Comments on Some Issues of Concern to Pimicikamak Regarding the Keeyask Generation Project Environmental Assessment

Lydia Thomas and Gertie Richard in Cross Lake – September 2013

Prepared for the Manitoba Clean Environment Commission Hearings

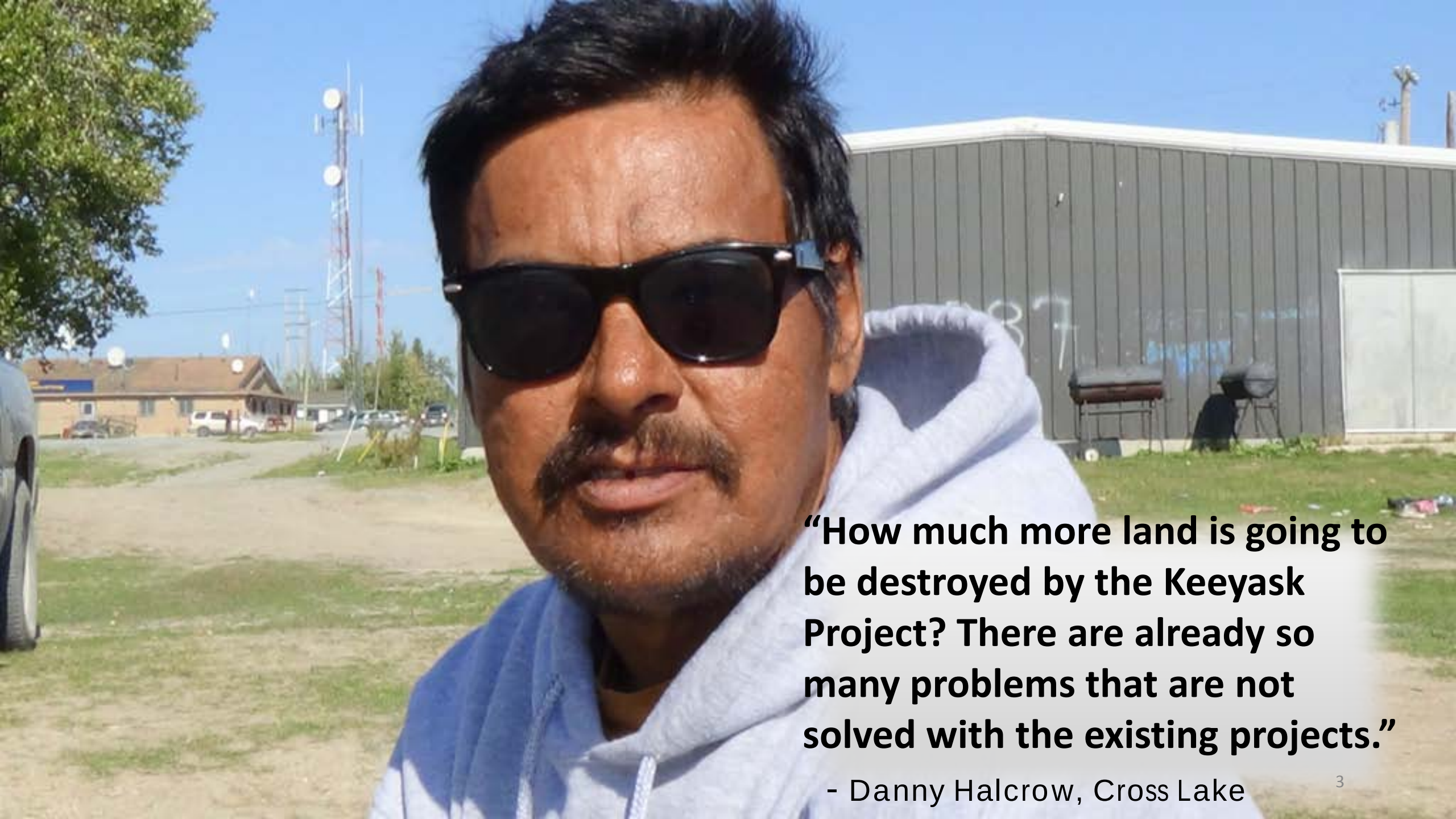
Review of the Keeyask Generation Project

Annette Luttermann PhD

December 2013

Background

- Review of the Keeyask EIS
- Discussions with Pimicikamak citizens
- Review of literature on the Nelson River region and other regions of Canada and the circumboreal north
- My own research in other boreal regions of Canada on the effects of hydroelectric development on riparian vegetation communities
- Field visits to parts of the upper Nelson River
- Review of literature pertinent to questions such as restoration and enhancement of riparian wetlands, sturgeon recovery efforts to date in other regions, and cumulative effects assessment concepts and methodology



“How much more land is going to be destroyed by the Keeyask Project? There are already so many problems that are not solved with the existing projects.”

- Danny Halcrow, Cross Lake

Pimicikamak Concerns

- What will be left of this river after all of this development?
- This river is so degraded now. The water quality, fish, birds, plants on the shorelines, insects, frogs, and many other animals have declined. Will Keeyask make this worse?
- How effective will the proposed mitigation measures be, especially for fish such as sturgeon, and for river shoreline habitats?
- Will there be any direct or indirect effects of the proposed project on the operation of the Nelson River hydroelectric system as a whole?


“The land and the river around here used to be so beautiful.
But now I can hardly look at it sometimes.
It makes me so sad.”

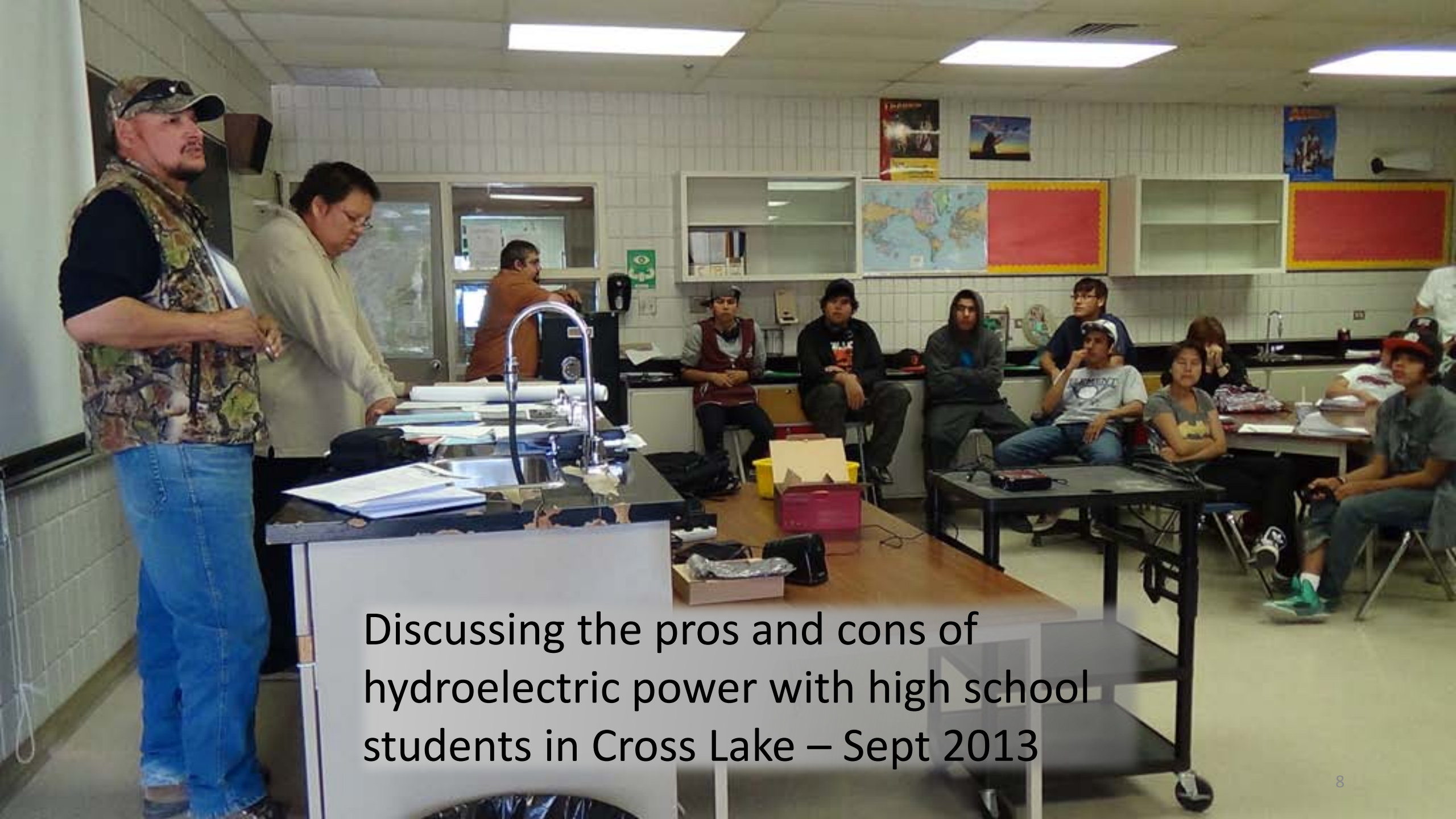
Pimicikamak Concerns cont'

Jenpeg Generating Station Nelson River

If we want to work towards increased "harmony and balance" in our environment,

should we not be working harder to mitigate the effects of the existing hydroelectric development rather than building more infrastructure?

"Some choices may be difficult, but we did not realise all of the negative effects there would be from the dams. Our grandchildren will not have a healthy environment "



Discussing the pros and cons of hydroelectric power with high school students in Cross Lake – Sept 2013

How do we reflect the cumulative alienation and degradation of the Nelson River with each new project?

Pimicikamak Concerns cont'

- Pimicikamak citizens live in the communities nearer to Keeyask ,and Pimicikamak do travel to the area to hunt and fish.

- In what ways will this project contribute to "sustainable development"?
- Don't we have any other choices for this river besides more hydroelectric development?

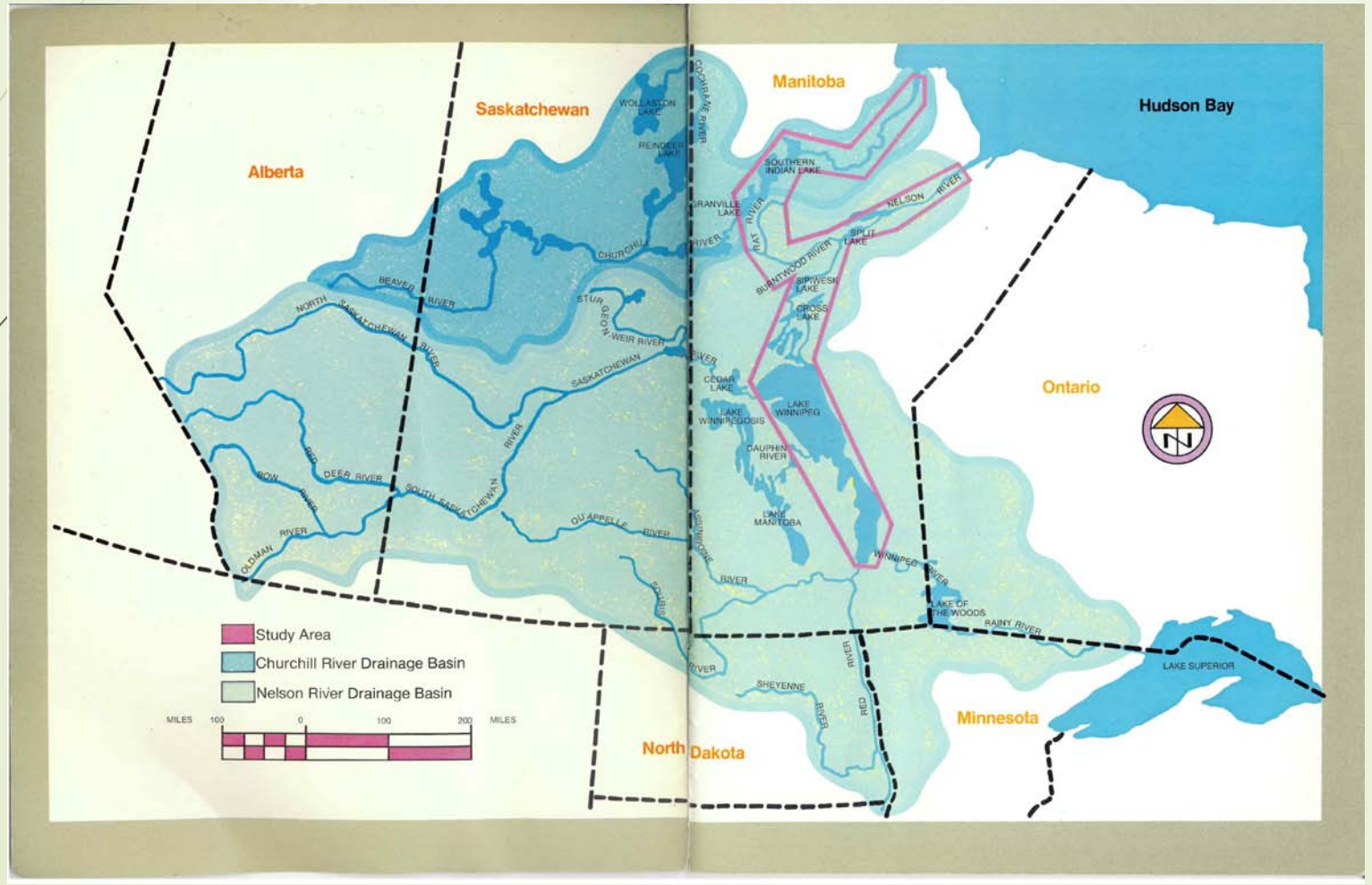
Key Concerns with the Keeyask Environmental Assessment Conclusions

- Keeyask EIS conclusions related to the significance of the cumulative degradation of riparian habitats in the Nelson River.
- The potential success of proposed mitigation measures for aquatic habitat conversion and lake sturgeon (*Acipenser fulvescens*) in particular.
- The limited geographical and temporal scope of cumulative effects assessment
- Does a major hydroelectric development meet the objectives of "sustainable development" in the context of concerns about climate change on a global and regional scale.

Direct and Cumulative Effects on Nelson River Riparian Habitats

- Limited spatial and temporal scope of assessment
- Concepts of spatial and temporal overlap in cumulative effects assessment
- Interpretation of the significance of residual effects of wetland habitat alteration and fragmentation

Watersheds constitute important ecological boundaries, however they are also permeable.



Source: Lake Winnipeg, Churchill, Nelson Rivers Study Board Summary Report, 1975

It is understood that the river system is connected by the flow of water

Nelson – Churchill Drainage Basin

Riparian corridors

"…a key landscape feature with substantial regulatory controls on environmental vitality"

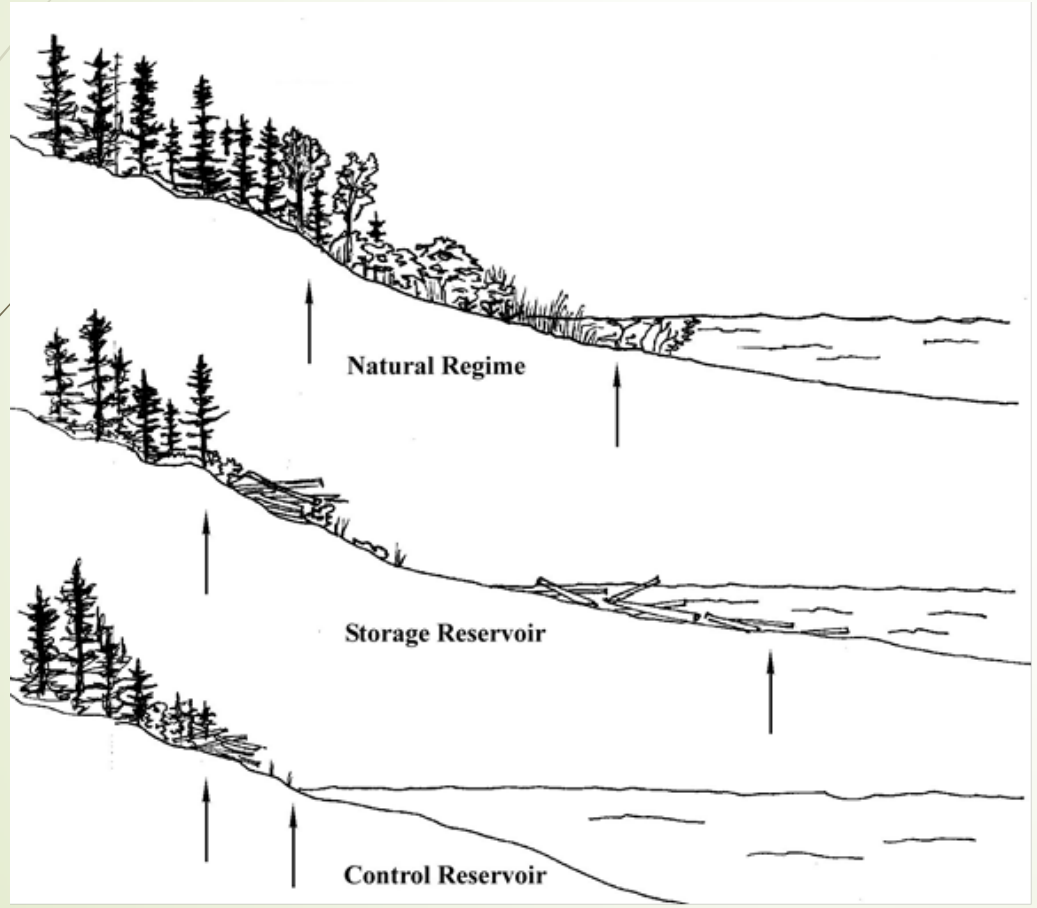
"…essential for maintaining regional biodiversity"

Naiman, R.J. 1992. New perspectives for watershed management: balancing long-term sustainability with cumulative environmental change. Springer-Verlag, New York.

Landsat Image of Nelson River, and portion of Churchill River

Source: Google Earth Imagery date 4/9/2013

Habitat quality of diverse riparian zones



A conceptual diagram comparing the width of active riparian zones and vegetation structure typical of slow flow, moderate slope shorelines under various hydrological regimes.

Arrows indicate average seasonal high and low water levels.

Reservoirs typically have large quantities of woody debris stranded on the shores, and sparse vegetation cover in the riparian zone.

A Shoreline on Sipiwesk Lake on the Nelson River

August 2013

A total of 5 species of vascular plants were observed at this site during an informal survey of 300 m of shoreline from the water to high water mark

Main stem riparian wetlands assessed in the Keeyask

- wetlands are valued ecosystem components
- concepts such as ecological functional complexity and diversity, resilience and uncertainty discussed in the Keeyask EIS
- "*All of the natural Nelson River shoreline wetlands in the Regional Study Area were either lost to flooding, or have been altered by modified water and ice regimes*." (Terrestrial Environment Section 2: Habitat and Ecosystems 2.8 Wetland Function p. 2-166).
- Analysis of historical air photo imagery in the lower Kelsey reservoir, Gull Lake, Kettle reservoir and Long Spruce reservoir concluded that well vegetated shorelines on the main stem constituted a relatively small percentage of the riparian zone, before hydro development. (Environmental Studies Program Report 11-05).

Riparian marshes and swamps of large rivers are species rich

- Riparian wetlands typically form approximately 1% of any region, however they are generally found to represent some of the most productive habitats within the broader landscape.
- The riparian habitats of the main stems of large rivers are typically more species rich in plants than smaller rivers in the same region (Nilsson et al. 2005).

A Riparian Area along the Lower Churchill River in Labrador
Mixed forest in upper zone - high shrubs (Salix spp. and Alnus spp.), to low shrubs in mid-zone, herbs and graminoids (grasses, sedges and rushes) in lower zone - dense growth of Equisetum fluviatile at the water's edge (Photo: A.Luttermann, 2001).

Nelson River riparian zones are not "pristine"

- It is acknowledged in the EIS that the Nelson River is not a naturally functioning system, and that the Nelson River riparian wetlands have been modified beyond recognition.
- However, reaches that would be flooded by the proposed Keeyask project are still influenced by riverine hydrological processes. Tributaries entering the Nelson River along this reach still maintain natural seasonal run-off patterns.
- "*In regions that are in relatively pristine condition, it is anticipated that some degree of area loss can be absorbed without adversely affecting ecosystem functions*" (Terrestrial Environment Section 2: Habitat and Ecosystems 2.8 Wetland Function p. 2-158).

Extensive loss of main stem riparian wetlands in Nelson River – no mitigation

- Nelson River shoreline habitats are described as “non-native wetland types” as a result of the severe effects of existing river regulation (Terrestrial Environment Section 2: Habitat and Ecosystems 2.8 Wetland Function p. 2-185).
- No further consideration of the possible landscape level effects of degradation of these habitat types throughout the river system
- No further consideration for the potential for mitigation for existing effects

What is the appropriate regional scope of assessment?

- "*Focusing on particularly important wetlands for evaluation and mitigation is an appropriate approach for this Project Assessment since the Project is located in a region with extensive wetlands that are in relatively pristine condition, except along the Nelson River*";
- "*The regional ecosystem is the appropriate ecosystem level to assess the effects of development on wetland function in a naturally functioning ecosystem*". (Terrestrial Environment Section 2: Habitat and Ecosystems 2.8 Wetland Function p. 2-160).
- "*In most cases, a development will affect a very small proportion of a regional wetland area, so the focus is on a screening technique that identifies wetlands that are particularly important for the regional level ecosystem*". (Terrestrial Environment Section 2: Habitat and Ecosystems 2.8 Wetland Function p. 2-161).

Important ecological questions include:

- What remains of the former riparian wetland habitats in the main stem of the river and tributaries directly affected by regulation?
- What is the condition of these areas at the present time?
- What are the implications for biodiversity and functioning of the riparian corridors of these large rivers?
- what is an appropriate level of effort to assess the significance of further alteration of wetlands in this river system?

Canada geese at Cross Lake

Cumulative Effects – Concepts of Spatial and Temporal Overlap

- Effects on the **characteristics of river shorelines** are one of the most apparent and direct consequences of river regulation.
- Vegetation structure, plant species richness, suitability for riparian wildlife species
- The natural **seasonal flow patterns** of water and sediment transport are the main drivers that form and maintain the complex morphology and habitats typical of large rivers.

Large river riparian habitats on the Labrador plateau

CEAA Guidelines and overlap with “VECs”

- The CEAA Guidelines refer to spatial and temporal “overlap” as a way to determine boundaries for cumulative effects assessment.
- Incremental and possibly synergistic effects of multiple developments on the environment
- Acknowledged in the EIS that the project effects do not need to overlap completely with the VEC in order for the boundary of the VEC to be used as a study boundary.
- The range of “metapopulations” could also be important to address long-term effects of fragmentation.
- Incremental loss of good quality habitat over a large, previously connected area of the landscape, coupled with direct barriers for dispersal, could result in important cumulative effects.

Importance of habitat connectivity along rivers

- Many species of terrestrial and aquatic plants and animals disperse over the short and long-term up and down river corridors with connected riparian habitats (Nilsson and Svedmark 2002).
- This habitat connectivity is likely an important function of riparian habitats along large rivers.

Declines in amphibian populations

- Distribution maps in the Keeyask EIS suggest that the Nelson River may have been a corridor along which frogs dispersed north of Lake Winnipeg. (Terrestrial Environment Section 5 Amphibians and Reptiles Appendix 5B p.5B-1)
- Pimicikamak elders observe that frogs were formerly abundant in the Nelson River riparian areas and are now scarce.
- post Jenpeg is cited as the time period when frogs began to disappear quickly
- dramatic declines in abundance and area of occupancy of northern leopard frog (*Lithobates pipiens*) in the mid-1970s and 1980s
- natural and anthropogenic factors are suspected to have been responsible (Environment Canada 2013).

Northern Leopard frog (*Lithobates pipiens*)

- ✓ marshes
- ✓ abundant aquatic vegetation
- ✓ moist uplands
- ✓ overwintering habitat – stable water levels

- ✓ Habitat connectivity
- ✓ Dispersal

Environment Canada. 2013. Management Plan for the Northern Leopard Frog (*Lithobates pipiens*), Western Boreal/Prairie Populations, in Canada. *Species at Risk Act* Management Plan Series. Environment Canada, Ottawa. iii + 28 pp.

Regional population resilience over time

- Local populations in other parts of Manitoba have increased considerably in the last thirty years following extensive die-offs in 1975 and 1976.

- To what extent has river regulation influenced these populations in combination with other factors?
- To what extent does the degradation of riverine riparian marshes and barriers on the rivers affect the ability for this species to rebound in this region?
- Could the habitat conditions be mitigated if the water control system was operated differently?

Nelson River shoreline

Naturally functioning riparian corridor as a VEC

- A naturally functioning riparian corridor of a large river should be considered to be one logical and meaningful “VEC” for a landscape level understanding of what may be required to maintain regional biodiversity over the long term.

- This is especially so for river systems regulated by dams and impoundments.

How does the proposed Keeyask Project overlap with this important landscape feature, and what is its current state?

- The approach taken in the Keeyask EIS uses in part the measure of likely “discernable or detectable effects” to define the study areas.
- Many direct effects are not expected to be detectable outside the hydrological zone of influence.
- However it is not possible to map or understand fragmentation of a corridor in this way.
- This approach cannot and does not capture an understanding of the effects of fragmentation of the northern river systems

How to measure fragmentation?

- Dams and reservoirs are permeable in various ways to some species.
- A river corridor is not the only travel route for all species, however it is likely an important one for many.
- Factors including the characteristics of the species, the patterns of water control and how these affect habitat, and the specific design of the infrastructure will influence the extent to which the river corridor is fragmented.

A question of scale

- Prospects for wetland enhancement and recreation
- The scale of cumulative effects assessment and mitigation effort should be equal to the scale of effects of the hydroelectric system as a whole.

A riparian wetland in Cross Lake on the Nelson River - Influenced by erratic water levels – Sept 2013

Mitigation for Effects on Sturgeon and Cumulative Effects

- The eventual success of fish habitat enhancement at Keeyask to replace lost habitat is not guaranteed
- The sturgeon stocking program will face many challenges in re-building self-sustaining populations
- Conclusion of “no residual effects with high level of confidence” is optimistic
- The species is severely depleted and there is limited mitigation for the effects of existing hydroelectric infrastructure on the Nelson River

Recovery Potential Assessment for Nelson River Lake Sturgeon

- Conservation stocking must not be considered a substitute for other measures to address habitat degradation.

Suggested mitigation measures for habitat degradation or loss from dams and impoundments:

- *Adjust water management operating conditions of dams and impoundments and other barriers for those currently in place and those planned in the future to optimize the survival and recovery of Lake sturgeon, especially during spawning and incubation periods.*
- *Rehabilitate habitat in key areas to mitigate habitat degradation or loss of important habitat (i.e. spawning sites) and improve age-0 and juvenile survival.*
- *Ensure design of new dams and modernization of existing dams does not jeopardize the survival and recovery of Lake Sturgeon (e.g. consider the need for fish passage).*
- *Protect spawning and rearing habitat.* (DFO 2010:12)

Pointe du Bois Spawning Shoal Creation

Pointe du Bois Generating Station on the Winnipeg River

The Keeyask Project will apply lessons learned at Pointe du Bois and at other sites to attempt spawning shoal creation in the tailraces of the new generating station.

There are many physical differences between the two stations that the Keeyask Project will try to address.

This is an important mitigation measure to implement but there is no guarantee of success.

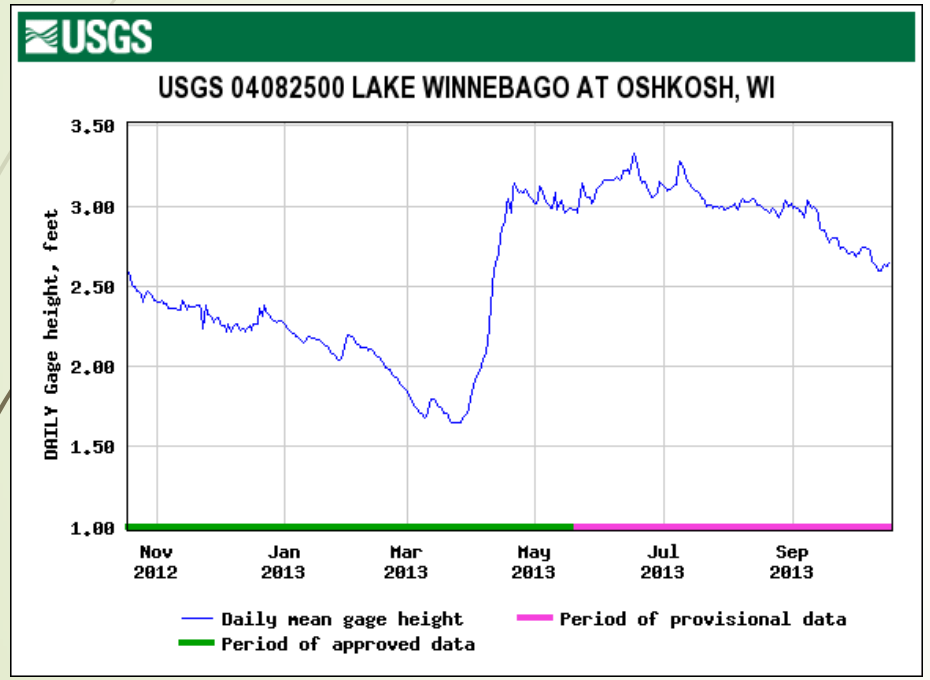
Stocking Programs as a conservation strategy

- *"Stocking as a conservation strategy may be an essential tool required to rehabilitate selected lake sturgeon populations.*
- *A stocking strategy has the potential to have negative impacts on wild populations and should only be applied where a strong biological rationale exists and where other strategies have been deemed unsuitable for achieving management objectives" (Smith 2009).*
- Other strategies could include protection of remaining functioning habitat in the Nelson River

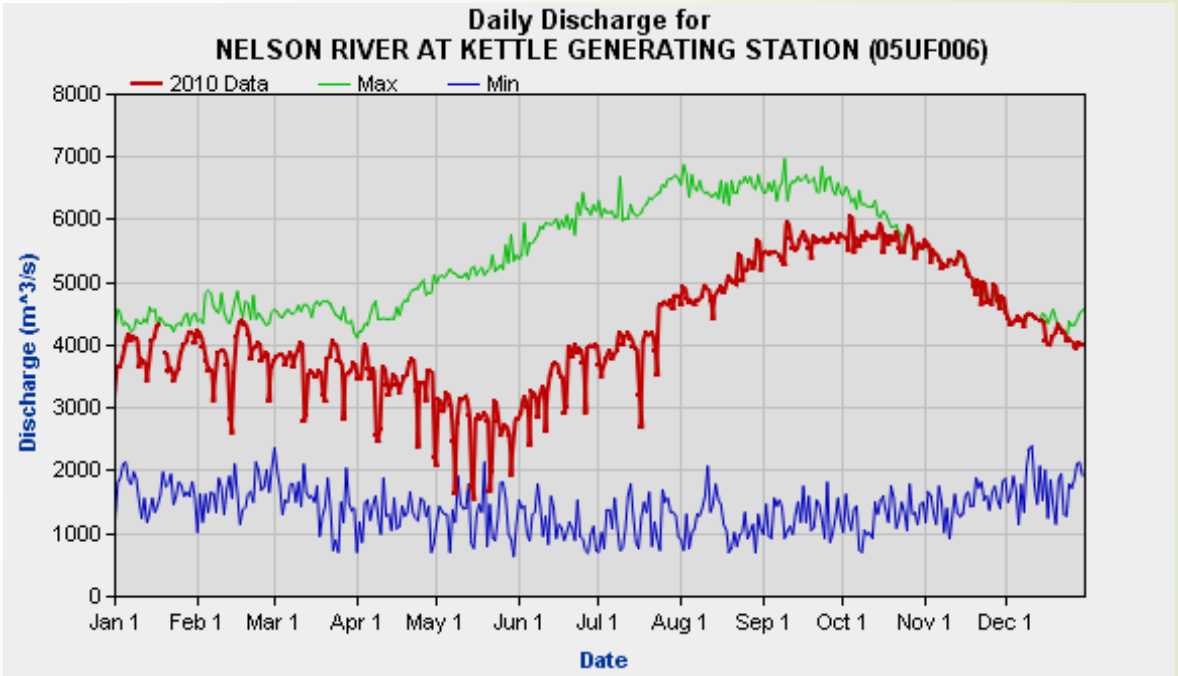
Winnebago Lake System, Wisconsin

- Wisconsin Department of Natural Resources viewed as a model of one of the most progressive stocking programs and is cited as a region where success has been achieved.
- One of the largest self-sustaining wild populations of lake sturgeon in the world.
- The watershed is also home to native shovelnose sturgeon (*Scaphirhynchus platorynchus*)
- Lake Winnebago is controlled by two dams constructed in 1850 and 1930.
- The lake levels are regulated with several objectives:
  - flood control
  - reduction of ice damage to private property
  - release water for hydropower and pollution dilution downstream
  - extend the high water season for boating

Water levels are one parameter of habitat conditions that may affect the life history stages of species such as Lake sturgeon



Daily water level (ft) Nov 2012 – Oct 2013



Daily discharge (m^3/s) Jan 2010 – Dec 2010

*Note that these graphs are not meant to be compared directly as there are several differences in data representation

Reservoir operations and sturgeon recovery

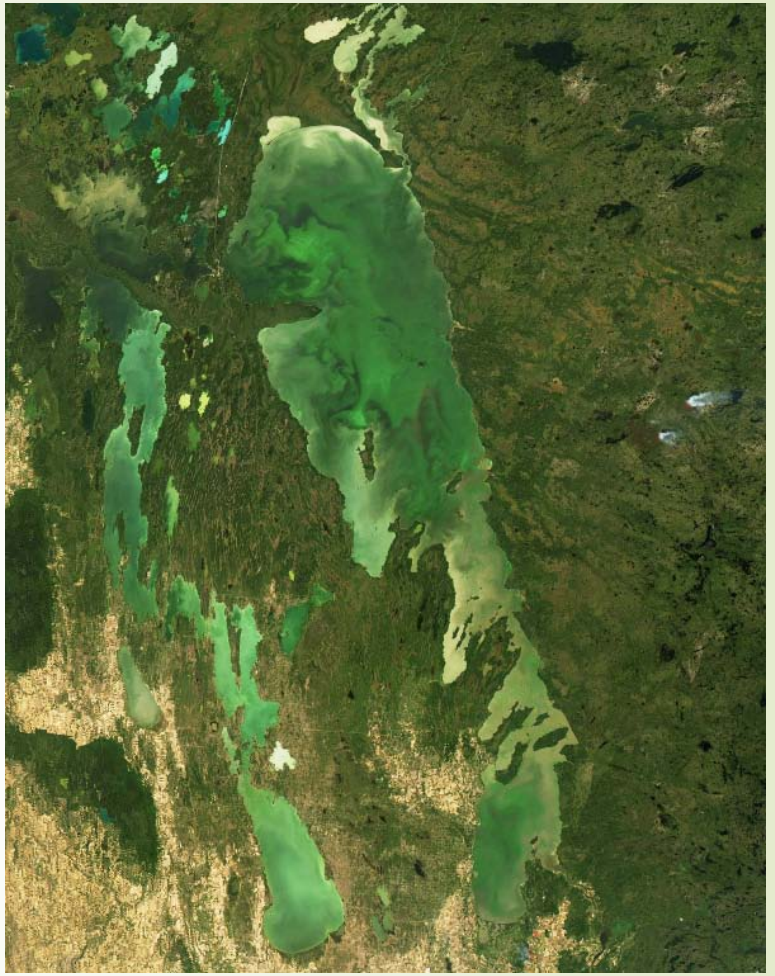
- Although influenced by regulation, Lake Winnebago water levels show a more natural seasonal pattern
- Constant fluctuations within 3m – daily and weekly - in the Stephens reservoir –- and downstream in the Long Spruce reservoir
- Keeyask would fluctuate within a 1m range most of the time with a daily and weekly peaking pattern
- There are many other variables in these river systems
- The extent to which these differences may influence stocking efforts and the ability to establish self-sustaining populations of lake sturgeon in the future with additional loss of spawning and rearing habitat is uncertain

Satellite image of Lake Winnipeg Algae blooms

Changes in levels of turbidity and dissolved oxygen that will be expected in different parts of the Keeyask reservoir, may affect the quality of sturgeon rearing and foraging habitat.

It is possible that future reservoir conditions may also be influenced by changes in water quality in the Nelson River as whole. In Lake Winnipeg eutrophication (excess nutrients leading algae blooms and oxygen depletion among other effects) is increasing.

The extent to which this may be having downstream effects on water quality in the



(Source: Lake Winnipeg Foundation http://www.lakewinnipegfoundation.org/lakewinnipeg/facts)

Great Lakes Sturgeon Recovery - Habitat Enhancement and Stocking

- Sturgeon populations in the Great Lakes are estimated to be about 1% of pre-1850 numbers
- “While recent spawning success in the Detroit River and other traditional spawning habitats is encouraging, recovery cannot be assumed.” (IJC 2012:157)

For Release: Thursday, August 29, 2013

“**DEC's Lake Sturgeon Restoration Efforts Achieving Success”**

- Researchers have captured two wild juvenile sturgeon in two different locations – evidence of reproduction from stocked fish
- First wild sturgeon caught in Oswegatchie River in 30 years

Lake Sturgeon Spawning in upper Nelson River

White pelicans feeding at the tailrace of the Jenpeg Generating station – Sept 2013

- Some spawning is still occurring in the upper Nelson River but recruitment is very low
- Is habitat is a limiting factor or are there simply too few individuals left to repopulate?
- Habitat factors are not well understood but suspected to be important.
- The survival of young of the year is in question.
- The efforts on the sturgeon stocking program in the upper Nelson are important and appear to be making progress. However, many challenges and questions remain
- Little work has been done on addressing habitat loss and degradation in the upper Nelson

Is habitat limiting sturgeon recovery in the upper Nelson River?

- thought that habitat could not be a limiting factor to population growth because some fish are surviving
- some indication that growth rates do not reflect food shortage
- an argument to be made for more analysis of habitat conditions, and opportunities for enhancement in these regulated reaches.

Typical shoreline along upper Nelson River at Sipiwesk

Sturgeon Stocking Program to mitigate effects of Keeyask and other existing hydroelectric development on the Nelson River

Lake sturgeon fingerlings at the rearing facility adjacent to Jenpeg –

September 2013

Sturgeon Stocking Program for Keeyask Mitigation

- A stocking program to attempt to recover sturgeon populations is likely a necessary and prudent conservation initiative
- A 25 year period is proposed along with monitoring to determine whether hatchery raised fish are reproducing in the wild
- At the present time, to what extent can we conclude that stocking will necessarily result in self-sustaining populations, capable of supporting domestic harvest in these reaches, in the long-term?
- There is uncertainty

Sturgeon Recovery in the Upper Nelson River

- long-term effectiveness of sturgeon stocking programs in the upper reaches of the Nelson River?

- increasing local expertise in sturgeon culture, both with spawn collection and rearing at the hatchery

- results of the stocking programs described for the *upper* Nelson River suggest that these initiatives are at a very early stage and have yet to demonstrate that stocking will re-establish self-sustaining populations

Sturgeon fingerling at the Jenpeg rearing facility Sept 2013. Hatched at Grand Rapids facility.

- Additional work must be done to more clearly establish the extent to which habitat is a limiting factor in the recovery of lake sturgeon in the upper Nelson.

Challenges at Grand Rapids Hatchery

- minimum of 15 to 20 years is required to begin to develop a comprehensive assessment that is capable of providing adequate evidence of success of stocking in any particular water body. The upper Nelson stocking program has been carried out since 1995.
- successful rearing has not been accomplished each year
- Lack of collection of spawn from females
- The introduction of the use of hormones to induce spawning in 2011
- Die-off of sturgeon in the hatchery – food? Disease? Improved practices?
- Death of female sturgeon used to collect spawn - 2012 – changed hormones 2013
- A survey conducted by Manitoba Hydro and the Nelson River Sturgeon Board near Sea Falls in this reach in 2012 captured nearly 100 young sturgeon (McDougall and Pisiak 2012).”

Columbia River White Sturgeon Recovery Plan

- *…dam construction, reservoir formation, and flow regulation are considered as primary causes of recruitment failure.*" (Hildebrand and Parsley, 2013:50).
- *"Remaining population segments are primarily restricted to reaches with significant riverine habitat and subpopulations in marginal habitat areas have been lost or consist solely of a few remnant individuals"* (Hildebrand and Parsley, 2013:49).
- *"The original long-term objectives to re-establish natural population age structure, achieve target abundance levels, and restore beneficial uses through self-sustaining recruitment, have not been achieved"* (Hildebrand and Parsley, 2013:iii).

Keeyask EIS conclusions

- Express a high level of confidence that mitigation measures including habitat enhancement and stocking will be successful
- Suggest that sturgeon will be better off with the project than without it because of habitat enhancement and large scale stocking program
- Emphasize that the Project will increase sturgeon populations and the information collected will add to the knowledge in the province

Conclusions Regarding Mitigation Measures for Sturgeon

- There is much uncertainty related to the potential success of stocking and habitat enhancement to prevent further decline of the remaining populations of sturgeon in these reaches
- Weight of evidence suggests that these measures are still at an experimental stage in other regions
- If measures are successful it will be in spite of the Project, not because of it - unless we understand that a financial commitment to mitigation for habitat loss will not be made without Keeyask
- Mitigation for habitat loss in other parts of the river has been limited to date
- The decision must be made whether to risk additional habitat loss for sturgeon given the endangered status of this species in the river at the present time

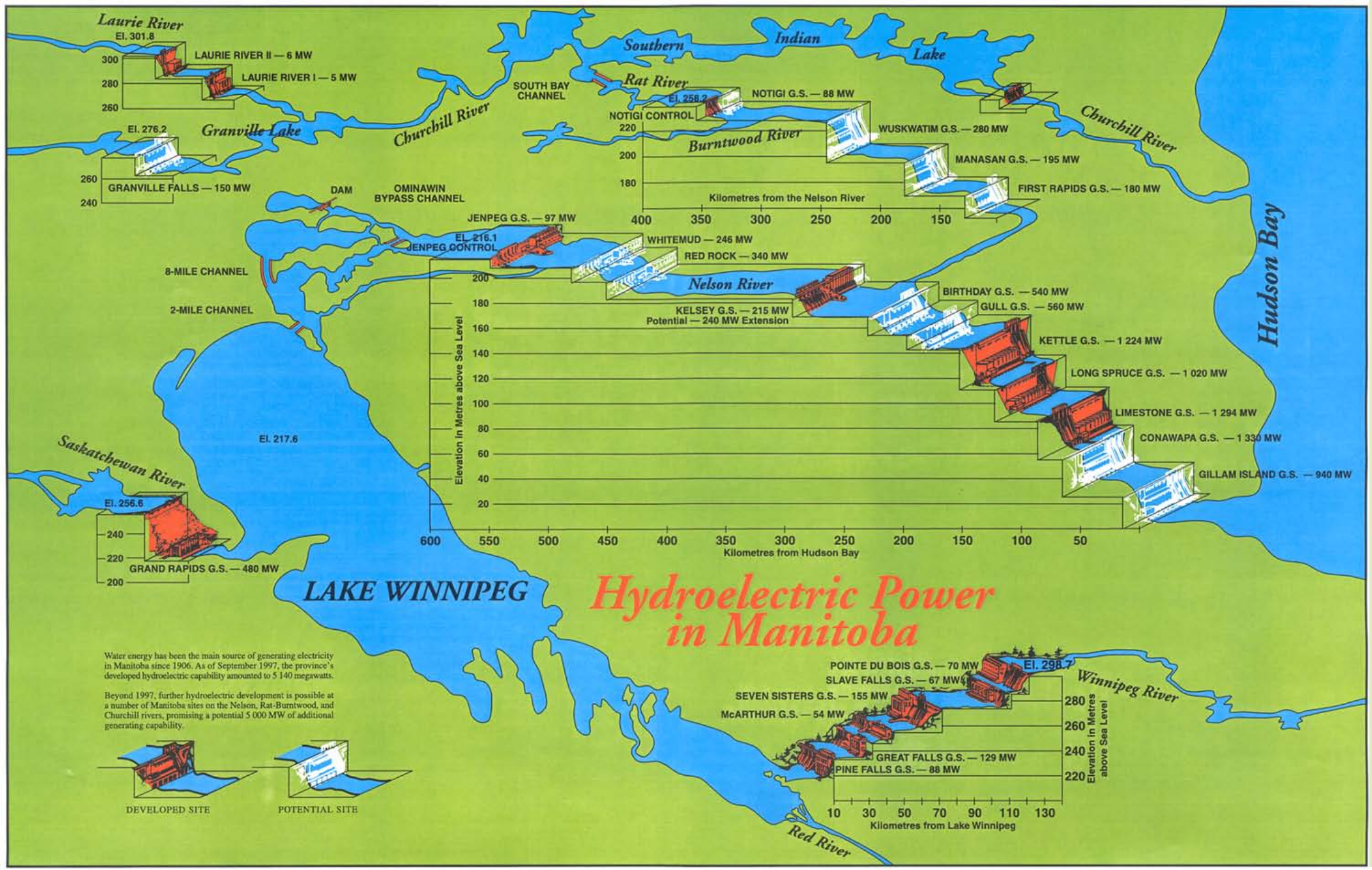
Concerns regarding additional habitat loss for Sturgeon

- Effects of Project on natural recruitment of remaining populations
- Heavy reliance on stocking programs
- Resilience of self-sustaining wild populations of this species over time may be further compromised with additional development
- With each new project, the opportunities for mitigation in the existing environment may become more limited, for ecological and practical reasons.
- The decision must be made whether to risk additional habitat loss for sturgeon given the endangered status of this species in the river at the present time

Cumulative effects of dams and impoundments, climate change, and sustainable development

Gull Lake and Rapids

Proposed Keeyask Generating Station and Spillway


Laurie River
El. 301.8
LAURIE RIVER II — 6 MW
LAURIE RIVER I — 5 MW
300
280
260
El. 276.2
Granville Lake
GRANVILLE FALLS — 150 MW
260
240
Churchill River
SOUTH BAY CHANNEL
Southern Indian Lake
Rat River
El. 258.2
NOTIGI G.S. — 88 MW
NOTIGI CONTROL
220
200
180
Burntwood River
WUSKWATIM G.S. — 280 MW
MANASAN G.S. — 195 MW
FIRST RAPIDS G.S. — 180 MW
Kilometres from the Nelson River
400 350 300 250 200 150
Churchill River
DAM
OMINAWIN BYPASS CHANNEL
JENPEG G.S. — 97 MW
EL. 216.1
JENPEG CONTROL
WHITEMUD — 246 MW
RED ROCK — 340 MW
8-MILE CHANNEL
2-MILE CHANNEL
Nelson River
KELSEY G.S. — 215 MW
Potential — 240 MW Extension
BIRTHDAY G.S. — 540 MW
GULL G.S. — 560 MW
KETTLE G.S. — 1 224 MW
LONG SPRUCE G.S. — 1 020 MW
LIMESTONE G.S. — 1 294 MW
CONAWAPA G.S. — 1 330 MW
GILLAM ISLAND G.S. — 940 MW
Elevation in Metres above Sea Level
200
180
160
140
120
100
80
60
40
20
600 550 500 450 400 350 300 250 200 150 100 50
Kilometres from Hudson Bay
Hudson Bay
El. 217.6
Saskatchewan River
El. 256.6
240
220
200
GRAND RAPIDS G.S. — 480 MW
LAKE WINNIPEG
Hydroelectric Power in Manitoba
Water energy has been the main source of generating electricity in Manitoba since 1906. As of September 1997, the province's developed hydroelectric capability amounted to 5 140 megawatts.
Beyond 1997, further hydroelectric development is possible at a number of Manitoba sites on the Nelson, Rat-Burntwood, and Churchill rivers, promising a potential 5 000 MW of additional generating capability.
DEVELOPED SITE
POTENTIAL SITE
POINTE DU BOIS G.S. — 70 MW
El. 298.7
SLAVE FALLS G.S. — 67 MW
SEVEN SISTERS G.S. — 155 MW
McARTHUR G.S. — 54 MW
GREAT FALLS G.S. — 129 MW
PINE FALLS G.S. — 88 MW
Winnipeg River
280
260
240
220
Elevation in Metres above Sea Level
10 30 50 70 90 110 130
Kilometres from Lake Winnipeg
Red River

Hydroelectric development versus climate change

- Goal 1 of the eight Federal sustainable development goals as discussed in the Keeyask EIS with regards to Climate Change is to: *Reduce greenhouse gas emission levels to mitigate the severity and unavoidable impacts of climate change* (Chapter 6, Section 9.2.2)

Many questions:

- Will there be a net displacement of fossil fuel combustion elsewhere due to the Keeyask Project?
- Could have benefits if this proves to be the case.

- Have we done enough with demand side management?
- Does this outweigh the local and regional effects?

What are some of the feared consequences of climate change?

- Extreme weather events such as drought
- Increased precipitation and severe weather events causing flooding
- Habitat change
- Melting of permafrost
- Invasion of non-native species
- Unpredictability of weather

Extreme weather events such as drought.

Many areas of the Nelson River and Churchill Rivers are permanently or periodically dewatered due to hydroelectric operations.

Jackson Osborne at a beaver lodge high and dry in Jenpeg fore bay – Sept 2013

Increased precipitation and severe weather events causing flooding.

Hydroelectric development causes immediate and long-term flooding and permanent loss of the natural riverine landscape to which native species are adapted.

Southern Sipiwesk Lake 1946

Same area of Sipiwesk Lake in 2013

Habitat change

From the perspective of species conservation, habitat change is one of the most important effects of climate change.

Dams and impoundments cause direct habitat change over large areas – fragmenting the main river corridor

Sipiwesk Lake shore August 2013

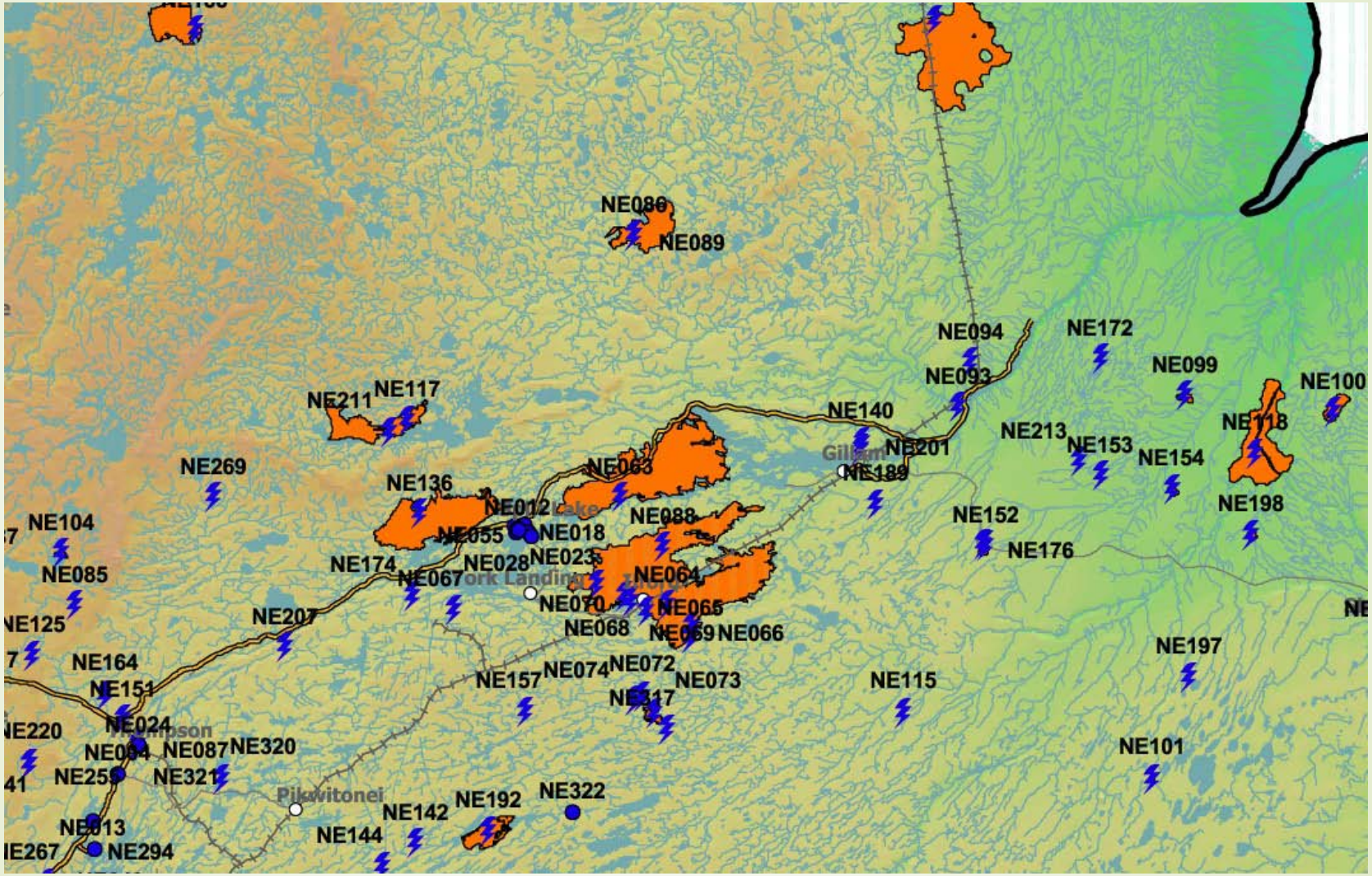
Invasion of non-native species with indirect additional, cascading effects on habitats is another potential effect of climate change.

Has the spread of any invasive species been facilitated by hydroelectric development along the Nelson River?

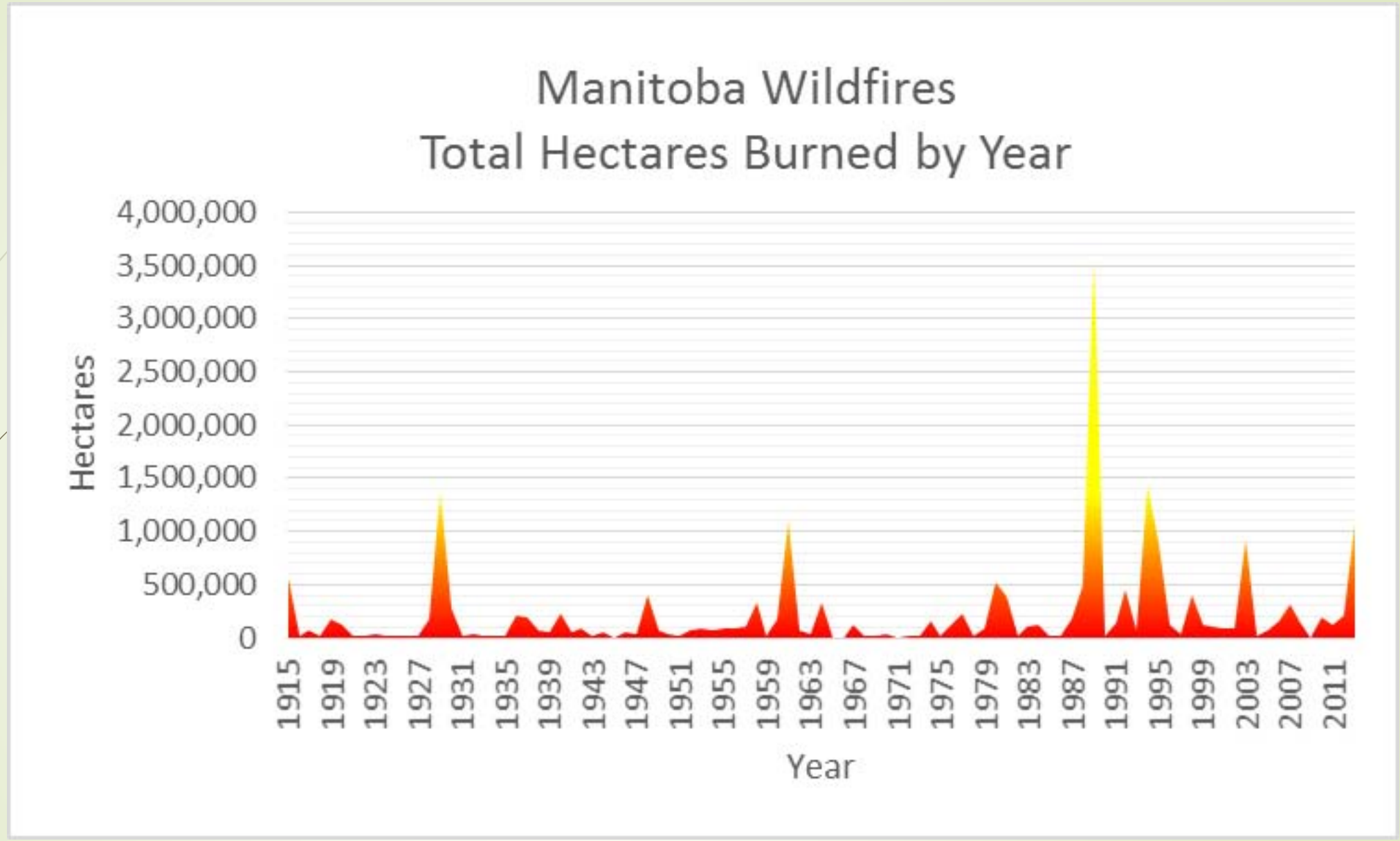
Common Carp in Cross Lake

June 1013

Fires in Keeyask Area 2013 ~1831 km^2

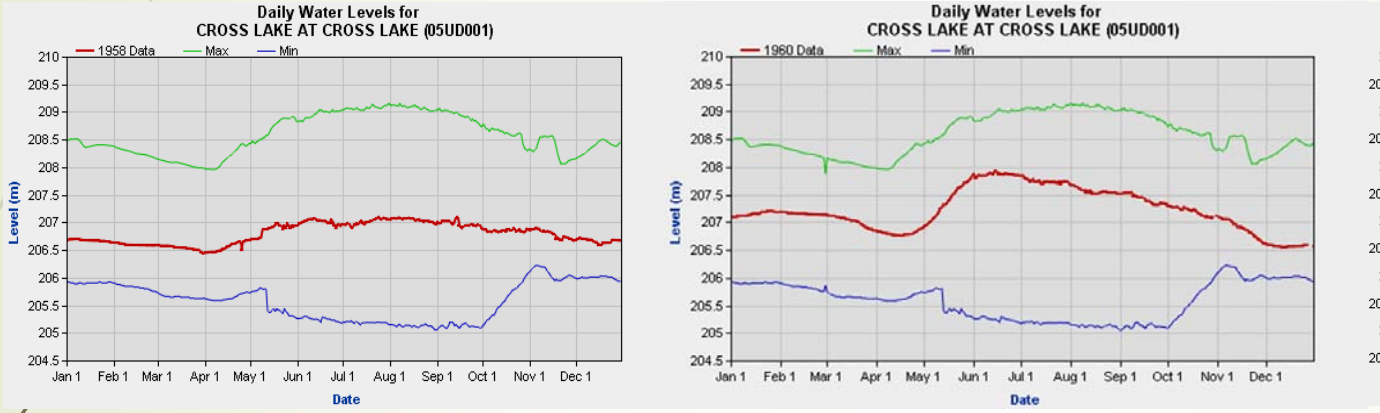


Data Source: Manitoba Conservation http://www.gov.mb.ca/conservation/fire/Fire-Maps/



Data Source: Manitoba Conservation http://www.gov.mb.ca/conservation/fire/Fire-Maps/

Unpredictability -
Water level fluctuations in the Nelson River at Cross Lake



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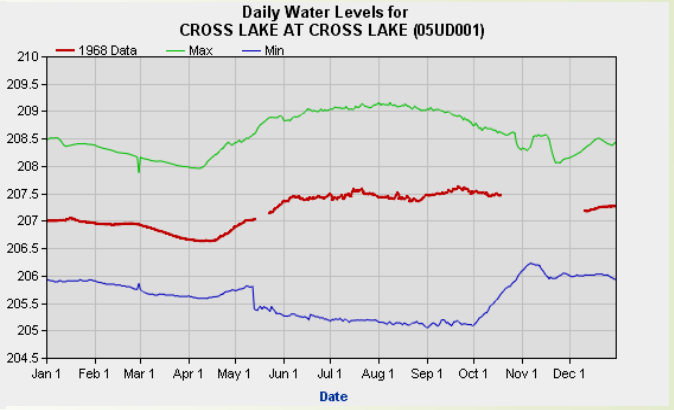

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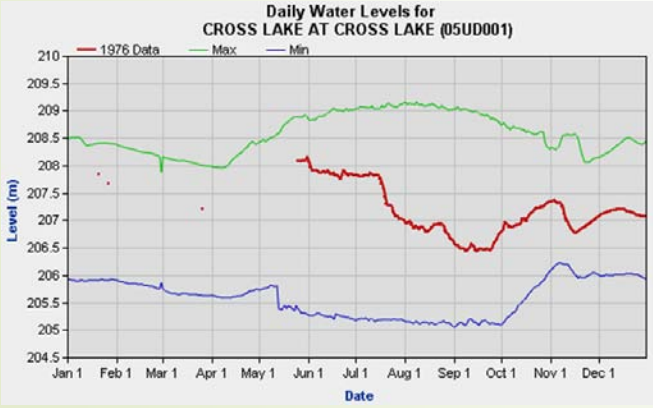

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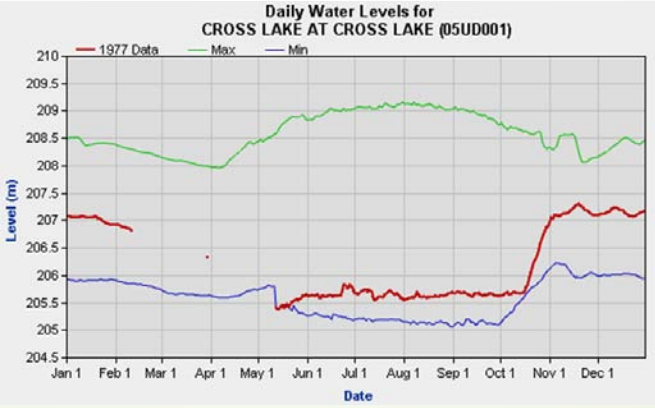

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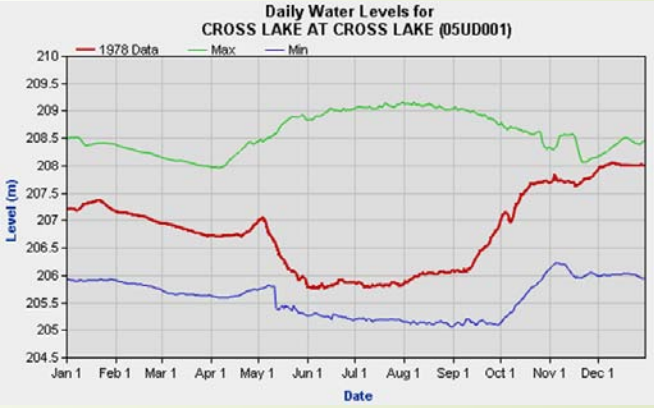
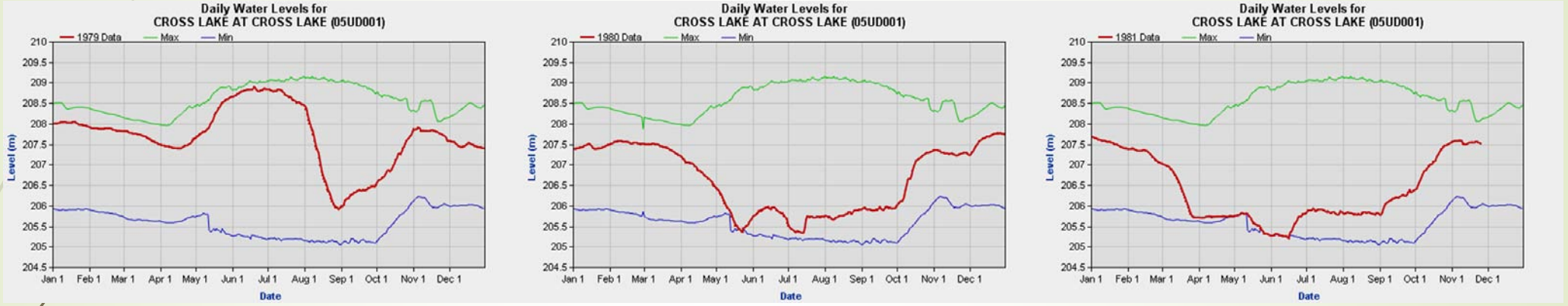
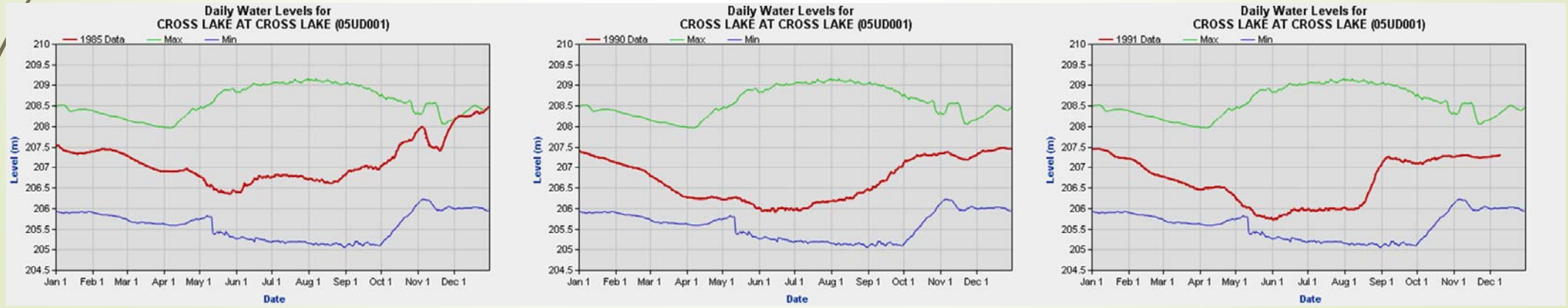


1978

Unpredictability -
Water level fluctuations in the Nelson River at Cross Lake cont'



1979 1980 1981



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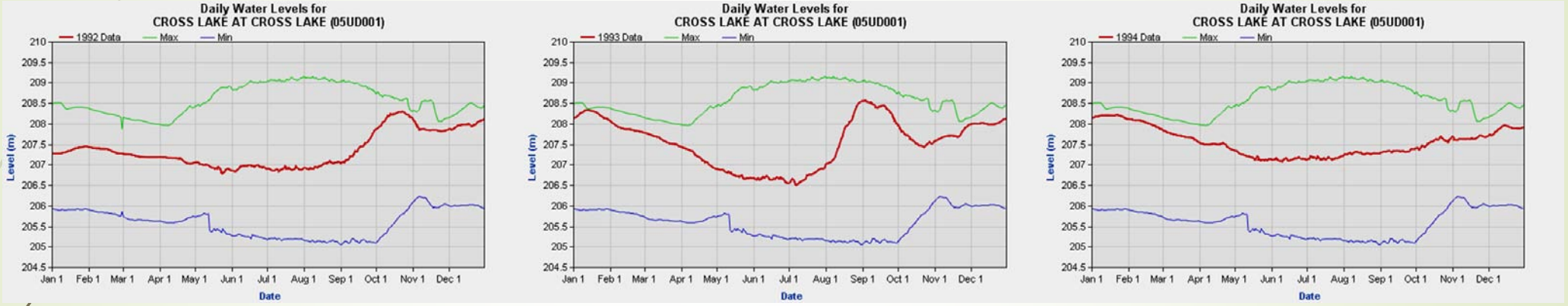
Unpredictability -
Water level fluctuations in the Nelson River at Cross Lake cont'



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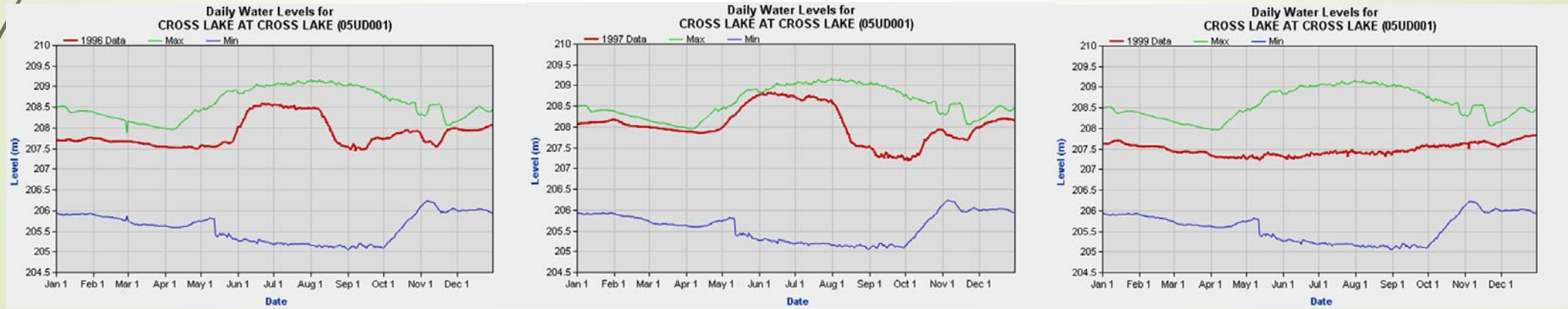

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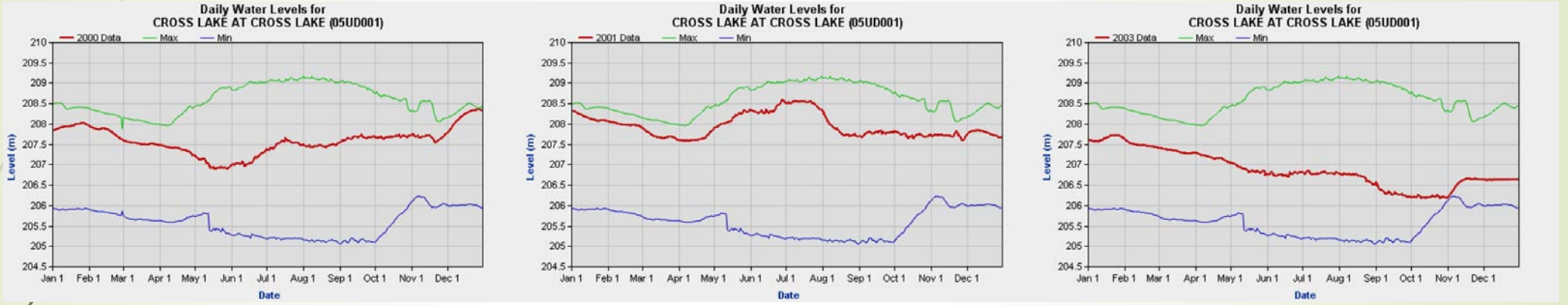
1999

Unpredictability -
Water level fluctuations in the Nelson River at Cross Lake cont'



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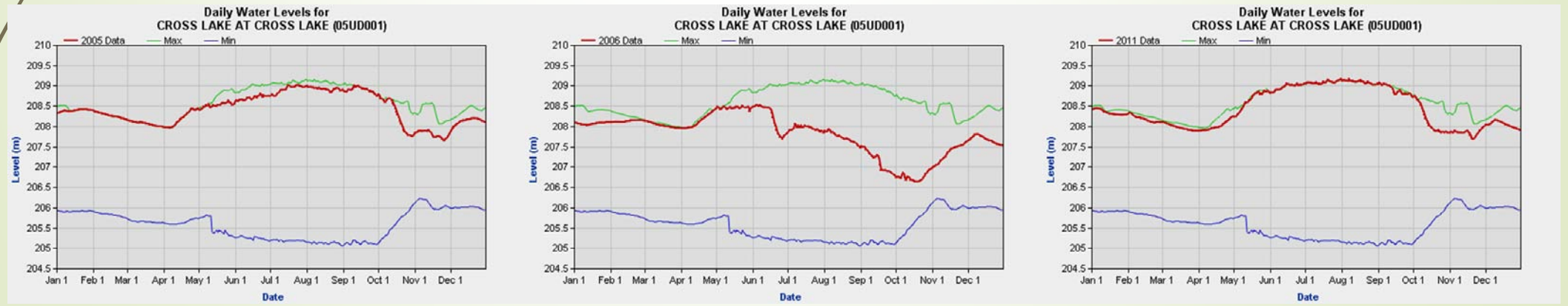


2005 2006 2011

System Effects due to Keeyask?

- “The changes in water levels associated with the addition of Keeyask are not expected to be discernable in the context of existing water level variations in the water bodies downstream of Lake Winnipeg”

- What does this mean?
- Already significant variability and unpredictability from season to season and year to year

Reservoir Operations and Sustainable Development

- Water level constraints within existing licences for Nelson River hydro infrastructure are primarily maximum and minimum levels in reservoirs, or flows below control structures, and restrictions on rates of change permitted. There do not appear to be many stipulations for water control that relate to seasonal ecosystem needs.
- These may be simply too inconsistent with power generation goals.
- Within these constraints, reservoirs are primarily operated to maximize energy revenue. The reservoir optimization scheme currently employed is not designed specifically to seek flow regimes that maximize ecosystem health.

Reservoir Operations and Sustainable Development

- Find a balance that would meet society's needs for water and power while better protecting the long-term health of the river ecosystem as a whole

(Richter and Thomas 2007, Jager and Smith 2008)

Marsh separated from the main stem of the Nelson by small dykes – Cross Lake 2013

Optimization studies that include environmental goals throughout the river system: - - potential for adjusting reservoir levels to provide periodic spring flooding

- explore seasonal flow patterns in downstream affected reaches to consider flows that may improve shoreline vegetation structure, or aquatic ecosystem

Hydropower Sustainability Assessment Protocol

- *"... freshwater fish move within river systems such as up tributary streams to spawn. Depending on their location, dams can present barriers to these species for migration in both upstream and downstream directions. As well as creating direct physical barriers, flow and water quality characteristics of the natural river regime may act as migratory cues. Whilst hydroelectric schemes can block passage of native or commercial fish, they can also facilitate passage of pest species into uninfested waterways through water transfers around the system."* (International Hydropower Association 2011)

The incremental effects of multiple dams and impoundments on aquatic environment can be better understood if the context of inquiry is not limited to the reaches of the river immediately affected by a new project.

Even if data are limited, the scope of the assessment should endeavour to include the wider watershed.

Hydropower Sustainability Assessment Protocol

- An additional large scale hydroelectric development on the Nelson River, with little additional habitat mitigation in other reaches of the river, should be seen to represent a compromise from the perspective of ecological health.
- If the energy and this specific type of economic development are necessary
- … as opposed to a model of sustainable development as suggested in the Keeyask EIS.

Cumulative Effects Assessment of Sequential Hydroelectric Development along Rivers

- Many environmental assessments of large hydroelectric projects in Canada are failing to adequately consider the incremental degradation of large river systems converted into stepped series of dams and impoundments.
- What proportion of a river system is acceptable to dedicate to hydroelectric production?
- Will the Keeyask project increase the economic incentive to manage the river primarily for hydroelectric production?
- Will it further restrict the opportunities to manage flows for ecological and cultural values?
- Options will be constrained by the economics of the projects, but the costs of hydroelectricity should reflect more clearly the ecological costs of its generation.

Science and the “Cree World View”

- Science itself is not a world view; rather it is a methodology
- Differences of opinion can occur from variable experience, observation, scientific methodology, and beliefs. They can also occur because of differences in values, whether we are asking all the questions that are important to us
- Conflict between economic growth imperative and a traditional world view of seeking to protect the land in as natural a state as possible
- Some concepts in the ecological sciences such as landscape ecology attempts to ask some of the broader questions that are of interest to the Peoples who know northern Manitoba as their homeland and are concerned with caring for the natural world the way it was before industrial development.
- It may offer some additional common ground for people to work together to understand the implications of building another dam on this river.

Conclusions

The geographical and temporal scope of cumulative effects assessment is too limited to be meaningful for several ecological questions.

- We need to identify some areas of focus for a broader assessment
- Consider the river corridor as an ecological and cultural landscape feature
- Consider the natural hydrological regime as a VEC and an indicator of ecological change in the river basin

- Would meet the spirit and intent of cumulative effects assessment of a river regulation project within the regulatory requirements.
- Would also better address some of the questions raised by Pimicikamak.

Conclusions

The assessment of “no significant effects” on Lake Sturgeon based on proposed mitigation measures must be viewed as speculative.

- This is not to say that there is not promise in the proposals, or that they should not be implemented if the Project is approved.
- It is simply that the known risks of further habitat loss for this endangered species are more certain.
- The mitigation measures proposed face several challenges and may not succeed as planned.

Conclusions

Climate change benefits of hydroelectricity

- Some of the effects of large-scale hydroelectric development are similar in nature, but more immediate and severe on the riverine ecological and cultural landscape than the regional effects of climate change.
- Effects are more strongly born by the people living along the river, and the benefits are not equally shared.
- These factors must be taken into consideration when assessing the environmental effects of a new hydroelectric project, compared to alternatives, in the context of climate change and sustainable development objectives.

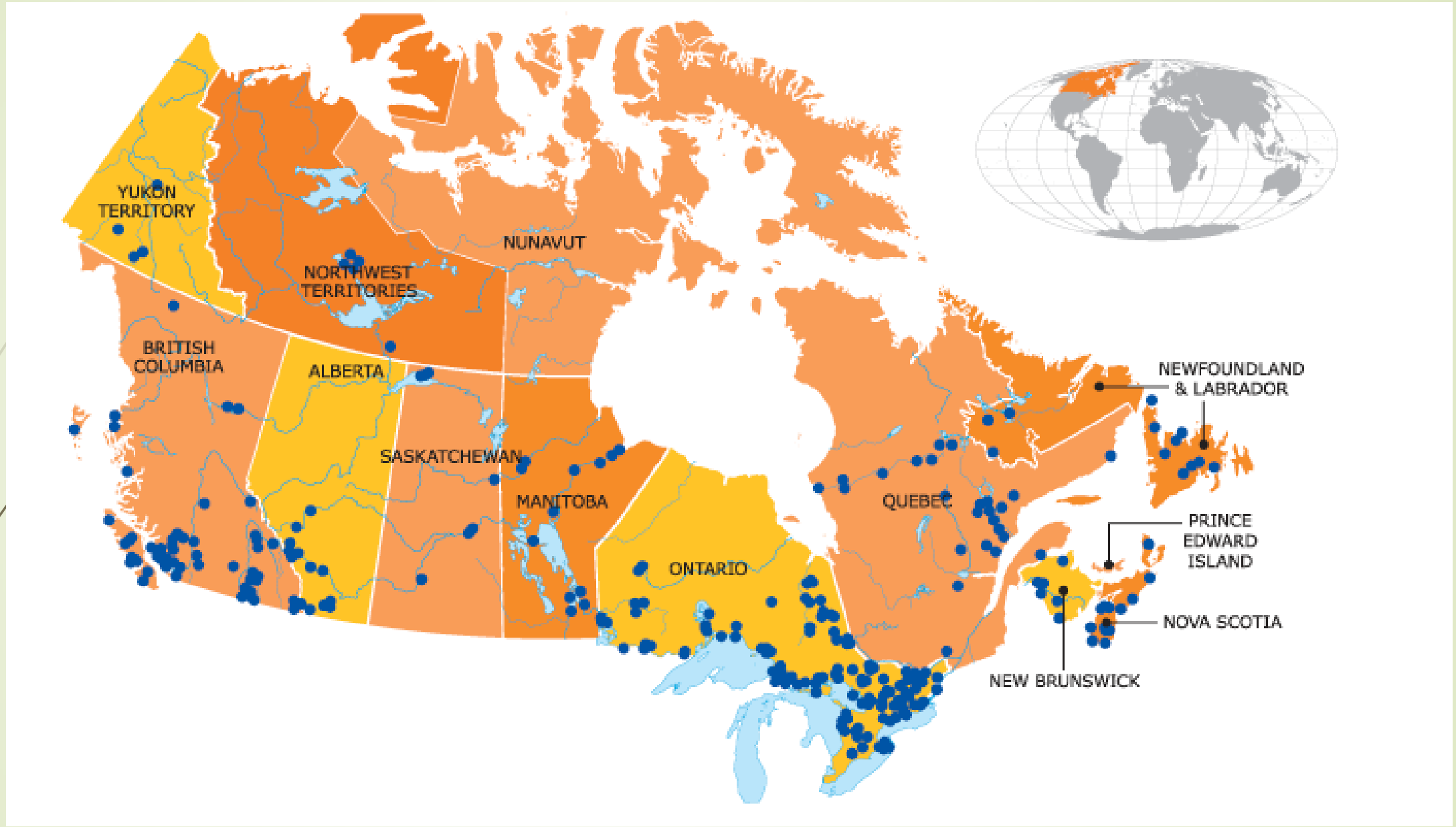
EIS should clearly acknowledge in its conclusions that ...

- There are adverse environmental and sociocultural effects directly associated with an expanding hydroelectric system in northern Manitoba.
- The geographical and temporal scope of these adverse effects is extensive.
- The various components of the system are interdependent physically, ecologically and financially.
- Large-scale hydroelectric development should not be described and marketed as simply “clean and cheap” power. It represents many significant compromises in exchange for economic activity, centralised energy production, and reduced GHG production relative only to fossil fuel generation, but not necessarily relative to other forms of smaller scale, decentralised production or energy conservation and efficiency.
- The costs are not born equally by different geographical and cultural groups.

Regional Cumulative Effects Assessment

- The province should initiate an independent comprehensive regional cumulative effects assessment
- Begin with a thorough review and interpretation of existing knowledge and data
- Develop research questions in close collaboration with affected Aboriginal Peoples

Duck Lake and Rapids, Nelson River 1946



Large hydroelectric generating stations in Canada