APPENDIX 2.1

Concordance Table

LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation or Acronym	Definition
ARD/ML	Acid Rock Drainage/Metal Leaching
BLFN	Black Lake First Nation
CEA Agency	Canadian Environmental Assessment Agency
CEAA	*Canadian Environmental Assessment Act*
D&R	Decommissioning and Reclamation
EIS	Environmental Impact Statement
LSA	local study area
MOE	Saskatchewan Ministry of the Environment
NO_x	nitrogen oxides
$PM_{2.5}$	Particulate Matter up to 2.5 microns in size
PM_{10}	Particulate Matter up to 10.0 microns in size
PSG	Project-Specific Guidelines
RSA	regional study area
SO_x	sulphur oxide
SAR	species at risk
TSP	total suspended particulates
UTM	Universal Transverse Mercator
VC	valued components

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
1.0	**INTRODUCTION**	
	The Proponent (Black Lake First Nation [BLFN] and SaskPower) has been informed that the proposed Tazi Twé Hydroelectric Project (the Project) will require an environmental assessment under the *Environmental Assessment Act (Saskatchewan)*, hereafter referred to as "The Act," and the *Canadian Environmental Assessment Act* (*CEAA).* The proponent is required to conduct an environmental impact assessment and prepare an environmental impact statement (EIS) for technical and public review.	**EIS represented by this document**
4.0	**SUMMARY OF ENVIRONMENTAL IMPACT STATEMENT**	
	Executive Summary An executive summary of the EIS is required, summarizing the EIS under the following topic areas: ■ introduction and Project overview; ■ description of the purpose of, need for, and alternative means of carrying out the Project; ■ description of all key components of the Project and related activities; ■ description of the scope of the Project and assessment; ■ summary of the consultation conducted with Aboriginal groups, the public, and government agencies, including a summary of the issues raised and the proponent's responses; ■ summary of environmental effects of the Project and proposed technically and economically feasible mitigation measures; ■ description of the significance of adverse environmental effects after taking mitigation measures into account; and ■ summary of the need for and the requirements of monitoring and follow-up programs.	**Executive Summary**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
5.0	**INTRODUCTION AND PROJECT OVERVIEW**	
5.1	**Geographic Setting** The EIS will contain a concise description of the geographical setting in which the Project will take place including the following:	Section 3.0
	■ Universal Transverse Mercator (UTM) coordinates of the main Project site;	Section 3.1
	■ current land use in the area and the relationship of the Project facilities and components with any federal lands;	Section 3.11
	■ environmental significance and value of the geographical setting in which the Project will take place and the surrounding area;	Section 3.0
	■ environmentally sensitive areas, such as national, provincial, and regional parks, ecological reserves, wetlands, estuaries, and habitats of federally or provincially listed species at risk and other sensitive areas;	Sections 3.8, 3.9
	■ local and Aboriginal communities; and	Sections 3.0, 3.11
	■ traditional Aboriginal territories, treaty lands, and Indian reserve lands.	
5.2	**Regulatory Framework and the Role of Government** The EIS will identify, for each jurisdiction, the government bodies involved in the environmental assessment including the following:	Section 2.0
	■ any federal power duty or function to be exercised that might permit the carrying out of the Project;	Sections 2.1.1, 2.1.4
	■ environmental and other specific regulatory approvals and legislation (federal, provincial, regional, and municipal) that are applicable to the Project;	Section 2.1.4
	■ describe implications of government policies, resource management, planning, or study initiatives pertinent to the Project;	Section 2.1.6
	■ describe any treaty or self-government agreements with Aboriginal groups that are pertinent to the Project;	Section 2.1.5
	■ describe any relevant Land Use Plans, Land Zoning, or Community Plans; and	Section 17.3.3
	■ summarize regional, provincial, or national objectives, standards, or guidelines that the proponent used in the evaluation of any predicted environmental effects.	Section 2.1.6
5.3	**Participants in the Environmental Assessment** The EIS will identify the main participants in the environmental assessment including jurisdictions other than the federal government, Aboriginal groups, community groups, and environmental organizations.	Section 2.1.3

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
5.4	**The Proponent** The EIS will include the following: ■ proponent's contact information; ■ identity of proponent and the name of the legal entity that would develop, manage, and operate the Project; ■ corporate and management structures, as well as insurance and liability management related to the Project; ■ mechanism used to ensure that corporate policies will be implemented and respected for the Project; ■ key elements of proponent's environment, health, and safety management system and discuss how the system will be integrated into the Project; and ■ identity of key personnel, contractors, or sub-contractors responsible for preparing the EIS.	Sections 1.2, 1.2.1, 1.2.2, 1.2.3
5.5	**Purpose of the Project** The EIS will describe the purpose of the Project including the rationale, background, and the problems or opportunities that the Project is intended to satisfy and the stated objectives from the perspective of the proponent.	Section 1.4
5.6	**Project Components** The EIS will describe the Project including the Project components, associated and ancillary works, activities, scheduling details, the timing of each phase of the Project, and other characteristics that will assist in understanding the environmental effects.	Sections 5.0, 5.2, 5.3 to 5.7
5.7	**Project Activities** The EIS will include the following:	Section 5.0
	■ descriptions of the construction, operation, maintenance, foreseeable modifications, and where relevant, closure, decommissioning, and restoration of sites and facilities associated with the Project; ■ details about the activities to be carried out during each phase, the location of each activity, expected outputs, and an indication of the activity's magnitude and scale;	Sections 5.3 to 5.7
	■ sufficient information to predict environmental effects and address identified public concerns;	Section 5.0
	■ detailed schedule including time of year, frequency, and duration for all Project activities; and	Section 5.2
	■ preliminary outline of a decommissioning and reclamation (D&R) plan for any components associated with the Project.	Section 5.7

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
6.0	**SCOPE OF PROJECT**	
	Project Scope The EIS will describe the scope of Project to be assessed including the construction, operation, and decommissioning of the following Project components:	Section 5.0
	■ water intake, power tunnel, powerhouse, and a tailrace channel leading into Middle Lake;	Sections 5.3 to 5.7
	■ any potential in-water structure (e.g., submerged weir) or suitable alternative method or technology to minimize effects on Black Lake water levels;	Section 5.3.9
	■ permanent access bridge over the Fond du Lac River; and	Section 5.3.2
	■ all related physical works and physical activities required to carry out these works and activities, including the associated cofferdams, access roads, borrow areas, waste rock disposal areas, concrete batch plant, construction power (diesel and electrical), fuel storage facility and fueling areas, explosives storage, construction camp, sewage lagoon, and dumping sites.	Section 5.3
7.0	**SCOPE OF ASSESSMENT**	
7.1	**Factors to be Considered**	
7.1.1	***Valued Components*** The EIS describes the importance of each Valued Component (VC) for the Project and the rationale for its selection.	Section 7.2.1
7.1.2	***Effects of Potential Accidents or Malfunctions*** The EIS will: ■ identify the probability of potential accidents and malfunctions related to the Project; ■ describe the safeguards that have been established to protect against such occurrences and the emergency response procedures in place if accidents or malfunctions do occur; and ■ present detailed contingency and response plans.	Section 5.10 Sections 8.4.3, 9.4.3, 10.4.3, 11.4.3, 12.4.3, 13.4.3, 14.4.3, 15.4.3, 16.4.3, 17.4.3, 18.4.3, 19.4.3, 20.4.3,
7.1.3	***Effects of the Environment on the Project*** The EIS will: ■ describe how local conditions and natural hazards, such as severe or extreme weather conditions and external events could adversely affect the Project and how this in turn could affect the environment; and ■ provide details about planning, design, and construction strategies intended to minimize the potential environmental effects of the environment on the Project.	Section 5.11, Appendix 5.2

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
7.2	**Scope of the Factors**	
7.2.1	***Spatial Boundaries*** The EIS will: ■ indicate the spatial boundaries to be used in assessing the potential adverse environmental effects of the proposed Project and provide a rationale for each boundary; and ■ consult with the Agency, federal and provincial government departments and agencies, local government, and Aboriginal groups and take into account public comment when defining the spatial boundaries used in the EIS.	**Sections 7.2.2.1, 8.2, 9.2, 10.2, 11.2, 12.2, 13.2, 14.2, 15.2, 16.2, 17.2, 18.2, 19.2, 20.2**
7.2.2	***Temporal Boundaries*** The EIS will: ■ span all phases of the Project: construction, operation, maintenance, foreseeable modifications, and where relevant, closure, decommissioning and restoration of the sites affected by the Project; ■ consider seasonal and annual variations related to VCs for all phases of the Project; ■ consider community and Aboriginal traditional knowledge; and ■ identify the boundaries used and provide a rationale if the temporal boundaries do not span all phases of the Project.	**Section 7.2.2.2**
8.0	**Alternative Means of Carrying Out the Project**	
	The EIS will identify and consider the effects of alternative means of carrying out the Project that are technically and economically feasible using the following steps: ■ identify the alternative means to carry out the Project; ■ identify the effects of each alternative means (environmental effects and potential adverse effects on potential or established Aboriginal and Treaty rights and related interests); ■ identify the preferred means; ■ address the following Project components: water intake, power tunnel, powerhouse and turbine, tailrace channel, submerged weir, waste rock disposal areas, borrow areas, access roads, construction power options, construction camp, and sewage treatment and potable water facilities; and ■ include options to deal with inadequate water supply at certain times of the year.	**Section 4.2**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
9.0	**Baseline Conditions**	
9.1	**Existing Environment**	
9.1.1	***Methodology*** The EIS should satisfy the following criteria:	
	■ include a description of the environment, including components of the existing environment and environmental processes, their interrelations and interactions as well as the variability in these components, processes, and interactions over time scales appropriate to the Project; ■ characterize the environment before any disturbance to the environment because of the Project;	**Section 3.0, Annexes I, II, III, IV, V, and VI**
	■ identify, assess, and determine the significance of the potential adverse environmental effects of the Project;	**Sections 8.4, 9.4, 10.4, 11.4, 12.4, 13.4, 14.4, 15.4, 16.4, 17.4, 18.4, 19.4, 20.4**
	■ include results from studies done prior to any physical disruption of the environment caused by initial site clearing activities, including environmental conditions resulting from historical and present activities.	**Annexes I, II, III, IV, V, and VI**
9.1.2	***Biophysical Environment***	
	<u>Atmospheric Environment and Climate</u> The EIS will describe the following: ■ ambient air quality in the Project areas including the following contaminants: Total Suspended Particulates (TSP), particulate matter less than 2.5 microns in size ($PM_{2.5}$), particulate matter less than 10 microns in size (PM_{10}), sulphur oxides (SO_x), and Nitrogen Oxides (NO_x); ■ current ambient noise levels at the Project site and within the local areas; ■ existing ambient light levels at the Project site and at any other areas where Project activities could have an effect; and ■ historical records of precipitation and temperature.	**Annex I Section 8.3 Appendices 8.1 and 8.2**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
	Geology and Geochemistry The EIS will describe the following: ■ bedrock geology of the area, including geological maps of appropriate scale and cross-sections: ▪ spatial distribution and thickness of lithologic units; ▪ alteration styles, mineralogy, bulk chemistry, occurrence, and intensity of bedrock units; and ▪ structural fabric (e.g. fractures, faults, foliation, and lineation) and structural relationships. ■ regional and local geological structures in the Project area that might affect the proposed infrastructure; ■ geomorphology and topography of areas proposed for construction of major Project components; ■ geological hazards that exist in the Project area including:	**Annex II** **Section 9.3.1** **Appendix 9.1**
	▪ history of seismic activity in the area;	**Appendix 5.2**
	▪ isostatic rise or subsidence; and ▪ landslides. ■ sites of paleontological or palaeobotanical significance; and	**Not applicable**
	■ geochemical composition of expected spoil disposal materials such as waste rock, overburden, and potential construction material including: ▪ mineralogy; ▪ elemental composition of lithologies in study area (major and trace elements); and ▪ potential for acid generation, neutralization, and contaminated neutral drainage.	**Annex II** **Section 9.3.1** **Appendix 9.1**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
	Acid Rock Drainage/Metal Leaching The ARD/ML prediction information will be used to predict water quality for effects assessment and determine mitigation requirements for the Project. The EIS will provide additional information on the following: ■ type and method used for the ARD/ML prediction and possible mitigation measures; ■ waste rock and overburden characterization, volumes, segregation/disposal method mitigation/management plans, contingency plans, operational and post-closure monitoring and maintenance plans; ■ assessment of short term metal leaching properties; ■ longer term kinetic testing to evaluate rates of acid generation and metal leaching; ■ assessment of the feasibility to successfully segregate potentially-acid generating and non-potentially acid generating waste materials during operations, proposed geochemical segregation criteria, and identification of operational methods that will be required to achieve geochemical characterization during operations; ■ sensitivity analysis to assess the effects of imperfect segregation of waste rock; ■ estimates of the potential for excavated materials to be sources of ARD or ML, estimates of potential time to the onset of ARD or ML, and the ability to prevent or control ARD and ML; ■ chemistry of groundwater pumped during power tunnel construction; ■ surface and seepage water quality from the waste rock disposal areas, stockpiles, and other infrastructure; ■ ARD/ML prevention or management strategies; ■ quantity and quality of leachate from samples of waste rock and overburden; ■ quantity and quality of effluent to be released from the site into the receiving waters; and ■ quality of humidity cell or column test liquid from acid rock testing.	Section 9.3.1.4 Appendix 9.1

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
	Surficial Geology (Terrain and Soil) The EIS will include the following: ■ baseline mapping and description of landforms and landform processes and soils within the local study area (LSA) and regional study area (RSA); ■ maps depicting soil depth by horizon and soil order within the Project site area to support soil salvage and reclamation efforts, and to outline potential for soil erosion; ■ sedimentological and geochemical characteristics of surficial sedimentary units and soils; ■ soil sample analysis completed and the quality assurance and quality control program followed; and ■ summary of the baseline data on the concentration of trace elements in site soils prior to Project development. If there is permafrost in the study area the EIS will including the following: ■ geomorphologic and topographic features of areas proposed for construction of major Project components; ■ permafrost conditions including distribution, thermal conditions, ground ice, thaw sensitivity, and active layer thickness; ■ bedrock lithology, morphology, geomorphology and soils, at proposed borrow and quarry sites, and other areas where earthworks are proposed. If eskers are identified as a potential source of granular material then include a description of granular material properties, including thermal condition and ice content; ■ potential for ground and rock instability at areas planned for Project facilities; ■ suitability of topsoil and overburden for use in the re-vegetation of surface-disturbed areas; and ■ permafrost temperatures at areas planned for Project facilities and infrastructure, including sensitivity to climate change and implications for stability and safety of infrastructures.	**Annex IV Section 13.0**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
	Water Resources The EIS will describe the following: ■ appropriate hydrogeologic model discussing the hydrostratigraphy and groundwater flow systems of the Project area; ■ detailed conceptual model with clearly defined model input parameters and boundary conditions; ■ sensitivity analysis to test model sensitivity to climatic variations and hydrogeologic parameters; and ■ description of the hydrogeology at the Project site and within the LSA and RSA including: ▪ physical and geochemical properties of hydrogeological units (including maps); ▪ regional and local groundwater flow patterns, rates, and quality, including seasonal variations; ▪ recharge and discharge areas; ▪ groundwater interaction with surface waters; ▪ local and regional potable groundwater supplies and quality; and ▪ description of all groundwater monitoring wells with respect to Project facilities. The EIS will describe surface water quality, hydrology, and sediment quality within the area of influence of the Project including: ■ delineation of drainage basins, at appropriate scales; ■ hydrological regimes; ■ flows or design peak flows for selected periods for the Project area; ■ interactions between surface water and groundwater flow systems under pre- development conditions and potential effects on these interactions during the various phases of the Project; ■ local and regional potable surface water resources; ■ seasonal water quality field and lab analysis at representative local stream and lake monitoring stations; ■ hydraulic conditions over the existing range of flows and water levels in Black Lake, Middle Lake, and the Fond du Lac River; ■ weekly average flow curves of the hydrological record for the section of the Fond du Lac River between Black Lake and Middle Lake; ■ existing ice cover development, stability, decay, and variability from year to year along the river and in Middle Lake; and ■ existing shoreline environments on Black Lake.	**Annexes II, III Sections 9.0, 10.0, and 11.0, Appendices 5.1, 9.2, 10.1, 10.2, 10.3, 11.1**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
	Wetlands The EIS will describe the following: ■ wetlands that might be affected by Project activities (i.e., location, size, type [wetland class and form], condition [based on hydrology and water chemistry criteria], species composition, and ecological function); ■ wetlands with the greatest potential to be affected; ■ key plant communities and animals that rely on wetlands.	**Annex IV** **Sections 14.3, 14.5, 15.3, 15.5,**
	Fish and Fish Habitat The EIS will describe the following: ■ limnology, hydrology, freshwater biota, presence of fish and other freshwater species, associated habitats and habitat distribution, and fisheries in potentially affected surface waters; ■ fish populations on the basis of species and life stage for affected waterbodies; ■ any rare fish or mussel species that are known to be present; ■ any potential waterbodies and fish habitat sites that could be rehabilitated or enhanced for possible habitat gains to offset losses from the Project; ■ physical and biological characteristics of the fish habitat that are likely to be affected, directly or indirectly, by the project; ■ site-specific in-stream flow needs for the Fond du Lac River; ■ hydrographic network (i.e., topographic map of water bodies and watercourses), including intermittent streams, flood risk areas and wetlands; and the boundaries of the watershed and sub watersheds of the study area; ■ biophysical characteristics, including the name of each watercourse and a description of the habitat by homogeneous section (i.e., length of the section, width of the channel from the high water mark, water depths, type of substrate, and aquatic and riparian vegetation, including bank slopes); and ■ name and description of each affected water body (i.e., total surface area, bathymetry, maximum and mean depths, water level fluctuations, type of substrate, location of submerged, floating, and emergent aquatic vegetation, and water quality parameters [e.g., water temperature, turbidity, pH, and dissolved oxygen profiles]).	**Annex III** **Sections 10.3, 10.5, 12.3, 12.5** **Appendices 12.1, 12.2, 12.3, 12.4**

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
	The EIS will include the following: ■ monthly, seasonal, and annual discharge data, including minimum and maximum flows; ■ natural obstacles or existing structures that hinder the free passage of fish; ■ habitat maps indicating the surface area of habitat for spawning, nursery, feeding, and migration routes; and ■ a description of fish sampling survey methods. For all watercourses or water bodies on which the Project is likely to have effects, the EIS will: ■ describe the fish species present based on the surveys carried out and the data available; ■ identify the sources of the data and provide the information concerning the fishing carried out; ■ specify the location and surface area of potential or confirmed fish habitats and describe how they are used by fish; ■ locate and describe suitable habitats for species at risk that appear on federal and provincial lists and are found or are likely to be found in the study area; ■ document any blasting activity near water where vibrations might affect fish behaviour, such as spawning or migrations; and ■ indicate how fish passage will be maintained for sites where stream crossings are to be installed, constructed, or modified.	**Annex III** **Sections 10.3, 10.5, 12.3, 12.5** **Appendices 12.1, 12.2, 12.3, 12.4**
	Birds, Wildlife, and Their Habitat The EIS will describe the following: ■ migratory and non-migratory birds (including waterfowl, raptors, shorebirds, marsh birds, and other land birds), ungulates, furbearers, amphibians, small mammals, and their habitat at the Project site and within the LSA and RSA; and ■ other wildlife and their habitat that could be affected by Project activities will be characterized using existing data, supplemented by surveys as appropriate, especially migratory animals, such as breeding, denning, or wintering areas, as well as breeding areas of species low in number and high in the food chain.	**Annex IV** **Section 15.3, 15.5**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
	Species at Risk and Species of Conservation Concern The EIS will describe the following: ■ identify all species at risk (SAR) including plant species listed under the *Species at Risk Act* or other provincial endangered species legislation that might be affected by the Project, using existing data and literature as well as surveys to provide current field data, as appropriate; ■ incorporate the finding and analysis of any published studies that describe the regional importance, abundance and distribution of all SARs; and ■ identify residences, seasonal movements, movement corridors, habitat requirements, key habitat areas, identified critical habitat or recovery habitat, and general life history.	**Sections 3.8.1 12.3.2, 14.3.4, and, 15.3.1,**
	Ecosystems The EIS will describe the species selected within each biotic flora VC including those of importance to health and socio-economic conditions, cultural heritage, and the current use of land and resources for traditional purposes by Aboriginal persons.	**Annex VI Sections 14.0, 14.3.5, and 17.3.1**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
9.1.3	***Human Environment*** The following VCs will be identified and described in the relevant sections of the EIS:	
	■ land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, and existing land development);	**Section 17**
	■ health and socio-economic conditions;	**Sections 17, 18, 19, and 20**
	■ physical and cultural heritage, including structures, sites or things of historical, archaeological, paleontological, or architectural significance;	**Section 16**
	■ current use of land and resources for traditional purposes by Aboriginal persons.	**Section 17**
	In describing how the Project might impede navigation, the EIS will: ■ identify any Project components and a description of any activities that might affect waterways and water bodies;	**Section 5**
	■ describe any recreational uses of natural waters;	**Section 17**
	■ provide information on current or historical usage of all waterways and water bodies that will be directly affected by the Project, including current Aboriginal uses, where available.	
	The EIS will describe: ■ all baseline information relevant to human health;	**Annex VI**
	■ functioning and health of the socio-economic environment, encompassing a broad range of matters that affect communities and Aboriginal peoples in the study area in a way that recognizes interrelationships, system functions, and vulnerabilities;	**Sections, 17, 18, 19, and 20**
	■ heritage resources, including structures, sites, or things of historical, archaeological, paleontological, or architectural significance, and	**Annex V**
	■ current uses of land and resources by Aboriginal groups for traditional purposes, including activities related to hunting, fishing, trapping, cultural, and other traditional uses of the land.	**Section 17**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
9.2	**Potential or Established Aboriginal and Treaty Rights and Related Interests**	
	For the purposes of developing the EIS, the proponent will: ■ engage with Aboriginal groups whose potential or established Aboriginal rights and Treaty rights and related interests might be affected by the Project; ■ hold meetings and make key environmental assessment summary documents accessible and making plain language summaries of these documents available to the following groups: ▪ Black Lake Denesuline First Nation; ▪ Hatchet Lake Denesuline First Nation; ▪ Fond du Lac Denesuline First Nation; and ▪ Métis Nation – Saskatchewan Northern Region 1, Stony Rapids Local 80. ■ ensure that the groups' views are heard and recorded.	**Section 6.0** **Appendices 6.1, 6.2, 6.3, 6.4, and 6.5**
	Aboriginal groups whose interests might be affected but who are further removed from the Project and its related effects include the Métis Nation – Saskatchewan Northern Region 1, Uranium City Local 50, and Métis Nation – Saskatchewan Northern Region 1, and Camsell Portage Local 79. For the purposes of developing the EIS, the proponent will: ■ make key environmental assessment summary documents (Draft EIS, Final EIS, and key findings) accessible and make plain language summaries of these documents available and ensure these groups' views are heard and recorded; and ■ ensure that Aboriginal groups, especially those most likely to be affected by the Project, have access to timely and relevant information that they require with respect to the Project and how the Project might adversely affect them.	**Acknowledged**
	The EIS will summarize available information on the potential or established Aboriginal and Treaty rights and related interests of the named Aboriginal groups that have the potential to be adversely affected by the Project. As part of this summary, the EIS will include for each Aboriginal group:	
	■ background information and a map of the group's traditional territory;	**Section 17.3.1**
	■ summary of engagement activities conducted prior to the submission of the EIS, including the date and means of engagement (e.g., meeting, mail, and telephone); ■ information on each group's potential or established rights (including geographical extent, nature, frequency, timing), including maps and data sets (e.g., fish catch numbers) when this information is provided by a group to the proponent; ■ overview of key comments and concerns provided by each group to the proponent; ■ responses provided by government or the proponent, as appropriate; ■ future planned engagement activities; ■ efforts undertaken to engage with Aboriginal groups; and ■ describe all efforts taken to solicit the information required to prepare the EIS.	**Section 6.0** **Appendices 6.1, 6.2, 6.3, 6.4, and 6.5**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
10.0	**Effects Assessment**	
10.1	**Environmental Effects**	
10.1.1	***Methodology*** The EIS will include the following: ■ indication of the Project's effects during construction, operation, maintenance, and foreseeable modifications, and where relevant, closure, decommissioning, and restoration of sites and facilities associated with the Project; ■ indication of the nature of the effect, mechanism, magnitude, duration, frequency geographic extent, and the degree to which it might be reversible for each potential Project-related environmental effect; ■ description of important details of direct and indirect, reversible and irreversible, short- and long-term environmental effects and clearly state the elements and functions of the environment that might be affected, specifying the location, extent, and duration of these effects and their overall effect; and ■ comparison of the biophysical and human environments between the predicted future conditions with the Project and the predicted future conditions without the Project, using the best available information and methods and substantiating all conclusions. The analyses included in the EIS will: ■ demonstrate that all aspects of the Project have been examined and planned in a careful and precautionary manner to ensure that they would not cause serious or irreversible damage to the environment; ■ outline and justify the assumptions made about the effects of all aspects of the Project and the approaches to minimize these effects; ■ ensure that in designing and operating the Project, priority has been and would be given to strategies that avoid the creation of adverse effects; ■ develop contingency plans that explicitly address accidents and malfunctions; and	**Sections 8.4 to 8.6, 9.4 to 9.6, 10.4 to 10.6, 11.4 to 11.6, 12.4 to 12.6, 13.4 to 13.6, 14.4 to 14.6, 15.4 to 15.6, 16.4 to 16.6, 17.4 to 17.6, 18.4 to 18.6, 19.4 to 19.6, and 20.4 to 20.6** **Appendices 8.1 to 8.3, 9.1 to 9.2, 10.1 to 10.3, 11.1, 12.1 to 12.4, 16.1, 18.1**
	■ identify any proposed follow-up and monitoring activities, particularly in areas where scientific uncertainty exists in the prediction of effects.	**Sections 8.7, 9.7, 10.7, 11.7, 12.7, 13.7, 14.7, 15.7, 16.7, 17.7, 18.7, 19.7, and 20.7**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
10.1.2	***Changes to the Environment*** The effects assessment sections of each VC in the EIS will describe any change that might be caused by the Project on the environment including the following: ■ land, water, and air, including all layers of the atmosphere; ■ all organic and inorganic matter and living organisms; ■ interacting natural systems that include the components described above; and ■ changes to components of the environment within federal jurisdiction.	**Sections 8.5, 9.5, 10.5, 11.5, 12.5, 13.5, 14.5, 15.5, 16.5, 17.5, 18.5, 19.5, and 20.5**
	The EIS will include a stand-alone section that summarises those changes that might be caused by the Project on the components of the environment listed in paragraph 5(1)(a) of *CEAA 2012*, (i.e., fish and fish habitat, aquatic species, and migratory birds).	**Section 23.1**
	Changes to the Environment that Would Occur on Federal or Transboundary lands The EIS will include a stand-alone section that summarizes any change the Project might cause to the environment that might occur on federal lands or lands outside the province in which the Project is to be located (including outside of Canada).	**Section 23.2**
	Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions In situations where the Project requires one or more federal decisions identified in Section 5.2, the EIS will include a stand-alone section that describes any change that might be caused by the Project on the environment that is directly linked or necessarily incidental to these decisions.	**Section 23.1**
10.1.3	***Effects of Changes to the Environment***	
	Effects of Changes to the Environment on Aboriginal Peoples The EIS will describe the effects of any changes the Project might cause to the environment, with respect to Aboriginal peoples, on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance.	**Section 23.3**
	Effects of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions In situations where the EIS has identified changes to the environment that are directly linked or necessarily incidental to federal decisions identified in Section 5.2, the EIS will include a stand-alone section that describes the effects of these changes on health and socio-economic conditions, physical and cultural heritage, or any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance, other than as they pertain to Aboriginal peoples (who are considered in the previous section).	**Sections 23.3.1, 23.3.2, and 23.3.3**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
10.2	**Adverse Effects on Aboriginal and Treaty Rights and Related Interests** The EIS will describe, from the perspective of the proponent, the potential adverse effects of the Project on the ability of Aboriginal peoples to exercise the potential or established Aboriginal and Treaty rights and related interests identified in Section 9.2. This section will summarise the following: ■ potential adverse effects on potential or established Aboriginal and Treaty rights and related interests that were identified through the environmental effects described in Sections 10.1.2 and 10.1.3; ■ specific issues and concerns raised by Aboriginal groups in relation to the potential adverse effects of the Project on potential or established Aboriginal and Treaty rights and related interests; ■ VCs suggested for inclusion in the EIS, whether or not those factors were included, and the rationale for any exclusions; ■ where and how Aboriginal traditional knowledge or other Aboriginal views were incorporated into the consideration of environmental effects and potential adverse effects on potential or established Aboriginal and Treaty rights and related interests; and ■ efforts undertaken to engage with Aboriginal groups as part of collecting the information identified above.	Section 6 and Appendices 6.1, 6.2, 6.3, 6.4, and 6.5 Section 23.3
	The assessment of the potential adverse effects of each of the Project components and physical activities, in all phases, will be based on a comparison of the exercise of the identified rights between the predicted future conditions with the Project and the predicted future conditions without the Project. It is recommended that the effect matrix methodology described in Section 10.1.1 be adapted for this purpose.	Section 23.3
10.3	**Public Concerns** This section will detail public concerns raised in relation to the Project, including concerns raised through public consultation conducted prior to the preparation of the EIS or community knowledge that might have been provided.	Section 6 and Annex VI

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
11.0	**MITIGATION**	
11.1	**Environmental Mitigation**	
11.1.1	***Methodology*** The EIS will describe the following: ■ standard mitigation practices, policies, and commitments that constitute technically and economically feasible mitigation measures for which they will be applied as part of standard practice regardless of location; ■ environmental protection plan and environmental management system used to deliver this plan; ■ mitigation measures that are specific to each environmental effect identified in Section 7.2; ■ proponent commitments, policies, and arrangements directed at promoting beneficial or mitigating adverse socio-economic effects; ■ actions, works, minimal disturbance footprint techniques, best available technology, corrective measures, or additions planned during the Project's various phases to eliminate or reduce the significance of adverse effects; ■ assessment of the effectiveness of the proposed technically and economically feasible mitigation measures; and ■ identity of person or group responsible for the implementation of these measures and the system of accountability.	**Sections 8.4, 8.5, 9.4, 9.5, 10.4, 10.5 11.4, 11.5, 12.4, 12.5, 13.4, 13.5, 14.4, 14.5, 15.4, 15.5, 16.4, 16.5, 17.4, 17.5, 18.4, 18.5, 19.4, 19.5, 20.4, 20.5, 21.0, and 22.0**
11.1.2	***Summary of Environmental Mitigation*** The EIS will summarise the mitigation measures, follow-up, and related commitments including: ■ changes to components of the environment within federal jurisdiction; ■ changes to the environment that would occur on federal or transboundary lands; ■ changes to the environment that are directly linked or necessarily incidental to federal decisions; ■ effects of changes to the environment on Aboriginal peoples; and ■ effects of changes to the environment that are directly linked or necessarily incidental to federal decisions.	**Section 23.0**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
11.2	**Measures to Address Effects on Aboriginal Rights** The EIS will describe the measures identified to mitigate the potential adverse effects of the Project on the potential or established Aboriginal and Treaty rights and related interests, including: ■ specific suggestions raised by Aboriginal groups for mitigating the potential adverse effects of the Project on potential or established Aboriginal and Treaty rights and related interests; ■ environmental mitigation measures to address potential adverse effects on potential or established Aboriginal and Treaty rights and related interests; ■ any potential cultural, social, or economic effects or benefits to Aboriginal groups caused by the Project; ■ where and how Aboriginal traditional knowledge or other Aboriginal views were incorporated into the mitigation of environmental effects of potential adverse effects on potential or established Aboriginal and Treaty rights and related interests; and ■ efforts undertaken to engage with Aboriginal groups as part of developing the information identified above.	Sections 23.3, 6.0 Appendix 6.4
11.3	**Measures to Address Public Concerns** The EIS will describe the following: ■ measures identified for addressing public concerns in relation to the Project; ■ on-going and proposed consultations and information sessions with respect to the Project at the local, regional and provincial levels; ■ summary of discussions, indicate the methods used and their relevance, locations of the consultation and information sessions, the persons, and organizations consulted, the concerns raised, the extent to which this information was incorporated in the design of the Project and EIS, and the resultant changes; and ■ efforts made to distribute Project information and to provide a description of information and materials that were distributed during the consultation process.	Section 6.0 Appendices 6.1, 6.2, and 6.3

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
11.4	**Follow-Up Program** The EIS will: ■ describe the proposed Follow-up Program in sufficient detail to allow independent judgment on the likelihood that it will deliver the type, quantity, and quality of information required to reliably verify predicted effects and confirm the assumptions and effectiveness of the mitigation; ■ include specific commitments that clearly describe how the proponent intends to implement them. ■ include any contingency procedures or plans or other adaptive management provisions as a means of addressing unforeseen effects or correcting exceedances as required to comply or conform to benchmarks, regulatory standards, or guidelines; ■ monitor the implementation of mitigation measures resulting from Aboriginal consultation, including: ▪ verifying predictions of environmental effects with respect to Aboriginal peoples, as well as residual effects that could not be addressed within the context of the environmental assessment; ▪ determining the effectiveness of mitigation measures as they relate to environmental effects with respect to Aboriginal peoples in order to modify or implement new measures where required; ▪ supporting the implementation of adaptive management measures to address previously unanticipated adverse environmental effects with respect to Aboriginal peoples or unanticipated adverse effects on Aboriginal rights; ▪ verifying measures identified to prevent and mitigate potential adverse effects of the Project on potential or established Aboriginal and Treaty rights; and ▪ providing information that can be used to improve or support future environmental assessments and Aboriginal consultation processes.	Section 21.3
11.5	**Proponent Commitments** The EIS will describe the proponent commitments including environmental mitigation measures to address public and Aboriginal peoples concern and Follow-up Program elements.	Section 22.0

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
12.0	**RESIDUAL EFFECTS**	
12.1	**Residual and Cumulative Environmental Effects**	
12.1.1	***Residual Environmental Effects*** The EIS will describe the residual environmental effects of the Project on the biophysical and human environments after having established technically and economically feasible mitigation measures.	**Sections 8.5, 10.5, 11.6.2, 12.6.2, 13.5, 14.6.2, 15.6.2, 17.6.2, 18.6.2, 19.6.2, and 20.6.2**
12.1.2	***Cumulative Environmental Effects*** The EIS will describe the Project's cumulative effects (i.e., changes to the environment due to the Project combined with the existence of other works or other past, present and reasonably foreseeable physical activities).	**Sections 11.6.3, 12.6.3, 14.6.3, 15.6.3, 17.6.3, 18.6.3, 19.6.3, and 20.6.3**
12.1.3	***Summary of Residual Environmental Effects*** The EIS will summarize the residual environmental effects (including cumulative environmental effects) identified in relation to the categories of environmental effects specified in Sections 10.1.2 and 10.1.3: ■ changes to components of the environment within federal jurisdiction; ■ changes to the environment that would occur on federal or transboundary lands; ■ changes to the environment that are directly linked or necessarily incidental to federal decisions; ■ effects of changes to the environment on Aboriginal peoples; and ■ effects of changes to the environment that are directly linked or necessarily incidental to federal decisions.	**Section 23.0**
12.2	**Outstanding Aboriginal issues** The EIS will describe the potential adverse effects on potential or established Aboriginal and Treaty rights and related interests that have not been fully mitigated as part of the environmental assessment and associated consultations with Aboriginal groups.	**Section 23**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
13.0	**SIGNIFICANCE DETERMINATION**	
13.1	**Significance of Adverse Environmental Effects**	
13.1.1	***Methodology*** The EIS will describe: ■ the significance of the residual environmental effects (including cumulative environmental effects) that are considered adverse; and ■ the criteria used to assign significance ratings to any predicted adverse effects. The following elements should be used in determining the significance of residual effects: ■ magnitude; ■ geographic extent; ■ duration and frequency; ■ reversibility; ■ ecological and social context; and ■ existence of environmental standards, guidelines, or objectives for assessing the effect. Where significant adverse effects are identified, the EIS will set out the probability (likelihood) that they will occur, and describe the degree of scientific uncertainty related to the data and methods used within the framework of its environmental analysis.	**Sections 8.6, 9.6, 10.6, 11.6, 12.6, 13.6, 14.6, 15.6, 16.6, 17.6, 18.6, 19.6, and 20.6**
13.1.2	***Summary of Significant Adverse Environmental Effects*** The EIS will summarise the significant adverse environmental effects identified in relation to the categories of environmental effects specified in Sections 10.1.2 and 10.1.3: ■ changes to components of the environment within federal jurisdiction; ■ changes to the environment that would occur on federal or transboundary lands; ■ changes to the environment that are directly linked or necessarily incidental to federal decisions; ■ effects of changes to the environment on Aboriginal peoples; and ■ effects of changes to the environment that are directly linked or necessarily incidental to federal decisions.	**Section 23.0**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
14.0	**SUMMARY TABLES**	
	The EIS will contain a series of tables summarizing the following: ■ potential environmental effects, adverse effects on potential or established Aboriginal and Treaty rights and related interests, and public concerns; ■ proposed mitigation measures and commitments by the proponent to address potential effects on environment, Aboriginal rights, public concerns, and Follow-up Program;	**Sections 8.4, 9.4, 10.4, 11.4, 12.4, 13.4, 14.4, 15.4, 16.4, 17.4, 18.4, 19.4, 20.4**
	■ potential residual and cumulative environmental effects and the significance of the residual environmental effects; outstanding Aboriginal issues and outstanding public concerns;	**Sections 8.5, 9.5, 10.5, 11.5, 12.5, 13.5, 14.5, 15.5, 16.5, 17.5, 18.5, 19.5, 20.5**
	■ comments from the public and proponent responses to these comments; ■ comments from Aboriginal groups and individuals and proponent responses to these comments; and	**Section 6.0**
	■ relationship of the identified VCs to Aboriginal groups' potential or established Aboriginal and Treaty rights and related interests.	**Sections 6, 21 and 23.**
15.0	**BENEFITS TO CANADIANS**	
15.1	***Changes to the Project Since Initially Proposed*** The EIS will include a summary of the changes that have been made to the Project since originally proposed, including the benefits of these changes to the environment, Aboriginal people, and the public.	**Section 1.1**
15.2	***Benefits of the Project*** The EIS will include a section describing the predicted environmental, economic, and social benefits of the Project. This information will be considered in assessing the justifiability of the significant adverse environmental effects, if necessary.	**Section 1.5**

Table 1: Concordance Table to Identify Where the Project Specific Guidelines are Met in the Environmental Impact Statement (continued)

Section in Project Specific Guidelines	Requirement	Section in the Environmental Impact Statement
16.0	**MONITORING PROGRAM AND ENVIRONMENTAL MANAGEMENT PLANS**	
	The EIS will describe the monitoring program including the following: ■ monitoring activities at all stages of the Project; ■ proponent's proposed commitment to implementing these activities; ■ resources provided for this purpose; and ■ key information such as contacts, protocols, measured parameters, deadlines, intervention in case of non-compliance of legal requirements and production of monitoring reports. A common and preferred approach in implementing a monitoring program is through the development of an Environmental Management Plan.	**Sections 21.0 and 22.0**

APPENDIX 5.1

Water Temperature Analysis

TECHNICAL MEMORANDUM

DATE October 2, 2013 **PROJECT No.** 10-1365-0004/DCN-186

TO Brian Christensen

CC

FROM Alison Lackie/Brent Topp

WATER TEMPERATURE ANALYSIS FOR THE FOND DU LAC RIVER TO DETERMINE THE EFFECT OF REDUCED WINTER FLOWS IN THE CHANNEL BETWEEN BLACK LAKE AND MIDDLE LAKE

An analysis was completed to determine the effect on winter water temperature from the proposed power generating plant and the associated diversions through the water intake structure and tailrace channel outflow on the Fond du Lac River between Black Lake and Middle Lake.

The proposed water intake structure located on the shore of Black Lake will divert water from Black Lake for power generation. After passing through the turbines in the powerhouse, the diverted water will be discharged into an open tailrace channel which outlets into the Fond du Lac River approximately 5 kilometres (km) downstream of the natural outlet of Black Lake and about 1 km upstream of Middle Lake. The water withdrawn from Black Lake through the water intake structure will pass through a 2.65 km long tunnel to the powerhouse, and be discharged through a 1.1 km long tailrace which reports to the Fond du Lac River. Water will not be heated, however in the winter it is likely that water withdrawn from lower depths (1 to 5 metres [m]) would be slightly warmer than water draining naturally at the lake outlet and into the Fond du Lac River. In addition, water passing through the tunnel would not have the same opportunity to cool (or warm) as would water passing down the Fond du Lac River under open channel flow conditions. Water entering the Fond du Lac River from the tailrace may cool slightly when exposed to cold air but is expected to be warmer that the natural flow in the Fond Du Lac River where the two flows converge, upstream of Middle Lake.

The design discharge through the water intake and tailrace channel is between 160 cubic metres per second (m^3/s) and 190 m^3/s. There is also a constraint that the flow in the Fond du Lac River below Black Lake will not fall below the winter riparian flow level that is currently under review but is expected to be between 40 m^3/s and 70 m^3/s for a low flow scenario, with current average winter flows being about 210 m^3/s in the Fond du Lac River. Should flows at the outlet of Black Lake decrease to below the selected riparian flow level, the flow rate at the intake will be reduced to allow more water to pass through the river channel. The scenario examined in this analysis was based on these flow values. In winter, warmer water from the tailrace will heat flows in the Fond du Lac River which will cool as the flow passes down the open river channel, particularly when riparian flows are lowest.

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A Water Survey of Canada (WSC) hydrometric station is located on the Fond du Lac River at the outlet of Black Lake, about 5 km upstream of where the tailrace channel enters the Fond du Lac River. Water temperature data is recorded at this station and was used in the analysis. The water level sensor used by WSC at the Fond du Lac River hydrometric station is temperature compensated and records water temperature as well as water level. The sensor is a Tavis Corporation Model 10477 and the manufacturer has indicated that the accuracy of water temperature is ± 3 degrees Celsius (°C). As a check on the suitability of the temperature data, same day average temperature was compared to temperatures from Solinst water level recorder installed by Golder Associates Ltd. near the outlet of the Fond du Lac River over the open water period of 2010. Temperatures from the two water level sensors were in in very good agreement with an average temperature difference of 0.13°C. The temperature accuracy for the Solinst sensor is ± 0.5°C.

Averages of the mean daily values for each month are listed in Table 1.

Table 1: Monthly Average of Hourly Water Temperature for the Fond du Lac River at the Outlet of Black Lake (Water Survey of Canada Station 07LE002), Data from 2000-2013

Month	Average Temperature (°C)	Month	Average Temperature (°C)
January	0.33	July	14.5
February	0.31	August	15.4
March	0.32	September	12.2
April	0.35	October	6.9
May	1.8	November	1.3
June	8.0	December	0.35

°C = degrees Celsius.

The analysis consisted of two parts:

- determine the estimated water temperature of the Fond du Lac River portion of the split flow when it arrives at the location of the tailrace outlet; and
- determine the estimated water temperature of the re-combined Fond du Lac River flow downstream of the tailrace channel outflow.

River Water Temperature Estimation

In order to estimate the temperature change in the Fond du Lac River riparian flow from the outlet of Black Lake (at the hydrometric gauging station location) to the point where the tailrace channel discharges back into the river, it is necessary to estimate how much heat is gained or lost from the river flow. This was done using SSTEMP, which is a model which uses a heat exchange basis to determine water temperature. This model is available from the United States Geological Survey and is described by Bartholow (2002) and Theurer et al. (1984). It requires geometric, hydrological, and meteorological data about the river reach being analyzed and then estimates the heat gain or loss to the water and the resulting temperature change. The program calculates values for one day (the time of year impacts the day length in the analysis); for this analysis monthly mean values were used so the date selected was the middle of the month for each month analyzed.

Geometric characteristics were estimated from surveyed cross sections of the river, with the representative sections chosen as those that appeared to reflect the most common characteristics based on GoogleEarth imagery of the area. The majority of the required meterological inputs (windspeed, air temperature, relative humidity) were taken from the Environment Canada 1980-2010 Climate Normals for the Stony Rapids "A" Station. The solar radiation input was taken from monthly mean values from the Atlas of Canada.

As previously mentioned, the discharges used in the analysis are 30, 40, 50, 70, and 210 m^3/s for the section of river downstream of the submerged rockfill weir and above the tailrace confluence.

The length of river between the outlet of Black Lake and the location of the tailrace discharge is approximately 5 km. For the SSTEMP analysis, the river was divided into two reaches with similar widths. The input water temperature for the first upstream reach was taken to be the average monthly temperature from the available hydrometric station water temperature data. For the more downstream reach, the output temperature for the first reach was used as the starting temperature. Only winter months were analyzed since these are the months when the minimum flow in the river would be expected to occur once the Project is operating. This is also the season of the year when the tailrace flows may be warmer than the river water, and could increase natural water temperatures in the river downstream of the tailrace outlet. As indicated in Table 2, the SSTEMP model analysis predicts that the river water temperature decreases as water flows from the Black Lake outlet to the tailrace confluence area between November and March, and increases slightly in April. The SSTEMP model predicts that riparian flow temperatures with the Project operating could fall as low as 0.0°C when Fond du Lac River riparian flows are reduced below about 50 m^3/s.

Table 2: Results from SSTEMP Water Temperature Analysis for the Fond du Lac River Between the Submerged Weir and the Tailrace Outflow

Month	Black Lake Outlet Initial Average Water Temperature[(a)] (°C)	Final Average Water Temperature, Q=210 m^3/s[(b)] (°C)	Final Average Water Temperature, Q=70 m^3/s[(b)] (°C)	Final Average Water Temperature, Q=50 m^3/s[(b)] (°C)	Final Average Water Temperature, Q=40 m^3/s[(b)] (°C)	Final Average Water Temperature, Q=30 m^3/s[(b)] (°C)
November	1.3	1.3	1.2	1.2	1.1	1.0
December	0.35	0.33	0.19	0.10	0	0
January	0.33	0.29	0.14	0.04	0	0
February	0.31	0.29	0.15	0.07	0	0
March	0.32	0.34	0.25	0.2	0.14	0.07
April	0.35	0.44	0.44	0.44	0.44	0.44

[(a)] Initial water temperature was assumed to be the mean monthly temperature from the hydrometric station (07LE002).
[(b)] Temperature predicted for the river flow just before the tailrace discharge location.
°C = degrees Celsius; m^3/s = cubic metres per second.

Mixing Analysis

Downstream of the tailrace channel outflow, the total river flow was assumed to be 210 m^3/s for the current, natural pre-development winter condition. The mixing analysis for the period after the Project is in operation assumes a tailrace outflow of 160 m^3/s, combined with 30, 40, 50, or 70 m^3/s minimum riparian flows in the Fond du Lac River. To determine the temperature of the combined tailrace and river flows, a simple mass balance equation was used:

$$T_{mixed} = \frac{T_1 \times Q_1 + T_2 \times Q_2}{Q_1 + Q_2}$$

The water temperature at the Black Lake water intake structure was assumed to be 0.6°C. This is based on limnology data collected in the winter of 2011 (Golder Associates Ltd. 2013). The water temperature at depths between 1 and 5 m was between 0.4°C and 0.6°C. The intake structure will be withdrawing water from Black Lake between these depths. The heat loss in the open channel tailrace was neglected; since the tailrace channel is relatively short (~1.1 km) and because the flow is quite large in a deep trapezoidal channel, it is reasonable to assume the heat loss would be very small. Thus the water temperature at the tailrace outlet is assumed to be 0.6°C.

The results for the mixed temperature model for each winter month is shown in Table 3, for the pre-development situation as well as a number of potential minimum riparian flow options being considered during Project design. The mixed temperature is highest in November, but the difference between the modelled river flow temperature upstream of the tailrace outlet and the mixed temperature is highest in December, January and February. This is to be expected as these are the months with the coldest air temperature and lowest solar radiation, consequently the heat loss in the river is highest and the river water temperature upstream of the tailrace outlet is lowest. The difference is greatest for the 30 m^3/s flow scenario, as the temperature in the river was predicted to drop lower upstream of the tailrace outlet for this scenario. In either case, the maximum difference between the river temperature upstream of the tailrace outlet and the mixed river temperature downstream of the tailrace discharge location was approximately 0.5°C.

Table 3: Final Mixed Temperature of the tailrace channel water and the river water downstream of the tailrace discharge

Month	Baseline Temperature, Q=210 m^3/s (°C)	Mixed Temperature, Q=70 m^3/s (°C)	Mixed Temperature, Q=50 m^3/s (°C)	Mixed Temperature, Q=40 m^3/s (°C)	Mixed Temperature, Q=30 m^3/s (°C)
November	1.3	0.79	0.73	0.70	0.66
December	0.33	0.48	0.48	0.48	0.51
January	0.29	0.46	0.47	0.48	0.51
February	0.29	0.46	0.47	0.48	0.51
March	0.34	0.49	0.50	0.51	0.52
April	0.44	0.55	0.57	0.57	0.57

Notes: the varying discharge (Q) values represent the discharge in the Fond du Lac River upstream of the tailrace outlet. The discharge from the tailrace outlet was constant (160 m^3/s) in each scenario.
m^3/s = cubic metres per second; °C = degrees Celsius.

A diffusion equation was used to estimate the length required for complete mixing; in all cases a significant downstream distance was required, further than the distance between the tailrace outlet and Middle Lake. Thus, it is likely that the water temperature would not be fully evenly distributed throughout the flow when the river transitions into the lake; but as the flow slows in the widening channel, mixing may require less distance (due to a lower velocity). From this analysis, the water temperature entering Middle Lake in the winter months may be, approximately, 0.3 °C warmer than under current conditions, given a scenario with minimum river flows (i.e., either 30 m^3/s or 40 m^3/s). This water may cool rapidly upon entering the shallow Middle Lake, but ice development on Middle Lake may be affected in the following ways:

- later freeze-up;
- earlier ice-out;

- thinner ice; and
- reduced spatial extent of ice cover.

This assessment is conservative in that the lowest river flow rate for mixing is used. With more average (higher) flows in the Fond du Lac upstream of the tailrace outlet location, a greater proportion of the mixed water would be river flow, and thus the tailrace flow would have a smaller effect on the temperature. A greater flow in the river would also likely result in less heat loss, meaning the water temperature in the Fond du Lac River upstream of the tailrace outlet would be higher. There is likely always going to be some temperature difference between the discharge from the tailrace outlet and the Fond du Lac River flow, since the measured temperature near the intake location was 0.6°C in the winter, which is marginally higher than the mean monthly temperature in the winter months recorded at the hydrometric station at the outlet of Black Lake (summarized in Table 1).

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Golder Associates Ltd. 2013. Tazi Twé Environmental Impact Statement Baseline Report, Annex III Surface Water Environment.

Theurer, F.D., Voos, K.A, and Miller, W.J. 1984. Instream Water Temperature Model. Instream Flow Inf. Paper 16 Coop. Instream Flow and Aquatic System Group, U.S Fish & Wildlife.

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APPENDIX 5.2

Effects of the Environment on the Project

1.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

1.1 Introduction

The local environmental setting can affect the construction, operation, and closure phases of the Tazi Twé Project (Project). This section of the Environmental Impact Statement (EIS) examines the interactions between the surrounding environment and the Project, to identify the main environmental conditions that can affect the Project. These environmental conditions are examined to determine their local severity, probability, and/or frequency. Mitigation, contingency plans, and designs for each are designed and monitored to confirm that risks to the Project are sufficiently reduced.

The environmental conditions that may affect the Project can be categorized based on the time over which they occur:

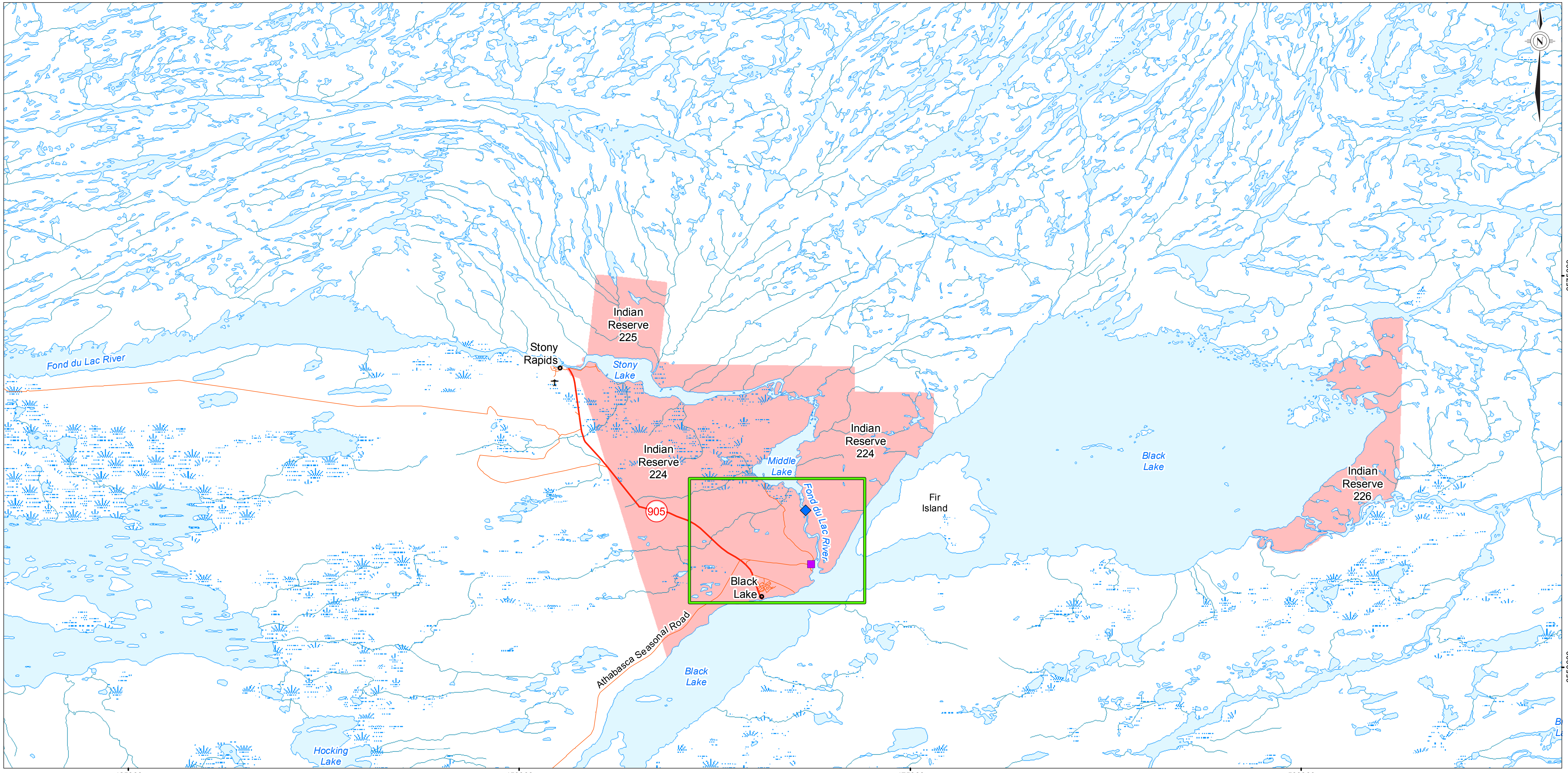
- Short-term events: these events are high intensity events that occur over a short time scale (e.g., storm events; temperature extremes). Mitigation for these events cannot generally be responsive due to the intense nature and short time period over which they occur.
- Seasonal events: These events can last weeks or months and can feature similar conditions to the short-term events (i.e., high precipitation), but will not necessarily include large extreme events. The effects would be cumulative in nature.
- Long-term events: These events can develop over a period of years. This category involves long-term variations in the environmental setting surrounding the Project.

Subsequent sections of this document provide information on the current environmental setting, together with further details on the short-term, seasonal, and long-term events that can influence the Project and associated mitigations.

1.2 Environmental Setting

The Project is located in northern Saskatchewan on the Chicken Indian Reserve No. 224, approximately 7 kilometres (km) north of the community of Black Lake, and 25 km southeast of the Northern Hamlet of Stony Rapids (Figure 1). Highway 905, west of the Fond du Lac River, joins the communities and is the only all-season road access in the area. The Project will include a water intake structure, a power tunnel, a powerhouse, and a tailrace channel between Black Lake and Middle Lake, as well as permanent access roads, waste rock disposal areas, a construction camp, and contractor's work areas.

The Project is located on the Fond du Lac River in the Athabasca River basin of Northern Saskatchewan, between upstream Black Lake and downstream Middle Lake. The area has a subarctic continental climate with long, very cold winters, and short cool summers (Acton et al. 1998). In the summer, mean maximum daily air temperatures reach a July high of 22.7 degrees Celsius (°C), while January mean minimum temperatures are as low as -30°C.



LEGEND

- VILLAGE
- RUNWAY
- HIGHWAY
- ROAD
- RIVER
- WETLAND
- WATERBODY
- INDIAN RESERVE
- ELIZABETH FALLS
- CAMP GRAYLING
- PERMANENT RESIDENT'S CABIN
- GENERAL PROJECT LOCATION

REFERENCE

DMTI HIGHWAYS AND ROADS
NTS MAPSHEET 74I, 74J, 74O, 74P
NAD 83 UTM ZONE 13

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
TAZI TWÉ HYDROELECTRIC PROJECT

TITLE
GENERAL PROJECT LOCATION

Tazi Twé
Hydroelectric Project

PROJECT	10-1365-0004		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 1
GIS	SM	12/07/13		
CHECK	BC	12/07/13		
REVIEW	MM	12/07/13		

FIGURE: 1

1.3 Short-Term Events

Short-term events are high intensity events that occur over a short time scale, and include storm events, temperature extremes, wind extremes, fires, and seismic events. While short-term events can have devastating effects to a Project, mitigation throughout Project design can be applied to reduce sufficiently the severity of these effects.

1.3.1 Storms

During summer months, storm events can occur and can be accompanied by intense rain, hail, lightning, and occasionally tornadoes (Fung 1999). Winter storms typically occur as extreme snowfall events or blizzards.

1.3.1.1 Rain Storms

Northern Saskatchewan generally receives low annual rainfall and low intensity events. The annual average precipitation at Stony Rapids, 20 km from the Project, is 424 millimetres (mm), with 66 percent (%) of this precipitation falling as rain during the spring, summer, and fall (Annex I). The highest daily rainfall event during the 40 years of meteorological record at Stony Rapids occurred on August 12, 1969 at 69.9 mm. Intensity-Duration-Frequency (IDF) data, calculated over a 20 year period from 1986 to 2006 at the Stony Rapids meteorological station is presented in Table 1. For example, a 100-year return period corresponds to an 86.7 mm precipitation event over 24 hours.

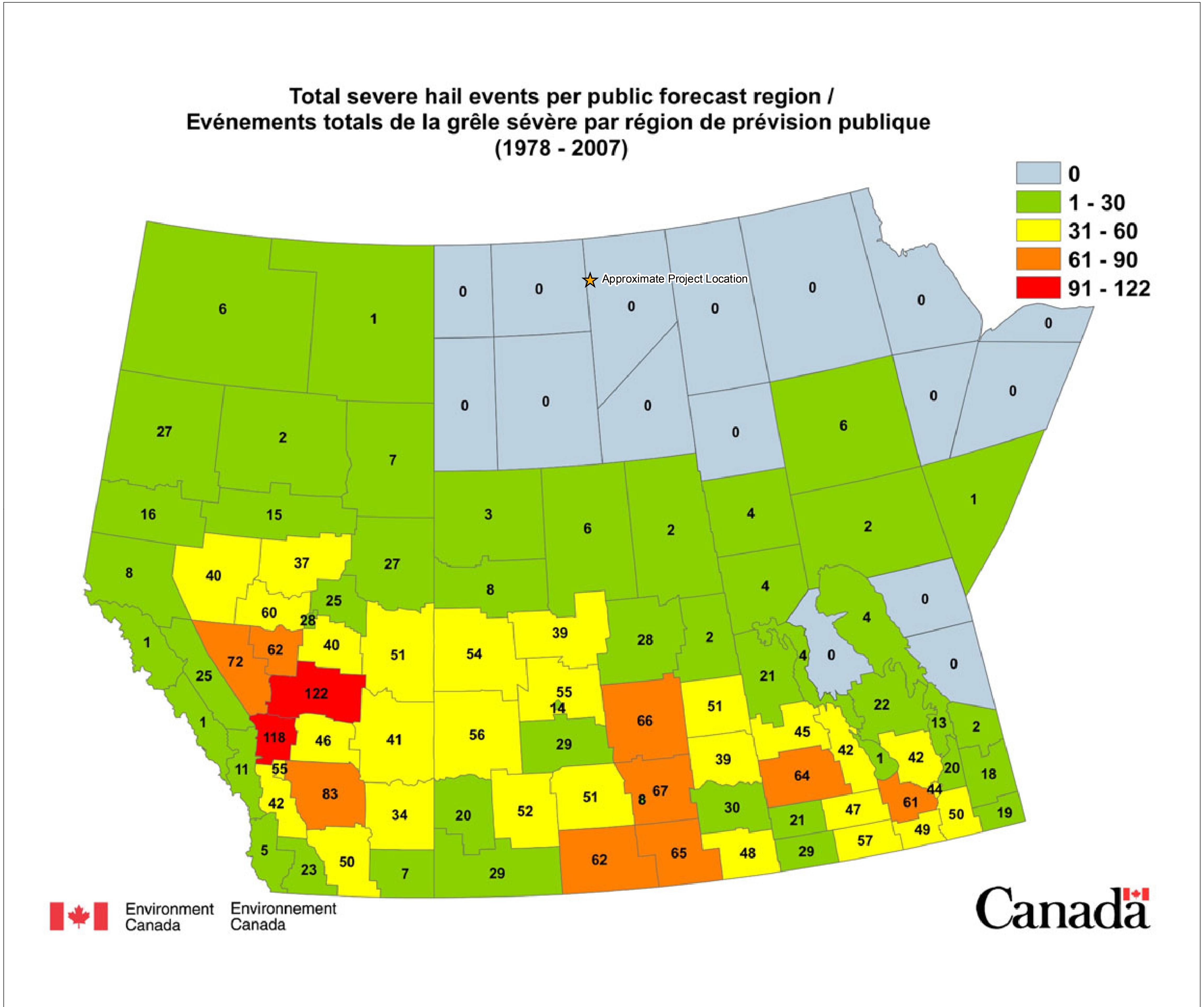
Table 1: Intensity Duration and Frequency Rainfall Statistics for Stony Rapids A (mm)

Duration	Return Period (years)					
	2	5	10	25	50	100
5 min	4.2	6.2	7.4	9.1	10.3	11.4
10 min	5.9	8	9.3	11.1	12.3	13.6
15 min	7.3	9.6	11.2	13.2	14.7	16.2
30 min	9.1	12.4	14.6	17.3	19.4	21.4
1 h	11.2	16.1	19.4	23.6	26.7	29.7
2 h	14.4	21.6	26.4	32.4	36.9	41.4
6 h	21.8	29.9	35.2	42	47	52
12 h	28.7	40.2	47.7	57.3	64.4	71.5
24 h	35.2	49	58.1	69.7	78.2	86.7

Source: Environment Canada 2012a
min = minute; h = hour; mm = millimetre

1.3.1.2 Hail

Hail is precipitation in the form of ice particles and usually forms during intense thunderstorms. While hail particles are at least 5 mm in size, they can be larger than a softball. Hail events are most common in summer months and in continental interiors. Hail data have been collected at the Stony Rapids Meteorological Station from 1986-2010 and indicate a total of five days with hail during this period; however, none of these were classified as severe events (Figure 2).



REFERENCE

ENVIRONMENT CANADA, 2013 (IMAGE PROVIDED BY NRCAN.GC.CA)

PROJECT

TAZI TWÉ HYDROELECTRIC PROJECT

TITLE

SEVERE HAIL EVENTS IN ALBERTA, SASKATCHEWAN, AND MANITOBA

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
GIS	LMR/SM	30/10/13		
CHECK	BC	30/10/13	**FIGURE: 2**	
REVIEW	MM	30/10/13		

1.3.1.3 Lightning

Lightning most often occurs during large summer storm events when warm air is mixed with cool air causing the atmosphere to become polarized and the resultant electrostatic electricity in clouds is discharged. However, lightning can be initiated in the presence of dust storms or tornadoes. While most lightning occurs within clouds or between clouds, approximately 25% of lightning events occur between clouds and the ground.

While electrical storms are not recorded and publically available near the Project site, lightning statistics are gathered at Key Lake, approximately 250 km to the south (Environment Canada 2012b). Over a 14.26 square kilometre (km^2) area at Key Lake, 65 flashes were observed between 1999 and 2008. Of these flashes, 60 occurred from the clouds to the ground. This results in an average of 0.42 cloud-to-ground flashes per square kilometer.

1.3.1.4 Tornadoes

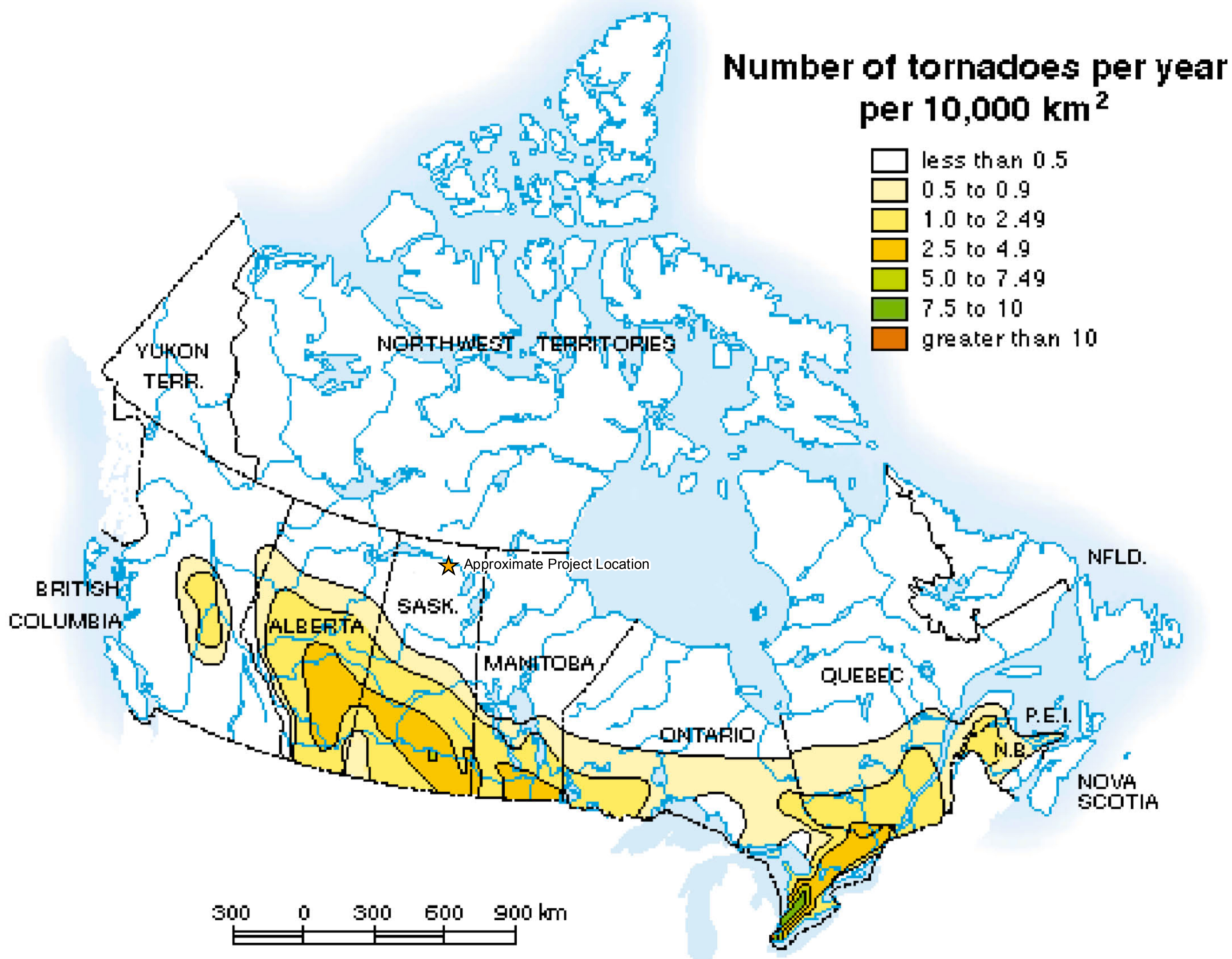
Tornadoes are localized events of violent wind and are associated with cumulonimbus or cumulus clouds. Tornadoes are ranked using the Fujita scale (Environment Canada 2007) as presented in Table 2.

Table 2: Tornado Description Based on the Fujita Scale

F Number	Wind Speed (km/h)	Percent of all Tornadoes (%)	Damage	
0	64-116	28	Light	Some damage to chimneys, TV antennas, roof shingles, trees, signs, and windows.
1	117-180	39	Moderate	Automobiles overturned, carports destroyed and trees uprooted.
2	181-252	24	Considerable	Roofs blown off homes, sheds, and outbuildings demolished, and mobile homes overturned.
3	253-330	6	Severe	Exterior walls and roofs blown off homes, metal buildings collapsed or severely damaged, and forest and farmland flattened.
4	331-417	2	Devastating	Few walls, if any, left standing in well-built homes, large steel and concrete objects thrown a great distance.
5	418-509	0.1	Incredible	Strong-framed houses lifted off foundations and carried considerable distances; automobile-sized objects fly through the air in excess of 100 m, trees debarked, and steel reinforced concrete structures badly damaged.

Source: Environment Canada 2007
km/h = kilometres per hour; % = percent; m = metre

The number of tornadoes per year per 10,000 km^2 across Canada (Environment Canada 2007) is shown in Figure 3. While an average of up to 2.5 to 4.9 tornadoes occur each year in southern regions of Saskatchewan, the Project is located in an area with a historical average of less than 0.5 tornadoes per 10,000 km^2. The *National Building Code* (National Research Council of Canada, 2010) provides categories associated with the probability of tornadoes and their intensity across Canada. The Project site is located in a Zone 1 area, which represents areas with very little tornado potential and low severity.



REFERENCE

ENVIRONMENT CANADA, 2007 (IMAGE PROVIDED BY NRCAN.GC.CA)

PROJECT	TAZI TWÉ HYDROELECTRIC PROJECT		
TITLE	TORNADO OCCURENCES IN CANADA		
PROJECT	10-1365-0004	FILE No.	
DESIGN		SCALE AS SHOWN	REV. 0
GIS	LMR/SM 30/10/13		
CHECK	BC 30/10/13	FIGURE: 3	
REVIEW	MM 30/10/13		

Tazi Twé Hydroelectric Project

1.3.1.5 Snowstorms

Historically, snowfall near the Project has occurred as early as September and as late as June. The largest snowfall events (snowstorms) usually occur in November with an average of 48 centimetres (cm). The largest daily snowfall event that occurred between 1960 and 2010 was March 16, 1995 and amounted to 31.0 cm (Environment Canada 2012c). The largest recorded daily snowfall events are presented in Table 3.

Table 3: Largest Daily Snowfalls between 1960 and 2007 at Stony Rapids

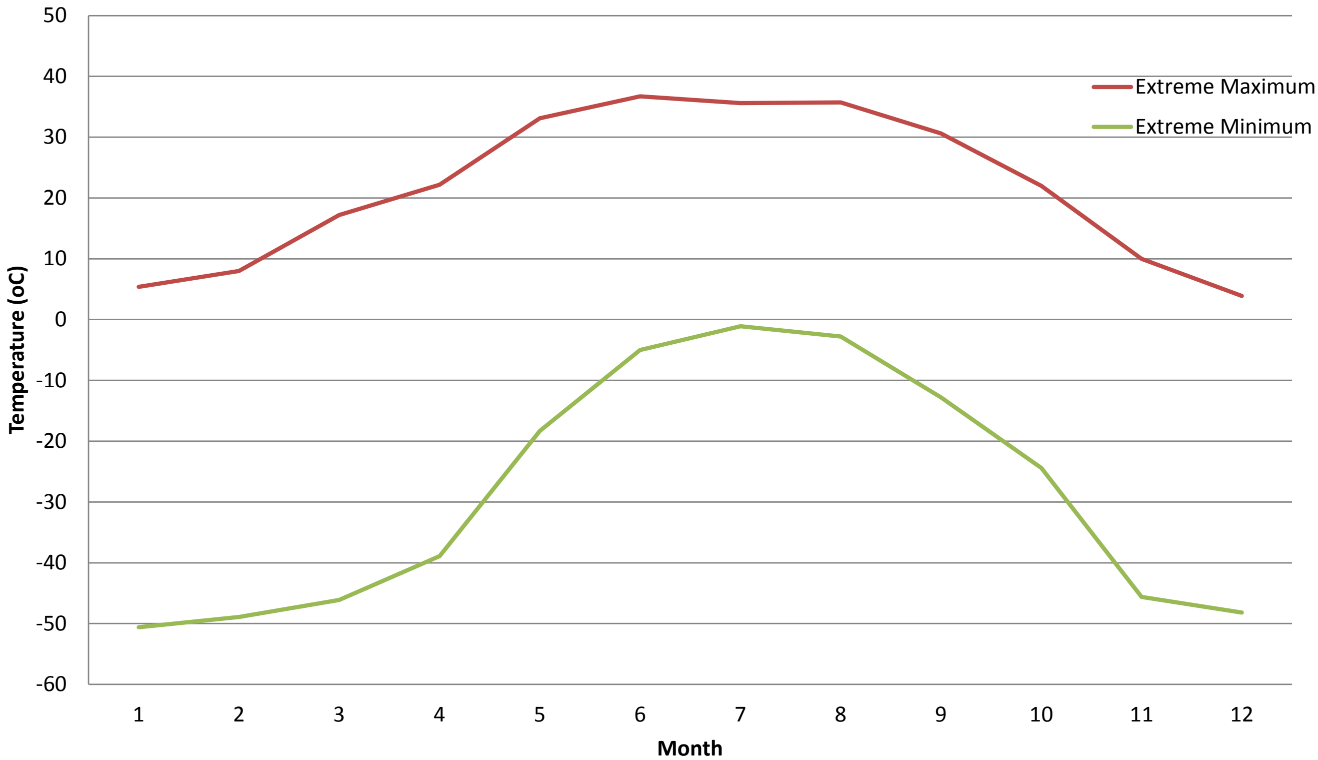
Rank	Snowfall (cm)	Date
1	31.0	March 16, 1995
2	25.4	January 11, 1961
3	25.2	December 5, 1987
4	23.0	May 27, 1989
5	21.2	April 22, 2009
6	20.6	May 2, 2002
7	20.4	April 9, 1999
8	20.3	November 21, 1966
9	20.0	March 27, 2004
10	19.0	March 15, 1999

Source: Environment Canada 2012c
cm = centimeters

1.3.2 Temperature Extremes

The Black Lake area has a subarctic continental climate with short, cool summers and long, very cold winters. Winter persists for about six months and there are few winter thaws. Summers are cool with frequent convective storms driven by evaporation from lakes and forests. In general, the warmest month is July; however the warmest day on record occurred in June 2012 at 36.7ºC. The coldest month is typically January with the coldest temperature recorded at -50.6ºC in January 1972. During the winter, winds can greatly increase the effects of cold temperatures. The minimum and maximum extreme temperatures recorded at the Stony Rapids meteorological station between 1960 and 2010 are shown in Figure 4.

Figure 4: Temperature Extremes for the Stony Rapids Meteorological Station between 1986 and 2010



Source: Environment Canada 2012c
ºC = degrees Celsius

1.3.3 Wind Extremes

Annually and seasonally, most winds come from the southwest or northwest with some variability in their strength among the seasons. On a seasonal basis, winds near the Project have the highest average speeds in spring (18.6 +/- 10.0 kilometres per hour [km/h]) and lowest average speeds in summer (14.5 +/- 8.5 km/h). The highest maximum gust recorded at the Stony Rapids meteorological station was 87 km/h, which occurred in September 1988.

1.3.4 Forest Fires

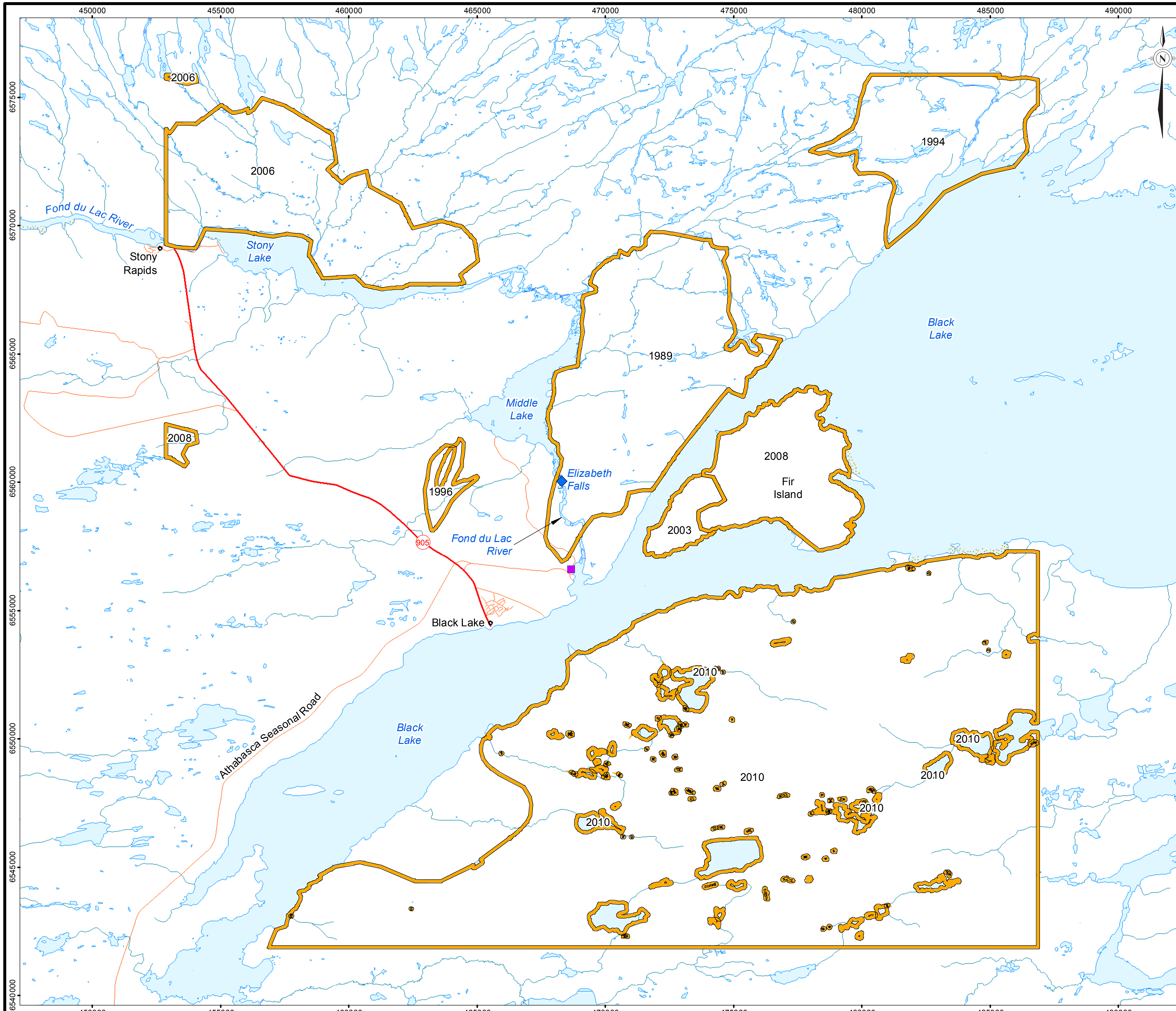
Forest fire characteristics (i.e., occurrence and severity) are closely related to weather and climate. Heat waves, droughts, cyclical climate changes (e.g., El Niño), and regional weather patterns (e.g., high-pressure ridges) can increase the risk and alter the behavior of forest fires. Forest fires are common in areas that have sufficient moisture to support vegetation communities, but also experience extended periods of hot and dry weather. Climate conditions, such as intense and extended droughts, generally are associated with severe forest fire seasons. Fire behavior and severity depend on a combination of factors, such as the availability of fuel, physical setting, and weather. Fire intensity increases during the daytime hours with increasing temperatures and wind speeds. Further, weather can provide the source of ignition for a forest fire as lightning is one of the major natural causes of wildfire.

Forest fire frequencies in the northern boreal region of western Canada have average fire cycles of approximately 39 years for jack pine or aspen dominated forests, 78 years for black spruce-dominated forests and 96 years for white spruce-dominated forests (Larsen 1997). The Project is situated on a transitional area between the boundaries of the Taiga Shield and Boreal Shield Ecozones in Saskatchewan (Acton et al. 1998). The portion of the Project occurring on the east side of the Fond du Lac River is in the Uranium City Upland Landscape Area within the Tazin Lake Upland Ecoregion of the Taiga Shield Ecozone. The portion of the Project on the west side of the Fond du Lac River is situated in the Fond du Lac Lowland Landscape area of the Athabasca Plains Ecoregion of the Boreal Shield Ecozone.

The Uranium City Upland Landscape Area is characterized by forests of black spruce (*Picea mariana*), but because fire is a frequent occurrence in this Landscape Area, forests of jack pine (*Pinus banksiana*) are common (Acton et al. 1998). White spruce (*Picea glauca*) tends to occur along the margins of fens and marshes and stands of trembling aspen (*Populus tremuloides*) typically occupy low, sheltered areas. Forests occurring in the Fond du Lac Lowland Landscape Area typically are stands of mixed wood containing species such as black spruce, jack pine, and white birch. Black spruce is common in wetlands and dwarf birch (*Betula pumila*) is frequently intermixed with the black spruce in these areas.

Multiple fires have affected the area during 1989, 1994, 1996, 2003, 2006, 2008, and 2010. Fire history data were obtained from the Saskatchewan Ministry of Environment (MOE 2012; Figure 5). Areas that were affected by fire in 1989, 1994, and 1996 are considered young forest because sufficient forest regrowth has occurred in these areas (Annex IV; Section 4.3.1.3). Areas that have been affected by fire in 2003, 2006, 2008, and 2010 are recent and therefore are considered recent burn.

The provincial government is responsible for addressing wildfires. The MOE believes that healthy, vibrant forests, renewed naturally by fire or through forest harvest that mimics natural fire, are in the best interest of northern residents, businesses, and the province. However, the provincial government will allocate resources to fight wildfires if they pose risk to communities or Projects.



LEGEND

- VILLAGE
- HIGHWAY
- ROAD
- RIVER
- WATERBODY
- FIRE HISTORY (1989 - 2010)

REFERENCE

NAD83 UTM ZONE 13
NTS MAPSHEETS: 73P/3,4,5,6

5 0 5
SCALE 1:150,000 KILOMETRES

PROJECT

TAZI TWÉ HYDROELECTRIC PROJECT

TITLE

FOREST FIRE HISTORY NEAR THE PROJECT

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.
DESIGN			SCALE AS SHOWN REV. 0
GIS	SM	12/07/13	
CHECK	BC	30/10/13	**FIGURE: 5**
REVIEW	MM	30/10/13	

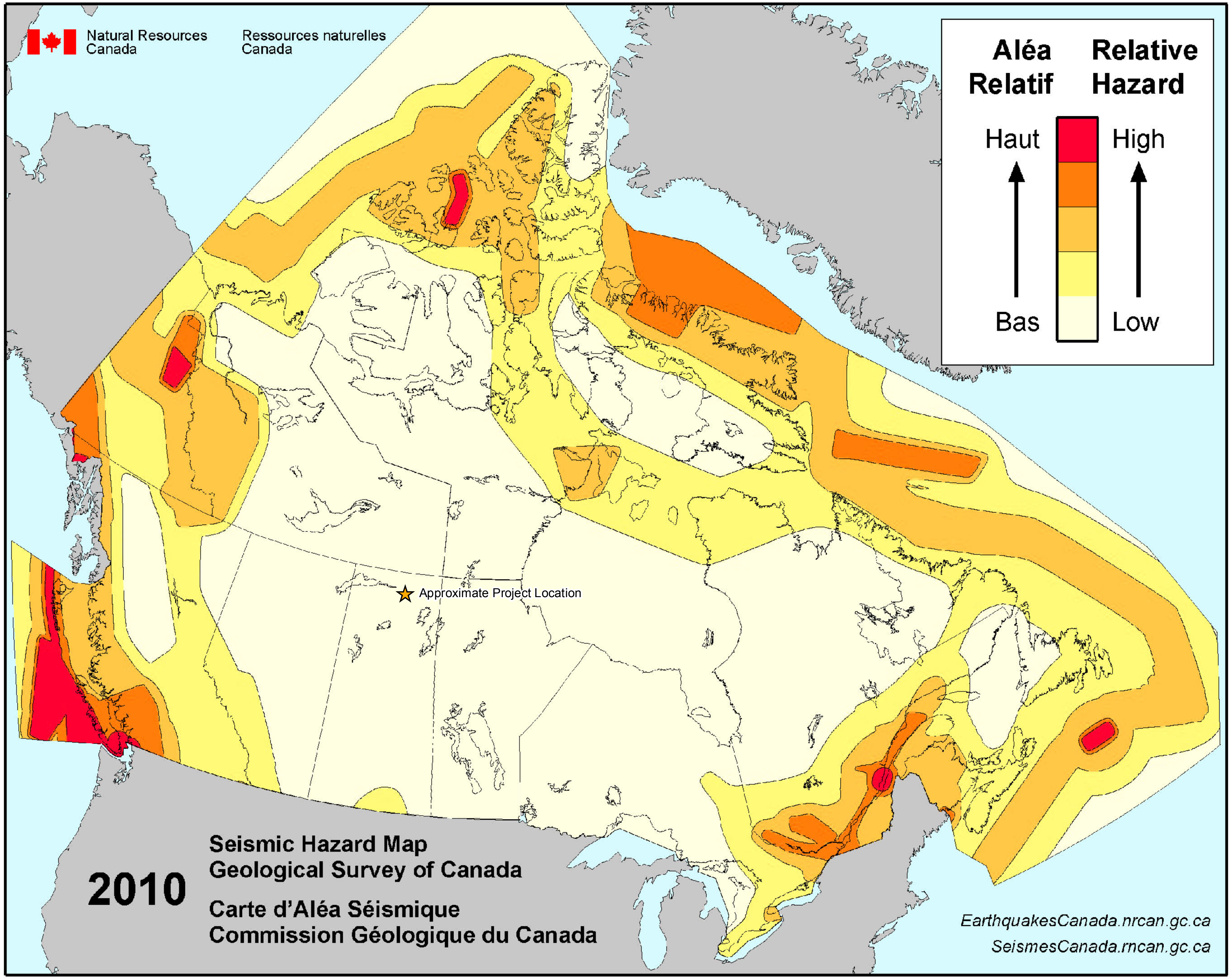
1.3.5 Seismic Events

The Atomic Energy of Canada Limited (AECL) has carried out extensive research related to the tectonic stability of the Canadian Shield in which the Project is located. From this research, AECL has concluded that the Canadian Shield is one of the most tectonically stable areas in the world (COGEMA 1997). Therefore, it is unlikely that the Project would experience a seismic event. The National Resources Canada seismic hazard map is shown in Figure 6 (Natural Resources Canada 2010b).

The historical earthquake occurrences in Canada from 1627 to 2009 are presented in Figure 7. No earthquakes have been "felt" at the Project site. However, two events have occurred within a 250 km radius; the largest of these events occurred 160 km to the northwest of the Project on May 18, 2005 with a magnitude of 2.6MN (i.e., Richter scale) (Natural Resources Canada 2013). The destruction potential associated with the Richter Magnitude Scale is included in Table 4.

Natural Resources Canada (2013) defines the earthquake design criterion in both spectral acceleration (Sa [T]) and peak ground acceleration (PGA) (measured in unit "g", the acceleration due to Earth's gravity) for an earthquake based on a 2% probability of exceedance in 50 years (i.e., a return period of 1 in 2,500 or a frequency of damage of 4×10^{-4} per year). The area has been identified as being in an Earthquake Intensity Zone of 0, which reflects low probability and magnitude for potential events.

Although the Project is situated within a seismic stable zone, there is the potential for mining induced seismicity. Mining activity can induce earthquakes, also referred to as mining tremors. Disruption to the earth's crust can cause stress concentrations in the rock. Considering the possibility for mining induced seismicity, infrastructure and structures built in areas near an operating mine should be engineered for potential seismic events of up to M3. Mining induced events have the potential to cause high accelerations at high vibration frequencies (PGAs up to 0.5 g), but the ground motion would be of very short duration (less than one second) and the affected area localized to within 1 km of the epicenter (Cameco 1995). Within a 250 km radius of the site, thirteen anthropogenic-induced seismic events have been recorded between 1985 and 2009, with magnitudes from 1.9 to 2.7MN (i.e., Richter scale).



REFERENCE

ENVIRONMENT CANADA (IMAGE PROVIDED BY NRCAN.GC.CA)

PROJECT

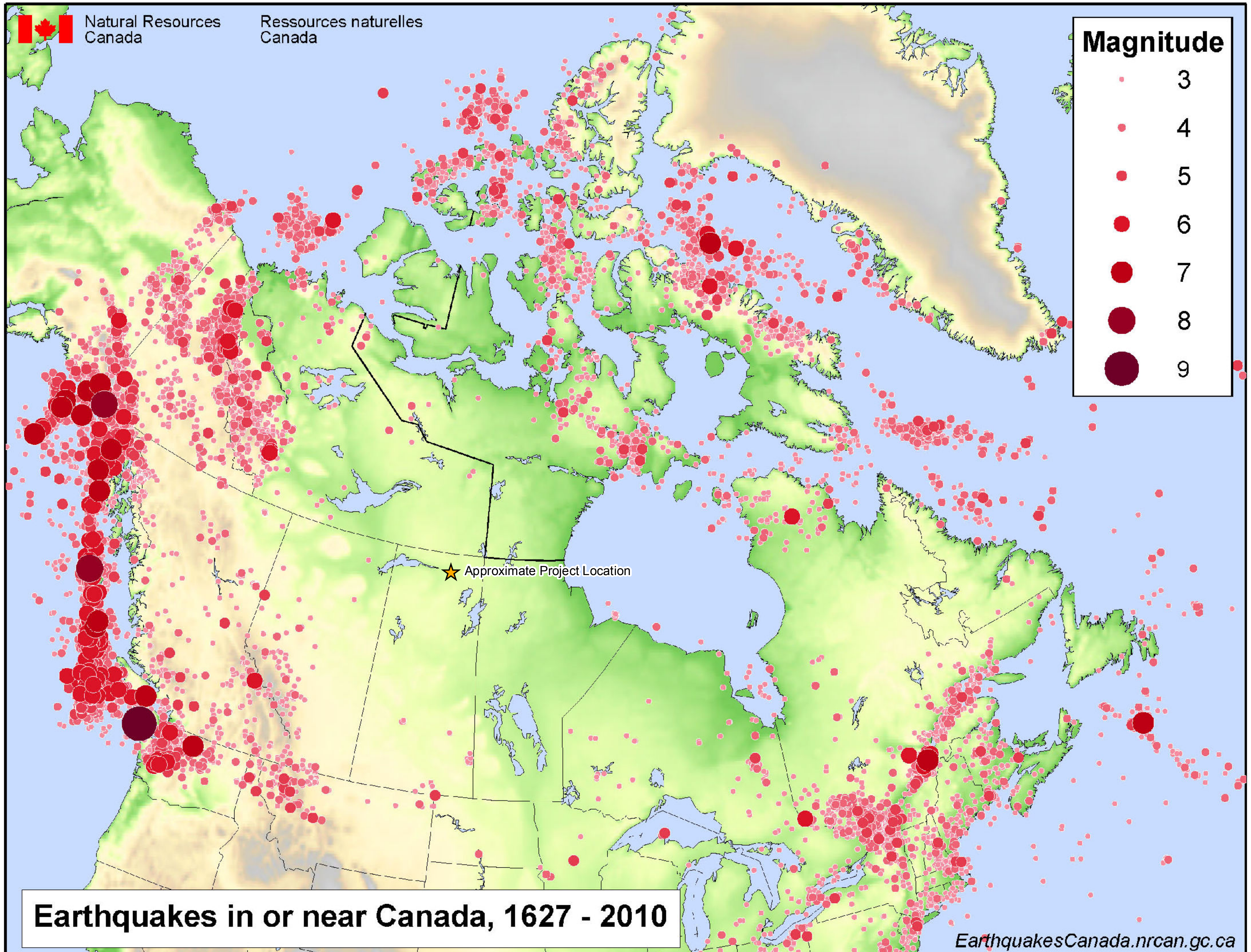
TAZI TWÉ HYDROELECTRIC PROJECT

TITLE

SEISMIC HAZARD MAP OF CANADA

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
GIS	LMR/SM	30/10/13	**FIGURE: 6**	
CHECK	BC	30/10/13		
REVIEW	MM	30/10/13		



REFERENCE

ENVIRONMENT CANADA (IMAGE PROVIDED BY NRCAN.GC.CA)

PROJECT

TAZI TWÉ HYDROELECTRIC PROJECT

TITLE

HISTORICAL EARTHQUAKE OCCURRENCES IN CANADA

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
GIS	LMR/SM	30/10/13	FIGURE: 7	
CHECK	BC	30/10/13		
REVIEW	MM	30/10/13		

Table 4: Likely Destructive Potential Based on Richter Magnitude Scale

<table>
<tr><th>Magnitude (ML)</th><th colspan="3">Destruction Potential</th></tr>
<tr><td>1</td><td>Not felt on the surface, but recorded by seismographs near the epicenter.</td><td rowspan="3">Generally, not felt but recorded.</td><td rowspan="5">At most slight damage to well-designed buildings, but can cause major damage to poorly constructed buildings over a small region.</td></tr>
<tr><td>2</td><td>Can be felt slightly near the epicenter, if at all.</td></tr>
<tr><td>3</td><td>Minor quake, often felt just near the epicenter, likely cases no to little damage.</td></tr>
<tr><td>4</td><td>Light quake, felt but causing little to no damage.</td><td rowspan="2">Often felt, but rarely causes damage.</td></tr>
<tr><td>5</td><td>Moderate quake, felt widely, can cause slight damage near epicenter.</td></tr>
<tr><td>6</td><td>Strong quake clearly felt over a wide area. Damage to poorly constructed buildings within 10 km.</td><td colspan="2">Has moderate destructive potential, but not likely to result in loss of life.</td></tr>
<tr><td>7</td><td>Major earthquake, causes serious damage, and possible loss of life up to 100 km from the epicenter.</td><td colspan="2" rowspan="3">Has a high destructive potential and likely to result in the loss of life.</td></tr>
<tr><td>8</td><td>Great earthquake, which can cause destruction, loss of life over 100 km from the epicenter.</td></tr>
<tr><td>9</td><td>Rare great earthquake, major damage, loss of lives over a large region even more than 100 km from the epicenter.</td></tr>
</table>

Source: Environment Canada 2013
km = kilometre; ML = earthquake magnitude (Richter Scale)

1.3.6 Effects of Short-Term Events on the Project

A summary of the short-term events that can occur near the Project, the potential environmental or Project effects and the mitigation strategies that will be employed to help reduce effects is shown in Table 5. While some of the short-term events could affect the Project or environmental interactions negatively, the likelihood of them occurring or the magnitude of their effects is sufficiently reduced through mitigation strategies.

All short-term events previously discussed have the potential to cause unsafe working conditions and, therefore, jeopardize worker safety. However, these effects will be reduced through the implementation of the SaskPower Safety Rulebook, which explains all relevant safe work practices, and complies with current provincial and federal Health and Safety regulations and the SaskPower ISO 18001 safety system. Relevant safety management policies include training personnel on the various unsafe working conditions and providing procedures and protocol to follow in the event that these conditions occur. The rulebook outlines the personal protective equipment and other equipment that will be provided on site.

There will be limited ability to fight a forest fire. Small fires could be handled and appropriate measures will be in place to do so. If a fire is too large (e.g., windy and dry conditions) then the provincial fire-fighting resources will be called for assistance. The first level of defence will be to prevention of fires (e.g., designating smoking areas and having fire extinguishers available).

Short-term events have potential to affect site infrastructure (i.e., buildings, roads, and cross drainage structures). However, these potential effects will be adequately reduced by following appropriate design standards. Buildings will be constructed following the NBC standard for the area, which enables buildings to withstand extreme short-term events. Additionally, cross drainage structures will be designed for flood events and a maintenance schedule will be developed to monitor the function of all infrastructures. A summary of the potential effects and the corresponding mitigation strategies for each is shown in Table 5.

Table 5: Summary of Potential Environmental Effects from Short-term Events on the Project and Associated Mitigation

Event	Potential Effect	Mitigation Strategies
Storms	Intense rain can cause erosion, which can compromise the integrity of site infrastructure.	Site will be graded and will include stable slopes, and will be landscaped to include armouring or vegetation where necessary according to the Erosion and Sediment Control Plan.
	Storm events can damage site infrastructure and interrupt site operations.	Site infrastructure will be designed according to NBC standards.
	High rainfall events can cause overtopping of site drainage structures and can limit access to site or ability to travel on site.	Road crossing structures will be designed to sufficient design standards for seasonal flood events, which are considerably higher than short-term rain events.
	Storm events can introduce dangerous working conditions.	The SaskPower Safety Rulebook explains all relevant safe work practices, and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
	Electrical storms could cause a power outage.	Power will be generated on site and the site will be connected to the SaskPower grid; backup power for the station service will be provided by a permanent diesel-powered generator.
	Lightning strike could start a forest fire.	An emergency plan will be developed to prevent and respond to fires and equipment will be available. The fire protection water system will be comprised of two electric motor driven pumps, each powered by separate electrical sources, and a by-pass to allow flow to pass in the event that both pumps fail.
		The SaskPower Safety Rulebook explains all relevant safe work practices and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
Extreme Snowfall	Snow drifts and ice on roads surrounding and on site can affect driving safety.	The SaskPower Safety Rulebook explains all relevant safe work practices, and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
	Poor visibility or deep snow can affect worker safety.	
Extreme Temperatures	Extreme temperatures can introduce unsafe working conditions.	
	Extreme temperatures can affect the performance of equipment and interrupt operations.	Procedures will be developed for maintaining the use of equipment during extreme temperature (e.g., storage and usage limits).
High Winds	High winds can introduce unsafe working conditions.	The SaskPower Safety Rulebook explains all relevant safe work practices, and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
	High winds can damage site infrastructure or equipment and interrupt operations.	Site infrastructure will be designed according to NBC standards.

Table 5: Summary of Potential Environmental Effects from Short-term Events on the Project and Associated Mitigation (continued)

Event	Potential Effect	Mitigation Strategies
Fires	Fires can damage site infrastructure and interrupt operations.	An emergency plan will be developed to prevent and respond to fires and equipment will be available. The fire protection water system will be comprised of two electric motor driven pumps, each powered by separate electrical sources, and a by-pass to allow flow to pass in the event that both pumps fail.
	Forest fires can introduce unsafe working conditions.	The SaskPower Safety Rulebook explains all relevant safe work practices, and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
Seismic Events	Seismic activity can damage buildings, injure occupants, and interrupt operations.	Site infrastructure will be designed according to NBC standards

1.4 Seasonal Events

Seasonal events last longer than short-term events (e.g., weeks or months). They can feature similar conditions to the short-term events (i.e., high precipitation), but will not necessarily include large extreme events. The effects of seasonal events could be cumulative in nature (e.g., drought).

1.4.1 Low Precipitation

Low precipitation rates result in droughts that can last from months to years. These conditions result from consistently low precipitation, as either a small snowpack at the end of winter, or low rainfall during the summer. Annual average precipitation at Stony Rapids is 424 mm, but the lowest annual precipitation on record (262.1 mm) occurred in 1970-1971. A summary of the hydrological years with the lowest total precipitation between 1960 and 2010 is shown in Table 6.

Table 6: Years of the Lowest Precipitation at the Stony Rapids Meteorological Station between 1960 and 2010

Rank	Total Precipitation (mm)	Year
1	262.1	1970-1971
2	299.0	2003-2004
3	332.7	1964-1965
4	347.6	1969-1970
5	348.9	1966-1967
6	349.2	2008-2009
7	358.3	1972-1973
8	363.0	2005-2006
9	365.0	1995-1996
10	377.6	2000-2001

Source: Environment Canada 2012
mm = millimetres

Low precipitation can result in low flows and water levels in the local waterbodies and watercourses. Low flow frequency and magnitude statistics for the Fond du Lac River are shown in Table 7 (Annex III).

Table 7: Low Flow Frequency and Magnitude for the Fond du Lac River

Frequency (years)	Low Flow Magnitude (m^3/s)
2	187
5	160
10	147
20	137
50	125
100	118

Source: Annex III
m^3/s = cubic metres per second

1.4.2 High Precipitation

High winter snowfall can result in a deep snowpack. The winter of 1990-1991 received the largest annual snowfall on record with 301 cm, however a portion of the annual snowfall typically melts or sublimates during the winter, and snow drifting can result in a heterogeneous snow pack with some areas considerably deeper or thinner than the regional average.

During rapid spring melt of a large snowpack, flood conditions can occur and persist if they are followed by high rainfall. The highest annual rainfall at Stony Rapids was 454.4 mm and occurred in 1977, while the highest total annual precipitation (579.2 mm) occurred during the 1996-1997 hydrological year. The years of highest total precipitation at Stony Rapids between 1960 and 2010 are shown in Table 8 (Environment Canada 2010c).

Table 8: Years of Highest Precipitation at the Stony Rapids Meteorological Station between 1960 and 2010

Rank	Total Precipitation (mm)	Year
1	579.2	1996-1997
2	571	1990-1991
3	499.7	1988-1989
4	497.5	1976-1977
5	494.1	1975-1976
6	493.4	1991-1992
7	479.5	1973-1974
8	464.2	2004-2005
9	463.4	2002-2003
10	447.7	1987-1988

Source: Environment Canada 2010c
mm = millimetres

High precipitation rates in winter and summer can result in floods in local waterbodies and watercourses. Flood frequency and magnitude estimates for the Fond du Lac River are shown in Table 9 and described in Annex III.

Table 9: Flood Frequency and Magnitude for the Fond du Lac River

Frequency (years)	Flood Magnitude (m^3/s)
2	453
5	564
10	636
20	705
50	792
100	856

Source: Annex III
m^3/s = cubic metres per second

1.4.3 Effect of Seasonal Events on the Project

Seasonal low and high precipitation events can affect aspects of the Project, as summarized in Table 10. However, the mitigation strategies applied to the Project adequately reduce the associated risks.

Table 10: Summary of Potential Environmental Effects from Seasonal Events on the Project and Associated Mitigation

Event	Potential Environmental or Project Effect	Mitigation Strategies
Low Precipitation	Dry events can increase the likelihood of fires.	Water required for fire suppression will be obtained from Black Lake or the Fond du Lac River.
	Drought conditions can affect the quantity of water available for tunnel operations.	The Water Management Plan for the Project outlines a detailed water management strategy that will allow maximum facility efficiency to be attained while maintaining minimum riparian flow in the Fond du Lac River.
	Drought conditions can affect the quantity of water available for domestic and industrial water supply.	The proponent will retrieve its water supply from local groundwater wells or directly from the Fond du Lac River or Black Lake, which all have sufficient water to supply the site even during extreme droughts (Section 9.0; Section 10.0).
High Precipitation	High seasonal precipitation or a rapid spring melt can cause flood conditions which can affect site infrastructure.	Drainage structures will be designed for flood events greater than that produced by snowmelt; culverts will be monitored and ice blockages will be removed, if required.
		Site buildings will be designed according to NBC standards and will be located well above high water levels.

1.5 Long-Term Events

1.5.1 Climate Change

Climatic changes are considered long-term events that can affect the Project. To quantify and evaluate potential climatic changes near the Project, a number of Global Climate Model (GCM) and Canadian Regional Climate Model (CRCM) simulations were run using The Canadian Climate Change Scenarios Network (CCCSN, 2013) interface. The GCM and CRCM models available from CCCSN (CCCSN, 2013) are internationally recognized models that have been identified in the most recent assessment report (Solomon, et al., 2007) by the Intergovernmental Panel on Climate Change (IPCC). The models represent physical processes and typically include atmospheric, oceanic, terrestrial, cryospheric, and aerosols and atmospheric chemistry components. Numerous projected emission scenarios are available to incorporate into the models. The emission scenarios represent “a coherent, internally consistent and plausible description of a possible future state of the world that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change" (CCCSN, 2013) and are constructed based on driving forces such as population, economic and social development, energy and technology, agriculture and land-use emissions, other gas emissions, and policies (Solomon, et al., 2007). There are up to three emission scenarios applicable for each model.

For the purposes of this assessment, five specific climatic variables were examined: precipitation, temperature, wind, relative humidity, and surface downwelling shortwave radiation. These parameters are directly relevant to the Project as they describe the general climatic conditions and are the main drivers of the local water balance. All available models and emission scenarios under the 2007 IPCC Fourth Assessment Report (Solomon, et al. 2007) available from CCCSN (2013) were assessed to capture the uncertainties associated with modeling these future climatic parameters and to incorporate the variability of projected emission scenarios. A summary of the number of ensembles used in this assessment to characterize each climate parameter is shown in Table 11.

Table 11: Number of Climate Models

Climate Parameter	Number of Ensembles
Precipitation	65
Temperature	65
Relative Humidity	25
Wind Speed (at 10 m)	56
Surface downwelling shortwave radiation	65

m = metre

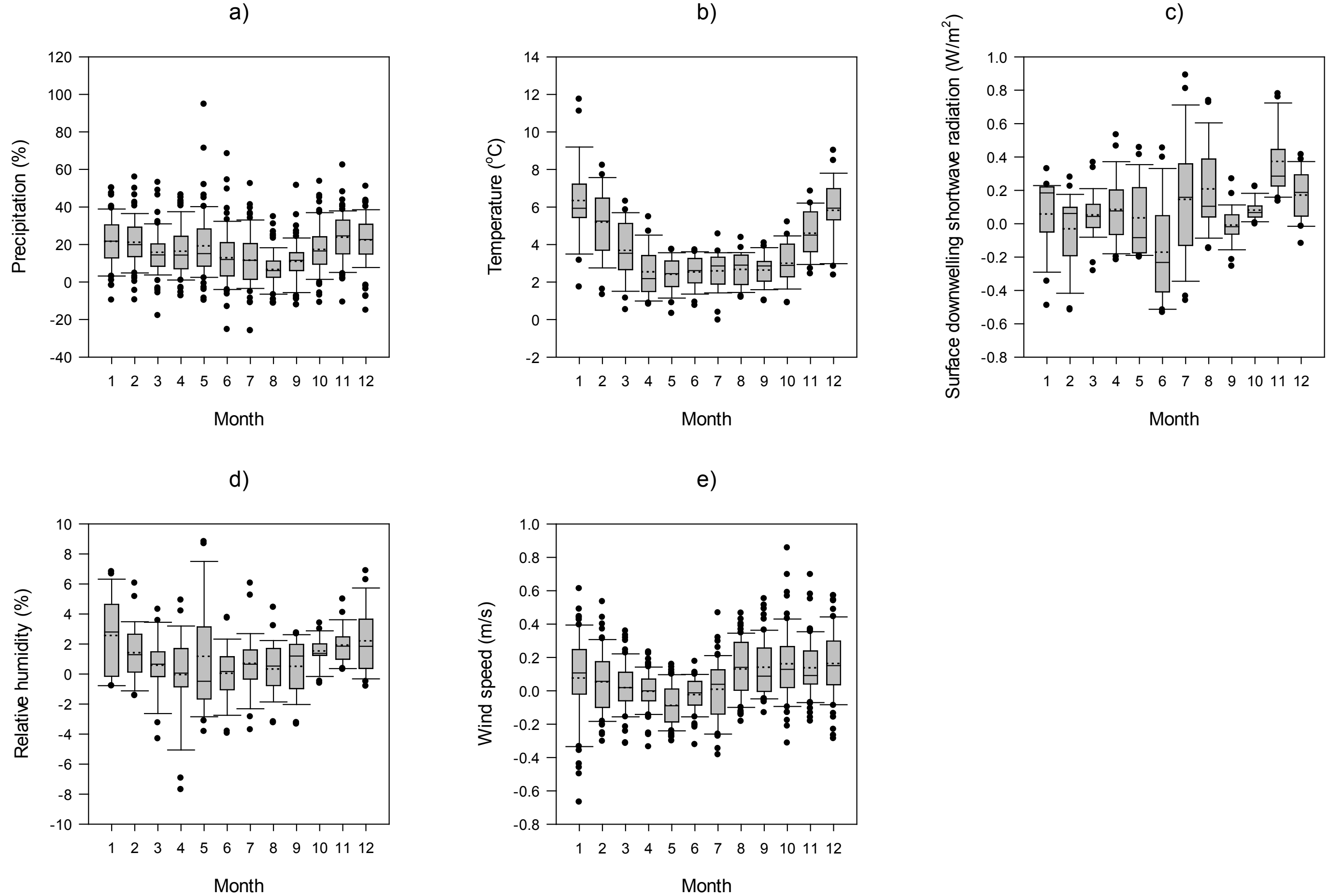
A summary of the average change by month for the period 2070 to 2099 relative to 1971 to 2000 near the Project is shown in Figure 8. The following is a summary of the climate change modeling results for the climatic parameters:

- **Precipitation:** Precipitation rates are predicted to increase through 2070 to 2099 with an annual average increase of 16.7% and mean monthly increase between 6.7% and 23.9%. While there is more variability between model predictions during the spring (May and June), the models generally predict a greater increase in precipitation during winter months (up to 23.9% in November) than in summer months (down to 6.7% in August).
- **Temperature:** The models consistently predict warming near the Project with only one ensemble predicting a 0.03ºC reduction, which occurs in June. Winter months display the most variability in predictions, but results indicate the most dramatic warming will occur in the winter, with an average increase in January of 6.0ºC. Spring and summer months (May through September) are more consistently modeled, with an average increase of 2.9ºC.
- **Surface downwelling shortwave radiation:** Surface downwelling shortwave radiation displays considerable variability, both between months and between models. The largest variability is predicted in July, with estimates ranging between a reduction by 25.6 watts per square metre (W/m^2) and an increase of 18.3 W/m^2. Overall, the models predict an annual reduction of -4.4 W/m^2.
- **Relative humidity:** Relative humidity is generally predicted to increase throughout the year with mean values consistently above zero. However, smaller increases are expected during the summer (average for June is 0.05%) and larger increases are expected in winter (average for January is 2.6%).

- **Wind Speed:** Wind speed is typically predicted to increase for July through February, with an average increase of 0.11 metres per second (m/s) during these months. The models generally predict wind speed to remain close to baseline conditions during March, April, and June. The largest average decrease in wind speed occurs in May at 0.09 m/s. However, there is considerable variability across the dataset with values ranging between an increase by 0.86 m/s and a decrease of 0.67 m/s.

While there is considerable uncertainty inherent in an assessment of this nature, results indicate a general increase in precipitation, temperature, and relative humidity near the Project. There are pronounced seasonal trends for temperature, with winter temperatures increasing more than summer temperatures. The models predicted a greater range in changes to wind speed and surface downwelling shortwave radiation, however some models predict that significant changes will occur. The distribution of values provided in this assessment can help to account for the inherent uncertainties, to incorporate a degree of conservatism, and to provide context to further climate-related assessments for the Project.

Figure 8: Modeled Climatic Changes for the Period 2070-2099 near the Project for a) precipitation, b) temperature, c) surface downwelling shortwave radiation, d) relative humidity, and e) wind speed.



Note**:** Changes are relative to 1971-2000 baseline conditions. Boxes indicate the 90th percentile, 75th percentile, median, 25th percentile, 10th percentile, the dots indicate outliers, and the dotted line indicates the mean

1.5.2 Effects of Long-Term Events on the Project

Climate change is formally recognized as an important environmental issue by federal, provincial, and territorial governing bodies. Increased concern has developed over climate change issues and an emphasis has been put on incorporating climate change issues into environmental assessments so that proponents manage and reduce climate change related risks and effects (CEAA, 2003).

Climate change can affect the Project by increasing the frequency and intensity of short-term events. While the changes to the frequency and intensity of short-term events are difficult to predict and the climate change models used in this assessment do not estimate how these events will change. The longer summers and warmer temperatures (Figure 8) suggest more energy in the climate system and likely an increase in frequency and intensity of short-term events (i.e., storms, high temperature extremes, wind extremes, and fires). While the magnitude of these changes is currently unknown, the Project incorporates sufficient conservatism into its design to address these potential issues. For example, cross drainage structures will be designed for infrequent flood events. Additionally, conservatism incorporated into the design criteria help to address potential long-term changes in the intensity of short-term events.

Climate change can affect the Project by increasing the frequency and/or intensity of seasonal events. While an increase in radiation, wind, and temperature can increase evaporation from waterbody surfaces, this is unlikely to offset the increase in total precipitation (Figure 8) and can result in a net increase in runoff. An increase in water levels and flow rates is not expected to affect the Project beyond the considerations discussed in Section 10 of this EIS and Section 1.4 of this Appendix.

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List of Abbreviations

Abbreviation	Term
AECL	Atomic Energy of Canada Limited
CCCSN	Canadian Climate Change Scenarios network
CRCM	Canadian Regional Model
EIS	Environmental Impact Statement
GCM	Global Climate Model
IDF	Intensity-Duration-Frequency
IPCC	Intergovernmental Panel on Climate Change
MOE	Saskatchewan Ministry of Environment
NBC	*National Building Code of Canada*
NRC	Natural Resources Canada
PGA	Peak ground acceleration
Project	Tazi Twé Project

List of Units

Unit	Term
%	percent
°C	degrees Celsius
cm	centimetre
g	earthquake peak ground acceleration
km	kilometre
km/hr	kilometres per hour
km^2	square kilometres
m	metre
MNL	Local Richter Magnitude
mm	millimetre
yr	year
min	minute
h	hour
m^3/s	cubic metres per second
W/m^2	Watts per square metre
m/s	metres per second