KEEYASK TRANSMISSION PROJECT

TERRESTRIAL HABITAT, ECOSYSTEMS AND PLANTS TECHNICAL REPORT

Prepared For Manitoba Hydro

By ECOSTEM Ltd.

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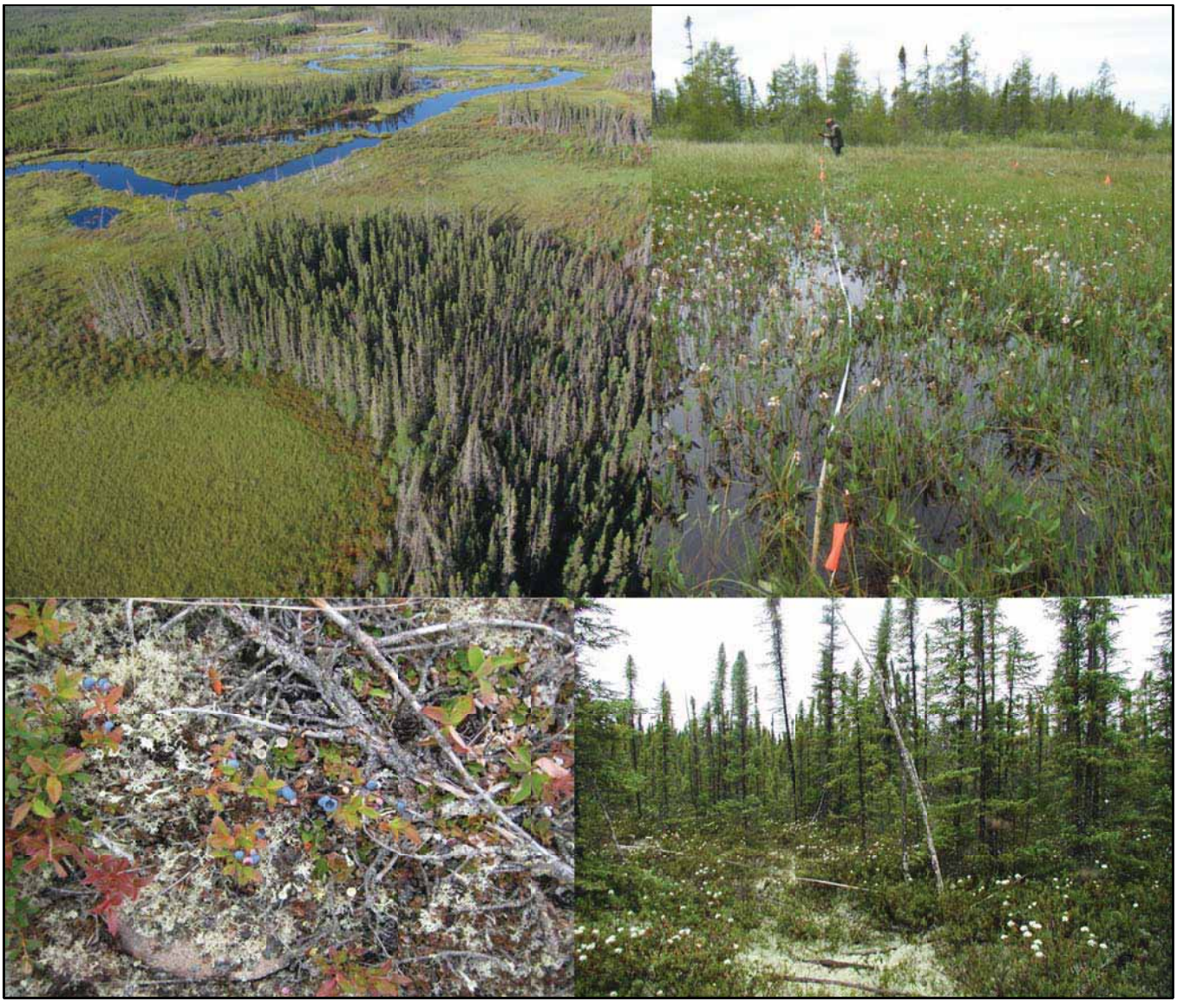

PREFACE

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, on 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) to transport electrical energy from: a) the existing transmission system to the Keeyask generating station site for construction purposes; and b) from the proposed Keeyask Generation Project into the Manitoba Hydro northern collector system and existing transmission system. The proposed Project includes the development of a Construction Power Transmission Line (138 kV) and Station that would convey power between an existing transmission line (KN36) and the site where the Keeyask Generation Station would be built, four Unit Transmission Lines originating at the Keeyask Generation Project generating station and terminating at the Keeyask Switching Station, the Keeyask Switching Station, three Generation Outlet Transmission lines that would link the Keeyask Switching Station to the Radisson Converter Station and upgrades to the Radisson Converter Station. The width of the right-of-way for the Construction Power line will be 60 m. A 200-m width will be required for the three Generation Outlet Transmission lines proposed between the Keeyask Switching Station and Radisson Converter Station. The proposed Keeyask SS will require 52 ha of potential land for Project development, with an additional 35 ha reserved for future developments.

Preliminary planning identified two alternative transmission line routes for the Construction Power Transmission lines and four alternative routes for the Generation Outlet Transmission lines. Manitoba Hydro conducted a site evaluation and selection process for the transmission line routes, which included recommendations on a preferred route from the biological, socio-economic, local community, cost and engineering perspectives.

This report evaluated the Construction Power Transmission and Generation Outlet Transmission alternative routes in terms of their potential effects on terrestrial habitat, ecosystems and plants as a component of the overall site selection process for the Keeyask Transmission Project. The alternative routes evaluation was focussed by selecting three valued environmental components to represent terrestrial habitat, ecosystems and plants, which included fragmentation, ecosystem diversity and priority plants.

There were no major concerns with any of the Construction Power Transmission or Generation Outlet Transmission alternative routes. The slightly preferred route for the Construction Power Transmission line was Alternative Route 1 because it was expected to create less fragmentation and have lower effects on ecosystem diversity. Alternative Route C was the preferred route for the Generation Outlet Transmission lines because it was expected to minimize effects on fragmentation, ecosystem diversity and priority plants, largely because more of this route was near existing human features. Alternatives A and D created the highest fragmentation effects and Alternative D had the highest ecosystem diversity effects.

Manitoba Hydro selected overall preferred routes for the Construction Power Transmission and Generation Outlet Transmission lines after considering the preferred route recommendations from the perspectives of biological effects, socio-economic effects, community concerns, cost and engineering limitations. Construction Power Transmission Alternative 1 and a combination of segments from Generation Outlet Transmission Alternatives B and C (with one minor modification) were the selected routes. By combining segments from Alternatives B and C, the preferred Generation Outlet Transmission route had slightly lower effects on ecosystem diversity.

This report also assessed the effects of the proposed Keeyask Transmission Project on terrestrial habitat, ecosystems and plants effects assessment based on the selected locations for the transmission line rights-of-way and the station sites. This effects assessment included an analysis of potential Project effects, recommendations for mitigation measures and predicted residual Project effects after recommended mitigation. Interactions of residual Project effects with other potential reasonably foreseeable future projects were considered. The assessment was focussed using the same VECs that were used for the Construction Power Transmission and Generation Outlet Transmission alternative route evaluations.

Based on the selected locations for the transmission line rights-of-way and the station sites, the Project was not expected to substantially affect terrestrial habitat, ecosystems and plants. Predicted residual effects on fragmentation, ecosystem diversity and priority plants were expected to be adverse and long-term but regionally acceptable given their limited magnitude and geographic extent. This largely occurred because the degree of past and current development in the Regional Study Area was limited and because substantial portions of the proposed Project were located near existing or planned human infrastructure. Some key mitigation measures included to reduce residual Project effects included ensuring that the final right-of-way routing avoids priority habitat sites to the extent practicable and conducting pre-construction rare plant surveys in portions of the transmission line rights-of-way that were not previously surveyed and have the highest potential for supporting provincially very rare to rare plant species. A limited program to monitor Project effects on fragmentation, ecosystem diversity and priority plants was recommended.

STUDY TEAM

James Ehnes was the project manager and study designer. Fieldwork was conducted by Brock Epp, Alanna Sutton, Jackie Krindle (Calyx Consulting), Alex Snitowski, Pierre-Hughes Tremblay, Karine Grotte and Chris Higgs. Data analysis, GIS analysis and report writing was completed by James Ehnes, Brock Epp and Alanna Sutton. Jackie Krindle provided the plant nomenclature and reviewed the plant results. Alex Snitowski completed GIS analysis and cartography.

1.0 INTRODUCTION

1.1 OVERVIEW

Keeyask HydroPower Limited Partnership is currently proposing to develop a generation station, the Keeyask Generation Project, on 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) to transport electrical energy from: a) the existing transmission system to the Keeyask generation station site for construction purposes; and b) from the proposed Keeyask Generation Project into the Manitoba Hydro northern collector system and existing transmission system. The Project includes the development of a Construction Power Transmission Line (138 kV) and Station that would convey power between an existing transmission line (KN36) and the site where the Keeyask Generation Station would be built, four Unit Transmission Lines originating at the Keeyask Generation Project generation station terminating at the Keeyask Switching Station, the Keeyask Switching Station, three Generation Outlet Transmission lines that would link the Keeyask Switching Station to the Radisson Converter Station and upgrades to the Radisson Converter Station (Map 1-1).

Once the Keeyask Generation Project is commissioned, the Construction Power Transmission Line and a portion of the proposed Keeyask Construction Power Station will remain in place to provide emergency power for black starting the Keeyask Generation Project. A portion of the land (2 ha) on which the Construction Power Station occurs will be salvaged. Two overhead 12.47 kV service lines will be constructed from the proposed Keeyask Switching Station to the Keeyask Generation Project to provide operational power supply to the Keeyask Generation Project.

The proposed Keeyask Switching Station will require 52 ha of potential land for Project development, with an additional 35 ha reserved for future developments. A 60 m wide right-of-way (ROW) is proposed for the Construction Power line. A 200-m wide ROW will be required for the three Generation Outlet Transmission lines proposed between the Keeyask Switching Station and Radisson Converter Station. Preliminary planning identified two alternative transmission line routes for the Construction Power Transmission lines and four alternative routes for the Generation Outlet Transmission lines (Map 1-1).

This report evaluates the Construction Power Transmission and Generation Outlet Transmission alternative routes in terms of their potential effects on terrestrial **habitat**, **ecosystem**s and plants as a component of Manitoba Hydro's overall site selection and environmental assessment (SSEA) process for the Project. The alternative route evaluations culminate in a preferred route recommendations for Construction Power Transmission and Generation Outlet Transmission.

During the SSEA process for the Project transmission line routes, Manitoba Hydro considered the Construction Power Transmission and Generation Outlet Transmission preferred route recommendations in this report in combination with other biological, socio-economic, local community, cost and engineering perspectives. Manitoba Hydro selected an overall preferred route for the Construction Power Transmission and Generation Outlet Transmission lines using this process. Chapter 3 of the Project Environmental Assessment Report (Manitoba Hydro 2012) describes the site selection and environmental assessment process in detail.

This report also describes and assesses the effects of the proposed Project on terrestrial habitat, ecosystems and plants effects assessment based on the locations for the transmission line rights-of-way and the station sites selected through the SSEA process. The effects assessment includes an analysis of potential Project effects, mitigation measures and predicted residual Project effects after mitigation. Interactions of residual Project effects with other potential reasonably foreseeable future projects are then considered. Monitoring recommendations are also provided.

An ecosystem-based approach was used to evaluate and assess the potential effects of the alternative routes and of the proposed Project on terrestrial habitat, ecosystems and plants. The ecosystem-based approach recognized that the terrestrial ecosystem is a complex, hierarchically organized system in which changes to one component directly and/or indirectly affect other components. A key element of the ecosystem-based approach was identifying the ecosystem components (i.e., elements, patterns, linkages, processes and functions) that are particularly important for maintaining terrestrial ecosystem health and could potentially be substantially affected by the Project. These ecosystem components, along with topics of particular social interest, became the **valued environmental component**s (VECs) that were used to focus the alternative route evaluation and the Project effects assessment. Where relevant, other important ecosystem components or influences were also considered.

The alternative route evaluations and the Project effects assessment were built on environmental assessments recently completed for the Keeyask Infrastructure Project (Manitoba Hydro 2009) and the Keeyask Generation Project (Keeyask HydroPower Partnership 2012a). Much of the existing environment information was either summarized or copied from the terrestrial sections of the Keeyask Generation Project Environmental Impact Statement. Details regarding methodology, methods and procedures can be found in Sections 1 to 3 of the Keeyask Generation Project Environmental Impact Statement Terrestrial Supporting Volume (Keeyask HydroPower Partnership 2012b).

1.2 PROJECT COMPONENT OVERVIEW

1.2.1 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).

1.2.2 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.

1.2.3 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).

1.2.4 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

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

salvaged back to the Keeyask Switching Station and utilized as a Generation Outlet Transmission Line.

1.2.5 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 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.

1.3 POTENTIAL PROJECT EFFECTS

Since habitat is the key pathway for most Project effects on terrestrial ecosystems, this introductory section includes a description of anticipated Project effects on terrestrial habitat and how those effects were incorporated into the alternative route evaluations and the Project effects assessment.

Potential direct Project effects on terrestrial habitat will include the loss, alteration and disturbance of habitat in the ROW, borrow areas used for tower construction and any associated access roads and trails. **Habitat loss** refers to the conversion of terrestrial habitat into human features or an aquatic area, either temporarily or permanently. **Habitat alteration** refers to changes in one or more habitat attributes that are large enough to convert a habitat patch to a different fine habitat type. Lesser changes in one or more habitat attributes are classified as **habitat disturbance**. An example of habitat disturbance is a habitat patch adjacent to the ROW that has had trees or debris pushed into it.

Direct Project effects will create indirect effects, both within the **Project Footprint** and in some surrounding areas. That is, a Project impact will have a zone of influence surrounding its physical footprint. For example, clearing trees on permafrost soils will generally lead to higher soil temperatures, both within the cleared area and in adjacent areas. A particular indirect effect may be several stages removed from the direct Project effect. Vegetation clearing that creates large openings on treed peatlands with thick ground ice will generally

lead to permafrost melting, followed by collapse of the soil surface to form craters, and then by the development of very wet peatland habitat and/or open water in the craters.

The size and nature of the indirect zone of influence will be determined by how the particular Project feature interacts with the ecosystem component of interest and local conditions. For example, tree clearing in dense, mature forest on permafrost soils will have a much larger zone of influence on terrestrial habitat than clearing sparsely distributed trees on a bedrock outcrop. The nature and spatial extent of indirect habitat effects can range from not measurable to conversion to aquatic or human infrastructure areas. It should be noted that the term **habitat zone of influence** refers either to the concept of indirect effects on terrestrial habitat or to the expected (*i.e.*, most likely) spatial extent of indirect effects on terrestrial habitat.

Indirect Project effects on vegetation, soils and other terrestrial habitat were expected to generally diminish below measurable levels within 10 m from the transmission line ROWs. Studies of vegetation clearing in forests have documented **edge effect**s that range from 15 m to 50 m, depending on the ecosystem component of interest, the type of human disturbance and local conditions (Euskirchen *et al.* 2001; Harper and Macdonald 2002; Rheault *et al.* 2003; Gignac and Dale 2005, 2007). However, none of these studies were conducted in an ecological region that is highly comparable to the Regional Study Area. An edge effects study conducted along more than 900 km of transmission line rights-of-way in north-western Manitoba (the study area overlapped the Regional Study Area) found that effects on overstorey vegetation extended less than 10 m from the cleared opening (Ehnes and ECOSTEM 2006). Compared with studies conducted in other ecological regions, the narrower zone of overstorey edge effects observed in north-western Manitoba was attributed to the very low proportion of area that is dense forest so that habitat attributes are more strongly influenced by factors other than those related to canopy closure. Only approximately 21% of the total area of the treed stands more than 50 years old in the detailed habitat mapping area had canopy closure greater than 60%.

Improved access is another potentially important pathway for indirect Project effects since this will bring more equipment, material and/or people into an area, which could lead to increased resource harvesting, invasive plant spread and/or human-caused fires, among other things.

A 50 m buffer of the transmission line ROWs was created to account for indirect Project effects on terrestrial habitat (*i.e.*, the terrestrial habitat zone of influence). This was a cautious overestimate of the anticipated total size of the terrestrial habitat zone of influence. Indirect Project effects on habitat could extend further than 10 m from the transmission line ROWs in localized areas along the routes. These localized exceptions could occur in wetlands, areas physically disturbed by construction equipment, for by-pass trails are needed in difficult terrain and/or areas affected by a low probability event (*e.g.*, a human

caused fire). To the extent these effects occur, they were expected to alter only a small portion of the total area in the peripheral 40 m of the 50 m buffer so that the 50 m ROW buffer was likely a substantial overestimate of the total area of transmission line ROW indirect effects.

A larger buffer of 150 m was used for station sites to account for the higher degree of impact associated with soil removal and permanent infrastructure construction as well as the higher potential for unplanned Project activities outside of the station footprint such as equipment moving outside of the designated Project Footprint or additional clearing.

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

N

0 2 4 Kilometres
0 2 4 Miles

1:150,000

Project Infrastructure

Alternative Transmission Line Routes

Map 1-1