECs, particularly those that are potentially affected by transmission projects. The analysis and write-up of VECs will highlight the interrelationship of a species and its environment in a manner that augments the other key sources of information (e.g., field data and literature) that would comprise the EA Report.

When considering whether it was appropriate to select an amphibian VEC, the study team considered that the two frog species most prevalent in the study area, wood and boreal chorus

frogs, are relatively widespread and present in low to moderate densities. For this reason, the potential for significant Project-related effects was judged to be small. Also, frogs, although important to the local people, as are all components of the environment (both living and inanimate) , do not have a similar status to moose, sturgeon or bald eagle. For these reasons, the decision was made not to select an amphibian VEC, but to evaluate amphibians as a group.

2.3 METHODOLOGY FOR EVALUATING ALTERNATIVE ROUTES AND INFRASTRUCTURE

2.3.1 Construction Power Transmission Line

Factors considered when evaluating the Construction Power Transmission Lines with respect to effects on amphibians 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 considered more sensitive sites that support higher-quality wildlife habitat. Reducing the number of stream crossings is desirable.

- Proximity to wetlands and lakes: Wetlands and lakes provide habitat for amphibians and other wildlife. Generally, the fewer of these features that the line passes close to, the better.

- Amphibian-specific considerations: Amphibian surveys were done along both Construction Power routes. These did not reveal a significant difference between the two routes with regard to amphibian populations. The number of wetlands and lakes was a factor considered when assessing the routes regarding amphibians.

2.3.2 Construction Power Station

The factors considered when siting the Construction Power Station with respect to effects on amphibians were habitat type and presence of wetlands/waterbodies..

Within the Study Area, five alternative Construction Power station sites (CP Sites 2, 3, 4, 5 and 6) were identified (Map 2-4). 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 by Manitoba Hydro as the access road would go through the center of these proposed sites. Site 6 (Map 1-1), is the preferred site for the Construction Power station.

Based on a desktop photo analysis and information from Keeyask Generation Project surveys, there did not appear to be a substantial difference with the five alternative sites regarding utilization by amphibians or potential for effects on amphibians.

2.3.3 Unit Transmission Lines

The route for the Unit Transmission line was considered with repsect to terrestrial habitat types crossed and the presence of any signifncant wetland areas or stream crossings along the route.

2.3.4 Generation Outlet Transmission Line

The factors considered, with respect to effects on amphibians, when siting the GOT lines included:

- Line length: Generally it was considered that the shorter the line length, the less potential for negative impacts to occur.
- Number of stream crossings: In the study area, stream crossings are considered more sensitive sites that support higher-quality habitat for amphibians and other wildlife. Reducing the number of stream crossings is desirable.
- Proximity to wetlands and lakes: Wetlands and lakes provide habitat for amphibians and other wildlife. Generally, the fewer of these features that the line passes close to, the better.
- Amphibian-related considerations: The main factors related to amphibians that were considered include terrestrial habitat types traversed and the number of wetlands and lakes present along each route. These habitats support amphibians, however, they are usually easily avoided when siting transmission towers, so no amphibian-related factor substantially affected the GOT line route selection.

2.3.5 Keeyask Switching Station

The factors considered when siting the Keeyask Switching Station with respect to effects on amphibians were habitat type and presence of wetlands/waterbodies.

Initially, a general Study Area for the proposed Keeyask Switching Station was based on the need to locate the proposed switching station on the north or south side of the Nelson River. Within the Study Area, seven alternative station sites were identified (Map 2-4). Three sites (Sites 5, 6 and 7) on the north side of the Nelson River were ruled out as the distance of the transmission lines would double, in addition to the need for approximately four to 16 electrical crossovers.

Four alternative sites on the south side of the Nelson River were identified. Site 1 was ruled out as the site was in the flood area of the Keeyask Generation Station and Site 2 was located in a rock quarry. Site 3 on the south side is the preferred site; Site 4 is the alternative location.

Manitoba Hydro is proposing to acquire both Sites 3 and 4 to allow for future expansion of the system (Map 1-1).

2.3.6 Radisson Converter Station Upgrade

The upgrades to the Radisson Converter Station necessary to accommodate the power delivered from the Keeyask Generation Station will all be confined to the existing footprint of the Radisson Converter Station. The station site is either gravelled or paved and no amphibian habitat exists on-site. Consequently, there were no specific siting criteria necessary for this Project component.

2.4 EFFECTS ASSESSMENT AND MITIGATION MEASURES

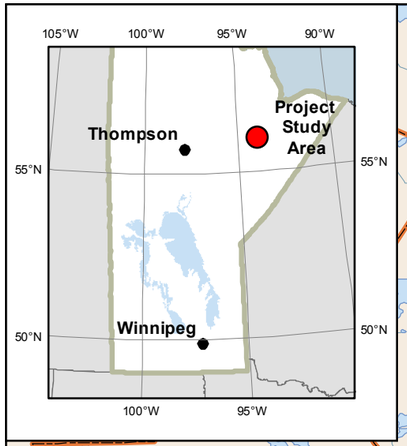
The environmental assessment involved identifying and analyzing potential effects associated with the preferred routes that could not be avoided during the route selection process. During the route selection process, detailed socio-economic and biophysical studies were conducted to determine potential effects more precisely. Potential effects and mitigative measures are detailed in Chapter 7 of the EA Report. Appropriate mitigation measures have been identified to reduce negative effects during all phases of Project development.

2.4.1 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 EA Report.



Manitoba Hydro

Keeyask Transmission Project

Project Infrastructure
- Project Study Area
- The Region

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 21, 2012

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The Keeyask Region

Map 2-1

File Location: G:_GIS_Project_Folder\00_Hydro\111420007_Kysk_Outlet_Transmission\ArcMap\TechnicalReports\AmphibiansKTP_TECHREP_Map2-1KeeyaskGenerationStudyArea_B_150K_20120926.mxd

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
- 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

Amphibians

- Amphibian 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
ECOSTEM, Stantec
Date Created: September 24, 2012

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2009 - 2011 Amphibian Survey Locations

Map 2-2

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
- C — Construction Power Station
- S — Switching Station
- Proposed South Access Road
- 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

Amphibian Monitoring

- Remote Recording Unit

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: September 24, 2012

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0 2 4 Miles

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Location of Remote Recorder Units to Monitor Amphibians

Map 2-3

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

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1:20,000

Alternative Construction Power and Switching Station Sites

Map 2-4

3.0 STUDY AREA CHARACTERIZATION

3.1 STUDY AREA OVERVIEW

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.

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 2012c). 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. (Keeyask Transmission Project; Terrestrial Habitat Technical Report, 2012).

In the Keeyask Generation Project Regional **Study Area**, boreal chorus frogs (*Pseudacris maculata*) and wood frogs (*Rana sylvatica*) were common where suitable breeding habitat exists (e.g., shallow vegetated ponds without fish). While northern leopard frogs (*Rana pipiens*) were not observed during environmental studies, their former range includes the Regional Study Area. Wood frogs and boreal chorus frogs spend the winter on the forest floor under leaf litter and woody debris at or near the ground surface; northern leopard frogs hibernate in lake-bottom mud, of deeper lakes that do not freeze. Frogs emerged from hibernation in the early spring (March–April), often moving short distances across snow and ice from their hibernacula to breeding areas, which may include seasonal pools, shallow ponds, and lake edges (Preston 1982; Government of BC 2002). In the boreal forest, both boreal chorus and wood frog use similar types of breeding ponds (i.e., wooded) during the spring breeding season. Northern leopard frogs prefer ponds surrounded by grassy or sedge-dominated areas but will also use lightly wooded breeding ponds shared by other frog species. By July, all species of frogs have usually finished breeding and moved into wetland edges or adjacent damp forests to forage. Since frogs are susceptible to desiccation, foraging activities for most adult frog species occurs within 100 m of water (Gibbs 2000).

3.2 ENVIRONMENTAL SETTING

3.2.1 Amphibian Overview

A total of 490 point-count stops were surveyed for amphibians between 2009 and 2011. Sampling efforts revealed the presence of two species of frog breeding within the areas surveyed: the boreal chorus and wood frog (Appendix A, Table A-1, Map 2-2). Of the 15 point-count stops where frog observations (both auditory and visual) were made during the three year study period, boreal chorus frogs comprised 73.3% of the total frog observations, while wood frogs comprised the remaining 26.6%.

A total of 14 recording posts were established to listen for amphibian breeding calls within the Region in 2011. Sampling efforts revealed the presence of two species of frog breeding within the areas surveyed: the boreal chorus and wood frog (Appendix A, Table A-2, Map 2-2). Of the 12 stops where frog observations (both auditory and visual) occurred during the 2011 study period, the relative presence frequency was as follows:

- Boreal chorus frogs comprised 33% of the total frog observations.
- Wood frogs comprised 8%.
- 59% of frog observations were of both boreal chorus frogs and wood frogs calling at the same site.

3.2.2 Abundance

The findings of continuing studies from 2009 through 2011 indicate that amphibians, particularly boreal chorus frogs and wood frogs, are widely dispersed and relatively abundant throughout the regional study area, although frog populations in boreal regions are generally lower than those observed in southern Manitoba (Cash *pers. comm.* 2006).

3.2.3 Diversity

Although Manitoba supports 12 amphibian species, only four amphibian species are predicted to range within the Project study area (Figure 3-1). These species include boreal chorus frogs (*Pseudacris maculata*), wood frogs (*Rana sylvatica*), northern leopard frogs (*Rana pipiens*) and American toads (*Bufo americanus*; Preston 1982). Boreal chorus frogs, wood frogs, and American toads are common throughout most of Manitoba (Figure 3-1), and are not listed by COSEWIC, SARA or MBESA as being rare or endangered.

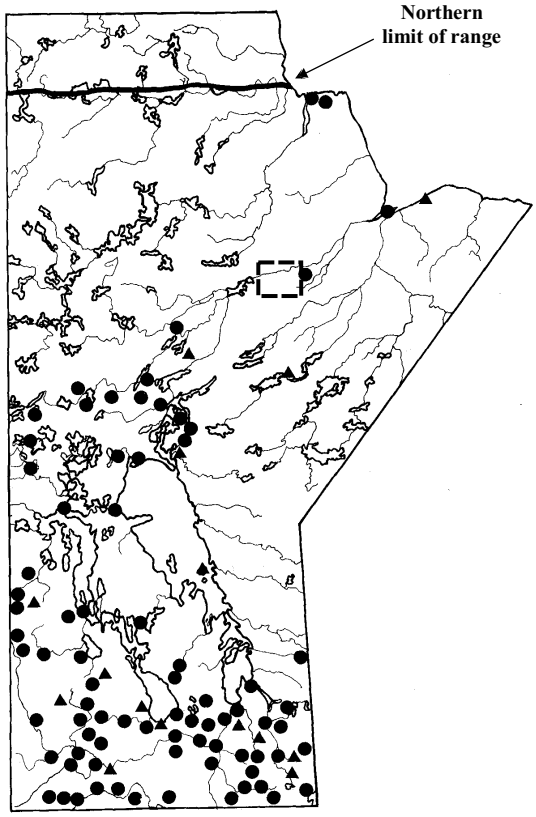
3.2.4 Valued Environmental Components

In the Project study area, both boreal chorus frogs and wood frogs are relatively widely distributed. They are present wherever suitable habitat occurs. These habitats are located across the various routing alternatives for the Construction Power and Generation Outlet Transmission Lines as well as at the station sites.

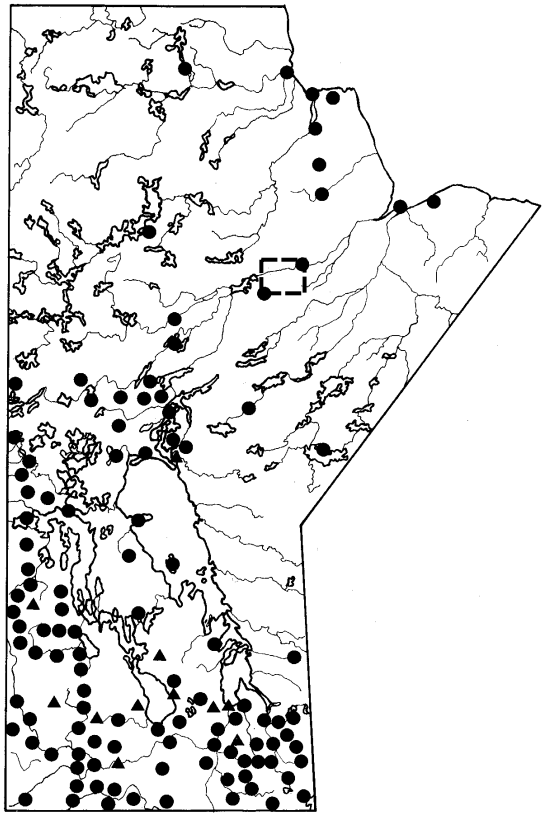
Due to their wide distribution and the location of suitable habitat along both the Construction Power and Generation Outlet Transmission (GOT) routes, neither frog species was considered to be suitable as a VEC. Therefore, impacts on amphibians are considered for the whole group rather than effects on a VEC species. There was little reason to prefer any of the alternative transmission line routes or the station sites with respect to amphibians.

3.2.5 Species at Risk

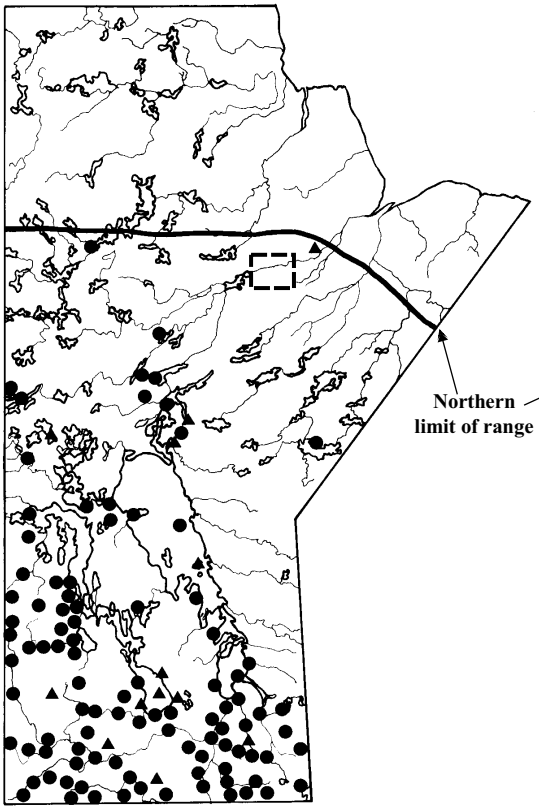
The northern leopard frog (special concern status by COSEWIC and SARA) is the only listed species observed during amphibian surveys conducted in the Keeyask area from 2001 through 2011. It is listed as ‘Species At-Risk’ by COSEWIC, SARA (Schedule 1; COSEWIC 2012; Government of Canada 2009). While uncommon, a single northern leopard frog was noted outside of the study area in 2004, indicating a small breeding population might exist. This species may be limited in the study area by the availability of suitable hibernacula (i.e., ponds that do not freeze to the bottom).



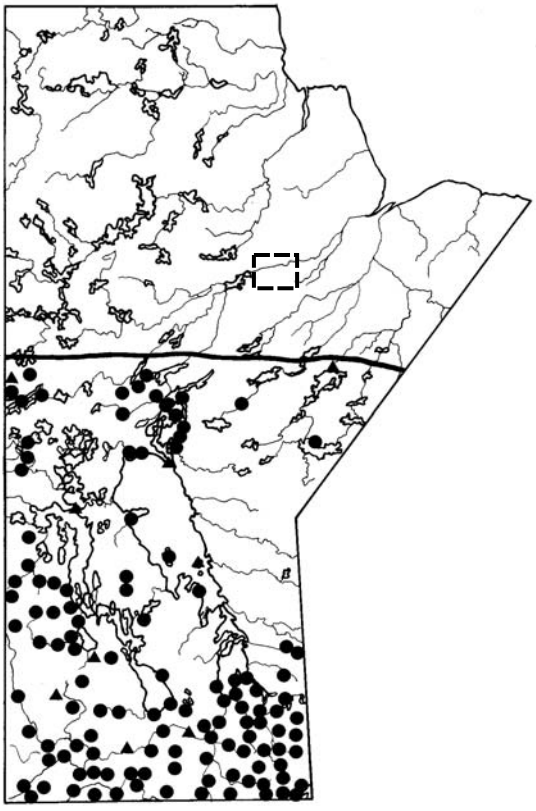
BOREAL CHORUS FROG



WOOD FROG



NORTHERN LEOPARD FROG



CANADIAN AND AMERICAN TOADS

LEGEND

- ● - Specimens located in collections of the Manitoba Museum of Man and Nature, the National Museum of Natural Sciences, the Royal Ontario Museum or the University of Manitoba
- ▲ - Literature records area
- ⬚ - Keeyask Region

Source: Preston 1982

frogdist7
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Distribution of Amphibians in Manitoba
Figure 3-1

4.0 EVALUATION OF ALTERNATIVE ROUTES AND OTHER INFRASTRUCTURE

4.1 CONSTRUCTION POWER TRANSMISSION LINE

Initially, there were two alternative routes for the CP line (Map 1-1).

A preliminary evaluation of the two alternative Construction Power Transmission Lines suggested that the environmental constraints for these two lines are similar. However, the westernmost route (Route Option 2) is somewhat longer.

As discussed in Section 2.4.1 Generally it is considered that the shorter the line, the less potential that impacts will occur or that habitat will be lost. This supports the selection of Route Option 1.

The two potential Construction Power Transmission Line route options transect comparable habitat types, none of which are considered to be rare within the Project Study Area. Black spruce (*Picea mariana*) on thin peatlands and black spruce on shallow peatlands were the two most abundant coarse habitat types by far, with each covering approximately one-third of land area. However, Route 2 contains more wet and riparians peatlands, which would likely contain amphibian habitat , so it is desirable to avoid them (Keeyask Transmission Project, Terrestrial Habitat Technical Report, 2012)..

4.2 CONSTRUCTION POWER STATION

Although the four of the five alternatives sites for the Construction Power Station were ruled out by technical considerations, all sites were evaluated with regard to amphibian habitat.

A desktop photo analysis of the alternative Construction Power Station sites and review of habitat mapping revealed that Sites 3, 4 and 6 are in a recently burned area with a lot of open ground. These sites offer very little amphibian habitat and are very simlair to one another. Sites 2 and 5 have more unburned area with larger black spruce. These sites have the potential to offer some limited amphibian habitat. Site 6 does not support any unique or locally important amphibian habitat. Therefore it is considered an appropriate location with regard to effects on amphibians.

4.3 UNIT TRANSMISSION LINES

The four Unit Transmission Lines will not traverse any unique or locally important amphibian habitat between the Generation Station deck and the Keeyask Switching Station. The habitat in

closer proximity to the Nelson River contains larger black spruce and somewhat drier ground conditions. Neither of these characteristics is preferred by amphibians.

4.4 GENERATION OUTLET TRANSMISSION LINES

The four alternative Generation Outlet Transmission (GOT) Line Alternative Routes (A, B, C, D) are shown on Map 1-1.

Isolated wetland habitat is generally more productive for amphibian communities than any other habitat type, including riparian habitat. The northernmost route (Alternative C) follows either an existing road extending from Gillam to the Butnau Dam or the proposed South Access Road. With respect to **fragmentation**, aligning the transmission route alongside the proposed route has some advantage over developing more contiguous habitat further south.

The terrestrial habitat composition of the alternative corridors, particularly A, B and D, was generally similar. Alternative C had considerably more black spruce treed on thin peatlands (a common habitat type), both in proportional and absolute terms, as well as considerably more black spruce treed on mineral soil (an uncommon habitat type). Alternative A had somewhat more black spruce treed on shallow peatlands (also a common habitat type), both in proportional and absolute terms. Both Alternatives A and B had higher proportions of wet and riparian peatlands than Alternatives C and D. Wet and riparian peatlands may provide good amphibian habitat. Alternative D had a higher proportion of broadleaf treed, broadleaf mixedwood and jack pine treed habitat than the other alternatives.

Construction of a transmission line along Alternative C would contribute to habitat fragmentation in a forest habitat previously fragmented by exploration activities (e.g., cutlines for mineral exploration). This route would also coincide with the proposed Keeyask Generation Project South Access Road route, thus minimizing the amount of undisturbed habitat lost.

Alternative B would be quite similar to Alternative C except that Alternative B traverses south away from the Butnau Road, meaning that it is not routed along a previously disturbed area for that portion of its routing. However, routing the GOT lines along Alternative B would not result in very different effects on amphibians.

Alternative A traverses undisturbed habitat for the majority of its length. While this habitat is not unique or locally important to amphibians, it is likely desirable to avoid disturbing a previously undisturbed area.

Alternative D will result in the GOT lines being routed along KN36 and then the Construction Power Route Option 1. This will result in an approximately 300-m-wide right-of-way, along KN36. It is possible that this wide right-of-way may constitute an impediment to movement for frogs (Gibbs 1998)..

This assessment of the alternative routes is based on an interpretation of information collected by the study team since 2007, including at least one year of fieldwork for each study workstream. Alternative C would be the shortest route and transverse adjacent to existing or proposed roads, i.e., sites that are already affected by existing and proposed infrastructure.

4.5 KEEYASK SWITCHING STATION

A desktop photo analysis of the alternative switching station sites and review of habitat mapping revealed that Sites 6 and 7 on the north side were located in recently burned habitat which offered very little suitable amphibian habitat. Site 7 does have Looking Back Creek running along its southern border. Wetlands adjacent to the creek may offer some amphibian habitat. Site 5, also on the north side, is largely unburned and contains larger Black Spruce. It may offer some limited amphibian habitat.

On the south side of the Nelson River, Site 3 and 4 are on a low, relatively open habitat types which is very widespread in the area. While they will offer some amphibian habitat, it is not limited in the study area. Site 2 adjoins the lake which runs into Gull Rapids Creek. Wet areas along this lake will offer some amphibian habitat. Site 1 is crossed by a creek for its entire length. It is likely that wetlands associated with this creek will be good amphibian habitat.

The site selected for the switching station (3 with 4 as a backup) is on a common habitat type for the Project Study Area. This habitat is widespread and abundant. Development of the switching station will not result in any substantial loss of amphibian habitat in the Project Study area.

Although final detailed design for the Keeyask Switching Station is not yet complete, major changes to environmental effects are not anticipated.

4.6 RADISSON CONVERTER STATION UPGRADE

The Radisson Converter Station site currently contains no wildlife habitat. The site is covered with machinery and equipment and any currently unused area is graveled over. As no changes in the existing boundaries of the existing station are anticipated at this time. No environmental effects on amphibians, from reconfiguring the Radisson Converter Station footprint are expected.

5.0 EFFECTS AND MITIGATION

This section will only address effects and mitigation for the project options selected by Manitoba Hydro. These include Option 1 for the Construction Power Transmission Line, Site 6 for the Construction Power Station, the 4 Unit Transmission Lines, a combination of Alternatives B and C for the Generation Outlet Transmission (GOT) Lines and Site 3 for the Keeyask Switching Station site. The selection process for the various project components is described in Chapter 6 of the Environmental Assessment Report.

5.1 ENVIRONMENTAL EFFECTS IDENTIFICATION

This section outlines potential effects on amphibian populations resulting from specific Project activities during the construction, operation, and decommissioning of the Keeyask Transmission Project.

Project-related activities that may affect amphibians include:

- Development and operation of the construction camp. Magnitude of effect will depend on the final configuration and location of the camp. If it is located on the right-of-way, the impact will be far less.
- Clearing and maintenance along the GOT Line and Construction Power Transmission Line rights-of-way.
- Installation of permanent transmission line towers.
- Construction of the Construction Power Station and Keeyask Switching Stations.
- Increased vehicular traffic during construction and operation phases of the Project.

Effects of the Project are generally considered to be:

1) Alteration of habitat resulting from clearing rights-of-way for generation outlet lines, construction power lines, and at switching stations; installation of permanent towers and creation of permanent ponds.
2) Effects of construction vehicles, increased use of seasonal access trails and transmission line rights-of-way, and other traffic and machinery-related effects.

All environmental effects are discussed below, under these two categories.

5.1.1 Effects from Habitat Alteration

The most substantial habitat alteration that will occur during the Keeyask Transmission Project is from clearing of the transmission line rights-of-way, at the construction camp, if it is not located on the right-of-way, and at the station sites.

Alterations in overall habitat composition can result during right-of-way clearing. These alterations can affect amphibian movement patterns, distribution and abundance. Fragmentation of forest habitat from clearing activities has been shown to affect juvenile amphibian dispersal between populations (Rothermal and Semlitsch 2002). This has been identified as one of many potential reasons for amphibian declines.

Clearing activities result in an opening of the forest canopy. Forest canopy is an important structural component of amphibian forest habitat, such as for adult wood frogs (Kanstra et al. 1995).

During clearing activities, debris piles are created along right-of-way edges and station site margins. Amphibian abundance has been found to increase with the creation and retention of woody debris (Ross et al. 2000). The debris is used both as cover and as overwintering habitat. The long-term retention of some debris piles is desirable with respect to maintaining amphibian populations.

Habitat can also be destroyed or altered during the construction of transmission line towers. Disturbance will occur at the tower site from construction vehicles and from the erection of the tower itself. For much of this area, the disturbance will be short term, but the presence of the tower will continue for the long term.

The last habitat alteration that can occur as a result of right-of-way clearing and other construction activities is the creation of pond and wetted areas. Often ponds form in low areas along cleared rights-of-way since vegetation which originally took up the available water has been removed. These ponds may provide some amphibian habitat, particularly if they are in close enough proximity to the forest edge to benefit from shading from the adjacent forest (W.A.T.E.R., 2012).

Maintaining a buffer zone along wetlands and streams is important as these provide cover and breeding habitat for amphibians (Seburn and Seburn 2000). These buffers can be as little as 10 m in width and should retain as much of the understory and shrub layer as is practicable. They are important for both cleared areas and undisturbed forest (Belisle 2002).

5.1.2 Traffic and Machinery-related Effects

An increase in vehicular traffic has been shown to have negative effects on amphibian populations. Vehicle noise can affect amphibian calling and decrease mating (Barrass 1985). Also, the vehicles traveling along trails and rights-of-way can result in direct amphibian mortality (Fahrig 1995).

5.2 MITIGATION MEASURES

There are several mitigation measures that will benefit amphibians. These include the following:

- Removal of all waste construction materials from construction sites to ensure no substances detrimental to amphibians enter the environment.

- Construction restrictions generally occur April to the end of July annually to meet restrictions under the *Migratory Birds Convention Act*. As amphibians and birds have similar breeding periods (April to June for amphibians, April to the end of July for birds), restriction of construction activities to outside of the bird breeding period will also benefit amphibians.

- Retention of buffers around wetlands and streams will benefit many wildlife species, including amphibians.The buffers suggested in the Aquatics Technical Report (7, 15 and 30 m) would be suitable for protection of amphibians as well. Tall trees, which may interfere with the transmission line, need not be retained in these buffers in order to protect amphibians.

- Retention of some debris piles or scattered debris from right-of-way clearing will provide amphibian habitat. The piles need not be large and they can be located in various habitat types, especially if they are in relatively close proximity to water. (Ross et al. 2000)

- When siting transmission tower locations, attention should be made to avoidance of amphibian habitat. As sites which constitute good amphibian habitat are often in close proximity to wetlands or ponds, they may not be desirable as tower locations anyway, due to poor stability.

5.3 RESIDUAL EFFECTS

No amphibian VECs were selected for the Keeyask Transmission Project. Although residual effects are normally considered as effects on a VEC, for amphibians the whole group was considered when assessing residual effects (Section 2.3) Residual effects as regards amphibians are:

- Minor habitat loss at station sites and tower locations

Residual effects will be minor and will not be measurable when considered over the entire project study area. (Table 5-1).

Table 5-1: Summary of Effects on Amphibians

Potential Effect	Project Phase	Mitigation	Residual Effect	Assessment Characteristics
Amphibian 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 amphibian habitat will be lost	Direction: Adverse 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 Keeyask Transmission Project included:

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

Potential effects on amphibians are expected to overlap with the effects of future projects in the Region. Effects include the loss of amphibian habitat due to reservoir creation for the Keeyask Generation Project. Traffic related mortalities will occur along access roads developed for the Generation Project as well as potential new roads in the Gillam area. Local drainage patterns and localized water quality can also be affected by road development. Effects on amphibian populations are expected to be minimal and not measurable.

5.5 MONITORING

Monitoring of Project-related effects on amphibian populations will be undertaken in conjunction with other wildlife-monitoring programs. This monitoring will help determine if predictions of effects were correct and whether unexpected effects are occurring.

5.5.1 Monitoring During Construction

The construction-related activity that has the most potential for effects on amphibians is the clearing and grubbing of habitat in the Project footprint. While formal monitoring activites are not anticipated specifically for potential effects onamphibians, it is expected that while undertaking other monitoring programs (eg. Breeding-bird surveys) the environmental study team willbe instructed to look for and record any amphibian effects that may be occurring. Also, the Environment Inspector/Monitor will be advised to report any significant amphibian mortalities that may occur. If any amphibian-related impacts are reported, the Environmental Protection Plan will be amended to address and alleviate the problem.

5.5.1.1 Objectives

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

- Determine if any unexpected impacts are occurring as a result of Project construction.
- Determine the effectiveness of mitigation measures and, if necessary, propose new mitigation options.

5.5.2 Monitoring During Operation

Potential for negative effects on amphibians from operation of the Keeyask Transmission Project is expected to be negligible. Therefore, no monitoring is proposed for the operation period.

6.0 CONCLUSIONS

During the routing and site-selection process for the transmission lines and stations for the Keeyask Transmission Project, alternatives were assessed based on their potential for impacts on the environment, including amphibians.

The two Construction Power Transmission Line routes and the three of four Generation Outlet Transmission Line Alternative Routes were surveyed and compared with regard to their potential for effects for all environmental components. Generation Outlet Transmission Line Alternative D was evaluated based on a desktop analysis of aerial photography and comparison to Route Alternative A, which traverses the most similar habitat types. The route options with the least potential for negative effects were identified for each component (e.g., amphibians, mammals, terrestrial habitat, etc.).

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

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

- Retention of some woody debris along cleared rights-of-way and station sites to provide cover and wintering habitat for amphibians.
- Retention of buffer zones around wetlands to protect amphibian habitat.

Effects of the Keeyask Transmission Project on amphibian communities will exist for the life of the Project. However, these effects are expected to be negligible, and likely not measurable within the range of natural variation of amphibian populations.

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

Residual effects of the Project are minor habitat loss at station sites and tower footprints. These are not expected to be measurable and should remain within the range of natural variation.

7.0 GLOSSARY

Amphibians: Cold-blooded animal of the Class Amphibia that typically lives on land but breeds in water (e.g., frogs, toads, salamanders).

Ecosystem Function: The outcomes of ecosystem patterns and processes viewed in terms of services or benefits. Examples include producing oxygen to breathe, habitat for animals, purifying water and storing carbon.

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.

Project: Keeyask Transmission Project.

Reptile: Cold-blooded animal of the Class Reptilia that includes tortoises, turtles, snakes, lizards, alligators and crocodiles.

Riparian: Along the banks of rivers and streams.

Study area: The geographic limits within which effects on a VEC (valued environmental component) or key topic is assessed.

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

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: Frog Observations During Point-Count Surveys, 2009-2011

Year	Code	Easting	Northing	Species
2011	1	ST7G		Wood Frog
2011	1	ST7C		Wood Frog
2011	1	380626	6242280	Wood Frog
2010	N/A	367364	6231910	Boreal Chorus Frog
2009	N/A	376369	6243664	Boreal Chorus Frog
2009	N/A	372966	6243334	Boreal Chorus Frog
2009	N/A	362261	6244226	Boreal Chorus Frog
2009	N/A	362191	3244364	Boreal Chorus Frog
2009	N/A	365169	6235016	Boreal Chorus Frog
2009	N/A	367134	6241894	Boreal Chorus Frog
2009	N/A	374448	6243354	Boreal Chorus Frog
2009	N/A	374293	6243332	Boreal Chorus Frog
2009	N/A	366861	6241626	Boreal Chorus Frog
2009	N/A	367041	6241606	Boreal Chorus Frog
2009	1	364378	6246116	Boreal Chorus Frog

Appendix A, Table A-2: Frog Observations During Remote Audio Recording Sessions, 2011

Year	Code	Easting	Northing	Species
2011	N/A	351907	6254253	Boreal Chorus Frog, Wood Frog
2011	N/A	345286	6254848	Boreal Chorus Frog, Wood Frog
2011	N/A	348549	6254656	Wood Frog; Boreal Chorus Frog
2011	N/A	349896	6254305	Boreal Chorus Frog
2011	N/A	354305	6253124	Boreal Chorus Frog
2011	N/A	360604	6250095	Boreal Chorus Frog; Wood Frog
2011	N/A	343384	6254859	Boreal Chorus Frog; Wood Frog
2011	N/A	352551	6253551	Boreal Chorus Frog
2011	N/A	353392	6252707	Boreal Chorus Frog
2011	N/A	355710	6251819	Wood Frog
2011	N/A	355744	6249110	Wood Frog; Boreal Chorus Frog
2011	N/A	372628	6245466	no frogs
2011	N/A	372689	6243711	no frogs
2011	N/A	374362	6243615	Wood Frog; Boreal Chorus Frog
2011	N/A	351907	6254253	Boreal Chorus Frog, Wood Frog