Review of Phase I and II of the Regional Cumulative Effects Assessment for Hydroelectric Developments on the Churchill, Burntwood and Nelson River Systems

An “on-system” shoreline
Riparian shrub zone to emergent aquatic vegetation
on east Cross Lake, Sept. 2017

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1 Introduction

"Heal the land, heal the people, heal the nation."

Pimicikamak[1] national policy on survival.

The joy of youth learning about the richness of our natural world through traditional family activities

Pimicikamak's primary interest is in developing strong, thriving communities within a healthy cultural and ecological landscape. The current state of the natural environment is of great concern to Pimicikamak as the observations of degradation over time within their traditional territory are numerous.

Hydroelectric development has clearly had a significant incremental influence on ecological processes in northern Manitoba river systems, and on the economies and socio-cultural environment of Pimicikamak and other Aboriginal peoples. Many other factors including historical and current legal systems, commercial trapping, forestry, mining, fishing, agriculture and urban development, have all combined to influence the current state of the land and the people in northern Manitoba.

Following environmental assessment hearings on the Bipole III Transmission project, The Clean Environment Commission recommended in 2013 that a "regional cumulative effects study" be done be prior to licencing approval for any new hydroelectric generation and transmission facilities in the region. The reason given was that there has been a "… *profound impact on communities in the area of these projects, as well as on the environment upstream and downstream".* The RCEA Phase II report mentions that the CEC acknowledged that the same concerns were expressed about cumulative impacts at the Wuskwatim hearings back in 2004.

The broad objective of such a study is to better understand the nature of combined effects throughout the affected river systems rather than just considering each new project and its particular footprint. The

[1] Pimicikamak is incorrectly equated with the Cross Lake Band of Indians in many instances in the RCEA Phase I and II reports. Please see Appendix A for an explanation of the entities known as Cross Lake Band and Pimicikamak.

idea is that this may help us to avoid over-development and inform future decision making around mitigation measures and new project proposals. Such a complex study requires careful design to prioritize concerns, decide how specific questions can best be investigated, determine information needs and data collection methods, and agree on how to allocate resources for the work. There is no simple way to go about such an initiative.

It is quite surprizing that a decision was made to base a RCEA study solely on existing data if it was intended to be a final report on the state of the environment as suggested by the Terms of Reference. The timeline determined by government did not allow any room for consultation with Pimicikamak and other Aboriginal peoples on the Terms of Reference for this regional cumulative effects study, or during the writing of the Phase II Report. Perhaps it was decided that this would be too complicated, expensive, and time consuming?

Keeyask, yet another new major facility on the Nelson River was already well into the planning stages when the CEC made its recommendation. Since Keeyask was underway, regulators and the proponent understandably did not want this CEC recommendation to hold up licencing of that project. Keeyask is now well under construction and other projects are going through final licencing or are up for re-licencing. The CEC recommendation to conduct regional cumulative effects assessment prior to more licencing development has not delayed anything.

The Terms of Reference for this RCEA were developed without further consulting the people who hold treaty rights in this region. There are elements of the affected river ecosystems which have been observed by Pimicikamak to have been significantly affected over large areas, and for which it is well known that there has been very little formal study. The RCEA documents cite many instances where data gaps exist due to the short timeline of the assigned assessment restricting the efforts of researchers.

As a consequence, the Regional Cumulative Effects Assessment documents represent a strong beginning on a technical level, but present many overall conclusions that are based on weak evidence, and fail to reflect what many northern Manitoba Aboriginal people anticipated for a more comprehensive assessment of the existing hydroelectric system. The RCEA report acknowledges that there have been widespread negative impacts, but then suggests in many ways that these are under control, or at least largely tolerated.

One passage reads:

> *"In Northern Manitoba, and for many of the RCEA ROI communities, the advent of extensive hydroelectric development throughout areas traditionally used by Aboriginal residents, has exacerbated and compounded the effects of* ***'modernization'****.* [emphasis added]
>
> *Specifically, communities in the RCEA ROI have indicated that hydroelectric development has contributed to the erosion of their ability to provide for themselves by reducing the quality and quantity of resources available to them, and by giving rise to fears about environmental health and the safety of traditionally harvested foods." …*

> *Despite such changes, communities throughout the RCEA ROI have consistently managed to maintain core cultural values and practices, and have worked increasingly to expand community-based programming that supports wellness."* (Manitoba Hydro 2015. RCEA Part III People p.3.3-129)

The word 'modernization' is used with a sense of negative influence on Aboriginal cultures, but also with a sense of inevitability. Regulation of rivers provides services including large quantities of electricity, a degree of flood control for certain regions, jobs and economic activity for many people. However, this 'modernization' in northern Manitoba, as it pertains to increasing industrialization of the landscape and local economies is viewed by Pimicikamak to have involved multiple forms of discrimination, dominance over decision-making, and exploitation of resources for the benefit of distant interests coupled with a lack of understanding and/or disregard for the long-term health of the local people and the land.

This should not have to be the case now and in the future. The word 'modernization' can also mean 'transformation', 'upgrading', 'innovation', 'reconstruction', 'renewal'. A process of a cumulative effects assessment, if designed and executed well, can contribute to a more positive form of modernization that is not unilaterally defined. The objective should be to work together to make decisions that do a better job of balancing interests. For this to be accomplished, the process must be a collaborative one from the start. It requires time and patience to develop studies and mitigation programs that are meaningful and that provide opportunities for collective learning and engagement.

The treaty-based privilege of sharing the land, and then proceeding to create major environmental transformations in order to extract resources should be understood to come along with responsibilities. This includes responsibility to share benefits without subjecting those most affected to onerous and adversarial processes, and to make a concerted and generous effort to avoid and mitigate negative environmental impacts wherever possible.

The study of cumulative effects is important to inform future decision making. We want to avoid undue degradation of our environment caused by multiple activities and actions that overlap in their effects. It is acknowledged that this is a complex task and the technical methods to address this are only in the early stages of development.

The issue of establishing thresholds is very important to Pimicikamak. It is of course essential to develop a better understanding and awareness of ecological limits that lead to excessive depletion of populations and possible extirpation of species. However, we also need to be careful not to set the threshold too low. When we cause the disappearance of species from areas where they have thrived for millennia, we have already gone much too far. Pimicikamak would like to see the broader objective be to restore and protect ecosystems and the cultural landscape wherever possible to contribute to a rich quality of life long into the future.

A reasonable start has been made on reviewing the literature and conducting some preliminary analysis for the first two phases of the RCEA. A lack of comprehensive historical pre-development research does limit the extent to which we can quantify certain changes in the environment due to hydroelectric development. However, there are also huge data gaps hindering our ability to objectively describe

current conditions. If we are serious about developing sound mitigation strategies for the future, we need to conduct more field research to better understand the relationships between regulated river conditions and environmental parameters and explore what can be feasibly improved.

Continued work on this RCEA needs to focus on filling gaps in our understanding of current environmental conditions, and further developing specific questions and hypotheses that can be tested with carefully designed research. Existing hydroelectric infrastructure will evolve in its operations as it adapts to watershed flows, societal needs, economic constraints and opportunities. Twenty or forty years from now, we do not want to be in as weak a position as we are currently in our collective understanding of the state of the environment in northern Manitoba's large river systems.

Pimicikamak would like to work together with others on mitigating the negative effects of hydroelectric development and avoiding further environmental and cultural degradation. The healing process must continue with a spirit of reconciliation. Honest collaboration in working towards positive solutions that address inequalities is essential.

Just upstream of the Jenpeg Control Structure for Lake Winnipeg Regulation at a site formerly known by Pimicikamak to be a beautiful and bountiful reach of the Nelson River.

Low slope shoreline on a muddy bay on Sipiwesk Lake in the heart of Pimicikamak traditional territory that is influenced by both LWR upstream and Kelsey Dam downstream. How do we understand and assess the significance of the cumulative effects of river regulation over such a large area? (photo: Luttermann 2014)

2 Report Summary

2.1 Purpose of the Regional Cumulative Effects Assessment

As people who are closely connected to a traditional territory, Pimicikamak is responsible for taking care of the natural environment for present and future generations. This is at the core of the ethos of life that Pimicikamak is working to regain, respect and implement.

Part of this responsibility involves understanding how human actions affect the ecosystems in our care – ecosystems that are vital to physical and cultural well-being. To view all elements of our environment including ourselves as interconnected is essential. To use this ethos as a basis of understanding in a practical way to do environmental assessment is complex.

During the most recent project specific environmental assessments in northern Manitoba for new components of the already extensive hydroelectric system, there were many recommendations for a "regional cumulative effects assessment". It was clear that research, monitoring and mitigation work has been pursued in parts of the regulated river systems over the years without a comprehensive plan for longer-term system-wide analysis.

The level of effort invested in pre-development data collection, analysis and post-development monitoring commitments has increased substantially for more recent new projects including Wuskwatim, Keeyask, and Bipole III within the provincial and federal requirements for environmental assessment. However, as each one of these projects was developed, the concern over the incremental degradation of these large river systems has also increased. Pimicikamak has been witnessing diminishing integrity of the environment in its traditional territory, while the myriad effects of each new project have been deemed to be "acceptable" by the provincial and federal regulators.

These observations and concerns include the combined effects on the landscape of hydroelectric development, commercial forestry, road building and transportation technology, mining and processing, agriculture and urbanization to the south, and tourism and recreation. However, because the hydroelectric system has such an obvious wide-ranging presence on the landscape and in the northern economy, attempting to clarify the environmental and cultural significance of incremental damming of the large rivers that flow through Pimicikamak territory is a central focus of concern.

The concept of a regional cumulative effects assessment is relatively new. The most appropriate and effective framework and methods are not at all clear and must be designed on a case by case basis. (Seitz et al. 2011, Duinker *et al.* 2013). The questions are complex but essential to investigate. There are many practical challenges that have been well described over recent years of practice of cumulative effects assessment (e.g. Bérubé 2007).

What is hoped ultimately, is that taking a "bigger picture" look at the effects of human actions affecting these river systems will help us all to make better decisions about how to reduce the negative effects of existing projects (mitigation). We want to ensure the long-term "sustainability" of species in the region

as a whole, but we also wish to maintain, restore and enhance the health of the river environments that are central to Pimicikamak culture and the evolution of the Pimicikamak cultural landscape.

It is also hoped that information generated by taking a broader view will provide us with useful tools when considering the wisdom of development decisions. It is understood that there is not a simple way to go about addressing these ambitious objectives. These are big questions being applied to very large areas.

A regional cumulative effects assessment must realistically be conceived of as part of an ongoing program of research and monitoring and adaptive decision making. In this case it was recommended by the CEC that regional assessment be done before any new projects were approved. Therefore, it was important to design a study framework and reasonable but meaningful expectations for what could and should be accomplished within an agreed timeline prior to new project proposals being entertained. This was done without involving directly affected indigenous, treaty rights holders at the design stage.

In part because of the weak approach to collaboration in project design, and in part due to inadequate data, it is clear that after Phase II we are at an early stage in a regional cumulative effects assessment of northern Manitoba river systems affected by hydroelectric development.

2.2 What has been accomplished so far with Phase I and II?

Those tasked with completing the work for this RCEA accomplished quite a bit in the arbitrarily assigned time period. The scale of effects related to multiple hydroelectric developments in northern Manitoba is enormous, directly affecting a huge geographical area, with a variety of changes in ecosystem processes created over a period of many decades and continuing at present and for the foreseeable future. The the set of reports is clear and well written.

The RCEA Phase I and II literature review is extensive and is a very useful consolidation of work to date. It serves to identify and summarise most of the formal environmental assessment work that has been done. It communicates a summary of many of the observations and concerns expressed by people living in the region. Some useful preliminary analysis has been conducted.

The RCEA explains the recent efforts that have been made through the Coordinated Aquatic Monitoring Program (CAMP) to standardize data collection and analysis for several aquatic environment parameters throughout all the river systems in Manitoba that are regulated by dams. This work is beginning to provide some very useful information for habitat mapping such as the recent mapping of lake and river substrates and average depths. It will help to identify trends in the ambient state of several elements of the aquatic environment in many locations.

The geographical scope and intensity of the sampling effort through CAMP while important for developing a comparable data base for environmental health indicators over a large area, may not be adequate to investigate some relevant questions about potential cumulative effects in these complex

systems. Additional focused studies may be better able to address questions such as whether variations in year to year and seasonal operations affect water quality especially in the more sheltered back bays that are less influenced by the main channel currents.

The CAMP program participants have been grappling with questions around indicator choices, sampling effort, and approaches to communicating results to a broader audience (Thrift 2015). A three-year report for 2008-2010 period was completed (CAMP 2014). Some more recent results have been posted on the CAMP website[2] and progress is beginning to be made towards presenting the material in a more accessible form. It is very important that this communications effort continue in order to improve the ability of a wide variety of people to access and interpret this information.

It could be quite productive to establish a working group on communications related to environmental science and Aboriginal Traditional Knowledge with Aboriginal educators, communications representatives, elders and youth to explore how information is interpreted depending on its presentation, and how it can be best shared.

Overall, this work in Phase I and II represents a good beginning for a regional cumulative effects assessment by compiling existing data, asking some broad questions, conducting some re-analysis of existing data on fish communities, identifying where many data gaps exist, and experimenting with some analysis based on remotely sensed imagery. It has come some distance in helping us to understand how some of this imagery can be used in cumulative effects analysis and in what ways it is limited.

The authors of the RCEA Phase II report make it clear that there was not enough time allotted to this exercise to do the following:

- pursue several types of analysis that would be possible with the existing data
- collect any new field data to address significant data gaps (this was in fact precluded according to the Terms of Reference)
- establish thresholds for measuring the significance of effects

With these limitations recognized by the authors, it appears clear that the RCEA Phase I and II could not be considered to meet the full objectives of the CEC recommendation.

The objective of any research and assessment is to support future decision making and decide on action to take to protect environmental values. It is important that we engage in a comprehensive process of determining what the priorities are, what is feasible to accomplish, how financial and human resources can be allocated to address problems. There is no doubt that this is extremely challenging in large and complex ecosystems. There are numerous data gaps that prevent quantification of the relative effects of various human actions.

Rather than providing a detailed response to every section of the entire set of RCEA documents, this review concentrates on discussing some significant concerns with the overall approach to the RCEA beginning with the Terms of Reference; observation and acknowledgement of what has been

[2] http://www.campmb.com/reports/

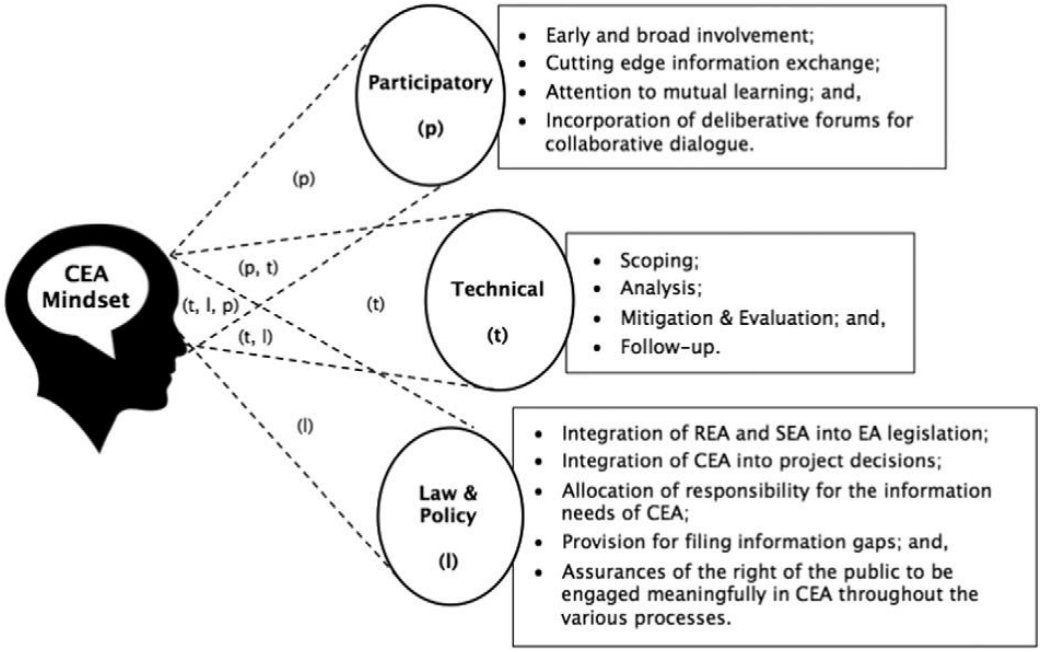
accomplished so far in the RCEA Phase I and II; discussing perspectives on several of the conclusions presented in the RCEA; and providing recommendations for next steps based on Pimicikamak concerns.

2.3 Next steps for the Regional Cumulative Effects Assessment

2.3.1 Increased Collaboration with Affected Aboriginal Peoples

This RCEA has not been guided to date by existing legislation, policy or consultation results that might help to more specifically define the specific objectives and requirements of the process. The framework, information needs, and limitations have been determined by Manitoba and Manitoba Hydro. There is no clear provision for a process to determine how the information will influence future decision making. Aside from existing monitoring programs, it is unclear if, how, and when any information gaps will be addressed.

It has been argued that approaches to a regional cumulative effects assessment require a number of basic elements in order to be effective (Sinclair et al. 2017). An element that is of central importance to Pimicikamak is that such a study be participatory in nature. Early involvement allows the opportunity to contribute to the development of the study priorities, specific questions, and methods. This will lead to a more collaborative approach to defining goals and expectations, and a process that includes more opportunity for mutual learning.



Elements of Effective Cumulative Effects Assessment (from Sinclair et al. 2017)

A meaningful collaborative process, especially with people who are directly affected by the changes in the river systems and are rights holders under treaty, will need to be further developed. It is understood by Pimicikamak that this is easier said than done. Nevertheless, we must continue to make a concerted effort.

An important part of any environmental assessment process including cumulative effects assessment is the initial stage of scoping concerns and questions and identifying priorities and approaches. This is necessary since we cannot study everything exhaustively and forever.

In other words, it is a process of deciding the following:

- What are we setting out to accomplish with this exercise? What are the broad and specific objectives?
- What questions will be most useful to pursue in order to address further mitigation of known or suspected impacts?
- What is feasible to study and within what time frame?
- What methods of study will be most useful and efficient?
- How is it best to allocate financial and human resources to this task?

Such a scoping process was conducted by Manitoba and Manitoba Hydro in developing the Terms of Reference for this study. Although these Terms of Reference mention the possibility of a "public engagement process", this is happening after the first two phases have been completed, not at the onset of the process as would be most appropriate. Treaty rights holders such as Pimicikamak who are signatories to the *Northern Flood Agreement* expect to be involved in a more truly collaborative process on issues that pertain to long-term land use planning.

Manitoba and Manitoba Hydro may have assumed that the interests and concerns of treaty rights holders such as Pimicikamak were already contained in existing documentation related to work on other environmental assessments, consultations, and mitigation projects over the years that led to the recommendation to do a regional cumulative effects assessment. However, when it comes to making decisions on future management, priorities need to be continually discussed and evaluated, especially where compromises have to be made. For example, should we put effort into waterfowl or aquatic mammal monitoring, or are resources so limited that any money available is better spent elsewhere?

Cumulative effects assessment must be recognised as a learning process for all of us. The "state of the art" is young and evolving. It is a concept that is based on the knowledge that we can cause more intense and widespread degradation of our natural environment if we fail to look at the big picture while pursuing a number of different activities. No one really knows how to do this type of assessment in the most reasonable way. New approaches have to be developed that make sense and are also meaningful and valuable for future decision making. Compromises have to be made based on what is feasible and what our standards are. Negotiation is necessary to come to some kind of agreement on what can be considered to be a reasonable and useful approach. Efforts need to be evaluated as we go along, and we need to be open to change and improvement.

Pimicikamak intends to be much more closely involved in future decision making that affects the ecological health of these river systems that form the heart of its traditional territory recognised by treaty. Pimicikamak expects that the next step in this RCEA process will involve developing a working committee on environmental assessment with Pimicikamak representation that will define a set of objectives, priorities and approaches beginning with the next five years to continue with this regional cumulative effects assessment.

Pimicikamak is eager to work closely and in a collaborative manner in this effort to develop a more comprehensive understanding of the state of the environment in northern river systems. Regardless of whether there is adequate pre-hydro data for most environmental components, a more comprehensive understanding of current conditions is also very important to track trends under the influence of climate change.

The ultimate goal is to determine the best ways to mitigate the negative effects of river regulation when coupled with other human impacts and climate change. We want to avoid further degrading Pimicikamak traditional territory. It is also important that Pimicikamak is able to fully benefit from the services that can be provided through hydroelectric development in such a way that Pimicikamak communities are strengthened and not further compromised. Good communication and close collaboration are essential for a more positive future.

The RCEA documents discuss how the lives of northern Manitoba Aboriginal people have been affected by many factors prior to and concurrent with the several recent decades of hydroelectric development. Patterns of human settlement related to economic activity have changed including immigration to the north and northern people travelling, moving and working elsewhere Resource extraction for export has increased dramatically. In addition to industrial development, federal and provincial government policies, legislation and regulation such as the ongoing influences of the *Indian Act*, the establishment of reserves, the residential school system, the Freshwater Fish Marketing Corporation and the registered trapline system have all contributed to alienating lands, reducing the control of Aboriginal people over their lives and traditional lands, and creating environmental change.

Hydroelectric development contributes to the cumulative influence of all of these factors that impose change on Aboriginal people. It is for this reason that it is especially important that a contemporary process to assess the cumulative effects is inclusive and strives to directly involve Aboriginal people in planning and decision-making.

2.3.2 Establishing Thresholds and Benchmarks

The purpose of defining a threshold is to have an objective measure to determine if an action has gone too far, the consequences are unacceptable and remediation is required. The RCEA Phase II document stated that there was not enough time to develop thresholds for impacts in the period allotted for the study. There was also no time devoted to consulting with affected people or other concerned Manitobans on this important and difficult issue. It would have been apparent from the start that there

were major data gaps that would definitely require further field research for most regional study components chosen.

As noted in the RCEA documents, thresholds for impacts must be based on ecological knowledge as well as limits to what is acceptable to society and treaty rights holders. This is a very complex and challenging thing to determine. It is unlikely that there will be agreement across all interests for many thresholds, however it is necessary to grapple with this issue if we are serious about trying to make more ecologically and culturally balanced decisions.

For Lake Sturgeon for example, a threshold could be whether there exists adequate habitat for all life stages in each reach of the river according to a generic index. The idea is that each population unit would have habitat to survive or be self-sustaining regardless of how many dams are built that alter the pre-existing habitat. Do we understand habitat needs well enough, especially with the potential effects of climate change? Or should a threshold include the preservation of a certain portion of the river from the effects of reservoir development (flooding) and dam infrastructure so that the cultural landscape is less altered and some natural spawning sites are left intact? This may add a precautionary approach to ecological and cultural conservation efforts, and hopefully provide some extra room to account for uncertainty.

It is understood that no part of the Nelson River, the Burntwood River or the Churchill River in Manitoba is currently free from the impacts of river regulation since all reaches are affected by upstream dams. The intensity of the impacts however varies depending on the degree of alteration. The types of thresholds that are developed can influence whether whole new facilities are approved, and what level of effort is put into mitigation of the effects of existing facilities.

The RCEA documents explain that instead of thresholds, this assessment used variety of benchmarks against which to compare levels of negative effects. For many regional study components there remains the problem of inadequate data to understand current conditions. For example, water quality data under the current monitoring program provide data that are meaningful on a large scale, and are not able to demonstrate how certain areas such as back bays compare to benchmarks. One of the next steps that can be taken now is a discussion of how meaningful and appropriate the use of certain benchmarks is to meet the objectives of the assessment.

In terms geographical scope, Pimicikamak has strong concerns about measuring cumulative impacts on the basis of the quantity/percentage of general habitat types affected within an Ecozone as a whole. This may be one way to measure the ability of certain species to persist in an area, but it does not reflect the concentration of effects on the environments of the major river systems. These large river environments have unique ecological characteristics and cultural significance.

It would be appropriate from Pimicikamak's perspective to continue to develop a more comprehensive assessment of the existing quality of habitat throughout the affected rivers. Then work on establishing thresholds that are based on the extent to which the suite of existing habitats in the major river systems currently support species such as muskrat, beaver, moose, waterfowl.

2.3.3 Comprehensive Research and Monitoring Plan to Address Data Gaps

One of the overall conclusions of our review of the Phase I and II RCEA documents is that there is a significant lack of data necessary to adequately characterize the current state of many of the chosen regional study components, and therefore meet the objectives of this particular effort at a regional cumulative effects assessment. This lack of data is clearly acknowledged in several respects in the RCEA reports. However, Phase II does not attempt to suggest to what extent this compromises the results to date.

The intent of a cumulative effects study is partly to reduce uncertainty about the regional effects of the system of hydroelectric projects on these major northern river systems. Due to these numerous important data gaps, an increased program of study is undoubtedly required in order to investigate the current conditions of the environment and provide improved and reliable information to support development decisions and project management.

Modelling can be a useful tool to estimate the magnitude of effects of a stressor over large areas. However, adequate sampling data are needed to provide valid inputs to models. The fact that water regimes are quite variable in different parts of these river systems, and even variable from year to year in some areas, means that we need to have some adequate field data from each area for example to verify habitat classifications to input into a model and be able to interpret the results in a reasonable manner.

This is the first “regional cumulative effects assessment” focused on hydroelectric development done in Manitoba. The level of effort applied must be sensible and realistic, but also equal to the magnitude of these developments that have such clearly extensive effects.

It is important to Pimicikamak that Manitoba and Manitoba Hydro come to work together to determine what additional information is essential to gather to further inform an adequate regional cumulative effects assessment and how best to do this. Traditional knowledge and observations of land users in all reaches of these river systems over the past several decades provide the basis for numerous impact assessment questions and concerns. Hypotheses regarding adaption of species to the changed hydrological regimes, cannot be further assessed with weak data.

While it may not be possible to answer some “before and after” questions quantitatively, several questions could be explored in more detailed qualitative terms. There is much to be learned from a more comprehensive assessment of the current physical environment. More comprehensive study is being done in areas surrounding the newest projects such as Keeyask, however large areas that are subject to ongoing effects of the older projects require more attention. This is will assist in developing a current baseline against which to assess future management and development decisions.

Interdisciplinary surveys of the current biophysical characteristics of specific sites for which there is traditional knowledge and cultural significance are one approach towards a more comprehensive ecological understanding. Such an approach could also enhance engagement and mutual learning.

As mentioned, it is understood that research is expensive, and that compromise is necessary. Pimicikamak must be involved in discussions around how these priorities are set.

2.3.4 Summary of Recommendations for Next Steps

Below is a preliminary list of some topics for consideration for further research, monitoring and mitigation program planning. Many of these focus on collecting more information on the state of the existing environment since it is impossible to conduct a cumulative effects assessment without more robust knowledge of current conditions. These study and program suggestions are presented at a conceptual stage and would require much more planning and refinement. This is also not to be considered a comprehensive list of what could or should be done to better assess regional cumulative effects over future years.

It would be very beneficial for a cumulative effects assessment process to have a strong focus on reconciliation and the future by designing research and monitoring plans, and experimental habitat enhancement pilot projects which include opportunities for education, mentorship and employment for Aboriginal youth.

Pimicikamak looks forward discussing the merits of these ideas in the context of a team effort. A process in which the specific recommendations made in this review will be addressed through a comprehensive written response, followed by formal discussions with Manitoba and Manitoba Hydro, would be a good start.

1. Conceptual Framework: Site-specific interdisciplinary studies of areas of particular cultural significance could contribute to a more holistic understanding of the state of the environment in these areas. These studies could be developed through collaboration among Aboriginal holders of traditional knowledge, resource harvesters and scientists. An approach like this may be useful to support mutual learning and a more integrated ecosystem focus for study and communications.

2. Water Regime and Operations: In collaboration with affected Aboriginal people, explore the questions and potential studies that could help to better inform the regional cumulative effects study about how specific operating regimes in various parts of the system affect habitat and human land use. Consider future scenarios under potential climate change.

3. Water Regime and Operations: Education and Communications. Plan a review of the overall operating regime for the northern hydroelectric system in conjunction with affected Aboriginal people to discuss the existing system as a whole, objectives and constraints, and the feasibility of any future changes.

4. Erosion and Sedimentation: Choose a sample of sites subject to high levels of erosion to conduct an assessment of the site condition and ecological and cultural factors affected by this process.

5. Erosion: Conduct habitat assessments of a sample of shorelines that have been artificially protected from erosion and consider whether other mitigation measures are feasible to increase habitat quality and aesthetic characteristics.

6. Erosion: Discuss ways to design a more detailed assessment of the level of the woody debris problem throughout the affected river systems, and the degree to which mitigation efforts have been effective to date.

7. Consider expanding the capacity either through CAMP or a separate project to plan some more intensive site specific water quality investigations over more limited time periods that would use consistent data collection protocols with CAMP.

8. Water Quality: Communications on the subject of water quality in surface waters and in community water services should be reviewed. Increased community-based communications strategies to share what is being learned through CAMP and explore questions and concerns about water quality and cumulative effects over time should be considered.

9. Fish Community Workshop: In collaboration with Pimicikamak, conduct a workshop to share the current state of knowledge on fish communities in northern Manitoba regulated rivers, evaluation of existing mitigation programs, and possible new mitigation ideas based on ATK, regional fisheries science and what has been learned in other regions. Explore the potential and limitations for work to investigate the decline of Lake Whitefish.

10. Fish Habitat Enhancement: Explore with Pimicikamak and fisheries managers, ideas for a pilot experimental habitat enhancement project at selected tributary streams to attempt to offset a portion of the cumulative effects of water regulation and other structures.

11. Methylmercury: Work together with Pimicikamak to review and evaluate the current level of communications on the issue of methylmercury and fish and wildlife consumption in Pimicikamak communities. If considered necessary, plan a communications strategy to share current knowledge of cumulative effects, and explore concerns.

12. Shoreline Habitats and Wetlands: In collaboration with Pimicikamak, conduct wetland surveys in targeted areas on and off-system that have not been the focus of recent environmental assessment work and therefore have inadequate data coverage. Collection of these survey data can support wetland mapping and interpretation of mapping and cumulative effects specific to this region and to the various regulated water regime conditions. Periodic monitoring should be done to develop a better understanding of change over time into the future in relation to watershed and operations variables.

13. Wetlands Classification: Develop a classification system for wetlands and riparian habitats within the regulated water regimes in order to support cumulative effects assessment.

14. Waterfowl: A survey protocol should be planned to begin to document waterfowl population trends in the upper Nelson in collaboration with Pimicikamak using ATK, standard survey and citizen science methods.

15. Beaver: Develop a program of focused research and monitoring in collaboration with Pimicikamak, including field work to develop a better data set to describe current beaver populations and habitat use in regulated and unregulated areas, as well as test specific hypotheses.

16. Muskrat: Include muskrat as a regional study component. Work together with Pimicikamak to conduct a literature review and document ATK for this species. Consider the development of a collaborative research plan to investigate the use of habitat by muskrat in understudied regulated and adjacent unregulated areas including education opportunities for youth and mentoring by elders.

17. Terrestrial Furbearers: Discuss the potential for doing some survey work and analysis on terrestrial furbearers such as mink that may be affected by degraded riparian habitats.

18. Colonial Water Birds: In collaboration with local Aboriginal people, develop a program of research to investigate habitat use by colonial water birds and nesting success to compare regulated and unregulated water bodies.

19. In collaboration with local Aboriginal people, explore the feasibility of an experimental program of colonial water bird habitat enhancement in areas where it is probable that nesting success has been compromised by direct habitat loss, or the effects of regulation that create unnatural patterns of seasonal water level change.

20. Develop a plan for a comprehensive planning process for research and monitoring at Sipiwesk Lake and Duck Lake to develop a state of the environment report for that area.

21. Establish a working group on communications related to environmental science and Aboriginal Traditional Knowledge with Aboriginal educators, communications representatives, elders and youth to explore how information is interpreted depending on its presentation, and how it can be best shared.

3 Process and Structure of this Review

This report summarizes a review done on behalf of Pimicikamak of the documents prepared by Manitoba and Manitoba Hydro for Phase I and II of the Regional Cumulative Effects Assessment (RCEA) of hydroelectric development in northern Manitoba.[3]

Walking a shoreline on east Cross Lake during low water period due to LWR drawdown. RCEA meetings, Cross Lake, September 2017

Darrell Settee acted as Pimicikamak Community Coordinator for the project and provided logistical support as well as advise on local ecological and cultural issues and mitigation programs. Pimicikamak retained Annette Luttermann Ph.D. of A.L.Ecologic to review the Phase I and II documents; consult other relevant literature; facilitate discussion around specific concerns expressed by Pimicikamak; and prepare this report. Meetings and individual discussions were held with Pimicikamak Okimawin representatives in Cross Lake to establish an approach to this review, develop questions and concerns, and discuss the content of the RCEA documents after initial review.

Prior to reviewing the materials submitted for these first two phases of the RCEA process, the following broad questions and concerns were considered:

1. Is the RCEA comprehensive and does it address key issues of importance to Pimicikamak regarding cumulative effects?
2. Does the RCEA present the history and views of Pimicikamak citizens accurately?
3. Have appropriate indicators been chosen for a cumulative effects assessment of hydroelectric development in this region that are capable of examining incremental and possibly synergistic effects of multiple stressors such as the overlapping effects on Sipiwesk Lake from LWR and Kelsey Dam?
4. Does the RCEA approach use measures that adequately consider landscape level connectivity effects in large river systems?
5. Does the RCEA give adequate consideration to potential cumulative effects of future climate change in addition to river regulation?

[3] The documents reviewed are located at:
https://www.hydro.mb.ca/regulatory_affairs/regional_cumulative_effects_assessment.shtml

6. Pimicikamak has concerns that the Terms of Reference for the RCEA precluded any new field research that may be required to better understand key cumulative effects given several known data gaps. How are these data gaps addressed in the RCEA?
7. Pimicikamak has concerns that there may be insufficient study of habitat conditions for aquatic mammals, riparian and aquatic plant communities, and avian habitats in order to understand potential cumulative effects. These are all clearly degraded by hydroelectric development in various ways depending upon the hydrological regime in different parts of the river and lake systems.
8. Pimicikamak is interested in additional measures that could be implemented to further mitigate the cumulative effects of multiple hydroelectric developments.

In order to address the broad conclusions that have been made to date in the RCEA Phases I and II, the structure of the Pimicikamak review generally follows the topic outline and conclusions presented in the RCEA *Integrated Summary Report.* Specific reference is made to the more detailed material included in the RCEA Phase I and II report volumes according to section title and page numbers where necessary.

Vegetation struggles to survive in the riparian zone of a shoreline subject to erratic regulated water levels. East Cross Lake, September 2017.

We appreciate how difficult it is to structure a set of topics and reports for such a broad study, and the authors probably debated extensively various ways to go about this. The way the RCEA Phase I and II documents are structured is artificial in terms of the separation of land and water into different categories, while assigning moose to water and colonial water birds to land. This makes a certain amount of sense in terms of some of the ways that hydroelectric development affects these species. It may not matter very much for a literature review for ease of compilation of existing studies.

The separation of impact assessment on the basis of river reaches and terrestrial ecozones also makes some sense but makes it very challenging for the general reader to follow the Integrated Summary. From the introduction to the Integrated Summary it seems that this decision on structure was made on the basis of an assumption that many people are only interested in reading about certain regions of these river systems. For a regional cumulative effects assessment, it is important that we all try to get a sense of the region as a whole, and the way the whole area is influenced by the developments.

Unlike the Integrated Summary, our comments for this review are combined for each of the chosen indicators across the Ecozones. For example, the discussion of the approach to the study of cumulative

effects on aquatic mammals is in one section in this review, whereas the RCEA Phase II report and the integrated summary reports have several sections on beaver split up by the designated Ecozones. This is done in order to focus the review on the principles and overall approaches to each topic area.

Due to the volume of RCEA Phase I and II material and the complexity of the issues, a comprehensive review of each topic here would be excessively lengthy.

We do begin with some more in-depth discussion about principles related to scope and methods, as well as approaches to collaboration, since these issues are highly important to Pimicikamak.

Shoreline of the Nelson River at the community of Cross Lake September 2017. More research on the characteristics of existing shorelines under regulation is of interest to Pimicikamak.

The report then focuses on a selection of major issues related to specific topics. Comments on the each of the regional study components for this review are presented in summarised form. Issues related to the impacts on people are integrated with the physical and biological topics. These are illustrated with a limited number of examples.

Recommendations for next steps in the RCEA process are outlined briefly. Pimicikamak looks forward to further formal discussion to contribute to the development of the next steps.

4 Scope and General Methods

4.1 Terms of Reference - Limitations and Inconsistencies

The recommendation by the Manitoba Clean Environment Commission that a regional cumulative effects assessment be done for hydroelectric development on northern Manitoba river systems was very much welcomed by Pimicikamak.

Over the many decades of river development, it had appeared that there was insufficient acknowledgement or understanding of the extensive, overlapping and long-term changes to the northern ecosystems and peoples created by the multiple projects collectively. As new projects were proposed, they have been assessed individually. Efforts towards cumulative effects assessment for each project, gave limited consideration to the degree to which the river systems as a whole were already degraded. This is despite the fact that there were progressive and insightful approaches to environmental assessment begun with the Lake Winnipeg, Churchill and Nelson Rivers Study Board which worked on developing a baseline and predictions for effects of the northern hydroelectric system as a whole.

In their report on the BiPole III hearings, the Clean Environment Commission recommended that a RCEA be conducted for the following reason:

> "…*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*."

The recommendation was based on what the CEC learned during hearings for Bipole III and Wuskwatim from affected communities and other concerned citizens in Manitoba. Affected communities have argued for additional research and monitoring that is more comprehensive and takes into account cumulative effects precisely because they have observed that inadequate work has been done on understanding widespread adverse ecological effects.

Motions were made during the Keeyask hearings to delay that project until a RCEA was done. The CEC determined that this work could be done based on existing documentation and no new field work would be required. In the Phase II report, Manitoba and Manitoba Hydro states that the RCEA documents describe and assess the health of the ecosystem "to the extent possible". If this is what is possible with existing documentation, it is reasonable to conclude that despite the volume of work conducted in the past, the existing documentation is not adequate to the task.

If consultation had been done with affected Aboriginal people while developing the Terms of Reference specifically for this RCEA, they would have had the opportunity to explain at the outset some specific areas where they feel additional research is essential.

The Terms of Reference state that: *"Early in Phase II, Manitoba and Manitoba Hydro will also determine the exact nature and design of any appropriate public engagement processes."* (emphasis added)

Aside from the fact that no public engagement was determined until after the Phase II report was complete, Pimicikamak is disappointed that government and Manitoba Hydro took such a unilateral approach to making decisions about the nature and design of a process so important to affected Aboriginal people. Pimicikamak would like to emphasize that a new relationship requires more collaboration to develop effective processes of communication.

There is much work yet to be done to manage the changes that have occurred due to river regulation in northern Manitoba. The Terms of Reference for the RCEA state that:

Regional cumulative assessments are typically used as a government's tool to facilitate broad, long-term planning decisions regarding a range of development options for a prescribed area or basin. In the case of the Nelson River sub-watershed, such planning decisions were made over forty (40) years ago and any impacts that may have resulted are largely irreversible at this point in time and/or the environment has now adapted. (Integrated Summary Report p. 149)

This text leaves the impression that there is a "what's done is done" attitude. Pimicikamak argues that it is sensible to take the view that there are still many long-term planning decisions to be made with regards to mitigation programs for certain impacts, research and monitoring to inform these efforts, and assessments of new hydroelectric projects and other development proposals and compensation. Informing such processes is part of the purpose of a regional cumulative effects assessment. Also, if it is argued that the environment has "adapted", then we need a better sense of how it has adapted and then consider whether there are ways to improve adaptation.

The Work Steps outlined in the Terms of Reference state that the RCEA final report will:

• *identify, describe and acknowledge the cumulative impacts of past Hydro developments;*

• *describe the current state of the environment in areas affected by Manitoba Hydro's system; and,*

• *describe a process for continued monitoring of and reporting on the state of the environment into the future.* (Integrated Summary Report p. 149)

There are limitations on how much data can ever be collected, and the extent to which the state of the environment can be described, however the Phase I and II stages are not sufficient for the first two tasks outlined above, and do not address the third task beyond what is already being done.

The Terms of Reference state that beyond Phase II, CAMP will be continued and the monitoring and reporting committed to for BiPole III will continue. One would think that the identification of data gaps in the RCEA literature review would lead to careful consideration of potential additional research and monitoring needs. The exercise has so far not led to any commitment for further research and monitoring based on the Phase II report.

There is more comprehensive research and monitoring being done in portions of the lower Nelson River where new developments are being constructed such as Keeyask. This project is subject to more recent environmental assessment legislation and some Aboriginal parties have entered into partnership agreements. Pimicikamak would like to see that same commitment to environmental assessment in

reaches of the river system that is experiencing ongoing impacts and which are still subject to Northern Flood Agreement provisions. Even if data are lacking from the past which limits the ability to quantify some effects, the current state of the environments needs more attention.

The "desired end product" as described in the Terms of Reference is an "Environmental Assessment and State of Knowledge Report". It states that this report will be a resource for government and all Manitobans on the *state of the environment* not just the state of *knowledge*.

The Terms of Reference even assigned a title to the Phase II report intended to be called: *"Regional Cumulative Effects Assessment for Hydro Developments on the Churchill, Burntwood and Nelson River Systems: Final Report"*. Pimicikamak strongly believes that it was inappropriate to predetermine that a final report would be possible for the assessment before a literature review was done to identify data gaps, and a collaborative process to determine whether additional research was needed was conducted.

Pimicikamak sent some formal comments about concerns regarding the Terms of Reference to Manitoba earlier in this process. See Appendix B for that correspondence.

4.2 The Need for More Collaboration

In a review of cumulative effects assessment models and practice, researchers have identified numerous challenges where improvements are needed starting with basic definitions (Duinker *et al.* 2013). All areas of practice including the conceptual framework, establishment of geographical and temporal scope and scale, indicators, thresholds, approaches to information gathering, and integration of different forms of knowledge require collaborative development. Compromise is always necessary. However, compromise means cooperation and negotiation.

Some of the issues to discuss include:

- Clearly not all interested parties will have the same questions.
- What questions can we reasonably answer with the information that we have?
- What questions could be reasonably answered with the collection of additional information?
- What is required to collect that additional information?
- What decision making processes could be informed with this study?
- How can decision making be influenced by more or less information?
- What can we reasonably expect to accomplish with this study?

4.3 Balancing Values and Interests in Study Design

It is often necessary for an exercise in environmental effects assessment, to identify certain potential effects based on expert and professional judgement. Observations and knowledge reported by Pimicikamak and others that are often gained through extensive land use experience are often simply listed in the RCEA as the views of First Nations. With more scientific study, observations and ATK developed over the years can be either supported and verified, supplied with more detail, altered, and/or discounted with systematic evidence.

It may be that certain potential effects are deemed not important enough, or too complicated, or the technical challenges are too great to commit resources to further study at the present time. Whether or not data and information are adequate to inform our management decisions should be discussed with affected peoples.

Snowmobile stuck in slush ice possibly caused by rising water levels from upstream regulated water releases in winter. (photo: Darrell Settee)

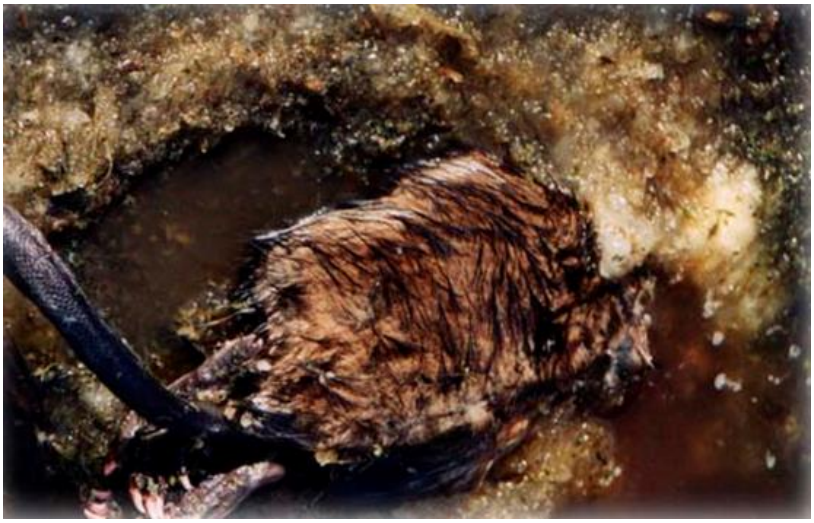
The issue of slush ice on waterways is an example of a physical condition that exists in nature, is quite variable, and is dependent upon weather conditions in any particular year. These can influence ice thickness and snow cover. A relatively warm early winter followed by heavy snowfall creates good conditions for the formation of slush ice. Climate change may increase the frequency of such weather patterns in northern Manitoba.

However, control structure operations can also significantly influence whether slush ice forms, its aerial extent, its depth, how long it lasts, etc. Changes in ice processes can in turn affect human land use, and can have ecological implications. Therefore, the combined effects of climate change and hydroelectric development on slush ice formation is an important topic for cumulative environmental effects study.

Determining the level of study required to adequately understand these effects is certainly difficult and is only one of many cumulative effects issues that hydroelectric development contributes to in this region. Studies should be planned in collaboration with Pimicikamak and others to document current and future conditions in on-system habitats compared with off-system, document more detailed ATK in relation to specific monitoring sites; develop opportunities for training in field methods, and employment opportunities to conduct the research and prepare reports.

Pimicikamak wishes to ensure that the final licences for all of components of the hydroelectric system are reviewed thoroughly and equally with sufficient understanding of the implications of the extent of landscape level effects, and the degree to which changes in operations in one part of the system may change options in another. A formal requirement for an adequate process for regional cumulative effects assessment should be incorporated into final licence conditions for both CRD and LWR.

The study must establish a set of feasible objectives through a collaborative approach among Aboriginal Peoples and scientists. The study must utilize the existing relevant information available, and determine what additional research can be conducted within a reasonable time frame in order to reduce uncertainties to a reasonable degree. Requirements for a comprehensive ongoing environmental monitoring program should be established.



Muskrat frozen into the ice. Cause of death not known. (Photo: Darrell Settee)

Pimicikamak citizens state that the existing infrastructure associated with CRD and LWR has been in place for a very long time and will be operated for a long time to come. Manitoba and Hydro's commitment to environmental research does not seem to reflect the temporal and geographic scope of many of the obvious effects. For example, wildlife populations may respond only over a period of many years to changes in habitat. Additional habitat degradation in the region may contribute to gradual population decline over a wider area. The effects on land use by local people are slowly manifest over time as well. For that reason, environmental research and monitoring programs should continue for a meaningful length of time.

During consultation discussions related to licencing of the Lake Winnipeg Regulation, many Pimicikamak citizens described their observations of environmental change and effects on land use. For example, Floyd Ross stated:

"I stopped trapping about ten years go. The water keeps going up and down – the slush comes. So many snowmobiles have broken down because of this. It costs too much for what you can get. There are hardly any muskrat on the river. There are some beavers – there used to be lots. Even on the trapline there is nothing. There used to be lots of geese, but over the past five years, there are not enough." (Floyd Ross, Cross Lake Sept 17, 2013)

There has been more monitoring work done on fish and water quality than on wildlife such as muskrat and waterfowl. The results of the community monitoring to date have not been incorporated into a comprehensive or ongoing assessment of habitat change and further mitigation options, although work is progressing in this regard.

The Clean Environment Commission's report on its review of the Bipole III Transmission Line suggested that additional mitigation and/or changes to the infrastructure and operations of the existing hydroelectric system in northern Manitoba may be found to be warranted following a regional cumulative effects assessment. It stated:

… in order to fully understand the impact of proposed future projects, it will be necessary to understand the impact of past and current projects in addition to new impacts. A regional cumulative effects assessment is needed for all Manitoba Hydro projects and associated infrastructure in the Nelson River sub-watershed. The result of such an assessment would be a greater understanding of the impacts of the individual projects, as well as the cumulative impacts of all projects together. Understanding these impacts may lead to the use of current mitigation measures being applied to past impacts, resulting in some remediation. Greater understanding may also lead to alterations in the structure or operation of existing projects, and may offset impacts from new projects. (CEC 2013 sect 13.4 p. 126)

Currently, Manitoba's environmental assessment processes for new projects does not require any regional cumulative effects assessment work prior to licence approval. This deficiency has been recognized for some time by the CEC.

The CRD and LWR were not originally subject to the same level of environmental assessment as new projects currently undergo. However, there was some early pre-project assessment done through the Lake Winnipeg, Churchill and Nelson Rivers Study Board in the 1970's, as well as post-project work done for example, through the Cross Lake Environmental Assessment Study in the 1980's. Baseline data were collected, impact predictions were made, mitigation and monitoring recommendations were made, and changes in licence conditions were suggested. Some of these recommendations were followed up and others were not. It is not always clear in past documentation why certain recommendations were not pursued.

Although past research for environmental assessment was not as comprehensive as it could have been, there is nevertheless a good deal of useful documentation that can be followed up on and used in a Regional Cumulative Effects Assessment. The Nelson River Study Board Report, for example, includes mapping for moose habitat, waterfowl use, and wetland quality in areas affected by CRD and LWR. The Cross Lake Environmental Assessment makes predictions about the expected results of the construction of the outlet control scheme on population recovery of fish and aquatic mammals in Cross Lake. No aquatic mammal research has been done to follow up on this prediction.

There is a base of reliable information that can be used to form a series of reasonable questions and develop a process for a future coordinated research plan for regional cumulative effects assessment. To contribute to the development of a pre-hydroelectric development historical baseline, a regional cumulative effects assessment should assess all available data sources for useful information and clearly qualify any conclusions. This includes qualitative description and historical imagery, oral history, review and follow-up on previous analyses such as the NRSB Report, general ecological knowledge from other regions. The Phase I and II reports make a good start on this and provide some direction on next steps by identifying data gaps.

This is something that Pimicikamak citizens feel is an essential effort that should be made for an energy production system with such wide-ranging and long-term effects on the natural environment, that claims to be "green".

Pimicikamak have discussed the need for more wildlife research over years in the context of environmental assessment and licencing consultations.

Waterfowl foraging in Nelson River September 2013. Pimicikamak observations suggest that waterfowl use of the regulated rivers has decreased. This was predicted by previous studies, but there are few resources invested in waterfowl monitoring.

Studies should be done here and all the places where the wetlands have been affected already. There are not many ducks in our marshlands compared to before. There are few water creatures compared to before, like water striders, crayfish and even caddis flies. The animals move around and there are large areas on the Nelson, Churchill and Burntwood Rivers where the marshlands are not like they were. (Danny Halcrow, Cross Lake, Sept 14, 2013)

It is understood that research and monitoring is expensive. Pimicikamak believe that in order to strike a better balance of interests with treaty rights holders, research priorities for cumulative effects assessment must be explored further and options reasonably considered in partnership with Aboriginal people.

4.4 Scope and Conceptual Framework

Challenges of RCEA Related to Past Environmental Assessment Expectations

The decision to limit the scope of the RCEA to existing data seemed to be based on a general sense that a lot of research and analysis has been done over the years, so it must be enough. Or if it isn't enough, the level of effort is already more than strictly required under legislation.

The introductory section of the RCEA Phase II (p. 1.3-1) states that environmental assessment done in the earlier years of hydroelectric development in northern Manitoba was not as rigorous due to fewer expectations from society and through the regulatory environment. However, it reads a bit like a list of excuses for why environmental assessment was not done to sufficiently high standards at the outset of the hydroelectric development on the Nelson and Churchill Rivers. This does not completely justify the fact that more than forty years later we have inadequate data to describe the current state of the environment and understand some of the basic relationships with hydroelectric development.

Methods of environmental study have evolved a great deal since the 1960's, and there was relatively little policy or legislation in place mandating formal environmental assessment. People may not have had the same expectations for formal study as we have today, however there were major concerns. These concerns were the reason for the development of policy and regulation over the years.

In the case of LWR and CRD there was considerable pre-project environmental assessment study for the time. The Lake Winnipeg, Churchill and Nelson Rivers Study Board was initiated in 1971 and reported in 1975 with numerous recommendations for additional follow-up research and monitoring. The Northern Flood Agreement was pursued and negotiated because of the high level of concern among affected Aboriginal people about the wide-ranging effects of this system of hydroelectric projects. Follow-up research and monitoring over the years has unfortunately been inadequate.

There are reasons that insufficient study was done to allow us to measure the effects of hydroelectric development and other changes that have occurred over the past fifty years. The question we should all be asking now in earnest is, "What can we do about this at present to better prepare for the future?".

Geographical Scope and Assessment Framework

The challenges involved in conducting a meaningful and accurate RCEA process have as much to do with the extensive geographical scope of the projects and their effects; the range of effects; the complexity of the ecological relationships; and the reality of the level of resources required to study these changes in the environment.

It is important to Pimicikamak that the people of Manitoba more clearly understand the regional cumulative effects of multiple hydroelectric development in major rivers systems. The sense of scale and ecological complexity must be communicated. The prevailing messages to the public in general in Manitoba tend to be simply that hydroelectric power is clean and green. The level of public environmental literacy surrounding issues such as the extent to which natural seasonal water flows affect the habitats and species that have evolved in river systems is generally very low.

The changes in the environment have implications on many different scales. For the RCEA conclusions the main indicators used were population trends of species such as beaver, or groups of species such as waterfowl, and habitat abundance within an Ecozone[4] in the region as a whole. This is useful to do. However, most boreal species are not endemic but are wide-ranging and relatively resilient. A decline in local abundance of moose for example, may not be considered significant within a large area, as there are other moose and other habitats elsewhere. However, it may be very significant to the people in that area. A decline in abundance of several different species in one area could be considered to be a cumulative effect for the people who live in that area. A focus on population trends and habitat quality throughout the main river systems themselves as geographical units is also an important and meaningful framework scale for analysis.

[4] The RCEA glossary explains that an Ecozone is the most general level in the National Ecological Framework for Canada, an ecological land classification. There are 15 terrestrial and five marine ecozones in Canada.

Assessing the cumulative effects on the ecosystem processes or functional attributes of the river systems can also form part of a comprehensive approach. For example, the degree to which the hydrological regime differs from a natural seasonal pattern is a meaningful metric. This is recognised in the RCEA approach for each regional study component, however it might be useful to do more exploration of how to interpret and communicate the changes in this functional attribute throughout the river systems as a whole.

When designing a RCEA it is important to be clear on the objectives. The CEC recommendation to conduct this assessment was based the rationale partially on the extent to which Aboriginal people have been affected long-term. It would be meaningful to people to establish regions of interest that relate to land use and traditional territory. Pimicikamak traditional territory is the more meaningful frame of reference for Pimicikamak rather than Registered Traplines which are an imposed system of jurisdiction.

The task of environmental assessment involves developing a meaningful, reasonable and feasible conceptual framework for the study, interpreting results and communicating these to the target audience. In this case, the target audience is very broad. The task of summarizing a very complex study, and one that is lacking in data on many levels is extremely difficult.

Perhaps there are ways in future to describe and these ecosystems in a more interconnected way. Site-specific interdisciplinary studies of chosen areas of particular cultural significance that are developed through collaboration among Aboriginal holders of traditional knowledge, resource harvesters and scientists might be a possible contribution to a more holistic understanding of some areas.

Recommendation: Conceptual Framework

Site-specific interdisciplinary studies of areas of particular cultural significance could contribute to a more holistic understanding of the state of the environment in these areas.

These studies could be developed through collaboration among Aboriginal holders of traditional knowledge, resource harvesters and scientists.

An approach like this may be useful to support mutual learning and a more integrated ecosystem focus for study and communications.

Example of a Regional Cumulative Effects Assessment

Although not focused on a river system, and not offered here as a template for a necessarily perfect approach, The Great Sand Hills, Saskatchewan is one example that offers an idea of some of the elements that should be involved in a regional cumulative effects assessment.

The Great Sand Hills regional environmental study (RES) was commissioned in 2004 to provide a strategic assessment of human activities that cumulatively affect the long term ecological integrity and sustainability of the region and to provide recommendations, in the form of a management plan, to guide future land use activities. The RES was completed in May 2007 (Noble 2008). Although that RES did not occur under any formal regulatory requirement for RSEA, as no such requirement exists in the province of Saskatchewan, the assessment was based explicitly on the principles and framework of RSEA — making it the first of its kind in the province and a step forward in regional CEA in Canada. The assessment was guided by the 1996 Bellagio Principles of sustainability and also by a number of additional underlying objectives important to good practice regional CEA, including:

a. integration of socioeconomic and cultural values as part of the assessment process;
b. use of multiple assessment scales, including coarse or landscape scale as the basis for ecological assessment;
c. consideration of the cumulative ecological impacts of human activities to date as the basis for considering the type and extent of future activities;
d. minimizing human footprint in the short term, while focusing also on emerging techniques for longer-term solutions;
e. protection of sensitive areas from development, including areas of cultural significance, and restoration of already disturbed areas to their original plant communities; and
f. facilitating short- and long-term monitoring of human impacts and restoration areas based on clear objectives, targets, and early warning indicators of undesirable change.

Temporally, the RES considered the cumulative effects of human activities and natural change from the 1950's, the beginnings of gas development in the region, and projected forward to 2020, at which time gas reserves would be fully tapped.

The assessment framework consisted of three main phases:

I. a baseline that characterized the current and cumulative biophysical, economic, and social conditions of the region;
II. the identification of historic trends in land use and associated cumulative change; and
III. development, projection, and assessment of alternative land use scenarios together with recommendation of a preferred scenario and guidelines for implementation, mitigation, and monitoring.

It is not suggested that the framework used for that assessment can or should be used exactly for investigating cumulative effects on Manitoba's northern rivers. There were several steps in that assessment that take the questions further than the work completed so far for the Manitoba Hydro RCEA. These are useful to examine in more detail for the next steps in this RCEA.

State of the River Environment Reporting

Approaches to “State of the Environment” reporting in other regions are also useful to consult for the next steps of this RCEA. An effort was made through the Canadian River Institute to compile existing scientific data, aboriginal traditional knowledge, values and hopes for the future, professional judgement and other information to describe the state of the Saint John River in New Brunswick (Kidd et al. 2011). As that report observes, an effective CEA requires a good understanding of an ecosystem’s environmental state. It acknowledges CEA as an evolving task and one that must include investigation of all stressors and agents of change.

This project was not carried out by a proponent for a particular industry and comes across as fairly objective. The report presents a clear synthesis of known information gaps, and recommendations for future research needs. Cumulative effects assessment

The RCEA Phase I and II efforts appear somewhat bound up by the lack of specific regulatory direction, and the desire by the industry and provincial government to not commit to more work and expense than strictly required. The RCEA Phase II summary has not attempted to suggest what the range of additional research and monitoring needs might be important for increasing our understanding of the state of the river environments.

5 Physical, Biological and Cultural Effects of Hydroelectric Development

5.1 Summary

In the section describing the summary of effects on water and shorelines, the RCEA Integrated Summary broadly acknowledges a range of major environmental effects that have been observed with hydroelectric development. Then a number of vague conclusions are drawn about negative and positive changes without very much clarity on the relative level of certainty associated with each of these.

For example, the section states that changes to the water regime can "*create wetlands and habitat for fish and wildlife, sometimes offsetting a portion of the effect of flooding*." (RCEA Integrated Summary p.42) It should be clarified that there is very little information about the quality of "created" habitats for a number of species, and whether aquatic and wetland habitats in regulated reaches can be considered to actually reduce the overall impact of flooding. There is a high level of uncertainty associated with this statement other than the fact that flooded terrestrial areas are converted to aquatic or wetland habitats. The areas that are flooded, included in reservoirs, and then managed with an unnatural water regime, alter all of the habitat flooded including the original aquatic and wetland habitats.

The summary states that changes in water quality and the water regime can "…*cause a shift in the communities of fish that live in the area from species that prefer a fast water habitat (e.g. Brook Trout, Longnose Sucker) to those preferring more lake-like habitat (e.g. White Sucker, Walleye)."* The text does not mention here that Lake Whitefish, which is considered to be a relatively adaptable species, has significantly declined in many parts of the regulated system. It does not seem to be doing well in some of the "lake-like" habitats and no one really knows why.

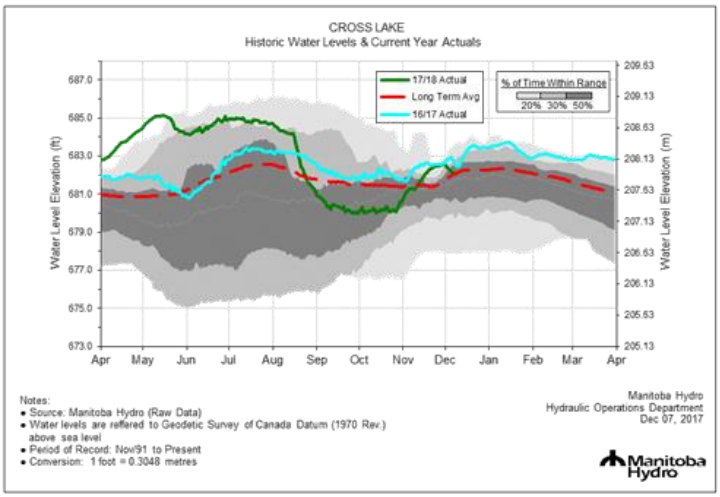
The summary goes on to list a few mitigation measures such as creation of new wetland areas and "*new fish spawning areas to replace those lost*." (Integrated Summary p. 43) This gives the impression that lost areas [all lost areas?] have actually been replaced. It fails to explain that many of these mitigation measures are experimental, that they are extremely small in scope compared to the area of habitat that has been affected, and that there is currently insufficient information to understand how effective they have been, even in small areas.

While a summary of such a complex report is difficult to write, the focus should be on making it as objective as possible and avoid summary statements that could be misleading. The main body of the set of RCEA Phase I and II reports presents the biophysical material in a relatively objective manner, explains data limitations and qualifies conclusions in a satisfactory way.

5.2 Water Regime and Operations

The Integrated Summary Report states that the "…*system is operated to meet the power requirements of the province in an economic manner while considering environmental and community concerns*." (p. 28). Operations decisions must be made to ensure reliable supply of energy within the province first. However, the power requirements of the province are clearly not the only motivation for building a system of this size. Export sales are a major part of the business of these projects which generate revenue for the province. To what extent are environmental and community concerns actually built into the design and operating parameters of this system as a whole?

Environmental and community concerns were incorporated into operating parameters to an extent that varies from facility to facility. This is partly based on the regulatory and environmental assessment requirements in place when each generating station or suite of control structures was designed and constructed. There have been some adjustments in operations over the years in response to observations of effects and what has been determined to be practical for operators. For example, according to Manitoba Hydro, the "November cutback" at Jenpeg to stabilize upstream ice conditions has been moderated as operators gain experience. This is described in the RCEA report and is evident in the hydrological data.



Cross Lake Water Levels for 2017 Actual, Long Term Average Under Regulation and Ranges. (Manitoba Hydro)

There are many environmental and community concerns that are certainly not directly considered in operating decisions. One of the reasons for this of course is related to the inherent characteristics of river regulation that changes natural flows, and the inevitable consequences of this as long as operations continue. The licence constraints that are in place especially for older projects are based on maximizing the power generation potential according to engineering design. These were not designed with ecological protection as a main objective.

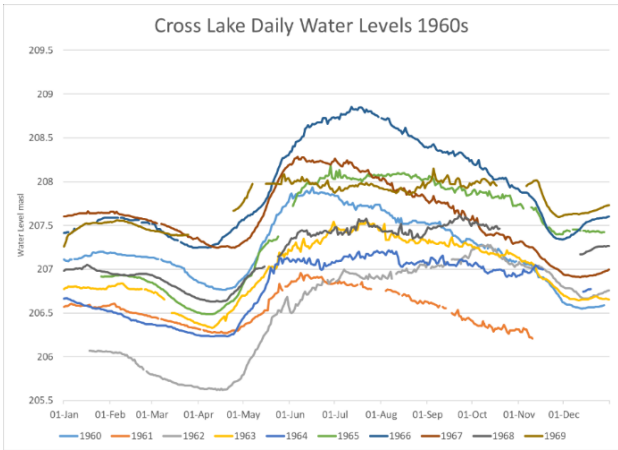
For LWR there are flood and drought control objectives in Lake Winnipeg that are the primary constraints in its use as a storage reservoir for downstream power generation. The effects of this system on the reaches downstream of Lake Winnipeg did not influence decisions about the operating parameters very much. Upstream and downstream interests have not always been balanced in a very fair manner.

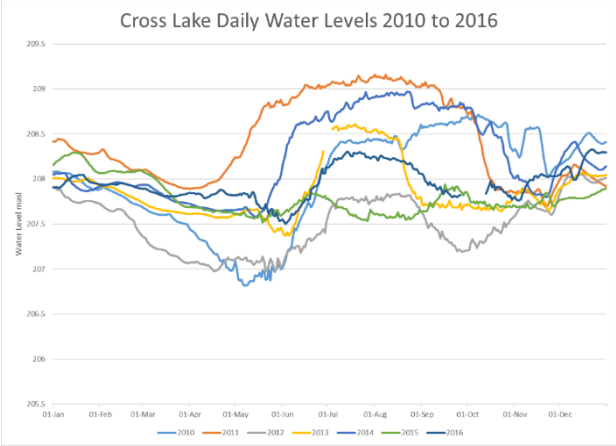
The description of operations in the RCEA Phase II goes on to correctly state that the criteria for daily operation is to optimize the generation of power. It is intended that this must be done within the

constraints of the licences. For LWR, the licence constraints were broadly developed to balance power production with an attempt to reduce flooding and ease drought conditions on Lake Winnipeg, depending on inflows into the system. Other operational constraints are in place for LWR to limit the rate of flow changes so that downstream flows do not fluctuate too suddenly over the course of a day. This is partly for safety reasons downstream and it is an important consideration. However, these constraints were put into place with only a general understanding of some of the likely downstream ecological effects.

Within the constraints of the licence for LWR and in consideration of water flow needed for winter power generation at facilities, there is some consideration for management of Lake Winnipeg water levels to balance downstream flooding such as allowing more water to flow downstream earlier in the year in anticipation if a wet spring is predicted.

There is some consideration of community and environmental concerns, however the relationships between operating regimes through the seasons from one year to the next and the ecological and socioeconomic effects up and downstream could be investigated in more detail. This would help to inform potential mitigation programs and future licencing decisions for existing and proposed facilities. It appears that there are some discussions happening around developing hydrometric indicators to be used in conjunction with interpretations of ecosystem health indicators. within the context of the Coordinated Aquatic Monitoring Program (Thrift 2015:12).





From the perspective of ecological processes and human use of the waterways, the daily flows and water levels from season to season and year to year are the most relevant data. The data presented in the RCEA focus more on averages over time. This is valid for reaches such as reservoirs that are kept at relatively consistent patterns through the year and from one year to the next.

One of the most important characteristics of the current water regimes in the reaches downstream of LWR is variability in seasonal patterns from one year to the next depending on how the upstream flows are regulated and the flow conditions in the larger watershed.

Graphs depicting daily water levels in Cross Lake in the 1960's as compared to more recent years from 2010 to 2016 demonstrate some of this variability in seasonal patterns related to regulation.

Recommendation:

Water Regime and Operations – Further Research

In collaboration with affected Aboriginal people, explore the questions and potential studies that could help to better inform the regional cumulative effects study about how specific operating regimes in various parts of the system affect habitat and human land use. Consider future scenarios under potential climate change.

Riverine wetland habitats are naturally not stable environments, but rather go through cycles depending upon the amount of water in the systems year to year. Periods of drought, followed by wetter years influence vegetation growth, decomposition, water quality and in turn influence the survival and abundance of higher taxa including birds and aquatic mammals. However, the seasonal patterns under natural conditions are more consistent within years whether it is on average wetter or drier that year.

It would be useful to begin to think about how to do more comprehensive analysis of the environmental and land use effects under current LWR operating conditions in recent years and under various watershed conditions year to year. These are not well understood, as study of the relationships between operations at that station and downstream habitat conditions is quite limited for many environmental components.

Compensation Programs

The RCEA documents explain the various mitigation and compensation programs that have been put into place over the years for local people directly affected by the hydroelectric development.

Pimicikamak have stated that receiving compensation for impacts has been a constant source of frustration over the years, especially for resource harvesters. One Pimicikamak citizen who helps other people to work through the claims process on a volunteer basis has described several stories of individuals applying for compensation and feeling like they were not being taken seriously

The problem of periodic slush ice due to changing water levels in winter downstream of Jenpeg is one source of equipment damage and travel difficulties that is made worse by hydroelectric regulation. For example, when making claim one person said he was told, “you are full of crap”. Another said he was told that it was not the upstream dam that was causing the increase in winter water flow, but it was “beavers letting the water out”. He didn’t think the person was joking, and if they were, it wasn’t a joking matter. These may be isolated incidents, and may seem insignificant to some people, but they contribute to a sense of powerlessness and devaluation of traditional activities that many Pimicikamak feel in relation to industrial control of the waterways. This demoralization is a significant contribution to cumulative social effects over time.

More recently there is a new arbitrator in place for the NFA. There have also been recent improvements in that way that compensation funding is being administered. According to Pimicikamak things are reportedly working a lot better than before. When there are major disputes, people have easier access to legal representation. It is important that work continue towards reducing the adversarial and uncertain nature of compensation programs.

Recommendation:

Water Regime and Operations – Education and Communication

Plan a review of the overall operating regime for the northern hydroelectric system in conjunction with affected Aboriginal people to discuss the existing system as a whole, objectives and constraints, and the feasibility of any future changes.

5.3 Erosion and Sedimentation

The RCEA documents note that erosion and sedimentation have increased in many areas of the affected river systems. These effects have been causing a high level of concern for Pimicikamak for many years as there are many negative consequences of increased erosion. These include effects on water quality, fish and wildlife habitat, accessibility of shorelines launching of boats, travel by foot along riparian areas, loss and degradation of cultural landscape including landmark islands eroding, and destruction of the beauty of the landscape; and disturbingly, the exposure of human remains where they were buried in formerly stable locations. Most of these effects are widespread and ongoing. Each new hydroelectric project in the system increases the cumulative effects.

Rivers naturally contain woody debris from dead trees falling into the water and eroding from active banks in swift river reaches. The increase in debris created by regulating the northern these large rivers, especially in flooded areas has been enormous. A great deal of effort has gone into gathering and burning large woody debris from affected waterways to increase navigational safety and access to shorelines. This has improved conditions in many areas, however it is an ongoing problem and a mammoth task to manually remove debris created by initial flooding and continual shoreline erosion.

An eroding shoreline at Sipiwesk Lake. Continual erosion of the soft sediments contributes to the turbidity of the water. Seasonal high turbidity would probably have occurred in this area prior to flooding.

If there was a way to design a more detailed assessment of the level of the woody debris problem throughout the affected river systems, and the degree to which mitigation efforts have been effective to date, this would be useful for a regional cumulative effects assessment.

In some areas the problem of woody debris is much more difficult to mitigate than in others. Sipiwesk Lake 2014.

Specific sites that have been subject to increased erosion in recent years are mentioned in the RCEA such as the outlet of Duck Lake upstream of Sipiwesk Lake. In this area, strong currents coupled with during an exceptionally high water periods starting in 2011 eroded a large channel through a point of land made up of soft sediments where there had previously been a productive marsh and a very good harvesting area for moose and waterfowl according to Pimicikamak who are very familiar with the site over. This erosion has seriously altered a culturally significant site for Pimicikamak that has affected navigation and harvesting in this area.

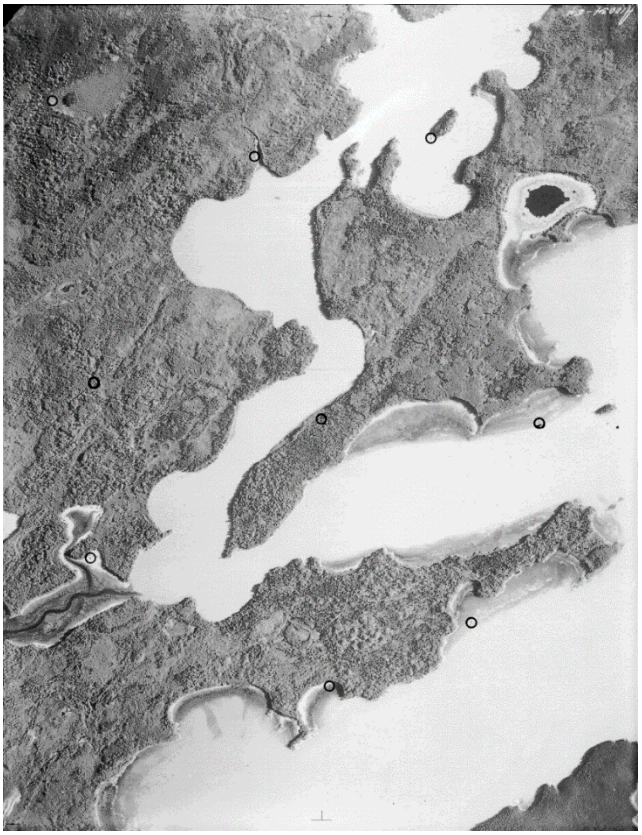
The high water levels in the summers of 2011 and 2014 were related to high precipitation and run-off in the watershed as a whole, but also to the ability of water to be drained from Lake Winnipeg much more quickly than under pre-hydro conditions due to the Lake Winnipeg Regulation infrastructure. Under current licence operating conditions that requires Manitoba Hydro to allow maximum flow when Lake Winnipeg is elevated, future wet years, as are predicted under climate change scenarios will likely continue to cause

Eroded channel with banks several meters high at Duck rapids. 2015.

increased rates of erosion downstream. It is difficult or perhaps impossible to predict the magnitude of this effect in future.

The new channel at the outlet of Duck Lake was eroded through the point of land at the marsh on the top right hand corner of this air photo taken in 1946.

A Google Earth image with poor resolution) depicts this area in 2016. We can see that erosion is proceeding in other areas.



Duck Rapids, Outlet of Duck Lake 1946 A10034-54

Outlet of Duck Lake on the Nelson River (Google Earth 2016)

Although these regions of the Nelson River have erodible soils and would have experienced natural rates of erosion, wetland and riparian vegetation communities were able to develop and provide diverse habitats. As the RCEA acknowledges, the rates of erosion have increased significantly. The quality of habitats that result over time is important to understand better in order to assess cumulative effects.

Armouring of shorelines to protect road bed and shoreline from high water. How much shoreline habitat has been degraded throughout the region due to threats of erosion?

There have been engineering solutions implemented in many areas to reduce erosion rates such as using large dimension rock to armour shorelines. This can help to protect adjacent terrestrial sites that are important for cultural reasons, or to avoid damage to roads and homes etc. The nature of this mitigation measure is such that it usually does not pay too much attention to riparian habitat quality.

The extent to which shorelines are ecologically degraded in this way is small in relation to the total length of shorelines degraded simply by unnatural water levels. However, it would be useful to consider this type of impact in the cumulative effects assessment.

Recommendation: Erosion

Choose a sample of sites subject to high levels of erosion to conduct an assessment of the site condition and ecological and cultural factors affected by this process. Conduct habitat assessments of a sample of shorelines that have been artificially protected from erosion and consider whether other mitigation measures are feasible to increase habitat quality and aesthetic characteristics.

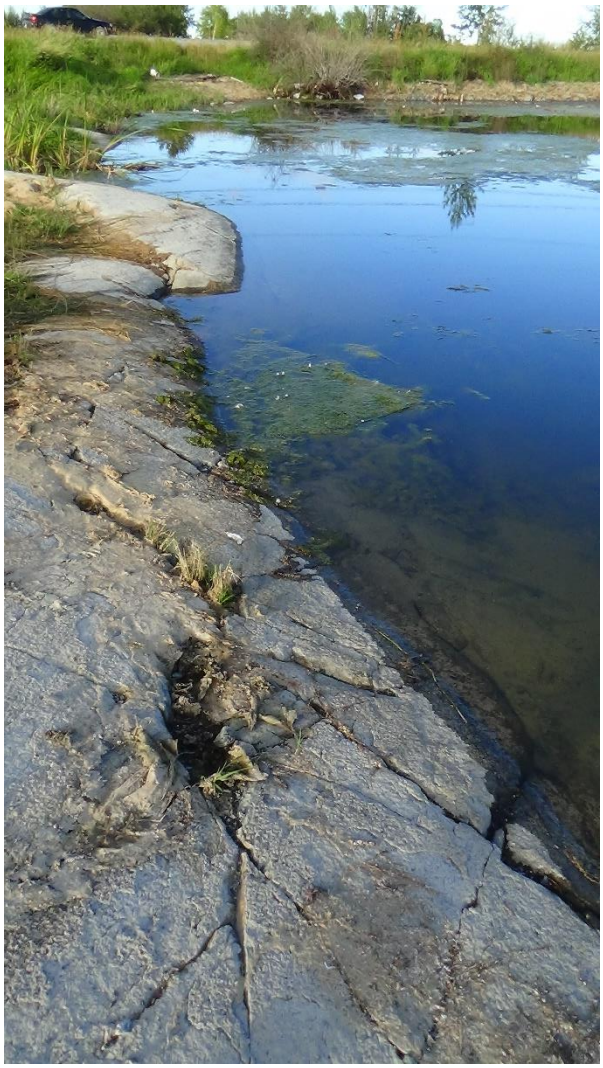
Recommendation: Erosion and Debris Management

Discuss ways to design a more detailed cumulative assessment of the level of the woody debris problem throughout the affected river systems, and the degree to which mitigation efforts have been effective to date.

5.4 Water Quality and Potable Water

Water quality for drinking and in the environment is consistently one of the most common concerns expressed by Pimicikamak citizens and other Aboriginal people in northern Manitoba as noted by the RCEA Phase II report. Water is the basis of all life. Human and ecosystem health as well as aesthetics are related to water quality in the rivers and lakes.

The RCEA documents describe a range of possible effects on water quality related to hydroelectric development, and the conclusions to date. Hydroelectric development has increased the potential rate of outflow from Lake Winnipeg, changed seasonal patterns throughout the Nelson River, increased erosion in some parts of all on-system rivers and likely decreased the effectiveness of riverine wetlands and riparian habitats that help to filter water. These systems can be important in that they contribute to nutrient uptake and retention, and anchoring of sediments. The inputs of excessive nutrients, especially phosphorus from the watershed due to agricultural and urban runoff from the surrounding watersheds to the south is a well known problem in Lake Winnipeg and likely contributes to higher nutrients downstream in the Nelson River.



Algae mats in a sheltered bay at Cross Lake. Sept 2013

A standardized water quality monitoring program has been established in recent years through the Coordinated Aquatic Monitoring Program (CAMP) to develop a long-term data set to describe characteristics and trends in water quality throughout the regulated rivers in Manitoba. This is an important initiative, especially since cumulative effects on water quality can be influenced by so many factors in addition to hydroelectric development.

Cumulative Effects on Water Quality are Complex

Surface water quality in the regulated system can be affected by inadequate local sewage treatment, as well as contamination from upstream in the watershed. Increased erosion in the system that increases organic matter in the water, in addition to elevated phosphorus inputs from upstream sources can degrade water quality.

Suspended sediment during high water periods such as the spring freshet is common in large rivers with clay and silt substrates. However, Pimicikamak have observed that water clarity in general is very low in many areas of on-system water bodies, and that there is an increase in algae on rocks and in the water close to shore. The level of water quality monitoring being conducted under the CAMP sampling protocol may not be sufficient to document trends in water quality in more isolated bays and shore areas that may be responding to increased phosphorus levels from upstream sources, erosion that contributes to turbidity and levels of dissolved organics, local sewage treatment inputs, and degraded riparian wetland vegetation communities, coupled with lower flushing rates.

Excessive decomposing organic matter contributing to poor water quality near shore. Cross Lake tributary during low water period Sept 2017.

Recommendation: Water Quality

Consider expanding the capacity either through CAMP or a separate project to plan some more intensive site specific water quality investigations over more limited time periods that would use consistent data collection protocols with CAMP.

Pimicikamak supports the CAMP efforts and would like to see these be well resourced. A capacity to consider more intensive site specific investigations over more limited time periods that would use consistent data protocols with CAMP would be worthwhile. Increased communications of monitoring design and results to a broader audience is important.

Potable Water

The People, Regional Profile chapter describes the concern about potable water expressed by all affected peoples in the region. The level of responsibility of Manitoba Hydro to support funding the provision of potable has been under dispute for many years. The RCEA explains that concerns about the

quality of surface drinking water existed prior to hydroelectric development in this region, and that potable water for reserves is a federal responsibility. (People Regional Profile, p.3.3-135)

The Integrated Summary Report states that Manitoba Hydro has met its obligations to Canada as outlined in the Northern Flood Agreement article 6,

"Canada shall be reimbursed by Manitoba Hydro to the extent of 50% of its reasonable expenditures incurred in providing potable water to any Reserve to the extent that such expenditures are attributable to adverse effects of the Project or to the risk of such adverse effects". (p.133)

While it is the case that ensuring an adequate supply of potable water is under federal jurisdiction, we still need to consider the factors that can contribute to degradation of the quality of surface water over time. The more surface water needs to be treated, the more expensive it is to operate water treatment systems. Systems put into place under agreements with the federal government can become ineffective if for example local populations grow, and source water becomes more degraded requiring higher levels of treatment. This can take many years to solve as negotiations for more resources are then necessary, making the problem of potable water in northern communities an ongoing concern.

It is important for a RCEA to explore the state of source water quality and relationships with potable water treatment facilities on reserves. Water treatment facilities must have the capacity to adequately treat source water and deliver it to the population. A growing population increases the demands on facilities. The quality of the source water is also an added stress on the effectiveness of systems.

Recommendation: Water Quality

Communications on the subject of water quality in surface waters and in community water services should be reviewed. Increased community-based communications strategies to share what is being learned through CAMP and explore questions and concerns about water quality and cumulative effects over time should be considered.

5.5 Fish Community and Fisheries

The RCEA analysis of the status of fish communities within the hydraulic zone of influence summarizes available catch and monitoring data and suggests some of the habitat changes that may be related to changes in abundance of the dominant species. One of the general conclusions of the summary report is that it is not possible with the existing information to differentiate hydroelectric effects on fish stocks from the effects of commercial or domestic harvest. This may be the case in terms of a strictly quantitative analysis. However, as discussed earlier, the purpose of a cumulative effects assessment is to attempt to understand the current state of the environment and the various influences that may be causing degradation collectively. The purpose of the RCEA shouldn't be only to attempt to differentiate the relative contribution to environmental degradation and decide how much hydroelectric development is responsible for.

As with other indicators and ecosystem values, the hope for a cumulative effects assessment of hydroelectric development is to build a stronger picture of the state of fish communities throughout the affected major river systems as a whole, monitor these communities, investigate the factors that may influence the sustainability, and consider ways to ensure recovery and sustainability to the best of our ability. Research conducted to date supported by Manitoba and Manitoba Hydro has increased our knowledge extensively. However, overall the cumulative loss and/or degradation of fish habitat in the regulated river systems of northern Manitoba is still not well understood.

A recent commentary on the flaws in the federal *Fisheries Act* laments that the focus on fish habitat protection has been lost in the changes to the Act made by the last federal government.[5] This weakening of the legislative protection for fish habitat will make it even easier to justify additional destruction of fish habitat as is being done currently with the construction of the Keeyask Generation project.

Much of the mitigation planned for the additional destruction of sturgeon spawning habitat for example at the Keeyask Generation Project is experimental in nature. The RCEA clearly explains that even though fish communities have received more research and monitoring attention than many other environmental components, there is a significant a lack of pre- and post hydroelectric development data on fish habitat characteristics and fish population dynamics in these northern river systems. Current populations of Lake Sturgeon for example are so small that observations based on field sampling are limited, as is the statistical power of analyses based on collected data. There has also been little previous habitat enhancement work attempted for sturgeon or other fish species in these rivers. Therefore, the results of these mitigation efforts cannot be predicted very accurately.

[5] https://www.thestar.com/opinion/commentary/2017/10/19/its-time-to-deliver-a-new-fisheries-act-scientist-say.html

Lake Whitefish Decline

The RCEA documents the current status of Lake Whitefish within the hydraulic zone of influence to the extent that data exist. It is clear that there have been significant declines in populations in many parts of the affected systems to the point in some that there are insufficient Lake Whitefish caught during monitoring to conduct population assessments. Apparently this is the case in Cross Lake.

Fisheries managers have expressed the conclusion that there has been a shift in fish community structure and this seems to be accepted as a result of river regulation. Pimicikamak citizens express deep concern about the state of Lake Whitefish populations and would like to see more work done on determining the specific reasons for the decline and whether there is anything that can be done to increase populations.

Lake Whitefish have been declining in many other regions as well including the Great Lakes, Maine and Michigan. Work is being undertaken to attempt to understand the relationship between these declines and such factors as habitat alterations, including those that lead to changes in food sources, harvest levels, and introduction of non-native species. The introduction of rainbow smelt is considered to have a strong potential negative influence on Lake Whitefish in other regions (Wood 2016, Kinnunen 2017[6]). Rainbow smelt are now present in the Nelson River system.

Habitat alterations can lead to complex ecosystem shifts that are very challenging to understand. However, it is recognized that research into habitat conditions and how these influence the population dynamics of fish communities experiencing impacts from invasive species is an important priority (Wood 2016).

Recent efforts to map bathymetry and the characteristics of lake and river bottoms is an important step towards more robust habitat description. This can be coupled with more work on spawning and rearing habitats including the specific and variable flow regimes in different parts of the affected river systems, food abundance, and habitat complexity.

Recommendation:

Fish Community Workshop

In collaboration with Pimicikamak, conduct a workshop to share the current state of knowledge on fish communities in northern Manitoba regulated rivers, and mitigation ideas based on ATK, regional fisheries science and what has been learned in other regions. Explore the potential and limitations for work to investigate the decline of Lake Whitefish.

6 http://msue.anr.msu.edu/news/declining_growth_condition_lake_whitefish_creates_concern_msg17_kinnunen17

Non-native Common Carp and other invasive species are being increasingly observed by Pimicikamak. Carp do better in low oxygen environments in bays than most native species and contribute to vegetation degradation and increased turbidity. Cross Lake 2015

Mitigation Initiatives for Downstream Passage at Existing Hydroelectric Facilities

Pimicikamak citizens are concerned about the effects of the multiple hydroelectric barriers on rivers on the rates of mortality of fish populations. It is not well understood how often fish including Lake Sturgeon are injured or suffer mortality while passing downstream through various hydroelectric facilities. The design of hydroelectric facilities including the structures of intake passages, turbines and spillways varies, and research to date has included small sample sizes. For a cumulative effects assessment, it would be useful to know to what extent these facilities contribute to mortality of fish. Some research has been done on the Nelson River to support environmental assessment of new hydroelectric projects that is beginning to aid in our understanding of this phenomenon (Pisiak et al. 2011; Hrenchuk and Barth 2013).

Lake Sturgeon forage and rest on the bottom of river habitats. There is some evidence from recent research supported by Manitoba Hydro on the Winnipeg River that bottom draw sluice gates can be part of mitigation efforts at hydroelectric facilities by providing a route for safer downstream passage for Lake Sturgeon (McDougall et al. 2014, Manitoba Hydro 2016:37).

A continued effort to investigate rates of entrainment and survival as well as feasible mitigation measures at existing facilities on the Nelson River is important to Pimicikamak. This is especially so if the recovery of populations in affected river reaches continues at a very slow pace. Investigation of fish passage downstream and survival rates at Jenpeg under variable flow regimes for example would be a useful effort.

As with most other forms of aquatic research this is expensive and technically challenging. Ongoing review of the relative priority and feasibility of such research and mitigation programming with Pimicikamak is important and useful.

Experimental Pickerel Spawning Stream Restoration Project

The deltas of second order streams entering lake expansions on the Nelson and Churchill Rivers often formerly developed rich marsh habitat that hosted diverse species of plants and vegetation structure benefitting waterfowl, beaver, muskrat, songbirds, and moose.

Some of the most obvious effects of water regulation on tributary deltas where water levels have been altered from a natural seasonal cycle include changes in the structure and species composition of vegetation communities, and altering water levels that can affect access to tributaries by spawning fish.

Cumulative effects on numerous fish spawning streams can result from changes in water regime in different parts of the main river system. At some tributaries there may be overlapping effects of water regulation and other factors. Changes in water levels in the regulated system may dewater the mouth of the stream, culverts under nearby roads may be left high and dry and further impede fish passage in that stream. This occurrence has been observed by Pimicikamak citizens.

Pimickamak ATK identifies this stream flowing into Cross Lake as having supported healthy populations of spawning pickerel prior to hydroelectric development. Sept 2017.

Pimicikamak is interested in exploring with fisheries managers some experimental habitat enhancement projects at specific streams to attempt to offset the cumulative effects of water regulation and other infrastructure such as roads.

Recommendation:

Fish Habitat Enhancement

Explore with Pimicikamak and fisheries managers some experimental habitat enhancement projects at selected tributary streams to attempt to offset a portion of the cumulative effects of water regulation and other structures.

5.6 Lake Sturgeon Decline and Recovery Efforts

In recent discussions about this RCEA, Pimicikamak have posed a number of questions about cumulative effects on sturgeon populations and their habitat including:

- How many former rapids that would have been good for spawning have been altered to the point where they are now unsuitable for spawning?
- Is it possible to quantify the number of known spawning sites that have been lost or altered throughout the affected river systems?
- Do sturgeon spawn below the tailraces of existing dams on the Nelson River?
- How are the degraded habitats distributed throughout the river system?
- Have distinct populations of sturgeon already been lost? Some Pimicikamak think this may be the case.
- Could any changes in operating regimes improve the potential for spawning below existing dams?
- What is known about entrainment and survival of fish at each of the existing facilities?
- Can anything more be done to decrease entrainment injury and mortality of fish at existing dams?
- How well can young sturgeon survive under current conditions in the rivers with changed seasonal water regimes, and murkier water at certain times of year?
- Has the overall potential productivity of the rivers for sturgeon in the future declined with ongoing regulation?

This is an issue of considerable concern to Pimicikamak as well and an important study component for a regional cumulative effects assessment.

Pimicikamak representatives participating on the Nelson River Sturgeon Board have likely discussed these questions and many others with researchers and managers planning studies.

What is known about the potential effects of river regulation on Lake Sturgeon is described in a relatively vague manner in the RCEA Summary document. The overall conclusions tell us that:

- Lake Sturgeon habitat has been substantially altered at a number of sites along the Churchill and Nelson River, and this would have affected population abundance and possibly population recovery.
- Recent studies have suggested that sufficient habitat exists to sustain Lake Sturgeon populations in almost all reaches of the Nelson River.
- It is not possible to separate the effects of habitat alteration from over-harvesting.
- It is not possible to quantify the effects of development since we have inadequate pre-hydroelectric data.

The Integrated Summary does not explain or convey the level of concern related to the conservation status of Lake Sturgeon on these rivers and other major rivers across the region. It does not mention the COSEWIC recommendations or what has been learned since the last status report.

The main body of the RCEA Phase II documents does describe well the state of ecological knowledge on Lake Sturgeon, potential pathways of effects related to hydroelectric development, work going into recovery efforts, and limitations in existing data for the Nelson and Churchill River systems.

This is a complex issue and very difficult to study. This species has been extirpated from parts of several river systems in Manitoba, populations are very low across the region and there are so many unknowns in terms of whether it will be possible for populations to recover and become self-sustaining in future even with the current level of development.

State of Knowledge on Lake Sturgeon

It is clear that commercial over-exploitation of Lake Sturgeon in many parts of Manitoba has been a principle cause of the severe depletion of Lake Sturgeon populations. Recovery of such a long-lived species that requires many years to reach reproductive age would take some time even under ideal habitat conditions and no excessive harvest.

It is also known that hydroelectric production has altered and degraded habitat throughout the river system and that new destruction is taking place with the construction of the Keeyask Generating Station.

In status report in 2006 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended listing populations of Lake Sturgeon in the Nelson River as “endangered” under the federal *Species at Risk Act* (COSEWIC 2006). This recommendation was due to their population status as well as concern about ongoing threats related to habitat degradation. This context of this is not well represented in the RCEA Integrated Summary but it is well explained in the main documents.

Keeyask Approved Despite Knowledge of Additional Degradation of Sturgeon Spawning and Rearing Habitat

Habitat compensation projects have been designed for mitigation of the loss of spawning and rearing habitat associated with the Keeyask Project, but these have not been tried before in the Nelson River. Lake Sturgeon stocking continues but it is too early to know whether it will be successful in re-establishing self-sustaining populations.

What was not well understood when Keeyask was approved are such questions as the extent to which sturgeon spawning habitat has already been lost in other parts of the affected northern river systems; the influence of changes in riverine reaches to reservoirs on life stages of each population unit; the spatial distribution of degraded habitats in the river; the effect of fragmentation throughout the main stems of the rivers as a whole due to dams as obstructions to movements; flow alterations in the whole system; longer term success of experimental stocking and artificial habitat creation. These are just some of the questions that were outstanding when a new major hydroelectric facility was approved on the Nelson River.

There has been some good work on communicating the results of sturgeon research, ecological knowledge, recovery efforts, hatchery, rearing and stocking program especially with youth through school programs.

There has been a lot of work done since the COSEWIC reports that has helped us learn more about the ecology of the species in Manitoba and improve our understanding about some of the possible pathways of effects related to hydroelectric facilities. This information does alter some of the hypotheses presented by the original COSEWIC review.

Recent genetic research indicating that there are distinct populations of Lake Sturgeon in the Nelson River with only minor downstream gene flow is very intriguing. The evidence that has been produced suggests that sturgeon did not historically migrate long distances up and downstream throughout the Nelson River (Gosselin et al. 2014). It was not necessary for self-sustaining Lake Sturgeon populations to be able to move long distances throughout the Nelson River system, since genetically distinct populations of this long-lived species evolved within different river reaches with only minimal downstream gene flow. If this is the case, then dams do not fragment the river systems in the way that they were thought for Lake Sturgeon at least. However, it has not been determined that multiple series of dams and associated flow regulation on the Nelson River do not actually impede the recovery of these populations today when they are so reduced.

One implication of this for an assessment of cumulative effects is that a focus on the ability of the suite of habitats in each reach of the river separated by dams or natural barriers to support all stages of life history for Lake Sturgeon is important. Some habitat assessment work has been done in this regard focused on what is known about the basic habitat requirements. This work is essential to continue to develop a more robust understanding of variables related to river regulation. Recent work on developing a habitat suitability index for sturgeon spawning that is applicable to the northern river systems is very useful (Sutton and McDougall 2016). It is hoped that this model will be tested at other structures in the system.

Manitoba Hydro reports on Lake Sturgeon recovery efforts and current state of knowledge are very useful and clear (Manitoba Hydro 2016 c). They explain that although spawning has been observed downstream of generating stations in other rivers such as the Winnipeg River, it has not been confirmed below Nelson River generating stations.

Significant field research challenges are described such as the fact that there are small population sizes in most reaches and it is difficult to sample in the extreme flow conditions at these sites. It is understood that flow, water temperature and predation are factors that are important to rates of survival as eggs hatch into larvae and move through the larval stage. However, it is very difficult to observe these stages of the sturgeon life history.

The complexity of studying the effects of flow regulation and habitat alteration on aquatic species such as Lake Sturgeon is discussed in a paper reporting the results of an investigation into the abiotic or habitat variables in a reservoir system (McDougal et al. 2014). Information such as this is very helpful in

understanding some of the existing technical challenges and limitations that hamper our ability to better understand the effects of river regulation.

There is concern that several sites that would have previously supported spawning habitat have been degraded or lost given that all the dams have been built at former rapids or falls and flooded upstream reaches thus reducing rapids habitats. As mentioned, the extent to which sturgeon are able to spawn in swift water downstream of each existing dam has not been established throughout the affected river reaches. There is evidence of natural spawning and recruitment occurring in different reaches of the regulated rivers. There is also some evidence that growth rates of juveniles may be similar in some reaches today as they were in the 1950's prior to hydroelectric development. The speculation that altered flows could be having a negative effect on spawning and recruitment has not been supported or ruled out.

The program of integrated research that is taking place is helping to develop a much better understanding of sturgeon in these river systems. Studies are yielding some encouraging results about the possibility for the existing habitat to support increased recruitment in the future. However, populations remain very low and it will take some time to observe the results of restrictions on harvest of sturgeon.

Continued focus on integrating study of questions related to habitat characteristics influenced by flow regimes is very important.

5.7 Fish Mercury

The RCEA presents a good summary of what is known about the phenomenon of elevated methylmercury and bioaccumulation in the northern river systems. The cumulative effects of elevated methylmercury levels on the lives of people who live along affected waterways need to be understood in a temporal and geographical, cultural and health context.

Even if mercury levels decrease over time after initial flooding, each new development that creates a reservoir contributes to the length of time this is an issue, and the extent of the river system that is affected. The issue creates anxiety and affects people's consumption of fish in general which is otherwise a healthy food choice. It affects traditional family fishing practices as well.

In discussions with Pimicikamak questions have arisen about the potential cumulative effects of heavy metal deposition from the Thompson smelter in combination with mercury increases due to reservoir creation. The recent rise in mercury levels measured in predatory fish reported in the RCEA documents raises more questions about the cause of this and fear for the future.

Recommendation: Methylmercury

Work together with Pimicikamak to review and evaluate the current level of communications on the issue of methylmercury and fish and wildlife consumption in Pimicikamak communities. If considered necessary, plan a communications strategy to share current knowledge of cumulative effects, and explore concerns.

There has been a fair amount of communications on this issue over the years with affected communities. Some of the people closer to areas where new projects are being constructed have been more involved in environmental assessment work including discussing methylmercury than those in areas where there are older components of the hydroelectric system. A new communication effort would be useful to pursue to share knowledge of the current status of the issue in general, and the monitoring data being gathered through CAMP with a broader audience. There may be concerns that this would raise unreasonable fears about fish consumption and ecosystem health rather than reassuring people. However, there is already a high level of fear about this issue.

5.8 Shoreline Habitats and Wetlands

In discussions related to this RCEA process, Pimicikamak citizens have raised concerns about the current state of the shorelines along all the affected river systems. Many people have observed declines in shoreline plant species, birds and amphibians, terrestrial furbearers which use riparian habitats such as mink, and moose which forage in wetlands and shorelines for succulent plants.

In the RCEA, there is a description of the ecological importance and uniqueness of the shore zone habitats of large river systems on the landscape.

"As corridors extending long distances through northern Manitoba, the continuous shore zones on the three large river systems may play substantively different or enhanced roles for the movements of material, nutrients and species. In addition to longitudinal flows, the shore zone can operate as a filter between the terrestrial and aquatic environments." (p.6.3-7)

The RCEA explains that there are large areas in the affected river systems where productive shoreline marshes have been lost. An understanding of the habitat quality of existing shorelines and the prospects for the future remain quite vague due to the limited survey data that we have. There is a fair amount of speculation in the RCEA based on limited data. The documents suggest that some new shoreline habitats have been created that may be good for beaver, but how suitable is this habitat in fact?

Cross Lake Shoreline in June 2013. Survey of species richness and cover of plants in the shore zone and shallow water in a number of locations would be useful to characterize the current state of the environment.

It states that the shore zone in some areas is "continuing to adjust" to changing shoreline positions, water levels and seasonal water level patterns. In what ways it is adjusting and what are the implications for habitat quality and human use? The RCEA explains that shorelines along Southern Indian Lake for example have largely not yet stabilised forty years after flooding, but that in some areas "effects on shoreline ecosystems may decline somewhat if marsh and floating-leaved vegetation establishes in the larger shallow water zone created by the flooding". It states that "many years are required for marsh and beach vegetation to develop on flooded land", but what kind of marsh and beach vegetation is likely to actually develop under various water regimes in these systems? Can we develop some more predictive capability in this region by examining the results from regulated rivers in other boreal regions, doing more detailed field surveys in this region and monitoring over time?

The RCEA also states that there has been some creation of new wetland areas to offset flooded wetlands as a mitigation measure. Adequate monitoring of any newly created wetlands is necessary to better understand characteristics such as vegetation and wildlife use of habitat in order to evaluate the actual effectiveness of these mitigation measures.

A diverse marsh and shallow water wetland adjacent to Cross Lake that is isolated from on-system water levels by a small control structure on a causeway. June 2014

There are many outstanding questions that are worth pursuing further if these projects have in fact caused widespread loss of some of the most productive wetland and riparian habitats. Studies of hydroelectric reservoirs in other boreal regions such as northern Quebec have shown that biodiversity can also decrease on islands in storage reservoirs, partly due to the degraded quality of riparian habitats caused by unnatural seasonal water patterns. There is little known about whether this may also be a concern in northern Manitoba rivers.

Reductions in certain species of medicinal plants have been noted by Aboriginal people with long-term knowledge of the region. Given these types of concerns and observations, and the vague conclusions possible through the use primarily of aerial imagery in many parts of the affected system, more field work is warranted to document the characteristics of wetland and shoreline habitats in the less studied regions of the affected river systems.

The structure and function of this on-system wetland at Cross Lake on the Nelson River is unique due to its unusual water regime. Sept 2017

Survey Data to Support Interpretation of Wetlands Mapping

Wetland classification systems have been developed for the most part based on natural wetlands in unregulated rivers. The richness, diversity and structure of vegetation communities in a wetland and the other species a wetland can support will depend in part on the water regime. This is described well by the researchers who contributed to the RCEA Phase I and II.

When mapping wetlands in the regulated rivers, we may need more detailed field survey data from different reaches various types of reservoirs, downstream reaches below different types of facilities such as daily peaking, run-of-river, or storage facilities.

A plan should be developed in collaboration with Aboriginal people to conduct wetland surveys in targeted areas on and off-system that have not been the focus of recent environmental assessment work and therefore have inadequate data coverage. Collection of these survey data can support wetland mapping and interpretation of mapping and cumulative effects specific to this region and to the various regulated water regime conditions. Periodic monitoring should be done to develop a better understanding of change over time into the future in relation to watershed and operations variables.

A Cattail Dominated Marsh. This marsh is only influenced directly by water level fluctuations from LWR at high water periods. Sept 2017.

This research and monitoring plan should include opportunities for education, mentorship and employment for Aboriginal youth.

Recommendation: Wetlands Surveys

A plan should be developed to conduct wetland surveys in targeted areas on and off-system that have not been the focus of recent environmental assessment work.

Recommendation: Wetlands Classification

Develop a classification system for wetlands and riparian habitats within the regulated water regimes in order to support cumulative effects assessment.

Cattail marsh with water levels lowered in early fall. The canals are made by beavers to maintain some water to travel in. How does this wetland function as plant and wildlife habitat from year to year? Cross Lake Sept 2017.

5.9 Waterfowl and Other Birds

In addition to colonial water birds, the RCEA chose to focus on waterfowl as a regional study component for the work to date. No other groups of birds such as song birds or raptors were included.

Bird survey data are quite limited in the western boreal region as a whole. There are few survey data documenting trends in waterfowl populations in the upper Nelson since hydro development. Pimicikamak resource users have observed a significant reduction in the populations waterfowl as a group in the on-system water bodies.

The RCEA Phase II document states:

"Due to the considerable on-system changes, and the moderate (less than 1% but greater than 10%) habitat loss within the ecozone, it is likely that waterfowl productivity in areas impacted by hydroelectric development has been reduced. Without long-term data to verify this, the precise extent of this reduction is uncertain. However, it appears that any potential reductions in productivity did not have a population effect within the Eastern Boreal Shield Ecozone. This is supported by the larger waterfowl population trends observed in the USFWS Stratum 24 population estimates. The USFWS population estimates indicate that larger waterfowl populations have remained steady in northern Manitoba, or have shown signs of a small increase." RCEA Sect. 6.4.3.2.1

As with the other study components, for Pimicikamak an effort to understand cumulative effects in the region must focus on the degree to which the affected river and lake systems continue to support waterfowl, and the degree to which they are compromised due to ongoing operations. These are the central questions.

Certain species such as bluebills (Lesser scaup) are much less common according to Pimicikamak over the past several decades coinciding with hydroelectric development. Observers attribute this trend to changes in aquatic vegetation availability in waterbodies affected by changing water levels due to regulation by hydroelectric facilities. A decline in this species of up to 50% has been estimated for the entire western boreal region and other factors may be influencing these changes according to speculation by other ornithologists. A summary document produced by Environment Canada stated:

Recommendation: Waterfowl

A survey protocol should be planned to begin to document waterfowl population trends in the upper Nelson in collaboration with Pimicikamak using ATK, standard survey and citizen science methods.

"Lesser Scaup populations in the Western Boreal have declined by more than 50% over the last three decades, while other species such as Green-winged Teal have doubled. Shifts in aquatic food webs due to climate change may be favouring generalist species, such as teal, instead of the more specialized diving ducks, such as scaup." (North American Bird Conservation Initiative Canada 2012:12)

That document also suggested that:

"Changes in water levels and water flow associated with hydroelectric power generation are affecting crucial feeding and nesting areas for waterfowl and other wildlife." (North American Bird Conservation Initiative Canada 2012:13)

Population data that exist are for the boreal region as a whole. Population surveys for waterfowl have not been done for most of the Nelson and Churchill River systems as explained in the RCEA Phase II.

The national map of active breeding bird survey routes shows that there is quite poor coverage in the northern region of Manitoba within the study area for this RCEA.[7]

The water fowl habitat mapping methods describe the use of basic waterfowl habitat requirements. (Appendix 6.4 A-1) These habitat classes were chosen to be representative of waterfowl breeding and brood-rearing habitat. The regional secondary waterfowl habitat model included the Coarse Habitat types "Water" (Deep Water) and "Shallow water". These habitat classes were chosen to be representative of waterfowl staging habitat.

White pelicans just downstream of Jenpeg. 2016

Based on mapped areas of emergent vegetation, the assessment of loss of on-system shore zone primary waterfowl habitat in the upper Nelson River estimates a decrease of these habitat types of 60%. (Table 6.4B-11: On-system, Shore Zone Waterfowl Habitat in the Upper Nelson Terrestrial Region) Other parameters that are important to consider in evaluating habitat quality are the vegetation communities and the seasonal water level regimes.

[7] https://ec.gc.ca/reom-mbs/default.asp?lang=En&n=207A6123-1#01

For example, the marsh habitat classifications in the RCEA mapping identify marsh as having >10% cover of emergent vegetation. There is wide marsh, narrow marsh etc. Many of the marshes off shore in Cross Lake have very low plant diversity and low density of vegetation to provide cover for brooding and rearing for some species of waterfowl. Some of these may be classified as shallow water secondary habitat.

It would be interesting and useful to compare vegetation diversity and structure, and habitat use by waterfowl with off-system marshes. Those that are separated from Cross Lake by causeways and small control structures for example, or just causeways appear more diverse. Results of such a study could inform future mitigation measures to increase the quality of waterfowl habitat in some areas.

Staging Geese on Cross Lake.

The text states that only areas that have adequate pre-and post hydro mapping data are used in the analysis. The areas around Sipiwesk Lake were regulated earlier within the Kelsey Dam reservoir. They are not included in the pre-hydro mapping presumably because the data are insufficient to accurately map pre-regulation marsh habitat. The fact that Kelsey Dam backed water up to the inlet to Sipiwesk meant that there were regulation effects in that large area before the Lake Winnipeg Regulation. Sipiwesk was therefore left out of the baseline study for LWR.

Duck Lake which is upstream of Sipiwesk was also not included. Given that areas such as Duck Lake were known by Pimicikamak to have had very good waterfowl habitat in the past, would it not be useful to use the available air photo imagery from the 1940's to map and interpret cumulative changes at least based on some general vegetation cover characteristics and water regime knowledge and Pimicikamak traditional knowledge? Then some more detailed current habitat and waterfowl surveys could be done to develop a better picture of existing habitat quality.

The quality of marsh habitat for waterfowl in this region is also influenced by the operations of the LWR in response to flows in the watershed from the south in any given year. Seasonal flow reversals still occur in some years and not in others. It would be useful to do some more detailed ground survey work to better understand the characteristics of these wetlands and their use by waterfowl, as well as other species.

A survey protocol should be planned to begin to document waterfowl population trends in the upper Nelson in collaboration with Pimicikamak using ATK, standard survey and citizen science methods.

Waterfowl surveys could be done using a citizen science protocol.

5.10 Beaver and Muskrat

Section 1.3.6 of the RCEA Phase II describes the selection of Regional Study Components for Water and Land. It was decided not to include terrestrial furbearers due to a lack of data and the fact that the effects of hydroelectric development are more concentrated on aquatic systems. Beaver were therefore chosen as an RSC. However, documented ATK and survey data are also seriously lacking for beaver.

Pimicikamak have explained in submissions related to other environmental assessments that the decline in muskrat in affected bodies of water are of significant concern. However, muskrat were not included in this RCEA study. The fact that there has been almost no study of beaver and muskrat populations and responses to habitat change due to hydroelectric development is of concern to Pimicikamak.

It may be that study of beaver, muskrat and other furbearers has not been made a priority due to the decreased importance of commercial trapping to the Aboriginal economy. Perhaps since beavers have rebounded in several parts of Manitoba some people have assumed that it is not very important if

habitat for this species is degraded in the major northern rivers? This is not the view of Pimicikamak who emphasize the importance of these species as components of a complete ecosystem. Regardless of economic considerations, observations of degradation in habitat conditions and populations struggling over what are very large areas influenced by water regulation are not inconsequential.

Abandoned Beaver Lodge and Canals during low water levels. Cross Lake, Sept 2017

The RCEA explains that quality habitat is essential to the health and sustainability of wildlife populations. The materials do a good job of describing the basic habitat requirements for beaver and how a model estimating change in primary habitat was used as a measurement of possible effects on beaver. The loss of beaver habitat in the Eastern Boreal Ecozone is estimated. The calculation is based partially on estimates of beaver density in the Keeyask region developed from some pre-hydroelectric data and surveys of beaver lodge density in support of the Keeyask Generation Project environmental assessment. For the southern region of this ecozone, there are no survey data useful to estimate densities before or after the lake Winnipeg Regulation project. The relatively limited data from the Keeyask region are used to assign densities to the southern region.

As with several other regional study components, the RCEA explains a range of important data limitations clearly. For the assessment of beaver in the region of interest the data limitations include:

- Shoreline habitat data based on remote sensing available for mapping pre- and post-hydroelectric development are of variable scales and quality.
- Not all areas have comparable overlapping habitat data available.
- Historic and current beaver census data are limited.
- There is very little published ATK or local knowledge available for beaver.

The RCEA explains that the data limitations restrict the analysis possible, but is satisfied that sufficient information exists to construct a “reasonably robust” assessment of the impacts of hydroelectric development on beaver within the region of interest.

This is not a satisfactory assessment for Pimicikamak. It is not enough to acknowledge that beaver have generally been reduced in the region due to habitat loss, but that since they are an adaptable species, they have simply moved to adjacent habitats. It is felt that a more detailed investigation of the existing quality of beaver habitat in the regulated river systems focused on how beavers respond to various hydraulic regimes is warranted. A better understanding of the response of aquatic vegetation communities to water regimes in different parts of the system is an important part of the picture.

Old Beaver Lodge in Jenpeg Forebay. 2015

Pimicikamak would like to investigate how existing patterns of regulation affect beaver and muskrat in order to understand whether there are ways to mitigate the poor survival of these species in parts of this very large system of rivers and lakes.

The use of limited surveys in the Keeyask and Wuskwatim areas of beaver lodges to estimate population densities is questionable. Changes in water regimes are one of the most important variables related to hydroelectric development that may affect beaver and this is recognised by the RCEA authors. It is therefore only valid to use surrogate population density data from areas that experience similar water regimes. The habitat in the reaches downstream of Jenpeg are quite different from that in the lower Nelson River as recognized in the RCEA.

Mapping of habitat is based on air photo interpretation for terrestrial habitats. The report states that although water regimes do not inform the criteria used to classify primary habitat for beaver, consideration of water level changes is applied in the qualitative assessment. However, the extent to which this is done is only to suggest some plausible effects that changes due to hydroelectric development may have. This method may be significantly under estimating the effect of water level regulation in some regions.

The RCEA explained that there is no information from this region on the effects of water regulation on beaver persistence (6.6.1.4 Approach and Methods). The suggestion that flooding has increased shoreline area and thus increased primary beaver habitat in some areas is based on weak evidence of actual habitat use and survival of colonies from year to year.

Also weak is the assumption that beaver do not use larger rivers and lakes due to bank steepness. Steepness and height of banks are certainly factors in choice of location for beavers to build lodges. Pimicikamak discussed observations of beavers frequently inhabiting bank lodges in the Nelson River. Beavers in large rivers are documented elsewhere to excavate bank lodges in sediments more frequently than building free-standing lodges in these environments. This is also this author's observations in other large rivers in northern Canada. Bank lodges are less detectable from aerial

surveys and unless active food caches can be observed, a lodge count is not necessarily a good proxy for estimating active beaver colonies (Keith 2010).

Beaver Lodge in a tributary marsh isolated from dewatering in Cross Lake by a causeway and high culvert. Sept 2017

Large areas of the Nelson, Churchill, Rat and Burntwood rivers have lake expansions with numerous protected bays that do not have adjacent swift flowing water. Numerous remnant abandoned beaver dams and lodges are observed by Pimicikamak in areas such as these especially at small tributaries flowing into the main river systems. These tributaries are also directly affected by flow regulation. Beavers naturally move in cycles as suitable vegetation is depleted. Over time they will recolonize areas as vegetation recovers. Long-term regulation may prevent recolonization and significantly reduce overall productivity in large areas of the main river systems.

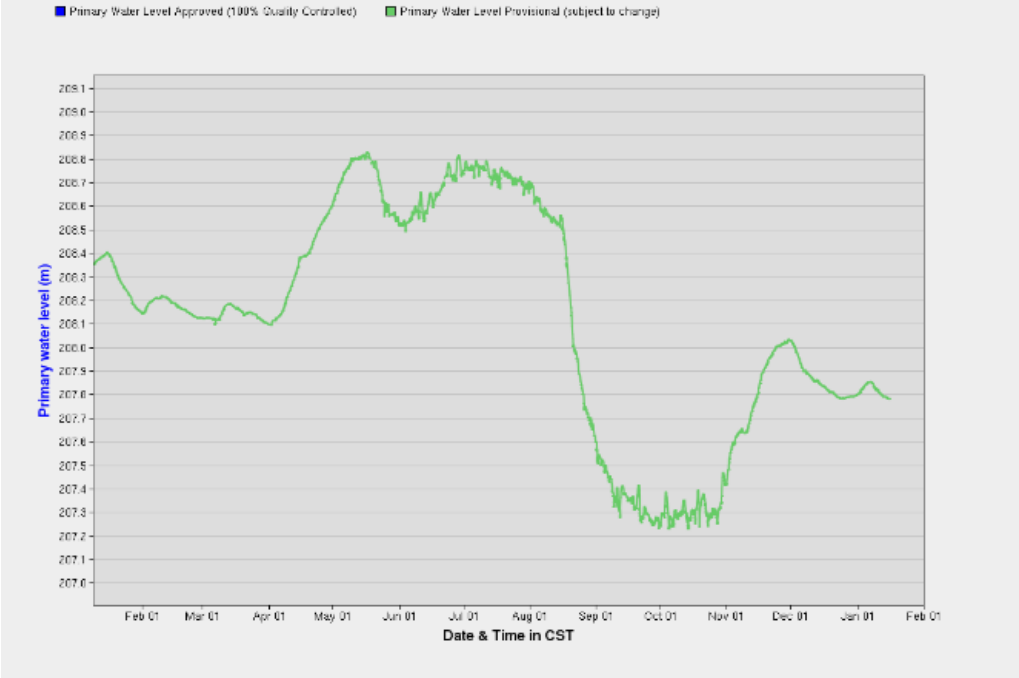
Effectiveness of the Cross Lake Weir as Habitat Mitigation

The RCEA states that the Cross Lake weir largely mitigated water levels. What does this mean? The Cross Lake weir as a mitigation measure did moderate the extremes in water levels on Cross Lake. The problem of very extreme downstream low water levels following LWR was addressed to some extent by the weir. Water levels upstream of the weir are kept higher and the widened outflow channel adjacent to the weir allows very high flows to drain from those water bodies more quickly.

However, as discussed in the section of this report on hydrological change, even following the construction of the Cross Lake weir, LWR can still have a significant ecological influence on the reaches downstream of Jenpeg. These water level patterns are still not similar to a natural rise and fall with the seasons in most years. There are several significant characteristics of boreal species life histories that evolved with and are adapted to the typical natural water level patterns.

How well beaver and muskrat are adapting to current water level patterns throughout the system in regulated is of interest. The extent to which patterns of water levels recorded and observed on Cross Lake are currently supportive of beaver and muskrat habitat could be more clearly studied. In most years since regulation there is a relatively steep drop in water levels in the early fall. This drawdown is due to water being held back in the Jenpeg forebay for ice stabilization. The magnitude of these water level changes has been moderated since the first years of regulation and water levels are more stable since the Cross Lake weir was built. However, water levels are still there has been no systematic study of current habitat use in these reaches by aquatic mammals.

When water levels fall significantly over a relatively sort period of time, aquatic mammals such as beaver and muskrat are extremely vulnerable to predation. This pattern of rapidly lowered water levels was observed in the fall of 2017. Compared to pre-regulation conditions where water levels would typically decrease gradually about .5 m over the course of the autumn months and stay low into the winter, in 2017 the water levels in Cross Lake were as high as 208.78 m in July, fell sharply in August over a meter to 207.3, stayed low through October and early November during freeze up and then rose again almost a meter.



Cross Lake Daily Water Levels 2017 Station (05UD001) [MB] (Water Survey of Canada)

In September 2017 abandoned beaver lodges in sheltered on-system bays of the Nelson River at Cross lake were high and dry with entrances and all surrounding canals exposed for quite distance from the lodge. Wolf tracks were observed adjacent to the lodge. These lodges are in areas where there has been significant beaver activity in the past, there is currently abundant deciduous woody vegetation to support a beaver colony, (emergent marsh vegetation, shore zone willows, and poplar and aspen on adjacent shore), and beavers have clearly attempted to establish there more recently. This early fall water level drop may lead to abandonment of lodges and/or predation of beaver foraging for food.

Later in fall after freeze-up, beaver which have succeeded in establishing new free-standing or bank lodges in preparation for winter, may succumb to predators if winter water levels rise above living platforms and they are potentially drowned or forced to exit the ice cover more often and succumb to predation. Periodic observations of sites like these would be needed to determine if active beaver colonies frequently abandon lodges following drawdown.

Muskrat nests and feeding platforms in push-ups where holes in the ice are kept open may suffer the same fate. Pimicikamak describe observations of dead muskrats frozen into the ice on Cross Lake.

There are some back bays and tributary marshes that are partially or completely isolated from the main water level fluctuations with causeways, high culverts and/or small control structures. It would be interesting and useful to compare these habitats and wildlife use in more detail.

The RCEA conclusions present a fairly simplistic suggestion for what happens to beaver in the regulated systems. Since they are a resilient and adaptable species, it was hypothesized that they would merely move to other unoccupied habitats in the area when the area was first regulated. There are several problems with this explanation.

There seems to be an assumption that adjacent habitat would be unoccupied. Certainly some habitat may be available if it was at a stage in the beaver cycle where suitable habitats were previously abandoned because local food supply had become scarce. Beaver and muskrat populations naturally fluctuate in response to such factors as habitat conditions, especially food sources and vegetation succession, intraspecific competition, disease, predation and population density.

Tributary Marsh on Cross Lake. Extensive old beaver activity at this site, and not currently occupied. Sept 2017. Are vegetation and water regime characteristics suitable for recolonization?

If unoccupied areas are at a stage in succession where food sources are regenerating, young beaver from regulated areas may be able to re-establish. Similarly, if an area had been subject to heavy trapping, disease or predation, there may have been some vacant habitat available. However, the more likely scenario would have been that even if individual beavers or whole colonies relocated when the rivers were initially regulated, these populations would have faced heavy competition for available habitat. Only a portion would have been able to successfully re-establish whole colonies.

It is not clear if the RCEA report authors are suggesting that if beavers were flooded out or dewatered, and simply moved, this would have increased the density of beavers in off-system areas after flooding? This may have been the case for a short period of time in some areas that had lower densities at the time. This would not be the case in the long-term as the carrying capacity of the off-system environments would not have changed.

Muskrats were observed in September 2017 building new nests with emergent vegetation (Great Bulrush) in Sand Bay on Cross Lake. Water levels were relatively low at the time. Rising water levels after freeze-up could affect survival here this season. This pattern may repeat itself each year.

For the purposes of a RCEA, we are less concerned about the fate of individual beaver colonies that lived 40 years ago, than we are with the ecological productivity of the river and lake systems over the longer term period of operations of the hydroelectric projects – at present and into the future.

Young beavers will typically disperse in spring from home colonies at two years of age to establish new colonies or join others, for example, where there is a lone adult female without a mate. Beavers may disperse from off-system water bodies each year to on-system areas that appear suitable in spring. It is possible that this occurs each year with younger beaver attempting to establish in on-system areas, and then failing to survive. A similar pattern could be experienced by muskrat.

So, rather than beaver and muskrat simply moving to new areas, there is the possibility that every year animals disperse from surrounding areas to regulated water bodies and then fail to survive if conditions are not suitable. There may be higher rates of mortality among dispersing individuals and/or poor or little reproductive success in some on-system water bodies. This may favour predators such as wolves and raptors?

Overall, Pimicikamak has a valid concern that there is a significant decrease in year to year aquatic mammal productivity in on-system areas, even where there is suitable vegetation in suitable proximity to water.

Recommendation: Muskrat

Include muskrat as a regional study component. Work together with Pimicikamak to conduct a literature review and document ATK for this species. Consider the development of a collaborative research plan to investigate the use of habitat by muskrat in understudied regulated and adjacent unregulated areas including education opportunities for youth and mentoring by elders.

It would be reasonable to develop a program of focused research and monitoring in collaboration with Pimicikamak, including field work to develop a better data set to describe current beaver and muskrat populations and habitat use, as well as test specific hypotheses. As with many other regional study components for which we have poor data, this is important for future management and development decisions. Pimicikamak would like to participate in a focused systematic monitoring of on-system effects on beaver and muskrat survival rates in the regulated systems and responses to various water level regimes from year to year.

It would also be worthwhile to discuss the potential for doing some survey work and analysis on terrestrial furbearers that may be affected by degraded riparian habitats.

Recommendation: Beaver

Develop a program of focused research and monitoring in collaboration with Pimicikamak, including field work to develop a better data set to describe current beaver populations and habitat use in regulated and unregulated areas, as well as test specific hypotheses.

Recommendation: Terrestrial Furbearers

Discuss the potential for doing some survey work and analysis on terrestrial furbearers such as mink that may be affected by degraded riparian habitats.

5.11 Moose

The conclusions presented in the RCEA Phase II documents regarding moose are that the moose have been negatively affected due to the decline of the quality of shoreline habitats preferred by moose including marsh and shallow water wetlands and low shrub and herb riparian habitats. This has reduced habitats suitable for moose forage and likely reduced moose densities around the on-system waterbodies. There was an increase in tall shrubs noted close to some shorelines and also large woody debris which can impede travel by moose and also make harvesting along shorelines for difficult for people. Moose forage on tall shrubs especially willow.

Some more systematic study of current moose densities along with documentation of ATK on moose habitat use would contribute to a stronger state of the environment report.

5.12 Colonial Water Birds

The change in availability and distribution of potential high quality habitat was used as an indicator for colonial water bird impacts from hydroelectric development since very little survey data or documented ATK is available for the region. A habitat model was developed to estimate the % change in primary habitat (number and area of rocky reefs and small islands) throughout the region since the first dams were constructed. Data were derived from National Topographic System mapping. Islands from 0.01 ha to 3.6 ha were included in the model.

No soil or vegetation characteristics for these features were documented for most of the region. The RCEA Phase II document does a good job of summarizing a number of possible effects on colonial water bird productivity due to habitat loss or degradation, changes in water regime, increased methylmercury levels due to reservoir creation, disturbance from roads and transmission lines, and sensory disturbance, changes in harvest levels, predation and climate change.

The conclusions made in the RCEA for impacts on colonial water birds are extremely vague due to the fact that there is very little data available to describe actual habitat use, reproductive success and population trends throughout the affected river systems. The summary document makes statements such as:

… the cumulative effects are low… … do not appear to have had an appreciable effect… …it appears that colonial water birds are still abundant… … colonial water birds seem to have found suitable nesting locations elsewhere… (Integrated Summary Report p.92)

The RCEA effort to date represents a start in developing some rough understanding of the change in this type of habitat. However, it does not provide any information on actual habitat use, nesting success, changes in population of species over time, and particularly the effect of variable water levels on vulnerable islands.

Collecting Gull Eggs on a Family Trip on Cross Lake (photo: Darrell Settee)

The environmental conditions in different parts of the regulated system vary significantly, particularly in terms of patterns of flow and water levels. A cumulative effects assessment must attempt to develop an understanding of the particular ecological conditions created by these variables.

Over the decades since the first dams on the Nelson River, Pimicikamak citizens have observed instances of waterfowl and colonial water bird nests flooded by high water or variable water levels at on-system sites. Although gulls for example may be capable of replacing lost clutches of eggs depending on the timing within the breeding season, there is really no information on nesting success in northern Manitoba river reaches that are influenced by upstream regulation. Multi-year study is important to obtain adequate data to account for natural variability as well as to discern the specific effects of dam operations.

Habitat enhancement experimentation in affected areas is also of interest. Pimicikamak have discussed the idea some establishing experimental floating nesting platforms in Cross Lake, Playgreen Lake and Sipiwesk Lake. Mitigation work that is being done in the Keeyask area could help to inform efforts in other parts of the system that are degraded from long-term operations.

Since there is very little information about colonial water bird distribution, habitat use and population trends in most of the region, a research and monitoring effort should be developed to better understand the status of these groups of species and how they respond to different types of river regulation.

Recommendation:

Colonial Water Birds

In collaboration with local Aboriginal people, Manitoba and Manitoba Hydro, develop a program of research to investigate habitat use by colonial water birds and nesting success to compare regulated and unregulated water bodies.

If there is evidence that rocky islands that should be suitable habitat are under-utilized over large areas possibly due to water level fluctuations, or if low nesting success is observed that may be related to regulation, then habitat enhancement should be considered.

It can take a considerable period of time to gain sound evidence of direct effects of regulation on nesting birds through monitoring. Pilot habitat enhancement projects could be attempted concurrently to test efficacy under different conditions. Such programs would also serve as important educational tools, local engagement in environmental mitigation efforts, and positive …

It is understood that a new program of research and monitoring will not provide quantitative data that can describe pre- and post development population changes. However, as the existing projects will continue to operate for a long time to come, new projects are under construction and others are considered for the future, there is a need for a more comprehensive understanding of current conditions. A current baseline is essential against which to gauge the effects of potential changes in operations. It will also be useful for environmental assessment in relation to re-licencing applications.

In collaboration with local Aboriginal people, Manitoba and Manitoba Hydro, develop a program of research to investigate habitat use by colonial water birds and nesting success to compare regulated and

Recommendation:

Colonial Water birds

In collaboration with local Aboriginal people, explore the feasibility of an experimental program of colonial water bird habitat enhancement in areas where it is probable that nesting success has been compromised by direct habitat loss, or the effects of regulation that create unnatural patterns of seasonal water level change.

unregulated water bodies. Monitoring nesting success and comparing this to a number of environmental variables including seasonal water level patterns as influenced by water control operations upstream over a number of years would be one example of a research program that could address questions of effects of river regulation.

In collaboration with local Aboriginal people, explore the feasibility of an experimental program of colonial water bird habitat enhancement in areas where it is probable that nesting success has been compromised by direct habitat loss, or the effects of regulation that create unnatural patterns of seasonal water level change.

6 Conclusions and Next Steps in the RCEA Process

The RCEA Phase I and II reports represent a solid effort to pull together much of the existing documented research that has been done on the environmental effects of the system of hydroelectric infrastructure that has been installed and continues to operate on the northern Manitoba river systems. Some additional preliminary analysis has been conducted that is useful in several respects.

Numerous important data gaps clearly exist that compromise our ability to conduct a robust regional cumulative effects assessment. These are coupled with the long-term observations of environmental change made to date over the life of this industrial complex made by Pimicikamak and others that indicate many forms of ecological degradation related to river regulation and other industrial processes.

The effects are cumulative over time and space. Much work remains to be done to fulfill our responsibility to do what we can to protect these lands and waters, while continuing to provide services and extract resources on a regional scale for export to the south.

The task of an assessment of regional cumulative effects of environmental manipulation over a long period of time is admittedly a complex idea. It is nevertheless an essential part of present and future planning and management. Priorities for focused research and inquiry to continue with this task must be developed. These must be developed in close collaboration with affected peoples.

The recommendations made to Manitoba and Manitoba Hydro to conduct a regional cumulative effects assessment of hydroelectric development in northern Manitoba came without a detailed framework on how such a task could be approached and implemented. The Terms of Reference that were subsequently established for this work were put together without direct consultation or collaboration with affected peoples in the region, or with the broader Manitoba public. This is despite the fact that the stated reason for this assessment is the extensive and long-term effects on the Aboriginal people of the region.

It is understood that such consultation can be challenging, time consuming and expensive. However, with the review of these preliminary steps in the RCEA process, we have an opportunity to continue the effort to better understand the effects of these projects that are known to have extensive and long term effects on river ecosystems.

The process of developing a strong, positive and productive relationship with Pimicikamak and other Aboriginal peoples affected by industrial energy production in the north will require teamwork with a focus on ecosystem restoration and protection to the extent possible. A candid assessment of the changes that have occurred that can inform future mitigation efforts and provide a clear sense of the associated costs and benefits of hydroelectric development are what is expected from a RCEA process.

Next steps recommended to take in pursuing an increased understanding of the regional effects of this extensive alteration of these river systems have been suggested throughout this review and are listed in the summary. Some of these relate to effective communication of results to date to Treaty rights

holders, and the general public. Other recommendations for next steps address specific questions that should be considered for the development of further research. Finally, a process for collaboration with Pimicikamak is suggested.

6.1.1 Formal Collaboration

Pimicikamak is interested in forming a formal environmental assessment working group that would meet with others involved in planning and implementing environmental assessment processes including regional cumulative effects.

The tasks would include:

1. discussing objectives and priorities,
2. reviewing data gaps and feasible ways to address these,
3. developing communications with community members,
4. working together on education and mentoring of youth to become involved in environmental assessment policy, management, science and field work.

This working group would contribute to the next steps in the regional cumulative effects assessment.

6.1.2 Research Planning

As identified in this review, there are a number of areas where additional research and monitoring are considered essential for a more comprehensive understanding of the state of the environment of the northern Manitoba river systems.

A comprehensive planning process for research and monitoring at Sipiwesk Lake and Duck Lake to develop a state of the environment report for that area is important to Pimicikamak. An ideal approach may be to conduct focused studies that work to develop interdisciplinary collaboration and a framework to explore ecological relationships in various specific habitat types at culturally significant sites. Detailed documentation of ATK for this region will be an important aspect which must be integrated with new study design.

6.1.3 Communications

Pimicikamak would like to be part of a collaborative effort to further develop and improve communications within Aboriginal communities and for the general public in Manitoba about what is being learned about the cumulative effects of hydroelectric development.

It would be very useful to produce synthesis maps and charts for the summary that provide a graphic representation of changes in indicators in various hydraulic reaches throughout the affected river systems. The purpose would be to enhance the reader's understanding of the types of changes observed and predicted changes related to different patterns of flow control.

Some of the mapping that has already been produced and included the main RCEA documents could be adapted to this purpose, as well as some of the graphic representation that has been recently produced through the CAMP program and posted online.

It is of course not possible to display all information in this way, issues of scale, and decisions around how to classify various effects or ranges of effects would be challenging. However, an effort made in this regard would enhance communication and understanding of the material for a wider audience.

Given that the conclusions for trends in several indicators are quite vague, the mapping and charts could also portray the reaches where data for specific components are too poor to make any firm assumptions. This graphic representation could then also possibly indicate where more research is needed.

Some examples of information that could be considered for additional mapping or simplified graphic representation according to hydrological zones in the rivers include:

- Nature of the hydrological regime in the various reaches
- Reaches of the river where elevated mercury levels have been measured, the range of levels, and the duration of the effect.
- Erosion rates and how these differ from estimated natural rates.
- Water quality parameters and results to date
- Changes in fish communities

Focus groups with affected Aboriginal people to review this type of information and discuss how it is interpreted would be useful.

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Appendices

Appendix A Authority of Pimicikamak Okimawin to Represent its People

Pimicikamak is an Aboriginal people and government. Pimicikamak signed Treaty 5 in 1875. The lands that comprise at least part of Pimicikamak's "title lands" or "traditional territory" became part of the Treaty 5 territory as a result. The Cross Lake Band of Indians and its structure was created by the Indian Act thereafter, and was essentially imposed on Pimicikamak, as all *Indian Act* provisions were imposed on all many Aboriginal peoples in Canada. The individuals who comprise Pimicikamak citizens, and members of the Cross Lake Band, are essentially the same.

For many years, Pimicikamak traditional government was suppressed under the *Indian Act* and other Crown laws and ways of life, but it never disappeared. Approximately three decades ago, Pimicikamak began to actively reassert itself and its rights to self-determination, which are acknowledged and accepted by Canada through its ratification of several instruments of international law and its own national policy.

Pimicikamak has a largely unwritten constitution, being its customary law. Some of that customary law has been written down in Pimicikamak's modern-day written laws. These laws are available on-line https://www.pimicikamak.ca/about/. They include the Pimicikamak Election Law. This Election Law provides that Pimicikamak's government is composed of the Three Traditional Councils (Elders, Women, Youth) and the Executive Council. The Executive Council of Pimicikamak's government also serves as ex-officio Chief and Council of the Cross Lake band of Indians (the Indian Act – created entity). "ex officio" means that the Chief and Council of the Band acquires its right to be and act as such, only through the Executive Council of the Pimicikamak government. As such, there is only one government of those persons who comprise the citizens of Pimicikamak and also comprise members of the Band – being the Pimicikamak government. Canada is aware of and has "accepted" the Pimicikamak Election Law (Canada treats it as a custom election code). This law remains valid and in force.

As such, the Pimicikamak government has the right, and is the only entity that has the right, to represent Pimicikamak as a people and its citizens as such (who are also members of the Cross Lake Band) on land use and protection and environmental assessment processes focused on Pimicikamak traditional territory.

Appendix B Previous Pimicikamak Comments on the RCEA Terms of Reference 2014

Comments on the Terms of Reference for the Regional Cumulative Effects Assessment of Hydroelectric Development in Northern Manitoba

Prepared for Pimicikamak Okimawin
A. Luttermann PhD
Sept 2014

Context

On May 27, 2014 Manitoba Conservation and Water Stewardship and Manitoba Hydro released Terms of Reference (TOR) for a Regional Cumulative Effects Assessment (RCEA) of hydro-electric developments on the Nelson, Burntwood, and Churchill River systems.[8] The interim report for phase 1 of the RCEA was also released at the same time at the end of May 2014.[9]

The following comments address concerns related to the RCEA process as described in the materials available to date.

1. **The Terms of Reference for the RCEA should have been developed in collaboration with affected Aboriginal Peoples.**

These TOR were developed without consultation with affected Aboriginal peoples in northern Manitoba. There was no period of review or consultation for the TOR. The TOR propose that consultation with affected peoples and the general public will take place during the second phase of the RCEA process. However, there are serious limitations to this approach which will likely render any resulting RCEA much less useful.

[8] Terms of Reference. Joint Approach to Undertaking a Regional Cumulative Effects Assessment for Hydro Developments as per Recommendation 13.2 of the Clean Environment Commission (CEC) Bipole III Report Manitoba Conservation and Water Stewardship and Manitoba Hydro.

[9] Regional Cumulative Effects Assessment for Hydroelectric Developments on the Churchill, Burntwood and Nelson River Systems. Phase 1 Report. May 2014. Manitoba Hydro.

These reports are available at:
https://www.hydro.mb.ca/regulatory_affairs/rcea/index.shtml

Given the difficult history of hydroelectric development in northern Manitoba, and given the fact that a RCEA has been requested by affected peoples for many years, it is important that the TOR for such a broad study be developed in collaboration with northern Aboriginal Peoples. The fact that it was not will likely lead to further lack of trust and exacerbate an already adversarial relationship. This is not in keeping with reconciliation.

It is understood that such a study cannot possibly address every concern, answer every question, or study every element of the environments affected by hydroelectric development. This is not physically, scientifically, or economically feasible. However, the objectives, methods, priorities and limitations can be discussed and agreed upon. This planning process should involve northern Aboriginal Peoples at the initial stages.

Legal counsel for Pimicikamak advises that Supreme Court of Canada case law on the duty to consult stipulates that consultation must begin at the earliest possible stages, at the strategic planning level. And as Manitoba Hydro and Manitoba know, many environmental assessment statutes require the opportunity for input by aboriginal peoples and affected stakeholders at the terms of reference or guidelines stages.

2. The objectives of a regional cumulative effects assessment must be inclusive and not foreclose options.

Consideration of what can be done to remediate or mitigate the effects of existing hydroelectric infrastructure and operations must address all viable options. The TOR describe the objectives of a RCEA in this way:

> *"Regional cumulative assessments are typically used as a government's tool to facilitate broad, long-term planning decisions regarding a range of development options for a prescribed area or basin. In the case of the Nelson River sub-watershed, such planning decisions were made over forty (40) years ago and any impacts that may have resulted are largely irreversible at this point in time and/or the environment has now adapted."* (p.4)

The TOR strongly appear to foreclose, from the outset, consideration of some options for remediation. It is true that decisions made 40 years ago cannot be changed. However, decisions can be made today that change the effects of those earlier decisions – this happens routinely when advances in science, policy, social understanding and law occur.

For instance, the operation of existing infrastructure can be changed, other uses of the watershed can be accorded more priority, and further remediation can be done in order to benefit the environment and aboriginal peoples and other users of the watershed. This may not be the preferred option from Manitoba Hydro's economic point of view, but it does not mean that other Manitobans and their concerns should not be considered. The RCEA is not only useful for governments to consider new development options – it is useful (and has been useful in other contexts) for a range of things, from

land use planning, environmental protection, species rejuvenation, to economic and social advancement.

3. An RCEA should have been done prior to licencing the Keeyask Project as a whole.

This initiative to conduct an RCEA has been taken in response to a non-licencing recommendation 13.2 of the Clean Environment Commission Report on the Public Hearings for the Bipole III Project. The recommendation is as follows:

> *"Manitoba Hydro, in cooperation with the Manitoba Government, conduct a Regional Cumulative Effects Assessment for all Manitoba Hydro projects and associated infrastructure in the Nelson River sub-watershed[10]; and that this be undertaken prior to the licensing of any additional projects in the Nelson River sub-watershed after the Bipole Ill project."*[11] (p.126)

The Minister of Conservation and Water Stewardship decided that the recommendation in terms of timing would not apply to the Keeyask Hydroelectric Generating Station and Transmission Line project which has since been licenced under the *Environment Act*. The TOR explain that:

> *On October 17, 2013, the CEC heard motions from participants in the Keeyask CEC process who were requesting that the Keeyask Generation Project hearing be delayed until the recommended regional cumulative effects assessment is complete. As part of this motions hearing, the CEC noted the volume of study that has been completed to date by Manitoba Hydro in the Nelson River region and suggested that Recommendation 13.2 could readily be satisfied by pulling together and analyzing this information, rather than undertaking new field work or seeking new information.* (p.3)

Pimicikamak continues to feel strongly that a RCEA should have been conducted prior to licencing the Keeyask Project. This is another very large project which represents a huge commitment of resources and another major alteration of the Nelson River. The volume of study conducted throughout the region may be considered by some to be substantial. It is not considered by Pimicikamak to be as extensive as necessary given the magnitude of the developments and their effects. For instance, studies to date have paid inadequate attention to Pimicikamak's (and many other aboriginal peoples') knowledge of, connections to, uses and occupancy of and values in the watershed. As Manitoba Hydro and Manitoba know, a land use and occupancy study of Pimicikamak's such connections, uses and values has just started.

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[10] A definition of the "Nelson River sub-watershed" is not provided.

[11] Manitoba Clean Environment Commission. Bipole III Transmission Project. Report on Public Hearings. June 2013 http://www.cecmanitoba.ca/resource/hearings/36/FINAL%20WEB%20Bipole%20III%20Transmission%20Project_WEB3.pdf

Furthermore, the area that has already been adversely affected is extensive, the effects are either permanent or long-term, and there are many ecological questions for which we have only vague answers.

It does not appear that the objectives of the CEC recommendation 13.2 will have been fully satisfied as stated in the RCEA TOR with the process that is being followed. The TOR appear to assume that all or most of the raw data exists and only has to be pulled together and organized, when Pimicikamak and others know it has not. This approach marginalizes if not ignores the aboriginal perspective and experience.

4. **The RCEA should include all of the northern hydroelectric system but also consider the effects of other disturbances such as all transmission lines, transportation corridors, community development, resource harvesting, mining, forestry operations, nutrient loading from agriculture, wildfires and climate change.**

The TOR agreed to by Manitoba and Manitoba Hydro expands the CEC recommendation to include the Nelson, Burntwood and Churchill River systems. This is reasonable and is the only approach that makes any sense.

However, documents reporting on the cumulative effects of hydroelectric development in northern Manitoba have frequently concluded that it is impossible to separate the effects of hydroelectric development from the effects of other disturbances or natural processes, and therefore, impossible to know to what extent hydroelectric development is affecting parameters such as water quality, waterfowl populations, or fish populations.

We need an RCEA that will at least consider the potential nature of the cumulative effects of multiple factors and provide some analysis (however broad) that will guide discussion for decision making. Some work has been done towards addressing this objective. For example, some investigation has considered the possible effects of linear corridor density on woodland caribou in the Keeyask Project study area. This could be more comprehensive by mapping the entire region and providing more discussion of what may be the long-term habitat requirements for this species in this region.

There is no doubt that there is a lack of quantitative baseline data for many parameters. However, environmental protection requires that we study the cumulative effects of all major disturbances that are under human control to some extent; that we think in longer-term time frameworks; that we use what data do exist; and that we consider collaboratively what additional research may be required and is feasible to address the concerns that we have.

5. The RCEA process should allow for consideration of the need for additional research.

The cover letter that accompanies the TOR states the following:

> *It is planned that the final RCEA report will be available in late fall 2015. It will be retrospective in nature and will:*
> *• identify, describe and acknowledge the cumulative effects of past Hydro developments;*
> *• describe the current state of the environment in areas affected by Manitoba Hydro's system; and,*
> *• describe a process for continued monitoring of and reporting on the state of the environment into the future.*
>
> *The final RCEA report will be based on a review and synthesis of past and ongoing studies and monitoring programs, and will include both technical science and Aboriginal Traditional Knowledge to the extent that each is available.*

It appears that no new research is planned for the RCEA itself. Some ongoing monitoring is being done such as sampling of aquatic habitat parameters through the Coordinated Aquatic Monitoring Program (CAMP). However, there are important areas where research is deficient and we are unable to adequately describe current conditions. If new research is feasible to address specific questions, this should be part of the RCEA process. If it is determined that no new research is economically possible, this decision must be made in a transparent manner.

The interim report for phase 1 of the RCEA was released at the end of May 2014. According to the TOR this report is "*intended to provide an early identification of the studies and information being gathered to undertake the final RCEA, and the methods to be employed for the assessment.*" This first phase should include an analysis of areas where additional research may be warranted.

For example, some monitoring for aquatic furbearers and habitat modelling has been conducted more recently in reaches of the lower Nelson River. However, it appears that data on aquatic furbearer populations and quality of habitat are quite limited in the area from Lake Winnipeg to Split Lake inlet. The Phase 1 RCEA report explains that habitat monitoring for beaver was conducted for the Bipole III route and some observations of sign during mammal and waterfowl surveys in sample areas in 2010. Fur harvest records are available, however as noted, these do not correlate well with population levels. Other than that, the Phase 1 RCEA reports that *"… no current information on furbearer populations was located."* (PHASE I REPORT PART V: WATER AND LAND p. 5-406)

This information suggests that additional research may be necessary to develop a better understanding of current conditions of aquatic furbearers in this area. And as stated above, research on aboriginal peoples' land use and occupancy should be conducted and considered in a comprehensive way.

Aboriginal knowledge of changes in aquatic furbearer populations and habitat conditions in the upper reaches of the Nelson River, and the significance of these changes to people's values and connections to the land is one area of useful research.

The RCEA TOR mention that beyond phase II, the Coordinated Aquatic Monitoring Program (CAMP) and the monitoring set out in the Bipole III EIS will continue. The TOR do not anticipate any additional primary research, or any additional parameters for research or monitoring. If this is the case, this exercise will likely not be adequate to meet the objectives hoped for by those advocating for a RCEA.

6. The timing of the RCEA Phase II Report may be premature if it is considered to be final.

The TOR state that a final report (the "end product") following Phase II of the RCEA study is planned for the fall of 2015. It is unlikely that this will be sufficient time to complete such a study satisfactorily. It will likely be determined through the process that additional primary research and new monitoring programs are needed to address some fundamental questions.

For example, the extent to which riparian habitats are being degraded by industrial activity is an important question. There is very little existing information on riparian vegetation community composition and structure, wildlife use of these areas, or the ecological effects of changes in rates of erosion and sediment transport and debris build-up, or changes in adjacent forest composition and structure in many parts of the regulated river systems, as compared to off-system lakes and rivers.

The TOR state that the Phase II report will provide:

> *"A determination of the current quality of the environment in areas affected by Hydro development based on more current monitoring and assessment data and in consideration of available thresholds and benchmarks, as well as conditions in off-system areas, where applicable"* (p.6)

If a report is issued in 2015 that is based entirely on existing data, it cannot be considered to be a final RCEA. The TOR do state that:

> *"The total length of the study is anticipated to be from January 2014 through October 2015. Work going beyond the submission of the final Phase II report can be determined outside of these Terms of Reference."* (p.8)

It should be made explicit that the RCEA process, as outlined in the TOR, should be considered to be a first step in a longer-term process. There will be many questions that will not be well answered with existing data. This is acknowledged in the TOR as it is intended that the Phase II report will identify information gaps. However, it is also important that there be a planning process to address information gaps where possible. The results of this phase of the study will certainly lead to the identification of further research programs. The limitations of the Phase II report must be clearly discussed.