Keeyask Generation Project

Environmental Impact Statement

Response to EIS Guidelines

Hydropower Limited Partnership

June 2012

CHAPTER 7

CUMULATIVE EFFECTS ASSESSMENT

KEEYASK

Hydropower Limited Partnership

CHAPTER 7
TABLE OF CONTENTS

Page

APPENDICES

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF MAPS

In print version, Appendix 7A Maps can be found in the accompanying Map and Figure Folio

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7.0 CUMULATIVE EFFECTS ASSESSMENT

7.1 INTRODUCTION

This chapter presents the results of the cumulative effects assessment (CEA) of the Keeyask Generation Project (the Project). The CEA describes the incremental effects likely to result from the Project on the environment when the effects are combined with the effects of other past, present or future projects or human activities listed in this chapter:

- The adverse effects of the Project in combination with other past and current projects are summarized from Chapter 6; and
- These adverse effects of the Project are assessed in combination with other future projects and activities.

7.2 APPROACH

As reviewed in Chapter 5, the Project is the subject of two evaluations. The first was conducted by the Keeyask Cree Nations (KCNs) for their internal purposes; the second was prepared to comply with the federal and provincial environmental regulatory process:

- KCNs Evaluation Process:

  The KCNs evaluation process has been underway for more than a decade with the support of Manitoba Hydro. The process assisted the KCNs to understand the Project and its impacts on their communities and Members and to determine the conditions under which they would approve the Joint Keeyask Development Agreement and support the Project. The Project was evaluated by each of the KCNs in terms of their own worldview, values and experience with past hydroelectric development, as well as their relationships with Mother Earth (see Chapter 2 and the KCNs' Environmental Evaluation Reports which are provided to assist other people to understand their independent decisions to be Project proponents).

- Government Regulatory Assessment Process:

  Work by Manitoba Hydro and the KCNs on the government regulatory assessment process has also been underway for many years. The Keeyask environmental impact assessment is in accordance with the regulatory framework outlined in Section 1.3,

> guidance provided by federal and provincial regulatory agencies, and standard environmental assessment practice. The existing environment and the manner in which it functions, including the effects on it caused by past and current projects, was studied and analyzed using the scientific method (referred to as "technical information" in the environmental impact statement (EIS)), Aboriginal traditional knowledge (ATK) and local knowledge. The regulatory assessment then predicted the effects on this environment if the Project is developed, and mitigation was identified to reduce the severity of adverse effects as much as possible. A monitoring program will determine if the prediction of effects are accurate and if mitigation measures are working as expected; and, if not, will assist in identifying new mitigation measure to apply.

The CEA for the Project was conducted for the government regulatory assessment process with consideration of the guidance provided by the following:

- EIS Guidelines; and
- Review of other guidance documents for cumulative effects assessment (*e.g., Cumulative Effects Assessment Practitioners Guide*, Hegmann *et al* 1999; Operational Policy Statement, CEAA 2007).

In addressing cumulative effects, Hegmann *et al* (1999) state in the Canadian Environmental Assessment Agency's *Cumulative Effects Practitioners' Guide* that:

> "… an assessment of a single project (which is what almost all assessments do) must determine if that project is incrementally responsible for adversely affecting a VEC beyond an acceptable point (by whatever definition). Therefore, although the total cumulative effect on a VEC due to many actions (defined as projects and activities) must be identified, the CEA must also make clear to what degree the project under review is alone contributing to that total effect. Regulatory reviewers may consider both of these contributions in their deliberation on the project application."

In conducting a CEA, it is necessary to consider, but not necessary to assess the regulatory significance of, the effects of other past, current and future projects (*i.e.,* it is not necessary to assess the effects of such other projects as being, for example, significant or adverse). The CEA for the Project determines the extent to which the Project is expected to be incrementally responsible for adversely affecting a Valued Environmental Component (VEC) beyond an acceptable point, taking into account the overall suite of stresses on the selected VEC (including stresses from other projects and activities).

The effects of past and current projects and activities on the existing environment, including effects expected in the future without the Project, are described in Section 6.2, Existing Environment (see Table 7-1 for a list of these other projects and activities). The additional effects that the Project will cause on this existing environment are then assessed in the

remainder of Chapter 6, Environmental Effects Assessment[1] and those VECs that will be adversely affected by the Project (after mitigation) in combination with past and current projects are identified.

Chapter 7's CEA begins by summarizing the effects of the Project in combination with other past and current projects (as assessed in Chapter 6). Chapter 7 then examines if these VECs will be further adversely affected by the Project in combination with other future projects and activities (see Table 7-2 for a list of the future projects and activities included in this CEA). Where VECs are further adversely affected by the Project in combination with other future projects and activities, the following steps are also taken in Chapter 7:

- Determine what, if any, additional mitigation may be required for these VECs to address the combined adverse effect of the Project with the further adverse effects of the identified future projects and activities and predict the residual effects of the Project in combination with the identified future projects and activities; and
- For each of these VECs, determine whether the regulatory significance of the Project's residual effects as assessed in Chapter 6 changes when they are combined with the effects of future projects and activities.

By focusing on individual environmental components, the VEC approach does not capture the broader concept of the Cree worldview, which emphasizes that all things are interconnected and should be viewed as a whole. An understanding of this worldview and the related KCNs' views regarding the cumulative effects of Project in combination with other past and current projects, as expressed by the KCNs who are directly affected by the Project, is provided in Chapter 2, Partners' Context, Worldviews and Evaluation Process (Section 2.2), and in the KCNs' Environmental Evaluation Reports. However, where ATK of specific environmental components was incorporated into the assessment, this is reflected in the CEA results.

[1] The temporal and spatial scope for the Chapter 6 assessment of Project effects on each VEC were defined as required to address CEA of the Project in combination with other past and current projects and activities.

7.3 PAST, CURRENT AND FUTURE PROJECTS AND ACTIVITIES

7.3.1 PAST AND CURRENT PROJECTS AND ACTIVITIES CONSIDERED IN THE CUMULATIVE EFFECTS ASSESSMENT

The Project is located in a region that has been greatly altered over the past 55 years by the development of the Lake Winnipeg Regulation Project (LWR), the Churchill River Diversion Project (CRD) and five generating stations. The Project is located on a reach of the Nelson River between the Kettle GS and the Kelsey GS where flows are regulated by the CRD and LWR. These alterations have replaced large rapids with dams, changed stretches of the river into reservoirs, diverted flows from the Churchill River into the Nelson River and reversed the seasonal flow pattern such that higher flows now occur in winter and lower flows in spring and summer. Past and current linear developments in the region, including upgrades to PR 280, may also overlap with the Project. Other agents of past and current change in the region that may overlap with the Project are mining, commercial forestry, commercial fishing of sturgeon and other activities as may be identified in the assessment of specific VECs (see Chapter 6).

Table 7-1 provides a list of the past and current projects and activities that are considered in the cumulative effects assessment for the Project. Additional information on the past and current projects and activities is provided in Section 6.2. Descriptions of past effects from the perspective of the KCNs are provided in Chapter 2 and in their individual KCNs Environmental Evaluation Reports. Additional information describing the individual past and current projects and activities considered in the cumulative effects assessment, including relevant maps, is also provided in Appendix 7A.

7.3.2 SUMMARY OF PROJECT PHYSICAL EFFECTS WITH PAST AND CURRENT PROJECTS / ACTIVITIES

As reviewed in Chapter 6 (Section 6.3), the Project will affect open water levels for about 41 km upstream of the Project and change a portion of this waterbody from a presently primarily riverine reach to a reservoir environment. About 45 km^2 of initial flooding is predicted. This inundation, along with ongoing erosion, will affect water quality, and terrestrial and aquatic habitat. Chapter 6 (Section 6.3) has described these effects in detail and the descriptions assisted in the evaluation of the VECs selected for CEA.

Table 7-1: Past and Current Projects and Activities Considered in the Cumulative Effects Assessment of the Project

Category	Projects Included	Summary Effects (see Chapter 6)
Manitoba Hydro generation-related developments	• Churchill River Diversion (CRD) • Lake Winnipeg Regulation (LWR) • Jenpeg, Kelsey, Kettle, Long Spruce, Limestone and Wuskwatim GSs (on Nelson and Burntwood rivers) • Kelsey re-runnering • Keeyask Infrastructure Project (KIP)	CRD and LWR as established in the 1970s have ongoing effects that overlap with Keeyask Project effects on the water regime, the related environment and local communities and peoples. Other generating stations, control structures and activities on the Nelson and Burntwood rivers (including Kelsey re-runnering) also have ongoing effects that overlap with the Project's effects. The north access road to the Project, including related temporary camp and work areas, that was licensed and constructed as part of KIP prior to the start of Keeyask construction have effects that overlap with the Project's effects on some components of the environment.
Linear development in the region	• Transmission lines, rail lines and highways, including upgrades to PR 280	Existing linear developments in the vicinity of the Project, including upgrades to PR 280, have ongoing effects (e.g., habitat disruption, fragmentation effects, increased access to resources, transportation safety) that overlap with the Project's effects on some components of the environment.
Other	• Mining (e.g., Vale) • Commercial forestry • Commercial fishing, including sturgeon • Other agents of change as may be identified in the assessment of specific VECs (see Chapter 6)	Other agents of change are identified in the assessment of specific VECs (see Chapter 6). Mining-related effects overlap with Project socio-economic effects in the Thompson area; minimal overlap of Project effects is expected with commercial forestry; commercial fishing has the potential to affect fish populations, and had a large effect on lake sturgeon populations prior to closure of the lake sturgeon commercial fishery in 1992.

In summary, the Project's effects on the physical environment are mainly associated with the construction footprint, the creation of a reservoir, and the associated hydraulic zone of influence on surface water and ice regimes upstream and downstream of the Project. The effects on the physical environment provide the context from which other environmental components (*e.g.,* aquatic and terrestrial) undertake their environmental assessment, including cumulative effects assessment.

7.3.3 FUTURE PROJECTS AND ACTIVITIES CONSIDERED IN THE CUMULATIVE EFFECTS ASSESSMENT OF THE PROJECT

Table 7-2 provides a list of future projects and activities considered as part of this cumulative effects assessment. Additional information describing the individual future projects and activities considered in the cumulative effects assessment is also provided in Appendix 7A. Figure 7-1 summarizes the currently anticipated timing of construction of future projects in the vicinity of Gillam, including employment estimates.

7.3.4 SUMMARY OF PROJECT PHYSICAL EFFECTS WITH FUTURE PROJECTS / ACTIVITIES

Two future Manitoba Hydro transmission projects Table 7-2 (the Bipole III Transmission Project and the Keeyask Transmission Project) are currently or will soon be subject to regulatory review. These will overlap in time and, to some extent, space with the Project. These future transmission projects are very different in nature from the Project and, with respect to the physical environment, there is sufficient spatial separation so that there is little or no overlap with effects of the Project in regard to erosion, noise, groundwater, and other physical environment effects of the Project. KCNs' perspectives (ATK based on past experience with Manitoba Hydro projects) indicate that the hydraulic zone of the Project effects may extend further than predicted in Chapter 6. Even if this extended zone is considered, there is little overlap of physical environment effects of the Project with those of these other future transmission projects.

In contrast, there would be some overlap with the release of sediment during in-stream construction activities of the Project and the potential future construction of the Conawapa GS if this proceeds for initial in-service in 2025. The incremental downstream effects of the Project during construction below Conawapa are expected to be minor and of short duration (one to three months per year for two years). The overlap effects on water quality are discussed in Section 7.5.1 "Aquatic Environment."

The operations of the above future projects are not expected to cause measureable incremental changes to the Project effects on the physical environment.

Table 7-2: Future Projects and Activities in the Vicinity of Gillam Considered in the Cumulative Effects Assessment of the Project

Projects Included	Summary Effects
Bipole III Transmission Project (includes Keewatinoow Converter Station and Ground Electrode and Camp/Construction Power, Collector Lines and Existing Station Upgrades, Bipole III Transmission Northern Segment #1)	The Bipole III Transmission Project being planned and developed by Manitoba Hydro is currently being reviewed by regulators for a potential construction start in 2013 and in-service in 2017. Bipole III components in the Gillam area will have effects during construction and operation that overlap with Keeyask Generation Project effects on some components of the environment.
Keeyask Transmission Project (includes construction power to the Keeyask Generation Project, and Generation Outlet Transmission lines with switching station and three new transmission lines to convey power from Keeyask GS to Radisson Converter Station)	The Keeyask Transmission Project is being planned and developed in the Gillam area by Manitoba Hydro, with construction power development planned between mid-2014 and mid-2015 and other component developments planned between early 2017 and early 2020. Keeyask Transmission Project components will have effects during construction and operation that overlap with Keeyask Project effects on some components of the environment.
Gillam Redevelopment	Gillam redevelopment (2013 to 2019) includes the potential for new housing within the Town of Gillam.
Conawapa Generation Project (includes Camp)	Conawapa Generation Project is a potential development by Manitoba Hydro. If developed for initial in-service in 2025, construction could start in early 2017 for completion by late 2027. Conawapa Generation Project components may have effects during construction and operation that overlap with Keeyask Project effects on some components of the environment.

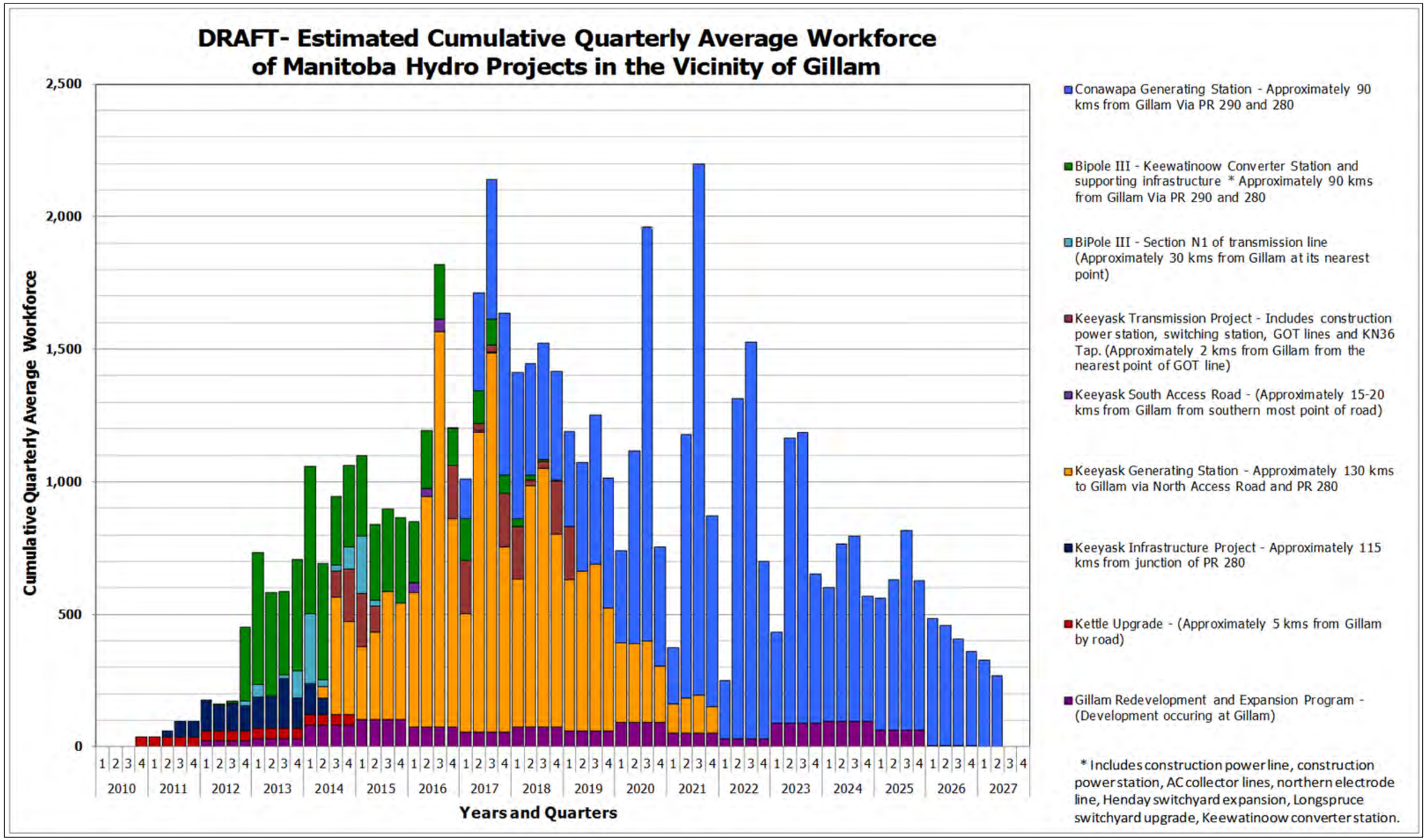


Figure 7-1: Major Construction Activity in the Gillam Area During Construction of the Keeyask Generation Project

Notes:

1. The estimates are quarterly average workforce requirements (averages within each quarter based on monthly information) based on information available at the time of compilation and are subject to change. In some instances the level of detail for the estimates vary and the footnotes below provide further details where necessary. Unless otherwise noted: the above information represents a forecast only, based on current regulations, present project plans, and experience with similar projects; contractors will determine specific job requirements when the project is being built; actual employment requirements will vary from the forecast presented. Unless otherwise noted, the above information indicates contractor site personnel (including supervisory and management positions); it also includes Manitoba Hydro site staff. The above forecasts do not include Manitoba Hydro Winnipeg office staff, or workforce for the construction of Substations and Transmission Lines.

2. Gillam Redevelopment and Expansion Program

- Estimated number of workers required per year. Assumes quarterly peak workforce is equal to number of workers required per year.

3. Kettle Upgrade

- Assumes peak quarterly workforce of 40 workers.

4. Keeyask Infrastructure Project

- The above forecasts are based on Manitoba Hydro's forecast of workforce and a construction schedule of November 2019 first unit in-service date.
- The Keeyask Infrastructure Project is expected to be completed by May 2014.

5. Keeyask Generating Station

- The above forecasts are based on KGS Acres and Manitoba Hydro's forecast of workforce and a construction schedule of November 2019 first unit in-service date.
- The Keeyask Generating Station project is expected to start in June 2014.
- The above forecast does not include the workforce for the South Access Road (SAR); SAR estimates are provided separately in the figure.

6. Keeyask South Access Road

- The above forecasts are based on KGS Acres and Manitoba Hydro's forecast of workforce and a construction schedule of November 2019 first unit in-service date.
- The Keeyask Generating Station project is expected to commence in June 2014.

7. Keeyask Transmission Project - Construction Power Station

8. Keeyask Transmission Project - Switching Station and GOT lines.

9. Bipole III

i. The following notes apply to N1 clearing and construction, Keewatinoow construction power line, Keewatinoow AC collector lines and the northern electrode line
   - Projections are extrapolated from Wuskwatim Transmission Line figures.
   - Projections based on a December 2012 construction start date.
   - Projections are assumptions only; each contractor will staff and schedule his/her section of the work as per their own preferences.
   - Breakdown is derived from Wuskwatim-Herblet actuals and then applied as a percentage to Bipole III projected figures
   - Estimate includes contractor workers and contractor supervisory positions and Manitoba Hydro workers and Manitoba Hydro supervisory positions.

ii. The following notes apply to Henday switchyard expansion, Long Spruce switchyard upgrades, and the Keewatinoow construction power station
   - Estimate includes contractor workers and contractor supervisory positions and Manitoba Hydro workers and Manitoba Hydro supervisory positions.

iii. Keewatinoow Converter Station
   - The above forecasts are based on Manitoba Hydro's forecast of workforce and a construction schedule based on an October 2017 BP III in-service date.

10. Conawapa Generating Station

- The above forecasts are based on KGS Acres and Manitoba Hydro's forecast of workforce and a construction schedule of May 2023 first unit in-service date, and was shifted to the current first unit in-service date of May 2025.
- The above information The above forecasts do not include Manitoba Hydro Winnipeg office staff, or workforce for the construction of Substations, Converter Station or Transmission Lines.

7.4 ASSESSMENT OF CUMULATIVE EFFECTS

The following sections present results of the CEA by environmental component for VECs that are adversely impacted by the Project:

- Biophysical Environment, organized separately by aquatic and terrestrial components; and
- Socio-economic Environment: organized separately by: infrastructure and services; personal, family and community life; and heritage resources.

All VECs examined in Chapter 6 were re-examined to determine if they should be included in the CEA for past and current projects and activities *(i.e.,* summary of assessment provided in Chapter 6) or for future projects and activities. The criteria for selection of the CEA VECs are as follows:

- There is an adverse effect on the VEC from the Project after mitigation, when considered in Chapter 6 in the context of past and present projects and activities (including those projects and activities identified in Table 7-1); and
- The adverse effect of the Project overlaps in space and time with the effects of one or more of the past and current projects and activities in Table 7-1 or the future projects or activities in Table 7-2.

Table 7-3 and Table 7-4 present the application of these criteria to biophysical and socio-economic VECs respectively. These tables identify:

- VECs adversely affected by the Project, and
- The other projects and activities (if any) which have effects on a VEC that overlap with adverse effects of the Project.

For each VEC, these tables distinguish overlaps with other past/current projects and activities (which were assessed in Chapter 6) from overlaps with other future projects and activities that are assessed in this Chapter 7.

7.5 BIOPHYSICAL ENVIRONMENT

Table 7-3 identifies the biophysical VECs included in the CEA *i.e.*, those VECs with an adverse effect from the Project (as assessed in Chapter 6) that overlaps spatially and temporally with effects from past/current projects or activities identified in Table 7-1, and/or with effects from future projects and activities identified in Table 7-2.

Table 7-3: Application of Cumulative Effects Assessment Criteria to Biophysical VECs

VECs Adversely Affected by the Project	Notes regarding Keeyask Effects	Overlap with Past/Current Projects or Activities	Overlap with Future Projects	Included (✓) in CEA for Future Projects or Activities
AQUATIC ENVIRONMENT				
Water Quality	Construction and operation phases	CRD, LWR,, hydroelectric stations developed on the Nelson and Burntwood rivers	Potential Conawapa GS	✓
Walleye	Construction phase	CRD, LWR, Kelsey GS (including re-runnering), Wuskwatim GS, Kettle GS, commercial fishery	No	
Northern Pike	Initial years of operation phase	CRD, LWR, Kelsey GS (including re-runnering), Wuskwatim GS, Kettle GS, commercial fishery	No	
Lake Whitefish	Construction phase	CRD, LWR, Kelsey GS (including re-runnering), Wuskwatim GS, Kettle GS, commercial fishery	No	
Lake Sturgeon	Construction phase	CRD, LWR, Kelsey GS (including re-runnering), Wuskwatim GS, Kettle GS, commercial fishery	No	
TERRESTRIAL ENVIRONMENT				
Habitat				
Ecosystem Diversity	Construction and operation phases	CRD, LWR, PR 280 upgrades, Keeyask Infrastructure project, Lower Nelson River generation projects, past transmission lines, mining activities, community development	Keeyask Transmission, Bipole III Transmission, Gillam Redevelopment	✓

Table 7-3: Application of Cumulative Effects Assessment Criteria to Biophysical VECs

VECs Adversely Affected by the Project	Notes regarding Keeyask Effects	Overlap with Past/Current Projects or Activities	Overlap with Future Projects	Included (✓) in CEA for Future Projects or Activities
Wetland Function	Construction and operation phases	CRD, LWR, PR 280 upgrades, Keeyask Infrastructure project, Lower Nelson River generation projects, past transmission lines, mining activities, community development	Keeyask Transmission, Bipole III Transmission, Gillam Redevelopment	✓
Intactness	Construction and operation phases	CRD, LWR, PR 280 upgrades, Keeyask Infrastructure project, Lower Nelson River generation projects, past transmission lines, mining activities, community development	Keeyask Transmission, Bipole III Transmission, Gillam Redevelopment	✓
Priority Plants	Construction and operation phases	CRD, LWR, PR 280 upgrades, Keeyask Infrastructure project, Lower Nelson River generation projects, past transmission lines, mining activities, community development	Keeyask Transmission, Bipole III Transmission, potential Conawapa Generation, Gillam Redevelopment	✓
Birds and Waterfowl				
Canada Goose	Construction and operation phases	CRD, LWR, Keeyask Infrastructure project, Lower Nelson River generation projects, past transmission lines	Keeyask Transmission and Bipole III Transmission projects, and potential Conawapa Generation Project	✓
Mallard	Construction and operation phases	CRD, LWR, Keeyask Infrastructure project, Lower Nelson River generation projects	Keeyask Transmission and Bipole III Transmission projects, and potential Conawapa Generation Project	✓

Table 7-3: Application of Cumulative Effects Assessment Criteria to Biophysical VECs

VECs Adversely Affected by the Project	Notes regarding Keeyask Effects	Overlap with Past/Current Projects or Activities	Overlap with Future Projects	Included (✓) in CEA for Future Projects or Activities
Bald Eagle	Construction phase (small, short-term noise related effects	CRD, LWR, Lower Nelson River generation projects, past transmission lines, Keeyask Infrastructure Project	Keeyask Transmission and Bipole III Transmission projects, and potential Conawapa Generation Project	No
Olive-sided Flycatcher	Construction and operation phases	LWR, PR 280 upgrades, Keeyask Infrastructure project, Lower Nelson River generation projects, past transmission lines, mining activities, community development	Keeyask Transmission and Bipole III Transmission projects	✓
Rusty Blackbird	Construction and operation phase	CRD, LWR, PR 280 upgrades, Keeyask Infrastructure project, Lower Nelson River generation projects, past transmission lines, mining activities, community development	Keeyask Transmission and Bipole III Transmission projects	✓
Common Nighthawk	Construction and operation phases	LWR, PR 280 upgrades, Keeyask Infrastructure project, Lower Nelson River generation projects, past transmission lines, mining activities, community development	Keeyask Transmission and Bipole III Transmission projects	✓
Mammals				
Caribou	Construction and operation phases	CRD, LWR, Kettle GS, Kelsey GS, Long Spruce GS, Limestone GS, KIP, transmission lines and highways, including upgrades to PR 280	Keeyask Transmission Project; Bipole III Transmission Project, potential Conawapa Generation Project, and Gillam redevelopment	✓

Table 7-3: Application of Cumulative Effects Assessment Criteria to Biophysical VECs

VECs Adversely Affected by the Project	Notes regarding Keeyask Effects	Overlap with Past/Current Projects or Activities	Overlap with Future Projects	Included (✓) in CEA for Future Projects or Activities
Moose	Construction and operation phases	CRD, LWR, Kettle GS, Kelsey GS, Long Spruce GS, Limestone GS, KIP, transmission lines and highways, including upgrades to PR 280	Keeyask Transmission Project; Bipole III Transmission Project, potential Conawapa Generation Project, and Gillam redevelopment	✓
Beaver	Construction and operation phases	CRD, LWR, Kettle GS, Long Spruce, GS Limestone GS, KIP, transmission lines and highways	Keeyask Transmission Project; Bipole III Transmission Project, and Gillam redevelopment	✓

7.5.1 AQUATIC ENVIRONMENT

The aquatic environment addresses environmental effects of the Project on the following VECs: water quality; walleye, northern pike, lake whitefish, and lake sturgeon.

7.5.1.1 EFFECTS OF PAST AND CURRENT PROJECTS AND ACTIVITIES

The aquatic environment in the lower Nelson River, including the area to be affected by the Project, has been substantially altered by past hydroelectric developments and continues to experience those effects today.

As discussed in Section 6.2 and in greater detail in the AE SV and the KCNs' Environmental Evaluation Reports, changes to the aquatic environment began with the first hydroelectric station, completed in 1961 at the Kelsey Rapids on the Nelson River upstream of Split Lake. The CRD and LWR, completed in the mid 1970s, altered the aquatic environment of the entire Nelson River. The reach of the river between Gull Rapids and Kettle Rapids was converted to a reservoir environment by construction of the Kettle GS, which was completed in 1974.

The most recent additions and alterations to existing hydroelectric developments are the construction of the Wuskwatim GS on the Burntwood River and re-runnering at the Kelsey GS on the Nelson River, both of which are directly upstream of Split Lake. The Cree world view that all parts of the environment are connected indicates that these would overlap with the effects of the Keeyask Project. The technical assessment of the spatial extent of effects of the Keeyask Project (Section 6.4) indicates that there is no overlap with these recent developments.

The Keeyask Infrastructure Project, which is being constructed adjacent to the Keeyask Generation Project, has minimal potential to affect surface waters, as the only watercourse crossings are a small unnamed stream and Looking Back Creek. Effects to Looking Back Creek are being avoided through the use of a clear span bridge. Other measures to manage sediment inputs from surface runoff and prevent the input of contaminants to surface waters are being employed during construction to avoid effects to water quality and aquatic biota (Keeyask Hydropower Limited Partnership 2009).

The following effects of past and current projects and activities, as they relate to each aquatic VEC affected by the Keeyask Project are summarized in Section 6.2.3.3 and discussed in detail in the AE SV (Sections 2.4 (water quality), 5.3 (walleye, northern pike, and lake whitefish) and 6.3 (lake sturgeon). The KCNs' Environmental Evaluation Reports provide information on the effects of past and current developments on the environment as a whole, including these VECs.

7.5.1.1.1 WATER QUALITY

The KCNs have noted a decline in water quality over decades and attributed this at least in part to CRD, LWR and the construction of individual generating stations. Increases in debris and sediment including silt and peat were noted on Split Lake, Clark Lake, Gull Lake and the Nelson River and water was stated to be more murky, dirty, muddy, and undrinkable throughout the system, including the Stephens Lake area before and more intensely after the Kettle GS was completed (Split Lake Cree Nation -Manitoba Hydro Joint Study Group 1996c). FLCN Members state that the decline in water quality in the Nelson River is an important cumulative impact that first began with the Kelsey GS (FLCN Environment Evaluation Report - *Draft*). At York Landing, residents have observed that water quality is getting worse each year with the dams (YFFN Evaluation Report (*Kipekiskwaywinan*)).

Technical information is very limited regarding Nelson River water quality pre-hydro development. Numerous technical analyses of changes to water quality as a result of CRD/LWR have been conducted and the results vary among studies, depending on the time periods analyzed; however, by the 1990s conditions in Split Lake appeared to have stabilized (AE SV Section 2.4). Water quality in Stephens Lake was affected in the initial years following construction of the Kettle GS, with increased concentrations of nutrients and total suspended solids, and periodic dissolved oxygen depletion but improved over time. At the present time, water quality within the river and lake sections of the lower Nelson River is moderately nutrient-rich, well-oxygenated, moderately soft to hard, and has a slightly alkaline pH. The majority of water quality parameters meet the Manitoba Water Quality Standards, Objectives and Guidelines (Section 6.2.3.3.2, see AE SV Section 2.4 for more information).

7.5.1.1.2 FISH

Though few specific observations are available with respect to fish distribution and abundance prior to completion of the Kelsey GS in 1961, KCNs Members state that fish were generally abundant throughout the lower Nelson River. In the post-Kelsey period, fish distributions are reported to have shifted in Split Lake (Split Lake Cree - Manitoba Hydro Joint Study Group 1996c). KCNs members have made observations with respect to declining lake whitefish, goldeye, mooneye and walleye in Split Lake and increases in sucker populations (Split Lake Cree - Manitoba Hydro Joint Study Group 1996c). Community Members have stated that following hydroelectric development, fish from the Nelson River, Split Lake and Stephens Lake are of poor quality and are described as being soggy, sour, discoloured, and generally unpalatable (CNP Keeyask Environmental Evaluation Report, FLCN 2010 Draft, YFFN Evaluation Report (*Kipekiskwaywinan*)).

Walleye, northern pike and lake whitefish

Technical studies conducted for this EIS found that walleye, northern pike, and lake whitefish in Split Lake, Gull Lake and Stephens Lake were abundant, with densities comparable to many off-system lakes. It is expected that the total number of these species in

Stephens Lake would have increased following construction of the Kettle GS, due to the greater amount of suitable habitat. Although no comparison to past conditions was provided, FLCN Members reported that walleye are abundant in Stephens Lake, Looking Back Creek and in Ferris Bay (FLCN 2010 Draft). As noted in AE SV (Section 5.3), methodological differences preclude the analysis of historic data to establish a clear trend of the effects of CRD and LWR to the fish communities.

The past and on-going commercial fishery in Split and Stephens lakes would have some effect on the populations of these species, though the extent is not known. However, given that catches are regulated by Manitoba Conservation and Water Stewardship, it is expected that harvest is sustainable.

Lake sturgeon

As summarized in Section 6.3.2.2.5, commercial fishing of lake sturgeon on the Nelson River severely depleted populations both upstream and downstream of the Kelsey GS. Precise estimates of commercial harvest for the area directly affected by the Keeyask GS are not available as catches were recorded by river reach, but interviews with resource users indicate a substantial commercial harvest in Gull Lake in the late 1950s and that harvest continued in Stephens Lake following construction of the Kettle GS into the 1980s.

In addition to harvest, lake sturgeon in the Nelson River have been adversely affected by hydroelectric development. Both CRD and LWR were reported to have caused a decline in lake sturgeon numbers (Split Lake Cree – Manitoba Hydro Joint Study Group 1996c). FLCN members stated that critical habitats were lost with each dam and fish could no longer move as freely within their natural habitat, as they were able to prior to dam construction (FLCN 2009 Draft). Technical studies have found that numbers of sturgeon have declined at all locations on the Nelson River where the construction of generating stations has altered habitat for specific life history requirements such as spawning. However, healthy sturgeon populations have been documented in areas affected by hydroelectric development where habitat to support all life history stages continued to be available (see examples in Table 6-16).

Due to historic declines and concerns about a continuing decline in population numbers, COSEWIC designated lake sturgeon in the Nelson River as endangered, and this species is currently being considered for listing under the *Species at Risk Act* (SARA).

7.5.1.2 Summary of Cumulative Effects of the Project with Past and Current Projects and Activities

Predicted effects of the Keeyask GS project on the aquatic VECs in the context of past and current projects and activities are summarized in Section 6.4.3.1 (water quality), Section 6.4.6 (walleye, northern pike, lake whitefish and lake sturgeon). A detailed technical analysis is provided in the AE SV. The Cree worldview places equal importance on all components of

the environment, as all parts are important and inter-related. A discussion of effects to the aquatic environment identified as particular concerns to the KCNs is provided in Section 6.4.2 and greater detail is provided in the KCNs' Environmental Evaluation Reports.

7.5.1.2.1 WATER QUALITY

Construction of the Project will alter water quality in the immediate receiving environment of construction-related inputs (*e.g.,* nutrient concentrations will be elevated from input of treated sewage effluent), as well as causing more widespread increases in TSS during instream construction. The largest increases will occur in Stephens Lake immediately downstream of the construction site. During two years of instream Project construction, elevated TSS levels will extend through Stephens Lake and downstream for 1-3 months each year. The predicted increase in suspended sediment at the Kettle GS is less than 5 mg/L (typically less than 3mg/L), but may be somewhat higher for a few days when the river is closed off (Section 6.3.8.1). In most instances, the TSS increases will be within the Manitoba guidelines (*i.e.,* <5 mg/L). Elevated TSS levels are expected to extend downstream of the Kettle GS to the estuary, though increases are unlikely to have a measureable effect on the biota, given the short duration of larger inputs during river closure.

In the initial years of Project operation, water quality in nearshore areas of the reservoir, in particular in sheltered backbays, will be characterized by elevated levels of TSS, nutrients, metals and other parameters, and periodic dissolved oxygen depletion (in particular in winter under ice). Effects will diminish over ten to fifteen years. Total suspended solids concentrations will be lower in the mainstem of the reservoir and the south western portion of Stephens Lake than at present, and this effect will persist for the lifetime of the Project.

Members of the KCNs at workshops to discuss Project effects and mitigation have stated that effects to water quality are expected to occur upstream of the Keeyask reservoir in Split Lake and water quality is expected to be poor in all areas affected by the Keeyask GS.

7.5.1.2.2 FISH

Overall, it is expected that there will be negligible effects to fish from specific Project construction activities, due to the use of management measures such as restrictions on the timing of instream construction to avoid sensitive periods, control of adverse effects to water quality, conduct of fish salvage during dewatering, and adherence to guidelines for blasting and water withdrawal. There is the potential for increased harvest due to the presence of a workforce, but the implementation of the Access Management Plan during the construction phase is expected to limit the increase in harvest.

Effects related to habitat loss and alteration begin during construction and continue during operation and are discussed below.

WALLEYE, NORTHERN PIKE AND LAKE WHITEFISH

The key adverse effect on walleye and lake whitefish is the loss of spawning habitat at Gull Rapids. This habitat will not be available during all times of the construction phase, but will be replaced by constructed habitat during the operation phase. While spawning habitat for walleye and lake whitefish is available elsewhere in the Stephens Lake Area, along reefs in Stephens Lake and upstream in its tributaries and in Ferris Bay, there may be a reduction in year class strengths in Stephens Lake due to a reduction in the total amount of available spawning habitat during construction. During operation, populations of walleye and lake whitefish are expected to remain the same (Stephens Lake) or increase (Keeyask reservoir) due to the increase in the amount of foraging habitat.

No effects to northern pike due to habitat alteration during construction are expected. The key Project effects on northern pike include a short term loss of some habitat types in the reservoir during the first ten to fifteen years of operation. Optimal spawning and foraging habitat for northern pike occurs in the Nelson River along shorelines with aquatic plant growth. Foraging and spawning habitat will continue to be available in the reach of the Nelson River and its tributaries upstream of the flooded area in Gull Lake. Over the long term, there will be an increase in feeding and spawning habitat as conditions evolve in newly flooded areas of the reservoir.

As with water quality, Members of the KCNs at workshops to discuss Project effects and mitigation have stated that they expect a decline in the numbers and health of most fish species as a result of the Keeyask Project and that adverse effects will extend to Split Lake.

LAKE STURGEON

Given the current vulnerable state of lake sturgeon and adverse effects of past hydroelectric developments, considerable effort was expended in developing plans to mitigate effects to lake sturgeon habitat and support the existing population in the area that will be directly affected by the Project. In addition, measures will be implemented to increase the regional population.

During Project construction, the loss of Gull Rapids as spawning habitat will affect the lake sturgeon population in Stephens Lake. To avoid missing year classes, sturgeon will be stocked during this time. Beginning during construction and during initial impoundment to full supply level, sturgeon in Gull Lake may respond to the change in depth and velocity by moving either upstream of Gull Lake or downstream past the generating station. Although the loss of adults from the reservoir cannot be fully mitigated, stocking will be used to maintain the population in the reservoir, if emigration occurs. In addition, the trap/catch and transport program in Stephens Lake during the operation phase may identify some downstream migrants from Gull Lake that will be transported back upstream.

During Project operation, sturgeon in the Keeyask reservoir will be affected by habitat alterations that may reduce the amount of suitable spawning and young-of-the-year habitat.

These effects will be addressed through the construction of suitable replacement habitat, if monitoring indicates that available habitat is not suitable.

In Stephens Lake, the spawning habitat lost in Gull Rapids will be replaced by constructed habitat below the tailrace of the generating station.

Overall, no adverse residual effects on lake sturgeon populations due to Project operation are expected due to mitigation measures to provide habitat for all life history stages and the implementation of a stocking program in the Keeyask reservoir and Stephens Lake. In addition, the Partnership will implement a stocking program targeting areas where sufficient habitat exists to support larger populations than currently exist in the reach of the Nelson River between the Kelsey and Kettle GSs. This program is expected to result in an overall increase in the number of sturgeon in the region.

Apart from the programs implemented for the Project, there are also several initiatives that would affect the abundance of sturgeon in this area. Manitoba Hydro, TCN, WLFN, YFFN, FLCN, SFN, and the KHLP have negotiated a Lower Nelson River Sturgeon Stewardship Agreement, which has the goal to conserve and enhance the present population of lake sturgeon in the lower Nelson River from Kelsey GS to Hudson Bay. Aspects of this initiative should begin to be implemented in 2012. While the potential listing of sturgeon under SARA would be expected to increase lake sturgeon numbers, the implementation of the Lake Sturgeon Stewardship Agreement would provide a more effective initiative for sturgeon recovery. The agreement focuses on enhancing the overall population while considering existing and future uses for the river. In contrast, reducing the mortality of individuals within an overall population has become the focus of species listed under SARA in other jurisdictions.

7.5.1.3 CUMULATIVE EFFECTS OF THE PROJECT INCLUDING FUTURE PROJECTS AND ACTIVITIES

The future projects and activities considered in the Project cumulative effects assessment are listed in Table 7-2. With the exception of the potential Conawapa GS, these are land-based developments with limited potential to affect the aquatic environment, in particular if appropriate management measures are employed during construction and operation. Potential cumulative effects of the Project including future projects and activities are discussed below.

Overall, as described below, review of other projects that could overlap with the effects of the Keeyask Project does not indicate any with the potential to result in cumulative adverse effects that require further mitigation for the Keeyask Project or would alter the conclusion with respect to the regulatory significance of adverse effects of the Project to Aquatic VECs presented in Section 6.4.

7.5.1.3.1 WATER QUALITY

Future developments that will occur concurrent with the construction of the Keeyask GS are listed in Table 7-2. Primarily land-based developments, including the Keewatinoow Converter Station and associated facilities (e.g., construction camp), Bipole III, Keeyask Construction Power Station and Transmission Lines, Keeyask Switching Station and GOT Lines, and Gillam Redevelopment are not expected to affect water quality at Gull Rapids and in Stephens Lake because appropriate management measures will be applied to avoid releases of contaminants or inputs of other substances into streams that would eventually reach the Keeyask Project area.

In two years of Project instream construction, elevated TSS levels are expected to extend downstream past the Kettle GS and to the section of the river where the Conawapa GS is being constructed. During open water periods lasting 1-3 months (depending on year), the predicted increase in suspended sediment at the Kettle GS is less than 5 mg/L (typically less than 3mg/L), but may be somewhat higher for a few days when the river is closed off. Increases of similar or slightly less magnitude are expected to extend to the Conawapa site. It is expected that the cumulative effect of TSS inputs of the concurrent construction of the Keeyask and Conawapa projects will have no measureable adverse effects to aquatic biota at Conawapa and further downstream because inputs from both projects will be managed to maintain the overall increase within levels that would not have harmful effects. Construction personnel responsible for real-time monitoring of sediment increases from construction set out in the Sediment Management Plans for both Projects will communicate to achieve this objective.

As discussed in Section 6.4.3.1, the technical analysis of Project operation effects indicates short to medium term changes in the near shore environment of the reservoir and a long-term reduction in TSS levels in the mainstem of the reservoir and the south west section of Stephens Lake. None of the developments listed in Table 7-2 are expected to affect water quality in these areas as they are either downstream from the site (*i.e.,* the potential Conawapa GS), or management measures are expected to prevent effects to water quality (*i.e.,* transmission developments, Gillam Redevelopment).

7.5.1.3.2 FISH

As discussed for water quality, there is limited potential for the overlap of effects of the Project with future developments listed in Table 7-2.

Based on the technical analysis no adverse effects to fish populations are expected from the Project outside of the Keeyask reservoir and Stephens Lake. For lake whitefish, walleye and lake sturgeon, potential negative effects are restricted to the Project construction period, and are not expected to have a long-term effect on the population. Adverse effects to northern pike will occur during the first period of Project operation, but be of small magnitude and be restricted to the reservoir. Therefore, the technical analysis indicates that there are no

adverse effects of the Project on fish populations that have the potential to overlap with those of other future developments.

Members of the KCNs at workshops to discuss Project effects and mitigation have stated that they expect a larger spatial and temporal extent of effects than indicated in the technical analysis summarized above, and also identified considerable uncertainty with the effectiveness of planned mitigation measures. However, even when considering a broader region (*e.g.*, Kelsey GS to the Nelson River estuary), the only other major instream project that would overlap with the effects of the Keeyask Project is the construction and operation of the potential Conawapa GS. It is expected that development of the potential Conawapa GS would be conducted to avoid significant adverse effects to fish populations. FLCN has stated that the number of fish harvested in the Conawapa area may increase. The mitigation plan for the potential Conawapa GS project will need to ensure that harvest is appropriately monitored and controlled.

7.5.2 TERRESTRIAL ENVIRONMENT

The terrestrial environment addresses environmental effects of the Project on the following VECs: ecosystem diversity, wetland function and intactness for ecosystems; priority plants for plants; Canada goose, mallard, bald eagle, olive-sided flycatcher, common nighthawk and rusty blackbird for birds; and caribou, moose and beaver for mammals. As reviewed in Table 7-3, the Project is expected to have adverse environmental effects on all of these VECs, and future projects are also expected to have effects that overlap with all of these VECs.

7.5.2.1 EFFECTS OF PAST AND CURRENT PROJECTS AND ACTIVITIES

The terrestrial environment in the area to be affected by the Project has been substantially altered by past hydroelectric developments, linear developments (including transmission lines, highways and rail lines), forestry and mining exploration, and other agents of change, and continues to experience those effects today.

The following effects of past and current projects and activities, which relate to the Regional Study Area for each terrestrial VEC, are reviewed in Chapter 6.

7.5.2.1.1 HABITAT, ECOSYSTEMS AND PLANTS

- **Ecosystem diversity:** The physical footprints of past and existing projects have removed approximately 5% of historical terrestrial habitat, which has reduced the total area of most, if not all, priority habitat types. Area losses have been relatively high for those types occurring on mineral sites, as these are the typical locations for roads, settlements and other infrastructure. Priority habitat types that tend to occur along the

Nelson River were also disproportionately affected by hydroelectric development, which flooded some reaches of the Nelson River and altered water regimes along its remaining length.

- **Wetland function:** Hydroelectric and public infrastructure development has reduced total wetland area as well as the amounts of moderate and high quality wetlands. Wetland composition was also altered by roads and other infrastructure that changed hydrology. All of the natural Nelson River shoreline wetlands have either been lost to flooding or altered by modified water and ice regimes. Off-system wetlands near the Nelson River were also affected by flooding and hydrological changes related to Nelson River water regulation.
- **Intactness:**[1] Past and existing linear features (*e.g.,* roads, railways, transmission lines) and other permanent infrastructure have reduced the intactness of the regional terrestrial ecosystem. Linear features have had a range of effects such as wildlife disturbance and increased wildlife mortality through improved access for people and predators. Improved access for people has also had a number of other effects such as more human-initiated fires and the spreading of invasive plants. Permanent human features have removed portions of core areas (*i.e.,* a large undisturbed area) and subdivided other core areas into smaller blocks. It is estimated that total core area in the Intactness Regional Study Area has been reduced to approximately 83% of land area.
- **Priority plants:** Past and existing human features have removed individual plants and their habitat and altered plant populations. Based on historical habitat effects, it is likely that plant species associated with mineral sites, the Nelson River shore zone and Nelson River shoreline wetland plants were more affected than species located in other areas.

7.5.2.1.2 BIRDS AND WATERFOWL

- **Mallard:** Effects on mallard of past and current projects include habitat loss or alteration and increased mortality from resource harvesting. Past and existing projects have contributed to increased water levels along the Nelson River, which has led to reduced availability of suitable mallard breeding and staging habitat in the back bays, inlets and creek mouths of the Nelson River. YFFN has indicated there are fewer geese and ducks in the Split Lake area because the shoreline habitat that they use has been flooded and eroded (YFFN Evaluation Report (*Kipekiskwaywinan*)). While mallard breeding and staging habitat is limited along the Nelson River, suitable habitat (e.g., creeks, creek mouths, inland lakes with marsh habitat) is widespread and abundant throughout inland areas of the Bird Regional Study Area.
- **Canada goose:** Effects on Canada goose of past and current projects include habitat loss or alteration and increased mortality from resource harvesting. As for mallard, past

[1] Intactness is the degree to which an ecosystem remains unaltered by human development and activities that remove habitat and increase fragmentation.

and existing hydroelectric projects have contributed to increased water levels along the Nelson River, which has led to reduced availability of suitable Canada goose staging habitat in the back bays, inlets and creek mouths of the Nelson River. The availability and quality of potential Canada goose staging habitat is highly variable along the Nelson River. In some years, low water levels have resulted in increased abundance of Canada geese in shallow back bays, inlets and creek mouths where suitable forage is available. In high water years, the quality of these areas, along with goose abundance, is reduced due to lack of exposed shoreline and preferred forage sources.

- **Olive-sided flycatcher:** The primary effect on olive-sided flycatcher from past and current projects has been habitat loss or alteration. The clearing of roads (*e.g.*, PR 280 and north access road) and transmission line right-of-ways (*e.g.,* KN 36), as well as cut lines, has reduced the availability of olive-sided flycatcher breeding habitat in the Bird Regional Study area. Past and existing hydroelectric projects have caused short-term increases in the availability of suitable foraging habitat by flooding treed areas. For a brief period, these dead standing trees provide important perch sites for olive-sided flycatchers foraging on flying insects. Suitable olive-sided flycatcher breeding habitat (*e.g.,* forest edge adjacent to bogs, beaver floods and burns) is widespread throughout the Bird Regional Study Area.

- **Common nighthawk:** The primary effect on common nighthawk from past and current projects has been long-term habitat loss or alteration. Forest clearing for the development of transmission right-of-ways, borrow pits, cut lines and trails has created new common nighthawk nesting habitat and enhanced that which already existed (*e.g.,* open, bare ground) within the Bird Regional Study Area. Long-term losses in common nighthawk nesting habitat have resulted from the development of permanent infrastructure including roads (*e.g.*, PR 280) and buildings. While these developments have resulted in the loss of some breeding habitat, they have contributed to increases in foraging opportunities through the creation of forest openings. Common nighthawk habitat is widespread throughout the region and not considered limited within the Bird Regional Study Area.

- **Rusty blackbird:** The primary effect on rusty blackbird from past and current projects has been habitat loss or alteration. Past and existing hydroelectric projects have contributed to habitat loss for this species (due to flooding of riparian habitats including treed areas on wet peatland). Land clearing associated with road and transmission line development has also contributed to the loss of some rusty blackbird breeding habitat, although to a lesser extent. Suitable alternate rusty blackbird breeding habitat is widespread throughout the Bird Regional Study Area.

7.5.2.1.3 MAMMALS

- **Caribou:** Effects of past and present projects on migratory caribou local movements and abundance in the Caribou Regional Study Area (Zone 6 in Map 6-28) include habitat loss, habitat alteration, and mortality risks associated with access, predation and resource harvest. Large and long-term population variability most likely resulted from natural shifts in range use and migration patterns that prevent over-utilization of food by caribou, habitat loss from large fires, changing snow fall and melt patterns, the timing and location of plant growth on the calving grounds, and long-term population cycles associated with food and predation. Habitat loss and access effects from past and present developments (*e.g.*, flooding of Stephens Lake, linear developments) can further depress populations that are periodically in decline from increased predation, and potentially from harvest over the entire migratory caribou range. KCNs Members have expressed concerns about the disappearance of large caribou herds in the region since the 1950s, and the limited return of caribou beginning in about the early 1990s and continuing today. Recent declines in migratory caribou and population sustainability are of further scientific attention and KCNs concern.

  Today, caribou populations occasionally mix in the Regional Study Area. Some KCNs distinguish a small group of woodland caribou from migratory barren-ground and coastal caribou herds in the Caribou Regional Study Area. Summer residents in the Stephens Lake area remain in the Regional Study area to calve, and are conservatively estimated to number 20 to 50 individuals. The long-term population trend of these animals is unclear given the recent return of caribou to this area, but these animals may have declined historically, as fewer caribou are now seen today. Similar to the technical scientific issues, the KCNs are concerned about past and present habitat loss, fragmentation, predation, harvest, changes in movement patterns, and accidental mortality of summer resident caribou attributed to development. Although past projects reduced winter habitat, and likely affected traditional movement corridors in the Local Study Area, primary calving habitat increased, *i.e.*, islands in lakes greater than 10 hectares (ha) in size or peatland complexes greater than 200 ha. Suitable calving habitat is not limited within the Regional Study Area, but it appears to be underutilized except for Stephens Lake which has become a highly productive calving and summering area for the small number of summer resident caribou. Range behaviour indicates that some summer resident caribou are coastal caribou.

  With the exception of recognized population ranges near Thompson, Manitoba, SARA-listed boreal woodland caribou have not been identified by the Provincial or Federal Governments in the Regional Study Area.

- **Moose:** Effects of past and present projects on moose include habitat loss and alteration and increased mortality from resource harvesting and predator access along linear features. Historically, moose occurred between Split Lake and Stephens Lake.

Following hydroelectric development, their presence on the shores of Split and Stephens lakes was diminished as a result of shoreline habitat loss and fluctuating water levels, and although animals are still hunted here, local resource users tend to go further afield to harvest animals. Today, moose appear to be common, widely distributed and clustered in the Moose Regional Study Area, particularly in burned areas, and the population appears to be increasing. Islands and shorelines continue to be important for calving and rearing, including those in Gull Lake and Stephens Lake. The KCNs are concerned about the sustainability of moose populations, and CNP is preparing a moose harvest sustainability plan to address this issue.

- **Beaver:** Effects of past and present projects on beaver include the loss and alteration of wetland habitat on the Nelson River system and increased mortality from resource harvesting and predator access along linear features. Historically, beaver were present on the Nelson River. Following hydroelectric development, their presence was diminished considerably as a result of habitat loss from flooding and fluctuating water levels, which continue to affect beaver today. The magnitude of decline in the beaver population is scientifically uncertain because large comparison rivers that are unaffected by hydroelectric development (*i.e.*, God's and Hayes rivers) tend to have fewer beaver; however, beaver are abundant in wetland habitat connected to these rivers. Today, beaver are still common and widely distributed in the Beaver Regional Study Area wherever there is suitable riparian habitat. The KCNs are concerned about beaver populations and the loss and alteration of wetland habitat on the Nelson River system.

7.5.2.2 Summary of Cumulative Effects of the Project with Past and Current Projects/Activities

The construction and operation of the Project was planned to minimize the effects to the terrestrial environment to the extent practicable.

The following effects of the Project, in combination with the effects of past and current projects and activities, are reviewed in Chapter 6 where relevant for terrestrial VECs.

7.5.2.2.1 Habitat, Ecosystems and Plants

- **Ecosystem diversity:** The Project would reduce the area of most priority habitat types, primarily through clearing, flooding, edge effects and reservoir-related groundwater changes. Due to a Project design process that carefully considered environmental effects (see Section 4.2.3 and the mitigation described in Section 6.5), it is predicted that Project effects on ecosystem diversity will be limited to relatively small area losses for most of the priority habitat types. Cumulative area losses for all priority habitat types are expected to remain in the small to moderate magnitude range.

- **Wetland function:** The Project would reduce total wetland area and alter wetland composition, primarily through clearing, flooding, edge effects and reservoir-related groundwater changes. Overall, the likely residual Project effects on wetland function are adverse but regionally insignificant because it is predicted that there is no net loss of high quality wetland area and the cumulative area losses for all of the low and moderate quality off-system wetland types remains well below 10% after mitigation.
- **Intactness:** The main Project effects on intactness are predicted to include a slight reduction in total linear feature density (positive effect) due to existing cutlines being replaced by Project features, and slight reductions (adverse effects) in total core area, average core area size and the size of the largest core areas. Overall, the likely residual Project effects on regional intactness are expected to be adverse but small because the Project Footprint is located in an area where intactness is already low due to past human activities.
- **Priority plants:** The Project would remove and alter individual plants, plant populations and their habitats. The Project is not expected to have significant adverse effects on priority plants. Species of high conservation concern are not expected to occur in the Plant Local Study Area. Effects on the species of particular interest to the KCNs are expected to be low because most of these species are widespread in appropriate habitats and the percentages of the known locations and available habitat affected by the Project are predicted to be low. For the remaining priority plant species, the Project would affect small proportions of their known locations and their habitats. In addition, the risk that invasive plants will crowd out priority species is minimized by precautionary and eradication measures included in the Environmental Protection Plans.

7.5.2.2.2 BIRDS AND WATERFOWL

- **Mallard:** The key residual Project effects on mallard in combination with past and current projects include the loss of some breeding habitat, decreased quality of staging habitats and increased mortality risk resulting from increased access (Section 6.5.7). Current breeding habitat for mallards is marginal along the Nelson River; optimal habitat occurs in inland areas (*e.g.,* lakes and creeks) where ponds, wetlands, shallow and creeks supporting emergent aquatic vegetation are available. Although these habitats are widespread throughout the Bird Regional Study Area, applied mitigation measures (*e.g.,* installation of artificial nest structures) will enhance these areas for breeding. Wetland enhancement measures will also benefit mallards by off-setting some of the losses in the quality of local staging habitats (*e.g.,* Gull Lake). The implementation of the Access Management Plan during the construction phase is expected to limit increases in hunter harvest due to increased access elsewhere. In order to reduce access to the Nelson River and inland lakes during operations, trails no longer required for construction or operation activities will be decommissioned.

- **Canada goose:** The key potential residual Project effects on Canada goose in combination with past and current projects are similar to those described for mallard (see above) with the exception that Canada goose breeding habitat will not be affected by the Project.

- **Olive-sided flycatcher:** The key residual Project effects on olive-sided flycatcher in combination with past and current projects are associated with the long-term loss of some breeding habitat. While mitigation measures involving the retention of trees in select areas of the reservoir back-bays may offset some of the losses in olive-sided flycatcher habitat, beaver activity and fire remain the main drivers of olive-sided flycatcher habitat creation in this area. Construction noise is expected to disturb some olive-sided flycatchers for the short-term; however, displacement of birds from their breeding territories is not expected due to their large home ranges.

- **Common nighthawk:** The key residual Project effects on common nighthawk in combination with past and current projects are associated with the long-term loss of some nesting habitat resulting from reservoir and infrastructure development. Retention of non-rehabilitated areas in decommissioned borrow sites will off-set some of the losses in nesting habitat resulting from the Project. Creation of forest openings at infrastructure sites may provide common nighthawk with foraging habitat, especially at infrastructure sites that use outdoor lighting (insect attractant). Foraging habitat (*e.g.*, forest openings including wetlands, lakes, burns) is widespread throughout the Bird Regional Study Area.

- **Rusty blackbird:** The key residual Project effects on rusty blackbird in combination with past and current projects are associated with the long-term loss of some nesting habitat resulting from reservoir and infrastructure development (*e.g.*, dykes or south access road). Construction noise may cause some blackbirds to avoid areas immediately adjacent to infrastructure sites, but only for the short-term.

7.5.2.2.3 MAMMALS

- **Caribou:** The main residual effects of the Project on caribou in combination with past and current projects are localized altered movements due to reduced intactness and sensory disturbance, distributional changes, and decreased populations due to decreased habitat and increased mortality. Most effects of the Project will be negligible to small, particularly since habitat currently appears to be underutilized, and affect two or more generations (*i.e.*, be long-term as defined in Chapter 5).

  Large variability in migratory caribou populations' ranges and migration routes will continue with the Project in response to natural shifts in range use and migration patterns that prevent an over-utilization of food, habitat effects from large fires, snow fall and melt patterns, the timing and location of plant growth on the calving grounds, and long-term population cycles associated with food and predation. These changes will

be exacerbated to a small degree by the Project in combination with past and present human developments. Past and current project effects have resulted in moderate regional habitat losses and alterations but most of these changes are limited to habitat near the Nelson River. In comparison, habitat effects over large migratory caribou ranges are negligible to small. Potentially, and with moderate scientific certainty, habitat effects, additive mortality from resource harvest and increased predator access, accidental mortality, and localized movement effects, which cumulatively affect the regional caribou populations, have occurred only to a small degree in the Regional Study Area.

Summer resident caribou abundance, distribution and movements are likely to be altered by the Project during construction and operation, primarily as a result of calving habitat loss and alteration from groundwater and peatland disintegration. Fragmentation effects are predicted for the south access road. With mitigation, and as measured by population and habitat benchmarks and the thresholds described (Section 6.5.8), Project effects on summer resident caribou are highly likely to remain negligible to small in the Regional Study Area.

The small loss of calving habitat that will occur in the Local Study Area will in part be offset by an increase in the number of smaller islands in the Keeyask reservoir. Small changes in habitat are expected compared to its widespread regional availability and use by caribou. Wolf numbers are not expected to change given that no changes in the moose population are expected as a result of the Project. Predator hunting efficacy is not predicted to change because linear feature density will not change.

A negligible change in cumulative effects measures, including intactness (as measured by core habitat availability and size), and fragmentation (as measured by linear feature density), is expected as a result of the Project. Finally, resource harvesting is not expected to change, and it is most likely manageable with Provincial harvest regulations and policy if it does increase unexpectedly for caribou. Therefore, only a small cumulative effect for the regional caribou populations is anticipated from the Project in combination with past and present projects.

Scientific uncertainty exists where human disturbance could exacerbate long-term natural changes in populations and habitat, and where these on-going effects might be affected by climate change, could reduce habitat availability and limit distribution and abundance in caribou ranges. The KCNs predict that with more development, caribou will likely disappear from the area and not return for a long time. Caribou activity in the Keeyask region will be monitored (see Chapter 8).

- **Moose:** The main residual effects of the Project on moose in combination with past and current projects are altered movements, distributional changes, and a decreased population. Moose abundance, distribution and movements are likely to be changed in the Local Study Area by the Project during construction and operation, primarily as a

result of habitat alterations along the Nelson River. With mitigation, and as measured by population and habitat benchmarks described (Section 6.5.8), it is highly likely that Project effects on moose will be negligible to small in the Regional Study Area. A small loss of calving habitat will occur in the Local Study Area, which in part would be offset by an increase in the number of smaller islands, and by at least one large island in the Keeyask reservoir. Small changes in habitat are expected compared to the regional availability. Gray wolf numbers are not expected to change given that no changes in the moose population are expected as a result of the Project. A negligible change in cumulative effects measures, including intactness and fragmentation, is expected as a result of the Project. Finally, although resource harvesting is not expected to increase with the offsetting program, opportunities and access have improved, and there could be an increase in licensed hunters in the region. These effects are manageable with the administration of a moose harvest sustainability plan for the Split Lake Resource Management Area and by Provincial harvest regulations. Therefore, only a small cumulative effect is anticipated for the regional moose population.

- **Beaver:** Beaver abundance is likely to decrease during construction and operation, primarily as a result of habitat loss and the removal of about 20 colonies near the Nelson River. Improved trapping access could reduce the population if local trapping efforts increase. Although habitat effects will be large primarily as a result of past projects in the Regional Study Area, beaver are resilient, have the ability to create habitat, and they reproduce and colonize rapidly. Overall, the beaver population is widely distributed and abundant throughout the Regional Study Area. Thus, Project effects on beaver will likely remain small and further changes in the Regional Study Area are highly unlikely to affect the sustainability of the beaver population. Trappers are stewards of their traplines, and are responsible for sustaining beaver populations on their Registered Traplines. Provincial furbearer management policies should be in place before the Project proceeds, and its application will further ensure that provincial harvest does not exceed sustainable levels, where trapping effort generally follows the price of fur.

7.5.2.3 CUMULATIVE EFFECTS OF THE PROJECT INCLUDING FUTURE PROJECTS / ACTIVITIES

Based on the regulatory assessment summarized in Table 7-3, adverse effects of the Keeyask Project are expected for all terrestrial VECs, and these adverse effects are also expected to overlap with the other future projects or activities listed in Table 7-2.

One or more of the reasonably foreseeable future projects listed in Table 7-2 would have spatial and temporal overlap with all of the terrestrial VECs. Details regarding these overlaps are discussed below.

Overall, as described below, review of other projects that could overlap with the effects of the Keeyask Project does not indicate any with the potential to result in cumulative adverse

effects that require further mitigation for the Keeyask Project or would alter the conclusion with respect to the regulatory significance of adverse effects of the Project to Terrestrial VECs presented in Section 6.5.

7.5.2.3.1 HABITAT, ECOSYSTEMS AND PLANTS

- **Ecosystem diversity:** Residual Project effects on ecosystem diversity are expected to overlap with effects from Gillam Redevelopment and all of the transmission projects. These future projects will increase the amounts of habitat loss and alteration for all priority habitat types. Based on the anticipated locations of these projects, cumulative area losses for all priority habitat types are predicted to remain in the small to moderate magnitude range.

- **Wetland function:** Residual Project effects on wetland function are expected to overlap with effects from Gillam Redevelopment and all of the transmission projects. Based on their anticipated locations, these future projects are not expected to affect any high quality wetland areas (*i.e.,* off-system marsh). Wetland mapping demonstrates that Gillam Redevelopment and the Keeyask Transmission Project would not overlap high quality wetlands. Although detailed wetland mapping was not available for the Bipole III route, even if it does overlap off-system marsh, effects are likely to be negligible given that clearing occurs in winter, clearing is minimized in riparian zones and buffers are typically maintained where transmission rights-of-way overlap riparian zones. For the moderate and low quality wetland types, the additional affected areas are expected to range from nil to relatively small so that cumulative area losses are likely to remain in the small to moderate magnitude range.

- **Intactness:** Residual Project effects on intactness are expected to overlap with effects from Gillam Redevelopment and all of the transmission projects. Based on the anticipated locations of these other projects, total linear feature density would increase but still remain in the lower half of the moderate magnitude effects range (*i.e.,* between 0.40 km/km^2 and 0.60 km/km^2) for the Intactness Regional Study Area and within the small magnitude range for the Regional Study Area outside of the Thompson area. Although total core area would decline by approximately 135 km^2, the percentage of the Regional Study Area in core area is expected to remain higher than 80% of land area, which is well within the range for low magnitude core area effects (*i.e.,* 66% to 100% of land area).

- **Priority plants:** Residual Project effects on priority plants are expected to overlap with effects from Gillam Redevelopment, all of the transmission projects and potential Conawapa Generation Project. All of these future projects, except for the potential Conawapa Generation Project, are expected to remove individual plants and their habitat and alter plant populations. Transportation and increased activity along Highway 280 for the potential Conawapa Generation Project could spread invasive plants. Based

on the low potential for species of high conservation concern to occur in the Plant Regional Study Area and the known locations of the remaining priority plant species and their habitats, cumulative losses for all priority plants are predicted to remain in the nil to moderate magnitude range, depending on the species.

7.5.2.3.2 BIRDS AND WATERFOWL

- **Mallard:** Residual Project effects on mallard are expected to overlap with the effects of reasonably foreseeable future projects in the Bird Regional Study Area. Construction-related cumulative effects of the Project on mallard include additional loss or alteration of some mallard upland nesting habitat in areas where future project infrastructure occurs near wetlands, creeks and inland lakes, as well as increased mortality risk due to increased hunter access and/or transmission line strikes. Loss of foraging and brood-rearing habitat (*e.g.,* wetlands, creeks) is not anticipated to occur with future projects.
    - Loss or alteration of mallard nesting cover for the development of future transmission projects is expected to be small and unlikely to have an effect on the local breeding population of mallard.
    - Increased human access resulting from the development of future transmission projects will increase the mortality risk to mallards through increased harvest. Although mallards are agile flyers and able to avoid obstacles, presence of transmission lines in areas where mallards concentrate will increase mallard mortality risk. It is expected that deflectors would be installed on lines where this risk would be elevated in order to minimize potential for bird mortality.
- **Canada goose:** Residual Project effects on Canada goose are expected to overlap with the effects of reasonably foreseeable future projects in the Bird Regional Study Area. Project-related cumulative effects of the Project on Canada geese are associated with increased mortality risk resulting from increased hunter access and presence of transmission lines near areas that concentrate geese. It is expected that deflectors would be installed on lines where this risk would be elevated in order to minimize potential for bird mortality. These cumulative effects are not expected to have measurable effects on the local Canada goose population. Geese use of the Bird Regional Study Area is largely limited to within the migration periods, at which time they occur on parts of the Nelson River, including the larger inland lakes that occur throughout the region.
- **Olive-sided flycatcher:** Residual Project effects on olive-sided flycatcher are expected to overlap with the effects of reasonably foreseeable future projects in the Bird Regional Study Area. It is expected that the Project in combination with other future developments will result in the additional loss of some olive-sided flycatcher breeding habitat. Losses are expected to be minimal as land clearing will be minimized to the extent possible. The potential effects on olive-sided flycatcher of the Project in combination with other future projects will be minimized through the application of

mitigation measures including clearing outside of the bird nesting season and retaining vegetation buffers around lakes, wetlands and creeks located adjacent to infrastructure sites (proposed for both the Keeyask Infrastructure Project and Bipole III Transmission Project and anticipated in the preliminary planning of the Keeyask Transmission Project).

- **Common nighthawk:** Residual Project effects on common nighthawk are expected to overlap with the effects of reasonably foreseeable future projects in the Bird Regional Study Area. A relatively small amount of additional habitat would be adversely affected by development of the transmission projects in combination with the Project. Suitable common nighthawk breeding habitat will be lost to infrastructure development (*e.g.,* substations), however some will be gained and maintained through land clearing and vegetation control associated with the transmission line ROWs. Moderate increases in foraging habitat will also result as land is cleared in preparation of the transmission line ROWs. The cumulative effects on the local common nighthawk population of the Project in combination with transmission line projects are therefore expected to be positive.

- **Rusty blackbird:** Residual Project effects on rusty blackbird are expected to overlap with the effects of reasonably foreseeable future projects in the Bird Regional Study Area. It is expected that future developments in combination with the Project will result in the additional loss of some rusty blackbird breeding habitat through land clearing. Losses are expected to be minimal as land clearing will be minimized to the extent possible. The potential effects on rusty blackbird of the Project in combination with other future projects will be minimized through the application of mitigation measures, including clearing outside of the bird nesting season and retaining vegetation buffers around lakes, wetlands and creeks located adjacent to infrastructure sites (proposed for both the Keeyask Infrastructure Project and Bipole III and anticipated in the preliminary planning of the Keeyask Transmission Project).

7.5.2.3.3 MAMMALS

- **Caribou:** Residual Project effects on caribou are expected to overlap with the effects of reasonably foreseeable future projects including the potential Conawapa Generation Project, Bipole III Transmission Project, the Keeyask Transmission Project and Gillam redevelopment.

  The Beverly and Qamanirjuaq barren-ground caribou herds may be in decline. The potential decline is mainly attributed to climate change, human activities, loss of winter habitat due to forest fires, harvesting and predation. Although the herd may be shrinking and/or has been redistributed, recent reports indicate that Qamanirjuaq caribou are still plentiful (about 348,000 estimated population in 2008). The redistribution of Pen Islands coastal caribou has also been reported. A combination of causes for the change include

increased mortality of animals due to differences in predation and hunting pressure across the traditional range, nutritional stress due to range deterioration, and redistribution of animals in response to habitat change or to disturbance among other hypotheses.

The Project is not anticipated to measurably affect caribou in the Regional Study Area. However, cumulative effects associated with future projects, including habitat loss and/or alteration, fragmentation, and access-related mortality from hunting and predation, could delay the cycle and recovery of wide-ranging caribou populations currently experiencing declines. Incremental changes in addition to the Project are highly unlikely to contribute measurably to a decline of the regional caribou population; especially with the mitigation measures associated with each individual project, or as these may be compared with the broader context of the range-wide requirements of coastal and barren-ground caribou beyond the Regional Study Area. Range-wide management efforts by Provincial and Federal Governments, and stakeholder representation on resource boards, including the Beverly and Qamanirjuaq Management Board, the Northeastern Caribou Committee, and the Split Lake, Fox Lake, and York Factory Resource Management Boards, are working to manage and monitor all risks associated with range-wide cumulative effects associated with harvestable caribou populations.

Incremental habitat fragmentation effects for summer resident caribou from the Project in combination with future projects are a concern within the Regional Study Area because of the scientific uncertainty associated with abundance and range use. For summer residents, the cumulative reduction in intactness (1%) is small compared to the Regional Study Area, and is highly unlikely to result in a measurable change to the population. While the Keeyask Transmission Project could result in one or more transmission line rights-of-way south of Stephens Lake, it is not likely to limit caribou from passing through the area and calving on islands in the lake. Less traffic on PR 280 is expected to improve the quality of adjacent caribou habitat and improve access to calving islands from the north shore. Existing human and fire disturbance in the Regional Study Area is already large, and may not be conducive to support a boreal woodland caribou population. The density of predators, however, is not expected to increase with a small increase in fragmentation because there is likely not enough caribou and moose biomass in the Regional Study Area to support a dense predator population. As such, incremental habitat fragmentation effects from future projects are more likely to have a small effect on the summer resident caribou population, whether they are coastal caribou, boreal woodland caribou, or both.

The management of access to and harvest of migratory coastal and barren-ground caribou in the lower Nelson River area has a high scientific and KCNs concern. Infrequent but potentially high harvest events, coupled with incremental habitat effects over a broad region, could result in a decrease and prolonged decline of coastal caribou

populations in particular. Although this type of event is unlikely to occur under existing harvest regulations and the management of caribou populations by the Resource Management Boards and the Province, to decrease the risk of cumulative effects occurring, all Project-related caribou mortality in association with other effects will be monitored (see Chapter 8).

A plan is being developed to coordinate caribou monitoring activities among northern hydroelectric developments, as well as with government authorities and existing caribou committees and management boards.

- **Moose:** Residual Project effects on moose are expected to overlap with the effects of reasonably foreseeable future projects including the potential Conawapa Generation, Bipole III Transmission, Keeyask Transmission and Gillam redevelopment. Although the Split Lake Resource Management Area moose population appears to be secure, recent declines in the abundance of moose in western and eastern Manitoba have occurred, where it is thought that access and harvesting were the main issues affecting these moose. Although minor changes including habitat alteration are likely to occur with each project, access issues and sustainable moose harvest are of concern. TCN has prepared a Moose Harvest Sustainability Plan to guide the management of their Adverse Effects Agreement Access Program to ensure the sustainability of the moose population in the Split Lake Resource Management Area. The Province is responsible for managing the licensed harvest while recognizing the priority of Aboriginal harvesting rights.
- **Beaver:** Residual Project effects on beaver are expected to overlap with the effects of the transmission line projects and Gillam redevelopment. Regional beaver populations are highly likely to maintain viable levels. Beaver populations are most likely to remain sustainable because beaver are widely distributed and abundant in creeks, steams, ponds and lakes, they create their own habitat in most areas where water occurs, breed quickly and are under harvest management regulations. The regional population will most likely continue to be depressed on the Nelson River because of water level regulation, and because beaver are unlikely to successfully re-colonize new shoreline wetland habitat in the long-term. As such, the system will most likely remain as it is today, and continue to depend on future fur prices and harvest. No measurable residual cumulative effects of the Project in combination with other future projects are anticipated.

7.6 SOCIO-ECONOMIC ENVIRONMENT

Table 7-4 reviews the socio-economic environment VECs examined in Chapter 6, and identifies those VECs included in the CEA, *i.e.*, those VECs with an adverse effect from the Project (as assessed in Chapter 6) that overlaps spatially and temporally with effects from past/current projects or activities identified in Table 7-1, and/or with effects from future projects and activities identified in Table 7-2. VECs assessed in Chapter 6 with positive

effects from the Project (*e.g.,* economy VEC s such as employment) or neutral effects from the Project after mitigation and compensation (e.g., resource use VECs such as domestic hunting and gathering, domestic fishing and commercial trapping) are not included in the CEA[1].

Socio-economic environment components and VECs primarily address people and communities in northern Manitoba that are impacted by the Project's effects on the biophysical environment (including effects that increase access to resources) and on local employment, business, infrastructure, services or other elements of local personal, family or community life, resource use and heritage resources. As such, these VECs represent different valued elements that affect the same people and communities – and there accordingly can be considerable overlap among VECs in the discussion of cumulative effects from past, current and future projects.

The socio-economic environment in the area to be affected by the Project has been substantially changed by past hydroelectric developments, linear developments (including transmission lines, highways and rail lines), forestry and mining exploration, and other agents of change, and continues to experience those effects today.

In addressing socio-economic, resource use and heritage resources effects on the KCNs communities and their Members, it is noted that each of the KCNs has entered into an adverse effects agreement with Manitoba Hydro to address known and foreseeable adverse effects of the Project on each respective Cree Nation. Each of the KCNs appointed representatives to work with Manitoba Hydro representatives to identify and recommend works and measures to "address and resolve all past, present and future Keeyask adverse effects" on their respective Cree Nations and their Members (TCN and Manitoba Hydro 2009; WLFN and Manitoba Hydro 2009; FLCN and Manitoba Hydro 2009). TCN, WLFN and FLCN based their decisions on adverse effects that are foreseen or could be reasonably foreseen with the exercise of due diligence. YFFN noted that this work was undertaken prior to the completion of the environmental impact statement and that the understanding of foreseeable Keeyask adverse effects was informed by past experiences with hydroelectric development and the environmental studies completed to March 2009. Each community held a referendum of its Members before signing the agreements.

The CEA analysis related to each socio-economic environmental component is provided below.

[1] Section 6.7 assesses the effects of the Project, in the context of other past and current projects, on three resource use VECs (domestic fishing, domestic hunting and gathering, and commercial trapping). The assessment concludes for each of these VECs, after considering positive versus negative effects, that the Project's effects on the VEC are neutral.

Table 7-4: Application of Cumulative Effects Assessment Criteria to Socio-Economic VECs

VECs Adversely Affected by the Project	Notes regarding Keeyask Effects	Overlap with Past/Current Projects or Activities	Overlap with Future Projects	Included (✓) in CEA for Future Projects or Activities
INFRASTRUCTURE AND SERVICES				
Housing	Construction phase – re: shortages in KCNs communities; shortages in temporary accommodation in Gillam and Thompson. Operation phase – shortages in Gillam	Kettle, Long Spruce, Limestone Mining and BRHA (for Thompson temporary accommodation)	Keeyask Transmission; Bipole III Transmission; potential Conawapa Generation Project; and Gillam Redevelopment	✓
Infrastructure and Services	Construction phase – re: shortages in KCNs communities and in Gillam	Kettle, Long Spruce, Limestone and KIP	Keeyask Transmission; Bipole III Transmission; potential Conawapa Generation Project; and Gillam Redevelopment	✓
Transportation Infrastructure	Construction phase – re: increased traffic wear and tear	Kettle re-runnering; KIP; other lineal development; mining	Keeyask Transmission; Bipole III Transmission; potential Conawapa Generation Project; and Gillam Redevelopment	✓
PERSONAL, FAMILY AND COMMUNITY LIFE				
Community health	Construction phase	Kettle, Long Spruce, Limestone generating stations	Keeyask Transmission; Bipole III Transmission; potential Conawapa Generation Project; and Gillam Redevelopment	✓
Mercury and Human Health	Operation Phase	Kettle	None	No

Table 7-4: Application of Cumulative Effects Assessment Criteria to Socio-Economic VECs

VECs Adversely Affected by the Project	Notes regarding Keeyask Effects	Overlap with Past/Current Projects or Activities	Overlap with Future Projects	Included (✓) in CEA for Future Projects or Activities
Public Safety and Worker Interaction	Construction phase	Kettle, Long Spruce, Limestone, current mining activities	Keeyask Transmission; Bipole III Transmission; potential Conawapa Generation Project; and Gillam Redevelopment	✓
Travel, Access and Safety	Construction phase (road, water and ice travel)	CRD, LWR, Kettle, KIP, mining activities	Keeyask Transmission; Bipole III Transmission; potential Conawapa Generation Project; and Gillam Redevelopment	✓
The Way the Landscape Looks	Construction and operation phases	CRD, LWR, Kettle GS, KIP, mining, other linear development, Kettle re-runnering	Keeyask Transmission; Bipole III Transmission; potential Conawapa Generation Project; and Gillam Redevelopment	✓
Culture and Spirituality	Construction and operation phases, particularly loss of rapids	CRD, LWR, Kettle GS, KIP and other linear development	Keeyask Transmission; Bipole III Transmission; potential Conawapa Generation Project; and Gillam Redevelopment	✓

Table 7-4: Application of Cumulative Effects Assessment Criteria to Socio-Economic VECs

VECs Adversely Affected by the Project	Notes regarding Keeyask Effects	Overlap with Past/Current Projects or Activities	Overlap with Future Projects	Included (✓) in CEA for Future Projects or Activities
HERITAGE RESOURCES				
Heritage Resources	Construction and operation phases	CRD, LWR, Kettle GS, KIP and other linear development	Keeyask Transmission Project	✓

7.6.1 EFFECTS OF PAST AND CURRENT PROJECTS AND ACTIVITIES

7.6.1.1 INFRASTRUCTURE AND SERVICES

Effects of past and current projects and activities are reflected in the current level of infrastructure and services as well as in the experience and expectations of local people with regard to the effects of similar major hydro-related and other construction projects. As reviewed in Table 7-4, based on the Chapter 6 assessment (which included consideration of cumulative effects related to past and current projects) the Project is expected to have adverse environmental effects on each of the following VECs:

- **Housing:** KCNs communities experience severe past and existing housing shortages, and housing capacity and temporary accommodation is also limited in Gillam; in Thompson, there tends to be a high demand for temporary accommodation related to other activities in that region (*e.g.*, Burntwood Regional Health Authority, Vale operations).
- **Infrastructure and Services:** Related infrastructure and services are already at capacity in KCNs communities and in Gillam. Past experience related to earlier hydro generation projects in this region (*e.g.*, Kettle and Long Spruce projects) has indicated increased service requirements related to social problems (*e.g.*, racism, alcohol abuse, family abuse) associated with interaction with project workers and the temporary infusion of income for local construction workers (see Chapter 6 and SE SV Section 4.3.3).
- **Transportation Infrastructure:** Existing infrastructure related to road, rail and air for movement of equipment, materials and people is geared to current and past requirements.

7.6.1.2 PERSONAL FAMILY AND COMMUNITY LIFE

Effects of past and current projects and activities are reflected in the experience and expectations of the KCNs Members and other local people with regard to the effects on personal, family and community life VECs of similar major hydroelectric-related and other construction projects, the community services currently available to address concerns related to such projects (particularly during construction), and the ongoing loss of cultural and physical landscape due to past hydroelectric developments affecting the lower Nelson River region.

As reviewed in Table 7-4, based on the Chapter 6 assessment (which included consideration of cumulative effects related to past and current projects) the Project is expected to have adverse environmental effects on each of the following VECs:

- **Community Health:** Past hydroelectric-related construction, with increased non-local construction workers coming into Gillam (and to some extent Split Lake), was seen to increase the potential for indirect adverse effects on local community health, including increases in communicable diseases, increased alcohol abuse and adverse interactions with community members such as women and youth.
- **Public Safety and Worker Interaction:** The KCNs have seen multiple hydroelectric development projects built and/or criss-cross their homeland since the mid-1950s (see Section 2 of the SE SV). As further noted in Chapter 6, based on experience with past hydroelectric project construction the KCNs, and TCN and FLCN Members in particular, have identified potential adverse effects of non-local construction worker interaction with community Members, especially direct effects on women and youth, as an important socio-economic concern associated with new major projects being developed in their traditional territories. In particular, many FLCN Members are to this day dealing with past loss, grief and anger related to adverse worker interaction effects of previous hydro projects (FLCN 2009 Draft).
- **Travel, Access and Safety:** In addition to increased road and air traffic during construction and the potential for increased traffic accidents, past local experience with hydroelectric-related projects notes adverse changes to water/ice-based travel as a result of these projects. This is of particular concern to YFFN in relation to travel safety on Split Lake.
- **Culture and Spirituality (KCNs):** The KCNs have expressed concern regarding the ongoing and extensive loss of cultural landscape and/or deterioration in overall Cree culture in relation to past hydroelectric development projects and activities in the Local Study Area including the creation of Stephens Lake and dramatic alteration of the lower Nelson River.
- **The Way the Landscape Looks (Aesthetics):** The Project is located in a region that has experienced considerable past hydroelectric development including several

generating stations, transmission lines, roads, cut trails and two converter stations which together have greatly altered the physical landscape (Split Lake Cree – Manitoba Hydro Joint Study Group 1996a and b). These changes include changes to the seasonal flows and water levels on the Nelson River due to the effects of the CRD and LWR projects, as well as loss of rapids and changes to local lakes as result of existing hydroelectric generation projects.

7.6.1.3 HERITAGE RESOURCES

Effects of past and current projects and activities have had adverse effects on heritage resources (known and unknown) stemming from physical disturbance to the landscape, flooding and erosion. This includes losses from previous hydroelectric development projects such as the CRD, LWR, Kelsey and Kettle GSs and associated transmission projects within the Local and Regional Study Areas. Little intact archaeological evidence of past human occupation remains in the Local Study Area (see Chapter 6 and the Heritage Resources component of the SE SV for further details). In addition to the physical (and sensory) changes due to the effects of past and current projects and activities on the cultural landscape, the continuous loss of tangible heritage resources also erases features that may prompt memories of past cultural history.

7.6.2 SUMMARY OF CUMULATIVE EFFECTS OF THE PROJECT WITH PAST AND CURRENT PROJECTS AND ACTIVITIES

The construction and operation of the Project has been planned to first minimize, and then mitigate the effects to the socio-economic environment to the extent practicable.

7.6.2.1 INFRASTRUCTURE AND SERVICES

The following effects of the Project, in combination with the effects of past and current projects and activities, are reviewed in Chapter 6 where relevant for infrastructure and services VECs. The following section provides a summary of the cumulative effects of the Project with past and current projects and activities.

- **Housing:** As noted in Chapter 6, because in-migration of KCNs Members seeking Project employment is expected to be minimal, the Project is expected to have very small residual adverse effects on the KCNs housing during the construction phase. The recent experience with construction of the Wuskwatim Generation Project reinforces this conclusion.

- For Gillam and Thompson, the Project is expected to have small residual adverse effects on short-term accommodation (*i.e.*, motel and hotel beds) due to the influx of non-local construction workers seeking amenities during time off.
- For Thompson, the Project is also expected to have small residual effects on housing due to some KCNs Members relocating to Thompson to enhance their project-related employment prospects, while accessing educational and health services.
- It is anticipated that all residual effects will be limited in KCNs communities due to existing housing shortages, and in Thompson due to high demand for temporary accommodation related to other activities in the Local Study Area. In the case of Gillam, additional housing is already being developed and/or planned as part of the Gillam Land Use Planning process to meet the added requirements arising from future Manitoba Hydro projects in the Gillam region.

- **Infrastructure and Services:** As noted in Chapter 6 for the construction phase, the Project is expected to have small to moderate residual adverse effects on KCNs' infrastructure and services, and small residual adverse effects on Gillam and Thompson infrastructure and services, primarily focused on an increased need for social services and the RCMP. As indicated in Chapter 6, the Project is predicted to result in small residual adverse effects on infrastructure and services in Gillam only (including FLCN) during the operation phase.
  - Gillam is expected to be affected community during Keeyask construction and operation due to its proximity to various future projects and activities in the area. The Gillam Land Use Planning process currently underway has the ability to address joint planning and development issues within the community arising from the Project, and within the context of other future projects in the vicinity of Gillam.
  - These services are already at capacity in the KCNs communities and any net in-migration of KCNs Members during construction, even if limited, will place an increased demand on these services. The KCNs' AEAs have the potential to improve community infrastructure and services.
- **Transportation Infrastructure:** As noted in Chapter 6 for the construction phase, the Project is expected to have small residual adverse effects on the transportation infrastructure in the Local Study Area and Northern Region (*e.g.*, increased use of roads, rail and air for movement of equipment, materials and people to the Project site); with moderate residual adverse effects related to road travel safety. It is expected that existing road, rail and air infrastructure can handle the increase related to the Project.

7.6.2.2 PERSONAL FAMILY AND COMMUNITY LIFE

The following effects of the Project, in combination with the effects of past and current projects and activities, are reviewed in Chapter 6 where relevant for personal, family and community life VECs.

- **Community Health:** The Project's residual effects on KCNs and Gillam community health are considered to have small adverse effects (see Chapter 6) due to environmental change, public and transportation safety issues and stress of concern re: effects on the community from construction-related worker interactions.
- **Public Safety and Worker Interaction:** As indicated in Chapter 6, the Project is expected to have moderate adverse residual effects on public safety and worker interaction in the KCNs communities and in Gillam, including TCN and FLCN Members, and in Thompson.
    - The assessment of effects that Project construction would have on the community of Gillam, KCNs Members and surrounding areas (*e.g.,* Split Lake and Thompson), as well as past construction activities is addressed in Chapter 6 (and Section 5 of the SE SV).
    - As noted in Chapter 6, the number of visits to Gillam and other communities (including Split Lake) is hard to predict. Mitigation measures to reduce the number of visits, as well as an overall Manitoba Hydro strategy to address worker interaction have been incorporated into the assessment of the Project (see Chapter 6 and Section 5 of the SE SV for details).
- **Travel, Access and Safety:** As indicated in Chapter 6, residual effects from the Project on water and ice-based travel are expected to be adverse and small in magnitude during the construction phase; and moderate short-term adverse effects are expected to road travel during construction of the Project.
- **Culture and Spirituality (KCNs):** As reviewed in Chapter 6, residual adverse effects on culture and spirituality stemming from the Project (after mitigation and the AEAs in place) are considered to be small related to the loss of the rapids and cultural narrative associated with the changed landscape within the Local Study Area for both the construction and operation phases (see Chapter 2 re: *Askiy* and Chapter 6, Section 6.6.5.6). A key factor in this finding are the AEAs that each of the KCNs have already agreed to.
- **The Way the Landscape Looks (Aesthetics):** As reviewed in Chapter 6, the Project's adverse residual effects on the way the landscape looks (after mitigation and the AEAs being in place) are small in magnitude during construction and operation. A key factor behind this finding is that the Project is located in a region that has experienced considerable past hydroelectric development (as noted previously) which has greatly

altered the landscape; and that each of the KCNs have entered into AEAs with Manitoba Hydro to address adverse effects of the Project on each respective Cree Nation. Overall, the landscape will be altered on a permanent basis, including the loss of the Gull Rapids.

- Areas required for Keeyask construction, including access roads, which are no longer needed during the operation phase, will undergo site rehabilitation.
- A detailed decommissioning and rehabilitation plan for such infrastructure and land areas will be developed during the construction phase and provided to regulators for review and approval. Guiding principles for disturbed site rehabilitation are included in Section 7.3 of the JKDA, including use of local plant species to re-vegetate areas associated with the Project and the implementation of the KCNs' principles regarding respect for the land.

7.6.2.3 HERITAGE RESOURCES

As indicated in Chapter 6, the regulatory assessment concludes that there will be moderate adverse effects on overall heritage resources (known and unknown) resulting from both the construction and operation phase of the Project. These effects will be within the Project construction site and the open water hydraulic zone of influence stemming from physical disturbance to the landscape, flooding and erosion. Archaeological sites that are to be protected through a mitigative buffer or avoidance will increase in sensitivity due to their increasing exclusivity.

7.6.3 CUMULATIVE EFFECTS OF THE PROJECT INCLUDING FUTURE PROJECTS AND ACTIVITIES

Based on the technical assessment summarized in Table 7-4 and detailed in Section 6.3, adverse effects of the Keeyask Project are expected to overlap with the other future projects or activities listed in Table 7-2.

Review of other future projects considered in the CEA that could overlap with the adverse effects of the Project indicates instances with the potential to result in cumulative effects on socio-economic VECs that require further mitigation and monitoring for the Project in combination with other future projects. Assuming that such further mitigation and monitoring occurs, the conclusions are not changed with respect to the regulatory significance of adverse effects of the Project on socio-economic VECs presented in Chapter 6.

7.6.3.1 INFRASTRUCTURE AND SERVICES

As Table 7-4 and Figure 7-1 illustrate, construction of the Keeyask Transmission Project, Bipole III Transmission, Gillam redevelopment, and the early years of the potential Conawapa Generation Project all overlap in time with the Keeyask construction period, creating overlapping effects on local housing, infrastructure and services, and transportation infrastructure. Spatial overlap within the socio-economic Local Study Area includes the Keeyask Transmission Project. Other developments may also occur in the area, including a planned Gillam housing expansion and redevelopment; although it is expected that many of these workers will be drawn from the local communities.

- Of particular note with regard to overlap of construction workers in the Gillam area, over 300 workers per quarter associated with components of the Bipole III and Keewatinoow Converter Station are needed in various years (*e.g.*, more than 300 per quarter (average) in 2014 with Q1 a high of over 900); and more than 250 per quarter (average) in 2015).

- Workers involved in the early stages of construction of the potential Conawapa Generation Project will overlap with the latter years of construction of Keeyask; these Conawapa workers will make use of facilities and services in Gillam (as it is the closest community with a range of amenities), exacerbating the demand for facilities and services.

- It is anticipated that the influx of non-local construction workers from other projects will exacerbate the additional pressure on community-based infrastructure and services, particularly emergency (*i.e.*, RCMP) and social services (*i.e.,* National Native Alcohol and Drug Abuse Program, Awasis, and family counselling) in Gillam.

- Operation staff for the Keewatinoow Converter Station and the potential Conawapa Generation Project are expected to be based in Gillam adding to the demands for infrastructure and services in this community.

More specific assessments of cumulative effects of the infrastructure and services VECs for the Project related to these other future projects are noted below:

- **Housing:** With severe housing shortages expected to continue in the KCNs communities, few non-resident KCNs Members are likely to relocate to the KCNs communities in conjunction with any of the future projects. Relocation to Thompson is less likely with the other future projects as they are further away from Thompson than Keeyask is; however, numbers cannot be predicted.

  All these projects require additional workforces with some workers likely drawn from local communities, and with a substantive portion of the workforce expected to be drawn from beyond the Local Study Area. This non-local workforce may place an increased demand for short-term accommodation in Gillam and Thompson. Expanding

accommodation in Gillam will help deal with pressures on that community. Thompson is considerably further from the future projects than Keeyask which will reduce the number of off-hours visits to the City from workers related to those future projects. As well, the accommodation sector in Thompson is likely to be under less pressure and more able to cope with new demands than in recent years as Vale slows down its capital spending in the City and closes its nickel smelting and refining operation. Thompson has also recently added hotel capacity.

- **Transportation Infrastructure:** The key concern with these overlaps of other future projects with Keeyask construction relates to the additional wear and tear and traffic levels on PR 391 from Thompson to PR 280 and on PR 280 from the PR 391 junction to the junction of the north access road in the Local Study Area. For example, during 2017 and 2018, when Keeyask construction activity is at a high level, this route will also be handling substantial traffic from the later years of Keewatinoow Converter Station construction and the early years of potential Conawapa Generation construction. These higher traffic levels could accelerate the schedule for road refurbishment, maintenance and/or upgrades. It could also require special measures (*e.g.*, more frequent dust control) to avoid increased accident risks on this route. Manitoba Hydro and Manitoba Infrastructure and Transportation (MIT) will need to keep each other informed on a regular basis prior to and during periods of overlapping construction traffic to identify requirements for road improvements and traffic management.

  For sections of PR 280 beyond the north access road there will be increased traffic into Gillam; however, most of the increase is anticipated to be related to future projects. There will be some Keeyask-related Project traffic such as workers traveling to Gillam from the site for leisure activities. The number of visits is difficult to predict; however, this is expected to be small to negligible in comparison to the increased traffic associated with future projects. Any added mitigation would have to be determined in the cumulative assessment of the other future projects.

It is anticipated there will be a lesser effect on PTH 6 from Winnipeg to Thompson in the Northern Region for the following reason:

- The feasibility of an increased use of rail as a mode of transporting equipment and materials from the south to the Henday Rail Yard, which is located in the vicinity of the Keewatinoow Converter Station and the potential Conawapa Generation Project (Bipole III EIS); and
- The anticipation that MIT will be able to address increased traffic levels on PTH 6 through their regular highway maintenance and upgrade program given the long lead time notice.

In light of expected sizeable increases in traffic on PR 391 from Thompson to PR 280 and PR 280 to the junction of the north access road, the magnitude of the residual effects when taking into account cumulative effects may change from small to moderate for the

short-term; however, this change related to cumulative effects would not modify the Chapter 6 regulatory significance determination for the Project's effects on the transportation infrastructure VEC.

Chapter 8 notes the monitoring necessary to track population changes, as well as the need to tie in any potential increased demand for housing with the land use planning process currently in place in Gillam. Manitoba Hydro is a proponent for these other major development projects in the socio-economic Local Study Area, and is involved in the community land use planning process for Gillam along with the Town and FLCN to address infrastructure and service requirements of future projects in the Gillam area. Implementation of the results of the planning process would enable the growth in demand for added infrastructure and services from future projects to occur in a timely manner with minimal disruptions. In this regard, there is an ability to plan and coordinate additional mitigation measures such as increasing the number of housing starts in Gillam, ongoing monitoring and coordination amongst all projects to reduce the likelihood of cumulative adverse effects. Beyond this joint community land use planning, no additional mitigation is required to address the cumulative effects related to the Keeyask Project.

Manitoba Hydro will continue to liaise with the Thompson Mayor and Council on future projects within the region to enable Thompson to plan for community growth (*e.g.*, housing and/or short-term accommodations). No additional mitigation is required.

In summary, the Chapter 6 assessment of significance for Keeyask Project effects on infrastructure and services VECs, which considered cumulative effects of past and current projects, is not changed by the above consideration of cumulative effects of other future projects.

7.6.3.2 PERSONAL FAMILY AND COMMUNITY LIFE

As reviewed in Table 7-4 and in the CEA review of infrastructure and services VECs (Section 7.6.3.1), Keeyask Project residual adverse effects during construction on several personal, family and community life VECs related to the KCNs and Gillam have the potential to interact cumulatively with adverse effects of other projects and activities planned during the Keeyask construction phase. As Figure 7-1 indicates, overlapping projects include the Keeyask Transmission Project, the Bipole III Transmission Project, the potential Conawapa Generation Project, and Gillam redevelopment. As reviewed in Figure 7-1 sizeable workforce will be required for these projects, with a substantive portion of the workforce expected to come from outside the Local Study Area (*e.g.,* non-local workers). The following identifies the key time periods when the construction workforce for the other projects is expected to add substantially to the number of workers who will be working on Keeyask construction (see Figure 7-1):

- Keeyask Project site preparation and supporting infrastructure in the early years of construction is expected to overlap with peak construction of the Keewatinoow Converter Station, Bipole III, Keeyask Transmission Project, and Gillam expansion.
- Keeyask Project main stages of construction in the middle years up to the first turbine being in service is expected to have a peak workforce of about 1600 workers in the summer. This is expected to overlap with a period of high level of construction for the Keewatinoow Converter Station, construction of the Keeyask Transmission Project, the early stage of the potential Conawapa Generation Project construction and Gillam expansion.
- Keeyask Project final stage of construction in the remaining few years is expected to overlap with the peak workforce for Conawapa of 2100 workers and the last phase of the Keeyask Transmission Project; all other future projects are anticipated to be completed by this time period.

The combination of these projects could be expected to multiply the number of visits by non-local construction workers to Gillam (and possibly throughout the Local Study Area) compared to the Keeyask Project alone and noticeably increase the potential for adverse interactions with community residents, including groups such as youth and women. Gillam is by far the closest community with relevant amenities for the other projects. The competition from Thompson is expected to be much less for these projects due to the much greater distance involved in going to Thompson.

Similarly, during the Keeyask operation phase there will be residual adverse effects on several personal, family and community life VECs related to FLCN and Gillam that have the potential to interact cumulatively with adverse effects of other future projects and activities planned.

More specific assessments of cumulative effects of personal, family and community life VECs for the Keeyask Project related to these other future projects are noted below:

- **Community Health:** It is anticipated that community health may be further adversely affected as future projects noted in Table 7-2 overlap with Keeyask construction. Temporal overlap between Keeyask operation and potential Conawapa construction and operation may also result in indirect adverse effects on community health.
    - The additional projects will increase the number of non-local construction workers coming into Gillam (and possibly other Local Study Area communities), thus increasing the potential for indirect effects on community health. Examples may include the potential for increases in communicable diseases, increased alcohol abuse and adverse interactions with community members such as women and youth. Monitoring of community health is the responsibility of government authorities (Manitoba Health and FNIHB); it is recommended that these authorities consider monitoring the number of incidents of communicable diseases, injury and

potential years of life lost in the Gillam area and develop communication strategies related to same.

- Operation phase cumulative effects with other future projects may result through increased population growth in Gillam associated with these projects, and the potential increase in community health issues. It is anticipated that these adverse indirect cumulative effects will be small to negligible.

- **Public Safety and Worker Interaction:** The residual adverse effects of the Keeyask Project on this VEC have the potential to interact cumulatively with adverse effects of other projects and activities planned during the Keeyask construction phase.

  - Mitigation measures to reduce the number of worker visits, as well as an overall coordinated approach to address worker interaction have been incorporated into the assessment of the Keeyask Project (see Chapter 6 and Section 5 of the SE SV for details); these mitigation measures are also included in the Bipole III EIS, particularly in relation to the Keewatinoow Converter Station. These measures are equally applicable to any of the other future projects for development in the Gillam area.

  - Additional mitigation in the form of ongoing coordination with Manitoba Hydro, contractors, monitoring advisory committees, the RCMP and social groups will be necessary to reduce the risk of material adverse effects.

  - Ongoing monitoring will be a necessary component of all Manitoba Hydro projects and activities in the vicinity of Gillam in particular (and possibly throughout the Local Study Area). Further discussion with the RCMP is recommended to facilitate appropriate level of staffing and to determine how best to track incidents related to separate projects.

  Given the sizeable increase in the number of potential visits by non-local construction workers to Gillam (and possibly the Local Study Area) and added adverse interaction opportunities, the planning for each of the future construction projects in Table 7-2 will need to address incremental mitigation and monitoring as required and reviewed above. Coordinated planning in this regard will be facilitated to the extent that Manitoba Hydro is responsible for these various other future projects.

  Assuming that the above mitigation and monitoring occurs, the Chapter 6 assessment of significance for Keeyask Project effects on this VEC, which considered cumulative effects of past and current projects, is not changed by the above consideration of cumulative effects of additional future projects.

- **Travel, Access and Safety:** In terms of road travel safety, the expected increases in traffic due to cumulative effects of the Project (during the construction phase) with other future projects may result in overall moderate to large residual effects for a short period of project overlap; however, the significance rating for the Project effect on this

VEC as provided in Chapter 6 remains unchanged. With regard to open water and ice-based travel, the Project's effects are not expected to overlap spatially in any meaningful way with other future projects.

- **Culture and Spirituality (KCNs):** Future projects and activities noted in Table 7-2 will add to the physical alteration of the land and water in the KCNs traditional territories, affecting their stewardship relationship with *Askiy* (see Chapter 2). The additional loss of their cultural connections to *Askiy* is likely to accentuate the adverse effect experienced by KCNs Members. Manitoba Hydro will work with the KCNs, and others, so that that these future projects are planned, constructed and developed in a way that minimizes adverse effects as much as possible. Where appropriate, Manitoba Hydro will negotiate adverse effects agreements with affected KCNs and others prior to the start of construction for these projects. As with Keeyask, these agreements are intended to address known and foreseeable adverse effects of the projects on these communities, including those which may affect cultural identity. Based on these measures, the Chapter 6 assessment of significance for Keeyask Project effects on this VEC, which considered cumulative effects of past and current projects, is not changed by the above consideration of cumulative effects of other future projects.
- **The Way the Landscape Looks (Aesthetics):** There is spatial and temporal overlap between the Keeyask Project and the Keeyask Transmission Project for both the construction and operation phases (due to the long-term nature of physical changes to the landscape and features remaining on the landscape in perpetuity, *i.e.,* dam, dykes, north and south access roads and transmission lines). While these other projects will affect the way the landscape looks, their effects should be less prominent, albeit more geographically dispersed, than the Keeyask Project. Given an already highly disturbed visual landscape and the prospect of rehabilitation after decommissioning, the significance rating for Keeyask Project effects on this VEC in Chapter 6 (which included consideration of cumulative effects of past and current projects) is not changed after considering the cumulative effects of other future projects.

7.6.3.3 HERITAGE RESOURCES

Based on the technical assessment summarized in Table 7-4, adverse effects of the Keeyask Project are expected for the heritage resources VECs, and these adverse effects are also expected to overlap with at least some of the other future projects or activities listed in Table 7-2 during the construction phase.

As Table 7-4 indicates, the Keeyask Transmission Project will overlap in space and time with the Keeyask Project relative to heritage resources. The Keeyask Transmission Project will include additional clearing and disturbance to the physical landscape, with the potential for disturbing or unearthing unknown heritage resources.

- The Keeyask Transmission Project has undergone a heritage resources impact assessment (NLHS 2009) undertaken under *The Heritage Resources Act* to identify and address known heritage resources; and in the case of unknown heritage resources, the future project will include a Heritage Resources Protection Plan to address unearthing any unknown heritage resources.

Given the mitigation and monitoring that will be associated with both the Keeyask Project and the future Keeyask Transmission Project, no additional mitigation or monitoring will be required. The significance rating for Keeyask Project effects on this VEC in Chapter 6 (which included consideration of cumulative effects of past and current projects) is not changed after considering the cumulative effects of other future projects.

APPENDIX 7A
RELEVANT OTHER PROJECTS AND ACTIVITIES

INTRODUCTION

The following appendix material provides a brief description of past and current projects and activities and information on future projects and activities considered in the cumulative effects assessment. More information on these projects can be found on the Manitoba Hydro website (http://www.hydro.mb.ca/).

PAST AND CURRENT PROJECTS AND ACTIVITIES

MANITOBA HYDRO GENERATION – RELATED DEVELOPMENT IN NORTHERN MANITOBA

CHURCHILL RIVER DIVERSION

The Churchill River Diversion Project involved diverting flow from the Churchill River into the Burntwood-Nelson river system to increase power production at existing and future generating stations on these two rivers (see Map 7A-1). The diversion raised the level of Southern Indian Lake by approximately three meters, reduced flows on the Churchill River downstream of Missi Falls, and increased flows on the Rat River/Burntwood River/Nelson River system.

The Churchill River Diversion Project was announced in 1966 and received an interim license in 1972. Construction began in 1973 and the diversion was in operation by 1977. The three main components of the diversion plan included:

- A control dam at Missi Falls that raised the lake by three meters and controls the outflow of water from Southern Indian Lake.
- Excavation of a channel from South Bay of Southern Indian Lake to Issett Lake which created an outlet for the diverted Churchill River to flow into the Rat River/Burntwood River/Nelson River system.
- A control dam on the Rat River at Notigi that regulates the flow into the Burntwood-Nelson River systems.

Under the terms of the license, Manitoba Hydro is permitted to divert the river flow up to 991 m^3/s from the Churchill River into the Nelson River between May 16 and October 31 and up to 963 m^3/s during the rest of the year. The license also stipulates that outflow from the control dam at Missi Falls must be at least 14 m^3/s during the open water season and 43 m^3/s during the ice-cover period.

Two weirs have been built, one on the Nelson River system and another on the Churchill River, to partially mitigate changes in water levels caused by the Lake Winnipeg Regulation (LWR) and Churchill River Diversion (CRD) Projects, respectively. The Cross Lake Weir

was constructed in 1991 to reduce the impacts caused by reversal of the historic pattern of water levels and fluctuations at Cross Lake. The weir at the Jenpeg Generating Station raised the minimum water level on Cross Lake by nearly 1.4 m during low flow conditions without raising water levels during floods in excess of the 1:100 year flood. This results in more moderate seasonal fluctuations than in the past. The effectiveness of the Cross Lake Weir continues to be monitored.

The weir on the Churchill River at Churchill was developed as part of a water level enhancement project to help offset reduced water levels resulting from the diversion of flows into the Burntwood-Nelson River system. Before the diversion, outflows from Southern Indian Lake averaged 991 m^3/s. Below Missi Falls, tributaries bolstered the Churchill River's natural flow to an average of 1,274 m^3/s emptying into Hudson Bay. With the diversion, the river's flows into Hudson Bay were reduced to an average of 510 m^3/s. Following receipt of environmental approvals, construction of the weir and associated works began in the late spring of 1998 and was completed in the summer of 2000.

LAKE WINNIPEG REGULATION

The Lake Winnipeg Regulation was developed to use Lake Winnipeg as a natural reservoir to regulate water flow for generating stations located on the Nelson River and also for flood and drought control (see Map 7A-1)[1].

The natural outflow of Lake Winnipeg into the Nelson River naturally increased in the summer and decreased in the winter, the opposite of energy requirements of the Province of Manitoba. Manitoba Hydro was granted a license in 1970 to regulate the outflow of Lake Winnipeg into the Nelson River. New channels were excavated and the Jenpeg Generating Station and Control Structure was constructed by late 1976. This new control structure allows Manitoba Hydro to adjust outflow patterns of Lake Winnipeg to meet the energy needs of the Province.

The three channels excavated were the 2-Mile Channel, 8-Mile Channel and the Ominawin Bypass Channel. They were excavated to a depth of 7.6 m for a total of 37.3 million m^3 of material excavated. The 2-Mile Channel was excavated to increase the natural outlet at Warren Landing. The 8-Mile Channel was excavated to increase water flow from Playgreen Lake. The Ominawin Bypass Channel was developed to avoid natural restrictions in the Ominawin Channel.

The Jenpeg Generating Station and Control Structure was constructed to regulate water in the main channel that provides outflow from Lake Winnipeg and to generate 135 megawatts of electricity from a 7.3 m operating head (waterfall). Construction was completed in 1979.

[1] In print version, Appendix 7A Maps can be found in the accompanying Map and Figure Folio.

The Kiskitto Dam was developed to prevent water from the Nelson River from spilling into Kiskitto Lake. Water levels in Kiskitto Lake are regulated by inlet and outlet structures within their natural range to provide maximum benefit for fish, wildlife and recreational users. The Kiskitto Dam is 600m long and a maximum of 15m high with an additional 16 dykes totaling a length of 14km to prevent water from flowing directly from the Nelson River.

Construction began in 1991 on the Cross Lake Weir to raise the water levels on Cross Lake during low flow conditions. The construction included a rock weir and channel excavation at the outlet of Cross Lake for a total of $9.5 million.

Under the Lake Winnipeg Regulation license, Manitoba Hydro must regulate water levels between 216.7m (711 feet) and 217.9m (715 feet) above sea level. The licence allows Manitoba Hydro to set outflows as required for power production purposes along the Nelson River when the lake is level is between 216.7m and 217.9m. During periods of high inflow when water levels in Lake Winnipeg rise above 217.9m, Manitoba Hydro must maintain maximum outflow into the Nelson River to return the lake to below 217.9m. During periods of low inflow and drought, the water level of the lake may fall below 216.7m. When this occurs, Manitoba Conservation determines outflow from the lake. Eight separate locations on Lake Winnipeg are measured daily to determine the water level. The average level of the lake has not significantly changed following the regulation. Prior to 1976, the average water level was 713.4 feet above sea level while following the implementation of the Lake Winnipeg Regulation the average level of the lake has been 713.6 feet above sea level.

LOWER NELSON RIVER GENERATION PROJECTS

In association with the Lake Winnipeg Regulation and the Churchill River Diversion water management system, four large hydroelectric generating stations were developed between 1957 and 1995. The Kelsey and Kettle Generating Stations were built prior to the Lake Winnipeg Regulation and the Churchill River Diversion. The Long Spruce and Limestone Generating Stations were constructed after the water management systems implementation (see Map 7A-1).

The Kelsey Generating Station is located on the upper Nelson River close to where it enters Split Lake, 40 km south-west of the community of Split Lake. Kelsey was the first hydroelectric generating station built on the Nelson River in order to provide 100 MW of power to serve INCO's mining and smelting operations in Thompson. The Kelsey forebay raised water levels approximately 9.5 m above natural levels and flooded around 5,767 ha for 150 km along the upper Nelson River from Kelsey to Sipiwesk Lake.

The Kettle Generating Station is located at the Big Kettle Rapids (*Kitchi Askiko Powstik*) site, approximately 7 km northeast of the Town of Gillam. It was the first of four projects outlined in Phase One of the framework for northern hydro-electric development recommendations submitted by the Nelson River Programming Board in 1965 to meet the

forecasted demand of electricity in Manitoba. The Kettle Generating Station construction activities took place over seven years from 1966 to 1974. The Kettle Generating Station has twelve generating units with a generating capacity of 1,232 MW. The station was fully operational in 1974. Construction of the Kettle Generating Station involved several projects that had effects on the local study area, such as construction of the Radisson Converter Station, transmission lines from Kelsey to Radisson, electrification and expansion of Gillam to accommodate the construction workforce, a new airstrip and a road. With the creation of the reservoir, water levels at the structure raised 30 m, flooded 21,000 ha and tripled the size of Moose Nose Lake, which was then renamed Stephens Lake.

The Long Spruce Generating Station is located approximately 27 km east of Gillam and 16 km downstream of the Kettle Generating Station on the Nelson River. Long Spruce was selected for hydroelectric development after Kettle Rapids to continue to meet the growing electrical demands in Manitoba. Construction activities took place over seven years from 1972 to 1979. At peak construction, 2,000 workers were employed on the Long Spruce Construction. The Long Spruce forebay was created in 1977, which raised the water level by about 26 m, flooding approximately 1,400 ha of land. The Long Spruce Generating Station has ten generating units with a generating capacity of 1,010 MW. Related project activities to the Long Spruce Generating Station included roads, a converter station and transmission projects, which in total affected approximately 9,300 ha of land.

The Limestone Generating Station is located approximately 6 km east of Fox Lake and 50 km northeast of Gillam. Construction of the Limestone Project began in 1976 with the development of a road, rail spur and construction of the Sundance town site. In 1979, construction was suspended as growth in electricity demand dropped. Construction activities were resumed in 1985 after a sale of power to the Northern States Power Corporation and took place over seven years. Power was first generated in 1990 and fully operational in 1992 when water levels at the station had been raised by 33.5 m. The Limestone Generating Station has ten generating units with a generating capacity of 1,340 MW. The Limestone Generating Station was developed as a run of the river station to minimize upstream effects. Increased water levels were mainly contained within the Nelson River banks resulting in 209 ha of flooding. Approximately 1,500 to 1,800 workers worked at Limestone during peak construction. Transmission projects associated with Limestone used approximately 1,100 ha of land. An all-weather road system was completed at this time from Thompson to Gillam.

WUSKWATIM GENERATING STATION PROJECT

The Wuskwatim Generation Project is currently under construction and involves the development of a 200 MW generating station, access road, construction camp, and other infrastructure. The Wuskwatim Generating Station is located at Taskinigup Falls on the Burntwood River, approximately 1.5 km downstream from the outlet of Wuskwatim Lake (see Map 7A-2). The Wuskwatim Generating Station includes a main dam, across Taskinigup

Falls, a powerhouse/service bay complex and a three-bay spillway built into the north bank of Taskinigup Falls. Using a low head design reduced flood impacts to less than 0.5 km^2.

The Wuskwatim Generating Station is anticipated to utilize the Churchill River Diversion flow that currently passes over the combined 22m elevation drop at Wuskwatim and Taskinigup Falls. The Wuskwatim Generating Station is expected to produce an average of about 1,550 GW.h of electricity per year that will be fed into the northern AC transmission system.

This location of the Wuskwatim Generation Project is within the Nelson House Resource Management Area. Manitoba Hydro and the Nisichawayasihk Cree Nation have jointly undertaken all the necessary engineering, environmental, consultation and other related activities to allow for the construction of the Wuskwatim Generation (and Transmission) Project. The Wuskwatim Generation Project is unique because it represents the first time Manitoba Hydro entered into an equity partnership with a First Nations community on a generating station project.

LINEAR DEVELOPMENT

PAST TRANSMISSION LINES

Manitoba Hydro's high-voltage transmission line system (see Map 7A-3) carries electricity from the generating stations in northern Manitoba to terminal stations in southern Manitoba where large transformers convert the high voltages to low voltages. Sub-transmission lines then feed the electricity into a distribution system where the voltages are again converted to lower levels. Manitoba Hydro's major high voltage transmission lines operate at 115 kV, 138 kV, 230 kV and 500 kV. At the terminal stations located in heavily populated areas, large transformers convert the voltages to 66 kV, 33 kV or 24 kV.

Manitoba Hydro generates and transmits electricity as alternating current (AC) because of the relative ease of transforming voltages to the desired levels. It is more efficient and economical to transmit electricity as high voltage direct current (HVDC) for the long distances between the Nelson River generating stations and southern Manitoba, where most of the electricity is used. Manitoba Hydro's HVDC transmission system consists of two identical steel tower lines, Bipole I and Bipole II. They follow a 900 km route from Gillam through the Interlake area to Rosser, located 26 km from Winnipeg on the northwest side.

The Jenpeg Generating Station has a 230 kV transmission line to Ponton. The Kelsey Generating Station has three 138 kV AC transmission lines to Thompson, two 138 kV AC lines to Gillam (which feed Gillam, Ilford and Churchill) and one 138 kV AC line to Split Lake. The Kettle Generating Station has one 138 kV AC transmission line to the Radisson Converter Station where a ±450 kV DC line traverses to Winnipeg. The Limestone Generating Station has a 230 kV AC transmission line traversing to the Henday Converter Station and a 500 kV DC transmission line from the converter station to the Radisson

Converter Station. The Long Spruce Generating Station has a 230 kV AC transmission line to the Radisson Converter Station, a 230 kV AC transmission line to the Henday Converter Station and a ±450 kV DC line to the Dorsey Converter Station.

WUSKWATIM TRANSMISSION PROJECT

The operation of the Wuskwatim Generation Project required new transmission lines and substations to connect the new generating station to the existing Manitoba Hydro transmission system (see Map 7A-3).

The new transmission facilities include a 230 kV station at the Wuskwatim Generating Station site. This substation will collect the electricity from the generating station and transform it to a higher voltage for transmission to the existing hydroelectric transmission system. A second switching station (Birchtree Station) is located at the Local Government District of Mystery Lake, just south of the City of Thompson. A 230 kV transmission line connect the Wuskwatim Switching Station to the Birchtree Station. This line was responsible for providing power to the Wuskwatim GS during its construction. Two 230kV transmission lines connect the Wuskwatim and Herblet Lake Stations and one 230 kV transmission line connects Herblet Lake to the existing Ralls Island Station in The Pas.

Currently, construction of all transmission lines, with the exception of the collector lines from the Wuskwatim Generating Station to the Wuskwatim switching station, is now complete. Commissioning is under way and has been completed for the Wuskwatim transmission lines to Herblet Lake, as well as to Birchtree. The Herblet Lake to Ralls Island transmission line commissioning is expected to take place in July, 2012. Construction of the Wuskwatim collector lines is underway and scheduled to be completed in July, 2012.

KEEYASK INFRASTRUCTURE PROJECT

The Keeyask Infrastructure Project (KIP) is located approximately 730 km north (by air) from Winnipeg. KIP consists of the construction of new infrastructure components required to initiate the timely construction of the proposed Keeyask Generation Project, if and when it receives the necessary approvals (see Map 7A-4). KIP received approval under *The Manitoba Environment Act* License No. 2952 dated March 8, 2011 and is currently under construction. Construction consists of a new all-weather gravel access road extending approximately 25 km from Kilometre 174 on PR 280 to the proposed Keeyask Generating Station location at Gull Rapids. It also includes a clear-span bridge structure over Looking Back Creek, site development for a road start-up camp (to accommodate road construction personnel), and construction of the first phase of a main camp.

The corridor width of the road is approximately 100 m with the road being constructed from materials excavated within this corridor. The road will be approximately 1.5 m above existing grade level and will meet Manitoba Infrastructure and Transportation (MIT) standards. One

stream crossing will use a single through-grade culvert at an unnamed tributary. A larger crossing at Looking Back Creek will use a clear span bridge.

The road start-up camp will be located at the approximate intersection of PR 280 and the north access road. A second start-up camp will be located at the bridge crossing at Looking Back Creek to house those involved in the construction of the bridge. The first phase of camp construction will include clearing and grubbing of areas, applying erosion and sediment controls, laying gravel and constructing a pad to allow placement of camp facilities. It is proposed that the Phase I construction activities will be complete by May 2012.

The KIP is estimated to provide 184 person-years of employment over the 3-year period, which began late 2011, with an average of 80 to 126 jobs at one time.

In the event that the Keeyask Generation Project does not proceed in the future, the proposed infrastructure would not be required and would be decommissioned. It is intended that decommissioning would return the environment to the pre-construction conditions to the extent reasonable and practicable. Decommissioning activities would include removal of the roadbed, clear-span bridge, culvert crossing and through-grade drains, and camp buildings and utilities. The roadbed and camp site would be re-graded and re-vegetated. A decommissioning plan would be prepared and submitted to the appropriate regulatory authorities for approval prior to implementation. Public notification of decommissioning and associated activities would also take place.

PR 280 UPGRADES

PR 280 is a provincial road classified as a Secondary Arterial with an Average Annual Daily Traffic (AADT) volume of 130 to 186 vehicles per day. PR 280 (Map 7A-5) was built on rolling terrain with a road width of 9.8 m between PR 391 and Split Lake and a width of 7.3 m between Split Lake and the proposed Keeyask North Access Road.

Manitoba Hydro engaged Dillon Consulting Limited to perform a safety analysis on PR 280 and the potential impact of additional traffic on the roadway related to construction of the proposed Keeyask Generating Station. The finding was that PR 280 did not meet current Manitoba Infrastructure and Transportation (MIT) standards for alignment and cross section guidelines and that safety improvements should be considered prior to the construction of the generating station.

Manitoba Hydro and MIT signed a Memo of Understanding (MOU) in 2010 that MIT would provide the design specifications, construction standards, obtain all permits and environmental licenses, secure necessary right-of way and associated legal surveys while Manitoba Hydro would provide the planning, detailed design and construction management of the road upgrades. Manitoba Hydro and MIT also agreed to split the project costs 50/50.

Required upgrades to PR 280 were identified in 45 locations between PR 391 and the proposed Keeyask North Access Road by both Manitoba Hydro and MIT. Improvements

included correcting excessive roadway gradients, sub-standard roadway widths and deficient crest and sag curves.

The upgrades were broken into two components:

- Crushing & stockpiling road aggregates and rock cuts; and
- Re-grading, re-aligning and re-surfacing.

The work was awarded as a Direct Negotiated Contract (DNC) to Amisk Construction Ltd., a joint venture between the Cree Nation Partners (CNP) and Sigfusson Northern Ltd. Crushing and stockpiling road aggregates and rock cuts began in 2010 and the re-grading, re-aligning and re-surfacing contract will be awarded in 2012. The total estimated cost of the upgrades is $28 million.

MINING ACTIVITIES

Mining has played an important role in the development of some parts of the north and the mineral industry is Manitoba's second largest primary resource industry. Manitoba mines produce base and precious metals, such as nickel, copper, zinc and gold; specialty minerals like lithium, cesium and tantalum; and industrial minerals such as dolomite, spodumene, silver, gypsum, salt, granite, limestone, peat, lime, sand and gravel (Manitoba Minerals 2012).

The mineral industry was the primary reason for the development of the City of Thompson and Vale currently has a large nickel mine complex a few kilometres northeast of the city. Exploration is prevalent in the area and although there are no operating mines within the Local Study Area, there are several mining claims to the north of Split Lake. Manitoba Hydro has applied for a number of quarry leases along the proposed right of way for the north and south access roads.

An exploration license has been granted approximately 10 km NE of the Project Footprint on the north shore of Stephens Lake. In February 2008 a Mineral Exploration License for a 12,341 hectare area on the north side of Stephens Lake was granted to Exploratus Ltd. to conduct exploration in the area. Exploratus Ltd. primarily explores for gold, nickel, platinum and base metals (Business Week 2010; Credit Risk Monitor 2010). There has been no indication of any major discoveries (however, it is possible that, for business purposes such information may not be publicly disclosed). The anniversary date for the exploration license is February 2013.

COMMERCIAL FISHING

Commercial fishing in the Split Lake RMA began in the late 1950s and early 1960s. The early fishery primarily focused on lake whitefish and secondarily on pickerel (walleye) and jackfish (northern pike). Most of the production was from remote inland lakes that were fished predominantly in winter. By the late 1960s, the fisheries were converted to summer

operations by using air transport to bring the fish to market. Split Lake has remained predominantly a summer fishery since the mid-1950s.

Increasing air transportation costs in the 1980s and 1990s led to a decline in the regional commercial fishery. The number of lakes fished decreased from 23 in the 1960s to just three in recent years.

Split Lake, Assean Lake, and Stephens Lake have been the only active commercial fisheries in the SLRMA since 1997. The Split Lake fishery accounted for over 96% of the fish production and value in the SLRMA between 1997 and 2008 (see Resource Use Section 1.3 of the SE SV). Split Lake has a 59,000 kg (129,800 lbs) round weight quota for pickerel, whitefish, northern pike, sauger and goldeye (see Resource Use Section 1.3 of the SE SV). Assean Lake has a 4,600 (10,120 lbs) quota for pickerel and jackfish. The Stephens Lake fishery operates under a special license for pickerel (no more than 500 lbs/day for 10 weeks annually). Current catches are regulated by Manitoba Conservation and Water Stewardship and are expected to be sustainable.

Commercial fishing for lake sturgeon in Manitoba gradually crept north along the shores of Lake Winnipeg during the late 1890s as various forms of transportation became available. Stimulated by high prices, lake sturgeon harvest reached the upper Nelson River area (in the vicinity of Sipiwesk Lake) in the early 1900s. Declining stocks in Lake Winnipeg prompted a province wide closure of the lake sturgeon fishery in 1911. When it reopened in 1916, the same year the HBC railway reached Gillam, lake sturgeon fishing was expanded farther down the Nelson River. Total production records are incomplete but prior to a 1931 closure, the estimated total harvest from the upper[1] and lower Nelson River reaches was 600,000 kg or 1.3 million pounds from which lake sturgeon populations have never recovered (see Resource Use Section 1.3 of the SE SV for sources and references). The commercial lake sturgeon fishery on the Nelson River was reopened for three additional periods (1937-1946, 1953-1960 and from 1970-1992 with a much reduced quota) each time requiring closure due to declining catches. Prior to 1970, lake sturgeon harvest records reported catch for both the upper and lower Nelson River reaches together after which five management zones were established. Zone 4 (Project area) harvest records from 1970-1987 indicated approximately 250-500 lake sturgeon may have been commercially harvested during this period (see AE SV Section 6.3). Interviews with resource users suggested that the actual catch may have been higher. The commercial lake sturgeon fishery was closed permanently in 1992.

Due to historic declines and concerns about a continuing decline in population numbers, COSEWIC designated lake sturgeon in the Nelson River as endangered, and this species is currently being considered for listing under the *Species at Risk Act* (*SARA*).

[1] At least 80% of the lake sturgeon production from the Nelson River was taken from a 160 km stretch of the river in the vicinity of Sipiwesk Lake upstream of the Kettle GS. This area is referred to as the upper Nelson River. The lower Nelson River refers to the Nelson River reaches downstream of the Kelsey GS to Hudson Bay.

Commercial lake sturgeon fishing also occurred on the Churchill River (near the mouth of the Little Churchill River) and intermittently on the Fox and Bigstone rivers which also are now closed.

COMMERCIAL FORESTRY

The forest industry has played an important part in the development of portions of northern Manitoba. As the industry modernized and mill capacities were increased at The Pas in the 1960's and 1980's, the Forest Management License (FML) #2 was also increased to include portions of the Nelson River Forest Section (NRFS), including Forest Management Units (FMU) 85, 87 and 89. These three FMUs overlap the western extremity of the Terrestrial Environment Regional Study Area.

As these areas are furthest away from the processing facilities at The Pas, past harvesting activities have been limited to the very south-western periphery of the Terrestrial Environment Regional Study Area. The global recession has hit the Manitoba forest industry particularly slowing harvest rates by up to 40% in FML #2 and forcing the shutdown of the sawmill at The Pas in 2009. This has resulted in a virtual stoppage of harvesting activities within the NRFS, that being a primary supply of sawlog material (Hunt *pers. comm.*, 2012).

If and when the forest industry recovers and the sawmill is re-started at The Pas, logging activities could resume in FMUs 85, 87 and possibly 89, however these areas remain the most distant from the processing facilities and are therefore among the least likely areas to be re-activated.

KELSEY RE-RUNNERING

The Kelsey Generating Station was designed and built in late 1950s primarily to serve INCO load. While the full generating potential based on the site and Nelson River flows was roughly 450MW, only a 7-unit 224 MW generating station was required to meet the design requirements for the INCO load. Consequently, the plant had historically operated at a relatively high capacity factor of 89% and spilled roughly 70% of the time.

Manitoba Hydro has considered a variety of expansion options to develop additional capacity at Kelsey over the past 30 years, including expansion of the powerhouse or replacement of the existing turbine runners with higher capacity turbines. The most attractive option from an economic perspective was re-runnering. In 2003, the Kelsey Re-runnering Project was approved in the capital plan, justified on the basis of required equipment overhauls to major mechanical and electrical components of the existing units in order to sustain reliable operation of the plant and minimize forced outages.

The Kelsey Re-Runnering Project would increase power production from Kelsey G.S. by adding up to 77 MW of capacity and 350 to 400 Gwh of average annual system energy production primarily through the increase of discharge capability of the generating station.

The increase in discharge capability captures the benefit from river flow that was previously spilled reducing the frequency of spill from 70% down to 35%, with all seven units re-runnered.

To date, five out of seven units have been completely overhauled with a sixth to be completed in Fall of 2012.

FUTURE PROJECTS AND ACTIVITIES

BIPOLE III

The proposed Bipole III and Keewatinoow Converter Station Project consists of building a new HVDC transmission line corridor from the new Keewatinoow converter station (northeast of Gillam) to the Riel Station located east of Winnipeg in order to increase system reliability and dependability. It includes two converter stations, two ground electrodes and transmission lines (see Map 7A-6). The system will be less vulnerable to power outages due to severe weather, fires or other unforeseen events with a second transmission corridor on the west side of the province, separate from Bipole I and II that run through the center of the province, and with a second converter station located in southern Manitoba.

The Bipole III Project includes 500-kilovolt HVDC transmission line with a total length of 1,384 km from north to south. A 66m right-of-way will be developed for the transmission line with average tower spacing approximately 480m, with a total of 3 to 4 steel towers per mile. Self-supporting towers will be used in agricultural areas to reduce agricultural operation effects. Guyed towers will be constructed in forested areas and areas compatible with this type of tower.

The Keewatinoow converter station is located approximately 63 km northeast of Gilliam and 268 km northeast of Thompson. The southern converter station is located at the Riel Station site east of Winnipeg. The Keewatinoow converter station will convert AC power to DC power for transmission, as DC power is more efficient over long distances. The Riel converter station will invert the DC power back to AC power for end use. One ground electrode will be located near each converter station.

Several 230 kV transmission line interconnections will be added to tie the new northern converter station to the existing northern AC system.

Construction of Bipole III and the converter stations are expected to create numerous employment and economic opportunities. The construction workforce at peak construction on the transmission line will be 700-900 employees for approximately 1,200 person years and 500-700 employees for both converter stations for approximately 1,600 person years. Construction contracts will give preference to local, Aboriginal and Manitoba businesses. Employment and on-the-job training will be encouraged for locals, Aboriginals and Manitobans.

On December 1, 2011 an Environmental Impact Statement (EIS) for Bipole III and the Keewatinoow Converter Station was submitted to Manitoba Conservation. Comments and public hearings will be held by the Manitoba Clean Environment Commission. Assuming regulatory approval, the project is anticipated to start construction in 2013 and in-service by 2017.

KEEYASK TRANSMISSION PROJECT

The proposed Keeyask Transmission Project will include the construction and operation of transmission facilities to transport electrical energy from the proposed Keeyask Generating Station into the Manitoba Hydro northern collector system (see Map 7A-7 and Map 7A-8). Completion of the Project is currently anticipated for early 2020.

The Project consists of two main components:

- 138 kV Construction Power transmission lines and a transformer station at the Generating Station site; and
- Generation Outlet Transmission, Keeyask Switching Station and upgrades to the existing Radisson converter station.

This Project involves constructing a 21-km, single-circuit, 138-kV, steel-lattice transmission line to connect the proposed Keeyask Generating Station site construction power transformer station, located on the north side of the Nelson River, with the existing Manitoba Hydro 138 kV transmission line KN 36 in order to provide construction power for the development of the generating station.

A single-circuit, 138 kV transmission line (about 41 km) will be advanced from the Radisson Converter Station to the Keeyask Construction Power transformer station site, as a source of backup power to the construction power source.

The Project will also involve developing four 138-kV unit lines from the Keeyask Generating Station to the proposed Keeyask Switching Station (approximately 4 km.), and two additional 138 kV lines from the proposed Keeyask Switching Station, to the Radisson Transformer Station which will tie the Keeyask Generating Station site into the northern collector system. These three 138-kV transmission lines are known, collectively as the Generation Outlet Transmission lines. Project completion is currently planned for early 2020.

Once the Keeyask Generating Station is commissioned, a portion of the proposed Keeyask Construction Power transformer station and the 138 kV transmission line from KN 36 will remain in place to provide emergency power for a "black start" of the Keeyask GS. A portion of the Construction Power transformer station will be salvaged.

It is expected that the Keeyask Transmission Project will involve a regulatory review under *The Manitoba Environment Act* starting in the fall of 2012.

CONAWAPA GENERATING STATION

The potential Conawapa Generating Station will be the largest hydro-electric project built on the Nelson River in northern Manitoba. The project will be located on the Lower Nelson River approximately 30 km downstream from the Limestone Generating Station and 90 km northeast of the town of Gillam in the Fox Lake Resource Management Area (see Map 7A-1).The Conawapa site is located at a narrow section of the Nelson River, 670m wide, near Horseshoe Bay. The river bottom is limestone and rises up to create a shelf. The river banks are approximately 50m high and fairly steep at this location, the nearly 30 km forebay and reservoir will be most contained within the natural river banks, limiting the net flooded area to about 5 km^2. The difference in water levels between the forebay and downstream of the generating station will be 30 to 31 m. During construction, structures will need to be recessed into the north bank to accommodate the river diversion requirements.

The Conawapa Generating Station will have ten turbine generators. The generating station powerhouse will be approximately 70 m wide and 310 m long and will be designed for a water flow of 5,000 to 5,500 m^3 per second. Water flow will be controlled by wicket gates during normal operation and vertical lift gates in the intake for maintenance and/or emergency situations. A seven-bay concrete overflow spillway will be used during construction and high flow conditions after the project is completed. The spillway will be approximately 120 m wide and 115 m long with each gate measuring at 13 m wide and 17 m high.

Construction is expected to take approximately 8 to 8.5 years once regulatory approvals and licenses are received with the earliest potential in-service start date in 2025. Approximately, 840,000 m^3 of concrete, 186,000 tonnes of cement and 40,000 tonnes of reinforcing steel will be required to construct the Conawapa Generating Station structures. Approximately 13,000 person years of direct and indirect employment is expected to be generated during construction.

Once in-service, the Conawapa Generating station is expected to produce 1485-megawatts, enough power to service 700,000 homes.

GILLAM REDEVELOPMENT

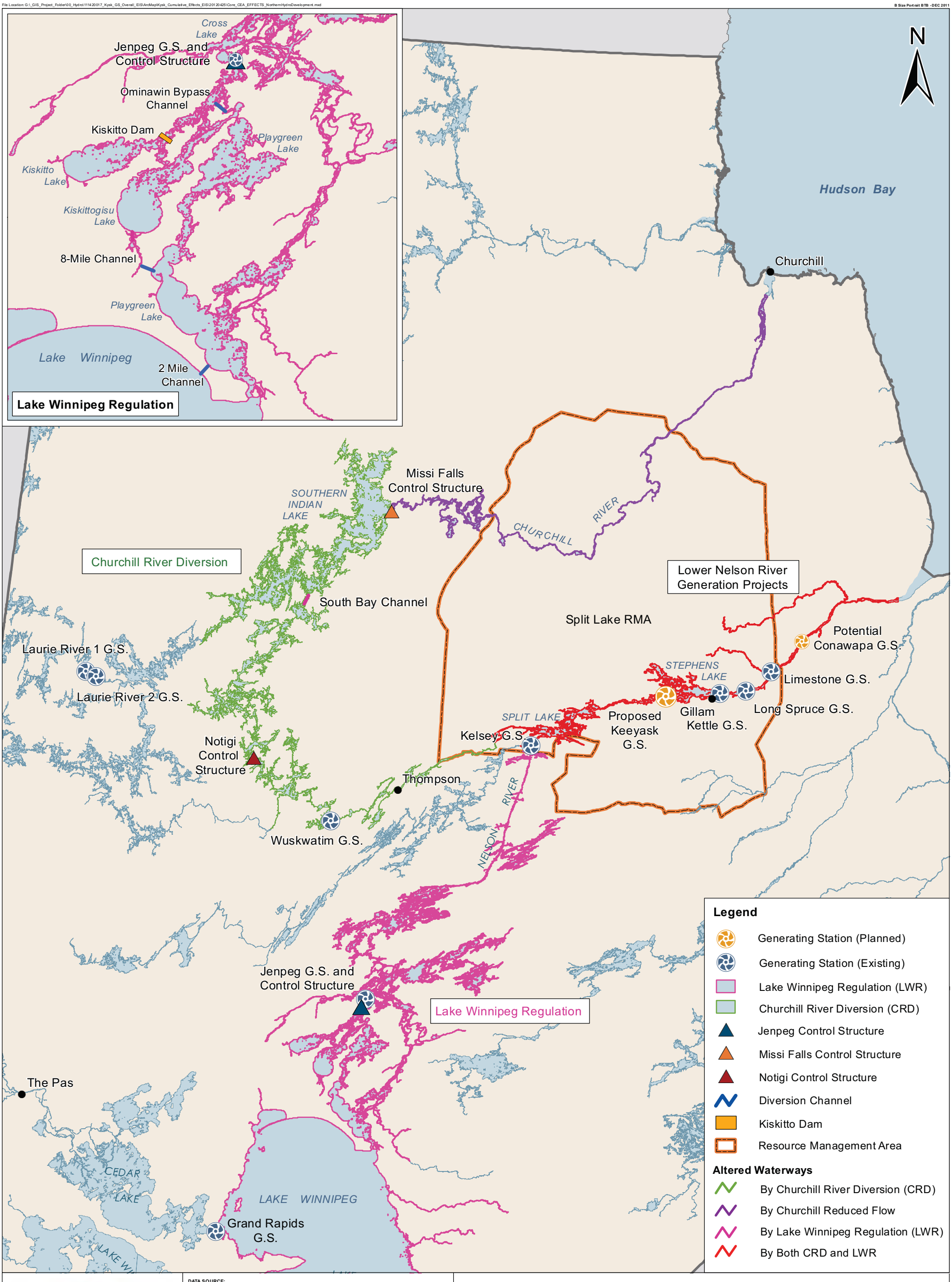
The mandate of the Gillam Redevelopment & Expansion Program is to repair existing 1970's infrastructure and build new infrastructure in anticipation of additional staffing required for northern projects. The infrastructure development under the Gillam Redevelopment & Expansion Program will recognize Gillam's future as an increasingly important northern hub for Manitoba Hydro. The Gillam Redevelopment & Expansion Program will focus on renovating and expanding Gillam incorporating qualities of permanence and durability to match the northern generating stations.

The Gillam Redevelopment & Expansion Program consists of numerous housing and infrastructure projects needed to accommodate the anticipated increase of Gillam's population as a result of expected new northern Project operational staff and their families. Population increase will also come from general town growth and from FLCN Members returning home to their traditional territory. It is estimated that Gillam will experience increasing population growth over the next 10 to 15 years.

The program may be deployed in phases to ensure that Gillam Redevelopment and Expansion proceeds in areas of priority, matches available funds and is coordinated with other major Project schedules.

File Location: G:_GIS_Project_Folder\00_Hydro\111420017_Kysk_GS_Overall_EIS\ArcMap\Kysk_Cumulative_Effects_EIS\20120425\Core_CEA_EFFECTS_NorthernHydroDevelopment.mxd

B Size Portrait BTB - DEC 2011



KEEYASK Hydropower Limited Partnership

DATA SOURCE: Manitoba Hydro, Province of Manitoba

CREATED BY: Stantec Consulting Ltd.

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	17-FEB-12	14-MAY-12
0 25 50 Kilometres / 0 20 40 Miles	VERSION NO: 1.0	QA/QC: APPROVED

Hydro Development in Northern Manitoba

Map 7A-1

Keeyask Proposed G.S.

N

Birchtree-Wuskwatim 230 kV Transmission Line

Thompson

Wuskwatim G.S.

Wuskwatim-Herblet Lake 230 kV Transmission Lines

Flin Flon

Snow Lake

Rall's Island-Herblet Lake 230 kV Transmission Line

Cormorant

The Pas

KEEYASK Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro, Government of Canada

CREATED BY:
Stantec Consulting

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	15-FEB-12	27-APR-12
0 10 20 Kilometres 0 10 20 Miles	VERSION NO: 1.0	QA/QC: APPROVED

Legend

- Generating Station (Planned)
- Generating Station (Existing)
- Community

Transmission Line (Existing)

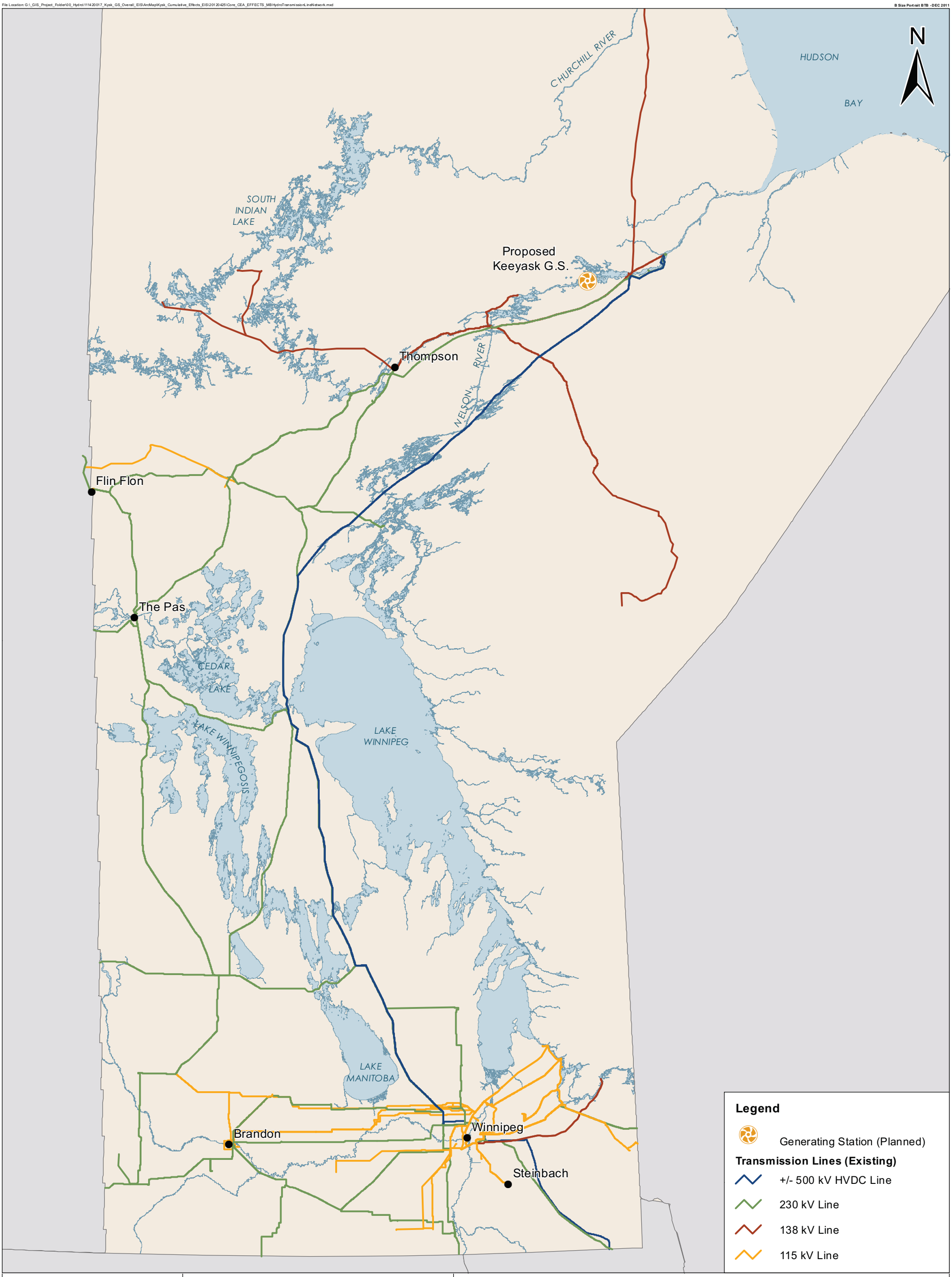
- +/- 500 kV HVDC Line
- 230 kV Line
- 138 kV Line
- 115 Line

Wuskwatim Transmission Project

Map 7A-2

File Location: G:_GIS_Project_Folder\00_Hydro\111420017_Kysk_GS_Overall_EIS\ArcMap\Kysk_Cumulative_Effects_EIS\20120425\Core_CEA_EFFECTS_MBHydroTransmissionLineNetwork.mxd

B Size Portrait BTB - DEC 2011



KEEYASK
Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro, NTS (Government of Manitoba)

CREATED BY:
Stantec Consultants

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z14N	15-JAN-10	19-JUN-12
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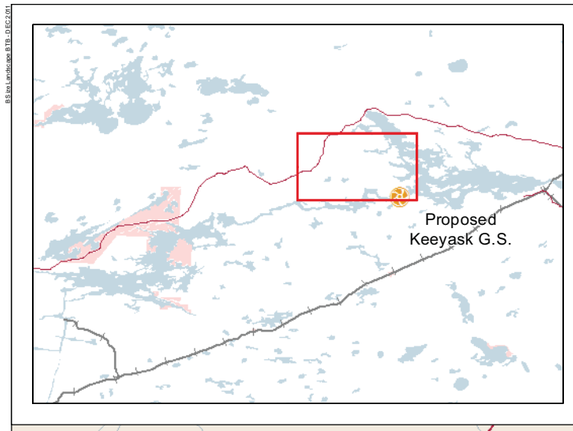
Manitoba Hydro
Transmission Line Network

Map 7A-3



KEEYASK
Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro, Government of Canada, Stantec Consulting Ltd., ECOSTEM Ltd.

CREATED BY:
Stantec Consulting Ltd.

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	13-FEB-12	27-APR-12
0 0.85 1.7 Kilometres / 0 0.7 1.4 Miles	VERSION NO: 1.0	QA/QC: APPROVED

Legend

- Stream Crossing
- Local Study Area

Project Footprint Components

- Road
- Start-Up Camp Footprint
- Main Camp and Other Infrastructure
- Borrow Area
- Main Camp Wells and Access

Keeyask Infrastructure Project Site

Map 7A-4

N

Proposed Keeyask G.S.

Proposed Access Road

Tataskweyak Cree Nation
Tataskweyak (Split Lake)

York Factory First Nation
York Landing (Kawechiwasik)

War Lake First Nation
Ilford

280

391

633

PR 280

DATA SOURCE:
Manitoba Hydro, Government of Manitoba

CREATED BY:
Stantec Consulting Ltd.

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	15-FEB-12	30-MAY-12
0 5.5 11 Kilometres / 0 5 10 Miles	VERSION NO: 1.0	QA/QC: APPROVED

KEEYASK
Hydropower Limited Partnership

Legend

- Generating Station (Planned)
- First Nation Community
- First Nation Reserve
- PR 280 Upgrade Segment

Provincial Road 280 Upgrade

Map 7A-5

File Location: G:_GIS_Project_Folder\00_Hydro\111420017_Kysk_GS_Overall_EIS\ArcMap\Kysk_Cumulative_Effects_EIS\20120425\Core_CEA_EFFECTS_BipoleIIITransmissionProject.mxd

B Size Portrait BTB - DEC 2011

N

Keewatinoow Converter Station

Fox Lake Cree Nation
Fox Lake (Bird)

Henday Converter Station

Waskaiowaka Lake

Bipole III Transmission Line (Final Preferred Route)

Proposed Keeyask G.S.

Stephens Lake

Fox Lake Cree Nation
A Kwis Ki Mahka Reserve

Gillam

Radisson Converter Station

Tataskweyak Cree Nation
Tataskweyak (Split Lake)

Split Lake

York Factory First Nation
York Landing (Kawechiwasik)

War Lake First Nation
Ilford

Nelson River

Burntwood River

280

Utik Lake

Bear Lake

Knee Lake

Legend

- Bipole III Transmission Line (Final Preferred Route)
- Converter Station (Proposed)
- Converter Station (Existing)
- Generating Station (Planned)
- Generating Station (Existing)
- Community
- First Nation Community
- Road
- Active Railway
- Abandoned Railway
- First Nation Reserve
- Waterbody

KEEYASK Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro, NTS (Government of Manitoba)

CREATED BY:
Stantec Consultants

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	15-FEB-12	30-MAY-12
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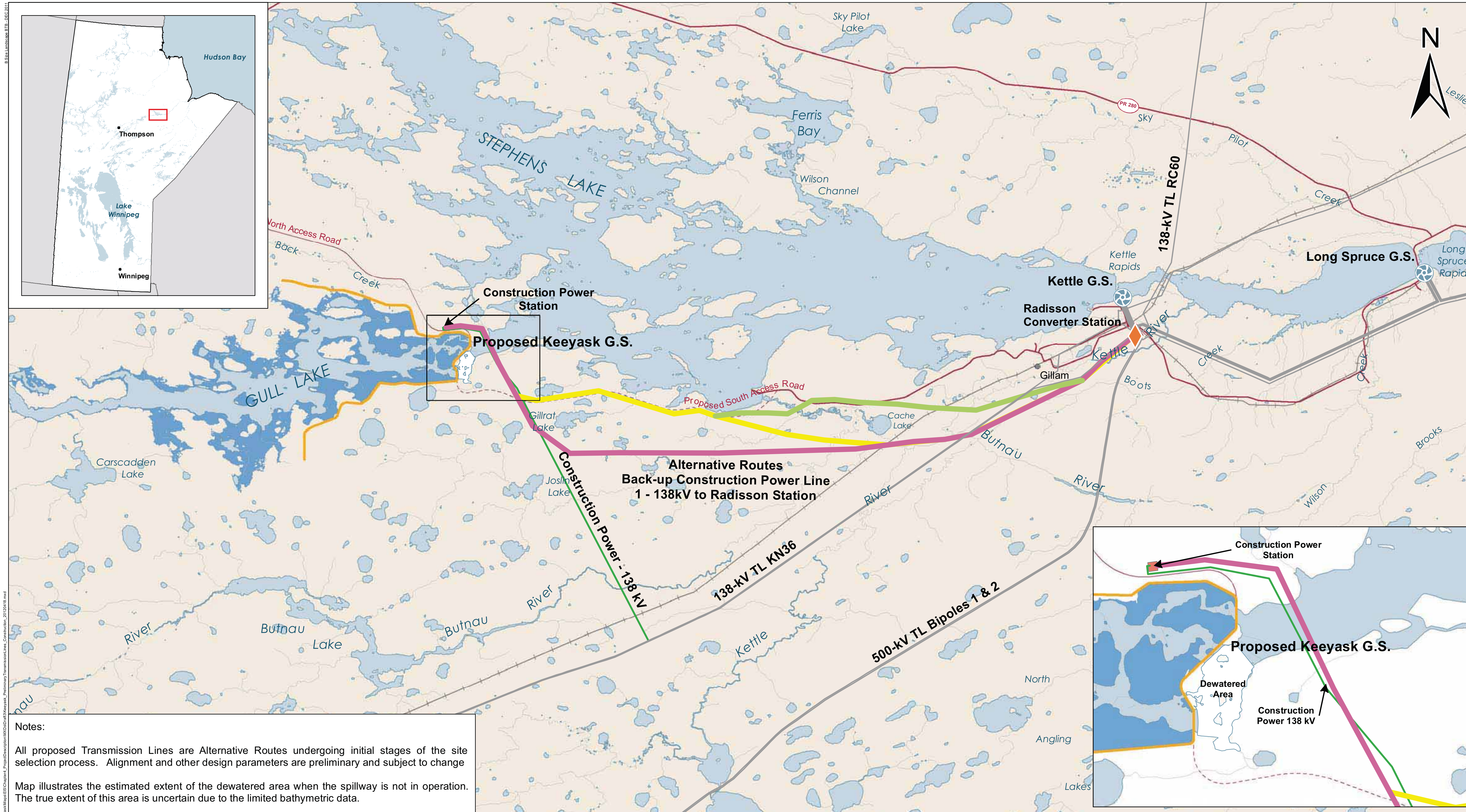
Northern Extents of Bipole III Transmission Project

Map 7A-6



Notes:

All proposed Transmission Lines are Alternative Routes undergoing initial stages of the site selection process. Alignment and other design parameters are preliminary and subject to change

Map illustrates the estimated extent of the dewatered area when the spillway is not in operation. The true extent of this area is uncertain due to the limited bathymetric data.

KEEYASK Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada; Manitoba Hydro - Transmission; Manitoba Hydro - Water Resource Engineering (PP_95perc_4327_159_shore_rev5)

CREATED BY:
Manitoba Hydro - Hydro Power Planning - GIS & Special Studies

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	13-FEB-12	24-APR-12
0 — 2.5 — 5 Kilometres; 0 — 1 — 2 Miles	VERSION NO: 2.0	QA/QC: APPROVED

Legend

- Transmission Line (Existing)
- Construction Power Line (Proposed)

Back-up Construction Power Transmission Line

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Generating Station (Existing)
- Converter Station (Existing)
- Keeyask Principal Structures
- Transmission Substation (Proposed)
- Dewatered Area
- Initial Flooded Area (159 m)
- Exisiting Water Level
- Highway
- Access Road
- Proposed Access Road

Keeyask Construction Power Project

Preliminary Transmission Corridors During Construction

Map 7A-7