Exhibit CAC# 45-8

CAC Manitoba: Book of Documents
NFAT Review

Tab	Document
1	Joint Keeyask Development Agreement, (May 29, 2009) p. 108-109
2	Keeyask Hydro power Limited Partnership, *Response to EIS Guidelines*, June 2012 p. 4-46
3	Keeyask Hydro power Limited Partnership, *Keeyask Generation Project: Environmental Impact Statement – Socio-Economic Environment, Resource Use and Heritage Resources* (June 2012) p. 3-53 to 3-55, 3-86 to 3-106, 3-114 to 3-121
4	Public Utilities Board, *NFAT Review Transcript,* March 13, 2014 p. 2301, 2393, 2395
5	Clean Environment Commission, *Report on Bipole III Transmission Project* (June 2013) p. 126
6	Conservation and Water Stewardship, Letter to Shannon Johnson from Gord Mackintosh, August 14, 2013
7	Fisheries and Oceans Canada, *Recovery Potential Assessment of Lake Sturgeon: Nelson River Populations (Designatable Unit 3),* (November 2010)
8	G & P Resource Services Inc. *Review of Keeyask Partnership - Human Health Risk Assessment Associated with Mercury in Fish*, Presentation: November 26, 2013 Slide 22, 26, 35
9	Clean Environment Commission, *Keeyask Hearing Transcript*, October 21, 2013 p. 155
10	Clean Environment Commission, *Keeyask Hearing Transcript*, October 21, 2013 p. 170
11	Table: Total Person Years of Employment - Wuskwatim

TAB 1

JOINT KEEYASK DEVELOPMENT AGREEMENT

between

TATASKWEYAK CREE NATION and WAR LAKE FIRST NATION operating as CREE NATION PARTNERS,

- and -

YORK FACTORY FIRST NATION,

- and -

FOX LAKE CREE NATION,

- and -

THE MANITOBA HYDRO-ELECTRIC BOARD.

DATED MAY 29, 2009.

12.6 CONSTRUCTION EMPLOYMENT

Mechanisms to Enhance Construction Employment

12.6.1 The **Training Initiative** described in section 12.1, the **BNA** provisions and the **Proposed Letter of Agreement** described in section 12.2, the job placement and referral provisions described in section 12.3, the special tender conditions described in section 12.4, the **Advisory Group on Employment** described in section 12.5, the commitments regarding business opportunities during construction of the **Keeyask Project**, including the **Employment Retention Contract** and the **Direct Negotiation Contracts** described in Article 13, and the transition funding described in section 17.1 and implementation funding described in section 17.2, are all mechanisms aimed at increasing the numbers of **Members** employed in the construction of the **Keeyask Project** and achieving the construction employment target set out in subsection 12.6.2.

Construction Employment Target

12.6.2 A total of six hundred and thirty (630) person-years of employment is a target agreed upon by the **Parties** for the employment of **Members** of the **Keeyask Cree Nations** on the **Keeyask Project**.

Measurement of Employment

12.6.3 The **Limited Partnership** shall measure whether the target set forth in subsection 12.6.2 has been met and shall share the results of such measurement with the **Keeyask Cree Nations** and with **Hydro.** The **Parties** agree that for the purposes of measuring whether the target set forth in subsection 12.6.2 has been met:

(a) employment of **Members** in jobs related to the **Keeyask Project** commencing after the **Date of this JKDA** and prior to the **Final Completion Date** will be counted as employment on the **Keeyask Project** including jobs:

(i) with any contractor, sub-contractor or material or equipment supplier on, or in relation to, the **Keeyask Project**;

(ii) on **Direct Negotiation Contracts**;

(iii) with the **Project Manager**;

(iv) with **Hydro** in a capacity other than as **Project Manager**, excluding **Operational Jobs**; and,

(v) funded by transition funding described in section 17.1 or implementation funding described in section 17.2;

(b) with respect to any job:

(i) under a **Direct Negotiation Contract**; or

(ii) of the type referenced in clause 12.6.3 (a), other than a job under a **Direct Negotiation Contract,** where the request for employment by the job placement and referral services contractor was for a duration of thirty (30) days or greater;

each **Member** employed in any such job for one (1) day or more, but thirty (30) days or less, in each consecutive thirty (30) day period, will be considered to have been employed for a month, and each such month of employment shall count towards the calculation of a person-year of employment;

(c) with respect to any job of the type referenced in clause 12.6.3 (a), other than a job under a **Direct Negotiation Contract**, where the request for employment by the job placement and referral services contractor was for a duration of less than thirty (30) days, each **Member** employed in any such job for one (1) day or more, but fifteen (15) days or less, in each consecutive fifteen (15) day period, will be considered to have been employed for one half (1/2) of one (1) month, and any two (2) of such half (1/2) months shall count as one (1) month of employment towards the calculation of a person-year of employment; and

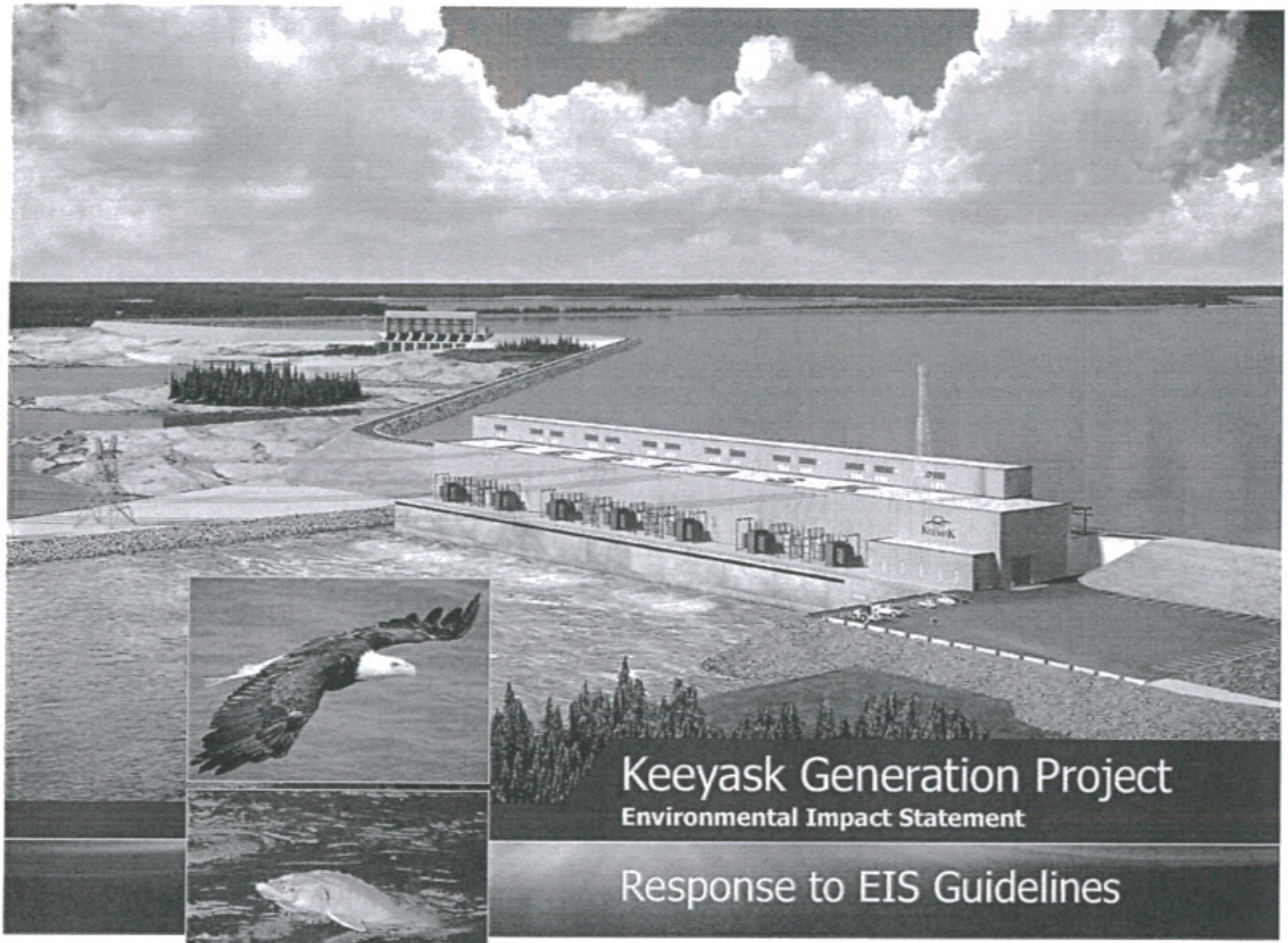
(d) one (1) person-year of employment on the **Keeyask Project** shall be calculated as any twelve (12) individual months of employment by one (1) or more **Members** in accordance with clauses 12.6.3(b) and (c), regardless of whether such months of employment by such **Member** are consecutive or not and are in the same job or in different jobs.

Enhancements to Operational Jobs Efforts if Target Not Met

12.6.4 If on the **Final Closing Date** it is determined that the employment target of six hundred and thirty (630) person-years of employment for **Members** of the **Keeyask Cree Nations** on the **Keeyask Project** has not been met for any reason, the **Parties** agree that the **Limited Partnership** will contribute up to an additional three million ($3,000,000) dollars, adjusted for inflation by the cumulative percentage change in the Consumer Price Index for Manitoba, using 2007 as the base year, of funding for the **Working Groups on Operational Jobs** pursuant to subsection 12.7.5 of this **JKDA**, determined on the following basis:

(a) if the employment of **Members** is greater than four hundred and ninety-nine (499) person-years of employment but less than six hundred and thirty (630) person-years, then the amount to be contributed will be one million ($1,000,000) dollars;

TAB 2



Keeyask Generation Project

Environmental Impact Statement

Response to EIS Guidelines

KEEYASK

Hydropower Limited Partnership

June 2012

Table 4-6: Construction Workforce Requirements by Job Category

Job Category	Person-Years	Percent of Total
Designated Trades	1,346	32%
Non-Designated Trades	952	23%
Construction Support	852	20%
Manitoba Hydro and Contractor Supervisory	1,068	25%
TOTAL	4,218	100%

Source: Derived from data provided by Manitoba Hydro, 2010.

4.6.17.4.2 CONSTRUCTION PHASE ESTIMATED GROSS EMPLOYMENT INCOME ANALYSIS

Table 4-7 provides a summary of estimated gross employment income that would accrue to KCNs, CBN and Northern Region workers during the construction phase. These estimates are provided for all contracts (DNCs and TCs) and have been presented for two scenarios: high and low wage ranges. Methodological details regarding these wage ranges are provided in Section 3 of the SE SV.

Table 4-7: Construction Phase Estimated Gross Employment Income Earned

	Gross Employment Income (in millions of dollars)	
	High Employment Estimates	Low Employment Estimates
KCNs	$62.2	$21.6
CBN Region (includes the KCN)	$127.8	$36.3
Northern Region (includes the CBN)	$180.1	$48.5

Sources:

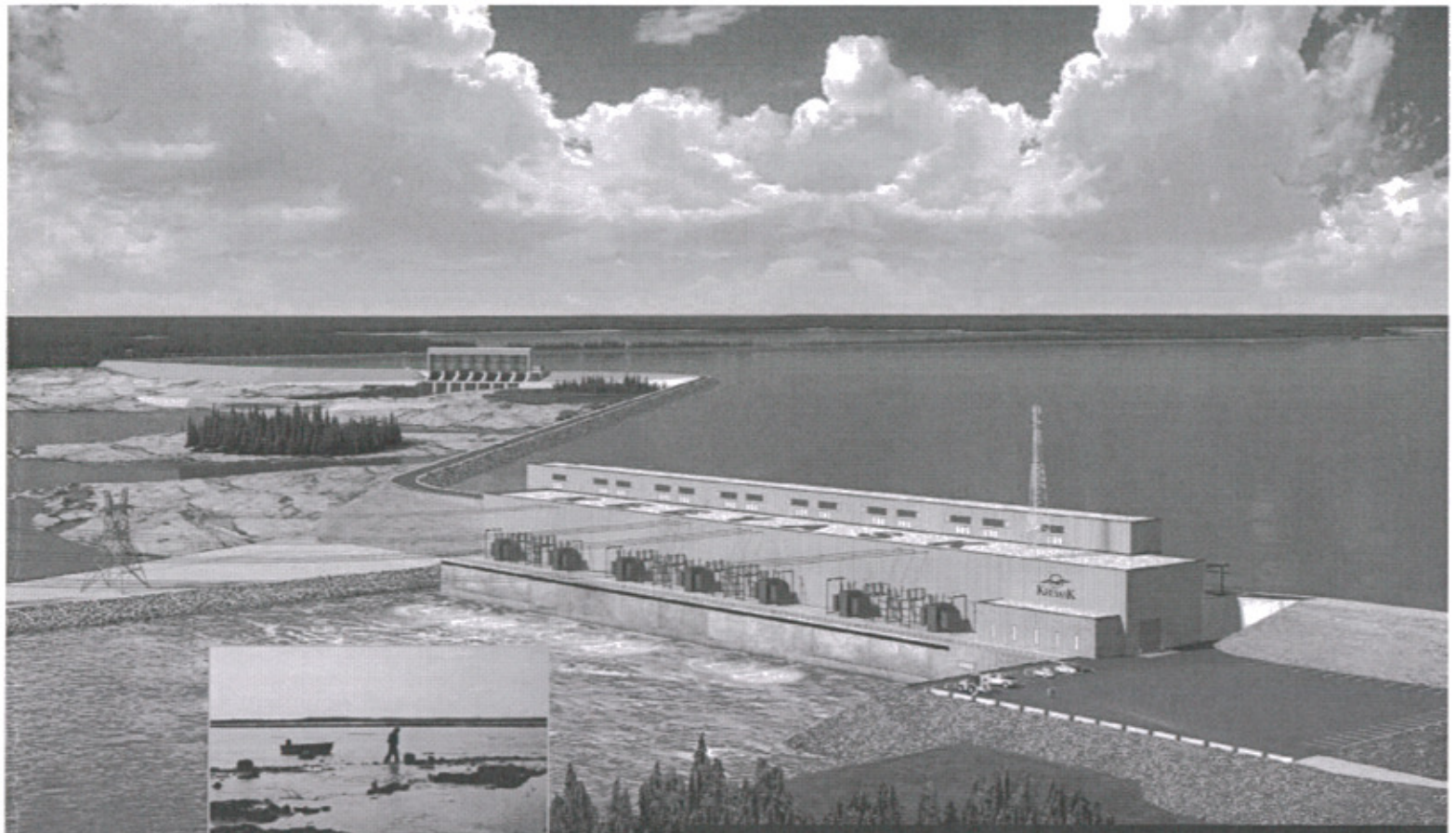
- Workforce estimates provided by Manitoba Hydro, 2010.
- Wage rates derived from BNA (Hydro Projects Management and Allied Hydro Council of Manitoba 2009).
- Analysis prepared by InterGroup Consultants Ltd., 2012.

Notes: Numbers are subject to rounding. Actual results will vary from estimates provided here.

4.7 PROJECT OPERATION

Manitoba Hydro will be contracted by the Partnership to operate the Project once construction is completed. The Project will operate as part of the Manitoba Hydro hydraulic system within the constraints of licenses granted for its facilities, including those for the

TAB 3



Keeyask Generation Project

Environmental Impact Statement

Supporting Volume

Socio-Economic Environment, Resource Use and Heritage Resources

KEEYASK

Hydropower Limited Partnership

June 2012

3.3.2.1 Keeyask Cree Nations

Aboriginal businesses (including those owned by the KCNs communities) are eligible to obtain Project construction contracts through Manitoba Hydro's Northern Procurement Policy. Under this policy First Nation-owned businesses, Aboriginally-owned businesses and/or joint ventures may obtain contracts for work near their communities, or in the broader Regional Study Area.

KCNs businesses that could potentially participate in Keeyask-related contracts include the following:

- Amisk Construction – This joint venture is between CNPLP #2, a Limited Partnership owned by the CNP communities (TCN and WLFN), and Sigfusson Northern Ltd. They indicate capacity to undertake site preparation and camp maintenance, clearing and construction of access roads and reservoir clearing.
- Ininew Limited Partnership – This partnership is based in Winnipeg and provides project management services in civil engineering and architecture, as well as community planning services. Ininew is owned and operated jointly by the Mosakahiken Cree Nation and TCN. The parthernship has been engaged in numerous projects in First Nation communities throughout Manitoba and has participated in environmental site assessments with Manitoba Hydro (Ininew 2010; updated by CNP June 2012).
- TC Building Materials Limited Partnership – This partnership is owned by TCN and is headquartered in Winnipeg. It provides building supplies and constructs buildings, including houses and ready-to-move houses for First Nations and other clients. Services include architecture, drafting and engineering services. Specific projects that TC Building Materials has been engaged in include an addition to the construction camp at the Kelsey generating station, modular housing units in Split Lake and construction of housing and buildings for the RCMP and Manitoba Infrastructure and Transportation.
- War Lake Construction – This company is operated by WLFN and is CORE certified. War Lake Construction has been active in the past few years building a road from Ilford to War Lake and contracting with the Provincial Government to build the winter road.
- Tataskweyak Construction Limited Partnership – This partnership is owned by TCN and is located in Split Lake. It provides services to businesses and government, including road building and maintenance, water and sewer, soil remediation, dyke construction, snow removal and house construction.
- United Cree Construction Joint Venture – This joint venture represents a business arrangement between TCN and the James Bay Cree and is associated with the Cree Construction and Development Company based in Québec. It undertook riprap work for Manitoba Hydro on the shorelines at Split Lake and built the local church.
- ESS-TCS Limited Partnership– This is a joint venture between TCN and ESS (part of Compass Group Canada) that provides camp services. ESS-TCS undertook a contract at the Project site.

- Iron North Limited Partnership– a 100% TCN owned business involved in the purchase and leasing of heavy construction equipment to contractors.
- Keeyask Emergency Medical Services Joint Venture- This is a joint venture between CNPLP # 3, a Limited Partnership owned by the CNP communities (TCN and WLFN), and Criti Care EMS Inc., an emergency medical services provider, formed to provide these services at the Keeyask construction site.
- Keeyask Maintenance Services Joint Venture- This is a joint venture between CNPLP #3, a Limited Partnership owned by the CNP communities (TCN and WLFN) and Newton Mechanical Inc. formed to provide camp maintenance services for Keeyask camps.
- Aboriginal Strategies Limited Partnership (ASI) – This is 80% owned by the TCN Trust and 20% owner by TCN. ASI is a financial management company providing a wide range of professional services; and has the capability of supplying services to Manitoba Hydro and the joint venture companies that are involved in Keeyask DNCs. ASI provides services in the following areas: accounting and financial advice; accountability assessments; on-site training; system analysis and computer installations; business evaluations; First Nation taxation issues and others.
- Northstream Communications Limited Partnership– a TCN-owned internet service provider serving TCN and WLFN. It could potentially provide internet services to Keeyask construction camps.
- Keewatin Railway Company Limited (KRC) – jointly owned by WLFN, TCN, and Mathias Colomb Cree Nation. This railway runs between The Pas and Pukatawagan. KRC provides the full range of track maintenance services, including gauging and ballast, to Manitoba Hydro at Kelsey and the Laurie River generating stations, to the Hudson Bay Railway and to Vale at Thompson. It is available to provide services for the Keeyask and Conawapa projects.
- Tataskweyak Gas Bar – providing local retail gasoline services to TCN and as a supplier to Penner Oil, TGB could provide gasoline and diesel fuel to construction companies and workers.
- FLCN partnership with Sodexo – FLCN has entered a partnership to operate the Mile 326 restaurant (formerly the Aurora Gardens restaurant). This partnership has also been contracted to operate the Conawapa camp.
- FLCN/Smook Contractors – Memorandum of Understanding to form a joint venture for construction activities.
- FLCN/Kleysen Transportation – Memorandum of Understanding to form a joint venture for transportation and materials management.
- FLCN/Multicrete – Memorandum of Understanding form a joint venture for concrete supply and batch plant.
- FLCN/Stefan Homes – Joint venture in relation to construction of buildings.

- FLCN – Has a Memorandum of Understanding with Hartman Construction based in Ashern, Manitoba to bid on contracts related to construction and heavy equipment operation (FLCN KPI Program 2009-2010).
- Fox Lake Contracting – Currently employs eight to ten FLCN Members on a seasonal basis to clear logs and debris along dykes and waterways (FLCN KPI Program 2008-2010).
- YFFN partnership with Sodexo – York Factory First Nation has an existing partnership for camp services at the Kelsey generating station and has used this arrangement as a means of training YFFN Members. YFFN is currently exploring options for taking over management of catering services at the Kelsey Generating Station (YFFN KPI Program 2009-2010).

In addition to the construction-related entities noted above, there are also establishments attached to the KCNs communities that provide accommodations. These hotels have the capacity to cater to visiting consultants and specialists, government employees, contractors and others:

- TCN Kistepinanek Hotel is located in Split Lake and is owned by TCN. It is a 14-unit hotel with a 32-seat restaurant that provides catering services for construction crews carrying out work near the community. This could provide accommodation for Project-related workers if needed.
- TCN ows the Wawatay Inn (a guest housing facility for First Nations patients and families in Thompson).
- WLFN has a two bedroom lodge that can be rented by visitors, and a trailer that can accommodate up to six people. In addition, the former Awasis Learning Centre is available for meeting space and accommodations for up to 15 people. This facility is equipped with a commercial kitchen.
- WLFN has plans to expand the Mooseocoot Convenience Store and Gas Bar to include a motel to accommodate visitors.
- York Landing Hotel is located in York Landing (*Kawechiwasik*) and is owned by YFFN. It provides accommodations and some meal services to construction workers and visiting consultants.

The availability of retail and grocery services varies among the KCNs communities, as in the case of other types of establishments. Split Lake is serviced by a Northern Store and the Tataskweyak Gas Bar, and WLFN recently opened the Mooseocoot Convenience Store and Gas Bar.FLCN has periodically operated the Fox Lake Groceteria located in Fox Lake (Bird). Fox Lake Lumber and Hardware is located in Gillam. YFFN owns and operates the Ripple River Store in York Landing (*Kawechiwasik*).

In terms of business development, the KCNs communities are engaged in the North Central Development Board (two Members from each community) that operates under the umbrella of Aboriginal Business Canada and Western Economic Diversification Canada to assist new entrepreneurs and community corporations with start up. The entrepreneurs may work with Aboriginal Business Canada to build competitive, sustainable businesses, with the provision of financial incentives for those who are eligible (North Central Development 2010).

3.4.1.2 Construction Employment Opportunities

Employment opportunities represent direct and indirect benefits associated with construction projects, particularly in the vicinity of communities where unemployment is typically high. The intent of this discussion is to characterize potential employment outcomes within the context of training opportunities in the north (for example, the HNTEI). Key considerations include the type of positions available (including required skills and experience) and their duration.

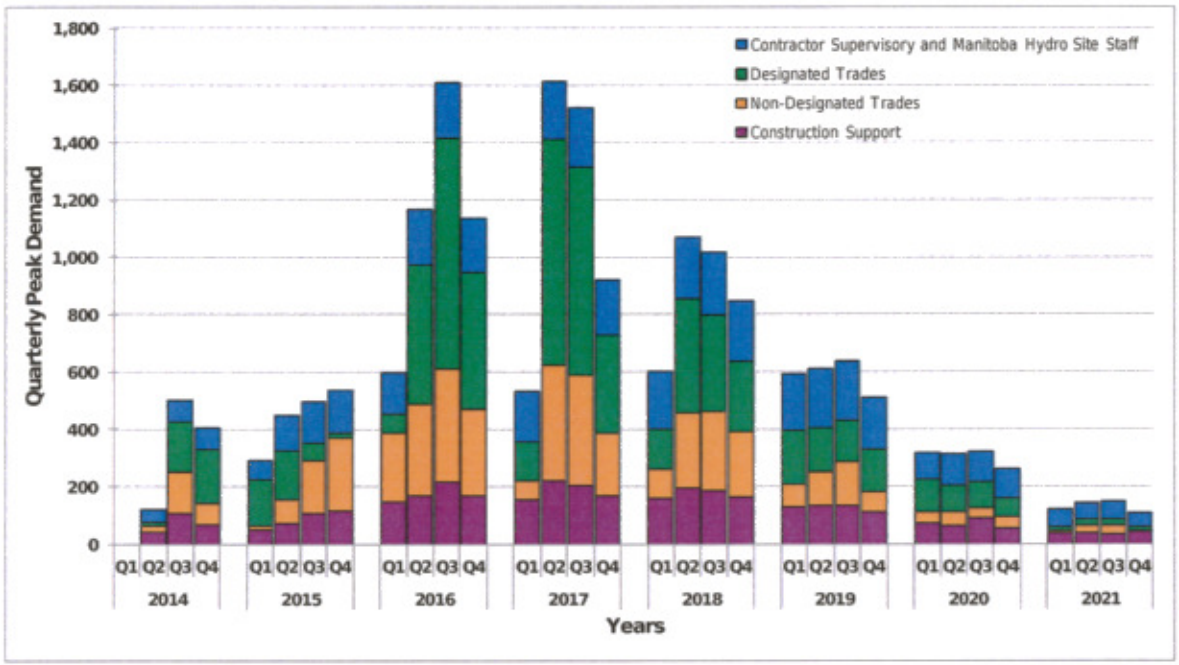
Construction employment opportunities are characterized by estimates of workforce requirements. This section illustrates the estimated workforce requirements overall, as well as by DNCs and TCs. Results are provided on an annual basis and by job category for DNCs and TCs.

Information about workforce requirements is presented in this section as follows:

- Peak quarterly employment, indicative of the number of jobs that would be filled in a given quarter (Figure 3-20); and
- Person-years, indicative of the volume of employment that would be available (Figure 3-21)[1].

Figure 3-20 illustrates quarterly peak workforce requirements during the Project's construction phase divided into four broad occupational categories: construction support including catering, security and administrative staff; non-designated trades including labourers, truck drivers and heavy equipment operators; designated trades consisting of occupations having formal apprenticeship programs including carpenters, electricians, and ironworkers; and contractor supervisory and Manitoba Hydro staff. The workforce estimates presented here are useful primarily as an indication of the size and composition of Project-related employment opportunities. Actual workforce requirements would vary from the estimate presented in the following sections. All employment estimates in this section, including all graphic representations of workforce demand, are based on current labour regulations, Project plans as of spring 2012 and past experience with similar projects. Contractors retained to undertake each contract would develop their own approach to the assignment, which could affect the timing, level and skill mix of workers required to complete the work.

[1] A person-year is a measure of the amount of work that could be available during a specific time period or for a specific type of work. One person-year approximates the amount of work that one worker could complete during twelve months of full-time employment. This would equate to between 2,090 and 2,295 hours per year (rounded, based on regular weekly hours of 40-44 hours/week).



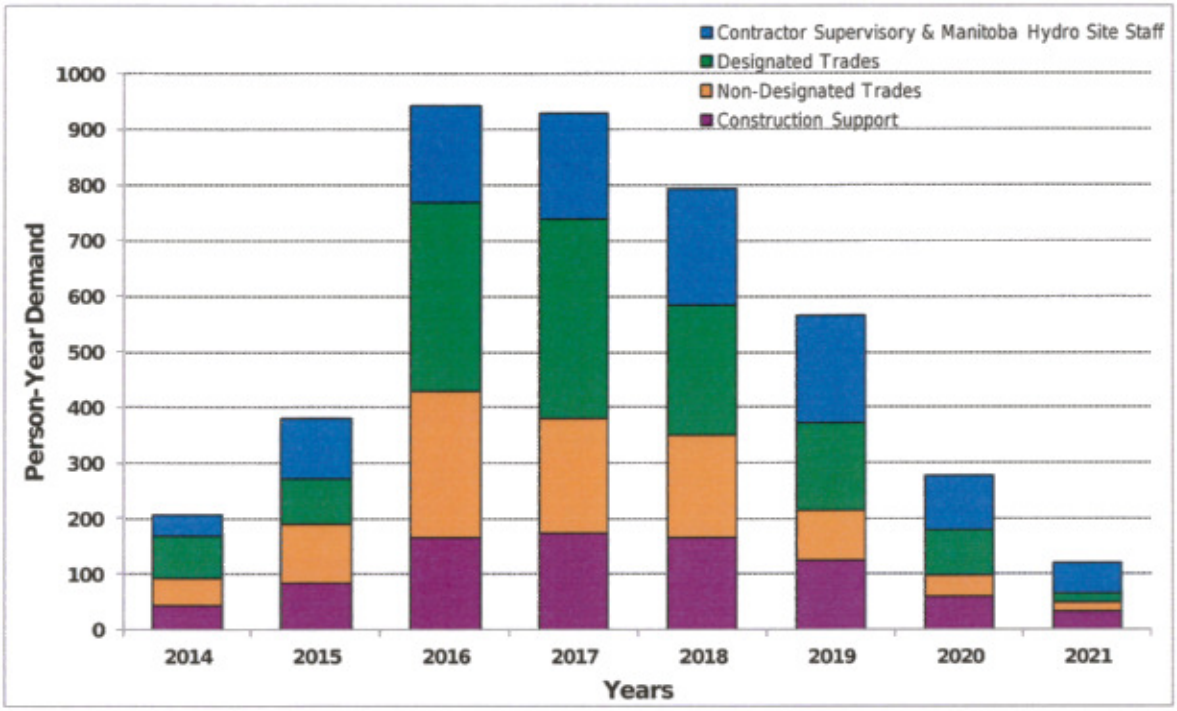
Source: Derived from data provided by Manitoba Hydro in 2010.

Figure 3-20: Construction Phase Estimated Workforce Requirements (Quarterly Peak) for the Keeyask Generation Project

Highlights of Figure 3-20 are as follows:

- Peak quarterly workforce requirements are highest during the Project's middle years, from 2016 to 2018, reaching the highest level in 2016 and 2017;
- The highest quarterly employment is set to occur in Q3 of 2016 and Q2 of 2017 at 1,610 workers; and
- Employment is seasonal. On average, the peak summer workforce during Q2 and Q3 increases in size compared to the previous winter.

Figure 3-21 illustrates construction workforce requirements by year (in person-years of employment).



Source: Derived from data provided by Manitoba Hydro in 2010.

Figure 3-21: Construction Phase Estimated Workforce Requirements (Person-Years) for the Keeyask Generation Project

The person-year employment pattern parallels the quarterly peak employment pattern with more moderate fluctuations.

Table 3-21 illustrates person-year construction workforce requirements by job category. Characteristics of person-year employment are as follows:

- Overall, the Project is expected to generate 4,218 person-years of construction employment;
- Construction support, non-designated trades and designated trades are expected to account for 3,150 person-years, with another 1,068 person-years generated by Manitoba Hydro and key contractor personnel; and
- Higher-skilled occupations (designated trades, contractor supervisory and Manitoba Hydro staff) account for 57% of total employment. Relatively lower skilled occupations (construction support and non-designated trades) make up the remaining 43%.

Table 3-21: Construction Workforce Requirements by Job Category

Job Category	Person-Years	Percent of Total
Construction Support	1,346	32%
Non-Designated Trades	952	23%
Designated Trades	852	20%
Manitoba Hydro and Contractor Supervisory	1,068	25%
TOTAL	**4,218**	**100%**

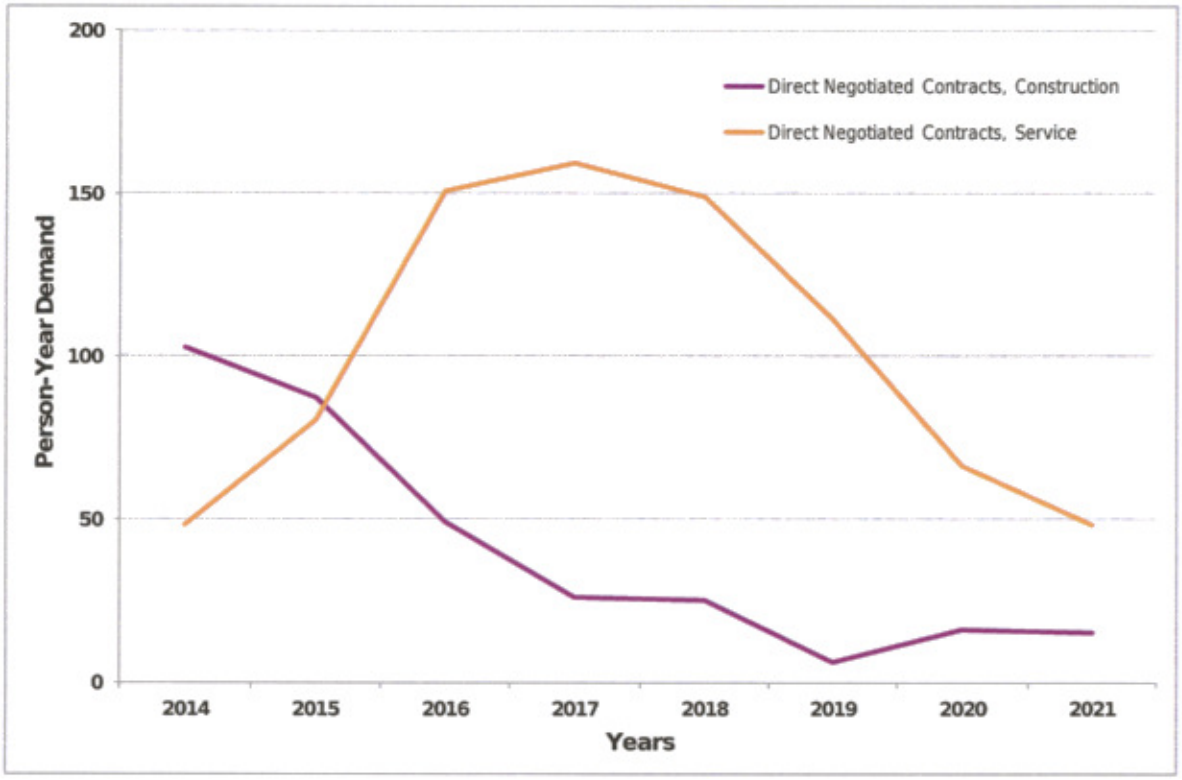
Source: Derived from data provided by Manitoba Hydro in 2010

DNCs are estimated to account for 1,142 person-years (36%) of contract employment, which does not include Manitoba Hydro or contractor supervisory employment. Most of these DNCs would begin in 2014, the first year of the Project and continue until the end of construction.

Figure 3-22 and Figure 3-23 focus solely on DNCs, which can be classified as follows:

- Construction DNCs (main camp; Phase II only): site preparation and development, main camp decommissioning, south access road construction, reservoir clearing, painting and architectural finish; or
- Service DNCs: catering, camp maintenance services, security services, employee retention and support services, and first-aid services.

Figure 3-22 illustrates workforce requirements for DNCs, broken down by construction and service contracts.

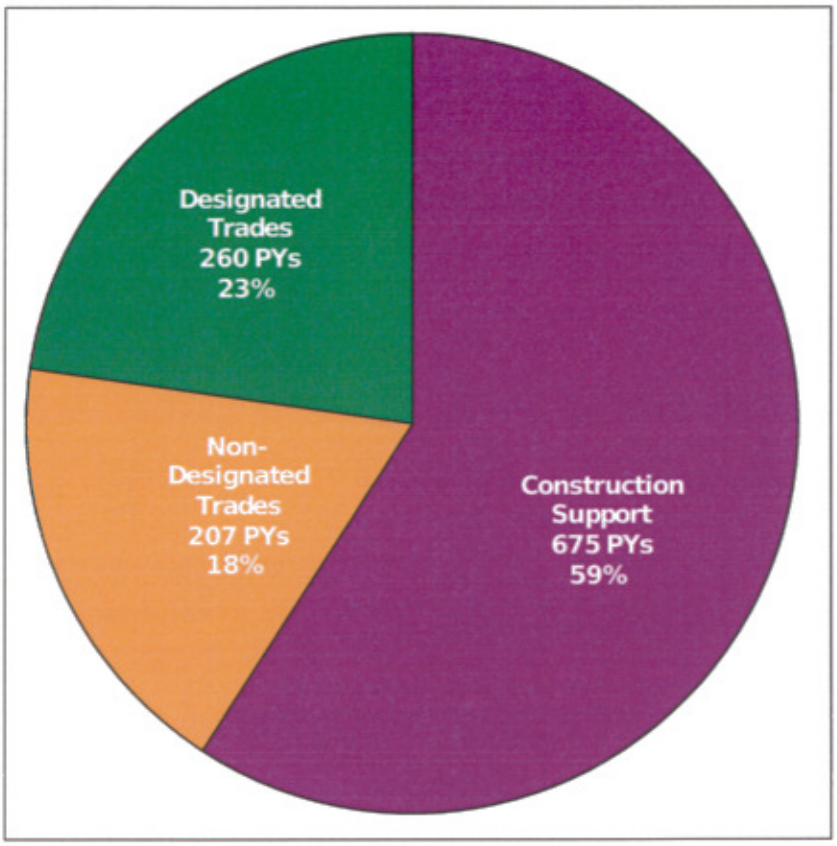


Source: Derived from data provided by Manitoba Hydro in 2010.

Figure 3-22: Construction Phase Estimated Workforce Requirements by Direct Negotiated Contract for the Keeyask Generation Project

Construction DNCs would account for 328 person-years of employment and would peak in 2014 at 103 person-years. DNC construction employment would then decline each year until 2019, when it would rise back to 15 person-years as part of the Project's demobilization activities. Service DNCs would account for 814 person-years of employment and would be active throughout the full duration of the Project. Employment related to DNC service contracts would follow a bell-shaped curve over the course of the Project, closely correlated with overall Project employment levels. Service contract DNCs would peak at 159 person-years of employment in 2017, with employment levels declining to 48 person-years by the end of the Project.

Figure 3-23 provides a summary of anticipated workforce requirements (by person-years) for the DNCs (construction and service contracts combined) by job category.

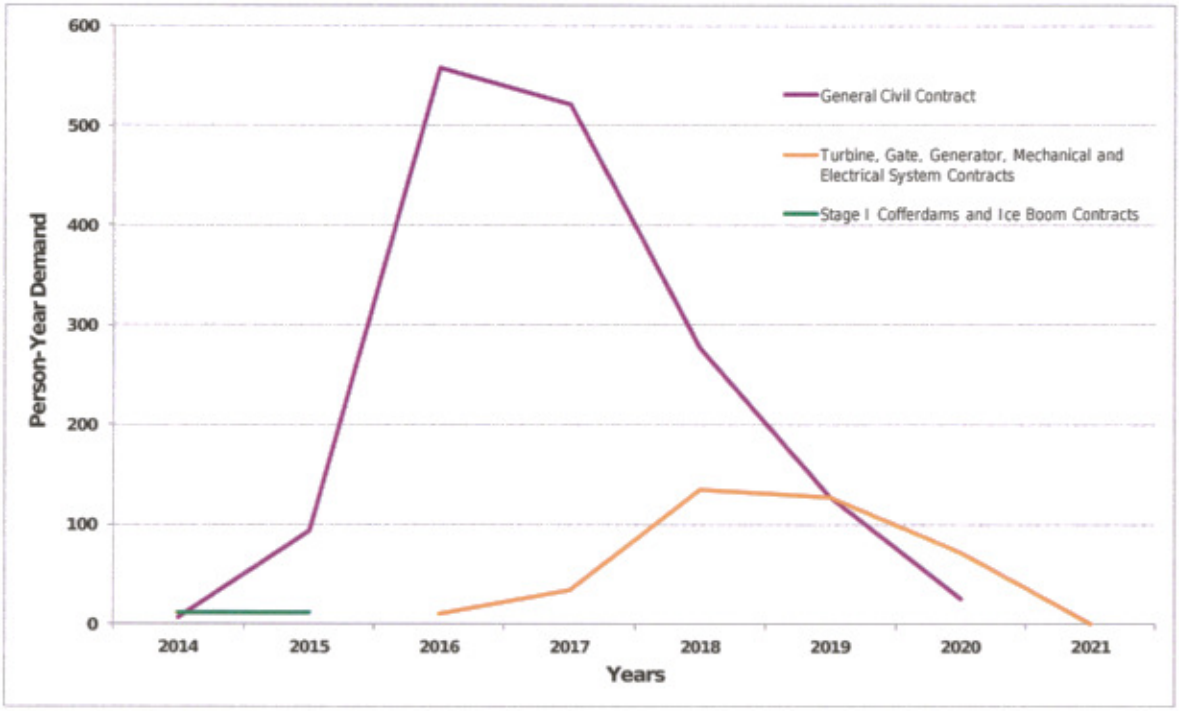


Source: Derived from data provided by Manitoba Hydro in 2010.

Figure 3-23: Construction Phase Estimated Direct Negotiated Contract Workforce Requirements by Job Category (Person-Years) for the Keeyask Generation Project

Construction support positions would account for the majority of the 1,142 person-years of available DNC employment. Designated trades would account for the next largest proportion, followed closely by the non-designated trades.

Tendered Contract workforce requirements would account for the majority of employment opportunities provided by the Project; Figure 3-24 and Figure 3-25 focus on these TCs. Figure 3-24 illustrates projected yearly person-year workforce requirements for the three categories of TCs: general civil contract; turbine-generator, mechanical-electrical and gate components, and Stage I cofferdam and ice boom construction.



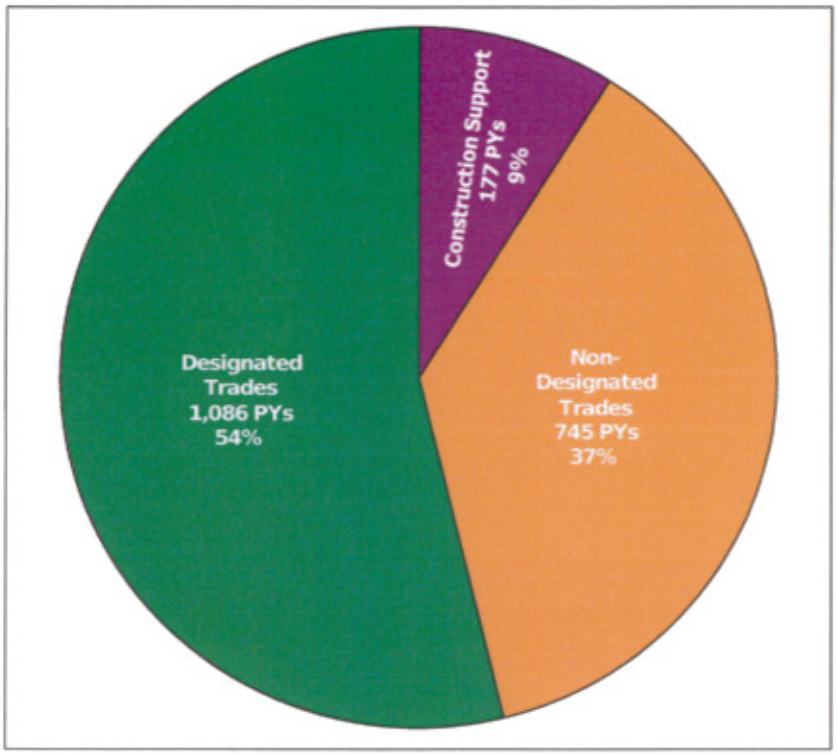
Source: Derived from data provided by Manitoba Hydro in 2010.

Figure 3-24: Construction Phase Estimated Tendered Contracts Workforce Requirements for the Keeyask Generation Project

The TCs would require 2,008 person-years (64%) of contract employment to complete:

- General Civil Contract employment would account for 1,607 person-years. General Civil Contract employment would begin in 2014 and last until 2020. General Civil Contract employment would peak in 2016 at 558 person-years and decline each year after, with 25 person-years of General Civil Contract employment expected in 2020. More than 92% of the person-years of General Civil Contract work would take place between 2016 and 2019, with 67% taking place in 2016 and 2017 alone.
- Most of the remainder (379 person-years) is accounted for by construction of the turbine-generator, mechanical-electrical and gate components of the Project, which would occur during the latter half of the schedule. These contracts would begin in 2016 and peak in 2018 at 135 person-years. Employment related to these contracts would occur through to the end of the Project as each of the final turbines becomes commissioned.
- Work related to Stage I cofferdam and ice boom contracts would create a total of 22 person-years of employment during the first two years of the Project.

Figure 3-25 provides a summary of estimated TC workforce requirements by job category (designated trades, non-designated trades and support positions).



Source: Derived from data provided by Manitoba Hydro in 2010.

Figure 3-25: Construction Phase Estimated Tendered Contract Workforce Requirements by Job Category (Person-Years) for the Keeyask Generation Project

Highlights of Figure 3-25 are as follows:

- Construction support positions would account for a relatively small proportion of the 2,008 person-years of contract TC employment, with designated trades accounting for over half of the person-years and non-designated trades at 37%.
- Compared to the distribution of DNC workforce requirements by job category, TC workforce requirements would show much higher demand for designated trades than for non-designated trades or construction support positions.

3.4.1.2.1 Factors Influencing Distribution of Construction Employment

An employment model was developed to estimate the portion of Project employment opportunities, as described above, that would be taken up by KCNs Members and by Aboriginal workers residing in the CBN area and in the Regional Study Area. In addition to using the workforce requirements, the model incorporated key factors that appear to influence the distribution of employment to these groups: labour supply, hiring preferences and challenges affecting level of local and regional employment. These key factors and the way they were used in the model are presented below. A description of the employment model and these employment challenges are provided in Section 3.2.1.1.

LABOUR SUPPLY

The labour supply portion of the model took the following into account:

- People already in the workforce; and
- Trainees that completed courses or programs of the HNTEI program implemented specifically for the Wuskwatim and Keeyask generation projects.

The employment model was applied to 2001 Statistics Canada occupational data for the Aboriginal workforce in the Regional Study Area, as well as to data regarding the outcome of the HNTEI program. Using these data as a base, the model generated projections of the Aboriginal workforce in the KCNs communities, in communities in the CBN area and in the Regional Study Area during the time period when Project construction would be underway.

HIRING PREFERENCES

The BNA and the JKDA are the two agreements in place that define hiring preferences for the construction phase of the Project. Based on the rules set out in these hiring preferences, the model was designed to undertake a sequence of simulated hiring as follows:

- For DNCs: Qualified KCNs workers were hired first. When the qualified KCNs labour supply ran out, qualified northern Aboriginal workers who were not KCNs Members were hired next; and
- For TCs: Qualified residents living in the CBN area were hired first. The CBN workers included KCNs workers and other CBN workers estimated according to a weighted average of their respective populations. When the CBN labour supply ran out, other qualified northern Aboriginal workers were hired.

OTHER CHALLENGES AFFECTING EMPLOYMENT

Challenges affecting employment were identified through community field research and a review of the Wuskwatim Generation Project experience regarding Aboriginal participation in construction employment. The review identified a number of factors/challenges that may affect the extent to which local and regional Aboriginal workers may be employed on the Project during the construction phase. The most important of these were incorporated into the employment model through the labour supply analysis and include the following:

- The extent to which qualified workers would be attracted to work on Project construction jobs;
- The extent to which local trades people and HNTEI trainees would be considered to have appropriate and sufficient work experience to be treated as qualified; and
- The extent to which potential applicants maintain their status in the job referral system and would therefore be eligible for referral when opportunities become available.

To characterize the effect of these challenges and to reflect uncertainty, low and high assumptions were applied in the employment model. Estimates that resulted in higher levels of KCNs, CBN and northern Aboriginal employment assumed that the influence of all of the challenges were less pronounced. In contrast, low employment estimates assumed that employment challenges were more pronounced. More detail regarding the assumptions made to incorporate employment challenges can be found in Section 3.2.1.1.

3.4.1.2.2 Construction Employment Estimates

Results of the Keeyask construction employment modelling analysis are presented below.

KEEYASK CREE NATIONS EMPLOYMENT EFFECTS

This section presents the estimated extent of participation by KCNs Members in Project construction employment, based on results of the employment supply/demand model. Key effects for discussion include person-years of employment and employment by job category. Analysis is also provided that estimates the percentage of available Project employment filled by qualified KCNs Members, as well as the job categories in which the KCNs estimated labour force would exceed the expected number of opportunities. Finally, estimates are provided for average total KCNs employment (quarterly and by job category).

Table 3-22 and Table 3-23 show the estimated person-years of employment for KCNs Members by job category for both high and low employment estimates. These tables do not include employment related to pre-construction activities or the Keeyask Infrastructure Project.

Table 3-22: Construction Phase Estimated Employment Participation by KCNs Members in the Keeyask Generation Project - High Employment Estimate (Person-Years)

	High Employment Estimate: KCN[1]									
Employment	**Construction Support**		**Non-Designated Trades**		**Designated Trades**		**MH and Supervisory[2]**		**Total**	
	PY	%	PY	%	PY	%	PY	%	PY	%
Total KCNs Participation	325	8%	170	4%	95	2	10	<1%	600	14%
Total Demand	852		952		1,346		1,068		4,218	

Source for the Demand: Derived from data provided by Manitoba Hydro in 2010.
Source for the Participation: Analysis prepared by InterGroup Consultants Ltd.
Notes:
1. Numbers are subject to rounding.
2. Estimated KCNs Participation within the Manitoba Hydro and Supervisory employment category resulted in a value of less than one percent.

Table 3-23: Construction Phase Estimated Employment Participation by KCNs Members in the Keeyask Generation Project - Low Employment Estimate (Person-Years)

	Low Employment Estimate: KCN[1]									
Employment	**Construction Support**		**Non-Designated Trades**		**Designated Trades**		**MH and Supervisory[2]**		**Total**	
	PY	%	PY	%	PY	%	PY	%	PY	%
Total KCN Participation	125	3%	45	1%	55	1%	10	<1%	235	6%
Total Demand	852		952		1,346		1,068		4,218	

Source for the Demand: Derived from data provided by Manitoba Hydro in 2010.
Source for the Participation: Analysis prepared by InterGroup Consultants Ltd.
Notes:
1. Numbers are subject to rounding.
2. Estimated KCNs Participation within the Manitoba Hydro and Supervisory employment category resulted in a value of less than one percent.

KCNs workers are projected to account for between 6% in the low employment estimate and 14% in the high employment estimate of the total construction workforce for the Project. This would constitute between 235 and 600 person-years of the 4,218 person-years of total construction employment. The participation percentages are strongly influenced by the relatively small number of qualified KCNs Members who could work on the Project relative to the large number of Project construction jobs that are available. While the percentage of the total appears to be relatively small, the absolute amount of employment is substantial for the KCNs as the Project is expected to involve a large percentage of available workers from the KCNs. The difference between the high and low estimates illustrates the effect that challenges to employment would potentially have on KCNs participation in construction employment. When these effects are assumed to be less prominent, KCNs employment is estimated to be substantially higher than when these challenges are assumed to have more influence.

For both high and low estimates of construction site employment, more than half of KCNs employment is expected to be in construction support occupations, while about one-third is expected to be in non-designated trades at higher estimates and about one-fifth at low estimates. About 18%-28% of KCNs employment is expected to be in designated trades and Manitoba Hydro and contractor supervisory occupations for low and high estimates, respectively.

Implications of these estimates are as follows:

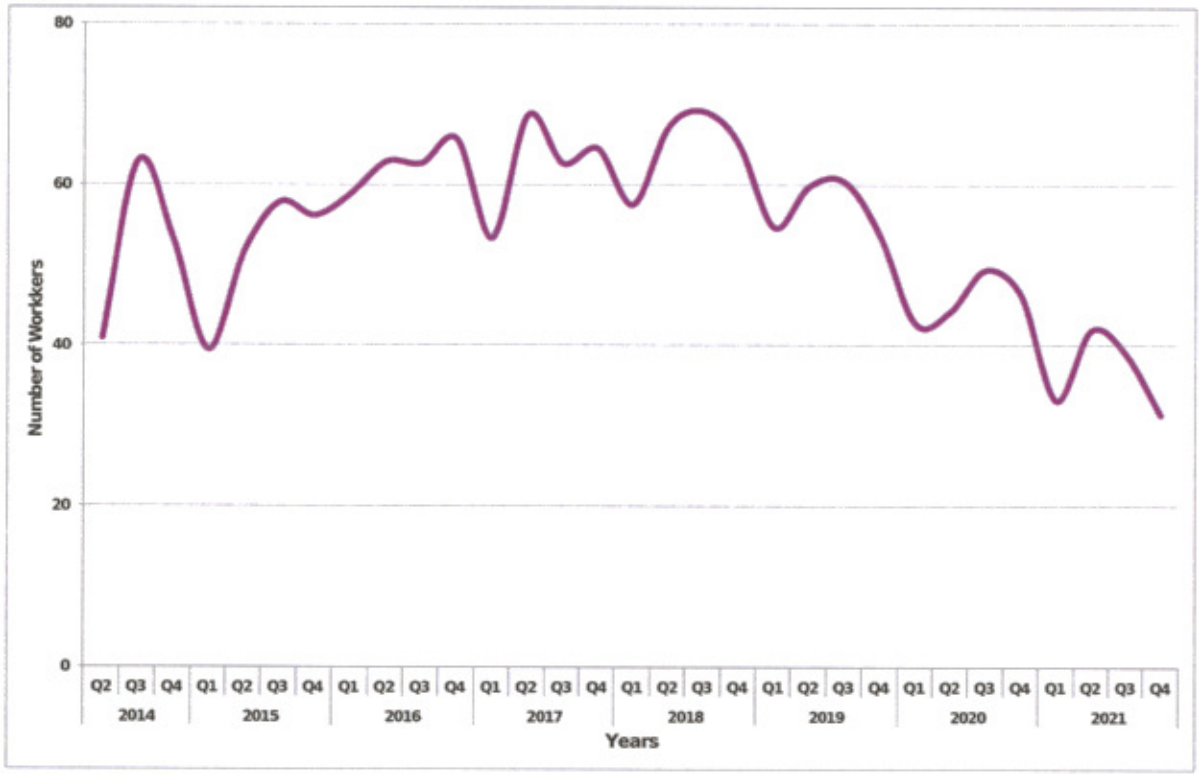
- In small to medium-sized First Nations these levels of employment could contribute noticeably to reducing unemployment levels for their rapidly growing labour force during the construction phase. If these were full-time positions, approximately 30 to 70 KCNs Members would be working throughout the construction phase. However, much of the Keeyask construction work would be seasonal and therefore, a person-year of work would be spread over several individual jobs. Assuming two jobs per person-year, the number of KCNs Members working during a given year would be on average 60 to 140 persons, which would be substantial in these high unemployment settings. This would vary among construction

years, reflecting differences in numbers and skills mix of workers required throughout the construction phase.

- The percentage of KCNs employment is affected by the nature of Project construction. Since the Project consists mainly of building the major civil works and installing mechanical and electrical equipment, the workforce requirements would be heavily oriented towards designated trades, requiring more trained and skilled workers. This would temper the levels of KCNs participation that could occur.

During construction, Project-related employment for KCNs Members will also be generated through on-site representatives, participation in technical and ATK monitoring programs, and community based job referral and partner implementation staff. These jobs will contribute at least 35-40 additional person-years of construction related employment for KCNs Members.

Figure 3-26 illustrates the quarterly peak employment levels of KCNs Members during construction of the Project.



Source: Analysis prepared by InterGroup Consultants Ltd.

Figure 3-26: Construction Phase Estimated Average Total Employment among KCNs Members (Number of Jobs Filled)

This figure illustrates the following:

- Throughout the construction phase from 2014 to 2021, KCNs employment is estimated to vary between 30 and 70 workers.

- Except for seasonal factors, KCNs employment is expected to remain steady. This is largely due to the high proportion of KCNs employment in DNCs most of which extend over the entire construction period. These contracts are expected to provide more stable employment than the TCs and produce higher levels of KCNs employment than comparable TCs.

The JKDA does include an employment target of 630 person-years of construction employment for the KCNs. The target includes their participation in construction of the generation project as well as their participation in Keeyask Infrastructure Project employment opportunities and all pre-construction employment following signing of the JKDA. The target is being measured and tracked by the Project partners through a separate process.

As with all major construction projects, Project-related construction employment levels in local communities will increase and decline and will eventually cease, contributing to a minor boom and bust situation. During the bust, local economic activity will decline and unemployment levels will rise in the Local and Regional study areas. However, this should be moderated in part by the experience gained during construction which will enhance the employability of KCNs Members and northern Aboriginal residents who have worked on the Project.

GILLAM EMPLOYMENT EFFECTS

In Gillam, during the construction phase, employment effects are expected to be generated primarily by direct construction employment and concentrated on FLCN Members living in Gillam. As one of the KCNs, employment effects on FLCN were already included in the KCNs employment analysis.

In addition, there could be a very small increase in employment in the Gillam retail and hospitality service sectors as a result of the spending of construction worker wages from two sources: increased income for FLCN Members who secure Project employment opportunities and expenditures by other construction workers visiting Gillam[1].

THOMPSON EMPLOYMENT EFFECTS

During the construction phase, employment effects in Thompson would primarily result from direct construction employment, in particular from KCNs Members living off-reserve in Thompson who would qualify for preferential hiring on the Project. These employment effects were already included in the KCNs employment estimate.

There could also be a small increase in employment in the retail/wholesale goods and services sector, hospitality services sector and transportation sector as a result of Project-related purchases by Manitoba Hydro and construction contractors; expenditures by KCNs Members who secure Project jobs; and expenditures by construction workers visiting Thompson.

[1] Hospitality services include accommodations, food and beverages services.

3.4.1.2.3 Mitigation/ Enhancement

Key measures to enhance participation by KCNs Members and Aboriginal workers from the Regional Study Area in Project construction employment opportunities are already in place through the HNTEI, BNA and JKDA. These include:

- Pre-project training through the HNTEI undertaken between 2001 and 2010 to develop construction skills;
- The extensive use of DNCs and the opportunity for direct hire provisions within these contracts, as well as preferential hiring provisions for TCs and associated Job Referral Service;
- The employee retention and services contract, expected to be implemented by YFFN and FLCN, which includes cross cultural training and on-site counselling services;
- On-site employee liaison workers;
- Funding for the hiring of an Aboriginal union representative by the Allied Hydro Council of Manitoba;
- Establishment of the Advisory Group on Employment that can serve as a forum for KCNs and others to identify and discuss construction employment issues; and
- Community based job referral officers.

While the planned measures are extensive and address key issues affecting KCNs participation in construction jobs, the analysis of factors affecting employment suggests that it would be beneficial to focus additional effort on challenges that can affect worker's availability for construction employment. These challenges include:

- Maintaining a candidate's status in the job referral system;
- Reaching a selected candidate about a specific job opportunity;
- A candidate not accepting job offers; and
- The ability of the candidate to make arrangements to get to the job site.

Consideration should be given to implementing additional availability oriented measures to complement the measures that have already been implemented or are defined in existing agreements. A starting point for this would be reviewing the Wuskwatim Generation Project experience with the respect to the challenges affecting availability and identifying opportunities for addressing some of the challenges. This would be a joint effort involving the KCNs, Manitoba Hydro Project staff, the Job Referral Service, key contractors and other relevant stakeholders.

As with the Wuskwatim Generation Project, a Socio-Economic Monitoring Program (SEMP) to monitor key data will be prepared and implemented (see Chapter 8 of the Response to EIS Guidelines for further details).

3.4.1.3 Business Opportunities – Local Study Area

As in the case of employment, business opportunities represent tangible benefits associated with construction projects. This discussion focuses on the nature of potential Project contracts (*e.g.*, TCs versus DNCs), opportunities for joint ventures between Aboriginal-owned companies and others, as well as entrepreneurial

opportunities that may arise. Indirect business opportunities are also important considerations since the increased employment and business income can provide benefits to businesses such as restaurants and accommodation providers.

During the construction phase, the Project is expected to generate substantial business opportunities across the Regional Study Area. Businesses owned by the KCNs or their Members are being provided with the opportunity to negotiate directly on a group of contracts (the DNCs), which would cover a wide scope of Project construction work. In addition, businesses located within the Local Study Area have the opportunity to provide construction supplies and services to all contractors working on the Project. Particularly in the regional centre of Thompson, the retail/wholesale goods and services sector, the hospitality sector and the transportation sector will benefit from the large numbers of people moving to and from the construction site and spending their days off from work in local communities.

3.4.1.3.1 Keeyask Cree Nations

Article 13 of the JKDA outlines the business opportunities to be made available directly to the KCNs. These opportunities relate primarily to the construction and removal of Project infrastructure components (*e.g.*, access road and camp) and to the provision of services to construction workers at the site during construction (*e.g.*, food services, security services and employee retention).

The JKDA Schedule 13-1 identifies which contracts would be DNCs and indicates the KCNs communities being provided the opportunity to negotiate these contracts directly. The schedule includes both the Keeyask Infrastructure Project and the Keeyask Generation Project. Table 3-24 identifies the DNCs that apply to the Project and which of the KCNs communities have been identified for their implementation (excludes DNCs identified in the JKDA that are part of the Keeyask Infrastructure Project). In order to secure one of the 11 contracts identified in the JKDA available for allocation to the Project, a business is required to be majority owned by a KCNs community or be a Member of the KCNs. Manitoba Hydro will negotiate each contract on an individual basis with prospective businesses to establish contract provisions and a value acceptable to both parties. Several KCNs businesses, especially those with capacity in construction-related activities could potentially benefit through this process. These are identified in Section 3.3.2.1.

Table 3-24: Direct Negotiated Contracts for the Keeyask Generation Project

Code	Service Contracts	KCNs Allocation
SC-1	Catering	FLCN and YFFN
SC-2	Camp Maintenance Services	CNP
SC-3	Security Services	FLCN and YFFN
SC-4	Employee Retention and Support Services	FLCN and YFFN
SC-5	First-Aid Services	CNP
	Construction Contracts	
IC-2	Main Camp (Phase II only) - Site Preparation and Development	CNP
IC-5	Main Camp - Decommissioning	CNP
IC-8	South Access Road Construction	CNP
PS-1	Reservoir Clearing	CNP
PS-2	Painting and Architectural Finish	CNP
PS-5	Rock and Unclassified Excavation	CNP

Source: JKDA, Schedule 13-1 (CNP *et al.* 2009).

In total, 11 work packages as identified in Schedule 13-1 of the JKDA have been allocated to KCNs communities as DNCs. These contracts are expected to generate most, if not all, local direct business income from the Project. These contracts will follow a series of DNCs that were awarded to the KCNs for Keeyask Infrastructure Project. The experience gained in implementing the Keeyask Infrastructure Project contracts is expected to strengthen the KCNs capacity to undertake DNCs for the Keeyask Generation Project.

Manitoba Hydro's most recent hydroelectric development project under construction (Wuskwatim Generation Project) provides useful information on overall business benefits to the local First Nation; and is therefore a good predictor of anticipated Project outcomes. The Wuskwatim Generation Project experience reported by Nisichawayasihk Cree Nation indicates they were able to establish a building supply company to serve the Wuskwatim Generation Project; the supply company subsequently expanded into Saskatchewan. In addition, Nisichawayasihk Cree Nation created joint ventures with road construction, catering and camp maintenance companies, gaining valuable experience negotiating business partnerships and creating jobs and revenue for Nisichawayasihk Cree Nation. "NCN has also created its own environmental monitoring company Aski'Otutoskeo Ltd (AOL) to provide services as a contractor to Manitoba Hydro and other monitoring companies working on the project" (NCN 2011b).

At the time of this analysis, negotiations were ongoing between Manitoba Hydro and KCNs businesses regarding all potentially contracted DNC work. Final contract amounts were yet to be determined.

It is expected that most of the contracts will be carried out by joint ventures made up of a company owned by a KCNs partner and a non-KCNs company that has extensive experience in performing the type of work required by the contract. In all cases, the company owned by the KCNs party will own the largest share of the joint venture. This approach will enable the KCNs partner to maintain control of the contract and receive the

largest share of the profits to be generated. These business opportunities are also expected to generate the following important business benefits:

- The process of negotiating, managing and completing these contracts in a joint venture setting will provide valuable business experience to the KCNs owners and managers selected for the Project.
- The revenues associated with the Project could be used to finance payments for up to nine years on buildings, equipment and capital items that could be used to secure future contracts within the region.
- The relationships developed as part of the joint ventures could be used to pursue additional joint venture contracts on other construction projects.

These enhancements to KCNs-owned businesses could have the following broader benefits for the KCNs communities:

- Increase the capacity of local businesses to expand and pursue future business opportunities within and outside of their home communities, including construction of future hydroelectric projects;
- Increase the role of local businesses in meeting communities' needs in such areas as building and maintaining houses and infrastructure;
- Strengthen the local economy of KCNs communities; and
- Provide continuing construction job opportunities for community residents.

Should these outcomes materialize, the DNCs awarded to KCNs-controlled businesses would yield not only short-term benefits during the construction phase, but would also generate benefits after Project construction is completed. A key factor in achieving these longer-term benefits is the meaningful involvement of KCNs owners in managing the DNCs, rather than relying solely on the non-KCNs joint venture partners for these skills. This could benefit KCNs business capacity through increased revenue and resulting business enhancements (*e.g.*, equipment upgrades). It could also lead to improved credibility of KCNs as viable, capable and progressive business owners, potentially leading to other business opportunities.

Some business opportunities are expected to result from the general increase in economic activity that would take place across the Local Study Area. Some of the employment income earned at the job site would be spent by Members of KCNs communities to support their households. The increased income resulting from the employment opportunities created by the Project could increase the market potential for businesses in KCNs communities, primarily for items such as groceries and other household items. This could contribute to improved viability of retail and consumer service businesses located in these communities. However, it should also be noted that the scope of services in these communities is limited and it is likely that spending of worker wages would also occur at businesses in other locations (*e.g.*, the regional centre of Thompson).

3.4.1.3.2 Gillam

During construction, business opportunities in the Gillam area relate primarily to the potential increase in demand for transportation and hospitality services by workers and other people associated with the Project as they travel to and from the construction work site. There could be some increased demand for construction-related supplies and services, although the current scale of construction-related retail services available in Gillam would likely limit these opportunities.

3.4.1.3.3 Thompson

Thompson could benefit from construction-related purchases. As the regional retail centre with the most well-established supply chains, Thompson is likely to be the source of these kinds of transactions. While the potential for increased demand for construction goods and services is not likely to result in new retail businesses being established in Thompson, there would be a substantial opportunity for existing businesses to increase sales and modify product lines in anticipation of this increased demand. Based on experience with the Wuskwatim Generation Project, the value of these purchases could be in the tens of millions of dollars. Businesses in the transportation, industrial supply and energy supply sectors would likely benefit most.

Business opportunities in the Thompson area could also arise from an increase in demand for transportation and hospitality services by workers and other people associated with the Project as they travel to and from the construction work site. In addition, some non-local construction workers are likely to spend time in Thompson during their days off, increasing business opportunities in these same sectors.

In recent years, the Thompson economy experienced very rapid growth, mainly as a result of major facility expansion and modernization undertaken by Vale. While this growth led to increased sales volumes for many local businesses, it also contributed to labour shortages in the local retail and consumer service sectors making it difficult for businesses to meet customer needs and to take full advantage of available opportunities. This local competition for labour put upward pressure on wages, which in turn led to rising local prices in some sectors, particularly in hospitality, trades and transportation-related sectors. The high demand for skilled trades resulted in labour shortages for many businesses, which led to schedule and cost implications for these businesses.

The anticipated Vale smelter and refinery closure (in 2015) may change the character of Thompson's economy from one of rapid growth with labour shortages to no growth or declining growth with labour surpluses. Local businesses could shift from a position of insufficient capacity to excess capacity. These changes may occur while Project construction is taking place. In this new context, the modest business opportunities flowing from Project expenditures would shift from potentially exacerbating existing labour shortages to being beneficial for the Thompson business community, offsetting some of loss in activity arising from the smelter closure.

Monitoring should be undertaken to determine what influence Project-related expenditures during construction have on the level of business activity and employment in Thompson. This could be done through a survey of relevant Thompson businesses. It is recognized that it will be difficult to isolate Project effects from other factors influencing the Thompson economy; nevertheless, even a limited understanding of these effects would be useful given the varied prospects for this city's economy in the future.

3.4.1.3.4 Mitigation

The DNCs are the most important measures for enhancing KCNs participation in Project business opportunities. Other measures for enhancing local business participation during the construction phase include the following:

- Provide a mechanism to identify entrepreneurial opportunities associated with Project construction; and
- As occurred in the Wuskwatim Generation Project, maintain communication with appropriate organizations on opportunities through Manitoba Hydro's Northern Purchasing Policy.

Monitoring will be undertaken as part of a SEMP, and will include tracking direct purchases, a KPI program in Thompson, Gillam and the KCNs communities to ascertain any indirect business opportunities generated as a result of the Project and KPIs with key participants in managing the DNCs.

3.4.1.4 Income – Local Study Area

New income would be generated in two ways in the Local Study Area during the construction phase of the Project: through wage employment and through business. Employees would be attracted to the Project in anticipation of the opportunity for new, and in some cases higher, income. In turn, once that income is earned, indirect economic activity would occur in nearby communities, particularly in the retail and hospitality sectors through the spending of wage income. These effects would become apparent early in the construction phase and would last until construction is complete.

The following discussion addresses direct employment income and business income. For employment income, gross and net income is estimated for construction employment. Business income, which consists of profits from increased business activity, is presented for the DNCs. Other sources of employment and business income including from local purchases by Manitoba Hydro and contractors and re-spending by Project workers have not been estimated. The following sections are broken down by employment and business income effects, with separate sections provided for effects specific to the KCNs, Gillam and Thompson.

3.4.1.4.1 Keeyask Cree Nations Income Effects

EMPLOYMENT INCOME

Table 3-25 provides a summary of estimated gross employment income by contract type and job category that would accrue to KCNs workers during the construction phase. These estimates are provided for all contracts (DNCs and TCs) and have been presented for two scenarios: high and low which encompass a combination of high and low employment estimates and wage ranges. Methodological details regarding these wage ranges are provided in Section 3.2.3.

Table 3-25: Construction Phase Estimated KCNs Gross Employment Income from the Keeyask Generation Project (in millions of dollars)

	High Wage Range			Low Wage Range		
	All Contracts	DNC	TC	All Contracts	DNC	TC
Construction Support	31.7	27.9	3.8	9.8	9.4	0.4
Non-Designated Trades	17.6	11.8	5.8	3.6	3.0	0.6
Designated Trades	12.3	7.8	4.5	7.6	5.3	2.3
Subtotal	61.6	47.5	14.1	21.0	17.7	3.3
Manitoba Hydro And Contractor Supervisory	0.6			0.6		
Total	62.2			21.6		
Construction Support	51%	45%	6%	47%	45%	2%
Non-Designated Trades	29%	19%	9%	17%	14%	3%
Designated Trades	20%	13%	7%	36%	25%	11%
Total	100%	77%	23%	100%	84%	16%

Sources: Derived from data provided by Manitoba Hydro in 2010 with analysis prepared by InterGroup Consultants Ltd.
Note:
- Numbers do not always add due to rounding. Actual results will vary from estimates provided here.

Keeyask Cree Nations workers are expected to earn between $21 and $62 million working on construction of the Project. Most of this income would be generated from DNCs, even though these contracts only represent about 27% of total Project employment.

The high level of KCNs employment on DNCs illustrates the importance of the DNCs to KCNs employment income. The importance of the DNCs can also be seen by comparing total KCNs income to estimated construction employment income that would accrue to the whole CBN area (see Section 3.4.1.8). Keeyask Cree Nations represents about 23% of the total CBN population, yet it is estimated that KCNs would secure between approximately 50% to 60% of CBN employment and gross employment income. Keeyask Cree Nations and CBN workers would share the same preferences on TCs.

Monitoring would be undertaken to determine the amount of gross labour income accruing to KCNs Members from Project construction employment.

BUSINESS INCOME

While businesses with awarded DNCs would be active during the entire course of the construction phase, profits from these contracts would depend substantially on how well the contractors are able to manage their costs over the length of the contracts. Profits generated and business income created by the DNCs would only be evident after the contracts are completed. If costs are effectively managed, profits in excess of $15 million could be earned on the DNCs, of which more than half could accrue to KCNs businesses, who must

own at least half of the contracted enterprises. This level of profit is based on a target return of 10% of contract earnings.

3.4.1.4.2 Gillam

Gillam would experience some income benefits as a result of the Project. Employment income would accrue primarily to FLCN Members living in Gillam; that income is included in estimates of employment income accruing to KCNs workers as a whole in Table 3-25.

Income benefits would also result from the increased economic activity that is estimated to occur in Gillam during the construction phase of the Project. This would affect both employment and business income for workers and businesses in the transportation, hospitality, retail and construction sectors. This spending is dependent on individual spending preferences of employees, therefore, quantitative estimates of spending in the specific Gillam economy are difficult to determine.

3.4.1.4.3 Thompson

Thompson is expected to experience some income benefits as a result of construction of the Project. Employment income effects would accrue primarily to the city's Aboriginal population many of whom are likely to have some level of hiring preference for Project construction jobs. Income benefits would also result from the increased economic activity that would occur in Thompson as a result of the Project. Income received through Project employment is expected to lead to indirect economic activity in Thompson, particularly in the construction, retail/wholesale goods and service and hospitality sectors. In turn this would affect both employment and business income for workers and businesses in these sectors. As in the case of Gillam, this spending is dependent on the type and location of preferences of individual employees and, therefore, quantitative estimates in the specific Thompson economy are difficult to determine.

3.4.1.4.4 Mitigation

No mitigation or enhancement is required.

3.4.1.5 Cost of Living – Local Study Area

Discussion regarding cost of living is intended to capture issues associated with the higher costs for housing, food and household items and transportation in northern communities. The increased employment and business opportunities associated with large construction projects can potentially affect these costs.

In addition to effects related to direct employment, business and income, construction of the Project is expected to result in indirect expenditures in the Local Study Area. Local construction workers and their families could increase their purchases of retail products, transportation and hospitality services as a result of increased income from the Project. Non-local workers could spend more money on transportation, and hospitality services. Local firms that sell products and services for businesses could also see an increase in sales to contractors. While these expenditures are likely to occur primarily in Thompson, some, particularly retail products and services, may also occur in other Local Study Area communities.

Despite the potential for increased purchases, local spending and construction-related expenditures associated with the Project are unlikely to affect the cost of living in the Local Study Area. Construction-related expenditures are anticipated to be concentrated in Thompson, where the size of the local economy would

3.4.1.6.2 Mitigation

Losses of in-kind income from reduced domestic resource use in the vicinity of the Project are expected to be compensated for by the Offsetting Programs contained in the AEAs that provide access to resource harvesting at alternative and unaffected locations. Trapline 15 domestic resource users are expected to be compensated for any decrease in domestic harvesting through a compensation agreement.

Losses experienced by commercial trappers will be compensated. Provisions exist in the TCN AEA (Members Claims) and FLCN AEA (Citizens Claims) to provide for losses in net revenue and damages to property incurred by commercial trappers on a Registered Trapline. These provisions are expected to address any Project-related losses experienced on the potentially affected traplines, which are Traplines 15, 9, 25 and 7. A five-year, extendable disturbance agreement has been reached with the holder of Trapline 9; an annual agreement with Trapline 15 is expected to be reviewed and renewed as needed on an annual basis; and a compensation agreement is expected to address the minor effects to Traplines 7 and 25 (a TCN community trapline).

Project-related effects during construction are expected to result in closure of the small-scale Stephens Lake fishing business that operates under a special licence to sell fish locally in Gillam and Churchill. Discussions between the operator and Manitoba Hydro are underway at the time of submission.

Implementation of TCN's guidelines and principles for the TCN Access Program should largely mitigate potential effects on lodges and outfitters located at or near alternate harvesting destinations. The guidelines and principles include respect for the land and environment (leaving areas clean and respecting others, including refraining from acts of aggression and disrespect to property). No further mitigation is required.

3.4.1.7 Construction Employment Opportunities – Regional Study Area

This section examines participation by Aboriginal residents of the Regional Study Area as a whole in construction employment opportunities associated with the Project. As was set out in Section 1.3.2, the Regional Study Area is defined according to the BNA. Also considered in this section, is participation by residents of the CBN area, a subset of the Regional Study Area that encompasses communities that have been affected by past hydroelectric development (also defined in Section 1.3.2).

Construction employment participation was estimated for qualified Aboriginal residents in the CBN area (the area designated for first order hiring preference on TCs) and for qualified Aboriginal workers in the Regional Study Area as a whole (the region for third-order hiring preference on all contracts).

The CBN area includes the KCNs communities, so all CBN employment results presented in this section incorporated KCNs employment estimates discussed earlier in this section. Similarly, estimates presented for the Regional Study Area incorporated employment estimates for the CBN area.

Employment estimates are presented in person-years (for high and low estimates) and by job category.

3.4.1.7.1 Churchill-Burntwood-Nelson Employment Effects

Table 3-26 and Table 3-27 present person-years of construction employment estimated to be taken up by qualified Aboriginal residents of the CBN area, by job category, under high and low employment estimates respectively.

Table 3-26: Construction Phase Estimated Participation by the Churchill-Burntwood-Nelson Aboriginal Workforce in the Keeyask Generation Project (Person-Years) – High Employment Estimates

	High Employment Estimates: CBN									
Employment	**Construction Support**		**Non-Designated Trades**		**Designated Trades**		**MH and Supervisory**		**Total**	
Total CBN (including KCNs)	510	12%	420	10%	230	5%	35	1%	1,195	28%
Total Demand	852		952		1,346		1,068		4,218	

Source for the demand: Derived from data provided by Manitoba Hydro in 2010.
Source for the participation: Analysis prepared by InterGroup Consultants Ltd.
Note:
- Numbers are subject to rounding.

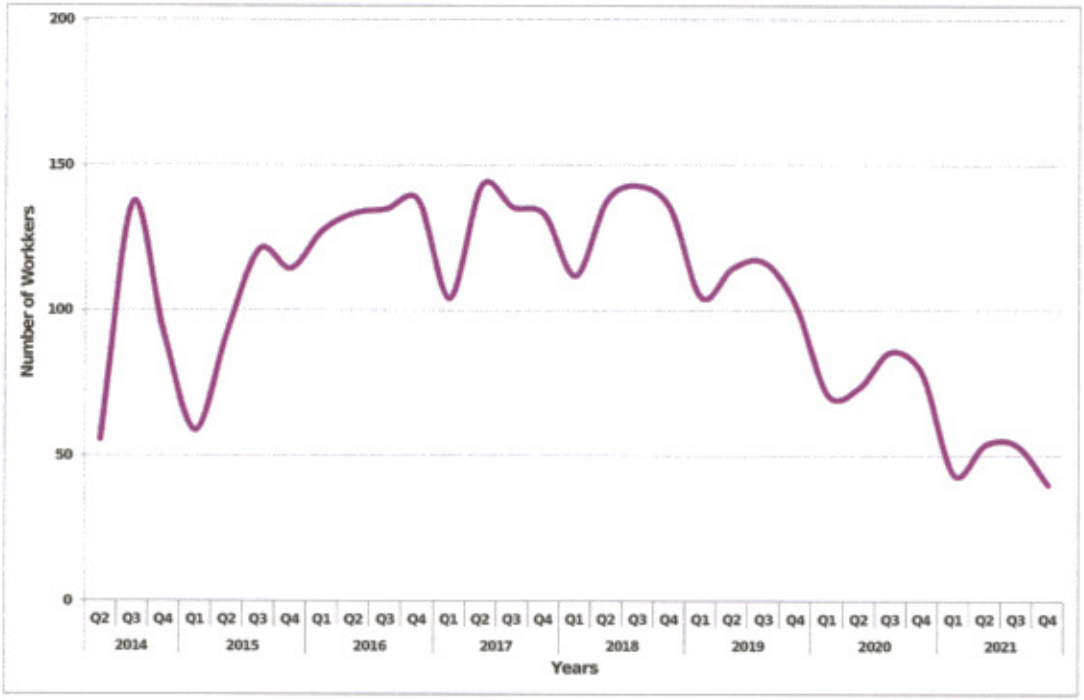
Table 3-27: Construction Phase Estimated Participation by the Churchill-Burntwood-Nelson Aboriginal Workforce in the Keeyask Generation Project (Person-Years) - Low Employment Estimates

	Low Employment Estimates: CBN									
Employment	**Construction Support**		**Non-Designated Trades**		**Designated Trades**		**MH and Supervisory**		**Total**	
	PY	%	PY	%	PY	%	PY	%	PY	%
Total CBN (including KCNs)	160	4%	100	2%	95	2%	35	1%	390	9%
Total Demand	852		952		1,346		1,068		4,218	

Source for the demand: Derived from data provided by Manitoba Hydro in 2010.
Source for the participation: Analysis prepared by InterGroup Consultants Ltd.
Note:
- Numbers are subject to rounding.

Aboriginal workers from the CBN area are predicted to obtain between 390 and 1,195 person-years of employment representing 9% (low estimate) and 28% (high estimate) of Project construction employment opportunities .Approximately two thirds of Aboriginal participants from the CBN area are expected to be employed in construction support and non-designated trades opportunities. Designated trades and Manitoba Hydro and supervisory jobs would account for approximately one-third of this employment.

As shown in Figure 3-27, participation by Aboriginal workers from the CBN area is estimated to vary between about 40 and about 140 workers over most active years of the construction phase.



Source: Analysis prepared by InterGroup Consultants Ltd.

Figure 3-27: Construction Phase Estimated Average Employment of the Churchill-Burntwood-Nelson Aboriginal Workforce

3.4.1.7.2 Regional Study Area Employment Effects

Participation by Aboriginal workers from the Regional Study Area as a whole (including Aboriginal workers from the KCNs and the CBN area) was estimated to range between 13% (low estimate) and 40% (high estimate) of total Project construction employment, representing between 550 and 1,700 person-years of employment (see Table 3-28 and Table 3-29).

Table 3-28: Construction Phase Estimated Employment Participation by the Northern Region Aboriginal Workforce in the Keeyask Generation Project (Person-Years) – High Employment Estimates

High Employment Estimates: Regional Study Area										
Employment	**Construction Support**		**Non-Designated Trades**		**Designated Trades**		**MH and Supervisory**		**Total**	
	PY	%	PY	%	PY	%	PY	%	PY	%
Regional Study Area Aboriginal Workforce (incl. CBN)	750	18%	535	13%	310	7%	105	2%	1,700	40%
Total Demand	852		952		1,346		1,068		4,218	

Source for the Demand: Derived from data provided by Manitoba Hydro in 2010.
Source for the Participation: Analysis prepared by InterGroup Consultants Ltd.
Note:
- Numbers are subject to rounding.

Table 3-29: Construction Phase Estimated Employment Participation by the Northern Region Aboriginal Workforce in the Keeyask Generation Project (Person-Years) - Low Employment Estimates

Low Employment Estimates: Regional Study Area										
Employment	**Construction Support**		**Non-Designated Trades**		**Designated Trades**		**MH and Supervisory**		**Total**	
	PY	%	PY	%	PY	%	PY	%	PY	%
Regional Study Area Aboriginal Workforce (incl. CBN)	225	5%	115	3%	105	2%	105	2%	550	13%
Total Demand	852		952		1,346		1,068		4,218	

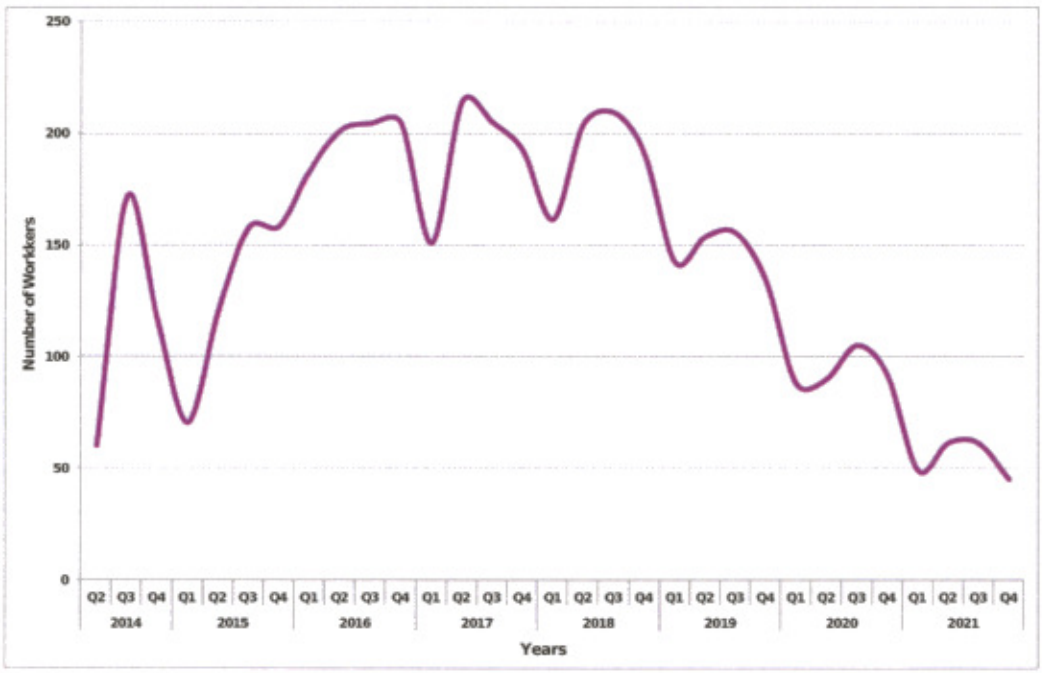
Source for the Demand: Derived from data provided by Manitoba Hydro in 2010.
Source for the Participation: Analysis prepared by InterGroup Consultants Ltd.
Note:
- Numbers are subject to rounding.

These percentages can be compared to that of the Wuskwatim Generation Project, under construction since 2006 and currently nearing completion. Like the Keeyask Generation Project, the Wuskwatim Generation Proejct construction occurred during and following the HNTEI initiative and followed the same preferential hiring provisions for northern Aboriginal workers. The construction phase has consisted of both infrastructure and major works. For a proper comparison of its employment results with the Keeyask Generation Project, only the major works construction can be considered. Construction of Wuskwatim

Generation Project major works resulted in 24% of its workforce being filled by Aboriginal workers from the Regional Study Area. This falls near the middle of the range of the Keeyask Generation Project estimates.

Aboriginal workers from the Regional Study Area (including KCNs and the CBN area) are expected to secure a high percentage of employment in the construction support (up to 88%) and non-designated trades (up to 56%) categories since there are a large number of Aboriginal workers who are qualified for these positions. A smaller proportion of designated trades and Manitoba Hydro and contract supervisory positions are likely to be filled by Aboriginal workers from the northern Region.

Figure 3-28 illustrates projected average quarterly peak employment for Aboriginal residents of the Regional Study Area.



Source: Analysis prepared by InterGroup Consultants Ltd.

Figure 3-28: Construction Phase Average Estimated Employment of the Regional Study Area Aboriginal Workforce in the Keeyask Generation Project

Employment of northern Aboriginal workers is estimated to vary between 45 and 215 workers over the construction phase. Comparing this to the average supply of northern Aboriginal workers, estimates from the employment analysis suggest that, on average, approximately 54% of those who have been identified as ready and qualified to work on the Project could gain employment. This would peak at 83% in the second quarter of 2017.

3.4.1.7.3 Mitigation

Mitigation for Regional Study Area employment includes taking the strategies described above for addressing the availability challenge and applying them to the Regional Study Area as well as tracking Aboriginal Regional Study Area employment as part of the SEMP.

3.4.1.8 Business Opportunities – Regional Study Area

There are no additional anticipated business opportunities related to construction in the Regional Study Area beyond those already discussed for the Local Study Area.

3.4.1.9 Income – Regional Study Area

Project construction will generate income from a number of sources including employment, business opportunities and payment of taxes. KCNs construction income will originate mainly from employment and to a lesser extent from business opportunities; while employment will be the main source of income for Aboriginal residents of the Regional Study Area.

As described earlier in this section, the BNA includes hiring preferences for Aboriginal workers from the CBN area and the Regional Study Area, according to the order set out in BNA Section 12.1.1.3. The following CBN and northern Aboriginal employment income estimates have been developed to illustrate the income effects of these hiring preferences.

All business income accruing to northern Aboriginal businesses is expected to result from DNCs with KCNs businesses. Tendered Contracts are typically not well-suited to the existing construction capacity in the Regional Study Area. Specifically, they usually require a large and very skilled labour force (beyond the capability of companies currently situated in the Regional Study Area). In addition, they typically require specialized equipment and experience that are not currently well developed in the Regional Study Area. Therefore, no Project business income is anticipated to accrue to northern Aboriginal businesses beyond the KCNs communities.

3.4.1.9.1 Employment Income - Churchill-Burntwood-Nelson Area

As a whole, Aboriginal workers from the CBN area, including KCNs Members, are expected to earn between $36 million and $128 million as a result of Project construction employment. Over half of this income is expected to result from DNCs, primarily from construction support employment. The remainder of employment income is expected to come from TCs, primarily through non-designated and designated trades.

In both the low and high employment estimates, more income is generated in the construction support category. Table 3-30 provides a summary of the income analysis results for the CBN area.

Table 3-30: Construction Phase Estimated Gross Employment Income Earned by the Churchill-Burntwood-Nelson Aboriginal Workforce (in millions of dollars)

CBN Region Income	High Employment Estimates			Low Employment Estimates[1]		
	All Contracts	DNC	TC	All Contracts	DNC	TC
Construction Support	51.0	41.2	9.8	12.1	11.7	0.4
Non-Designated Trades	43.8	18.1	25.7	8.4	6.2	2.2
Designated Trades	30.3	14.9	15.4	13.1	8.5	4.6
Subtotal	125.1	74.2	50.9	33.6	26.4	7.2
Manitoba Hydro And Contractor Supervisory	2.7			2.7		
Total	**127.8**			**36.3**		
Construction Support	41%	33%	8%	36%	35%	1%
Non-Designated Trades	35%	14%	21%	25%	18%	7%
Designated Trades	24%	12%	12%	39%	25%	14%
Total	**100%**	**59%**	**41%**	**100%**	**79%**	**21%**

Sources:
Workforce estimates provided by Manitoba Hydro in 2010.
Wage rates derived from BNA (Hydro Projects Management and Allied Hydro Council of Manitoba 2009).
Analysis prepared by InterGroup Consultants Ltd.
Note:
- Numbers do not always add due to rounding. Actual results will vary from estimates provided here.

The estimated effects of the hiring preferences for the CBN area outlined in the BNA for TCs, and the hiring preferences provided to KCNs Members within the CBN area for DNCs, can be seen by comparing total income estimates. The CBN area represents approximately one-third of the total northern Aboriginal population. Churchill-Burntwood-Nelson workers, however, are projected to earn 71%-75% of the total gross employment income anticipated to accrue to northern Aboriginal workers constructing the Project.

3.4.1.9.2 Employment Income – Regional Study Area

Aboriginal workers from the Regional Study Area, including all CBN workers, are estimated to earn between $49 million and $180 million in employment income during the construction phase. On average about 66% of this income is expected to be from employment under DNCs and about 34% from employment under TCs. Direct Negotiated Contract employment in both sets of estimates is expected to be focused in the construction support category, while employment under TCs is expected to be related more to non-designated and designated trades.

Table 3-31 provides a summary of estimated construction employment income for Aboriginal workers in the Regional Study Area as a whole.

Table 3-31: Construction Phase Estimated Gross Employment Income Earned by the Regional Study Area Aboriginal Workforce (in millions of dollars)

Regional Study Area Income	High Employment Estimates			Low Employment Estimates[1]		
	All Contracts	DNC	TC	All Contracts	DNC	TC
Construction Support	75.5	59.7	15.8	16.1	15.2	0.9
Non-Designated Trades	55.4	19.5	35.9	9.8	7.1	2.7
Designated Trades	41.0	16.9	24.1	14.4	8.6	5.8
Subtotal	171.9	96.1	75.8	40.3	30.9	9.4
Manitoba Hydro and Contractor Supervisory	8.2			8.2		
Total	**180.1**			**48.5**		
Construction Support	44%	35%	9%	40%	38%	2%
Non-Designated Trades	32%	11%	21%	24%	18%	7%
Designated Trades	24%	10%	14%	36%	21%	14%
Total	**100%**	**56%**	**44%**	**100%**	**77%**	**23%**

Sources:
Workforce estimates provided by Manitoba Hydro in 2010.
Wage rates derived from BNA (Hydro Projects Management and Allied Hydro Council of Manitoba 2009).
Analysis prepared by InterGroup Consultants Ltd.
Note:
- Numbers do not always add due to rounding. Actual results will vary from estimates provided here.

3.4.1.10 Cost of Living – Regional Study Area

There are no anticipated effects from the Project related to cost of living in the Regional Study Area.

3.4.1.11 Resource Economy – Regional Study Area

During the construction phase, Project effects related to the resource economy in the Regional Study Area are limited to effects on tourism (lodges and outfitters) and forestry within the Split Lake Resource Management Area. Effects are likely to result from shifting patterns of resource use due to the TCN AEA Offsetting Programs.

TOURISM, COMMERCIAL FORESTRY AND MINING

During Project construction, effects on tourism, specifically the lodges and outfitters sector of the resource economy, are likely to result from the increased wage economy (*e.g.*, challenges associated with hiring), presence of a large workforce and increased competition for resources. While construction is occurring, effects from shifting patterns of resource use due to AEA Offsetting Programs could also occur. In addition,

TAB 4

should proceed with something or not.

And sometimes as you learn more you decide there -- there's a -- you should delay, and as you learn more maybe you should delay more. Other cases, you decide, no, you've learnt something and you should proceed. Now, that -- that isn't putting it very well but -- but there was an interrogatory that we had prov -- provided a response, PUB/Manitoba Hydro-I-279, where we provided some work we had done on the effects of learning on our pathways.

You will remember there were five (5) pathways, and -- and we said for each pathway there were different plans you could go with, and that also in the plans -- I'll use Conawapa as the -- the big one, we don't have to necessarily decide right away. And now we're in 2018 to Conawapa, we could decide to do gas or we could defer Conawapa and do it later.

And one of the benefits, and this is discussed in Chapter 14, is between now and 2018 we'd learn more. We'd learn more about DSM, gas prices, export prices, Dave Cormie's negotiations.

And so there -- we -- we did have work -- work in this PUB-1-279, where we took the pathways and applied just a different -- I won't try and explain the whole thing here, but decision points. And the --

MR. ED WOJCZYNSKI: In -- in that chapter we were refer -- we were defining it that way, and -- and that's how we determined what the in-service dates were with the 2012 in-service date -- the 2012 load forecast, my apologies. As we communicated earlier that when we got the new load forecast, even in the submission there wasn't the same need for Conawapa to be in '25. And so then we moved it to 2026, even though we still could have probably got '25.

So in -- in this chapter that you're referring to here, it was in the context of that chapter. If you go to Chapter 14, which I don't know if you're going there, but in Chapter 14 we introduced the concept of pathways and the flexibility, and how in the real world any company who is undertaking projects, whether it's an electric utility company or otherwise, will adapt its plan to the circumstances; and that is part of the plan. To be flexible in what you're doing is part of the plan.

So but in -- in the very narrow definition of Preferred Plan, yes, it's Keeyask and Conawapa. In the broader definition of what we used in Chapter 14 and in the overview, we said there was flexibility and optionality and we would adapt to the circumstances. And that -- what the real decision with

51. If you could turn to page 51 of our book of documents, please. At the bottom of the page, line 11 -- and this is from chapter 12 of your business case, the chapter just referred to, sir. If we go to line 11, we see, three-quarters (3/4s) down the line, the sentence starts:

> "Plan 14 in Table 12.10 is the Preferred Development Plan with the fixed in-service dates for both Keeyask and Conawapa generating station. Plan 14(a) is a variant of the Preferred Development Plan in which the in-service date for Conawapa generating station is deferred for four (4) years with a four (4) times DSM."

So you can perhaps understand why I, reading this, didn't understand the same thing that you're telling us today is -- and what you're telling us today is that the Preferred Development Plan is not putting Conawapa in at its earliest in-service date, but it's optionality?

MR. ED WOJCZYNSKI: The Preferred Development Plan has Conawapa following Keeyask, that's -- that's the plan, but with flexibility as to what the

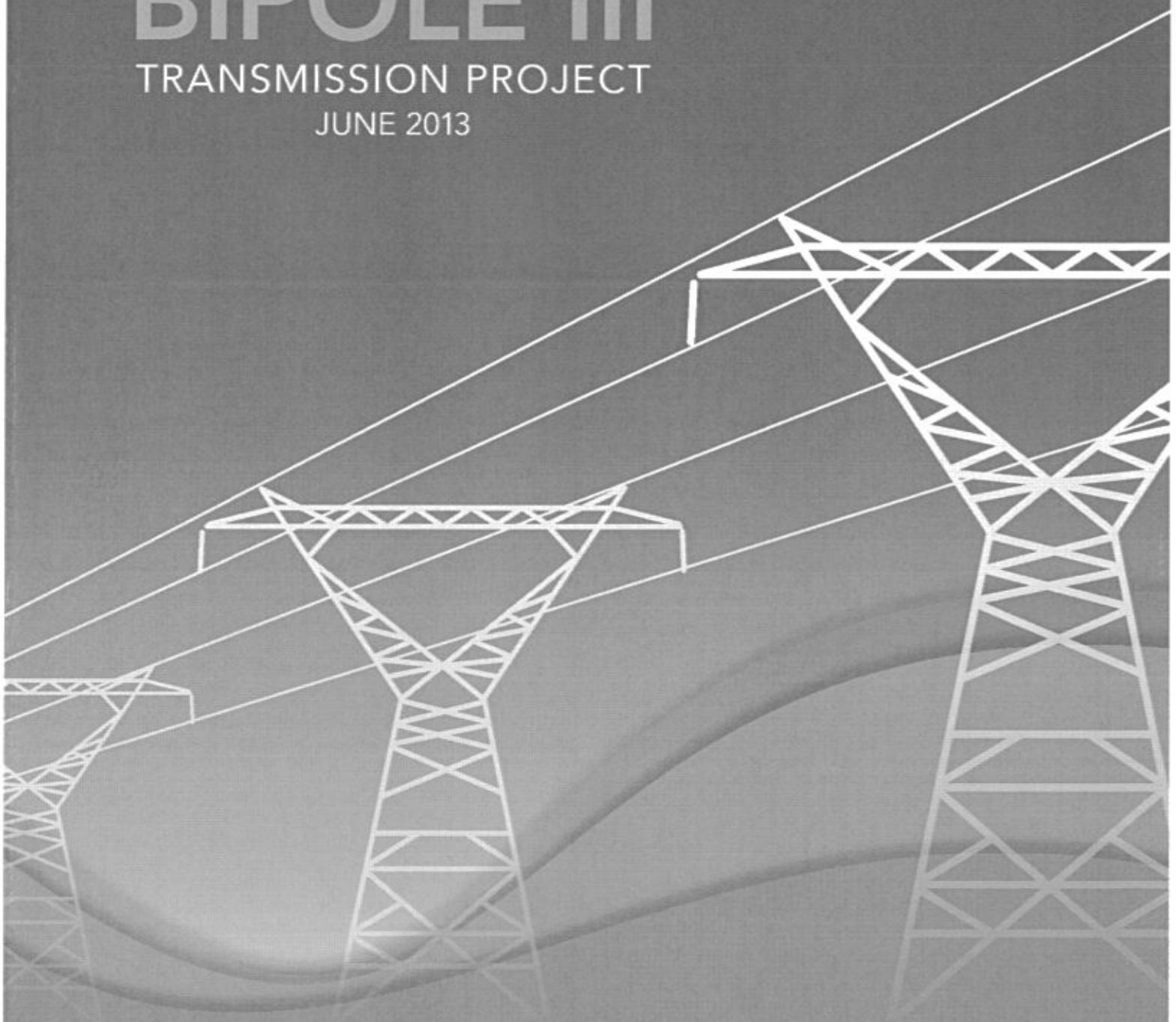
TAB 5

REPORT ON PUBLIC HEARING

BIPOLE III

TRANSMISSION PROJECT

JUNE 2013



Manitoba CLEAN·ENVIRONMENT COMMISSION

Manitoba

42

- *Provide comprehensive and clear guidance for proponents, consultants and practitioners.*

- *Establish protocols for best professional practice.*

The new environmental assessment process must, at a minimum, address: use of traditional and local knowledge, selection of appropriate valued environmental components, establishment of baseline conditions, and establishment of thresholds in the conduct of environmental assessments.

The protocols should reduce uncertainty, enhance effectiveness and improve predictability of future environmental assessments.

13.4 The Need for a Regional Cumulative Assessment

During the Bipole III hearings, it became apparent that past hydro-electric 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. Bipole III and projects proposed for the near future will add to these impacts. As the Commission heard from the affected communities, the cumulative effects of these projects need to be considered as a whole. The Bipole III cumulative effects assessment did not take into account and was not required to take into account the breadth of all these projects.

However, 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.

It is recommended that this Regional Cumulative Effects Assessment be undertaken prior to the licensing of any additional projects in the Nelson River sub-watershed and that this regional assessment be part of the cumulative effects assessment carried out for any individual future project. The regional assessment must include, but not be limited to, Jenpeg, Kettle, Long Spruce, Limestone, Bipole I, II and III and all associated transmission lines and infrastructure.

Non-Licensing Recommendation

The Commission recommends that:

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

TAB 6

MINISTER OF
CONSERVATION AND WATER STEWARDSHIP

Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

CLIENT FILE NO.: 5433.00

August 14, 2013

Shannon Johnson
Manitoba Hydro
820 Taylor Avenue
Winnipeg MB R3M 3T1

Dear Ms. Johnson:

Enclosed is **Environment Act Licence No. 3055** dated August 14, 2013 issued to **Manitoba Hydro** for the construction, operation and maintenance of the Development being the Bipole III Transmission Project, consisting of a new 500 kV HVdc transmission line connecting two new converter stations, one in the north near Gillam (Keewatinoow Converter Station) and one in the south near Winnipeg (Riel Converter Station), two new ground electrodes connected to each of the new converter stations, and new 230 kV ac transmission collector lines to connect the new northern converter station to existing northern converter stations, in accordance with the Proposal dated December 14, 2009, the Bipole III Transmission Project Environmental Impact Statement (EIS) filed under The Environment Act in December 2011, supporting information filed in association with the EIS dated June 22, July 31, August 8, September 17 and 20, October 2, 23, and 19, 2012, January 28, February 19, and 25, 2013, in consideration of the June 2013 Clean Environment Commission Report on Public Hearings.

In addition to the enclosed Licence requirements, please be advised that it is my intent to ensure that all of the non-licensing recommendations in the Clean Environment Commission report be implemented. Technical staff in my department will contact you in the near future to discuss implementation of the recommendation to cooperatively conduct a Regional Cumulative Effects Assessment for all Manitoba Hydro projects and associated infrastructure in the Nelson River sub-watershed.

Further to the above, Manitoba Hydro will be required to invest in educational and/or knowledge transfer programs that promote trapping as well as plant harvesting to affected communities. Department staff will be in contact to discuss this further.

.../2

In addition to the enclosed Licence requirements, please be informed that all other applicable federal, provincial and municipal regulations and by-laws must be complied with. A Notice of Alteration must be filed with the Minister for approval prior to any alteration to the Development as licensed.

Pursuant to Section 27 of *The Environment Act*, this licensing decision may be appealed by any person who is affected by the issuance of this Licence within 30 days of the date of the Licence.

Yours truly,

Gord Mackintosh
The Environment Act

Enc.
c: Don Labossiere, Director, Environmental Compliance and Enforcement
Regional Directors: Pierce Roberts, Wayde Roberts, Perry Stonehouse, Rob Nedotiafko
Public Registries, Public Distribution List

NOTE: **Confirmation of Receipt of this Licence No. 3055 *(by the Licencee only)* is required by the Director of Environmental Approvals. Please acknowledge receipt by signing in the space provided below and faxing a copy (letter only) to the Department by August 28, 2013**

On behalf of Manitoba Hydro **Date**

****A COPY OF THE LICENCE MUST BE KEPT ON SITE AT THE DEVELOPMENT AT ALL TIMES****

TAB 7

Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences
Central and Arctic Region
Canadian Science Advisory Secretariat
Science Advisory Report 2010/050

RECOVERY POTENTIAL ASSESSMENT OF LAKE STURGEON: NELSON RIVER POPULATIONS (DESIGNATABLE UNIT 3)

Lake Sturgeon Acipenser fulvescens
© J.R. Tomelleri

Figure 1. DU3 for Lake Sturgeon (coloured area).

Context:

*The Lake Sturgeon (*Acipenser fulvescens*) was common in nearshore waters across much of Canada in the nineteenth century, but intensive fishing, habitat loss and degraded water quality caused severe reductions in population size or extirpation across their range. Today they remain extant from the North Saskatchewan River in Alberta, to Hudson Bay in the north, and eastward to the St. Lawrence River estuary. In November 2006, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed Lake Sturgeon in Canada. Designatable Unit (DU) 3, the Nelson River populations, includes Lake Sturgeon in the Nelson River in northeastern Manitoba, downstream of Lake Winnipeg (to Hudson Bay), and all related drainages. The Lake Sturgeon in this region is considered a distinct DU unit on the basis of distinguishable variation in three nuclear microsatellite loci. COSEWIC assessed and designated DU3 as Endangered as Lake Sturgeon in this DU declined severely over the past century. Historically, over-exploitation from commercial fisheries probably was the primary threat which led to depletion of Lake Sturgeon in DU3. More recently, habitat degradation or loss associated with dams/impoundments and other barriers and impacts of fishing have become the most important threats.*

DU3 Lake Sturgeon is being considered for legal listing under the Species at Risk Act *(SARA). In advance of making a listing decision, Fisheries and Oceans Canada (DFO) has been asked to undertake a Recovery Potential Assessment (RPA). This RPA summarizes the current understanding of the distribution, abundance and population trends of Lake Sturgeon in DU3, along with recovery targets*

and times. The current state of knowledge about habitat requirements, threats to both habitat and Lake Sturgeon, and measures to mitigate these impacts for DU3 are also included. This information may be used to inform both scientific and socio-economic elements of the listing decision, development of a recovery strategy and action plan, and to support decision-making with regards to the issuance of permits, agreements and related conditions, as per sections 73, 74, 75, 77 and 78 of SARA.

SUMMARY

- Six Management Units (MUs) have been identified for DU3: MU1 is located between Playgreen Lake and Whitemud Falls, MU2 between Whitemud Falls and Kelsey Generating Station (GS), MU3 between Kelsey GS and Kettle GS, MU4 between Kettle GS and Long Spruce GS, MU5 between Long Spruce GS and Limestone GS and MU6 between Limestone GS and Hudson Bay.
- Available data and expert opinion indicates that Lake Sturgeon abundance in DU3 ranges from very low to moderate.
- In MU1, the current status is critical, population trajectory is increasing due to stocking but recovery potential is low for the indigenous population and unknown for the stocked population.
- The status, trend and recovery potential of MU2 is cautious, stable or possibly increasing and moderate, respectively.
- The status, trend and recovery potential of MU3 is cautious, unknown and moderate, respectively.
- In MUs 4 and 5, population status is critical, trajectory is unknown and recovery potential is low.
- The status of MU6 is healthy, trajectory is unknown and recovery potential is high.
- Survival and recovery of Lake Sturgeon in DU3 depend on maintaining the functional attributes of habitat, including the ecologically-based flow regimes needed for spawning, egg incubation, juvenile rearing, summer feeding and overwintering, as well as migration routes between these habitats.
- The long-term recovery goal for DU3 is to protect and maintain healthy, viable populations of Lake Sturgeon in all MUs in the Nelson River system.
- The most important current threats to survival and recovery of Lake Sturgeon in DU3 are habitat degradation or loss resulting from the presence of dams/impoundments and other barriers, mortality, injury or reduced survival resulting from fishing, and population fragmentation resulting from the presence of dams/impoundments and other barriers.
- Mitigation measures that would aid recovery include prevention of mortality, protection of habitat and public education.
- Activities that damage or destroy functional components of habitat or key life components of the life cycle pose a very high risk to the survival or recovery of Lake Sturgeon in MUs 1, 4 and 5, a moderate to high risk in MUs 2 and 3 and a moderate risk in MU6.

BACKGROUND

Rationale for Assessment

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Lake Sturgeon in DU3 as Endangered in 2006 (COSEWIC 2006) and it is now being considered for listing under the *Species at Risk Act* (SARA). When COSEWIC designates an aquatic species as Threatened or Endangered and the Governor in Council decides to list it, the Minister of

Fisheries and Oceans Canada (DFO) is required by the SARA to undertake a number of actions. Many of these actions require scientific information such as the current status of the DU, the threats to its survival and recovery, and the feasibility of its recovery. Formulation of this scientific advice has typically been developed through a Recovery Potential Assessment (RPA). This allows for the consideration of peer-reviewed scientific analyses in subsequent SARA processes, including recovery planning. If listed, decisions made on permitting of harm and in support of recovery planning need to be informed by the impact of human activities on the species, mitigation measures and alternatives to these activities and the potential for recovery. The information and scientific advice provided in this document may be used to inform both scientific and socio-economic elements of the listing decision, development of a recovery strategy and action plan, and to support decision-making with regards to the issuance of permits, agreements and related conditions, as per sections 73, 74, 75, 77 and 78 of SARA.

Species Biology and Ecology

The Lake Sturgeon is a large bottom-dwelling freshwater fish. They can attain over 3 m in length and 180 kg in weight, though they mostly range about 0.9-1.5 m in length and about 5-35 kg in weight (Cleator *et al.* 2010). Studies conducted in the lower Nelson River in the 1990s found the largest Lake Sturgeon caught each year were 1.4-1.6 m in length and 17.3-30 kg in weight (Cleator *et al.* 2010). Fish surveyed in the Kelsey Generating Station (GS) to Kettle GS reach of the Nelson River from 2001-2008 ranged in length from 0.3 to 1.6 m and weighed 1.1 to 49.9 kg (Cleator *et al.* 2010). Females are usually heavier than males.

This species is found in large rivers and lakes usually at depths of 5-10 m or more over mud, clay, sand or gravel substrates in water temperatures within the range of 3-24°C (COSEWIC 2006). The Lake Sturgeon has been described as largely sedentary, making localized (1-20 km) seasonal movements, with high site fidelity except to move over longer distances for spawning. Lake Sturgeon in the Nelson River can remain in small local areas for periods of up to five years, while others have been shown to undertake movements of over 300 km (Cleator *et al.* 2010). Tagging studies indicate that younger, smaller Lake Sturgeon do not move as far as older, larger individuals (Cleator *et al.* 2010).

Sexual maturity (i.e., the age at which spawning is first observed) typically occurs between 14 and 33 years of age in females and between 14 and 22 years in males (Cleator *et al.* 2010). Data collected in the Nelson River in the mid-1950s indicated that females and males in DU3 reached sexual maturity at 20-23 years (average length: 113.1 cm) and 18-20 years (97.8 cm), respectively (Cleator *et al.* 2010). In the lower Nelson River (MU6), females have been found to mature at 71.5 cm (fork length (FL)) and males at 63.5 cm (FL) (Cleator *et al.* 2010).

Spawning occurs in May and June, once the river is free of ice and water temperatures are in the range of 11.5–16°C (Cleator *et al.* 2010). In the Lower Nelson River (MU6), spawning occurs when water temperatures are in the range of 11-17°C (Cleator *et al.* 2010). Adults move upstream to suitable areas containing rapids or below barriers (e.g., falls or dams) where they typically spawn in swift current near shore with individual spawning females surrounded by several males (Cleator *et al.* 2010). Females may contain between about 50,000 and >1,000,000 eggs, with heavier individuals producing more eggs. The interval between successive spawnings is estimated to be 3-7 years for females and 2-3 years for males (Cleator *et al.* 2010). Lake Sturgeon scatter their eggs and move quickly downstream after spawning, providing no parental care to the eggs or fry.

The eggs hatch in 5-10 days, depending on water temperature, and remained burrowed in the substrate until the yolk sac is absorbed. The young typically emerge at night within 13-19 days

after hatching, and disperse downstream with the current (up to 40 km) before returning to a benthic habitat. By that time they resemble miniature adults and start feeding. Age-0 fish grow rapidly from 1.7-1.8 cm at emergence to approximately 11-20 cm total length (TL) by the end of the first summer (COSEWIC 2006).

The sex ratio at birth is assumed to be 1:1, based on data from populations with little or no anthropogenic mortality, but following maturation can favour either females or males as a result of targeted exploitation. Information about survival is limited. In Lake Winnebago during 1936-1952, survival of Lake Sturgeon aged 16-36 years was 0.946 and older than 36 years was 0.866 (Cleator *et al.* 2010). The estimate of survivorship of adult and sub-adult Lake Sturgeon below the St. Lawrence FDR Power Project at Massena, New York, was 0.86 (Cleator *et al.* 2010). Recruitment (i.e., the number of fish which grow into the catchable size range in a year) in populations which are self sustaining is reported to be in the range of 4.7-5.4% (Cleator *et al.* 2010). The annual estimate of survival, taking into account natural and fishing mortality, in the Gull Lake area of the Nelson River (MU3) is currently thought to be about 0.85 (Cleator *et al.* 2010).

There are historic records of Lake Sturgeon living up to 150 years of age. Lifespan today is typically more in the range of 25-50 years, with an average generation time of about 26-30 years (Cleator *et al.* 2010). Shorter average lifespan today may reflect current and/or past effects of harvest. Out of a small sample of Lake Sturgeon caught and aged from the lower and upper Nelson River in the 1990s, the oldest were 43 and 90 years of age, respectively (Cleator *et al.* 2010). These data likely underestimate the oldest ages present as older fish may have been caught but not aged and very large Lake Sturgeon can escape gill nets so they are rarely caught.

The Lake Sturgeon follows a benthic generalist feeding strategy. Age-0 fish mostly feed on amphipods and chironomid larvae while the diet of juveniles also includes oligocheates, aquatic insects (e.g., ephemeroptera nymphs, trichoptera larvae), mollusks and fish eggs (Cleator *et al.* 2010). A shift in diet has been reported to occur when Lake Sturgeon reach about 70-80 cm TL, from a diet comprised mainly of soft bodied insects to a wide range of benthic organisms including bivalves or crayfish (Cleator *et al.* 2010). Some pelagic feeding has also been reported. The Lake Sturgeon feeds actively throughout the year, though consumption may decline in the fall and winter.

ASSESSMENT

Historic and Current Distribution and Trends

DU3 includes the Nelson River, which flows from the north end of Lake Winnipeg to Hudson Bay for a distance of about 660 km, and its immediate drainages in northeastern Manitoba (Figure 1). Five hydroelectric GSs currently exist on the Nelson River, resulting in a series of lake-like impoundments interspersed with unimpounded river sections. Recent tagging data indicate that Lake Sturgeon from the Nelson River (DU3) move into the Hayes River (DU7) from Hudson Bay which brings into question the boundaries of these two DUs (Cleator *et al.* 2010).

Six Lake Sturgeon MUs, separated from each other by natural or man-made barriers, have been identified in the Nelson River (DU3) (Figure 2): (1) from Playgreen Lake to Whitemud Falls, (2) from Whitemud Falls to the Kelsey GS, (3) from Kelsey GS to Kettle GS, (4) from Kettle GS to Long Spruce GS, (5) from Long Spruce GS to Limestone GS and (6) from

Limestone GS to Hudson Bay. Within each of these MUs there may be one or more spawning stocks.

Scientific knowledge of the historic distribution of Lake Sturgeon in DU3 is limited. The construction of hydroelectric dams, beginning in 1960, fragmented the distribution of this species and isolated Lake Sturgeon into a series of reservoirs, particularly between Kettle and Limestone GSs (Figure 2). The current area of Lake Sturgeon occupancy in DU3 is estimated to be < 40,000 km^2, and the trend in area, extent or quality of habitat is declining in response to dam construction (COSEWIC 2006).

Cleator *et al.* (2010) contains detailed physical descriptions of each MU.

Playgreen Lake – Whitemud Falls (MU1)

The Lake Sturgeon was present in Playgreen and Cross Lakes between the 1890s and 1920s, but then largely disappeared due to over-exploitation by commercial fisheries (Cleator *et al.* 2010). Stocking was undertaken in MU1 starting in the mid-1990s.

Whitemud Falls – Kelsey GS (MU2)

Sipiwesk Lake was the center of the Nelson River commercial Lake Sturgeon fishery during the 1950s and again during the fishery from 1970-1991. Lake Sturgeon remain in MU2 and are known to spawn upstream of Sipiwesk Lake at Bladder Rapids and downstream at the mouth of the Landing River (Cleator *et al.* 2010).

Kelsey GS – Kettle GS (MU3)

Commercial fishing of Lake Sturgeon on the Nelson River in the vicinity of Split Lake (MU3) began around 1915, when the Hudson Bay Railway was constructed and fish could be shipped south to markets (Cleator *et al.* 2010). Today, the Lake Sturgeon occurs throughout the MU (Cleator *et al.* 2010).

Kettle GS – Long Spruce GS (MU4)

The Lake Sturgeon is currently present in MU4. No historic information is available.

Long Spruce GS – Limestone GS (MU5)

The Lake Sturgeon is currently present in MU5. No historic information is available.

Limestone GS – Hudson Bay (MU6)

No historic information about Lake Sturgeon distribution is available for MU6.

Three spawning locations are currently known in MU6: the Lower Limestone Rapids, mouth of the Angling River and mouth of the Weir River. Recent tagging studies have shown that Lake Sturgeon tagged near the mouth of the Weir River are being recaptured in the Hayes River (DU7) demonstrating they can move between the mouth of the Nelson and Hayes rivers (Cleator *et al.* 2010). A spawning location on the Gods River has been identified by the residents of Shamattawa and there are likely others.

It appears Lake Sturgeon can make extensive movements up the Hayes River and its tributaries which raises questions about whether these areas warrant consideration as separate DUs. Recent genetics research indicated that Lake Sturgeon in the Hayes River was more closely related to Lake Sturgeon from the Gull Lake reach (MU3) than the lower Nelson River (MU6). Additional analyses are underway with increased sample sizes which may provide further insight into the relationship between these populations. Consideration should be given as to whether the Hayes-Gods river system is included in DU3 or whether MU6 (in DU3) is included in DU7 (Southern Hudson Bay and James Bay populations).

Historic and Current Abundance and Trends

The Lake Sturgeon was historically abundant in DU3. Commercial fisheries in the Nelson River were established by 1902 (Cleator *et al.*, 2010) and the last fishery closed in 1991 (COSEWIC 2006). Over the past 50 years, a history of over-exploitation, combined with the construction of hydroelectric dams that blocked migration routes, resulted in population declines in DU3. Today, the Lake Sturgeon in the Nelson River continues to be affected by exploitation and hydroelectric development. Spawning populations have been reduced, though successful spawning and recruitment are known to be occurring in the Sipiwesk Lake to Kelsey GS reach (in MU2), Kelsey GS to Gull Rapids reach (in MU3), and Limestone GS to Nelson River estuary reach (MU6). There is much less certainty about recruitment in Stephens Lake (in MU3), Long Spruce and Limestone forebays (in MUs 4 and 5, respectively), and upstream of Whitemud Falls (MU1). The overall number of mature individuals in DU3 is unknown but based on the most recent population estimates available, could be in the range of several thousand adult Lake Sturgeon.

The current conservation status, based on the precautionary framework (see Cleator *et al.* 2010 for explanation), of each of the MUs in DU3 was evaluated on the basis of available information and expert opinion (Table 1).

Playgreen Lake – Whitemud Falls (MU1)

Playgreen Lake was fished extensively for Lake Sturgeon starting around 1900 (Cleator *et al.*, 2010). In 1925, the annual limit for Lake Sturgeon was 40,000 lbs (18,144 kg) in Playgreen and Cross Lakes (Cleator *et al.*, 2010). Little information on Lake Sturgeon abundance is currently available above Sipiwesk Lake, but the Cross Lake and Playgreen Lake stocks are considered to be nearly extirpated (Cleator *et al.*, 2010) (Table 1). Any Lake Sturgeon remaining in this reach would be part of a remnant population. Until 1994, this population was either stable at a very low level or declining. Stocking was considered the only useful tool to recover this area. Since 1994, approximately 25,000 fingerlings reared from eggs harvested from spawners captured in MU2 have been stocked in this area and local fishers from Norway House have reported increasing numbers of small Lake Sturgeon caught incidentally in the area. The status of Lake Sturgeon in MU1 is critical and its trajectory is increasing as a result of stocking (Table 1).

Whitemud Falls – Kelsey GS (MU2)

Prior to the 1960s, at least 80% of the Lake Sturgeon production in DU3 was taken from this MU (Cleator *et al.*, 2010). The initial population estimates of 12,000 adult Lake Sturgeon in the early 1960s and corrected estimates of 6,000 in 1987 (Cleator *et al.*, 2010) had declined by 90% and 80%, respectively, to about 1,200 adults in 2000, most of which were males (COSEWIC 2006). Juveniles and pre-spawners constituted 87% of the fish harvested during the last commercial

harvest in Sipiwesk Lake in the early 1990s (Cleator *et al.*, 2010). The current number of mature individuals in Sipiwesk Lake may be about 150 fish (COSEWIC 2006).

Hundreds of Lake Sturgeon used to spawn in the rapids at the mouth of the Landing River, a tributary to the Nelson River downstream of Sipiwesk Lake (Cleator *et al.*, 2010). This spawning run was heavily harvested from 1991 until 1993. Since 1994 only small numbers of spawning Lake Sturgeon are observed at this location, typically as few as a single female and up to four males. Upstream of Sipiwesk Lake, Bladder Rapids is also an important area for Lake Sturgeon spawning (Cleator *et al.*, 2010).

Growth rates in Lake Sturgeon were similar in the 1990s to those recorded in the 1950s, prior to hydro development (Cleator *et al.*, 2010), suggesting that food resources are not limiting the current Lake Sturgeon population. This MU likely contains fewer than 1,300 adult Lake Sturgeon, however the harvest has declined and the current population trajectory is thought to be stable (Table 1). Current population estimates available for the Sipiwesk Lake to Kelsey GS reach of MU2 indicate both adult and, especially, juvenile Lake Sturgeon are increasing in number and showing signs of recovery (Cleator *et al.*, 2010). As younger fish reach sexual maturity, the population trajectory may improve. The current population status and trend of MU2 is cautious and stable or possible increasing, respectively (Table 1).

Kelsey GS – Kettle GS (MU3)

Between 1998 and 2004, 875 Lake Sturgeon were tagged from Kelsey GS to Kettle GS. The 2007 population estimate for mature Lake Sturgeon in the Kelsey GS/Burntwood River area of the MU was 473 adults. The 2008 population estimate for mature Lake Sturgeon in the Birthday Rapids to Gull Rapids reach was 360 (Cleator *et al.*, 2010). There have been too few mature Lake Sturgeon captured in Stephens Lake to generate a population estimate. Subadult and adult Lake Sturgeon are captured throughout the MU. Concentrations of age-0 Lake Sturgeon have been found in the north channel of Gull Lake and below Gull Rapids. Most recaptures of tagged fish have occurred in the same waterbodies in which they were applied. However, Lake Sturgeon move between Kelsey GS and the Burntwood, Grass and Odei rivers and Split Lake. Of 573 Lake Sturgeon tagged in the Birthday-Gull Rapids reach, two were captured in Stephens Lake and seven in Split Lake. Seven percent of Lake Sturgeon tagged in Stephens Lake (n =70) were captured in the Gull Lake area. Spring gillnetting in 2003 and 2005 indicated that 80% were immature or non-spawners (Cleator *et al.*, 2010). The current status of MU3 is thought to be cautious although the trajectory is unknown (Table 1).

Kettle GS – Long Spruce GS (MU4)

Research conducted in recent years indicates there are small numbers of Lake Sturgeon in this MU. Within this reach, there are fish younger than the age of the impoundment but there is no confirmed evidence of spawning. Population status and trajectory in MU4 is critical and unknown, respectively (Table 1).

Long Spruce GS – Limestone GS (MU5)

Research conducted in recent years indicates there are small numbers of Lake Sturgeon in this MU. Within this reach, there are fish younger than the age of the impoundment but there is no confirmed evidence of spawning. Population status and trajectory in MU5 is critical and unknown, respectively (Table 1).

Limestone GS – Hudson Bay (MU6)

The 2004/2005 population estimate for the lower Nelson River from Limestone GS to Hudson Bay is 5,467 adult Lake Sturgeon (95% CI: 3,768-8,018) (Cleator *et al.*, 2010). Over 300 Lake Sturgeon have been known to congregate in the vicinity of the Weir River mouth during spring (Cleator *et al.*, 2010). In spite of the fact that MU6 does not contain prime Lake Sturgeon habitat and experiences large daily variations in flow as a result of hydroelectric generation, it supports a substantial Lake Sturgeon population likely due to its inaccessibility to exploitation. Prior to construction of the Conawapa road, around 1990, this area was almost completely inaccessible to all but the most knowledgeable local harvesters. The status of Lake Sturgeon in MU6 is healthy although the population trajectory in unknown (Table 1).

Information to Support Identification of Critical Habitat

The earliest age-0 stage, from hatch to first feeding (about 7-10 days), is assumed to be critical for survival and recovery of Lake Sturgeon but research on this life stage is only now underway. Age-0 fish have been captured in a variety of habitat types, from shallow water to depths > 10 m, substrates comprised of clay, sand and gravel/cobble, and water velocities of 0.1-0.3 m/s^{-1} (Cleator *et al.* 2010). Finer substrate types, like clay and sand, are reported to be preferred habitat for juvenile Lake Sturgeon as they contain larger amounts of small benthic prey, however they have also been found in areas of coarse-sand and pea-sized gravel. Juveniles use water depths ranging from 3-6 m to > 14 m and currents of 0.25-0.50 $m \cdot s^{-1}$ (Cleator *et al.* 2010). Depth was shown to be the primary abiotic factor influencing habitat selection in juveniles from the Winnipeg River (Cleator *et al.* 2010). The habitat requirements of young Lake Sturgeon appear to be more restricted, thus availability of suitable habitat may be more limiting for age-0 and early juvenile life stages, than for adults. Adult life stages tend to be more plastic, adapting to various habitat conditions (Cleator *et al.* 2010).

Tagging studies have documented that Lake Sturgeon movements are complex. Some individuals may move substantial distances away from core areas and then return weeks or months later, while others will remain in the core area or leave and not return. Regardless, many or most Lake Sturgeon groups demonstrate a preference for certain areas, at least in riverine environments, that contain hydraulic features characterized by transition from high-current velocities to slower velocities (e.g., the confluence of the main river channel with a tributary). These local changes in size and shape of the river result in depositional substrates where silt accumulates, providing good habitat for invertebrates which, in turn, provides good feeding habitat for Lake Sturgeon. In riverine environments, adults generally prefer water depths of ≥ 5 m with moderate water flow (< 0.6 $m \cdot s^{-1}$), and appear to avoid areas with high current velocity, except during spawning (Cleator *et al.* 2010).

The Lake Sturgeon is thought to move to deeper waters during warmer periods and return to shallower waters when temperatures decline. This may reflect seasonal or diel changes in distribution and also may vary by waterbody. Migration is functionally linked to movement between the adult feeding and spawning habitat. Open connections between these habitats are necessary, as adults may be required to migrate considerable distances to find suitable spawning habitat.

Adults typically spawn in late spring, in water temperatures of 11.5-16°C in high-gradient reaches of large rivers, often below rapids or dams, with current velocities of 0.5-1.3 $m \cdot s^{-1}$, water depths of 0.5 to 10 m, and over substrates of cobble, boulders, coarse gravel, hardpan, or sand (Cleator *et al.* 2010). Cascades and/or suitable water flows are necessary to keep the eggs and newly-hatched young healthy yet prevent them from being carried downstream before

larval drift occurs. Seasonal and annual changes in flow may affect fidelity to specific spawning and feeding areas. A number of actual and suspected spawning sites are known for DU3 (Cleator *et al.* 2010).

Not as much is known about the habitat preferences of Lake Sturgeon during winter. One study reported that adults spend the winter at water depths of 6-8 m (max. 20 m) and water velocities of ≤ 0.2 $m \cdot s^{-1}$ (max. 0.4 $m \cdot s^{-1}$), over silt and sand substrate (Cleator *et al.* 2010). Juveniles tended to congregate at approximately the same depths, substrate types and flow velocities, although some were observed at flow velocities as high as 0.4-0.6 $m \cdot s^{-1}$ (Cleator *et al.* 2010). In the upper Nelson River, Gull Lake may provide overwintering habitat (DFO 2010).

Within DU3, extensive habitat mapping has been conducted or is underway from Whitemud Falls to Kelsey GS (MU2), from Kelsey GS to Kettle GS (MU3) and from Limestone GS to the Nelson River estuary (MU6).

In summary, maintaining the functional attributes of habitat, including the ecologically-based flow regimes, needed for spawning, egg incubation, juvenile rearing, summer feeding and overwintering, as well as migration routes between these habitats, is critical to the survival and recovery of Lake Sturgeon. The current distribution of Lake Sturgeon in the Nelson River system (DU3) is fragmented by dams which negatively affect spawning habitat. More dams are planned so it is anticipated that further habitat fragmentation and degradation (e.g., changes in flow regime) is likely in the future. The availability of spawning habitat may become limiting for Lake Sturgeon in some MUs if access to necessary habitat is affected. It is essential that conditions that optimize the survival and recovery of Lake Sturgeon be maintained in DU3, especially during the spawning and incubation periods.

Residence

SARA defines a *residence* as "a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating". Residence is interpreted by DFO as being a *constructed* place (e.g., a spawning redd). The Lake Sturgeon does not change its physical environment or invest in a structure during any part of its life cycle, therefore no biological feature of this species meets the SARA definition of residence as interpreted by DFO.

Recovery Targets

The long-term recovery goal for DU3 is to protect and maintain healthy, viable populations of Lake Sturgeon in all MUs on the Nelson River. To reach this goal, each MU must have at least 413 spawning females each year (i.e., 4,130 adults) and at least 974 ha of suitable riverine habitat or 1,948 ha of suitable lake habitat[1]. The aim is to reach these population and distribution objectives within three generations (i.e., 3 x 36 years = about 108 years) (Cleator *et al.* 2020). If undertaken, this recovery target would achieve a significant reduction in the probability of extinction of Lake Sturgeon in DU3. If a less precautionary recovery target is

[1]Population viability analysis of stage-structure demographic matrices was used to determine recovery targets (Cleator *et al.* 2010). Minimum viable population (MVP) was defined as the number of adults necessary to achieve a 99% probability of persistence of Lake Sturgeon over 250 years, given a probability of catastrophe (50% decrease in the abundance of all life stages in one year) of 14% per generation, and assuming a balanced sex ratio, 5-year spawning periodicity and a sufficient number of juveniles to support the adult population goal.

chosen, the number of spawning females per year would be reduced and years to recovery increased accordingly.

The MVP modelling uses vital rates as inputs, and it is important to note that there are uncertainties associated with these vital rates. For example, the vital rates data may not have been specific to the DU being modelled, recent unpublished data may not be available or assumptions used in the model (e.g., a balanced sex ratio) may not accurately represent current conditions for that DU. Additionally, the recovery target may not reflect historic Lake Sturgeon abundance before over-exploitation and habitat degradation or loss began. In spite of uncertainty around the model output, its results are still useful and provide a recovery target to work towards. The model can be updated once new information comes available.

Modelling indicates that when current abundances are assumed to be 10% of the recovery target, times-to-recovery range from about 20 years to around 95 years (i.e., about 1-3 generations), depending on the recovery actions implemented (Cleator *et al.* 2010) (Figure 3). Recovery timeframes diminish if Lake Sturgeon spawning periodicity is shorter or reproductive effort is higher than expected and, conversely, will lengthen if spawning periodicity is longer or reproductive effort is lower than expected. Without recovery actions, time to recovery would be significantly longer.

The recovery potential and importance to recovery of each of the six Lake Sturgeon MUs in DU3 was evaluated on the basis of available information and expert opinion (Table 1). Available information for MU1 suggests there are relatively few indigenous Lake Sturgeon left so recovery is unlikely if left unaided. Potential for recovery of the non-indigenous (stocked) Lake Sturgeon in this MU is unknown as the stocked fish have not yet reached maturity. Recovery potential in MUs 2 and 3 is thought to be moderate. Both MUs are long, have known spawning areas and population estimates in the range of 1,300 and 875 adults, respectively. Thus, recovery may be possible within the recommended timeframe (i.e. three generations). Recovery potential for MUs 4 and 5 is low as both are relatively short in length and largely contain flooded forebay areas above GSs. Thus their recovery may be, at best, very protracted and likely limited by available habitat. The current population estimate for MU6 is 5,467 adults (95% CI: 3,768-8,018) so recovery within the recommended timeframe is highly probable and, therefore, rated as high. The importance of MUs 2, 3 and 6 to species recovery in DU3 is thought to be high while the importance of MUs 1, 4 and 5 is low.

Threats to Survival and Recovery

Mortality, injury or reduced survival resulting from fishing activities can pose a threat to Lake Sturgeon. While the Lake Sturgeon in DU3 is no longer fished commercially, net fisheries for others species occur on all of the major waterbodies within the DU with the exception of Stephens Lake. Incidental catches of Lake Sturgeon are rarely reported though they are known to occur occasionally between Sipiwesk Lake and Kelsey GS (in MU2). The Lake Sturgeon was, and remains to a slightly lesser degree, an important domestic fishery for First Nations along the Nelson River (Cleator *et al.* 2010). Today, most Lake Sturgeon harvested in DU3 is taken through a legal subsistence harvest. The Nelson River Sturgeon Co-management Board was established in 1992 to provide for the subsistence and cultural needs of local communities and for the preservation of the declining Lake Sturgeon stock. A conservation closure is in place on the Nelson River from Whitemud Falls to Kelsey GS (MU2), which prohibits fishing for Lake Sturgeon until after July 15 every year. A year-round closure exists for a small stretch of the Nelson River extending 8 km up and downstream of the mouth of the Landing River. There are no harvest limits or mesh size restrictions during the open season. Current levels of legal harvesting through the subsistence fishery are low and poaching has not been confirmed.

Recreational angling directed at Lake Sturgeon is allowed in this DU, though it is minimal, and any captured individuals must be released.

Annual rates of harvest for Lake Sturgeon are not available for this DU. Regardless, it is worth noting that annual harvest rates that are thought to be sustainable for Lake Sturgeon are typically 5% or less (Cleator *et al.* 2010). A guideline developed for rehabilitation of Lake Sturgeon in the State of Michigan, for populations that currently exist, specifies maintaining fishing mortality below 3% for an expanding population and below 6% to maintain Lake Sturgeon abundance (Cleator *et al.* 2010).

Five hydroelectric GSs were developed on the Nelson River: Kelsey (completed in 1960), Kettle (1970), Jenpeg (1975), Long Spruce (1977) and Limestone (1990). At least two more hydroelectric GSs (Keeyask, formerly called Gull, and Conawapa) are planned (Figure 2). Dams and control structures elsewhere have been shown to alter the natural flow regime and fragment habitat resulting in degradation and/or loss of Lake Sturgeon habitat, loss of genetic diversity, reduced spawning success, reduced prey availability and mortality (Cleator *et al.* 2010). Dam construction can extirpate local Lake Sturgeon populations (Cleator *et al.* 2010) by preventing fish from accessing spawning areas and stranding fish between impassable barriers. Larger structures, like hydroelectric dams, can also cause direct mortality, injury or reduced survival by entrainment[1], impingement[2] and fish passing downstream through the turbines. However, the intakes of most hydroelectric GSs are covered by bars or grates spaced such that they prevent passage of adult Lake Sturgeon through turbines. By the late 1970s, the perception of community fishermen on the Nelson River was that all combined Lake Sturgeon harvests had drastically decreased in response to the construction and operation of hydroelectric GSs (Cleator *et al.* 2010). Fragmentation is one of the limiting factors for MUs 4 and 5 on the lower Nelson River, however changes in flow regime and alteration of habitat are more significant throughout the DU.

In summary, the most important current threats to survival and recovery of Lake Sturgeon in DU3 are habitat degradation or loss resulting from the presence of dams/impoundments and other barriers, mortality, injury or reduced survival resulting from fishing, and population fragmentation resulting from the presence of dams/impoundments and other barriers (Table 2). The likelihood and severity of individual threats may vary by MU. All other threats that have been identified for other DUs in Canada are relatively unimportant or their impacts are unknown in DU3. The timeframe and impacts of climate change are unknown.

Limiting Factors for Population Recovery

The Lake Sturgeon possesses several intrinsic or evolved biological characteristics that make this species susceptible to over-exploitation and habitat changes and may naturally influence or limit potential for recovery: (1) slow growth and late maturation, (2) intermittent spawning intervals, (3) specific temperature, flow velocities and substrate requirements to ensure uniform hatching and high survival of eggs and (4) high fidelity to spawning areas. The early age-0 stage (transition from larvae to exogenous feeding) is a critical life stage for Lake Sturgeon.

[1]Entrainment occurs when fish eggs and larvae are taken into a facility's water-intake systems, pass through and back to the water body.
[2]Impingement occurs when fish are trapped or pinned by the force of the intake flow against the intake.

Mitigation, Alternatives and Enhancements

The Lake Sturgeon in DU3 is most sensitive to harm on early adults, followed by late adults, late juveniles, early juveniles and age-0 (in decreasing order) (Cleator *et al.* 2010). These results highlight the importance of reducing mortality on, and maximizing survival of, adults and late juveniles as the key to recovering this DU. However, the potential for improving survival of adults is low relative to the potential in age-0 and young juveniles (Table 3), therefore the possibility of implementing recovery strategies that improve age-0 and juvenile survival (e.g., habitat rehabilitation) should also be considered. For example, conservation stocking using fish from the same genetic stock has the potential to improve survival of age-0 and young juvenile fish so long as it also addresses potential impacts on genetic variability, artificial selection and transmission of disease from cultured to native fish. Conservation stocking should be undertaken only after careful consideration and as part of a comprehensive conservation stocking strategy for the DU, not a substitute for other effective mitigation or alternate measures outlined in this document.

Fertility rates in both early and late adult stages are less sensitive to perturbation (Cleator *et al.* 2010). Regardless, continuous and intense recruitment failure caused by blocking spawning migration by dams and barriers or habitat degradation can still produce more apparent population constraints than adult mortality (Cleator *et al.* 2010). Complete blockage of spawners at barriers can eradicate a population in a generation from continuous reproductive failure and strong site fidelity for spawning (Cleator *et al.* 2010).

Table 4 provides an inventory of possible mitigation measures, alternatives and enhancements to anthropogenic activities that pose threats to Lake Sturgeon survival and recovery. Mitigations, alternatives and enhancements for the most important threats for DU3, as identified in Table 2, are shown below.

Mitigations and alternatives

Habitat degradation or loss: dams/impoundments and other barriers

- Adjust water management operating conditions of dams/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 the spawning and incubation periods.
- Rehabilitate habitat in key areas to mitigate habitat degradation or loss of important habitat (e.g., spawning sites) and to 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 possible need for fish passage).
- Protect spawning and rearing habitat.

Mortality, injury or reduced survival: fishing

- Immediate release of bycatch to promote survivability.
- Examine ways and means of altering commercial net fisheries to reduce impacts on recovering Lake Sturgeon populations (e.g., trapnets versus gillnets, netting off the bottom, area closures such as limiting fishing near river mouths, close fishery).
- Regulate or encourage fishing practices that improve fish survival for catch-and-release fisheries, such as cutting lines of deeply-hooked fish, tight-line fishing, and minimizing "playing" and handling of hooked fish.
- Consider closure (e.g., conservation closures, closed seasons and areas), or at least reduce mortality, for adults through the use of legal size limits.

- Educate the public about the importance of Lake Sturgeon and what measures they can take to prevent over-exploitation.
- Ensure effective enforcement of regulations.

Mortality, injury or reduced survival: population fragmentation

- Prevent any additional fragmentation, particularly downstream of the Limestone GS, to prevent further loss of connectivity in this region.
- Provide effective upstream and downstream fish passage for Lake Sturgeon at new dams and modernization of existing dams if necessary.
- Remove barriers that prevent Lake Sturgeon from migrating to known historical spawning sites, or provide effective upstream and downstream fish passage at current barriers if necessary.
- Rehabilitate habitat in key areas to mitigate habitat degradation or loss of important habitat (e.g., spawning sites) and to improve age-0 and juvenile survival.
- Select the most appropriate design option for new dams and modernization of existing dams to ensure Lake Sturgeon survival and recovery are not jeopardized.

Enhancements

The following population enhancements could be considered supplementary measures to the mitigations and alternatives indicated above.

- Enhance age-0 and young juvenile survival through a conservation stocking program that does not introduce disease or reduce the genetic fitness of naturally-reproducing Lake Sturgeon.

Allowable Harm

Modelling analyses for DU3 indicate that once the main causes of population decline are removed, maximum allowable harm should not exceed reductions of 1.7-2.4% in adult survival, 3.5-6.6% in juvenile survival, 11.8% in age-0 survival and 14.2-49.0% in fertility rates (Table 3).

While modelling allowable harm at the DU level provides useful information, careful examination of conditions within an MU is necessary to fully assess the level of risk posed by harm from human-induced mortality and habitat modifications. Available data and expert opinion indicate that survival and recovery would be, at best, very slow in MU1 and likely restricted in MUs 4 and 5. Thus, activities that damage or destroy functional components of habitat or key life components of the life cycle (e.g., spawning, recruitment and survival) pose a very high risk to survival or recovery of any remaining Lake Sturgeon populations there. Recovery in MUs 2 and 3 may be possible within the recommended timeframe so harmful activities pose a moderate to high risk to survival or recovery. MU6 supports a substantial Lake Sturgeon population, likely because it contains prime habitat and is relatively inaccessible to exploitation, so recovery within the recommended timeframe seems highly probable. However the current population trajectory is unknown, there are no current data on levels of harvest and this section of the Churchill River is significantly impacted by variations in flow, thus activities that damage or destroy habitat or key life components pose a moderate risk to survival or recovery in MU6. Allowable harm in DU3 should be assessed on a case-by-case basis, keeping in mind the cumulative effects of all threats to the DU, to ensure that survival and recovery of Lake Sturgeon are not jeopardized.

Research activities should be allowed if they are beneficial to the species and would not jeopardize the survival or recovery of an MU.

Data and Knowledge Gaps

The relationship between key life history stages and habitat in DU3 needs to be better understood, as does the current level of domestic harvest. Obtaining reliable estimates of population size, population growth rate and harvest in each MU is a high priority. Surveys are needed to identify where spawning and feeding occur and whether access to, and the quantity and quality of spawning habitat for, individual MUs is sufficient. The habitat needs of age-0 and juvenile Lake Sturgeon should be better understood. Determination of the impact of altered flow regimes and other environmental factors on egg, larval and juvenile survival, and corresponding mitigation measures would be useful. The additive or cumulative effects of multiple dams/impoundments and barriers on Lake Sturgeon populations also should be investigated. MVP modelling needs to be updated as new knowledge about vital rates is obtained for each MU.

Sources of Uncertainty

Age estimates made using a longstanding technique (i.e., counting growth increments on pectoral fin spine cross sections) were recently found to underestimate the true age of fish older than 14 years and error increased with age. The average difference was -4.96 ± 4.57 years, and ranged from +2 to -17 years (Cleator *et al.* 2010). A correction factor has been developed to correct existing age estimates obtained using this method, though validation studies are needed to determine whether there are differences among populations.

Some uncertainties may exist regarding the Lake Sturgeon vital rates used in the MVP modelling. For example, the vital rates data may not have been specific to the DU being modelled, recent unpublished data may not be available or assumptions used in the model (e.g., a balanced sex ratio) may not accurately represent current conditions for that DU.

Assessing population size for Lake Sturgeon is difficult given the behaviour and ecology of the species. This makes it difficult to determine whether recovery targets are being met.

CONCLUSIONS

Six MUs have been identified for DU3: MU1 is located between Playgreen Lake and Whitemud Falls, MU2 between Whitemud Falls and the Kelsey GS, MU3 between Kelsey GS and Kettle GS, MU4 between Kettle GS and Long Spruce GS, MU5 between Long Spruce GS and Limestone GS and MU6 between Limestone GS and Hudson Bay.

Over the past century, Lake Sturgeon in DU3 declined in number primarily as a result of over-exploitation from commercial fisheries and a significant portion of their habitat has been degraded or lost as result of dams/impoundments and other barriers. Current information suggests there are several thousand adult Lake Sturgeon in this DU.

Available data and expert opinion indicate that the current status of MUs 1, 4 and 5 is critical where relatively few Lake Sturgeon are known to occur. The population trajectory of MU1 is increasing, due to stocking, and unknown for MUs 4 and 5. The status of MUs 2 and 3 is

deemed to be cautious with a trajectory that is stable or possibly increasing in MU2 and unknown in MU3. The status of MU6 is healthy and trajectory is unknown.

Survival and recovery of Lake Sturgeon in DU3 depend on maintaining the functional attributes of habitat, including the ecologically-based flow regimes, needed for spawning, egg incubation, juvenile rearing, summer feeding and overwintering, as well as migration routes between these habitats. It is essential that conditions that optimize the survival and recovery of Lake Sturgeon be maintained, especially during the spawning and incubation periods.

The long-term recovery goal for DU3 is to protect and maintain healthy, viable populations of Lake Sturgeon in all MUs within the Nelson River system. To reach this goal it will be necessary for each MU to have at least 413 spawning females each year (i.e., 4,130 adults) and at least 974 ha of suitable riverine habitat or 1,948 ha of suitable lake habitat. The aim is to reach these population and distribution objectives within three generations (i.e., about 108 years). If a less precautionary recovery target is chosen, the number of spawning females per year would be reduced and years to recovery increased accordingly.

The most important current threats to survival and recovery of Lake Sturgeon in DU3 are habitat degradation or loss resulting from the presence of dams/impoundments and other barriers, mortality, injury or reduced survival resulting from fishing, and population fragmentation resulting from dams/impoundments and other barriers. The likelihood and severity of individual threats may vary by MU. The timeframe and impacts of climate change are unknown.

A variety of mitigation measures and alternatives could be implemented to aid in the survival and recovery of Lake Sturgeon in DU3 including protecting spawning and rearing habitat, minimizing activities that cause habitat degradation or loss, rehabilitating habitat in key areas and reducing impacts of the fishery through education and effective enforcement. Conservation stocking using fish from the same genetic stock may be a useful enhancement tool as part of a comprehensive conservation stocking strategy for the DU and when combined with mitigation measures and alternatives.

Activities that damage or destroy functional components of habitat or key life components of the life cycle pose a very high risk to the survival or recovery of Lake Sturgeon in MUs 1, 4 and 5, a moderate to high risk in MUs 2 and 3 and a moderate risk in MU6. Research activities should be allowed in DU3 if they are beneficial to the species and would not jeopardize the survival or recovery of an MU.

OTHER CONSIDERATIONS

There are several jurisdictions involved in the management and recovery of Lake Sturgeon in DU3 including the Nelson River Sturgeon Co-Management Board, Government of Manitoba and DFO.

SOURCES OF INFORMATION

Cleator, H., K.A. Martin, T.C. Pratt and D. Macdonald. 2010. Information relevant to a recovery potential assessment of Lake Sturgeon: Nelson River populations (DU3). DFO Can. Sci. Advis. Sec. Res, Doc. 2010/082. vi + 32 p.

COSEWIC. 2006. COSEWIC assessment and update status report on the Lake Sturgeon *Acipenser fulvescens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 107 p. / COSEPAC. 2006. Évaluation et Rapport de situation du COSEPAC sur l'esturgeon jaune (*Acipenser fulvescens*) au Canada - Mise à jour. Comité sur la situation des espèces en péril au Canada. Ottawa. xi + 124 p.

DFO. 2010. Proceedings of the Central and Arctic Regional Science Advisory Process on the Recovery Potential Assessment of Lake Sturgeon for Designatable Units 1-5; October 20-22, December 3 and 17, 2010. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2010/047.

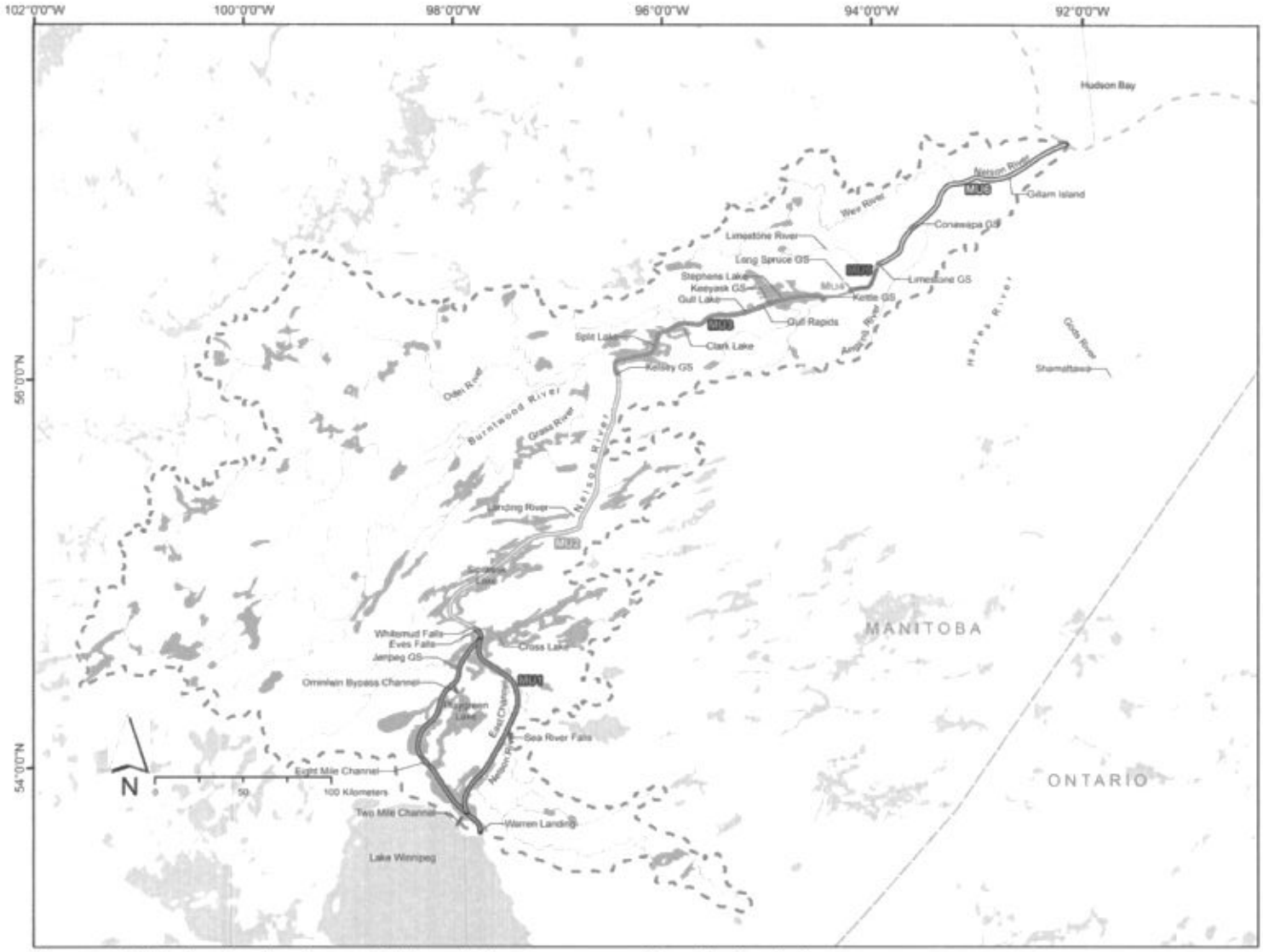


Figure 2. DU3 showing locations of MUs and place names mentioned in the text.

62

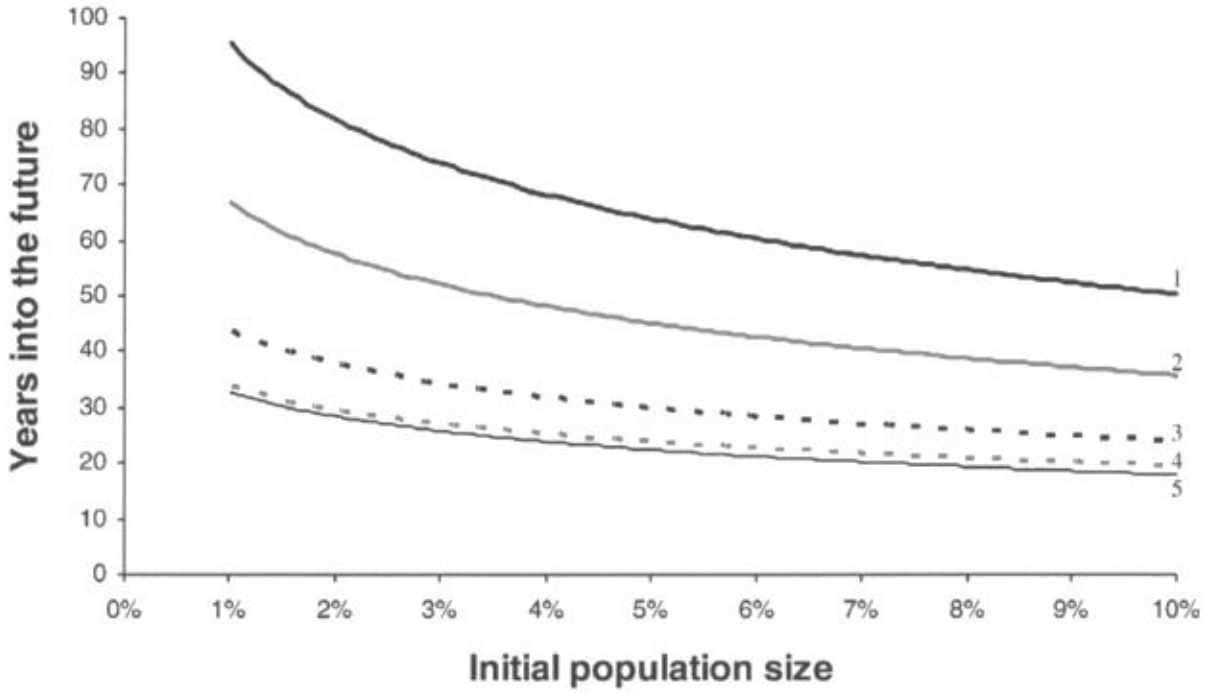


Figure 3. Stochastic projections of times to recovery for Lake Sturgeon based on initial population size (i.e., percentage of MVP) under five different recovery scenarios. Strategy 1 (solid black line) was the maximization of the survival rates of early adults, strategy 2 (solid grey line) added a 10% increase in the survival rates of late juveniles, strategy 3 (black dotted line) added a 20% increase in the survival rates of age-0 and early juveniles, strategy 4 (dotted grey line) added the maximization of the survival rate of late adults, while strategy 5 (black dashed line) added a 20% increase in fertility. Initial population size is expressed as a percentage of the recovery target (from Figure 8 in Vèlez-Espino and Koops 2009, as cited in Cleator et al. 2010).

Table 1. Assessment of the current conservation status, population trajectory, overall importance to species recovery and recovery potential of the six Lake Sturgeon Management Units (MUs) in the Nelson River system. Conservation status was based on the best available information and Precautionary Framework (see Cleator et al. 2010 for explanation); population trajectory was rated as Unknown, Stable, Increasing or Decreasing; importance to species recovery evaluates the importance of the MU to the overall recovery of Lake Sturgeon within DU3. For example, if a DU contained only one Lake Sturgeon MU whose conservation status was considered to be Healthy, then its importance to species recovery would be rated High as catastrophic loss of that MU would result in extirpation of the DU. Recovery potential is based on a combination of current conservation status and current threats status. Importance to species recovery and recovery potential were rated as Nil, Low, Moderate, High or Unknown; Ind=Indigenous, St=Stocked.

MU	Location	Conservation status	Population trajectory	Importance to DU recovery	Recovery potential
1	Playgreen Lake – Whitemud Falls	Critical	Increasing[1]	Low	Low (Ind) Unknown (St)[2]
2	Whitemud Falls – Kelsey GS	Cautious	Stable or possibly increasing	High	Moderate
3	Kelsey GS – Kettle GS	Cautious	Unknown	High	Moderate
4	Kettle GS – Long Spruce GS	Critical	Unknown	Low	Low
5	Long Spruce GS - Limestone GS	Critical	Unknown	Low	Low
6	Limestone GS – Hudson Bay	Healthy	Unknown	High	High

[1]As a result of stocking of offspring from MU2 broodstock.
[2]The stocked fish have not yet reached reproductive age.

Table 2. Current status of threats to Lake Sturgeon in DU3 by Management Unit (MU), defined in terms of the likelihood of occurrence followed by level of severity, based on current knowledge of the MUs and the areas in which they occur. (0=Nil, L=Low, M=Moderate, H=High, U=Unknown). The most important threats are highlighted. Note: In cases where a man-made barrier occurs at the start (upstream end) of an MU, it is included in the MU. For example, Limestone GS is included in MU6.

THREATS	Playgreen Lake – Whitemud Falls	Whitemud Falls – Kelsey GS	Kelsey GS – Kettle GS	Kettle GS – Long Spruce GS	Long Spruce GS – Limestone GS	Limestone GS – Hudson Bay
	MU1	MU2	MU3	MU4	MU5	MU6
Mortality, injury or reduced survival						
Entrainment, impingement and turbine mortality (e.g., from hydroelectric dams and other barriers, urban or irrigation intakes)	L,L	L,L	L,L	L,L	L,L	0,0
Population fragmentation (e.g., from dams/impoundments and other barriers)	L,L	L,L	L,L	H,H	H,H	L,L
Fishing: commercial net (bycatch)	H,L	H,M	H,L	0,0	0,0	0,0
Fishing: domestic / subsistence	M,L[1]	H,H	H,H	0,0	0,0	H,H
Fishing: recreational / commercial tourism	0,0	0,0	0,0	0,0	0,0	0,0
Fishing: illegal harvest	0,0	M,M	M,M	0,0	0,0	M,M
Habitat degradation or loss[2]						
Dams/impoundments and other barriers (e.g., hydroelectric dams or water control structures)	H,M	H,M	H,M	H,H	H,H	H,M
Industrial activities (including oil and gas, and pulp and paper)	0,0	0,0	0,0	0,0	0,0	0,0
Forestry exploration/ extraction	H,0	H,0	0,0	0,0	0,0	0,0
Mining exploration/extraction	L,0	0,0	M,L	0,0	0,0	0,0
Agricultural activities	0,0	0,0	0,0	0,0	0,0	0,0
Urban development	H,L	0,0	0,0	H,L[3]	0,0	0,0
Sturgeon culture						
Genetic contamination	L,L	L,L	0,0	0,0	0,0	0,0
Disease	U,U	U,U	U,U	U,U	U,U	U,U
Non-indigenous and invasive species	H,L	H,L	H,L	H,L	H,L	H,L
Climate change[4]	U,U	U,U	U,U	U,U	U,U	U,U

[1]Subsistence fishery does not target Lake Sturgeon in this MU.
[2]Examples: changes in flow regime, water temperature, concentrations of sediments, nutrients and contaminants, habitat structure and cover, food supply and migration/access to habitat, surface hardening and pollution.
[3]The Town of Gillam discharges its sewage into the Kettle River which flows into the Nelson between Kettle and Long Spruce GS (MU4).
[4]Examples: changes in water temperature, patterns of precipitation, river morphology and hydrology.

Table 3. Minimum recovery effort and maximum allowable harm with respect to annual survival and fertility of Lake Sturgeon in DU3 based on results of modelling (Vélez-Espino and Koops 2009, as cited in Cleator et al. *2010). Minimum recovery effort indicates the minimum increase in vital rates necessary to stabilize or stimulate population growth. Maximum allowable harm indicates the maximum reduction in survival or fertility rates in a population that can occur while still allowing the population to recover, once the main causes of population decline are removed. These percentages are not additive.*

Vital Rates	Minimum Recovery Effort	Maximum Allowable Harm
Age-0 survival	29.6%	11.8%
Early juvenile survival	27.3%	6.6%
Late juvenile survival	11.3%	3.5%
Early adult survival	4.3%	1.7%
Late adult survival		2.4%
Early adult fertility		14.2%
Late adult fertility		49.0%

Table 4. Possible mitigations and alternatives to threats to ensure that activities (including structures) do not jeopardize the survival and recovery of Lake Sturgeon.

Threats	Mitigations and Alternatives	Life stage enhanced
Habitat degradation or loss[1]		
Dams/impoundments and other barriers	Follow ecologically-based flow regimes for key life stages to optimize conditions especially during spawning, incubation and larval drift periods	Age-0[2], eggs
	Protect spawning and rearing habitat at new and existing dams and other barriers	Age-0[2], eggs
	Select the most appropriate design option for new structures, or those being modernized, to enhance survival and recovery	All
	Rehabilitate habitat in key areas	All
Industrial activities (including oil and gas), forestry and mining exploration/extraction	Prohibit activities that cause significant sedimentation especially during winter or spring	Age-0[2], eggs
	Prohibit activities that cause removal of substrates in known or suspected spawning areas	Age-0[2], eggs
	Prohibit activities that cause significant changes in water flows especially during spring	Age-0[2], eggs
	Prohibit activities that cause significant changes in water temperature, total gas pressure, salinity or nutrient concentrations	All
Agricultural activities	Prohibit activities that cause significant sedimentation especially during winter or spring	Age-0[2], eggs
	Prohibit activities that cause removal of substrates in known or suspected spawning areas	Age-0[2], eggs
	Prohibit activities that cause significant changes in water flows especially during spring	Age-0[2], eggs
	Prohibit activities that cause significant changes in water temperature, total gas pressure, salinity or nutrient concentrations	All
	Minimize release of contaminants	All
Urbanization	Enforce discharge limits on potential pollutants	All
	Improve effluent from water treatment plants	All
	Increase protection during work permit reviews	All
	Protect spawning and rearing habitat	Age-0[2], eggs
	Rehabilitate habitat in key areas	All

[1]Examples: changes in flow regime, water temperature, concentrations of sediments, nutrients and contaminants, habitat structure and cover, food supply and migration/access to habitat, surface hardening and pollution.

[2]Age-0 survival could also be enhanced through conservation stocking (see Mitigation, Alternatives and Enhancements section for explanation).

Table 4. (Continued)

Threats	Mitigations and Alternatives	Life stage enhanced
Mortality, injury or reduced survival		
Entrainment, impingement and turbine mortality (e.g., from hydroelectric dams and other barriers, urban or irrigation intakes)	Provide protection measures to exclude Lake Sturgeon from passing through facility intakes	All
	Provide effective upstream and downstream passage[3]	All
	Select the most appropriate design option for new structures, or those being modernized, to enhance survival and recovery	All
Population fragmentation (e.g., from dams/impoundments and other barriers)	Prevent any additional fragmentation	All
	Provide effective upstream and downstream passage[3] at new dams and modernization of existing dams if necessary	Age-0[2], eggs
	Remove barriers to migration to known historical spawning sites or provide effective upstream or downstream fish passage at current barriers if necessary	Age-0[2], eggs
	Rehabilitate habitat in key areas	All
Fishing[4]	Regulate or encourage practices that improve fish survival	Late juvenile, both adult stages
	Ensure immediate release of bycatch	All juvenile and adult stages
	Close fishing by season and/or area, or modify fishing practises	All juvenile and adult stages
	Improve public education	Late juvenile, both adult stages
	Ensure effective enforcement of regulations	Late juvenile, both adult stages
Sturgeon culture		
Genetic contamination	Develop effective and controlled stocking policy/plan	All
	Ensure broodstock, fertilized eggs and/or larval fish are from the same genetic stock	All
Disease	Monitor for bacteria and viruses	All
Non-indigenous and invasive species[5]		
	Monitor non-indigenous and invasive species	All
	Ban use of live bait	All
	Establish measures to prevent introduction or spread	All
Climate change[6]		
	Monitor environmental changes	All

[3]Examples: construction of a fishway, partial dismantling or removal of barriers.
[4]Commercial net (bycatch), domestic/subsistence, recreational/commercial tourism and illegal harvest.
[5]Examples: Common Carp (*Cyprinus carpio*), Zebra Mussels (*Dreissena polymorpha*), Rainbow Smelt (*Osmerus mordax*) and Rusty Crayfish (*Orconectes rusticus*).
[6]Examples: changes in water temperature, concentrations of sediments, nutrients and contaminants, habitat structure and cover, food supply and migration/access to habitat, surface hardening and pollution

FOR MORE INFORMATION

Contact: Tom Pratt
Great Lakes Laboratory for Fisheries and Aquatic Sciences
1219 Queen St. East
Sault Ste. Marie, ON
P6A 2E5

Tel: (705) 941-2667
Fax: (705) 941-2664
E-Mail: thomas.pratt@dfo-mpo.gc.ca

This report is available from the:

Center for Science Advice (CSA)
Central and Arctic Region
Fisheries and Oceans Canada
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Telephone:(204) 983-5131
Fax: (204) 984-2403
E-Mail: xcna-csa-cas@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1919-5079 (Print)
ISSN 1919-5087 (Online)

La version française est disponible à l'adresse ci-dessus.

CORRECT CITATION FOR THIS PUBLICATION

DFO. 2010. Recovery potential assessment of Lake Sturgeon: Nelson River populations (Designatable Unit 3). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2010/050.

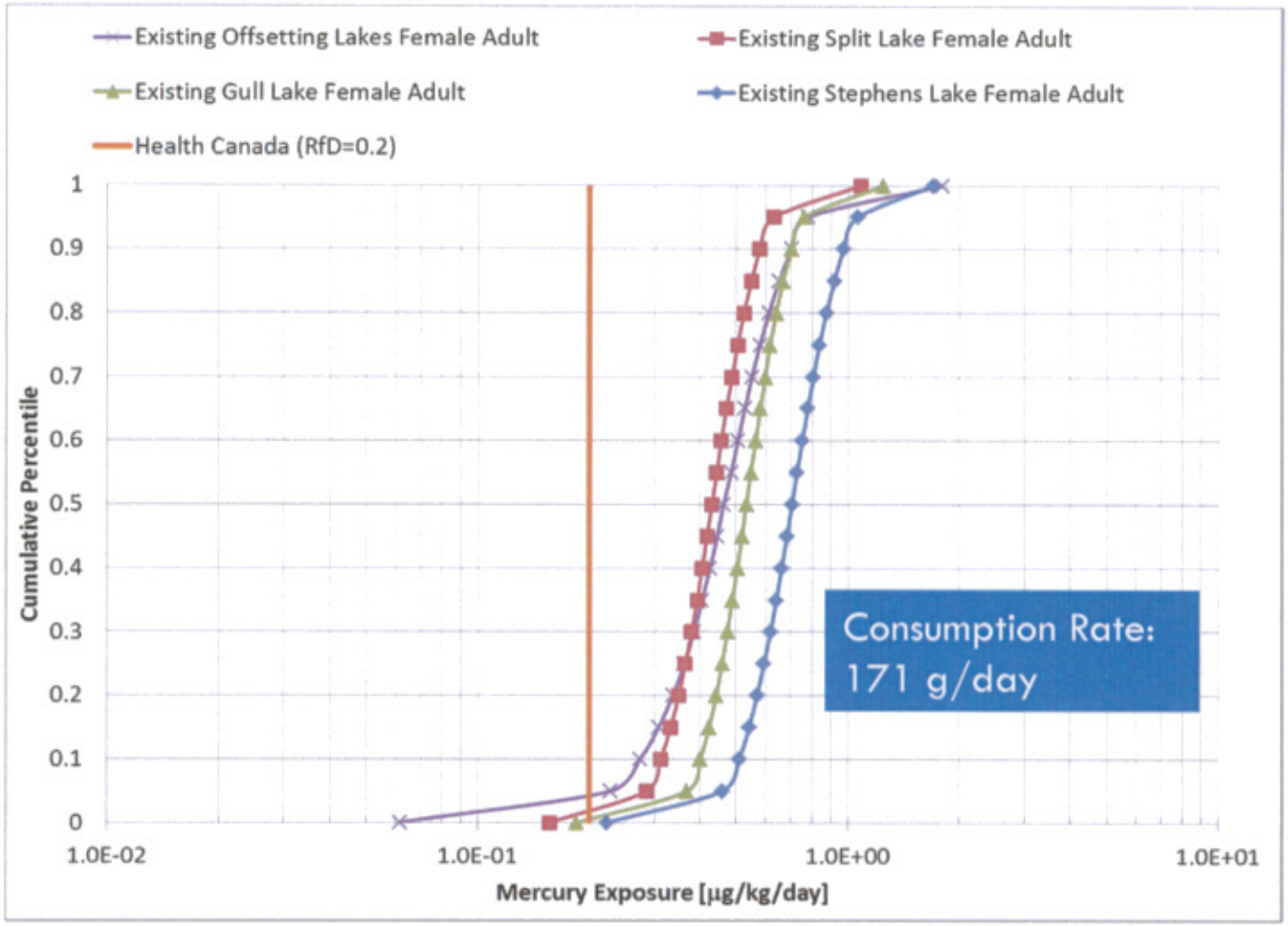
TAB 8

REVIEW OF KEEYASK PARTNERSHIP HUMAN HEALTH RISK ASSESSMENT ASSOCIATED WITH MERCURY IN FISH

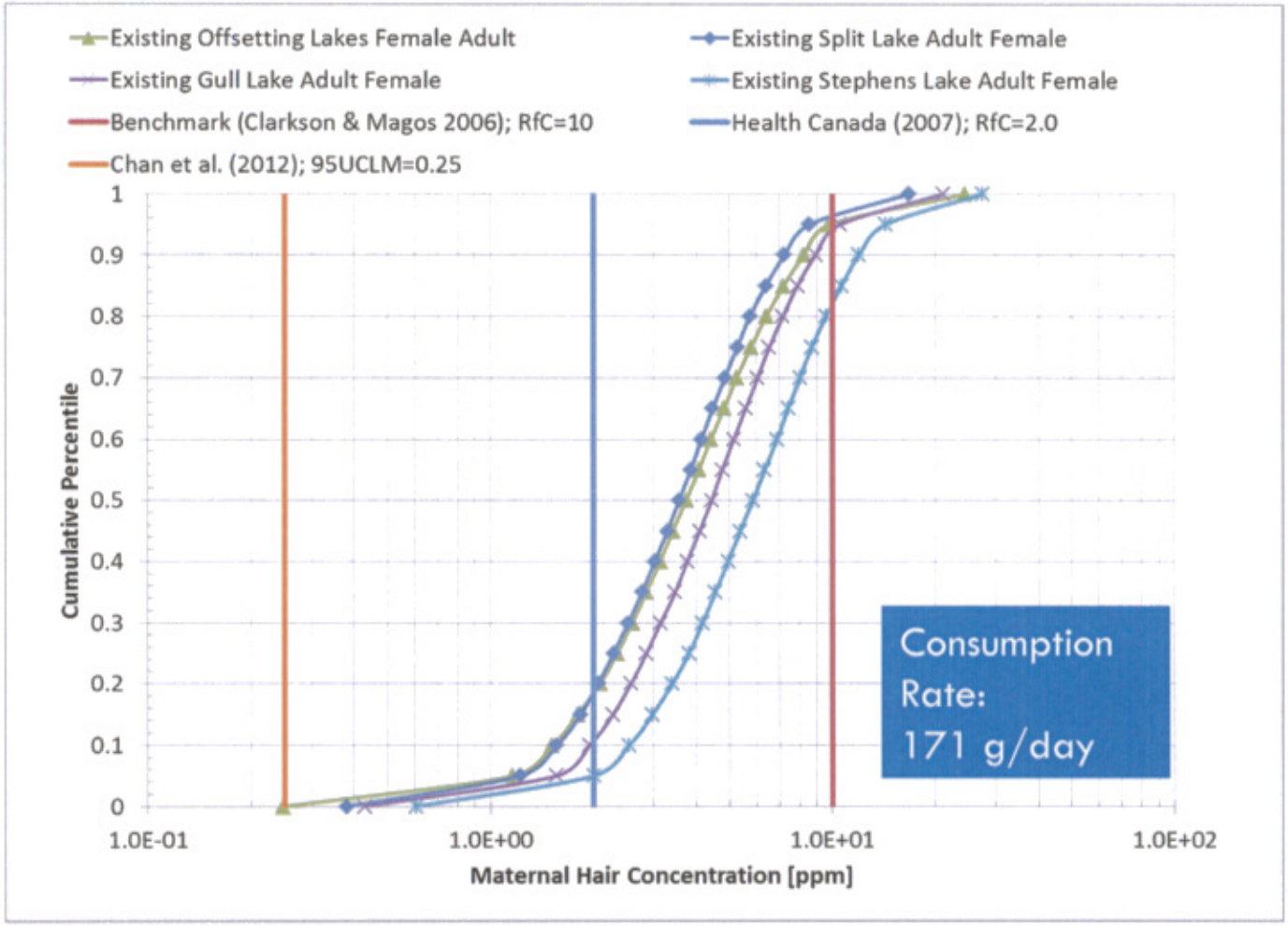
G & P Resource Services Inc.

November 26, 2013

Modeling Existing Exposures - Adult



Concentration in Hair - Existing



Conclusions and Recommendations

- We agree that the highly conservative exposure assumptions in the Keeyask HHRA did substantially overestimate risks to local consumers. In particular, assumed fish consumption rates, based on consumer information provided by local communities, are the major contributor to predicted health risks.
- Health risks predicted in the HHRA for existing conditions would also apply to the "offsetting" lakes, indicating that risks may be predicted regardless of where the community harvests fish.
- Present average mercury concentrations in study area lakes are below the commercial guideline of 0.5ppm, are similar to or lower to mercury concentrations measured in other (un-impacted) Canadian lakes, and are similar or lower to mercury concentrations measured store-bought fish.

TAB 9

in favour of the adverse effects agreements, 85 of ballots.

In May 2009, York Factory Chief and Council signed the JKDA and Adverse Effects Agreements on behalf of the First Nation. The signing of the JKDA and Adverse Effects Agreement marked York Factory's decision to become a partner and co-proponent in Keeyask. This is not an easy decision for the community to make, given the circumstances and the diversity of views held by the community members regarding the Keeyask generation project.

Members faced a deep moral dilemma in terms of assessing the potential environmental impacts that would affect the community. Even with the best planning, mitigation and monitoring programs, York Factory feels that there will still be substantial adverse effects to the land and our way of life.

For York Factory, the decision to become a partner in Keeyask was made so that our youth and future generations will benefit from project revenues, jobs, training and capacity building opportunities.

It has also been important for York

TAB 10

development agreement and our adverse effects agreement.

In short, for the first time in history finally, we are part of the process, not the object of the process. We are partners in this project because for the first time in history, this is not their project, but theirs and ours. That is the revolutionary concept. This is not to say, as we testified, for example, at this Commission's hearings on Bipole III, that we achieved all of our goals or that the terms of the limited partnership or adverse effects agreement are fully consistent with all of the things we might like to have had included; or for that matter, that all of the potential impacts on our lives will have been defended, mitigated or compensated.

The agreements are not perfect from our perspective, they are not perfect from the perspective of any of the partners including the other Cree Nations. But most importantly, the trade-offs have been thoughtful and our people have been given full opportunity to express themselves on the details and desirability of the terms of the project.

TAB 11

Total Person Years of Employment - Wuskwatim

	Deloitte Original Values	Deloitte Updated Values	Updated Volumes as Percentage of Total
Non Manitobans	858	1305	36.90%
Other Manitobans (excluding Northern Manitobans and Northern Manitoba Aboriginals)	912	1056	29.90%
Northern Manitobans (excluding Northern Manitoba Aboriginals)	145	201	5.70%
Northern Manitoba Aboriginals	944	973	27.50%
Total Person Years of Employment	2859	3,535	100%

Source: MH EXHIBIT 128