CAC Exhibit #77
Transcript Page #9336

Undertaking 129: CAC to file the report in which Dr. Gunn relies upon for the suggestion that there has been evidence presented by the KHLP suggesting that the region has already been substantially altered.

Response: The complete report of Dr. Noble and Dr. Gunn has been provided. In order to show that the statements made on pages 15 to 17 of the Report have been accurately reflected, the pages from the Keeyask EIS from where the quotations originate have been included, as set out below.

Tab	Document
1	Bram Noble and Jill Gunn, *Review of KHLP's Approach to the Keeyask Generation Project: Cumulative Effects Assessment*, November 5, 2013 **Note: p. 15-17**
2	KHLP, *Keeyask Generation Project: Response to EIS Guidelines: Chapter 6: Environmental Effects Assessment*, June 2012 p. 6-7, 6-12, 6-13, 6-20, 6-54
3	KHLP, *Keeyask Generation Project: Response to EIS Guidelines: Chapter 7: Cumulative Effects Assessment*, June 2012 p. 7-4, 7-16, 7-23, 7-24, 7-31, 7-32, 7-37

TAB 1

Review of KHLP's approach to the Keeyask Generation Project Cumulative Effects Assessment

Prepared for the Public Interest Law Centre, Winnipeg, Manitoba

November 5, 2013

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[1] The views presented in this report are those of the authors and not of the University of Saskatchewan.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Scope and objectives

This report presents our review of the Cumulative Effects Assessment (CEA) prepared as part of the Keeyask Generation Project (Keeyask Project) Environmental Impact Statement (EIS). Our review is focused on Keeyask Hydropower Limited Partnership's (KHLP) overall approach to the CEA, specifically the soundness of the CEA methodology. Cumulative effects assessment methodology typically unfolds in four stages: scoping, retrospective analysis (i.e. looking from the past to the present), prospective analysis (i.e. looking to the future), and management of significant adverse cumulative effects. We examine KHLP's assessment practices related to each of these stages to identify what was done well and where improvements could be made. We do *not* address whether the Keeyask Project will cause cumulative effects on Valued Ecosystem Components (VECs), nor render judgment on whether any such effects are significant given past, present or future VEC conditions.

The objectives of the review, as set forth by the Public Interest Law Centre, Manitoba, are to:

- explain the role of CEA in environmental impact assessment practice;
- examine whether the CEA provided by KHLP meets a reasonable standard of practice; and
- provide any recommendations that might assist the Manitoba Clean Environment Commission (CEC).

In undertaking our review, we adopted standards appropriate to the evaluation of CEA practice within the context of single project development. As such, our review is based on what can reasonably be expected of a proponent, in this case the KHLP, within the confines of the proposed Keeyask Project. That being said, by definition, cumulative environmental effects are of a scope and nature that requires proponents to adopt a broad view of the project's environment and of the project's potential effects and interactions with other past, present and future developments. Our expectations of a reasonable standard of practice for CEA in a project setting reflect this view.

Our review of the KHLP's CEA for the Keeyask Project is also considerate of the CEC's (2013) recommendation emerging from its report on the Bipole III project, that:

> "Manitoba Hydro, in cooperation with the Manitoba Government, conduct a Regional Cumulative Effects Assessment for all Manitoba Hydro projects and associated infrastructure in the Nelson River sub-watershed; and that this be undertaken prior to the licensing of any additional projects in the Nelson River sub watershed after the Bipole III

Project" (p. 126).

In our view, undertaking a regional CEA in the Nelson River sub-watershed that considers the potential cumulative effects of all Manitoba Hydro projects and associated infrastructure is a prerequisite to effective CEA, and to understanding and managing the potential cumulative effects of hydroelectric development in the region. The 50-plus year history of incremental hydro development on the Nelson River unquestionably warrants it.

Interestingly, some of the limitations to the Keeyask Project CEA identified in the EIS are attributed to inadequacies in the Bipole III EIS. For example, several times in the Keeyask Supporting Volumes (SV), the lack of information available concerning the potential effects of the Bipole III project on certain VECs is noted as problematic. But, both the Keeyask and Bipole III projects are Manitoba Hydro projects, and both have been preceded by numerous other Manitoba Hydro projects in the region. The lack of connection from one project to the next suggests that the incremental, cumulative effects of development are likely being missed, and underscores the need for regional CEA. That being said, neither the presence nor absence of regional CEA is a valid excuse for any proponent not to conduct a 'good' CEA for their project.

1.2 Qualifications of the authors

The authors have both academic and professional practice experience in environmental assessment, including the assessment of cumulative effects. Bram Noble, PhD, is a Professor of environmental assessment at the University of Saskatchewan. Bram has served in a number of environmental assessment consulting and advisory roles for government and industry, including: Alberta Environment; Canadian Environmental Assessment Agency; Environment Canada; Fisheries and Oceans Canada; Major Projects Management Office; Aboriginal Affairs and Northern Development Canada; Stantec; Rath and Company; Teck Coal; and Nalcor Energy. Bram is author of Canada's leading textbook on environmental assessment, *Environmental Impact Assessment: A Guide to Principles and Practice*, and co-author of the Canadian Council of Ministers of the Environment's guidance on regional-strategic environmental assessment. Since 2000, Bram has published over 50 peer reviewed scientific papers on environmental assessment; 12 book chapters; and more than 100 technical reports and presentations. He is an editorial board member of *Impact Assessment and Project Appraisal*, journal of the International Association for Impact Assessment, *Environmental Impact Assessment Review*, and associate editor of the *Journal of Environmental Assessment Policy and Management*. In 2012, Bram co-authored the report *Critical Review of the Cumulative Effects Assessment Undertaken by Manitoba Hydro for the Bipole III Project* with Jill Gunn, commissioned by the Public Interest Law Center of Manitoba.

Jill Gunn, PhD, MCIP, RPP, is an Assistant Professor at the University of Saskatchewan. From 1997-2003 Jill was a consultant to British Columbia Hydro on integrated resource management for electric utility transmission rights-of-way in the northern half of British Columbia, including non-integrated generation sites. Her work focused on documenting a decade-long informal program to address a wide variety of environmental, social, and economic management imperatives through innovative, site-specific vegetation management strategies. Jill completed a PhD specializing in strategic and cumulative effects assessment in 2009. Her academic contributions regularly appear in internationally regarded periodicals such *Impact Assessment and Project Appraisal*, the *Journal of Environmental Assessment Policy and Management*, and the *Journal of Environmental Planning and Management*. Since her appointment in 2009, she has published 14 peer reviewed scientific papers, book chapters and reports on environmental assessment and given more than 20 presentations. Jill co-authored the Canadian Council of Ministers of the Environment guidance on regional-strategic environmental assessment, which served as a basis for the Alberta government's innovative Land-use Framework. She has also provided expert advice to a range of other organizations including the Public Interest Law Center of Manitoba; Pape, Salter and Teillet Barristers and Solicitors; the Canadian Environmental Assessment Agency; Fisheries and Oceans Canada; Alberta Environment; the Canadian International Development Agency; the Canadian Institute of Planners; and the City of Saskatoon. Jill co-authored the report *Critical Review of the Cumulative Effects Assessment Undertaken by Manitoba Hydro for the Bipole III Project* with Bram Noble in 2012.

1.3 Report format

The report is presented in four sections, including the Introduction. In Section 2, we provide a brief overview of cumulative effects so as to ensure that the reader is familiar with the concept of cumulative effects and the importance and role of CEA in assessing the significance of the proposed Keeyask project. We explain in Section 3 how we approached our review of the Keeyask CEA and the documents consulted. A synthesis of our findings is presented in Section 4; including observations about the significance of the Keeyask project in a region that has already been substantially altered by hydroelectric and other project developments. The detailed results of our methodological review are included in an Appendix to this report.

2.0 CUMULATIVE ENVIRONMENTAL EFFECTS

2.1 What are cumulative effects?

Cumulative environmental effects are changes to the environment that are caused by an action in combination with other past, present and future actions (Hegmann et al. 1999). The Keeyask Project

EIS adopts a very similar definition:

> "...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..." (p. 7-1).

A cumulative environmental effect is based on the understanding that each individual disturbance or impact, regardless of its magnitude, can represent a high marginal cost to the environment. Describing the loss of wetlands along the east coast of the United States between 1950 and 1970, for example, Odum (1982: 728) explains:

> "No one purposely planned to destroy almost 50% of the existing marshland along the coasts of Connecticut and Massachusetts...However, through hundreds of little decisions and the conversion of hundreds of small tracts of marshland, a major decision in favour of extensive wetlands conversion was made without ever addressing the issue directly".

In other words, cumulative environmental effects are often the culmination of effects that occur through many, sometime small-scale, activities such as habitat loss due to linear disturbances (e.g., pipelines, seismic lines, river crossings), the degradation of wetlands in a region, multiple water impoundments or diversions, or the incremental withdrawal of water from a river system (Noble 2010).

Cumulative effects are often described as 'progressive nibbling', 'death by a thousand cuts' and the 'tyranny of small decisions'. 'Progressive nibbling' refers to the often-insidious process of land conversion and/or environmental degradation that occurs slowly over time and typically in the absence of a regional perspective on development. 'Death by a thousand cuts' refers to the phenomenon whereby small, but repetitive, insults to the same environmental component occur over and over and eventually, but often unexpectedly, cause its 'death' or total demise. The 'tyranny of small decisions', a concept originally introduced by economist Alfred Kahn in the 1960s, helps explain how both of these phenomena can occur simultaneously: it is a situation in which a number of separate decisions cumulatively, and often unintentionally, result in a condition that is neither optimal nor desirable.

Fundamental to managing cumulative effects is thus recognizing that a significant adverse effect can result over time due to the culmination of seemingly small and insignificant actions. The US Council on Environmental Quality (1996), for example, notes that the most devastating environmental effects may result from the combination of individually minor effects of multiple actions over time. Similarly, the BC Forest Practices Board (2011: 4) explains:

> "...a series of individually insignificant effects can accumulate to result in a significant overall effect. For example, each water license on a stream may only withdraw a small amount of water, but a large number of small licenses may withdraw enough water to negatively affect fish habitat near the mouth of the stream."

As such, the assessment of cumulative effects must always be approached from the perspective of the receiving environment – i.e., the affected environmental component(s) or systems.

2.2 Cumulative effects assessment

Cumulative effects assessment is focused on the condition of environmental receptors (and nature and quality of relationships among them) and whether the total effects via all stressors in the project's regional environment are acceptable, including the potential additional stress caused by the proposed project.

The CEA for the Keeyask Project was conducted based on guidance provided in:

- the EIS guidelines;
- the *Cumulative Effects Assessment Practitioner's Guide* (Hegmann et al. 1999); and
- the Canadian Environmental Assessment Agency CEA Operational Policy Statement (OPS) 2007.

The EIS states that:

> "The CEA for the project determines the extent to which the Project is expected to be incrementally responsible for adversely affecting a Valued Ecosystem 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)."

This is consistent with our understanding of the general approach to good CEA in a project-based context. It is also the expected industry standard for CEA, as described in federal guidance (see Hegmann et al. 1999), and is echoed the scientific literature (see Ross 1994; Smit and Spaling 1995; Baxter et al. 2001; Duinker and Greig 2006; Canter and Ross 2010).

The importance of CEA to good environmental assessment cannot be understated: the significance of any individual project or action cannot be understood in the absence of an assessment of the total effects of development pressures on the environmental components of concern. For example, if there is concern for the survival of a particular wildlife species (or population), such as caribou, then understanding the total effects of development pressures in the region on caribou habitat is a prerequisite to determining whether the effects of one more additional project would pose unacceptable risk to the caribou population or result in undesirable habitat change.

In the context of river systems, cumulative effects can result from changes to watershed processes caused by multiple anthropogenic disturbances (Reid 1998). Almost all land use activities in a watershed directly alter environmental parameters, including soil, topography, and vegetation, which, in turn, modify the transport of water, organic matter, pollutants and sediments that accumulate in river systems (Johnson et al. 1997; Schindler 2001). As such, the health of a river system is largely a function of the types of interactions and processes that occur both in-stream and on the landscape within the boundary of the watershed (Seitz et al. 2011). Understanding the significance of the effects of any single project development, such as the effects of a hydroelectric project, requires an understanding of the total effects of other human activities and natural processes that occur within the watershed, such as forestry, mining, linear features, water withdrawal, in-stream and other disturbances to aquatic and terrestrial habitat (see Xian et al. 2007; Scrimgeour et al. 2008; Kelly et al. 2010).

Although it is not always reasonable to expect a single project proponent to accurately predict, or manage, the total future development pressures of other projects and disturbances in the project's regional environment (Hegmann et al. 1999), it is reasonable to expect that a project proponent adopts a sound CEA methodology that analyzes environmental trends and is inclusive of the proponent's own history, and future, of regional development activity.

2.3 Fundamental components of CEA

There is a variety of guidance available for CEA (e.g., Ross 1998; Hegmann et al. 1999; European Commission 1999; Duinker and Greig 2006; Canter and Ross 2010; Noble 2010), all of which identify several necessary components in undertaking CEA. In the absence of any one of these components a CEA is incomplete.

These components are:

a) Cumulative effects scoping, which serves to establish which other projects and actions—past, present, and future—will be included when evaluating a project's contributions to cumulative processes of change. Good CEA adopts ecosystem health and functioning as a core determinant of VEC selection; thus effective CEA must be spatially and temporally bound based on the distribution of the VECs affected by both the project in question and the effects of other projects and disturbances – past, present and future.

b) Retrospective analysis, focused on determining baseline conditions, how conditions have changed over time, whether that change is significant to the sustainability of the environmental components of concern (i.e. threshold determination, setting acceptable limits), and whether and how that change is attributed or connected to past and present development activities. An attempt is made to identify relationships between indicators of change in VEC conditions (e.g. caribou population; water quality indices) and measures of human or natural disturbance so as to determine trends and associations that can be used to predict VEC conditions or responses to future cumulative change.

c) Prospective analysis, centered on quantitative modeling or scenario-based approaches, which serves to assess potential impacts or responses to disturbances in the future, including disturbances directly attributable to the proposed project and to other present and future projects and actions within the project's regional environment. Models are developed (spatial, linear, quantitative, qualitative), based on retrospective analysis and information gained from new data or lessons from elsewhere, to predict how VEC indicators (e.g., caribou population; water quality index) may respond to additional stress in the future – stress caused by the project and by other projects and actions in the regional environment (e.g., landscape fragmentation; river crossings). In other cases, where data are not available, lessons from the outcomes of similar projects and expert judgment are used to explore possible future conditions.

d) Management, designed to identify appropriate mitigation and monitoring actions for those components subject to cumulative effects. Understanding how much more change in an affected environmental component is tolerable, or acceptable, is key to significance determination, which requires knowledge of other development actions in the region – past, present, and future. In those cases where a VEC is already unhealthy and/or regional conditions are already unsustainable, the management efforts must focus on rectification or restoration of conditions, and delivering net positive contributions to regional sustainability.

There is also guidance available for undertaking CEA in a more strategic context, for the purpose of regional land use planning (e.g. CCME 2009; Gunn and Noble 2009). This level of CEA is normally carried out, or commissioned, by government (e.g. GSH SAC 2007) and used to inform regional land use planning or policy development. It is also used to inform CEA at a project level and to guide project decisions. The principles and practices informing this type of CEA, sometimes referred to as 'regional strategic environmental assessment' or 'regional CEA, involve a different set of standards than project-based CEA and are not considered in this report.

3.0 APPROACH TO THE CEA REVIEW

We applied a number of criteria to evaluate the CEA for the Keeyask Project EIS (Table **1**). The review criteria correspond to each of the four stages of a standard methodology for project-based CEA, as described above.

Table 1. Review criteria for the Keeyask Project cumulative effects assessment

Cumulative effects assessment component	**Guiding criteria (review questions) for good practice**
A. Scoping practices for cumulative effects	i) The CEA considers all types of activities and stresses (human-induced and natural disturbances) that may interact with the project's effects on VECs ii) The CEA adopts ecologically-based scoping iii) An explicit rationale is provided for CEA VEC selection iv) Spatial boundaries reflect the natural distribution patterns of VECs selected for the CEA v) The CEA adequately captures past development and other certain and reasonably foreseeable future projects and activities
B. Retrospective analysis of cumulative effects	i) The baseline analysis delineates past and present cumulative effects ii) The baseline analysis establishes trends in VEC conditions and known or suspected relationships between changes in VEC conditions and the drivers of change iii) Thresholds (e.g. management targets, benchmarks, or ecological limits) are specified against which cumulative change and the significance of effects can be assessed
C. Prospective analysis of cumulative effects	i) The time scale of cumulative effects predictions is sufficient to capture the scope of impacts associated with the project's life cycle ii) There is sufficient analysis/evidence to support conclusions about potential cumulative effects iii) The tools and techniques used are capable of capturing cumulative effects pathways and the uncertainties of future developments iv) Trends and linkages are established between VEC conditions and disturbances in the baseline analysis and used to inform predictions about cumulative impacts in the future v) Cumulative effects analysis is centred on the total effects on VECs in the project's regional environment, and the project's incremental contributions
D. Cumulative effects management measures	i) Is the significance of a project's cumulative effects measured against a past reference condition and not simply the current, cumulative or disturbed condition? ii) Is the significance of cumulative effects adequately described and justified (e.g. based on regulatory thresholds, environmental policies, expert evaluation, public concerns, etc.) and based on VEC sustainability, defined by a desired or healthy

		condition or threshold as opposed to the magnitude of the individual project stress on that VEC?
	iii)	Are the incremental impacts of the proposed initiative 'traded off' against the significance of all other disturbances of activities in the region (i.e. minimized or masked)?
	iv)	Are mitigation measures identified that help offset significant cumulative environmental effects, and if so, is consideration is given to multi-stakeholder collaboration to develop joint management measures?
	v)	Is adaptive management identified for significant cumulative effects contingent upon future and uncertain developments and impact interactions?

The review criteria are similar to those used in our review of the Bipole III CEA (see Gunn and Noble 2012), and are based on principles and standards for CEA that are well-established in the scientific literature and in good practice CEA guidance. The review criteria were derived from a number of sources, including the *Cumulative Effects Assessment Practitioner's Guide* (Hegmann et al. 1999); the two leading international scientific journals on environmental assessment (*Environmental Impact Assessment Review* and *Impact Assessment and Project Appraisal*); publically available books and technical guidance on good practices in CEA in Canada (e.g. Beanlands and Duinker 1983; Noble 2010); select guidance from other jurisdictions (e.g. British Columbia, Alberta)[2]; and other project-based reviews of CEA in Canada. We also referred to previous (e.g. Baxter et al. 2001) and more recent (e.g. Canter and Ross 2010) reviews of CEA practice and the lessons emerging.

The information sources used to inform our review criteria are available in the public domain through the internet, government and University libraries and would have been accessible by KHLP. Interestingly, we found only three references on CEA literature or guidance in the Keeyask Project EIS reference list.

In undertaking our review, we consulted the relevant chapters and supporting volumes of the Keeyask Project EIS; submitted Information Requests to KHLP regarding cumulative effects; reviewed responses to our own Information Requests and to Information Requests submitted by others concerning cumulative effects (see Table 2).

Table 2. Keeyask Generation Project materials reviewed

EIS Supporting Documentation and Other Reports
▪ Environmental Impact Statement (Response to EIS Guidelines)
▪ Select Environmental Impact Statement project maps and GIS shape files
▪ Physical Environment SV

[2] See, for example, http://environment.alberta.ca/documents/CEA-In-EIA-Reports-Required-under-EPEA.pdf; http://www.fpb.gov.bc.ca/SR39_Cumulative_Effects_From_Assessment_Towards_Management.pdf; http://www.fpb.gov.bc.ca/SR39_Cumulative_Effects_From_Assessment_Towards_Management.htm

- Aquatic Environment SV
- Terrestrial Environment SV
- Keeyask Cree Nations Partners Environmental Evaluation
- *Cumulative Effects Assessment Practitioners Guide* (Hegmann et al. 1999)
- CEAA Operational Policy Statement (OPS) on cumulative effects (2007)
- Select Information Requests and responses focused on cumulative effects (Rounds 1-3)
- Keeyask Traditional Plans Workshop Summary (Supplemental Filing # 1)
- Updated Caribou Sections (Supplemental Filing # 2)

4.0 SYNTHESIS OF KEY FINDINGS AND OBSERVATIONS

When we first reviewed the Keeyask Project EIS, and in particular the CEA, we observed that many of the expected elements of a good practice CEA framework were present. For example, the EIS claimed to adopt an ecosystem perspective (see Ch 6 and Terrestrial Environment SV), which is appropriate for both scoping and analyzing the cumulative effects of the Project given its scale and context. The CEA claimed to examine past conditions, the effects of past projects and of the proposed Project, and to examine future conditions with and without the proposed Project and in combination with the effects of other future projects and activities (Ch 5, p. 5-3; Ch. 7, p.7-1). All of this is required for retrospective and prospective analysis in CEA. Perhaps of greatest significance is the following commitment, noted earlier, to determine the extent to which the Project is incrementally responsible for adversely affecting VECs beyond an acceptable point, in relation to the overall suite of stresses on a VEC (Ch. 7, p. 7-2). Reporting a Project's incremental contribution to the total stress on a VEC, including anticipated stress from reasonably foreseeable future projects and activities is core to good CEA.

Thus, we find that the intent was sound. However, as we read more carefully into the CEA to determine what was actually done, the conclusions made and the evidence provided (to either explain or support those conclusions), many of the claims and conclusions quickly became unravelled. Our detailed assessment of the CEA can be found in the Appendix. Here we provide a synthesis of our review, and offer a number of observations concerning the CEA and the significance of the decision at hand in relation to the proposed Keeyask Project. We trust this information will assist the Manitoba CEC in its review of the Keeyask Project and in its recommendations.

4.1 What was done reasonably well?

- The EIS does not dismiss that there will be cumulative effects or interactions with other past, present and future projects. The EIS, including the CEA chapter, mention on several occasions that the Project is proposed in an area that has been significantly altered by development over the past 55 years and that cumulative effects are anticipated. This is an improvement over previous practices (e.g. Bipole III), where admissions about cumulative effects were almost non-existent.

- The first three basic components of a CEA methodology are present in the EIS, namely scoping, retrospective analysis and prospective analysis.

- The EIS recognizes the importance of adopting an ecosystem perspective and employs ecosystem-based boundaries in the effects assessment.

- Intactness is presented both spatially and temporally, making it possible to quantify changes over space and at different periods of time in the local and regional study area. Thresholds are identified. Changes in intactness (i.e., habitat) are related to risk factors, or vulnerability, to wildlife species – namely caribou.

- Benchmarks, standards or thresholds have been identified for some indicators in the SVs, with respect to past and present conditions.

- Data limitations are generally well acknowledged in both the SVs and in the EIS.

4.2 Where are improvements needed?

The Keeyask Project's incremental effects appear to be underestimated, and in many instances dismissed, given explicit recognition in the EIS that: a) the Nelson River sub-watershed has already been 'substantially altered' by past developments over the past 55 years; b) those effects persist today; and c) the Keeyask Project will cause additional effects to an already substantially altered environment.

- Spatial boundaries in CEA scoping should be VEC-centered and not project-centered. Although regional ecological boundaries are adopted for the direct effects assessment, these are not broad enough to capture other existing and future developments to the northeast of Study Zone 5 that will impact Project VECs. The CEA is also not scoped broadly enough to communicate any potential indirect cumulative impacts that may be eventually be experienced further afield by communities and environments beyond the project region.

- The future temporal limit for the CEA is unclear. The anticipated life of the project is not stated and nature and timing of decommissioning and reclamation activities are unclear.

- Scoping for the CEA characterizes the Wuskwatim Generating Station as a "past or current" project but it has only been in service for a few years. Thus, its future effects should have been captured in any prospective analysis done for the CEA.

- Some critical components of CEA are not captured in the EIS, specifically trends analysis, to properly assess the cumulative effects of future projects and activities in the Nelson River sub-watershed.

- Thresholds and benchmarks are identified in the EIS (Ch. 6) and SVs for several VECs (or indicators), but those thresholds and benchmarks are not used in the interpretation of the significance of the potential cumulative effects (Ch. 7) of future projects and activities. One of the few exceptions is terrestrial habitat disturbance.

- Many of the baseline assessments of past and current conditions are not carried forward with any analytical rigor to support the analysis of future cumulative effects.

- For some VECs, there is limited supporting evidence/analysis of cumulative effects to support the conclusions and the statements about the Project's cumulative effects, or conclusions are vague or unqualified. Claims about significant adverse cumulative effects of the Project–that there aren't any—are not always adequately evidenced.

- Given the acknowledged constraints in data and uncertainties, many of the conclusions about cumulative effects are much more certain than they should be. This is misleading. For example, 'no measurable change' is predicted when no future modelling or measurement actually occurred, or could be found.

- There is a 'disconnect' in the cumulative effects analysis between aquatic VECs (or indicators) and the multiple pathways that lead to cumulative effects in watersheds. For example, although intactness is measured in the local and regional study area, it is not connected to sedimentation for present and future disturbances in the sub-watershed – an important pathway of cumulative effects to the aquatic environment. This does not reflect the ecosystem view presented by the EIS (see, e.g., Ch 6, 6.2.3.2) or the holistic view of the (Keeyask Cree Nations) KCN.

- There are gaps in knowledge/data in the CEA for some VECs (or indicators) (e.g. plants, wetlands). Similar issues were identified in the Bipole III CEA analysis (see Gunn and Noble 2012). Both projects are under the control of the same proponent.

- The incremental impacts of the proposed initiative are often "traded-off" (i.e. masked or minimized) against the significance of other disturbances in the project region, an error that was earlier noted in the Bipole III CEA review.

- If there is any reason to believe that significant residual cumulative effects may result from the Project, there should be additional provisions made in the EIS to manage them. With respect to aquatic and terrestrial VECs, there is no management plan proposed beyond that for mitigation of the direct significant adverse effects of the project.

4.3 What is the significance of the Keeyask project decision with regard to cumulative effects?

The focus of our analysis was not on whether the cumulative effects of the Keeyask Project are significant per se, but on the overall methodological approach to the CEA meets a reasonable standard of practice. However, after reviewing the CEA, various sections of the EIS, select technical reports, and a large number of IRs and responses, we offer the following observations concerning the significance of the Keeyask Project with respect to cumulative environmental effects in the Nelson River sub-watershed.

The EIS states several times that the local and regional environment in which the Project is proposed has already been 'substantially' altered. For example:

> "The aquatic environment in the lower Nelson River, including the area to be affected by the Project, has been substantially altered by past hydroelectric development and continues to experience those effects today" (EIS Ch 7, p. 7-16).
>
> "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" (EIS Ch 7, p. 7-23).
>
> "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" (EIS Ch 7, p. 7-37).
>
> "Particularly influential have been the construction and operation of the four generating stations and the substantial water management projects of the LWR and CRD noted above, which taken together, have substantially adversely affected the land, water and traditional

way of life of the KCNs" (EIS Ch 6, p. 6-13).

"The aquatic environment of the Nelson River where the Project will be constructed has been substantially altered by hydroelectric developments, in particular the Churchill River Diversion (CRD) and Lake Winnipeg Regulation (LWR), and the construction of the Kettle GS. Effects of the Project will be super-imposed on this disrupted environment" (EIS Ch 6, p. 6-54).

Further, it is reported in the EIS that:

"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" (Ch. 7, p. 7-23 and 7-24).

The Keeyask Project "will affect open water levels for about 41 km upstream...[and] about 45 km^2 of initial flooding is predicted. This inundation, along with ongoing erosion, will affect water quality and terrestrial aquatic habitat " (Ch. 7, p. 7-4).

"From the late 1950s to the present, more than 35 major generation, conversion and transmission projects have been undertaken by Manitoba Hydro in northeastern Manitoba affecting the traditional territories of the KCNs, their communities and members" (Ch. 6, p 6-12).

"The most detailed information is provided for the hydroelectric development era between 1957 and the present in order to depict how the construction and operation of these northern hydroelectric projects resulted in life-altering changes to the water, land and traditional way of life for First Nations members living in the Keeyask area (CNP Keeyask Environmental Evaluation Report; YFFN Evaluation Report (*Kipekiskwaywinan*); FLCN Environment Evaluation Report (Draft); FLCN 2009 Draft; Split lake Cree-Manitoba Hydro Joint Study Group 1996a, 1996b)" (Ch. 6, p. 6-7).

"A sizeable portion of CNP's major waterways in their homeland ecosystem are no longer able to sustain their traditional ways due to alterations from hydroelectric development" (Ch. 6, p. 6-20).

"Based on the regulatory assessment...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..." (Ch. 7, p 7.31 – 7.32).

Given the above, the EIS is clear in that:

i) the regional environment in which the Keeyask is proposed has already been substantially altered by past development; and
ii) the Keeyask project will be super-imposed on this disrupted environment.

The Merriam-Webster Dictionary defines 'substantial' as 'being considerable in quantity', or 'significantly great' – the word is synonymous with 'major', 'consequential' and 'significant'. It is puzzling then, that the cumulative effects of the Keeyask project in combination with the effects of past, current and future projects are determined to be not significant. Chapter 7 of the EIS, sec. 7.5.2.3 (p 7.31 – 7.32), states:

> "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 results in cumulative adverse effects that require further mitigation for the Keeyask Project or would alter the conclusion with respect to the regulatory significance..."

Technical and procedural analyses aside, the above conclusion seems contradictory to the series of statements made in the EIS indicating that the area to be affected by the Project has already "been substantially altered". If a region has already been "substantially altered" (i.e. significantly affected), then would not any additional effect, no matter how small or incremental in nature, be considered cumulatively significant?

For example, the EIS Executive Summary states:

> "The Project is located close to communities that have been greatly affected by past hydroelectric and other developments. Each of the Keeyask Cree Nations has documented the history of its people, and the profound effect that hydroelectric development over the past 55 years has had on its relationships with the environment, changing its way of life and culture" (p. 37).

The Cree Nation Partners "concluded that, like previous hydroelectric developments, the Project will have certain major unavoidable effects" (p. 15) and "The Keeyask Cree Nations know that the effects of past development cannot be undone" (p. 15). In other words, current environmental and socio-economic conditions in the region, which form the development context for the Keeyask Project, are in fact the present day expression of the cumulative effects of past developments and these are clearly agreed by the KHLP partners to be significant or substantial.

However, the EIS concludes that there will be no significant adverse cumulative effects attributable to the Keeyask Project (Exec Sum p. 36; Ch 7 p. 7-21). The rationalization often presented in the CEA, Chapter 7, is that any additional cumulative effects on the already stressed environment are insignificant because: a) they are either local and thus insignificant on a larger (regional) scale, or b) they are insignificant in comparison to the magnitude of change that has already occurred. Chapter 7, p. 7-28, for example, with regard to intactness, states: "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."

Perhaps, one could argue that the incremental effects caused by further hydroelectric (or other) development in the Nelson River sub-watershed are insignificant given the magnitude of change and the degree of hydrological alteration that has already occurred over the last 55 years, and that the future of the region is to be designated as a hydroelectric development area. In other words, any incremental change from point forward doesn't matter given the already 'substantially altered' state of the Nelson River sub-watershed environment. **But, given that the region has already been substantially altered by hydroelectric development, and that it is agreed past alterations have been cumulatively significant, one could also argue that any further development must be also considered cumulatively significant and should not proceed unless net positive contributions to the sustainability of the sub-watershed, including its ecological functions and people, can be demonstrated.**

There is no 'scientific' answer, but the question is more than philosophical – it is **fundamental** to determining whether the additional effects caused by the Keeyask project, in an already significantly altered environment, are acceptable to the CEC and to the citizens of Manitoba. Given the magnitude and imminence of the future Conawapa hydro-electric generation project, the Keeyask Project represents a critical decision point in the future of hydroelectric development and sustainability in northern Manitoba and in the province as a whole.

Duinker and Greig (2006: 153) perhaps put it best: "...continuing the kinds and qualities of CEA currently undertaken may be doing more harm than good." Looking back on the Keeyask EIS two, five or ten years from now, the quality of the CEA will not be judged by the number of maps produced or volumes of information about VECs, but by the role it played in supporting a sound decision about the overall significance of the Project in the broader Nelson River sub-watershed.

APPENDIX

Detailed Assessment of the KHLP's CEA approach for the Keeyask Generation Project

A. Scoping Practices for Cumulative Effects Assessment

Scoping is a judgment process to determine "from all a project's possible impacts and from all the alternatives that could be addressed, those that are key, significant ones" (Glasson et al. 1999: 90) and should be subject to further assessment. Simply put, scoping is the exercise that determines what will be included and what will be excluded from the assessment. Cumulative effects assessment scoping must be sufficiently spatially and temporally broad to not only capture the direct effects of a Project but also its subsequent indirect or 'ripple' effects. The scoping stage in a CEA is critically important because, when done properly, it allows for a more complete rendering of a project's contribution to regional development, its influence on regional ecological dynamics, and its incremental impact on VECs.

The Keeyask Project EIS does consider a range of past and current projects in the CEA, acknowledging that: "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" (p. 7-4). The EIS also acknowledges that "past and current linear developments in the region, including upgrades to PR (provincial road) 280, may also overlap with the Project. Other agents of past and current change....are mining, commercial forestry, commercial fishing of sturgeon and other activities" (p. 7-4). We find, however, that project scoping-in for the purpose of CEA to be somewhat incomplete, which affects subsequent analysis and the ability to draw defensible conclusions. As well, the spatial and temporal bounds of the CEA are in some respects questionable or not clearly stated.

A-1. Inadequate consideration of certain past and future developments

Good practice scoping in CEA should adequately capture reasonably foreseeable and future developments (Hegmann et al. 1999). With respect to future projects and activities, the EIS considers the Bipole III transmission project, the Keeyask transmission project, a housing redevelopment in the town of Gillam and the Conawapa Generation Project. However, the CEA also does not account for the Bipole I & II transmission line and several other key Manitoba Hydro projects that affect the same region. We also note there is insufficient consideration given to the potential cumulative effects of such future projects and activities, i.e. they are not described or examined in adequate detail to be able to be able to complete a prospective analysis or re-evaluate the significance of the Project's effects in light of cumulative effects.

The Keeyask Project optimizes the Province's investment in five large existing hydro generating stations, which together produce 70% of energy in Manitoba (Executive Summary, p. 7), and these development are captured in the analysis of the Project's direct effects. But three projects in particular are excluded or not adequately dealt with in the scoping phase of the CEA: the existing Bipole I&II transmission right of way, the Wuskwatim Generating Station, and the Conawapa Generating Station.

The CEA identifies the Bipole III transmission right-of-way as a relevant future project (Ch 7, p. 7-7); it therefore stands to reason that the existing Bipole I&II line should also be scoped into the list of past projects provided in Table 7-1 (Chapter 7, p.7-5). Although Table 7-1 identifies "transmission lines" as part of the linear development in the region as possibly contributing to cumulative effects, the Bipole I & II lines are not specifically named. Although the Bipole I & II line is mentioned briefly in Appendix 7A, it is not clear how it was captured in the CEA prospective analysis. To understand the combined effects of both the Bipole I & II lines, and of the future Bipole III line, on terrestrial and aquatic VECs it would be necessary to analyze the effects of the projects together, along with all other linear developments that may affect habitat intactness (terrestrial and riparian), sediment loading to the aquatic system, etc. This linkage is not made because the Bipole I & II projects are not specifically named in the CEA, and the analysis of intactness, for example, performed earlier in the EIS did not include the Bipole III. The CEC also raised similar concerns (CEC Rd 2 CEC-0103a), that numerous existing and proposed developments located outside the Study Zone 5 Regional Study Area could also impact upon Project VECs but are scoped-out of the CEA, including a variety of transmission lines, generating stations, converter stations, highways, roads and trails, work sites, communities, etc.

Further, the Wuskwatim Generation Project is considered a 'past or current project' in the CEA. However, its three turbines have only been in operation less than two years, with construction beginning in August 2006. As such, although it is an existing project it's effects will unfold far into the future. Because it was included as a "past and current" project in the Keeyask Project environment, its future effects would not have been modelled: just the effects experienced since construction began to the present day: a total of less than seven years. In our view, this is a scoping error because the future effects of the Wuskwatim project will unfold over many decades and will not have been adequately captured in either the assessment of past and current projects, or the assessment of future projects.

The Conawapa Generation Project (including camp) is listed in Table 7-2 as a future project that could contribute to the cumulative effects of the Keeyask Project (Chapter 7, p. 7-7). It is identified as potentially affecting (Chapter 7, Table 7-3) water quality (an aquatic environment VEC), but somehow not any of the four fish species named as VECs will experience significant adverse effects from the construction and operation of the Keeyask Generating Station. In other words, the potential cumulative effects of the Conawapa project are scoped-out of the cumulative effects analysis for fish (see Table 7-3, p. 7-12). Since the future effects of the Wuskwatim Generation Project are largely unknown and the Keeyask Generation Station is not yet built, it stands to reason that there could be a very significant effect combined effect on water quality and fish VECs, especially given the previous hydro-electric developments on the Nelson River. This is not captured in the Keeyask Project CEA.

A-2. Uncertain future temporal limits and truncated spatial limits

CEA scoping must be sufficiently spatially and temporally broad to not only capture the direct effects of a Project but also its subsequent indirect (secondary or induced) effects—which may be experienced far beyond the boundaries of the Project's anticipated direct effects. With respect to capturing reasonably foreseeable future activities, the CEA does not clearly specify a time horizon. Although there is no standard future temporal limit in CEA, it is generally accepted that CEA utilizes long-term boundaries in its analysis (Hegmann et al. 1999): "...the boundary in the future typically ends when pre-action conditions become re-established" (p. 15). Other future temporal limit options for CEA include the end of the operational life of the project or that time after which project abandonment and reclamation has been complete. A hydro-electric generating station of Keeyask's magnitude implies a distant future time horizon to capture decommissioning and reclamation activities, likely 100 years or more. The operational life of the project is not stated in the CEA. If decommissioning and reclamation activities are planned for the Keeyask Project, and there are similar plans for all generating stations on the Nelson River and associated infrastructure, these activities could cause further cumulative effects on the biophysical and social environment of the region. Yet the nature and timing of these activities are not explored in the CEA. Chapter 7 does not mention or describe any future decommissioning or reclamation activities.

In the description of the cumulative effects of the project including future projects and activities (see Ch. 7, 7-31 to 7-36), the future temporal limit for cumulative effects analysis for many terrestrial environment VECs including ecosystem diversity, wetland function, priority plants, etc., are unspecified. It may well be that time frames for direct impact assessment are clearly stated earlier in the EIS (Ch. 6), but only past and current projects are captured in the earlier sections of the EIS. The future temporal limit of analysis for addressing future activities and projects should be clearly articulated in the CEA; currently this is not the case. The Bipole III CEA, by way of comparison, clearly adopted a 50-year future temporal limit. Though it was later shown that the actual analysis of cumulative effects was much more temporally restrictive, and the life cycle of the project was likely 100 years or more - but at least a future time was specified. The KHLP, in its response to CEC Rd 1 CAC-0012, explains:

> " Ultimately, the focus of the assessment **was on the future** rather than on the past, i.e., on examining the vulnerability of each VEC **today and in the future** without the Project, ...in order to help in identifying the extent to which incremental effects on a VEC from additional changes caused by the Project could potentially result in a cumulative significant adverse effect on the VEC."

Smit and Spaling (1995) (quoted in Squires et al. 2010: 120) note that: "Limited temporal and spatial dimensions generally narrow impact analysis to inclusion of immediate effects of a specific environmental attribute at an individual site", thus, to demonstrate that an adequate effort has been made in CEA scoping, an expansive future temporal limit should be clearly stated.

Spatial limits for good practice CEA in project-based assessment, by definition, must be broader than that which is necessary to capture direct effects because cumulative effects are of an additive, interactive, synergistic, and often indirect nature (Hegmann et al. 1999). Cumulative effects modelling generally takes into account not just first-order interactions of a project's effects with the effects of other past, present, and reasonably foreseeable projects and activities, but also other indirect effects that may occur at some distance in time or space from the project. Because the Keeyask Project includes infrastructure and operations that are regionally disruptive (e.g. transmission line corridor construction, changes to water flow on the Nelson River), its cumulative effects may eventually be experienced by communities and environments much further afield. For this reason, spatial and temporal limits for CEA might necessarily be more expansive that those utilized for the assessment of direct impacts on project VECs.

The CEC expressed concern (CEC- Rd 1 CAC-0012), as noted above, that the spatial limits of Study Zone 5 Regional Study area were insufficient to adequately capture the effects on VECs of a variety of other developments located just beyond it (within 60 km further northeast). In justifying the approach to boundary setting, the KHLP explained in CEC Rd 2 CEC-0103a that:

> "Once the total area required to capture a viable VEC population was determined, the next step for the terrestrial assessment was to delineate the study area boundaries that captured the required area. To support the regional, ecosystem-based approach used for the terrestrial

> assessment...the Study Zone appropriate to capture a population for a VEC was selected as the VEC's Regional Study Area... On this basis, the assessment evaluates the VEC populations directly affected by the Keeyask Project, rather than using a study area delineated by the locations of all past, current, and future projects to assess effects on those VECs. When applying the VEC-centric approach used in terrestrial assessment, another project or development does not have to be physically located within a VECs Regional Study Area in order for effects of that development to be evaluated as a cumulative effect with the Project."

This is not the approach we would recommend for boundary setting in CEA, though we agree it should be ecosystem-based and VEC-centric. Direct effects analysis should adopt boundaries based from the project itself, but good practice CEA goes beyond, adjusting boundaries to be able to assess VEC sustainability, i.e. adopts boundaries that capture both the project's effects and effects of all other projects and activities (including the projects and activities themselves) that create cumulative pressure on VEC sustainability.

B. Retrospective Analysis of Cumulative Effects

A common practice in CEA is to use the state of the current environment as the baseline. This cannot be considered the most appropriate way to assess multiple impacts because this assumes no changes have occurred to date and amalgamates the effects of past and present actions of individual contributors into an accumulated baseline (McCold and Saulsbury 1996). Cumulative effects assessment requires examination of both past and current conditions. Baseline studies to support CEA must provide more than a simple *description* of conditions past or present. Baseline studies must delineate past and present cumulative effects (i.e., VEC condition and changes in VEC conditions) in the study area; establish trends, where possible, in VEC conditions (spatial or temporal) and known or suspected relationships between changes in VEC conditions and the drivers of change; and identify thresholds or levels of acceptable change (e.g. benchmarks, management targets) in VECs or VEC indicator conditions against which the significance of a change in VEC condition (past, present, or future) can be assessed.

The EIS does commit to trends identification and delineation of the effects of past and present actions. In sec. 5.3.1 (p. 5-5), for example, it reads: "The existing environment...a description of the existing environmental setting of the study area, including trends, conditions, and the major influences of past and present projects and activities, in shaping the current and future environmental setting without the project." However, we identify two areas of concern about the retrospective analysis or baseline assessment: the first concerns the use of trends in the CEA to examine baseline conditions; the second concerns thresholds or benchmarks for interpreting the significance of past and future cumulative effects.

B-1. Identification/use of condition trends in the CEA process

A reasonably good example of identifying past and present conditions and effects can be found in the response to CEC Rd 2 CEC-0102c and in the Keeyask Project Cumulative Effects Summary, filed in response to CEC rd1 CEC-0020. Spatial data for terrestrial habitat conditions are presented for four periods: historical (pre-Kettle GS); existing (including all past and present projects and activities in the area considered in the CEA; the Keeyask Project footprint; and future projects and activities. Linear disturbances and core area changes are presented across space and for different time periods. As discussed in the Habitat Relationships and Wildlife Habitat Quality Models for the Keeyask Region (Report # 13-02), understanding the loss and fragmentation of habitat plays an important role in understanding overall habitat effectiveness for sustaining caribou populations.

What is weak in the baseline assessment concerning habitat (loss and fragmentation) is a trend that can be projected forward, specifically the 'rate of loss' and spatial patterns (including feature buffers) of loss or disturbance, from past to present to future, and how VECs have responded and are expected or predicted to respond. Salmo et al. (2003) and Antoniuk et al. (2009) report that focal wildlife species can be adequately assessed by two indicators that tract direct and indirect footprint and habitat loss: total area disturbed and total corridor density. We recognize that this approach, typically based on correlations, is characterized by uncertainty given the complexity of relationships between disturbance and wildlife response, including time lags; however, the objective is to identify trends or patterns over time and across space to indicate whether conditions are 'not changing', 'getting better' or 'getting worse' and what might happen under different future Project conditions. This is important to understanding potential future cumulative effects of wildlife populations, including caribou, but was poorly developed in the CEA.

There are some areas where trends in baseline conditions are difficult to discern; some of this is attributed to limited data availability. For example, the AE-SV, sec. 2.3.4.3 indicates a temporal analysis of water quality that is focused on "evaluation of potential temporal changes in water quality within the study area" based on statistical analysis of historical water quality data in Split Lake for recent 20-year period, published literature, and an assessment of water quality data collected from Stephens Lake and area since the 1970s. It's reported in the EIS that technical information is limited regarding Nelson River water quality pre-hydro development and, in the AE SV, sec 5.3, it's reported that "methodological differences preclude the analysis of historic data to establish a clear trend of the effects of CRD (Churchill River Diversion) and LWR (Lake Winnipeg Regulation) to the fish communities." We acknowledge that in many cases data are simply not available to establish long-term trends in VEC conditions, particularly for aquatic environments. This is not a problem that is unique to the Nelson River. In recognized absence of such data or trends, however, the conclusions about no significant adverse cumulative effects, and in particular no measurable effects, on water quality, seems overconfident. We address this issue below in section C.

For aquatic cumulative effects assessments, Ball et al. (2012) explain that where data on water quality or aquatic biota indicators are limited, there is the potential to use surrogate indicators to establish trends, such as land use and land cover metrics (e.g., riparian zone habitat, stream crossing density). Seitz et al. (2011) suggest that landscape metrics can act as indicators of responses by affected systems to cumulative change, and can be used in regression and correlation analyses to provide an indication of cause–effect relationships between cumulative change and cumulative effects (see also Johnson and Gage 1997; Gergel et al. 2002). Seitz et al. (2012), for example, report that simple linear, stepwise and multiple regressions are commonly used to describe the effects of landscape and land use stressors on river system response.

B-2. Thresholds (or targets) against which cumulative change is assessed

Thresholds are important to understanding and interpreting the significance of cumulative effects, including the effects of past cumulative change and of future conditions. Thresholds in cumulative effects are typically associated with the degree of change in an indicator. To be useful for cumulative effects management, thresholds also need to be linked to decision-making processes. Squires and Dubé (2012) suggest that 'benchmark' is the more acceptable terminology, particularly in the regulatory environment, as thresholds imply that sufficient knowledge exists to understand when the assimilative capacity of an environmental system has been exceeded. We agree, and use the term thresholds broadly to include ecological limits, benchmarks, management targets, and maximum levels of allowable change. There are few thresholds identified in the EIS that are actually used in the CEA. The exceptions are habitat thresholds for caribou populations and linear feature benchmarks. TSS guidelines are noted for water quality, but the threshold is not applied to assess the significance of cumulative effects (see below, sec. C) – perhaps because the TSS levels are reported to be above the Manitoba regulatory guidelines.

We did observe that benchmarks, stated as % changes, for priority plants are presented in Chapter 6 of the EIS, sec. 6.5.4.2.1 (p 6-331 – 6-332), identifying < 1% as small magnitude, between 1% and 10% as moderate magnitude, and > 10% as high magnitude. One of the citations provided supporting these benchmarks for priority plants is Hegmann et al. (1999), leading one to believe that the practitioner's guide on CEA has established such benchmarks. Nowhere in the Hegmann et al. (1999) guidance is there recommended benchmarks for plants of any kind. This is misleading. More importantly, however, these benchmarks are NOT carried forward in the CEA to examine significance. See sec. C-1 below.

We acknowledge that thresholds are not available for many ecological receptors. However, stressor-based thresholds set based on maximum limits of allowable change or disturbance can be applied – such as in the case of caribou habitat. Squires and Dubé (2012), for example, report that at the scale of the watershed, single-contaminate thresholds are often not as applicable due to the large spatial scale of these types of assessments. Instead, assessments on a watershed scale can rely on indicators of landscape development (e.g., road density, population density, forest cover) as stressor-based thresholds. There is often reluctance to set thresholds or to limit development when our understanding of natural variability and adaptability within the system is poor. However, in general, for any assessment it is important to have a management target or benchmark against which to assess condition change, otherwise it is difficult to determine when to take action and what action to take when undesirable change occurs.

C. Prospective Analysis of Cumulative Effects

In its response to CEC Rd 1 CAC-0012 (p. 3), the Proponent states:

> "Ultimately, the focus of the assessment was on the future rather than on the past, i.e., on examining the vulnerability of each VEC today and in the future without the Project (due to whatever factors might affect this vulnerability), in order to help in identifying the extent to which incremental effects on a VEC from additional changes caused by the Project could potentially result in a cumulative significant adverse effect on the VEC."

We agree that, in principle, good CEA should ultimately focus on the future (see also Duinker and Greig 2006), drawing on the knowledge and understanding that we have gained from past conditions and changes in conditions over time and across space. The Keeyask CEA does demonstrate modest improvement over the Bipole III CEA with regard to the temporal scope of future effects; however, we *disagree* with the Proponent's claim that "ultimately, the focus of the assessment was on the future rather than on the past." For example:

- Section 2.10 of the TE-SV, for example, states: "As described in the Response to the EIS Guidelines Section 7.2, VECs... This section provides that assessment." However, we observed that the total 'assessment' of cumulative effects for the terrestrial environment (i.e., for future projects), upon which the CEA chapter of the EIS is based and conclusions drawn about the nature and significance of cumulative effects, constitutes only 3.5 pages of a 319 page technical report.

- Section 3 of the TE-SV, focused on Terrestrial Plants, is a 138-page document of which only 3.5 pages of descriptive text is provided about potential cumulative effects; there is no reference to any supporting analysis. The majority of the volume is dedicated to a description of current and past conditions and distributions of plants; cumulative effects, with regard to future projects, receive minimal treatment and no analysis.
- AE-SV describes past and current conditions and synthesizes water quality and sediment, including trends, but provides little by way of analysis of future conditions, specifically an analysis of the cumulative effects of the Project in combination with the effects of other project and activities. The word 'cumulative' does not even appear in the water and sediment quality section of the AE-SV.

We are not suggesting that length is a good measure of the quality of the CEA; but if, as suggested in CEC Rd 1 CAC-0012 (p 3), "[u]ltimately, the focus of the assessment was on the future rather than on the past…", then one would expect to see much more analysis to support the conclusions made in the EIS, Chapter 7, about future cumulative effects. In particular, a good CEA should use trends and patterns from retrospective analysis to project forward potential change in VEC conditions as a means to evaluate and understand the potential significance of a project's potential cumulative effects. There is limited trends analysis in the CEA, particularly with regard to the effects of future projects and activities, aside from intactness assessments; however, even for intactness the analysis is a series of temporal snapshots versus trends analysis and futures projections per se.

In our view, many of the claims about cumulative effects with respect to future project and activities are poorly supported by analysis, or even reasoned argumentation. The CEA does a reasonably good job of characterizing the 'what was' and 'what is' in the local and regional study areas, considering the constraints of available data; however, the futures part of the Keeyask CEA (i.e., predicting, modeling and evaluating the effects of other projects and activities) is, for many VECs, below an acceptable standard of practice.

In the sections below we identify three main areas of concern with regard to the identification and assessment of the future cumulative effects of the Project in combination with other projects and activities. We did not review the supporting volumes for ALL VECs included in the CEA. The examples we provide below are not comprehensive of the entire Keeyask EIS.

C-1. Assumptions and analyses to support conclusions about future cumulative effects

The EIS Scoping Document, sec. 5.1 Project Effects, states that: "In reporting on the assessment of potential environmental effects, the EIS will describe the approach and methods used to identify and assess the effects, and it will also provide a record of assumptions and analyses that support the conclusions." This is consistent with good practice guidance and we assumed that this standard was also adopted for the CEA section of the EIS. However, in reviewing the CEA, Chapter 6 of the EIS, and the relevant supporting volumes, we observed that cumulative effects are often 'described' but the nature and quality of the evidence presented to support the conclusions about cumulative effects is quite variable. Several examples are discussed below.

Example 1 - Intactness: 'Intactness' is one example from the CEA where reasonably good practice has been demonstrated. In the TE-SV, for example, linear feature density, core area effects and fragmentation effects are identified based on the current accumulated state and metrics (e.g. km/km^2, total and % area change) used to identify total effects in the local and regional study areas due to the combined actions of the Project and those future projects and activities identified in Chapter 7 of the EIS. Specified management targets are also identified to provide a rationale for the interpretation of the significance of change, in this case the % of the regional study area in core area that is expected to remain over the first 30 years of the Project (see TE-SV sec 2.10.2, Table 2-51). Such values are then related to summer caribou habitat intactness estimates for undisturbed habitat in the regional study area.

Example 2 - Water Quality: The PE-SV indicates that: "While there will likely be temporal overlap in the construction and operation phases of all the foreseeable projects, none are expected to influence the sedimentation processes within the hydraulic zone of influence." The KCN disagree with this assessment. The EIS Chapter 7, sec. 5.1.2.1, concludes: "Elevated TSS levels are unlikely to have a measurable effect on the biota, given the short duration of larger inputs..." It is also noted that these levels will be elevated for at least 10 to 15 years.

The nature of our concern with regard to the quality of the CEA analysis related to: i) whether and how the cumulative effects of other future disturbances in the watershed (e.g., forestry, mineral lease sites, linear features) that cause vegetation disturbance or clearing and wetland loss in the drainage area may result in increased sediment loading over time; and ii) the rationale for the conclusion that sediment levels would be elevated for at least 10 to 15 years, but there would be no adverse cumulative effects to biota, including sturgeon.

Each of these is addressed below.

i) We acknowledge the model (see PE -V, Appendix 7A Model Descriptions) using critical shear stress for erosion to assess the deposition potential for silt, sand and gravel downstream of Gull Rapids near the young-of-the year habitat area for Lake Sturgeon; however we were not able to find any specific models, correlational analysis, or even reference to studies from elsewhere, to validate the conclusions about potential future cumulative effects of the Project in combination with other future projects and activities in the watershed with regard to sedimentation and effects on biota.

The EIS Chapter 7, Table 7-3, identifies the potential Conawapa GS as a project that overlaps with the proposed Keeyask project, having a potential to cumulatively affect water quality. No other activities or disturbances in the area are identified as acting cumulatively with the Project's impacts to water quality, specifically sedimentation. Sedimentation is identified in the EIS (Chapter 6, sec. 6.4) and in the AE-SV (sec. 2) as "large for all aspects of shoreline erosion." The cumulative effects analysis is focused on in-stream and shoreline disturbance. Sedimentation caused by terrestrial disturbances receives limited (if any) attention in the cumulative effects analysis for future projects and activities. Roads, trails, other linear features and cleared areas, for example, are a major source of fine sediments to streams in disturbed watersheds (see Yarmolov and Stelfox 2011). The PE-SV, sec. 7.4.5, discusses interactions with Bipole III, the Keeyask Construction Power and Generation Outlet Transmission Lines, and the Potential Conawapa GS, but potential sediment loading as a result of these projects, and of other activities in the watershed, including forestry, access roads, lease sites, etc., are not considered in any analytical framework or evaluated against Manitoba guidelines.

ii) Lake Sturgeon was not identified in the EIS Chapter 7 (Table 7-3) as a VEC to be included in the CEA for future projects or activities. Studies from northeastern Ontario indicate that erosion and sedimentation resulting from linear disturbances (e.g. logging roads or access roads) contribute to impaired water quality in sturgeon habitat (Ferguson and Duckworth 1997 – cited in Kerr et al. 2011). Sedimentation of critical habitat was also identified as the cause of a reduction in white sturgeon recruitment in the Nechaka River, British Columbia (McAdam et al. 2005 – cited in Kerr et al. 2011). The cumulative effects of flooding, land uses/clearing (e.g. forestry, access roads, transmission lines) and stream crossings can significantly increase the cumulative amount of sediment loading to that expected from natural processes (Yarmoloy and Stelfox 2011). Sediment loading can have adverse effects on food production for fish. Catchments subject to higher densities of landscape disturbance can be associated with lower fish population densities and factors of healthy habitat conditions (Jackson 2008).

In a river systems context, cumulative effects result from changes to watershed processes, caused by the additive and synergistic interactions of multiple anthropogenic disturbances on the landscape (Reid, 1998). Almost all land use activities directly alter environmental parameters, including soil, topography, and vegetation, which, in turn modify the transport of water, sediment and organic matter that culminate in river systems (Johnson et al, 1997; Schindler, 2001). Given that the EIS claims to adopt an ecosystem perspective, we expected to see the above issues, identified in the baseline and effects assessment, analyzed as part of the CEA for future projects and activities in the region and the results used to determine the significance of cumulative effects (i.e. water quality/sedimentation) with regard to the stated guidelines of 5 mg/L[3] and potential effects to/changes in biota/sturgeon.

Example 3 - Wetlands: The EIS, sec. 5.3.1 (p. 5-5) states: "The existing environment...a description of the existing environmental setting of the study area, <u>including trends</u> *[emphasis added]*, conditions, and the major influences of past and present projects and activities, in shaping the current and future environmental setting without the project." The TE-SV, sec. 2.8.3.3 reports: "Past and existing human impacts and climate change are expected to continue to drive future changes in wetland function and wetland condition in the Regional Study Area...there may also be lagged effects on wetlands..." It is also noted: "While these ongoing adverse wetland area responses to past human developments are locally important, their magnitude at the regional scale is very small since the amounts of area affected are relatively small."

The TE SV does provide a spatial overview of wetlands, and a classification and ranking of wetlands by type and importance in the project's local and regional environment. Section 2.10 of the TE-SV provides the assessment of cumulative effects to wetlands with future projects. The 0.5 page analysis reports that: "Detailed mapping indicates that Gillam Redevelopment and the Keeyask Transmission Project are not expected to affect any particularly important wetland areas (i.e., off-system marsh). The affected areas of the remaining wetland types are expected to be relatively small." It goes on to note: "For Bipole III, even if the route overlaps off-system marsh, effects are likely to be negligible...The affected areas of the remaining wetland types are expected to be relatively small, depending on the final locations of the transmission ROWs."

There is limited spatial-temporal trends analysis of wetland decline (and/or recovery) to make predictions about the cumulative effects to wetlands of the Project in combination with other future hydro projects AND in combination with other human-induced disturbances on the landscape in the sub-watershed (e.g., forestry, access roads, lease sites, etc.). Given that the GIS data have been

[3] See: Canadian Council of Ministers of the Environment 1999. Canadian environmental quality guidelines. Canadian Council of Ministers of the Environment. Winnipeg, MB; Manitoba Water Quality Standards, Objectives and Guidelines 2011. Water Science and Management Branch, MWS. MWS Report 2011-01.

collected and wetland area mapped, a scenario-based analysis was expected, and transition-based (e.g. discrete-time Markov chain[4]) analysis may have been possible, to examine future probable wetland states due to changes in disturbances along the river and in the watershed due to future projects and activities.

The TE-SV, p. 2-200 and 2-201 indicates that "detailed habitat mapping was not available for the Bipole III footprint" and bases the assessment on assumptions as opposed to actual analyses or modeling of wetland distributions, rates of loss and/or recovery, and cumulative risk. It's also interesting that the limitations of the Bipole III CEA have now become a constraining factor in the CEA for the Keeyask Project – both projects are proposed by the same proponent.

Example 4 – Priority Plants: Chapter 6 of the EIS, sec. 6.5.4.2.5 (p. 6-336) states: "The adverse residual effects of the Project on priority plants will overlap spatially and temporally with effects from the following future Projects: the Keeyask Transmission Project, Bipole III Transmission Project and Gillam Redevelopment. These cumulative effects are discussed in Chapter 7." We agree that these effects are discussed in Chapter 7, and given a paragraph of treatment, but there is no actual supporting analysis of cumulative effects to priority plants due to the Project in combination with these other future projects and activities.

The TE-SV, sec. 3.3.3, reports that past and existing human impacts and climate change are expected to continue to drive future habitat change in the Regional Study Area even if the Project does not proceed, which would affect priority plants directly and indirectly through habitat effects. The TE-SV also reports that ongoing shoreline erosion caused by the Project will continue to remove terrestrial plants and their habitat, and it is estimated that approximately 91 ha of inland habitat would be lost to ongoing mineral bank erosion in the Keeyask reach of the Nelson River. In sec. 3.5.2 of the TE-SV, with regard to cumulative effects, it is reported that effects from all of the future projects would overlap spatially and temporally with residual Project effects on priority plants. All of these future projects, except for the Conawapa Generation Project, are expected to remove individual plants and their habitat and alter plant populations. Section 7.4, p. 38, of the Cree Nation Partners environmental evaluation report also expresses concern that medicinal plants will be lost due to flooding.

The conclusion presented in the EIS is that: "Based on the potential for species of high conservation concern to occur in the 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

[4] A mathematical analysis of system transition, and probabilities associated with any transition, from one state to another among a finite or countable number of possible states.

to moderate magnitude range, depending on the species."

We are not questioning the Project's own effects, since the area to be flooded is known. Our concern relates the cumulative effects of this loss in combination with the effects of other future projects and actions in the regional environment and, more specifically, the limited analysis/rationale provided to support the conclusions:

i) The TE-SV reports that field studies were conducted within and near the anticipated locations of the Keeyask Transmission Project ROWs, but that field studies were not conducted within the anticipated locations of the Bipole Transmission Project ROW or the Gillam Redevelopment area.

ii) The Terrestrial Ecosystems and Vegetation Technical Report prepared for the Bipole III EIS identified residual effects from the Bipole III project (see Table 26) and potential cumulative effects. Table 37 in the Bipole Terrestrial Ecosystems and Vegetation Technical Report summarizes the cumulative effects assessment of other actions (including hydroelectric projects, forestry, mining, infrastructure etc.), using numbers of plants or hectares as the indicator, and concludes that there will be loss of plants of conservation concern and loss of plants valued by Aboriginal people. The conclusions that there will be no significant cumulative effects does not seem consistent with the above observations, and it is certainly not supported by any analysis.

iii) The Bipole III EIS indicated that there will be loss of plants of conservation concern and loss of plants valued by Aboriginal people. The Keeyask EIS identifies that the region has already been substantially altered and priority plants lost, and that the Keeyask will contribute to some additional loss. It also indicates that other future projects and activities may contribute to the loss of priority plants. The cumulative effects are not deemed to be significant, but the benchmarks identified earlier in the TE-SV are not used here as the standard of assessment. How will predicted future cumulative loss in the region measure-up against the benchmarks of < 1% small magnitude, between 1% and 10% moderate magnitude, and > 10% high magnitude, stated previously in Chapter 6 of the EIS, sec. 6.5.4.2.1 (p 6-331 – 6-332)?

C-2. Vague and/or contradictory cumulative effects conclusions

Closely related to the above, there are a number of conclusions about potential cumulative effects that do not seem to add up based on the nature of the CEA approach. Precision and confidence are presented in some conclusions, but such precision and confidence are not always supported by the information presented in the EIS. We are not suggesting that it is possible to be 'certain' in cumulative effects predictions; rather, a degree of certainty is presented in the CEA that is not always substantiated by the EIS. It is evident in some cases that the conclusions are not based on quantitative models per se, but on the best judgment of the assessor. We are not suggesting that quantitative models are always required, or always best; however, whether quantitative or qualitative the conclusions about cumulative effects must be substantiated.

Chapter 7 of the EIS, p. 7-27, for example, notes: "...the magnitude of decline in the beaver population is scientifically uncertain because large comparison rivers that are unaffected by hydroelectric development ...tend to have fewer beaver." We don't disagree; however, later (p. 7-36) it is concluded that there is "no measurable residual cumulative effects of the project in combination with other future projects are anticipated." If it is scientifically uncertain, the claim that there is no measurable residual cumulative effect makes no sense. It is implied that some standard of measure has been adopted in the CEA, and the analysis conducted yielded no statistically or scientifically detectable differenced based on the predicted change. This doesn't seem to be the case. The conclusion is misleading.

Concerning wetlands (see TE -V, p. 2-201), it is concluded that "the additional affected areas are expected to range from nil to relatively small so that cumulative area losses could remain in the small to moderate magnitude range, depending on the final locations of the transmission ROWs" (with reference being made to the Bipole III project). Certainly it "could", but it is not known and there is no future model developed in the EIS to explore the range of possible outcomes associate with future cumulative wetland loss. Refer to sec. C-1 above.

Section 7.3.4 summarizes the Project's physical effects with future projects and activities. It reports that, with respect to the Bipole III and Keeyask transmission project, "...there is sufficient spatial separation so that there is little or no overlap with effects of the Project ..." and "...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..." but that these effects are "not expected to cause measurable incremental changes to the Project effects on the physical environment." First, we would ask what defines "sufficient separation" and "some overlap" – clearly these are spatial and temporal attributes that are measurable, but we are not able to find in the analysis definitions for what constitutes a sufficient spatial separation of effects. Note that separation of effects is quite different than separation of physical footprints, particularly in a watershed where cumulative effects to an aquatic system are associated with pathways of effects (i.e. the transport of water and sediment) versus physical footprints per se.

Caribou has received considerable attention in the EIS. Table 3a in the Keeyask Project Cumulative

Effects Summary, filed in response to CEC rd1 CEC-0020, indicates that: "Habitat loss will be small (< 1%). Changes to intactness and mortality are negligible...little effect on landscape movement and distribution. Overall, effects are expected to be negligible to small for both resident and migratory caribou." We are not clear on what constitutes a 'small' effect in terms of caribou population numbers. More importantly, on p. 18 of the same document it states: "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." This statement seems at odds with the conclusion stated above that effects are expected to be "negligible to small." The KCNs predict that with more development, caribou will likely disappear from the area again and not return for a long time.

C-3. Use of appropriate methods to capture the complexity and uncertainty associated with cumulative effects

The future is uncertain, environmental systems are complex, and precise predictions often never turn out to be correct. Because of this, the Keeyask CEA must make better use of scenarios. Uncertainty is acknowledged in the EIS, and data limitations are often explicit. Yet, many of the predictions about cumulative effects appear quite certain. In other cases, as noted above, cumulative effects predictions lack supporting evidence, are vaguely stated, or both.

We agree with Duinker and Greig (2006) in that CEA done well demands the explicit use of scenario-based analysis. We are not suggesting that the CEA must contain alternative policy visions of the future; rather, the CEA must consider a range of possible cumulative effects outcomes, and under different conditions and assumptions. For example: different rates of wetland decline and recovery; different rates and sedimentation volumes from land use disturbances; range of possible risk to sturgeon and mercury concentration levels, etc. Greig et al. (2004) report that a CEA that is focused solely on the "most-likely" approach, and outcome, to the development future is doomed.

Broad, policy-based land use scenarios about future developments outside the hydroelectric sector may be beyond the reasonable expectations of a project proponent in any single EIA. However, the exploration of alternative rates and configurations of development within the sector, particularly when a single project proponent largely controls the sector's activities and future plans, is a reasonable expectation. Further, the consideration of 'best' and 'worst' case scenarios in terms of the cumulative effects outcomes to VECs due the Project's effects in combination with the effects of other known future projects and activities is a requirement for good CEA.

Much of retrospective analysis in the EIS adopts spatial analysis, use of GIS, and modeling to allow scenario exploration to proceed, but the approach is not utilized. This is a shortcoming of the CEA.

D. Cumulative Effects Management Measures

Following the prospective analysis of cumulative effects, standard CEA procedure involves two steps: identification of mitigation strategies, followed by an evaluation of the significance of any residual cumulative effects (Hegmann et al. 1999). First, mitigation and offset measures are proposed along with adaptive management strategies, in order to address cumulative impacts as they unfold. Ideally, these strategies should be long-term and regionally-based (Hegmann et al. 1999), though of course they should also aid in mitigating local, direct effects as much as possible. It is important that the significance of a project's cumulative effects are measured against a past reference condition, and not simply the current, cumulative of disturbed condition. In general, the significance of residual adverse cumulative effects should be adequately described and justified from a VEC sustainability perspective. The incremental impacts of the proposed initiative should not be 'traded' off against the those of other projects, and thereby minimized or masked. These are the good practice performance standards also used to assess the CEA management phase for Manitoba Hydro's Bipole III project (Gunn and Noble 2012).

According to Chapter 7, the KHLP does not anticipate any cumulative effects of the project, and that is presumably why both mitigation strategies for cumulative effects and a significance determination specific to CEA are absent from the Keeyask EIS. However, we find the conclusion of 'no cumulative effects' questionable given the highly disturbed state of the region. We also note in Chapter 7 that the incremental impacts of the Project are often "traded off" against the significance of all other disturbances of activities in the project region.

D-1. No anticipated cumulative effects despite a highly disturbed region

Significance determination in CEA involves finding out "how much further effects can be sustained by a VEC before suffering changes in condition or state that cannot be reversed" (Hegmann et al. 1999: 42). The significance of an effect is usually described according to a number of attributes including: direction; extent (scope); duration; frequency; and magnitude (Hegmann et al. 1999). The significance determination can also be declared with varying levels of confidence: uncertainty disclosure is very important as CEA generally involves greater levels of scientific uncertainty "because of a longer time horizon and larger study area" (Hegmann et al. 1999:48).
However, the significance of any cumulative effects resulting from the the Keeyask project in combination with the wide variety of other existing and planned project developments in the region is not addressed in the CEA, because no cumulative effects of the project are anticipated by the

KHLP. For example, with respect to terrestrial VECs, the Keeyask EIS claims:

> "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 listed in Table 7-2" (Chapter 7, p.7-31) (i.e. Bipole III; Keeyask Transmission Project; Gillam Housing Redevelopment; and Conawapa Geration Project)." **<u>But</u>** that the "...review of other projects that could overlap with the effects of the Keeyask Project does not indicate any with 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" (p. 7-31,32) (i.e., as performed for the direct effects assessment.)

A very similar claim is made with respect to aquatic VECs (Chapter 7, p. 7-21): "...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..."

The same claim is ultimately made about socio-economic VECs. Chapter 7 (p. 7-45) explains that: "...adverse effects of the Keeyask Project are expected to overlap with the other future projects or activities listed in Table 7-2" and that there is potential for adverse cumulative effects on socio-economic effects to occur and that these effects require further mitigation and monitoring. However, "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..." (Chapter 7, p. 7-45). But Hegmann et al. (1999) suggest that significance may appear to decrease as the perceived effectiveness of mitigation measures increases.

Such sweeping claims are made in spite of the fact that Chapter 7 also includes statements that suggest not all predicted cumulative effects in the region will be minor, including:

VEC	Predicted Cumulative Effect
Ecosystem diversity	"...cumulative area losses for all priority habitat types are predicted to remain in the small to **moderate** magnitude range" (p. 7-32)
Priority plant species	"...cumulative losses are predicted to remain in the nil to **moderate** range, depending on the species" (p. 7-33)
Fish	"...the technical analysis indicates that there are no adverse effects of the Project on fish populations" (p. 7-23) but that "Members of the KCNs...have stated that they **expect a larger spatial and temporal extent of effects** than indicated in the technical analysis" (p. 7-23). "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**" (p. 7-20).

When drawing conclusions about cumulative effects and their significance, Hegmann et al. (1999: 48) suggest project proponents "make conservative conclusions (i.e. assume that an effect is more rather than less adverse). This is referred to as the Precautionary Principle." They also suggest: "Significance conclusions in assessments should be defensible through some form of explanation of how the conclusions were reached" (p. 42). Given the types of statements above and the deficiencies of the prospective analysis of cumulative effects noted earlier (see Part C of this Appendix), we find the conclusion of 'no cumulative effects' on VECs neither conservative nor convincing.

A large part of the reason that no residual cumulative effects of the Project are anticipated is that a robust management plan (monitoring and follow-up) is in place to address the Keeyask Project's effects (Chapter 8). Similar plans have presumably been in place for all previous hydroelectric development projects in the Nelson River sub-watershed subject to an environmental assessment process. Yet, the KHLP agrees that the region has been and is now 'substantially' altered (see Sec 4.3), and Chapter 7 describes in detail how past and current projects and activities have contributed to this altered baseline environment. How did this level of cumulative change occur if previous management plans were as successful as the Keeyask Project management plan is expected to be? The past record of development and resulting regional environmental disturbance, again, seriously challenges the notion that the Project **will not** contribute to processes of adverse cumulative environmental change already in motion, and that the incremental effects of the Project **would not** be cumulatively significant. Common sense, and the record of past change documented in the Keeyask EIS, suggest otherwise.

D-2. Masking or minimizing cumulative effects

The cumulative effects of any individual development project can only be properly appraised when evaluated in relation to the **total effects** of all past, present, and future projects on VEC sustainability (Hegmann et al. 1999; Keeyask EIS Chapter 7, p. 7-2). While determining the relative significance of the impacts of any one project on VEC sustainability can admittedly be challenging—particularly in the absence of defined sustainability thresholds, and the difficulty in assessing both probability of occurrence and degree of scientific certainty (Hegmann et al. 1999)—the basic concept is sound. One way that the contribution of a project to cumulative effects can be masked or minimized is to compare those effects favourably against the effects or disturbances caused by other projects. In other words, if the effects of the proposed project are 'less than' those caused by other projects, they are sometimes dismissed as insignificant in comparison. This particular issue was flagged in the review of the Bipole III CEA (Gunn and Noble 2012).

However, a second way that cumulative effects can be masked or minimized is to broaden the geographic scale of reference. Hegmann et al. (1999: 44) explain: "Significance may appear to decrease as the study area size increases". Joao (2002) has demonstrated that any effect can be made to seem inconsequential if the regional study area (geographic boundary) is large enough. Some examples of statements that mask or minimize potential cumulative effects of the Keeyask Project (Chapter 7) include:

With respect to moose: "Small changes in habitat are expected compared to the regional availability" (p. 7-31).

With respect to caribou: "For summer residents, the cumulative reduction in intactness (1%) is small compared to the Regional Study Area" (p. 7-35).

With respect to intactness: "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) (p. 7-32).

With respect to beaver: "Regional beaver populations are highly likely to maintain viable levels...(but)...The regional population will most likely continue to be depressed on the Nelson River because of water level regulations, and because beaver are unlikely to successfully re-colonize new shoreline wetland habitat in the long-term" (p. 7-36).

The practice of displacing responsibility for cumulative effects from one project to the next by minimizing their importance in a particular project context is unacceptable (Duinker and Greig 2006) and almost ensures that cumulative effects will never be adequately addressed by any of the projects, or for the projects cumulatively. This point was previously emphasized in the Bipole III CEA review.

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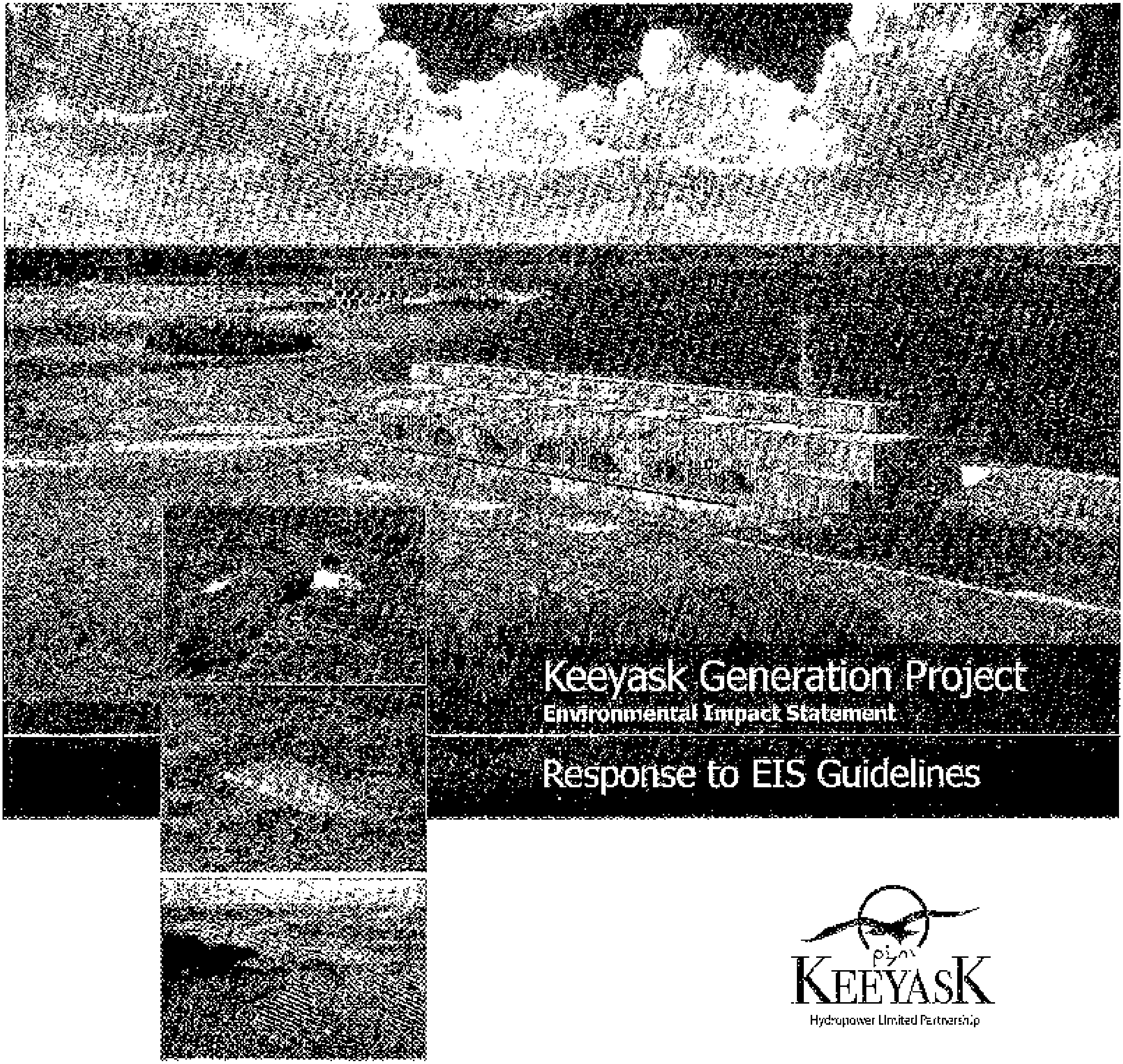
TAB 2



Keeyask Generation Project

Environmental Impact Statement

Response to EIS Guidelines

KEEYASK

Hydropower Limited Partnership

June 2012

CHAPTER 6

ENVIRONMENTAL EFFECTS ASSESSMENT

KEEYASK
Hydropower Limited Partnership

6.2.2 THE PAST

Through their own words, each of the KCNs has documented the history and present situation of their people who have inhabited the Keeyask area for thousands of years. The Cree people of TCN, WLFN, YFFN and FLCN have shared their stories, culture and history in Chapter 2 and in their evaluation reports. The KCNs' stories illustrate how changes over the past 200 years have had a profound effect on their relationships with the environment, changing their way of life and culture. The most profound of these changes took place over the past 55 years with the onset of hydroelectric development, which greatly altered their environment.

Section 6.2.2 summarizes key drivers of change and notable developments in the history of the KCNs from the pre-contact period, the pre-hydroelectric period focusing on contact with European explorers and the fur trade, and the hydroelectric period focusing on the most recent history. Figure 6-1 presents a visual timeline of these periods in history (see SE SV for further details).

Understanding the KCNs' past is important context to understand today's existing environment and future trends without the Project. In the sections that follow, emphasis is placed on key drivers of change since European settlement and industrial development. Context is provided in the Pre-Contact and Pre-Hydroelectric sections.

The most detailed information is provided for the hydroelectric development era between 1957 and the present in order to depict how the construction and operation of these northern hydroelectric projects resulted in life-altering changes to the water, land and traditional way of life of First Nation members living in the Keeyask area (CNP Keeyask Environmental Evaluation Report; YFFN Evaluation Report (*Kipekiskwaywinan*); FLCN Environment Evaluation Report (Draft); FLCN 2009 Draft; Split Lake Cree – Manitoba Hydro Joint Study Group 1996a, 1996b). The Socio-Economic Supporting Volume (SE SV, Section 2) provides a more detailed review of recent and past historic events that shaped the human history of northeastern Manitoba and includes discussion of the ATK and perspectives of the KCNs. Chapter 2 of this document provides historical context and details about the Cree worldview.

Nations respectively. In 1912, Manitoba's political boundaries were extended northward to include the entire northern area of what is known today as the Province of Manitoba (Manitoba Historical Society 2010). Among the many other external forces that followed were the *Natural Resources Transfer Act* of 1930, the registered trapline system, residential schools and the development of transportation and communication infrastructure. The Hudson Bay Railway, which has been under construction off and on since 1910, was completed in 1929 (Malaher 1984). Ilford and Gillam were among the communities established along the rail line. Roads, air strips and snowmobiles expanded the transportation network. (For greater explanation, see Section 2 of the SE SV). These forms of infrastructure opened the north for further industrial expansion related to mining, commercial forestry and hydroelectricity. All of these changes profoundly affected the way of life and culture of the Keeyask area's Aboriginal population, transforming their migratory way of life, responding to seasonal change, to a more sedentary way of life based in communities.

6.2.2.3 Hydroelectric Period

From the late 1950s to the present, more than 35 major generation, conversion and transmission projects have been undertaken by Manitoba Hydro in northeastern Manitoba affecting the traditional territories of the KCNs, their communities and Members. Specifically, between 1957 and 1995, four large hydroelectric generating stations and associated transmission lines were constructed within the Split Lake Resource Management Area, in addition to works associated with the Lake Winnipeg Regulation project (LWR) and the Churchill River Diversion (CRD) water management system (see Map 6-1[1] for the location of these generating stations described in detail). Kelsey Generating Station (GS) (1961) was the first of the four generating stations built along the Nelson River, followed by Kettle GS (1974); these projects both pre-dated the Lake Winnipeg Regulation and the Churchill River Diversion projects (1976). The Long Spruce GS was officially opened in 1979 and the Limestone GS in 1991. In conjunction with the hydroelectric projects on the Nelson River, the Town of Gillam was expanded in the mid-1960s with a sudden influx of non-local workers to serve as the operations and administration base for Manitoba Hydro's Nelson River generation, conversion and transmission activities. Construction and operation of these northern hydroelectric projects resulted in life-altering changes to the water, land and traditional way of life of First Nation Members living in the Keeyask area (FLCN 2009 Draft). In the words of Cree Elder, Joe Keeper, "The Cree world had completely changed, yet they hadn't moved". The KCNs' Environmental Evaluation Reports (as well as Chapter 2) describe how hydroelectric development in northern Manitoba has resulted in the profound changes to the way of life of their people. Through necessity of articulating and advocating for their rights and perspectives to those outside their homeland, the KCNs have spent much effort documenting how the effects have dramatically changed their physical and

[1] In print version, Chapter 6 Maps can be found in the accompanying Map and Figure Folio.

cultural surroundings. The above-noted documents provide additional detailed understanding of these effects. These generation stations and associated works have added to the changing character of land used by community **Members** and added to the area's workforce and population.

These direct effects have, in turn, resulted in changes to the surrounding environments and their use, including the following broad categories of environmental and socio-economic effects (Split Lake Cree – Manitoba Hydro Joint Study Group 1996b, 1996c):

Physical environment: water levels and flows, **debris**, erosion, ice and land area affected;

Biological environment: vegetation, wildlife, fish and associated habitats;

Resource use patterns: trapping, hunting, fishing, gathering; and

Socio-economic environment: economy, population, social and cultural well-being, way of life, governance, navigation and travel, and community infrastructure.

Particularly influential have been the construction and operation of the four generating stations and the substantial water management projects of LWR and CRD noted above, which taken together, have substantially adversely affected the land, water and traditional way of life of the KCNs. The following sections provide a summary of the most direct and obvious effects on water (change in levels and flows), land (area disturbed) and workforce (peak and total workforce) associated with these developments.

6.2.2.3.1 Kelsey Generating Station

The Kelsey GS is located on the upper Nelson River close to where it enters Split Lake. It is at the southern edge of the Split Lake Resource Management Area (RMA), several kilometres upstream from York Landing and 40 km southwest of the reserve community of Split Lake. The Kelsey GS was the first hydroelectric generating station developed on the Nelson River, built in response to the request of INCO for the Manitoba Hydro-Electric Board to provide over 100 MW of power to serve the new nickel mining and smelting operations and associated town site development now known as Thompson. The main construction took place over four years between 1957 and 1961, beginning with the building of an airstrip and rail spur line from the construction site to the Hudson Bay Railway line used for transporting the construction workforce and materials to and from the site. The town site of Thompson, 90 km from the western edge of the Split Lake RMA, was constructed during this time. Thompson did not exist prior to its development as the INCO workforce town site (Fraser 1985).

The Kelsey reservoir raised water levels by approximately 9.5 m above natural levels and flooded approximately 58 km^2 of land for 150 km along the upper Nelson River from the Kelsey GS to Sipiwesk Lake. No shoreline was cleared in advance, leading to considerable debris in the river along with flooding, erosion, mercury contamination and large-scale changes in the landscape on the upper Nelson River (Split Lake Cree – Manitoba Hydro

Perspectives from the Cree Nation Partners

The hydro dams, reservoirs and the resultant altered **water regime** (particularly of the Nelson River) have substantially affected the Split Lake Cree homeland (eg., more than 70% of Manitoba's electricity is generated within the Split Lake RMA). Other infrastructure includes converter stations and high voltage transmission lines including Bipoles I and II. CNP indicated that these projects have combined to have "devastating effect(s) on our customs, practices and traditions" (CNP Keeyask Environmental Evaluation Report). As of 1996, Manitoba Hydro's footprint in the Split Lake RMA totalled about 50,139 ha (123,899 acres) (Split Lake Cree – Manitoba Hydro Joint Study Group 1996b). This footprint is slightly larger than the size of Winnipeg (46,400 ha or 115,000 acres). A sizeable portion of CNP's major waterways in their homeland ecosystem are no longer able to sustain their traditional ways due to alterations from hydroelectric development.

The CNP have a duty of caring for the land and waters so that those waters and land will provide for the people in return. This sense of duty, including honouring and observing proper relationships based on respect, has been challenged by the changes that have happened to the waterways.

Perspectives from York Factory First Nation

As Cree people, YFFN Members have their own way of knowing, experts, and understanding of a highly complex and interconnected world. YFFN has described their *Ininiwi-kiskenihtamowin* (traditional knowledge) as "fundamental and central to who we are as a people and culture" (YFFN Evaluation Report (*Kipekiskwaywinan*)). It is held by community Elders and passes from generation to generation. It is also a "dynamic, living process that is added to and adapted in the lives of successive generations of Cree people" (YFFN Evaluation Report (*Kipekiskwaywinan*)). To YFFN, *Ininiwi-kiskenihtamowin* is a "way of life".

YFFN Members have lived at York Landing on Split Lake since 1957, prior to the Lake Winnipeg Regulation, Churchill River Diversion, and the construction of the present day dams. YFFN Elders remember the conditions and characteristics of the water, land, fish and wildlife in that period and they have observed and experienced changes to all these aspects of the environment following the development of the Kelsey Generating Station and subsequent hydroelectric developments on the Churchill, Burntwood, and Nelson River systems. YFFN's traditional way of life and relationships with the land, water and wildlife have been eroded by hydroelectric development. The land, waters, and YFFN Members continue to adjust to the ongoing and **cumulative effects** of past development.

Over the last several decades, fluctuating water levels have continued to erode all shorelines near York Landing (Kawechiwasik) even though the Lake Winnipeg, Churchill and Nelson Rivers Study Board predicted that shorelines would stabilize within 10 years of the Lake Winnipeg Regulation project. Shoreline erosion has resulted in the loss of boat launches, beaches, camps and scenic places important for family and community gatherings and social distributed debris along with some areas of moderately dense debris. Only two locations had high-density debris. In the Clark Lake to Gull Lake reach, the majority of classified debris was beached woody debris and standing dead trees, although leaning trees were not uncommon and often associated with beached debris. The majority of classified debris in the Gull Lake to Stephens Lake reach was standing dead trees and beached debris, although the shores downstream of Gull Rapids area were characterized by leaning trees Map 6-17 Shoreline Debris.

Debris was also classified for the year 2008, but only in a portion of the Local Study Area (Gull Lake, Gull Rapids). The 2008 classification showed greater densities of debris as compared with 2003. A substantial amount of submerged and floating debris was identified in 2008, which was a very high flow year. It is believed that debris that might be classified as standing dead or beached during a low-flow period like 2003 may have become submerged or floating debris during a high-water period like 2008.

Future debris conditions without the Project are expected to remain similar to existing conditions; specifically, most of the shorelines would have either no debris or low-density debris that is sparsely distributed. Areas of dense debris would remain few and localized. Beached, floating, standing dead and leaning trees would remain the dominant types of debris.

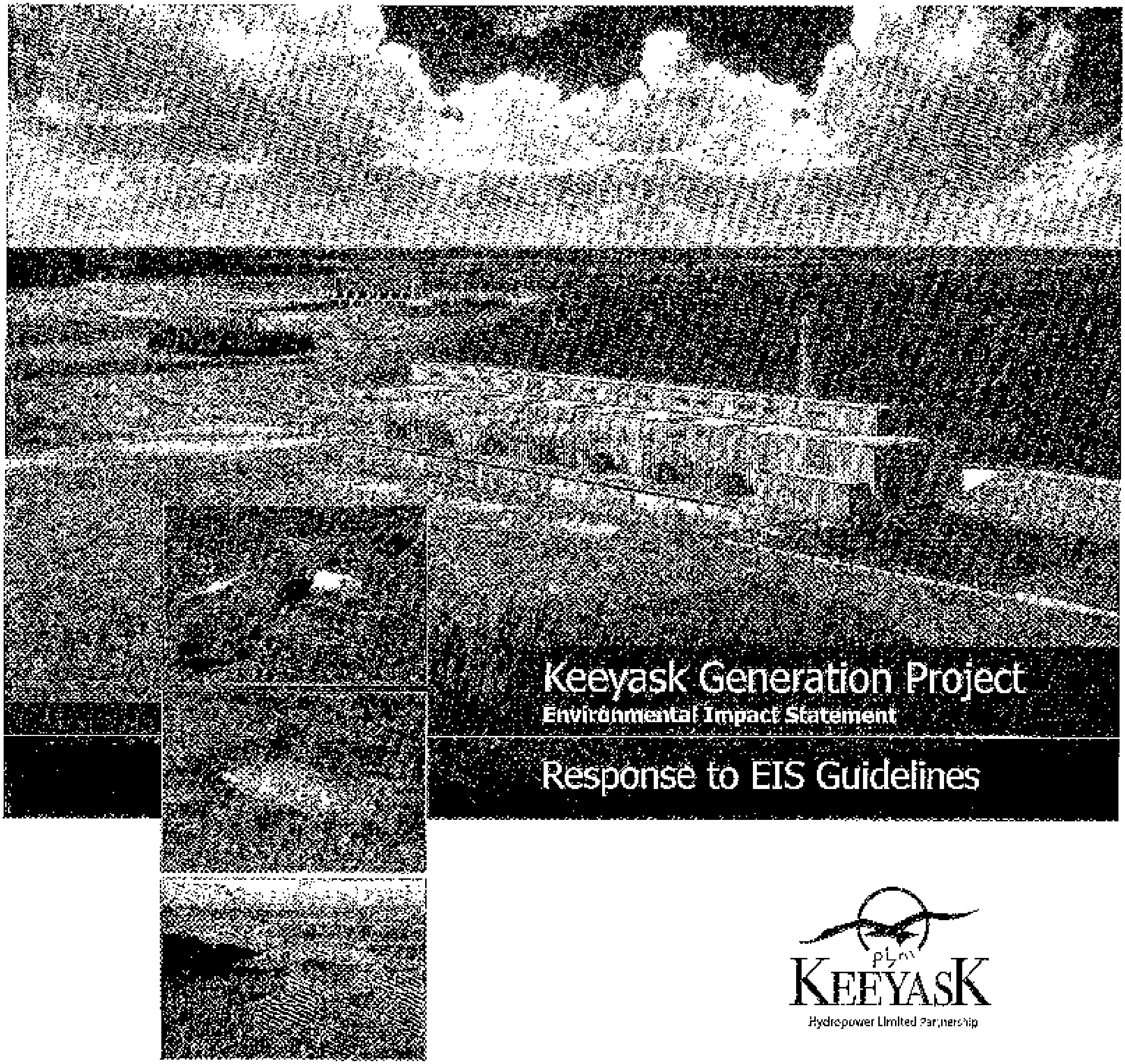
6.2.3.3 AQUATIC ENVIRONMENT

6.2.3.3.1 INTRODUCTION

The aquatic environment of the Nelson River where the Project will be constructed has been substantially altered by hydroelectric developments, in particular the Churchill River Diversion (CRD) and Lake Winnipeg Regulation (LWR), and the construction of the Kettle GS. Effects of the Project will be super-imposed on this disrupted environment.

Project effects will arise as a result of changes to the physical environment, as well as due to the presence of the generating station (GS) and associated structures. An ecosystem-based approach was used to conduct the environmental assessment (AE SV Section 1.2). This approach recognizes that the aquatic environment is a complex system. Key points recognized in this approach are: that different levels of the ecosystem should be assessed; that changes in one component can directly and/or indirectly affect other components; that the spatial scale of effects and scales at which specific components use the environment must be considered; and that the system is subject to considerable temporal variation (i.e., seasonally, between years, and in the long-term).

TAB 3



Keeyask Generation Project

Environmental Impact Statement

Response to EIS Guidelines

KEEYASK
Hydropower Limited Partnership

June 2012

CHAPTER 7
CUMULATIVE EFFECTS ASSESSMENT

KEEYASK
Hydropower Limited Partnership

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 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.

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' 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' Evaluation Reports provide information on the effects of past and current developments on the environment as a whole, including these VECs.

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.

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

effects from the Project (e.g., economy VECs 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.

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[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.