CRITICAL REVIEW OF THE REGIONAL CUMULATIVE EFFECTS ASSESSMENT (RCEA) FOR HYDROELECTRIC DEVELOPMENTS ON THE CHURCHILL, BURNTWOOD AND NELSON RIVER SYSTEMS

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ACKNOWLEDGMENTS

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ACRONYMS

CAC	Consumers Association of Canada
CCME	Canadian Council of Ministers of the Environment
CEA	Cumulative Effects Assessment
CEC	Clean Environment Commission
CRD	Churchill River Diversion
LWR	Lake Winnipeg Regulation
NFA	Northern Flood Agreement
RCEA	Regional Cumulative Effects Assessment
ROI	Region of Interest
RSC	Regional Study Components
VEC	Valued Ecosystem Components

1.0 INTRODUCTION

1.1 Background and objectives

Calls for a regional cumulative effects assessment (RCEA) in northern Manitoba have been ongoing for more than a decade. Through a number of recent public hearings regarding various proposed new hydroelectric developments "*...it became apparent that past hydroelectric developments in northern Manitoba have had a profound impact on communities in the area of these projects, as well as on the environment upstream and downstream*"[1]. In September 2004, as part of the Wuskwatim Generation and Transmission Project public hearings, the Manitoba Clean Environment Commission (CEC) recommended that[2]:

> The Government of Manitoba should undertake a regional planning initiative in northern Manitoba and on the east side of Lake Winnipeg, to address existing and future hydroelectric and other developments…A cooperative regional planning approach would be more appropriate to assess the cumulative effects of past, present and future developments in northern Manitoba. The Commission further notes that there is potential for a strategic environmental assessment approach to future planning and development in northern Manitoba that includes hydroelectric development along with future mining, transportation, infrastructure and related projects (Recommendation 7.4.4).

In November 2012, Gunn and Noble[3] reviewed the cumulative effects assessment prepared for the Bipole III transmission project and found the approach dismissive of the cumulative effects of the project in combination with the effects of other past, current and future and prospective projects and activities. In other words, the Bipole III project's impacts were often 'compared to' the effects of other actions, versus 'in addition to' any past changes in valued ecosystem component (VEC) conditions and 'in addition to' the effects of other current and future actions. As a result, they also recommended that:

> …the Government of Manitoba undertake immediately a regional-strategic environmental assessment of the cumulative effects of current and future land uses, particularly in the northern portion of the Bipole III study area.

Shortly thereafter, in its 2013 report on the Bipole III Project public hearing process, the CEC again recommended that:

> Manitoba Hydro, in cooperation with the Manitoba Government, conduct a Regional Cumulative Effects Assessment [RCEA] for all Manitoba Hydro projects and associated infrastructure in the Nelson River sub-watershed; and that this be undertaken prior to the

[1] CEC 2013. Report on Public Hearings: Bipole III Transmission Project, pg. 126
[2] CEC 2002. Report on Public Hearings: Wuskwatim Generation and Transmission Project, pg. 119
[3] Gunn and Noble 2012, pg. 16

licensing of any additional projects in the Nelson River sub-watershed after the Bipole III project (Recommendation 13.2).

This recommendation was accepted by Manitoba and a Terms of Reference for a RCEA of hydroelectric developments was agreed to by Manitoba and Manitoba Hydro in May 2014. The scope for the RCEA was expanded to include areas beyond that identified in the Commission's recommendation to include the Churchill, Burntwood and Nelson River systems. The study was completed in two phases. The first phase was completed in May 2014, and included a compilation of available data and a description of the assessment approach to be used to analyze the data in the second phase. On August 20, 2015, terms of reference were issued to the CEC to conduct public outreach meetings regarding the RCEA of the Churchill, Burntwood and Nelson River systems. The second phase report was completed in December 2015.

The purpose of this review is to provide an independent assessment of the Manitoba and Manitoba Hydro RCEA to the Manitoba Clean Environment Commission on behalf of the Consumers Association of Canada (CAC) (Manitoba) Inc. Specifically, the objectives are to critically review the RCEA filing and provide expert advice that will establish the strengths and weaknesses of the RCEA, and provide recommendations about ways the initiative could be improved, with a particular focus on the approach and process taken to assessing cumulative effects. The review shall be consistent with established principles and methodological guidance for RCEA in Canada as endorsed by the Canadian Council of Ministers of the Environment, and with established RCEA guidance as reported in other peer-reviewed, published expert works, both Canadian and international.

This review does not assess the scientific accuracy or disciplinary appropriateness of the filing in presenting past and current effects, but rather focuses on the overall approach to cumulative effect characterization, and the cumulative effects assessment methodology as presented in the filing. Similarly, the review does not assess the filing's accuracy in presenting community perspectives and concerns, but instead focuses on the overall approach taken to considering and integrating community perspectives and concerns with the cumulative effects assessment approach and methodology.

1.2 Qualifications of the authors

Dr. Jill Blakley[4], PhD, MCIP, RPP, has academic and professional practice experience in environmental assessment and natural resources management, including the assessment of cumulative effects and hydroelectric developments. She is an Associate Professor in the Department of Geography and Planning and cross-appointed to the School of Environment and Sustainability at the University of Saskatchewan. She has been Chair of the Regional and Urban Planning Program since 2014. From 1997-2003 Dr. Blakley acted as a consultant to British Columbia Hydro on integrated resource management for electric utility transmission rights-of-way in the central,

[4] Surname formerly Gunn, which appears on Bipole III, Keeyask, and NFAT cumulative effects assessment reviews.

northern, and western regions of British Columbia, including non-integrated generation sites. She documented a decade-long informal program to address a wide variety of environmental, social, and economic management imperatives via innovative, site-specific vegetation management strategies. Dr. Blakley completed a PhD specializing in strategic and cumulative effects assessment in 2009. Her academic contributions regularly appear in internationally regarded periodicals such as *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, her body of work on environmental assessment grown to include 41 peer-reviewed scientific papers, book chapters, and professional reports, and 44 conference presentations. In the area of cumulative effects assessment, she has co-authored numerous expert reports, many with Dr. Bram Noble, including:

- the Canadian Council of Ministers of the Environment (CCME) guidance on regional-strategic environmental assessment (CCME 2008, 2009) which informed Section 3.5 (Regional Impact Assessment) of the recent federal Expert Panel report *Building Common Ground: A New Vision for Impact Assessment in Canada* (Gelinas et al. 2017, see Section 3.5 Regional Impact Assessment), and also served as a foundation for the Alberta government's innovative Land-use Framework;
- a guide to assessing the macro environmental impacts of the preferred plan and alternatives in Manitoba Hydro's Needs for and Alternatives Too (NFAT) review of Keeyask and Conawapa Generating Stations;
- a report defining key cumulative effects concepts for CCME's 14 jurisdictions (CCME 2014);
- the *Critical Review of the Cumulative Effects Assessment Undertaken by Manitoba Hydro for the Bipole III Project* expert report (2012); and
- the *Review of KHLP's Approach to the Keeyask Generation Project Cumulative Effects Assessment* expert report (2013).

Since 1997, Dr. Blakley has provided expert advice to a range of organizations including the Canadian Environmental Assessment Agency; Fisheries and Oceans Canada; Alberta Environment; the Canadian International Development Agency; the Public Interest Law Center of Manitoba and the Consumers Association of Canada (Manitoba); Pape, Salter and Teillet Barristers and Solicitors; the Canadian Institute of Planners; and the City of Saskatoon.

Dr. Ayodele Olagunju, PhD, PMP is an environmental assessment professional with the Government of Alberta. He earned a PhD in 2016 specializing in environmental assessment and the integration of assessment, planning, and policy-making on a regional scale. His work on improving governance arrangements to facilitate regional environmental assessment has been featured in numerous international peer-reviewed journals including *Environmental Impact Assessment Review*, *the Journal of Environmental Assessment, Policy and Management*, and *Impact Assessment and Project Appraisal*. Dr. Olagunju has co-authored several environmental assessment technical reports including the *Manitoba Hydro's Needs for and Alternatives to (NFAT) Review of the Keeyask and Conawapa Generating Stations: Macro Environmental Impact Assessment guidance* (with Dr. Blakley) commissioned by the Consumers Association of Canada (Manitoba) in 2014 and more recently, *A*

Review of the Application of Cumulative Effects Assessment in the Context of Project Environmental Assessments: The James Bay Territory (with Dr. Bram Noble and Jackie Martin, MSc) prepared for the James Bay Advisory Committee on the Environment Quebec.

1.3 Report format

The report is presented in four sections, including this Introduction. In Section 2, an explanation of the nature and importance of regional cumulative effects assessment is provided, including a description of its core principles and methodology. In Section 3, we describe our overall approach to the critical review, and the review criteria that were used. Section 4 presents the results of the review of the RCEA filing. Both the strengths and weakness of the filing are considered. Section 4 also contains recommendations to improve the RCEA initiative, and guide Manitoba and Manitoba Hydro further toward good practice regional cumulative effects assessment of hydroelectric developments affecting the Churchill, Burntwood and Nelson River systems.

2.0 REGIONAL CUMULATIVE EFFECTS ASSESSMENT

2.1 What is regional cumulative effects assessment?

Cumulative effects

Cumulative environmental effects are commonly defined as "changes to the environment that are caused by an action in combination with other past, present and future actions."[5]. Some definitions also emphasize the contribution of natural processes to cumulative environmental change, such as that recently issued by the Canadian Council of Ministers of the Environment: "a change in the environment caused by multiple interactions among human activities and natural processes that accumulate across space and time" [6]. The actions referred to in these definitions are often varied (heterotypic) in nature, but also can be identical (homotypic) actions. For example, activities associated with forest harvesting such as road building, stream crossings, and clearing native vegetation in cut blocks together can degrade wildlife habitat for fur-bearers such as gray wolf[7], but repetitive, episodic discharges of pulp mill effluent into a river can also degrade water quality for salmon and other freshwater biota[8]. In both cases, the perturbations can overwhelm the ability of the receiving environment to absorb the change, causing a cumulative environmental effect.

Cumulative effects have been described as 'progressive nibbling', 'death by a thousand cuts' and the 'tyranny of small decisions'[9]:

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[5] Hegmann et al 1999: pg 3
[6] CCME 2014
[7] Houle et al. 2009
[8] Marmorek et al. 1992
[9] Noble and Gunn 2013

> '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.

Thus, cumulative effects are often insidious: while many development activities and decisions can be individually insignificant, together their impacts can have regional and even global repercussions.

Cumulative effects assessment

Cumulative effects assessment (CEA) and management has been a key element of good practice impact assessment for more than 40 years in countries such as the United States and Canada, and around the world. The International Finance Corporation (IFC) of the World Bank describe this process as:

> (a) analyzing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and nature environmental and social external drivers on the chosen VEC [valued environmental component] over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risks to the extent possible[10].

Cumulative effects assessment and management is arguably best performed on a regional scale because this scale of assessment is broader both geographically and temporally than single project-focused impact assessment typically is, and it is better positioned to capture the range of stressors that are affecting a VEC of concern. Within Canadian and international environmental impact assessment literature, it is well established that regional-scale CEA is a more effective means to address cumulative effects[11]. It differs from CEA in project-based assessment in a number of ways:

- it adopts ambitious, as opposed to restrictive, scoping, meaning that the impact analysis goes beyond the evaluation of the site-specific, direct impacts of a single project to encompass broader regional understandings of development pressure and considerations of the various sources of cumulative environmental change[12];

[10] IFC 2013, pg. 21

[11] For e.g., see: Roots 1986; Davey et al. 2002; Kennett 2002; Cooper and Sheate 2004; Horvath and Barnes 2004; Dalal-Clayton and Sadler 2005

[12] Harriman and Noble 2008

- the goal of the assessment is to evaluate the full range of impacts on VECs caused by past, current and proposed future initiatives, ideally on a multi-sectoral basis, and determine whether ecological thresholds have already been crossed. If a threshold has been crossed, any future impact on a VEC must be considered significant. With this information, it is easier to determine which environmental management strategies are necessary to restore, maintain, or enhance VEC sustainability;
- ideally, it is strategic in nature. When RCEA is approached as a strategic exercise, its purpose is different – it is used to compare competing development scenarios and determine a preferred development path for the future, including the desired nature and pace of development. The results can be used to inform and influence other regional planning and policy-making exercises, and subsequent project approvals and conditions;
- it is often used to establish long-term, coordinated adaptive management and monitoring programs to ensure stewardship and protection of key resources, as well as enhance social license to operate in a resource development region; and
- it provides a unique forum for conversation, innovation, and relationship building among project proponents, governments, NGOs, and the public to help ensure the resiliency of VECs is maintained in the face of ongoing regional development. An open and collaborative approach to RCEA is essential.

2.2 Why is it important to assess regional-scale cumulative effects?

The increased pace and intensity of resource development in many regions of the world, combined with increased concern for environmental protection, has brought RCEA into focus in recent years. At the top of many research and policy agendas across Canada and elsewhere is developing partnerships and innovative means to address cumulative effects such as climate change, worsening air quality, fresh water shortages, deforestation, noise and light pollution, and wildlife habitat fragmentation. Some specific examples of regional-scale cumulative effects issues include:

- Incremental loss of prairie wetlands and pollution of freshwater caused by agricultural practices which affects migratory birds and other wildlife species[13];
- Shoreline damage and damage to the landscape, flora, fauna, and historical artifacts in marine areas caused by repeated visits by ship-based tourists in the Antarctic Peninsula Area[14]. Tourism related impacts affecting wildlife conservation efforts are also experienced in Canadian national parks[15];
- Sulfur dioxide and nitrous oxide pollution created by electricity generation, factories, and vehicles which is transformed into acid rain; leading to acidification of wetlands and water bodies and loss of species diversity[16];

[13] Government of Canada 2017
[14] National Science Foundation 2000
[15] Cooke et al. 2017
[16] https://www.epa.gov/acidrain/what-acid-rain

- Greenhouse gas emissions leading to glacier melt and rising sea levels and loss of polar bear habitat[17]; and
- Access roads and fly-in fly-out programs introduced in northern development regions leading to strain on community health and infrastructure services, stark income disparities among local and migrant workers, and increases in alcohol and drug use as well as crime and family violence[18].

In August 2016, the Canadian Minister of Environment and Climate Change established an Expert Panel to investigate options for impact assessment reform in Canada. The report of the Expert Panel[19] underscored the importance of regional-scale impact assessment by establishing it as a core component of 'next generation' impact assessment practice and signaling the federal government's intention to assess the collective impacts of development on a regional basis. The report of the Expert Panel builds upon principles and a methodology for regional strategic environmental assessment established by the Canadian Council of Ministers of the Environment about a decade prior[20]. It recommends that regional and strategic impact assessments be used to guide project impact assessments, whereby strategic and regional impact assessments produce the policy and planning foundations for improved and efficient impact assessments"[21].

Although formally promoted by the CCME, interest in regional cumulative effects assessment has also grown organically in the 21st century in Canada. Numerous provincial and federal government departments, NGOs, and industries in Canada have initiated or called for regional impact assessments independently over the past decade or so, based on its perceived value-added. These include: Fisheries and Oceans Canada; the Saskatchewan Ministry of the Environment; Alberta Environment and Parks; Parks Canada Agency; Teck Coal; Aboriginal Affairs and Northern Development Canada (in partnership with the energy industry, Inuvialuit and other regional stakeholders); the Canadian branch of the World Wildlife Federation; the Wildlife Conservation Society of Canada and Ecojustice; and ConocoPhillips[22], among others.

The goals and objectives of these initiatives are variable, reflecting different environmental, social, and political contexts and value systems. As well, the nature of each assessment is different, with some assessments being strategic in nature and others not[23].

Taking a strategic approach to regional cumulative effects assessment means that the assessment is proactive and objectives-led, and designed to influence development policies, plans, or programs at

[17] https://www.carbonbrief.org/polar-bears-and-climate-change-what-does-the-science-say
[18] Leung et al. 2016
[19] Gelinas et al 2017
[20] CCME 2009
[21] Gelinas et al. 2017, pg. 3, 6
[22] See for example: GSH RES 2007; BSStRPA 2009; Gunn and Noble 2009; Kirchhoff et al 2010, 2011; Johnson et al. 2011; Fidler and Noble 2013; Noble and Gunn 2013; Chetkiewicz and Lintner 2014
[23] See: Harriman and Noble 2008

the highest level and earliest opportunity possible. The focus is on articulating desired goals, objectives, and alternatives for future development. It involves assessing the impacts of either a single or multiple development sectors, and in either case, sets the context for subsequent project development. Single-sector, strategic approaches to regional cumulative effects assessment:

> …evaluate the potential effects of proposed sector-based initiatives and alternatives in combination with impacts from previous, existing, and future activities and initiatives of a similar type in order to identify a preferred sector-based environmental development strategy. The 'sector' generally refers to plans and initiatives of a particular industry such as forestry, mining, or energy[24].

According to the CCME[25], the potential substantive benefits of a strategic approach to regional cumulative effects assessment include:

- integrating sustainability considerations in regional policies, plans, programs and development initiatives;
- establishing a common, long-term framework for regional decision making;
- analyzing impacts neither individually or collectively subject to project impact assessment;
- managing impacts at the appropriate geographic scale; and
- contributing to discussions of sustainable regional development.

The CCME notes potential procedural benefits as well:

- the opportunity to improve regional databases and create mechanisms for information sharing;
- facilitating state of the art environmental monitoring and reporting;
- saving time and resources by strategically avoiding impacts (reducing the amount of mitigation necessary in project impact assessment);
- setting performance standards for subsequent project-based impact assessment; and
- providing indication of public interest in regional environmental issues.

The importance of undertaking a strategic regional cumulative effects assessment exercise in northern Manitoba at this time cannot be understated. Following nearly six decades of hydroelectric planning and development (plans for the Grand Rapids Hydro Project began in earnest as early as 1957[26] and it became operational in 1964), significant cumulative change to the environment, including social and cultural impacts to Indigenous and non-Indigenous communities in the region, is undeniable. This is prominently noted in the Keeyask environmental impact statement[27], which clearly acknowledges that the regional environment has already been substantially altered by past

[24] See: Harriman and Noble 2008
[25] CCME 2009
[26] Waldram 1984
[27] Noble and Gunn 2013

development:

> 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" (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" (Ch 7, p. 7-37).
>
> The aquatic environment of the Nelson River where [new projects may] 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 [new projects] will be super-imposed on this disrupted environment" (Ch 6, p. 6-54).
>
> 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 [Indigenous] communities and members" (Ch. 6, p 6-12).

Rivers have been diverted, wildlife killed, reserve land flooded, communities relocated, etc., with many key decisions in the first two decades of development (1960-1977) being rushed and Indigenous communities faced with decisions totally unlike anything with which they had ever been confronted[28].

In 1979, a Commission of Inquiry Into Manitoba Hydro (the 'Tritschler Report') found that with respect to impact assessment and compensation, by 1972 Manitoba and Manitoba Hydro did not have a compensation scheme, that the various government departments failed to cooperate in the areas of compensation and mitigation, and that they adopted a confrontational, hostile stance toward the affected Indigenous communities[29]. In 1977, the Northern Flood Agreement (NFA) was signed by Manitoba, Manitoba Hydro, and the federal government, and ratified by First Nations leaders[30] to address mitigation and management deficiencies. Between 1978 and 1992, a number of major efforts were made to implement the agreement, including land use studies, ecological monitoring programs, and community infrastructure upgrades. However, there was general discontent with the way implementation and compensation was handled, leading to Manitoba

[28] Waldram 1984
[29] Waldram 1984
[30] Information on the Northern Flood Agreement in this paragraph is drawn from Know History (2016), commissioned by the Manitoba Clean Environment Commission.

Hydro signing major implementation settlement agreements between 1992 and 1997. Additional, supplemental agreements with NFA communities were signed between 2004 and 2015. At issue were ongoing concerns such as flooding of land and damage to shorelines by the Churchill River Diversion and Lake Winnipeg Regulation Projects, compensation for adverse high-water events that occurred between 1977 and 2016; and provision of alternative employment opportunities.

At present, there is a unique and unprecedented window of opportunity for policy change regarding hydroelectric and other development in northern Manitoba, before additional development decisions are taken that affect the region. The Manitoba CEC has recommended that a RCEA be undertaken prior to the licensing of any additional projects in the Nelson River sub-watershed after the Bipole III project. If carefully designed, the RCEA initiative can help focus attention on the issues to get them on the policy agenda, create or strengthen coalitions that sustain attention around an issue, and increase the knowledge that policy-makers have about issues important to northern residents today and over the past half century. Most importantly the RCEA can serve as a means to proactively address regional cumulative effects issues, as promoted by the CCME, as well as inform and strengthen related policy initiatives such as the Manitoba Clean Energy Strategy, the Growing Our Watersheds initiative, and potentially, a publicly endorsed vision for development in the north.

2.3 What are the key elements of regional cumulative effects assessment?

With respect to good practice RCEA, guiding principles, a methodological framework that details important stages in the process, and specific guidance on assessing cumulative effects are all publically available. Each of these is summarized below.

In 2009, the Canadian Council of Ministers of the Environment issued a number of core and methodological principles for regional strategic environmental assessment (Table 1)[31] – which is essentially RCEA set within a strategic assessment context[32]. The core principles are that it is: strategic; futures-oriented; commences early on; cumulative effects focused; multi-tiered; multi-scaled; participatory; opportunistic; and adaptive. In terms of methodological approach, it should be: integrated; focused on alternatives; regional VEC-based; interdisciplinary; and structured and systematic. Some of these elements are the same as they would in be in any impact assessment (e.g. participatory, early commencement, adaptive), and some are specific to a regional assessment context (e.g. integrated, regional VEC-based, multi-tiered, multi-scaled).

[31] See: CCME 2009, pg. 14, 15

[32] It is regional strategic environmental assessment that Gunn and Noble called for in 2012 at the Bipole III hearing, and the CEC called for in 2004 at the Wuskwatim hearing.

Table 1. Core and methodological principles of regional strategic environmental assessment

Core Principles	
Strategic	Goals and objectives-led. Identifies strategic initiatives, evaluates alternatives, and formulates a strategy for moving forward toward a desired future state.
Futures-oriented	Focuses on identifying possible futures and the means to shape regional outcomes
Early commencement	Is undertaken at the earliest possible stages of decision making, to inform the development of strategic initiatives, policies, plans, or programs
Cumulative effects focused	Identified cumulative effects as the real effects of concern operating at the regional scale
Multi-tiered	The assessment informs, and is informed by, broader regional and multi-regional environmental management and also downstream project assessment and decision making
Multi-scaled	Primary issues of cumulative effects can be revisited, where needed, not only at different tiers but also at different spatial scales. Analysis of impacts is multi-scaled
Participatory	Ensures early and ongoing involvement of relevant stakeholders and interested parties in assessment (scoping, impact evaluation, significance determination), monitoring, and management
Opportunistic	Provides an opportunity to examine regional development through broader stakeholder debate, and identifies the need to create or modify institutional arrangements for improved environmental management
Adaptive	Treats strategies, and policies, plans, and programs as 'experiments', expecting to modify and adapt them as new knowledge is gained through implementation, monitoring, and feedback
Methodological Principles	
Integrated	Core elements of the process should be tailor-made and integrated with the decision making system in place. Should be an integral part of, and provide overall guidance to, the development of regional strategies and initiatives. Should integrate multiple scientific perspectives and disciplines
Focused on alternatives	Emphasizes the creation and evaluation of alternatives, often in the form of alternative development scenarios for a region. By comparing multiple, alternative development scenarios, decision makers are able to obtain a vivid picture of the likely consequences of different courses of action
Regional VEC-based	Cumulative effects processes are often linked with highly complex global and regional environmental management issues such as climate change or biodiversity. Thus, the concept of a valued ecosystem component must be relevant to a regional scale of analysis, and be represented by broad indicators of ecosystem health and regional environmental change
Interdisciplinary	Involves multiple levels of interest, ranging from political decision makers to disciplinary specialists, and various sectors of the public including industry. Emphasizes a inter-disciplinary (as opposed to simply multi-disciplinary) approach; one that enables all parties to identify and address common issues and to appreciate where, and in what form, their information is useful to others and at different tiers of decision making
Structured and systematic	The methodological framework should be flexible to the particular policy and planning context, but it remains important that systematic and structured methodological frameworks are employed at the strategic level, as they are at the project level

The basic methodology, or process, to conduct a regional strategic environmental assessment is shown in Figure 1, below. The process is structured and systematic yet designed to be used flexibly

in a variety of development and decision-making contexts. There are three phases[33]:

(i) ***pre-assessment phase*** (steps 1-3) in which goals for the exercise are established, the spatial and temporal boundaries of the assessment are determined, VECs of interest are selected, and the regional baseline is described as are regional stressors and change trends. Opportunities to influence future policies, plans, and project decisions are identified, along with key partners and contributors to the assessment;

(i) ***assessment phase*** (steps 4-6) which is used to identify strategic options or alternatives for the region and their potential effects, opportunities, and risks. Emphasis is placed on assessing cumulative impacts to VECs, and using this information to identify a preferred development path for the region; and

(ii) ***post-assessment phase*** (steps 7-9) which focuses on implementation including adaptive management and monitoring. Follow-up and review is conducted periodically after the assessment so that adjustments to the impact analysis and/or management plan can be made as new knowledge emerges or conditions change.

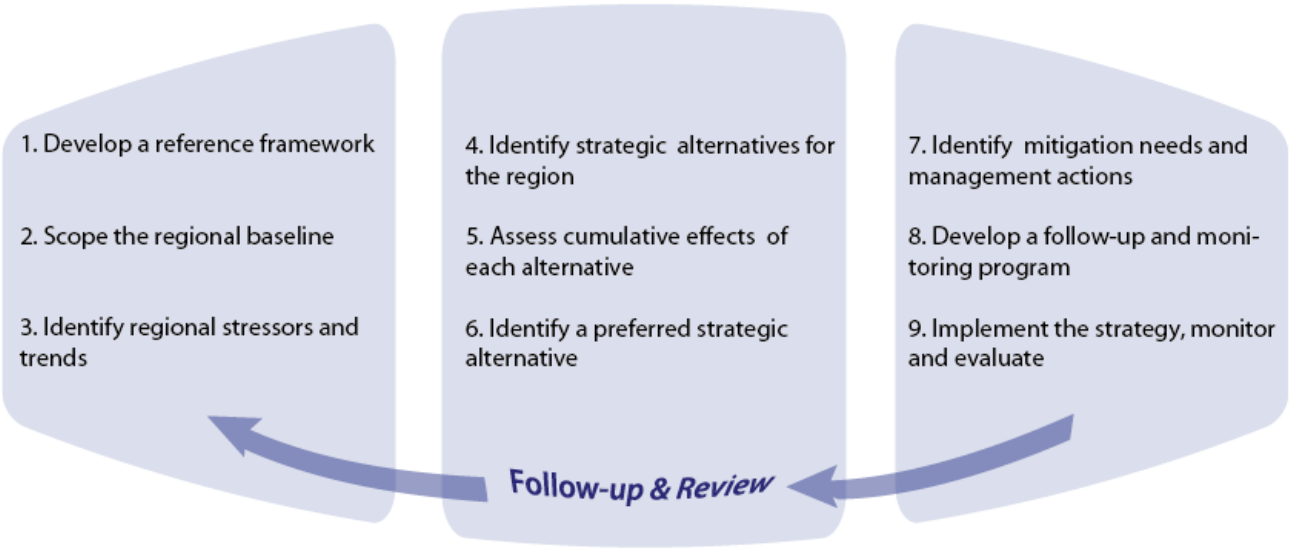

Figure 1. Basic methodological process for regional strategic environmental assessment

At the core of any regional-scale impact assessment process is CEA (step 5 in the framework above). There is plenty of guidance available for CEA[34], all of which identifies several necessary components

[33] Steps are described in more detail in Noble and Gunn, Ch 5, Hanna text; and Gunn and Noble, Ch 5, in Morrison-Saunders, et al. text.

[34] See for e.g., CEQ 1997; Ross 1998; European Commission 1999; Hegmann et al. 1999; Duinker and Greig 2006; INAC 2007; Canter and Ross 2010; Noble 2010; IFC 2013; Duinker et al. 2013; CEAA

in undertaking CEA. The core components of CEA are essentially the same whether in a regional, strategic, or project assessment context. In the absence of any one of these components a CEA is incomplete. The components are:

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

b) ***Retrospective analysis***, focused on determining baseline conditions, how conditions have changed over time, whether that change is significant to the sustainability of the VECs 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 projects in question and to other present and future projects and actions within the 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 VECs subject to cumulative effects. Understanding how much more change in an affected VEC is tolerable, or acceptable, is key to significance determination or sustainability test, as the case may be in a regional assessment, and this 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 rectifying or restoring conditions, and delivering net positive contributions to regional sustainability.

3.0 APPROACH TO REVIEW AND REVIEW CRITERIA

Consistent with the scope of the work outlined in Section 1, we undertook a critical review of the Manitoba and Manitoba Hydro RCEA for hydroelectric developments on the Churchill, Burntwood and Nelson River systems. Methodologically, this involved a literature review (Section 2.0) to establish a basis for the review, and subsequent analysis of the filing to determine core strengths and weaknesses, and identify any areas for recommended improvements.

Although the CEC's Bipole III recommendation does not call specifically for a *strategic* regional cumulative effects assessment in northern Manitoba, and the Terms of Reference for the RCEA reflect this, the CEC did previously recommend a strategic approach in the Wuskwatim hearing. Noble and Gunn also recommended a strategic approach to regional cumulative effects assessment in their review of the Bipole III filing. Given that the Consumers' Association of Canada (Manitoba chapter) have asked to learn more about a strategic approach to regional cumulative effects assessment and how the Manitoba and Manitoba Hydro RCEA compares, our selected review criteria include: the CCME's core and methodological principles for regional strategic environmental assessment, Noble and Gunn's step-wise process to undertake regional strategic environmental assessment, and the four components of a standard methodology for CEA, as described above. These are summarized in Table 2.

Table 2. Review criteria for the Manitoba and Manitoba Hydro RCEA

Part A. Core and methodological principles for regional strategic environmental assessment	
Core	
Strategic	Is the assessment goals and objectives-led? Are strategic alternatives to the development status quo identified?
Futures-oriented	Is a preferred future development strategy identified for the region?
Early commencement	Is the exercise undertaken early enough to inform strategic decisions about the future of the region?
Cumulative effects focused	Are regional-scale cumulative effects a central concern?
Multi-tiered	Can the assessment results provide context for 'upstream' (policy) and downstream' (project) decision-making, and vice-versa?
Multi-scaled	Are different spatial scales used to better understand regional cumulative effects?
Participatory	Are stakeholders and key informants involved in scoping, assessment, monitoring, and management activities?
Opportunistic	Does the exercise inform broader stakeholder debate and opportunities to modify institutional arrangements for improved environmental management?
Adaptive	Is the assessment flexible enough to be modified as new knowledge is gained through implementation, monitoring, and feedback?
Methodological	
Integrated	Does the assessment draw information from existing regional studies, and can it add value to other regional planning or management exercises?
Focused on alternatives	Are multiple alternative development scenarios assessed such that the likely consequences of different courses of action are illuminated?
Regional VEC-based	Are selected valued components relevant to a regional scale of analysis, and represented by broad indicators of ecosystem health and regional

	environmental change?	
Interdisciplinary	Is a cross-section of disciplines and interests engaged, including government, non-government, scientific, public, and industry representatives? Are these perspectives developed in the assessment in an inter-disciplinary fashion?	
Structured and systematic	Is a structured and systematic methodological environmental assessment framework employed?	
Part B. Step-wise methodological process for regional strategic environmental assessment		
Pre-assessment phase • develop reference framework • scope the regional baseline • identify regional stressors and trends	Assessment phase • identify strategic alternatives for the region • assess the cumulative effects of each alternative • identify a preferred strategic alternative	Post-assessment phase • identify mitigation needs and management actions • develop a follow-up and monitoring program • implement the strategy, monitor and evaluate • follow-up and review
Part C. Cumulative effects assessment components[35]		
Cumulative effects scoping	i) The CEA considers all types of activities and stresses (human-induced and natural disturbances) that may interact with VECs of concern ii) The CEA adopts participatory, 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	
Retrospective analysis	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	
Prospective analysis	i) The time scale of cumulative effects predictions is sufficient to capture the scope of impacts associated with the life cycle of projects in question 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 regional environment, and ability to withstand further stress	
Management	i) Is the significance of cumulative effects measured against a past reference condition and not simply the current, cumulative or disturbed condition in the region? ii) Is the significance of cumulative effects adequately described and	

[35] Similar components and review questions were utilized in both the Bipole III and Keeyask CEA reviews.

	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? iii) Are the incremental impacts of the projects in question not '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 developments and impact interactions?

The review criteria incorporate the best available national guidance for regional strategic environmental assessment that was available at the time that the RCEA was performed, including principles and standards for CEA that are well established in the scientific literature and professional guidance documents. The review criteria for CEA are derived from a number of sources, including the *Cumulative Effects Assessment Practitioner's Guide*, publically available books and technical guidance on good practices in CEA in Canada[36], the two leading international scientific journals on environmental assessment (*Environmental Impact Assessment Review* and *Impact Assessment and Project Appraisal*), and select guidance from other jurisdictions (e.g. British Columbia, Alberta)[37]. We also referred to previous and more recent reviews of CEA practice in strategic and project contexts and the lessons emerging[38]. 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 to Manitoba and Manitoba Hydro.

In undertaking our review, we consulted the relevant chapters and supporting volumes of the RCEA (Table 3). While we reviewed almost the entire filing including the terms of reference and the integrated summary report, we report selectively on those sections most relevant to the assessment and characterization of cumulative effects, and our review criteria (i.e. relevant subsections of Phase II Parts I, III, IV, V, and VI, the Terms of Reference for the RCEA, and the Integrated Summary Report). We did not review technical Appendices. In our review, we rely primarily on the information provided in Phase II of the RCEA, as the Phase I report issued by Manitoba and Manitoba Hydro was considered preliminary and incomplete.

Table 3. RCEA materials reviewed

Terms of Reference
Phase 1
Part I. Introduction and Approach
Part II. History of Hydroelectric Development in the Region of Interest
Part III. People

[36] See for example: Beanlands and Duinker 1983; Hegmann et al. 1999; Noble 2010; CEAA 2014
[37] See for example: Alberta Environment n.d.; Forest Practices Board 2011
[38] See for example: Baxter et al. 2001; Canter and Ross 2010; Gunn and Noble 2011

Part IV. Physical Environment
Part V. Water and Land

Phase 2

Part I. Introduction and Approach
Part II. History of Hydroelectric Development in the Region of Interest
Part III. People

- 3.1 Introduction (all)
- 3.2 Study Scope, Approach and Methodology (all)
- 3.3 Regional Profile (all—Introduction, Key Historical Events as well as Population, Economic and Other Socio-Economic Indicator Trends in the RCEA Region of Interest)
- 3.4 Summary of Hydroelectric Effects on People, and Key Mitigation, Remediation and Compensation Measures in the Region of Interest (all)
- 3.5 Summary of Community Information (Overview, Structure of the Chapter, and Context for the Chapter)

Part IV. Physical Environment

- 4.1 Introduction and Background (all)
- 4.2 Environmental Setting (all-Climate and Geophysical Landscape)
- 4.3 Water Regime (Introduction, Approach and Methods and the Twelve Hydraulic Zones Influenced by Lake Winnipeg Regulation and Churchill River Diversion)
- 4.4 Erosion and Sedimentation (all—Introduction and Description of Erosion and Sedimentation Processes in the Twelve Hydraulic Zones)

Part V. Water

- 5.1 Introduction and Background (all)
- 5.2 Water Quality (Introduction, all sections on Cumulative Effects of Hydroelectric Development on Water Quality, Summary of Effects of Hydroelectric Development in the Region of Interest on Water Quality)
- 5.3 Fish Community (Introduction, all sections on Cumulative Effects of Hydroelectric Development on the Fish Community, Summary of Effects of Hydroelectric Development in the Region of Interest on Fish Community)
- 5.4 Lake Sturgeon (Introduction, all sections on Cumulative Effects of Hydroelectric Development on Lake Sturgeon, Summary of Effects of Hydroelectric Development in the Region of Interest on Lake Sturgeon)
- 5.5 Mercury in Fish (Introduction, all sections on Cumulative Effects of Hydroelectric Development on Fish Mercury, Summary of Effects of Hydroelectric Development in the Region of Interest on Fish Mercury Concentrations)
- 5.6 Fish Quality (Introduction, all sections on Cumulative Effects of Hydroelectric Development on Fish Quality, Summary of Effects of Hydroelectric Development in the Region of Interest on Fish Quality)
- 5.7 Seals (Introduction, all sections on Cumulative Effects of Hydroelectric Development on Seals, Summary of Effects of Hydroelectric Development in the Region of Interest on Seals)
- 5.8 Beluga (Introduction, all sections on Cumulative Effects of Hydroelectric Development on Beluga, Summary of Effects of Hydroelectric Development)

Part VI. Land

- 6.1 Introduction and Background (all)
- 6.2 Intactness (Introduction, Summary of Effects of Hydroelectric Development in the Region of Interest on Intactness)
- 6.3 Terrestrial Habitat (Introduction, Summary of Effects of Hydroelectric Development in the Region of Interest on Terrestrial Habitat)
- 6.4 Waterfowl (Introduction, Effects of Hydroelectric Development in the Region of Interest on Waterfowl)
- 6.5 Colonial Waterbirds (Introduction, Effects of Hydroelectric Development in the Region of Interest on Colonial Waterbirds)
- 6.6 Aquatic Furbearers (Introduction, Effects of Hydroelectric Development in the Region of Interest on Aquatic Furbearers)
- 6.7 Barren-ground Caribou (Introduction, Cumulative Effects of Hydro Development, Effects of

Hydroelectric Development in the Region of Interest on Barren-ground Caribou)
- 6.8 Coastal Caribou (Introduction, Cumulative Effects of Hydro Development, Effects of Hydroelectric Development in the Region of Interest on Coastal Caribou)
- 6.9 Boreal Woodland Caribou (Introduction, Cumulative Effects of Hydro Development on Boreal Woodland Caribou, Effects of Hydroelectric Development in the Region of Interest on Boreal Woodland Caribou)
- 6.10 Moose (Introduction, Effects of Hydroelectric Development in the Region of Interest on Moose)
- 6.11 Polar Bear (Introduction, Effects of Hydroelectric Development in the Region of Interest on Polar Bears)

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4.0 SYNTHESIS OF KEY FINDINGS AND OBSERVATIONS

The Terms of Reference for the Manitoba and Manitoba Hydro RCEA did not explicitly call for a strategic assessment, thus the RCEA is not a strategic in nature. While it would not be appropriate to criticize the lack of strategic elements in the RCEA given the Terms of Reference, we strongly suggest that unless the RCEA is revisited as a strategic exercise much of the potential value-added of the RCEA will be lost to the citizens of Manitoba. While the RCEA does offer a strong retrospective analysis of historical impacts to select land and water Regional Study Components (RSCs)[39], it could offer so much more: not in terms of pages added, but in terms of perspective added. We elaborate further on this in Sec. 4.3.2.

Overall, we conclude that the Manitoba and Manitoba Hydro RCEA falls short of good practice CEA. Good practice CEA, whether in a project-based or regional context, involves four basic stages: scoping, retrospective analysis, prospective analysis, and management. With respect to scoping, many expected elements of good practice are present for all parts of the filing (People, Physical Environment, Land and Water), including adapting the geographic scale of analysis to suit the nature of each RSC. RSCs selected for retrospective analyses also seem appropriately scoped given the context of assessing the impacts of a hydropower complex. However, it is impossible to conclude whether the RSC list is complete and appropriate until regional stakeholders publically vet it.

Although we did observe that many expected elements of good practice retrospective analysis were present for the Land and Water Parts of the filing (less so for the Physical Environment and People Parts of the filing), attention to prospective analysis was absent throughout all Parts of the filing. Impact management was addressed only to the extent that a number of existing regional monitoring programs were mentioned. Without prospective analysis to help assess and predict the possible environmental changes that could occur given future development, we conclude that the primary value of the RCEA is as a regional baseline study. Further, public engagement through every stage of

[39] Regional study components are defined in the report as "Topics that have been selected to focus the assessment, represent the overall effects of hydroelectric developments within the Region of Interest and reflect key ecological and social concerns, or are of key importance to the people living in the area" (Phase 2, Part1, p. XXV).

any environmental assessment is standard of practice accepted in Canada and internationally, and has been since the 1970s: regardless, the RCEA did not involve any public engagement in scoping, in performing the retrospective analysis, or in discussing the significance of identified regional impacts.

Below we provide an overview of our findings and conclusions. Our detailed review of the RCEA can be found in the Appendix, and includes reference to specific sections of the RCEA as well as key evidence to support our findings.

4.1 What was done reasonably well?

- The RCEA addresses both environmental and socio-economic effects. Part III People provides a very detailed historical account of the socio-economic effects of hydro development in the ROI, while Part IV Physical Environment gives an elaborate characterization of the physical environmental impacts on the hydraulic zones identified—both sections are used to support Land and Water which are the strongest Parts of Phase II in terms of retrospective analysis.

- The RCEA consistently reports changes and trends over time for the RSCs examined in Part III People, Part IV Physical Environment, Part V Water, and Part VI Land, providing both quantitative and qualitative descriptions. However, this effort is often significantly confounded by data limitations including lack of pre-development data, lack of data in the development period, and data that are incongruent and not able to be compared.

- The RCEA consistently attempts to summarize the cumulative impact to each RSC from the pre-development period through to the year 2013 and assess the overall health of the selected RSCs within the regional ecosystem, while clearly identifying information sources and acknowledging data limitations.

- The RCEA consistently provides a high-level overview of predominant pathways of effects in the form of network diagrams that illustrate drivers, pathways, and effects for each selected RSC for Physical Environment, Land, and Water (an accepted CEA method). Other sectors of development contributing stress to each RSC in the region are also identified in the network analysis.

- The RCEA compares pre-development conditions to conditions during the development period in many instances where data is available, for all Parts: People, Physical Environment, Land and Water.

- The RCEA compares on-site/on-system conditions with off-site/off-system conditions in many instances where data is available for Part V Water and Part VI Land.

- The spatial scope of analysis is adjusted to suit each RSC. Typically, a sub-regional (sometimes location specific) approach to assessing effects is utilized (e.g. the hydraulic zones identified in Part IV Physical Environment), and at times the boundary of analysis is extended beyond

the ROI to capture the extent of migratory habitat, for example.

- The RCEA consistently uses indicators, metrics, and benchmarks to assess impacts to Part V Water and Part VI Land RSCs. However, this is not evident in Part III People or Part IV Physical Environment.

- The RCEA identifies driver and response indicators to facilitate a clearer picture of the overall health of each RSC in Part IV Physical Environment, Part V Water and Part VI Land. In our view this is a useful, innovative practice.

4.2 Where are improvements needed?

- Scoping the RCEA as a retrospective exercise rather than a strategic exercise represents a missed opportunity in light of the CEC's past statements identifying the need for a strategic assessment of cumulative effects in the region.

- The scope of projects in the RCEA Region of Interest (ROI) includes the Keeyask generation project. However, analysis of impacts in the RCEA is strictly confined to an historical analysis of past impacts based on records and monitoring data published previous to 2013. We fail to see how the future impacts of the Keeyask project to the Nelson River system and estuary, which has yet to be completed, can therefore have been adequately captured in a retrospective analysis.

- Regional stakeholders were not engaged in the development of the RCEA, except indirectly through review of historical transcripts and reports, though this is a core principle of good practice for any assessment process in Canada and worldwide.

- The list of RSCs chosen for the study is fairly limited, with many wildlife species affected by hydroelectric development not included on the list. It is possible that certain important RSCs have not been captured, as impacts are likely to be expressed sooner at other levels of ecosystem organization than they are at the species level[40]. Some RSCs could correspond with key ecosystem services. For example, biodiversity underlies all ecosystem services and could constitute an RSC. "Supporting" ecosystem services include nutrient cycling, soil formation, primary production; "provisioning" ecosystem services include food supply (food web), fresh water, wood and fibre, fuel; "regulating" ecosystem services include climate regulation, flood regulation, disease regulation, water purification; "cultural" ecosystem services include aesthetic, spiritual, educational, and recreational services. Until the list of RSCs has been publically and independently vetted, it is not possible to determine if the list is complete or appropriate.

- The RCEA does not include prospective analysis, which is a core component of good practice

[40] Treweek 1999

CEA. The Terms of Reference precluded prospective analysis in spite of the fact that a major question regarding the future welfare of the environment and communities in northern Manitoba is the potential for more dams; particularly, whether or not to sanction the Conawapa generating station and others on the Nelson River system. Manitoba has significant undeveloped hydro potential remaining in the north and has already invested about $380 million on the Conawapa project[41].

- In general, save for a few instances, the use of environmental thresholds that could help assess the significance of historical impacts on RSCs is avoided in the RCEA. In Part V Water and Part VI Land, the short timeline of the RSEA was often cited as the reason thresholds could not be developed. The reason cited in Part III People is " lack of socio-economic and demographic-specific data pre-1980s" (Phase II, Part III, p. 3.3-33), and in Part IV Physical Environment it is "absence of high-quality, long-term records with good spatial coverage" (Phase II, Part IV, p. 4.2-5). Use of thresholds is accepted as good practice in CEA.

- One of the biggest opportunities in a regional scale assessment is to identify opportunities and partnerships for coordinated mitigation and management of regional impacts. The RCEA does not address the management phase of CEA beyond referencing some of the established programs in the region. At minimum, providing a list of past and current monitoring and remediation programs and initiatives in the RCEA would help to identify strengths, weaknesses, gaps, and opportunities to strengthen regional impact management.

- The dominant focus on the direct, additive effects of hydroelectric development on each environmental component is one of the weaknesses of the RCEA. Arguably, a synergistic approach linking multiple stressors to each component in both quantitative and qualitative terms is more likely to yield useful perspective for answering questions about total impacts of developments on the social and biophysical environment. Without sufficient and deliberate effort at characterizing the synergistic impacts of natural and human perturbations (including hydro) on each VEC, a true understanding of cumulative effects cannot be achieved. The least that could be done is to identify where synergistic interactions might be affecting Land and Water RSCs. The RCEA makes a couple of attempts to do this, and the effort should be expanded.

- It is apparent in the RCEA that the total stress on certain sub-regions of the ROI is much greater than others (the sub-region "Area 2" – the Nelson River and estuary – being the most stressed), but the RCEA does not attempt to qualify the total, cumulative stress placed on any given sub-region.

- The designated ROI does not include a significant (southern) portion of the existing Bipole I and II transmission line, nor does it include the imminent Bipole III transmission line. In general, not enough attention is given to the effects of transmission line construction,

[41] Manitoba Hydro 2017, Tab 3, pg. 18

clearing, and vegetation maintenance *en masse* in the ROI, particularly if non-selective vegetation clearing techniques are common (e.g. mowing). While the intactness analysis in Part VI Land concludes that the ROI remains reasonably intact, the effects of a single major transmission right-of-way (such as the Bipole I and II corridor, and the Bipole III corridor) can be serious and persistent to local wildlife if not carefully mitigated[42].

- The RCEA avoids the issue of significance altogether. Scientific benchmarks are consistently used to gauge the seriousness of noted cumulative effects to RSCs in Part V Water and Part VI Land, but the societal significance of the cumulative effects throughout the RCEA is not addressed. Assigning significance to the impacts caused by hydropower development in northern Manitoba is not merely a scientific exercise. Significance is dynamic, contextual, political, and ultimately a judgment call: scientists evaluate significance differently from one another and from local communities[43]. If a threshold has been deemed crossed, any future impact on an RSC must be considered significant.

- There is inconsistency in the approach taken to the retrospective analysis when comparing Parts III and IV (People and Physical Environment) to Parts V and VI (Water and Land). While many defensible conclusions are drawn with respect to the cumulative effects of hydroelectric developments on Water and Land, the information-provision approach that is adopted for the People and Physical Environment sections does not allow for the same kinds of conclusions to be drawn. An overt focus on description of social conditions and the physical setting without consideration to quantifying or qualifying the magnitude and pathways of combined perturbations (hydro and other developments) on People and Physical Environment RSCs is a slippery slope toward diminishing the substantive goals of a RCEA.

- At times in Part VI Land, the cumulative impact of hydro development on an RSC is qualified *relative* to the impact attributable to other developments, and deemed proportionately less: this is wrong-headed, as it is the total impact of all activities on an RSC that is important. In other words, the incremental impacts of hydroelectric development are 'traded-off' (i.e. minimized) against the significance of other disturbances in the region; an error that was noted in both the Bipole III and Keeyask CEA reviews.

4.3 Key recommendations to improve the Manitoba and Manitoba Hydro RCEA initiative

The above review details a number of concerns about Manitoba and Manitoba Hydro's approach to RCEA for hydroelectric developments on the Churchill, Burntwood and Nelson River Systems. Based on these, we suggest a number of improvements they may wish to consider:

[42] Harriman 2000
[43] Noble 2015

4.3.1 Recommendations specific to the RCEA filing

i) We recommend that the purpose of the RCEA be clearly stated. It is not currently specified as to whether the RCEA is intended as a resource to inform a provincial energy policy; a watershed protection plan; a regional land use plan; future project impact assessments, approvals, or conditions; or a future strategic assessment exercise. Without a clear statement of the tactical purpose of the RCEA, it is difficult to conceptualize the influence of this work, its value as a resource, and to whom.

ii) We recommend that the RSC list be publically and independently vetted.

iii) We recommend that the RCEA include prospective analysis, particularly related to the potential cumulative effects that would be induced by addition of the Keeyask and Conawapa generation projects to the Nelson River system and estuary.

iv) We recommend that all of the Bipole III transmission line be included as part of the ROI, and that further analysis of the cumulative effects of transmission line construction, clearing, and vegetation maintenance *en masse* in the ROI is undertaken, particularly with respect to wildlife habitat and riparian zone degradation.

v) We recommend independent scientific review of the use of thresholds in the RCEA to determine whether their near absence is justified. We further recommend that Manitoba and Manitoba Hydro invest the time and resources necessary to develop scientific environmental thresholds appropriate to assist in future environmental assessments in northern Manitoba.

vi) We recommend that a reasonable attempt be made to communicate any synergistic effects in the ROI affecting RSCs, as well as the total cumulative effects on RSCs on an area-by-area basis, particularly for the Nelson River system and estuary and other sub-regions of the ROI experiencing the greatest total levels of stress.

vii) The RCEA uses linkage diagrams to illustrate drivers, pathways, and effects for each RSC for Part V Water and Part VI Land. Other factors influencing impacts on RSCs are named in each linkage diagram. We recommend a more explicit depiction of the other developments taken into account in the RCEA analysis, when possible.

viii) We recommend stakeholder engagement in the RCEA initiative, particularly to assist in scoping RSCs and determining impact significance. We further recommend that the Minister of Environment reinstate the full public hearing on the RCEA that was originally planned. This would help immensely to modernize and legitimize the RCEA process and report.

ix) We recommend that the RCEA report include a complete list of past and current monitoring and remediation programs and initiatives in the RCEA to facilitate a gap analysis. We further

recommend that the results of the RCEA should inform the development of an comprehensive regional monitoring and management plan that includes public, industry, and Indigenous partnerships as appropriate, and is based on clear articulation of thresholds, indicators, benchmarks, and actions for achieving or maintaining sustainability of each RSC.

x) We recommend that Part III People and Part IV Physical Environment be developed beyond an information-provision approach to also include retrospective and prospective analysis of change trends and their significance.

4.3.2 Recommendations for a strategic RCEA in northern Manitoba

The Minister of Environment and the CEC have requested assistance in identifying next steps for the RCEA[44]. The RCEA is a forward-looking document and process, and can be transformed to achieve the original intent of CEC's advice in the Wuskwatim hearing, and Noble and Gunn's advice to Manitoba Hydro during the Bipole III and Keeyask project hearings. We feel transforming the RCEA from non-strategic to strategic is essential in order to reach its fullest potential in strengthening Manitoba's environment, economy, and people.

i) We recommend that the RCEA initiative be revisited as a strategic exercise that is objectives-led, includes evaluation of alternative development scenarios, and results in the selection of a preferred alternative that details the desired nature and pace of development in northern Manitoba in the future. "The review of alternatives is the key step to make regional impact assessment not just an information gathering tool about past and present but also a management tool to address the future"[45].

ii) We further recommend that the results of a strategic RCEA be used to inform future hydroelectric development project approvals in northern Manitoba, including the Conawapa Generating Station and associated infrastructure, as well as related regional policy and planning processes such Growing Outcomes in Watersheds (GROW) and Manitoba's Provincial Clean Energy Strategy.

iii) We recommend that the opportunity to designate the RCEA ROI as one of the identifiable pilot projects for regional impact assessment in Canada be explored, as described in Building Common Ground: A New Vision for Impact Assessment in Canada, the final report of the Expert Panel for the Review of Environmental Assessment Processes[46]. We recommend that the Manitoba Government use such an opportunity to undertake a "northern vision" project to help establish the goals and objectives of a strategic RCEA.

[44] http://www.gov.mb.ca/sd/eal/registries/5714hydro/revised_cec_t_of_r2017-03-02_v1.pdf
[45] Gelinas, et al. 2017
[46] Gelinas et al. 2017, pg. 79, 80

APPENDIX: DETAILED ANALYSIS OF THE RCEA FILING

A. Core and methodological principles

Tables 1 and 2 summarize the extent to which the Regional Cumulative Effects Assessment (RCEA) currently conforms to the core and methodological principles for Regional Strategic Environmental Assessment as set forth by the Canadian Council of Ministers of the Environment (CCME). This is intended as a learning tool for the Consumers' Association of Canada (CAC) (Manitoba chapter) and may be viewed as helpful information by the Manitoba Clean Environment Commission (CEC), Manitoba Conservation and Water Stewardship, and Manitoba Hydro.

Table 1. Conformity to CCME Regional Strategic Environmental Assessment Core Principles

Core Principles	
Strategic	Not yet. The exercise should be 'objectives-led'. At present the goals and objectives of the RCEA are not explicitly stated and there is no clear, publicly endorsed vision for the future of the Region of Interest (ROI).
Futures-oriented	Not yet. The RCEA is currently retrospective in nature only, with no prospective analysis, designation of strategic alternatives for development, or assessment of the likely cumulative effects of those.
Early commencement	The RCEA was completed approximately 60 years after the commencement of hydroelectric development in northern Manitoba. However, at least half of the capacity for hydroelectric power in the province has yet to be developed, with more generating stations being considered for future development—six planned for the Nelson River (five currently), three more reservoirs on the Burntwood (one currently), and two new reservoirs planned for the Upper Churchill River (none there currently). This is a very significant amount of further development to a region that has already been acknowledged as significantly altered. It is still 'early' if one considers the development that still may come in northern Manitoba. In the short term there is opportunity to influence decisions about the future of the Conawapa project. In addition, there is opportunity to inform and influence strategic policies and plans such as Growing Our Watersheds and the Provincial Clean Energy Plan.
Cumulative effects focused	Yes. However, prospective analysis of strategic alternatives for the region is recommended.
Multi-tiered	Not yet. There is no deliberate connection with project-based environmental impact assessment identified, nor any connection to 'upstream' policy or planning decisions affecting the Region of Interest (ROI).
Multi-scaled	Yes. Scale of analysis in the retrospective analysis is adjusted to suit each Regional Study Component (RSC).
Participatory	Not yet. The RCEA process should meaningfully engage affected northern communities and other stakeholders in (at minimum) the tasks of scoping, creation and analysis of alternative development scenarios, significance determination, impact mitigation and monitoring strategies and activities, adaptive feedback.
Opportunistic	Not yet. Does not identify opportunities to enhance institutional policies or arrangements, for example.
Adaptive	Not yet. Although a comprehensive list of past and current remediation and compensation efforts by Manitoba Hydro are identified, no changes to existing management, monitoring plans in the region are suggested or intended as yet.

The RCEA was not designed as a strategic exercise. Rather, the approach taken is that of a retrospective description of past cumulative effects in the region. Manitoba Conservation and Water Stewardship and Manitoba Hydro agreed to Terms of Reference for the RCEA in May, 2014. In them it is stated that Manitoba and Manitoba Hydro believe the best option to address Recommendation 13.2, made by the Clean Environment Commission (CEC) following the Keeyask public hearing, is the development of [a RCEA document] that is "retrospective in nature" (p.1) and "describes environmental change over time as a result of previous hydro development, including impacts, mitigation measures, community issues, compensation and the current quality of the environment" (p.3). The RCEA is "based on a review and synthesis of past and ongoing studies and monitoring programs" (p.3). Although the CEC does not specifically ask for a strategic assessment in Bipole III Recommendation 13.2, previous calls for strategic assessment in the region have been registered (e.g. CEC's 2004 Wuskwatim recommendation; Gunn and Noble's 2012 Bipole III recommendation).

The positioning of the RCEA as retrospective, descriptive exercise pre-empts, or forestalls, a significant opportunity to publically debate alternative development scenarios and identify a preferred future development path for northern Manitoba. It also precludes stipulating the desired nature and pace of development in the future and/or establishing criteria to evaluate the acceptability of proposed future projects. The terms of reference do not state the purpose for which the RCEA is intended other than it will serve "as a resource" (p.5). It is not specified whether the RCEA would be used as a resource to perhaps inform the Manitoba provincial Clean Energy strategy, a regional sustainable development plan (e.g. Growing Our Watersheds initiative), future project impact assessment approvals or conditions (e.g. Conawapa), or a future regional strategic assessment exercise. Without a clear statement of the tactical purpose of the RCEA, it is difficult to conceptualize the influence of this work, its value as a resource, and to whom.

The previous call for a collaborative approach to assessing the cumulative effects of past, present, and future development in northern Manitoba has been overlooked as well (specifically mentioned in the CEC's 2004 Wuskwatim recommendation and implied in Gunn and Noble's 2012 Bipole III recommendation). The amended terms of reference for the RCEA have greatly reduced opportunity for meaningful participation, and face-to-face participation from northern residents – which was established as the standard for consultation as early as the Berger Inquiry in 1974, when Thomas Berger modelled good practice for working with Indigenous communities and meaningful engagement in environmental impact assessment[47]. In cumulative effects assessment (CEA), public input has been shown to be especially important when selecting the valued components for study[48]. There appears to have been no consultation with the public or Indigenous communities in the tasks of scoping Regional Study Components (RSCs); creation and analysis of alternative development scenarios; significance determination; impact mitigation and monitoring strategies and activities; or plans to integrate adaptive feedback. The list of RSCs appears to have been determined by MB Hydro and Manitoba Conservation and Water Stewardship acting alone. As well, Sections 3.5.4 through 3.5.19 of Phase II, Part III People, are currently missing from the RCEA at present:

[47] Mulvihill and Baker 2001; Gibson 2013
[48] Olagunju and Gunn 2013

"Communities will have the opportunity to review and comment on their summaries [of cumulative effects of development on them] before they are made public. This review and comment will occur throughout the RCEA Public Outreach Program being undertaken by the CEC" (Phase II, Part III, p. 3.5-9). At the time of this report, plans for public consultation have been greatly reduced as per the amended Terms of Reference and the sections are still incomplete.

Current strengths of the RCEA from a strategic assessment standpoint include that it is cumulative effects focused, and it is multi-scaled. That being said, the retrospective analysis of cumulative effects to Water and Land RSCs is stronger than that for People. Considerable work remains to be done to adequately characterize cumulative impacts to affected Indigenous communities, and as well, analysis of synergistic and indirect environmental effects to Water and Land RSCs is rather weak in the RCEA at present. There are western scientific and Indigenous traditional knowledge disparities of opinion regarding the cumulative effects to certain Water and Land RSCs, the total stress on sub-regions and the ROI as a whole has not been characterizes as yet, and the significance of cumulative effects in the ROI has not been evaluated. All of these observations are described in more detail in the sections below.

Table 2. Conformity to CCME Regional Strategic Environmental Assessment Methodological Principles

Methodological Principles	
Integrated	Not yet.
Focused on alternatives	Not yet.
Regional VEC-based	Yes, the RSCs selected appear to be sensitive to the regional context (e.g. water quality, fish community) though their numbers are small and their appropriateness has not been publically or independently vetted. Until they are, it will remain unclear as to whether these are the 'only' or 'best' RSCs to focus on.
Interdisciplinary	Not yet. Assessment is not interdisciplinary in that it does not evaluate the status of any RSC based on integrated scientific perspectives from various branches of knowledge. However the RCEA is cross-disciplinary in that there are various kinds of scientific analysis provided.
Structured and systematic	Yes, in the sense that the RCEA systematically examines existing information, evaluates new information, looks at changes in indicators over time, and summarizes change for RSCs over the period of development to the extent possible given data limitations.

Current strengths of the RCEA with respect to the methodological principles set forth by the Canadian Council of Ministers of Environment (CCME) include that it is regional VEC-based, in that the current RSC list does include species of noted concern and important in the ROI, and it has adopted a structured and systematic approach to the retrospective analysis. To become a strategic assessment, the RCEA would need to be integrated with other regional policy and planning initiatives such that there is a mutually reinforcing relationship; it would need to adopt and prospectively assess the cumulative effects of alternative development scenarios in preparation to select a desired future path forward; and finally, the interdisciplinary aspects of cumulative effects analysis would need to be improved. At present a multi-disciplinary approach is evident in the retrospective analysis, but to explore synergists and total impacts to the region, an interdisciplinary approach to

evaluating the evidence is critical. For example, to better understand the cumulative effects to fish quality, for which (it is claimed in the RCEA) there is no direct scientific linkage, the noted indirect linkages must be explored – and if an interdisciplinary team does this, the cumulative effects might become much more readily apparent.

B. Methodological approach

With respect to the phases of a basic, step-wise process established for Regional Strategic Environmental Assessment[49], the RCEA is missing many key components. Table 3 briefly summarizes which steps have been addressed, and which are outstanding.

Table 3. Conformity to the Basic Step-Wise Process for Regional Strategic Environmental Assessment

Pre-Assessment	
Develop a reference framework	Does provide and conform to a Terms of Reference, though Terms of Reference are non-strategic and the amended Terms of Reference greatly reduce opportunities for public engagement.
Scope the regional baseline	Yes. This is done reasonably well with the caveat that there are many data gaps that need to be addressed through additional research in the ROI. There is a strong basis for prospective analysis for many of the RSCs that are used in the RCEA although that list should be publically and independently vetted, and possibly expanded.
Identify regional stressors and trends	Does identify hydroelectric developments driving regional stressors or trends, and does name other developments affecting the condition of RSCs in the ROI via network diagrams (however, this analysis should be performed in greater depth if and when possible).
Assessment	
Identify strategic alternatives for the region	Not yet. Does not currently identify strategic development alternatives for the region.
Assess cumulative effects of each alternative	Not yet. Does attempt to assess cumulative effects, but not for strategic alternatives for the region, and not prospectively. "The RCEA is intended to retrospectively assess (qualitatively and/or quantitatively) environmental and socio-economic change over time" (Phase II, Part I, pg. 1.2-1).
Identify a preferred strategic alternative	Not yet. Does not identify a preferred strategic alternative that meets stated goals and objectives for development of the ROI.
*Post-Assessment**	
Identify mitigation needs and management actions	Not yet. The RCEA does provide a comprehensive overview of past and current mitigation and compensation initiatives in Part III People: "Where applicable, the assessment includes a discussion of mitigation and remedial works that have been put in place to reduce effects and compensation provides for effects that could not be mitigated" (Phase II, Part I, pg. 1.2-6). However, the RCEA does not revisit those strategies based on the results of a prospective analysis or significance determination. Ideally these activities would inform and influence a coordinated regional mitigation and monitoring plan going forward.
Develop a follow-up and monitoring program	Not yet.
Implement the strategy,	Not yet.

[49] Gunn and Noble 2009

monitor and evaluate	
Adaptive follow-up and review	Not yet. As the preferred scenario is implemented, lessons learned should be used to adapt development initiatives, programs, plans, and policies for the region to ensure desired outcomes are achieved.

* The Next Steps document to be issued following public consultation on the RCEA has not yet been issued by Manitoba and Manitoba Hydro. Therefore, information regarding follow-up and monitoring, including any intended mitigation and management actions is unavailable at present.

Looking at the basic step-wise methodological process that has been established for RSEA, the RCEA only addresses two pre-assessment phases reasonably well at present and they are: scoping the regional baseline and identifying stressors or trends. If the RCEA were to be transformed into a strategic exercise, a new Terms of Reference would have to be issued to reflect the activities still to come in the assessment and post-assessment phases of the framework. The assessment phase would be centered around identifying and evaluating strategic alternatives to the 'status quo' hydroelectric development path. The post-assessment phase would be focused on carefully adapting the current mitigation and monitoring regime in the ROI based on the significance determination of identified cumulative impacts in the ROI. The approach would become proactive, with the RSC-sustainability at its heart. That being said, compensation programs such as the Northern Flood Agreement (NFA) would naturally retain their importance and be maintained into the future.

C. Cumulative effects assessment

This part of our review provides a detailed analysis of the cumulative effects assessment (CEA) exercise undertaken in relevant subsections of Part III People, Part IV Physical Environment, Part V Water, and Part VI Land of the Phase II RCEA report. Manitoba and Manitoba Hydro's guidance for undertaking CEA apparently consists of consulting the Hegmann et al. (1999) guidance: we were unable to find reference to any other guidance within the RCEA report (though it is a very lengthy report and it is possible we overlooked additional sources that were consulted). The Hegmann guidance is still relevant and widely used, however, many other good reference manuals are publically available, including:

- Canadian Council of Ministers of the Environment (CCME), 2009. Regional strategic environmental assessment in Canada: Principles and guidance. Canadian Council of Ministers of the Environment, Winnipeg, MB.

- Canadian Environmental Assessment Agency, 2014. Technical guidance for assessing cumulative effects under the Canadian Environmental Assessment Act, 2012. CEAA, ON, Canada. Available at http://www.ceaa-acee.gc.ca

- Canter L and Sadler B, 1997. A toolkit for effective EIA practice – Review of methods and perspectives on their application. International Association for Impact Assessment, Fargo, ND, USA.

- Council on Environmental Quality (CEQ), 1997. Considering cumulative effects under the National Environmental Policy Act. Executive Office of the President of the United States, Washington, DC, USA.

- Duinker P, Burbidge E, Boardley S, Greig L, 2013. Scientific dimensions of cumulative effects assessment: toward improvements in guidance for practice. Environmental Reviews 21(1): 40-52. 1dx.doi.org/10.1139/er-2012-0035. Available at http://www.nrcresearchpress.com/journal/er

- Duinker, P and Greig L, 2007. Scenario analysis in environmental impact assessment: Improving explorations of the future. Environmental Impact Assessment Review 27:206-219. doi.org/10.1016/j.eiar.2006.11.001

- Hegmann G and Yarranton G, 2011. Alchemy to reason: Effective use of cumulative effects assessment in resource management. Environmental Impact Assessment Review 31(5): 484-490. doi.org/10.1016/j.eiar.2011.01.011

- Indian and Northern Affairs Canada, 2007. A citizen's guide to cumulative effects. Minister of Public Works and Government Services Canada, Ottawa, ON, Canada.

- International Finance Corporation, 2013. Cumulative impact assessment and management guidance for the private sector in emerging markets: Good practice handbook. World Bank Group, Washington, DC, USA. Available at http://www.ifc.org

- Noble, B. 2014. Introduction to environmental impact assessment: A guide to principles and practice, 3rd edition. Oxford University Press: Toronto.

Scope

Spatial scope

Scoping the RCEA as a retrospective exercise rather than a strategic exercise represents a missed opportunity in light of the CEC's past statements identifying the need for a strategic assessment of cumulative effects in the region. That being said, spatially, the ROI for the RCEA[50] includes the Churchill, Burntwood and Nelson River systems which is an area broader than that identified in the CEC's Bipole III recommendation. The ROI was designated as such because it captures "the main areas directly affected by Manitoba Hydro's northern developments associated with LWR, CRD, associated transmission projects, and other associated infrastructure" (Phase II, Part I, p. 1.3-2). However, RCEA should scoped widely enough to include attention to indirect effects as well, as may affect other areas of the province. It is noted that the "spatial scope for People, Physical

[50] See Map 1.3.2.1. RCEA Region of Interest – Areas 1 - 4, and Map 1.3.2.2 Assessment Areas (both in Phase II report, Part I).

Environment, Water, and Land vary for socio-economic and biophysical reasons" (Phase II, Part I, p. 1.3-2) (see Sec. 3.2.11 for People, Sec. 4.1.1.1 for Physical Environment, Sec. 5.1.2.2 for Water, and Sec. 6.1.2.2. for Land), so it is possible that some indirect effects are captured but not specifically highlighted in the RCEA.

The RCEA ROI does not include the southern portion of the Bipole I and II transmission line corridor, nor does it include the planned Bipole III transmission line corridor. The ROI does not include portions of the Grand Rapids to Ponton 230 kV line, the Herblet Lake to Ralls Island 230 kV line, the Herblet Lake to Cliff Lake 230 kV line, etc. The explanation for this is probably that the region of interest is already larger than that recommended in the CEC's Bipole III report so perhaps it cannot be critiqued from that perspective. But technically, the RCEA should include ALL of the development, including the southern portion of the Bipole I and II, and especially the Bipole III as it is an approved and imminent development.

It is important to consider all linear developments when assessing land-based cumulative effects from the perspective of habitat fragmentation. The assessment does not fully account for the effects of road building on the environment over time. Road developments are captured in an intactness assessment, but the impacts of roads are very complex, far- and long-reaching, and multi-faceted. The indirect effects of road building are arguably far more insidious than the direct effects of their initial construction. Roads bring people in and resources out of a region, forever altering the environment, economy, and culture of a region. Some of the known impacts of roads include: increased wildlife mortality associated with construction; increased human mortality due to vehicle collision; modification of wildlife behavior; alteration of the physical environment; alteration of the chemical environment; spread of exotic species; increased alteration and use of habitats by humans; emissions of air, noise, light and heat pollution; regional effects such as fragmentation of wildlife habitats and rapid community growth, to long-term effects such as global warming effects from carbon dioxide emissions[51]. In the context of the ROI, to take just one example, there have been noted significant effects to the commercial fishery for Lake Sturgeon on the Nelson River (see Phase II, Part V, p.5.4-5), and other commercial fisheries in the ROI – some of this pressure may have been facilitated by the presence of roads which provide access to local and other markets.

The spatial scope of the ROI may possibly exclude some communities potentially affected by the Lake Winnipeg Regulation project (outside the southern extent of the ROI) and other potentially affected communities such as the Shamattawa First Nation "because current understandings suggest the community is not directly affected by the historic hydroelectric developments under consideration" (e.g. The Shamattawa First Nation, p. 3.2-3). Nothing is said regarding whether the development of future hydroelectric projects may alter this assumption.

It is acknowledged that there are a number of other factors, beyond hydroelectric development, that have affected the RCEA ROI (Phase II, Part I, p. 2.6-1): "These include, among other things: mining developments, highway developments; the establishment of commercial resource harvesting

[51] Trombulak and Frisell 2000; Olagunju 2012

activities, government policies and acts, the introduction of western schools and churches, the establishment of a reliable electrical supply, and connection of some of the RCEA ROI communities to other parts of Manitoba via new highways and other road systems". Manitoba and Manitoba Hydro claim that the effects of these other projects have been considered when they can provide context or other relevant information:

> When assessing impacts to the aquatic environment, "the effects of other projects (e.g. mines) and activities (e.g. commercial fishing) are discussed to the extent that they provide overall context, but the focus of the assessment is on the cumulative effects of hydroelectric development in the ROI" (Phase II, Part I., pg. 1.2-6).
>
> The RCEA focuses on the effects of hydroelectric development, however, the effects of other developments (e.g. mines) and activities (e.g. commercial fishing) are described at a high level to provide context for the assessment" (Phase II, Part V, p.5.1-1).

In cases where effects of hydroelectric development cannot be separated from other effects, they are addressed in measures of current condition. For example, the section on People attempts to describe in qualitative terms key historical events and large resource developments (e.g. treaties, residential school system, reserve system, transportation development, mining and forestry). The combination of effects may lead to a decline in fish population for example, when each in isolation would not have resulted in a population decline (Phase II, Part V, p. 5.1-11). However, Manitoba Hydro continually asserts that it is difficult to isolate the effects of hydroelectric development from many other agents of change in the ROI (e.g. Section 3.5.3 pages 3.5-5 to 3.5-6). This hydroelectric development-focused approach is consistent across all RSCs considered. There is no evidence in the entire Phase II that the effects of other projects are systematically examined and factor into the conclusions reached on RCEA. They may or may not have been.

The spatial scope of analysis is adjusted to suit each RSC, which is widely considered good practice in CEA. Typically, a sub-regional (sometimes location specific) approach to assessing effects is utilized (e.g. the hydraulic zones identified in Part IV Physical Environment; for Part III People, the resource management areas/registered trapline areas, and the traditional use areas; for Part V Water the four main RCEA areas, and for Part VI Land, the terrestrial regions and terrestrial ecozones), and at times the boundary of analysis is extended beyond the ROI to capture the extent of migratory habitat. There is evidence throughout that these regions are respected in the retrospective analysis. For example:

> The assessment of the aquatic environment divided the RCEA Region of Interest into four areas…These areas were used for the Lake Sturgeon, mercury in fish, fish quality, seals, and beluga RSCs. For the water quality…and fish community… RSCs, each area was further subdivided…to facilitate the discussions (Phase II, Part V, p. 5.1-1).
>
> The effects of hydroelectric development on each RSC will be discussed first by area (or subdivision within the area where applicable) and then for the RCEA ROI as a whole (Phase II,

Part V, p.5.1-1).

Temporal scope

The temporal scope of the RCEA is retrospective only and focused on "the effects of previous hydro-electric development in the ROI" (Phase II, Part I, pg. 1.2-1). Information and data up to 2013 are utilized in the RCEA. A very limited amount of information from 2014 and 2015 has also been incorporated (Phase II, Part I, p. 1.3-5). A list of past developments considered in the RCEA is provided (Phase II, Part I, Table 1.3.2-1). These include generation and water regulation projects, converter stations and associated infrastructure projects, and transmission projects. Several projects currently in development or regulatory review are included in the RCEA: the Bipole III transmission project, Keewatinohk Converter Station and associated infrastructure projects, the Keeyask generation project, and the Keeyask transmission project. However, analysis of impacts in the RCEA is strictly confined to an historical analysis of past impacts based on records and monitoring data published previous to 2013. We fail to see how the future impacts of the Keeyask project to the Nelson River system and estuary, which has yet to be completed, can therefore have been adequately captured in a retrospective analysis.

There is no prospective analysis or trend projection into the future: "The cumulative effects of any potential future hydroelectric developments (i.e. those not currently being constructed or part of any formal regulatory process) will be addressed outside of the RCEA, during the regulatory review process for those developments" (Phase II, Part I, pg. 1.3-8). The temporal scale of the assessment does not include any aspect of future hydroelectric development in northern Manitoba.

Scope of regional study components

Regional Study Components were selected by Manitoba and Manitoba Hydro with no public input. Selection criteria were one or more of the following (Part II, Phase 1, p. 1.3-14):

- Overall importance/value to people as identified by residents in the ROI through various forums (e.g., CEC hearings, ATK reports from the First Nations, NFA claims)
- Umbrella indicator (an indicator that represents changes for a broad group of species and one or more ecological pathways)
- Importance/value to overall ecosystem function
- Known to be susceptible to direct or indirect effects from hydroelectric developments.

For Part V. Water, the RSCs include: 1) water quality; 2) fish community; 3) Lake Sturgeon; 4) mercury in fish and fish quality; 5) beluga and seals (Phase II, Part I, p.1, 3-16). For Part VI. Land, the RSCs include: 1) terrestrial habitat; 2) intactness; 3) birds (waterfowl and colonial waterbirds); 4) furbearers (aquatic, i.e. beaver); 5) caribou; 6) moose; and 7) polar bear (Phase II, Part I, p.1.3-17). Although initially considered in Phase I, in Phase II forest birds and terrestrial furbearers were dropped as RSC sub-components (Phase II, Part I, p. 1.3-14)]. Other potential RSCs were considered and dropped or not evaluated in certain areas of the ROI, with rationales provided. For example:

> It should be noted that the aquatic assessment of effects to the Nelson and Churchill River estuaries was limited to beluga and seals, which are the species of greatest concern. Due to the large tides that make it difficult to work in the estuary, there is an almost complete absence of historic, qualitative data for water quality and the fish community, which are subsequently not discussed for estuaries" (Phase II, Part V, p. 5.1-5).
>
> With further research, it has become apparent that there are few to no population data available for terrestrial furbearers in Manitoba, and limited information regarding their distribution within the RCEA ROI…the greatest impacts on furbearers have likely resulted within the riparian zones affected by flooding or dewatering. Therefore, the effects assessment for furbearers will focus on aquatic furbearers, using beaver as the focal species (Phase II, Part VI, p. 6.1-6).

Although the RCEA cannot include all affected species as this would go against the purpose of scoping (which is to focus the assessment), the rationale for Water and Land RSC selections are somewhat questionable.

Regarding aquatic fur-bearers, flooding and dewatering have likely equally impacted other important species apart from the beaver, a keystone species. No terrestrial fur-bearers at all were selected as RSCs. Other important fur-bearers in the boreal ecosystem include: fisher, muskrat, mink, marten, fox, wolverine (western wolverine is listed as 'Special Concern' by COSEWIC[52]), otter (listed as 'Threatened' by COSEWIC), wolves, lynx, bobcat, etc[53]. We have the same kinds of concerns about scoping of bird species: of all possible species, the RSC list is limited to just waterfowl and colonial birds. According to the Nature Conservancy, 325 bird species rely on the boreal forest for nesting or migratory stopover habitat[54]. Both the Nelson and Churchill Rivers empty into estuaries. Estuarine environments are known to be especially important as habitat that supports local wildlife habitat, and especially sensitive. Estuaries are naturally highly productive, producing more fish biomass per cubic meter of water than either freshwater or marine environments[55]. Seals and beluga are identified as RSCs, (very little is known about the cumulative impacts upon them over the last half century related to hydroelectric development), but the connection among fish abundance, quality, and availability, and impacts to seals and beluga are not made even though it is noted that scientific "evidence suggests that estuaries may be important feeding areas for seals" (Phase II, Part V, p. 5.7-2). Beluga are "red-listed by the International Union for Conservation of Nature (ICUN) as 'Near Threathened'" (Phase II, Part V, p. 5.8-2).

Part III of the RCEA is not specific on whether the evaluation of cumulative effects to People was guided by RCSs; rather the identification of issues/events presumed to have had some cumulative

[52] Committee on the Status of Endangered Wildlife in Canada
[53] See: http://thefurbearers.com/about-us/who-are-the-fur-bearers
[54] See: https://www.nature.org/ourinitiatives/regions/northamerica/canada/explore/birds-of-the-boreal-forest.xml
[55] Weddell 2002

effects on the ROI is the focal point of this portion of the assessment. The following socio-economic effects are individually linked to generation and transmission projects (Phase II, Part III, p. 3.2-8):

- Resource Use;
- Navigation, Transportation and Public Safety;
- Culture, Way of Life and Heritage Resources;
- Health Issues and Concerns;
- The Way the Landscape Looks (Aesthetics);
- Home Relocation;
- Worker Interaction;
- Land Use;
- Personal Property Loss and Damage;
- Infrastructure and Services;
- Benefits of Electrification; and
- Employment, Training, Business and Income Opportunities.

While there is high probability that they mirror broad indicators of socio-economic satisfaction and/or potential regional socio-economic change, no evidence exists that affected communities identified these as issues of concern. In Phase II, Part III, on p.3.2-8, it is stated that: "The sources used in the development of this Chapter include past environmental impact assessments, past settlement negotiations, perspectives shared by communities, the MMF and resource user groups over time, and various community-led studies and histories that have been shared with Manitoba and Manitoba Hydro." Evidently, no direct effort was made to engage the community even on the socio-economic issues perceived to be triggered by the hydro development in the region.

Three broad "components of the physical environment" were identified as focal points for the assessment in Phase II Part IV Physical Environment. They were further broken down to sub-components/indicators to help track environmental changes (e.g. soils, geology, topography, permafrost and Peatlands for geographic landscape). They are examined from a location-specific context (not tied to cumulative effects) based on the 12 hydraulic spatial zones identified.

Overall, the list of RSCs used in the RCEA is fairly limited, with many wildlife species affected by hydroelectric development not included on the list. It is possible that certain important RSCs have not been captured, as impacts are likely to be expressed sooner at other levels of ecosystem organization than they are at the species level[56]. Some RSCs could correspond with key ecosystem services. For example, biodiversity underlies all ecosystem services and could constitute a RSC. "Supporting" ecosystem services include nutrient cycling, soil formation, primary production; "provisioning" ecosystem services include food supply (food web), fresh water, wood and fibre, fuel; "regulating" ecosystem services include climate regulation, flood regulation, disease regulation, water purification; "cultural" ecosystem services include aesthetic, spiritual, educational, and recreational services. Until the list of RSCs has been publically and independently vetted, it is not

[56] Treweek 1999

possible to determine if the list is complete or appropriate.

Scope of public engagement

In terms of who was involved in preparing the RCEA, regional stakeholders were not engaged except indirectly through review of historical transcripts and reports, though this is a core principle of good practice for any assessment process in Canada and worldwide. Public engagement is planned subsequently in the form of a comment period online and with limited opportunities to meet with the CEC in person. The Minister of Conservation and Water Stewardship requested of the CEC that it carry out a public outreach program following the submission of the Phase II report (Phase II, Part I, pg. 1.1-2). This will include public meetings with all potentially affected First Nations and other communities identified in the assessment study area and the Manitoba Metis Federation. Web-based review of the Phase II report will also be facilitated for interested parties outside the ROI (Phase II, Part I, p. 1.2-7).

The Phase II portion of the RCEA is meant serve to as a basis to inform discussion with communities. The key objectives with regard to community consultation (which will include Aboriginal and other communities) appears to be: to check accuracy in presenting past and current effects, and identify any additional sources of information that might have been missed (Phase II, Part I, pg. 1.1-2). Apparently, "efforts have also been made to capture and present community issues and concerns throughout each of the main components of the Phase II document" (Phase II, Part I, pg. 1.2-6) – but to the limited extent that this may have happened, it was accomplished entirely through post-hoc analysis.

For example, the RCEA process did not engage stakeholders in terms of an effort to document and record their current concerns but relied instead on existing records to make their judgment on socio-economic effects in the ROI. The reliance on secondary sources (though extensive) misses the opportunity for communities to debate the impacts of hydroelectric development in the ROI and perhaps does not fulfill the legal obligation to consult and accommodate Indigenous interests on Aboriginal lands as mentioned in the RCEA filing itself (Phase II, Part III, p. 3.3-29). There are places in Part V Water and Part VI Land where the scientific and Indigenous viewpoints on the environmental impacts on certain RSCs are plainly divergent, such as regarding impacts to the fish community, fish quality, and Coastal caribou. For example: "There is no scientific evidence to suggest that the taste, texture or palatability of fish has been affected by hydroelectric development in Area 1. However, the people who consume the fish in the communities have clearly identified this as an issue that is related to the hydroelectric development" (Phase II, Part V, p. 5.6-10). This makes an even stronger case to engage Indigenous communities and other affected community interests in evaluating environmental impacts and preparing the RCEA.

It is our considered view that, while the potential difficulty to "definitively or quantitatively separate the impacts of these other developments, events and policies from hydroelectric development" (Phase II, Part III, p. 3.2-6) may be a genuine drawback and deserves to be recognized, such consideration is outweighed by the potential benefits to the ROI communities to debate,

understand, and anticipate the impacts of hydro developments in the context of socio-economic trends and patterns in the region.

Retrospective Analysis

This is a largely approached as a descriptive exercise with no new data collected; however, some *de novo* analysis is performed.

> The report includes the collation and analyses of existing information and available data for the ROI and, in some cases, presents new analyses for data that were previously collected but not analyzed or interpreted (Phase II, Part I, pg. 1.1-2).

The information sources include findings of scientific and community-based studies, ongoing monitoring programs, regulatory processes and settlements negotiations and claims processes (Phase II, Part I, pg. 1.1-2). The RCEA addresses both environmental and socio-economic effects. Part III People provides a very detailed historical account of the socio-economic effects of hydroelectric development in the ROI, while Part IV Physical Environment gives an elaborate characterization of the physical environmental impacts on the hydraulic zones identified—both sections are used to support Land and Water which are the strongest Parts of Phase II in terms of retrospective analysis.

Establishing baseline conditions

The RCEA consistently attempts to summarize the cumulative impact to each RSC from the pre-development period through to the year 2013 and assess the overall health of the selected RSCs within the regional ecosystem, while clearly identifying information sources and acknowledging data limitations. Past assessments in the ROI typically did not attempt to integrate information collected under various programs in the same waterbody (Phase II, Part V, p. 5.2-13 and p. 5.3-9), whereas, notably, the RCEA does. Where integration of past data is performed in the RCEA, it should be regarded as a significant contribution of the retrospective analysis given that this effort contributes new information about the state of the environment in the ROI. Also notably, the RCEA compares pre-development conditions to conditions during the development period in many instances where data is available, for all Parts: People, Physical Environment, Land and Water. The RCEA also compares on-site/on-system conditions with off-site/off-system conditions in many instances where data is available for Part V Water and Part VI Land. Both of these are good practices, in our view.

That being said, data were very limited in most cases for pre-development periods and there was often not enough data collected over the years to assess change over time, for example, as related to the health of the fish community in the ROI (Phase II, Part V, p. 5.3-9). Other data limitations included an almost total lack of data on furbearers (information on the single furbearer RSC - beaver - was available in just two terrestrial regions, yet impact assessment results were extrapolated to the whole ROI); there is essentially nothing known about impacts to seals and beluga, colonial sea birds (although, reportedly, there has likely been a large impact) or the reason that Lake Sturgeon populations remain stressed and depressed.

As a result, change was often discussed qualitatively, based on the current state of knowledge and past studies, as well as previously captured Aboriginal traditional knowledge. For example:

> In some cases, where a historic quantitative or qualitative assessment is not possible, current information from monitoring programs such as Manitoba and Manitoba Hydro's Coordinated Aquatic Monitoring Program (CAMP) provides the ability to describe the current state of the environment and how it compares to other on-system and off-system areas (Phase II, Part I, pg. 1.2-5).

The lack of data in certain instances did not preclude ' comprehensive analysis' of impacts to some RSCs. For example, water quality data and fish community data from numerous sources were compiled for selected sites and waterbodies and analysed, in spite of data limitations. Manitoba Hydro claims there is enough data to provide a general indication of likely long-term, marked effects of hydroelectric development on the fish community for most major lakes (Phase II, Part V, p. 5.3-9).

Generally speaking, however, the significant data gaps lend a degree of uncertainty to some of impact characterizations in the RCEA. Below is a partial list of acknowledged data gaps:

- very little is known about impacts to seals in the Nelson and Churchill River estuaries based on a "lack of quantitative pre- and post-hydroelectric development data" (Phase II, Part V, p. 5.7-4);
- "a few waterfowl species have decreasing trends. However, species-specific population trends were not examined further in this study due to a relative lack of detailed waterfowl data, and the numerous factors (e.g. wintering habitat) beyond the RCEA ROI that affect waterfowl populations" (Phase II, Part VI Land, p. 6.4-75);
- very little is known about impacts to beluga "due to a lack of quantitative pre- and post-hydroelectric development data, which precludes a determination of hydroelectric development effects on beluga in the RCEA ROI" (Phase II, Part V, p. 5.8-6);
- "…there is a lack of suitable pre-development data on fish mercury concentrations for most waterbodies in the ROI" (Phase II, Part V, p. 5.5-11);
- "very little information exists on mercury concentrations of Lake Sturgeon in Area 1 over the past 50 years, particularly for years predating LWR [Lake Winnipeg Regulation]" (Phase II, Part V, p. 5.5-27); and
- "For this assessment, post-hydroelectric development population densities [of beaver] are only available for two terrestrial regions; therefore, data for these areas were used to assess relative change in populations due to hydroelectric development" (Phase II, Part VI, p. 6.6-6).

A data gap analysis, looking across all RSCs, would generate a list of additional studies needed to inform future decisions about projects that are being considered for future development in the ROI such as Conawapa and the five additional reservoirs for the Nelson River and estuary. A prioritized agenda for additional research in the ROI should be developed, in part based on public feedback and issues of importance to them. More information is also needed to resolve some of the conflicts of

scientific and Indigenous opinion on the nature of impacts to certain RSCs such as fish community, fish quality, and Coastal caribou, as noted above.

With regard to cumulative effects on People (Phase II, Part 1, pg. 1.3-12), the approach taken is to create a profile and history for each of the 21 First Nations and communities in the ROI, based on documented testimony from the communities. To the extent possible, a longitudinal analysis of certain demographic indicators is made for each community, acknowledging the range of other factors, in addition to hydro-electric development, that have changed the lives of ROI residents. Relying on data from government bodies and technical reports such as Statistics Canada, Aboriginal and Northern Development Canada, and Lake Winnipeg Churchill Nelson Rivers Study Board, trends on population, economic, health and wellness, and other socio-economic factors are provided in Section 3.3. Many of the data are also presented in tables and bar charts depending on the characteristics of the components, which may be adequate since historical socio-economic issues are in focus.

In Part IV (Physical Environment), much of the data for the section is drawn from historical records and secondary sources e.g. for erosion and sedimentation: "The information presented was largely derived from a review of the available literature that reported on water quality and erosion monitoring programs over about the last 40 years" (p. 4.1-5). As noted earlier, the sub-section on Erosion and Sedimentation employed some good practice analytical techniques such as Landsat and Air Photo Analysis. The sedimentation section presents information on Total Suspended Solids (TSS), turbidity and Secchi depths reported in historical and contemporary data sources (p. 4.4-7). For Water and Land, the Phase II report provides as assessment, to the extent possible, of the effects of past hydroelectric developments on the aquatic and terrestrial environments. Where data gaps exist a description of the current state of the environment is provided, where available.

Consideration of change trends

There is acknowledgment that in areas affected by hydroelectric development, the natural hydrological regime was altered, to varying degrees. Drivers of change are listed as: flooding; reversal of flow patterns; transmission lines; linear developments such as access roads; and other infrastructure (not specified) (Phase II, Part V, p. 5.1-2). Specific drivers of change, or "primary pathways of effects" (see Figure 5.1.2-1 in Phase II, Part V) in areas with increased water levels may include:

- increased water depth and changes to water velocity;
- reversal of the timing of flows (e.g. increased winter flows and decreased summer flows);
- changes in the rate and magnitude of water level fluctuations;
- changes in ice cover/slush ice and timing of freezing;
- changes in water quality due to decomposition of vegetation and leaching of materials from flooded soils;
- increases in erosion and sediment deposition; loss of aquatic habitat due to the physical presence of these facilities;
- the blockage of upstream fish movements;

- flooding of terrestrial habitat and creation of new aquatic habitat; and
- increased debris in the water and along the shorelines.

A similar list of primary pathways of effects is also provided for areas with decreased water levels.

The RCEA consistently provides a high-level overview of predominant pathways of effects in the form of network diagrams that illustrate drivers, pathways, and effects for each selected RSC for Physical Environment, Land, and Water (an accepted CEA method). Other sectors of development contributing stress to each RSC in the region are also identified in the network analysis. Direct and indirect pathways of effects are characterized using network diagrams for the fish community RSC (Phase II, Part V, p. 5.3-2) and for all other Water and Land RSCs. However, as previously mentioned, indirect effects are not highlighted in the RCEA beyond a quick mention in the network diagram provided for each Water and Land RSC, and insofar as they may be incidentally captured within the spatial scope of the ROI. For example, with regard to the effects of hydroelectric development in the ROI on fish quality: "…it should be noted that hydroelectric development can cause changes to fish diet, water quality, water temperature, algae, and growth rates, all of which can, in turn, affect the taste and texture of fish. These potential indirect linkages have not been subject to scientific studies in the RCEA ROI" (Phase II, Part V, p. 5.6-32).

In the assessment of change to the ROI during the development period, not enough attention is given to the effects of transmission line construction, clearing, and vegetation maintenance *en masse* in the ROI, particularly if non-selective vegetation clearing techniques are common (e.g. mowing). While the intactness analysis in Part VI Land concludes that the ROI remains reasonably intact, the effects of a single major transmission right-of-way (such as the Bipole I and II corridor, and the Bipole III corridor) can be serious and persistent to local wildlife if not carefully mitigated. From a socio-economic context, the nature of effects triggered by generation projects are distinguished from those from transmission projects and from construction phase to operation phase, and also vary by location. For example, Phase II Part III People (p. 3.4-18) highlights drivers of negative change for health and well-being as follows:

- potential increased mercury exposure;
- potential changes in water quality;
- changes to patterns of traditional food consumption and food security, and
- stress and anxiety brought about by social change.

The RCEA consistently reports changes and trends over time for the RSCs examined in Part III People, Part IV Physical Environment, Part V Water, and Part VI Land, providing both quantitative and qualitative descriptions. However, this effort is often significantly confounded by the data limitations mentioned earlier, including lack of pre-development data, lack of data in the development period, and data that are incongruent and not able to be compared.

The RCEA does evaluate change trends over time for water quality using data available. The fundamental question related to water quality in the RCEA was whether water quality changed in such a manner that it rendered it unsuitable for aquatic biota (Phase II, Part V, p. 5.2-14). Spatial

comparisons of water quality across sites within the ROI were undertaken, where appropriate, to evaluate whether there was evidence of change in water quality conditions between upstream and downstream sites on the same system. These also allowed for an examination of potential cumulative changes along the length of a river, or reach of a river system, and assisted with identification of potential causes of observed changes. Data collected at off-system waterbodies (i.e. lakes or river sites where water levels and flows are either entirely or largely unaffected by Manitoba Hydro's hydraulic operating system) have also been included to provide context (Phase II, Part V, p. 5-2-16). As well, statistical analyses were undertaken to evaluate temporal differences in water quality metrics for some larger data sets (Phase II, Part V, p. 5-2-17). Exploration of relationships between hydrologic metrics, such as water level and discharge, and water quality metrics was undertaken for some sites and data sets using linear regression analysis (Phase II, Part V, p. 5-2-17). The sub-section on Erosion and Sedimentation employed an array of good practice spatial analytical techniques, including Landsat Analysis and Air Photo Analysis.

In the appendixes that accompany the Physical Environmental section, the results of the trend analysis for temperature indicates increasing annual, winter and spring temperature trends, though fewer trends detected in summer and autumn (Appendix 4.2A, p.21). Appendix 4.3A also provides an assessment of hydraulic impacts on LWR and the CRD on the Nelson River using a study period from 1914 to 2014 and with the conclusion that "Lake Winnipeg Regulation has reduced the range in water levels on Lake Winnipeg by reducing the peak water levels during flood and raising the lowest water levels during drought" (p. 20). These are useful conclusions that should be replicated for all components and indicators in order to have a strategic view of the aggregate impacts.

We noted inconsistency in the approach taken to the retrospective analysis when comparing Parts III and IV (People and Physical Environment) to Parts V and VI (Water and Land). While trend-based analysis is consistently used to characterize the cumulative effects of hydroelectric developments on Water and Land, the information-provision approach that is adopted for the People and Physical Environment sections does not allow for the same kind of trend analysis to be performed. An overt focus on description of social conditions and the physical setting without consideration to quantifying or qualifying the magnitude and pathways of combined perturbations (hydro and other developments) on People and Physical Environment RSCs is a slippery slope toward diminishing the substantive goals of a RCEA.

Use of indicators, metrics, benchmarks, thresholds

The RCEA consistently uses indicators, metrics, and benchmarks to assess impacts to Part V Water and Part VI Land RSCs. However, this is not evident in Part III People or Part IV Physical Environment. Scientific benchmarks are also utilized in Phase II Part V Water and Part VI Land to help contextualize cumulative impacts to each RSC and suggest an appropriate level of concern for the cumulative impacts detected. Benchmarks are described as standard points of reference against which indication of negative change could be detected (Phase II, Part I, p. 1.3-19). Benchmarks were defined based on:

- the degree of change that has occurred between pre- and post-hydroelectric development

conditions;
- the Manitoba Water Quality Standards, Objectives and Guidelines;
- the Canadian Water Quality Guidelines for the Protection of Aquatic Life (PAL);
- the federal recovery strategy for boreal woodland caribou in Canada (Environment Canada 2012);
- whether an RSC (e.g. moose) is increasing, decreasing, or stable;
- use of models/scientific literature to determine relative condition for key parameters;
- changes outside the limits of natural variation;
- how the RSC compares to an RSC in a non-affected waterbody in a similar geographic area;
- whether the RSC is able to continue to support Fisheries Management Objectives (e.g. able to continue to support a commercial fishery); and
- professional judgment.

A range of indicators and metrics for each RSC was identified and used. However, the proponent performed selection of focal species, and indicators and metrics with no apparent public engagement or scrutiny [see Sections 5.1.2.3. (Water) and 6.1.2.3 (Land)]. Indicators were aimed at describing and/or characterizing, in a measurable way, the state of that RSC. Selection criteria for the various indictors are specified as:

- Does the indicator assist in determining the health or condition of the RSC;
- Is the indicator measurable;
- Is there sufficient information available on the indicator to make it useful in determining the condition of the RSC; and
- Is the indicator easy to understand and meaningful to the general public (Phase II, Part I, p. 1.3-18).

The RCEA identifies driver and response indicators to facilitate a clearer picture of the overall health of each RSC in Part IV Physical Environment, Part V Water and Part VI Land. In our view this is a useful, innovative practice.

In general, save for a few instances, the use of environmental thresholds that could help assess the significance of historical impacts on RSCs is avoided in the RCEA. In Part V Water and Part VI Land, the short timeline of the RSEA was often cited as the reason thresholds could not be developed. The reason cited in Part III People is “lack of socio-economic and demographic-specific data pre-1980s” (Phase II, Part III, p. 3.3-33), and in Part IV Physical Environment it is “absence of high-quality, long-term records with good spatial coverage” (Phase II, Part IV, p. 4.2-5). Use of thresholds is accepted as good practice in CEA.

Consideration of impact significance

It is acknowledged that multiple hydroelectric developments have resulted in cumulative effects, such as:

- additive effects (e.g. multiple generating stations affecting several areas of spawning habitat

for a fish species);
- synergistic (e.g. the input of two contaminants that combine to make a more toxic substance); and
- subtractive (e.g. the Wuskwatim Generation Project has reduced water level fluctuations on Wuskwatim Lake that were caused by the Churchill River Diversion) (Phase II, Part V., p. 5.1-10).

It is also acknowledged that there have been both direct and indirect effects from hydroelectric development. "In some cases, the pathways lead to the effects directly (e.g. the physical presence of the Limestone Generating Station blocked upstream fish movements), and in other cases, the pathways lead to the effects indirectly (e.g. daily water level fluctuations decreases habitat quality/availability in the littoral zone; decreased littoral habitat quality reduces benthic invertebrate production; reduced benthic invertebrate production affects fish dependent on this food source; and decreased fish populations lead to reduced harvests by fishers) (Phase II, Part V, p. 5.1-10).

Pathways of effects diagrams for hydroelectric development and interactions with other projects and activities is provided (See Figure 5.1.2-1 in Phase II, Part V – already mentioned above). Linkage diagrams showing potential pathways of effect of hydroelectric and other factors on water quality, and fish community are provided (See Figure 5.2.1-1; 5.3.1-1 in Phase II, Part V). The dominant focus on the direct, additive effects of hydroelectric development on each environmental component is, however, one of the weaknesses of the RCEA. Often missing is the assessment of impacts to important connections between or among people, the physical environment, water, and land. Arguably, a synergistic approach linking multiple stressors to each component in both quantitative and qualitative terms is more likely to yield useful perspective for answering questions about total impacts of developments on the social and biophysical environment. Interestingly, it is noted in the study limitations (Phase II, Part 1, p.1.3-20) that:

> The ability to quantify the effect of hydroelectric developments may be masked by the effects of other projects and activities (e.g. the loss of land due to clearing for hydroelectric developments in an area with large scale forestry operations), and
>
> Depending on the data sources, while it may be possible to quantify the cumulative effects of all developments over the period on an RSC, it may or may not be possible to separate out the proportion of those effects resulting specifically from hydroelectric development (e.g. the change in a population of animals).

In Phase II, Part V, p. 5.1-2, it is also stated:

> "While the changes in aquatic biota are strongly linked to changes in the physical environment, they are also linked to socio-economic conditions (e.g. changes in fish prices can result in the targeting of specific species by commercial fishers).

However, these statements which explicitly recognize potentials for synergistic interactions are not

revisited.

Without sufficient and deliberate effort at characterizing the synergistic impacts of natural and human perturbations (including hydro) on each VEC, a true understanding of cumulative effects cannot be achieved. Synergistically, an obvious connection between water quality and effects on the fish community are made in a network analysis (see Figure 5.3.1-1) but this linkage is not explored in depth in the summary of cumulative effects on fish community in the ROI. Further, it is important to identify where synergistic interactions affecting Land and Water RSCs might also affect People RSCs. For example, with respect to mercury concentrations in fish:

> Based on the entire data set for the ROI, mean mercury concentrations of piscivorous fish species from on-system waterbodies have regularly and often substantially exceeded the 0.5ppm Health Canada standard for the commercial sale of fish. These exceedences have typically been observed for 5-25 years but in some cases for more than 35 years after flooding (Phase II, Part V, p. 5.5-98.

It is also noted that:

> Hydroelectric development considerably changed Lower Churchill shoreline ecosystems as indicated by surface water area, shoreline length, waterbody morphology, water and ice regimes, bank and beach attributes, the distribution and abundance of shore zone, offshore and tall shrub vegetation and large woody debris accumulation (Phase II, Part VI, p. 3-431).

The same "high" cumulative effects are noted for Nelson River shoreline ecosystems (Phase II, Part VI, p. 6.3-442, p. 6.3-451, p. 6.3-452). From a cumulative effects perspective, it seems important to explore how high mercury concentrations in piscivorous fish and the major alteration of shoreline ecosystems of combined with decreased fish quality (according to Indigenous people) and decreased availability of fish per cubic meter in the Nelson and Churchill River estuaries, together have synergistically impacted food security and cultural intactness for Indigenous communities in the ROI. The RCEA does make a couple of attempts to identify synergistic impacts, and the effort should be expanded.

At times in Part V Water, and Part VI Land, the cumulative impact of hydro development on an RSC is qualified *relative* to the impact attributable to other developments, and deemed proportionately less: this is wrong-headed, as it is the total impact of all activities on a RSC that is important. In other words, the incremental impacts of hydroelectric development are 'traded-off' (i.e. minimized) against the significance of other disturbances in the region; an error that was noted in both the Bipole III and Keeyask CEA reviews. For example, water quality in the ROI is considered to be suitable for aquatic life for most sites and periods, with the most notable exceptions being low oxygen concentrations at some locations (e.g. Notigi Lake), iron and aluminum levels above PAL (protection of aquatic life) guidelines, and phosphorous commonly exceeding the nutrient guideline (Phase II, Part V, p. 5.2-210). These findings are downplayed or 'minimized' through comparison: "these conditions are also observed in lakes that are not affected by hydroelectric development" (Phase II,

Part V, p. 5.2-210), and:

> The existence of multiple pathways [of effects on beluga] makes distinguishing hydroelectric-related effects from other drivers a difficult task. For example, commercial exploitation of beluga in the RCEA ROI began in the late 1600s…Additionally, the Port of Churchill…undergoes regular underwater maintenance activities…(Phase II, Part V, p. 5.8-6).

Similarly, with respect to caribou: "…the highest levels of hydroelectric development disturbance occur[s] in the Wabowden Range, with 6% of the total area disturbance attributed to hydroelectric development. However, the largest contributor to disturbance in all ranges remains natural disturbance…" (Phase II, Part VI, p. 6.9-57). And with respect to moose: "Hydroelectric development has contributed to the majority of landscape alteration, though this quantity of habitat loss is small (approximately 1%) relative to the historic contribution of forest fires" (Phase II, Part VI, p. 6-10-208). It is total impact on RSCs that matters and is needed to understand the significance of further impacts caused by any additional projects in the ROI.

It is apparent in the RCEA that the total stress on certain sub-regions of the ROI is much greater than others (the sub-region "Area 2" – the Nelson River and estuary – being the most stressed), yet the RCEA does not attempt to qualify the total, cumulative stress placed on any given sub-region, nor on the ROI as a whole. In other words, despite the volume of information provided, Manitoba and Manitoba Hydro do not integrate their observations to arrive at a statement about the overall well being and/or sustainability of the environment or communities of the region. In fact, the RCEA avoids the issue of the significance of impacts altogether. Scientific benchmarks are consistently used to gauge the seriousness of noted cumulative effects to RSCs in Part V Water and Part VI Land, but there is no attempt to evaluate significance either using the classic criteria (magnitude, duration, likelihood) or by applying a 'sustainability test.' Further, the societal significance of the cumulative effects throughout the RCEA is not addressed. Assigning significance to the impacts caused by hydropower development in northern Manitoba is not merely a scientific exercise. Significance determination is dynamic, contextual, political, and ultimately a judgment call: scientists evaluate significance differently from one another and from local communities[57]. If a threshold has been deemed crossed, any future impact on a RSC must be considered significant.

Prospective Analysis

The RCEA does not include prospective analysis:

> …environmental trends are discussed, where appropriate, to understand and provide context for environmental change over time, but predictions of future conditions due to climate change, introduction of non-native species, and other ongoing anthropogenic effects are limited, as they are new, evolving and currently not available in the literature" (Phase II, Part I, pg. 1.3-5).

[57] Noble 2015

Unfortunately, prospective analysis is a core element of good practice CEA and the lack of it must be considered a major shortcoming of the RCEA. It is unclear why the Terms of Reference precluded prospective analysis given that a major question regarding the future welfare of the environment and communities northern Manitoba is the potential for more dams; particularly, whether or not to sanction development of the Conawapa generating station. Manitoba has significant undeveloped hydro potential remaining in the north and has already invested approximately $380 million on the Conawapa project (Manitoba Hydro 2017).

Management

One of the biggest opportunities in a regional scale assessment is to identify opportunities and partnerships for coordinated mitigation and management of regional impacts. The RCEA does not address the management phase of CEA beyond providing a list of past and current remediation and compensation programs in the region.

> Where applicable, the assessment includes a discussion of mitigation and remedial works that have been put in place to reduce effects and compensation provides for effects that could not be mitigated (Phase II, Part I, pg. 1.2-6).

Phase II, Part III People documents past/ongoing efforts by Manitoba Hydro at mitigating effects due to hydroelectric development in the ROI, some of which are collaborative in nature e.g. Lake Sturgeon Stewardship and Enhancement Program (p. 3.4-26) and Coordinated Aquatic Monitoring Program (p. 3.4-26). Most of the effects (Resource Use, Navigation, Transportation and Public Safety etc.) are mitigated via existing Settlement Agreements that stipulate compensation arrangements and/or agreements for addressing hydroelectric development impacts. Other location-specific initiatives (e.g. *Kischi Sipi Namao*, formally Lower Nelson River Sturgeon Stewardship Agreement) and programs (e.g. Waterways Management Program, including Boat Patrol Program, Debris Management Program, Safe Ice Trails Program, and Water Level Forecast Notice Program) are documented as “mitigation measures” for Navigation, Transportation and Public Safety. These efforts are largely presented in the context of hydro development and not in the context of offsetting significant cumulative effects affecting the people in the ROI.

Part IV Physical Environment is silent on the topic of impact mitigation and management measures, although it alludes to the value of collaborative monitoring without elaborating on the application of such collaborative efforts on cumulative effects management. For example, the section states: Water Survey of Canada (WSC) and Manitoba Hydro are part of the National Hydrometric Program—a cooperative endeavour between the federal, provincial, and territorial governments to provide accurate, timely, and standardized data and information on the current and historic availability of surface water (4.3-5). The reason advanced for this collaborative initiative is to support operational and cost efficiencies and not for the purpose of offsetting significant cumulative environmental effects.

Thus, although the list of past remediation and compensation programs provided does serve as a

useful basis to identify strengths, weaknesses, gaps, and opportunities to strengthen regional impact management, this work has yet to be done.

> Following completion of the Phase II report and the public outreach program, Manitoba and Manitoba Hydro will review all of the RCEA documents, the outcomes of the public outreach program, as well as current monitoring and planning/licensing initiatives and consider next appropriate steps. Efforts will be made to develop next steps in a comprehensive and coordinated fashion. Next steps will be outlines in a final RCEA Next Steps document, available in spring 2017" (Phase II, Part I, pg. 1.1-2).

At the time of this review, the Next Steps document was not completed.

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