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LOWER CHURCHILL PROJECT

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February 25, 2010

Board of Commissioners of Public Utilities
120 Torbay Road
P.O. Box 21040
St. John's, NL
A1A 5B2

Attention: Cheryl Blundon, Director – Corporate Services and Board Secretary

Dear Ms. Blundon:

Re: Application by Nalcor Energy pursuant to Section 5.5(1) of the Electrical Power Control Act (Water Management Agreement)

Further to your letter of February 11, 2010, enclosed are nine copies of the English translation of Attachment 1 (pages 13-90 of 126) and Attachment 2 (pages 86-147 of 168) of Hydro's response to information request PUB-NE-47, with regards to the above-noted application.

Sincerely,

per Geoffrey P. Young
Senior Legal Counsel

GPY/jc

cc. Peter Hickman and Jamie Smith, Q.C., Counsel for Churchill Falls (Labrador) Corporation
Dan Simmons, Legal Counsel for Public Utilities Board
Jim Haynes, President, Twin Falls Power Corporation
David Schulze, DIONNE SCHULZE, Counsel for Innu of Ekuanitshit (Mingan)
Gary Carot, O'Reilly & Associates, Counsel for Innu of Uashat Mak Mani-Utenam et al

HYDRO
THE POWER OF COMMITMENT

Lower Churchill Hydroelectric Generation Project

Project Registration Pursuant to the Newfoundland and Labrador *Environmental Protection Act*

and

Project Description Pursuant to the *Canadian Environmental Assessment Act*

Submitted by Newfoundland and Labrador Hydro

November 30, 2006

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HYDRO
THE POWER OF COMMITMENT

PREFACE

Newfoundland and Labrador Hydro ("Hydro") has achieved an important stage in planning for the development of the hydroelectric potential of the lower Churchill River with the filing of this Registration and Project Description of the Lower Churchill Hydroelectric Generation Project (the "Project") for environmental assessment. This document will start the formal environmental assessment processes of both the federal and provincial governments. It is a Registration under the provincial environmental assessment legislation (Newfoundland and Labrador *Environmental Protection Act*) and a Project Description intended to commence the federal environmental assessment process under the *Canadian Environmental Assessment Act*. The document also provides the basis for governments to discuss coordination of the environmental assessment.

Engineering design and baseline environmental studies for the Project are already well advanced by virtue of past and on-going efforts to plan the undertaking and to assess its potential environmental effects. The Project includes the generation sites at Gull Island and Muskrat Falls, as well as the interconnecting transmission lines between these two generating sites and Churchill Falls. Together, these two sites will generate an estimated 2,800 Megawatts (MW) of electricity. By way of comparison this represents over one half of the capacity at the Churchill Falls Generating Station (5,428MW). While substantial, the power to be generated by the Project can be absorbed by the growing energy demand in eastern North America.

Planning for developing the hydroelectric potential of the lower Churchill River has been underway for over 30 years. Thus, there exists an impressive body of knowledge about the Project, the issues of concern and how the Project may affect the environment. One complete environmental assessment was conducted in 1980, including a Panel Review and Hearings. The Panel found that the proposed project was acceptable, provided environmental and socio-economic conditions were met. More recently, additional extensive environmental studies were conducted. As a consequence, the environmental assessment process will be supported by a comprehensive understanding of the natural environment of the lower section of the Churchill River valley. Regulatory authorities will be able to rely on this existing body of knowledge throughout the environmental assessment process. Most of the time and effort associated with the environmental assessment can therefore be focused on an informed discussion of the Project, the known issues and concerns, and mitigation measures.

While acknowledging there are important issues to be addressed through the environmental assessment processes, Hydro is encouraged by the extensive benefits to be realized with the development of the lower Churchill River for electric power generation. The rationale for this Project is summarized by these potential benefits:

- provision of a sustainable energy supply;
- reduced greenhouse gas production by replacing carbon intensive sources of energy generation;
- realization of a long term revenue source for the Province;
- a proposed Impacts and Benefits Agreement for the Labrador Innu;
- direct employment and economic benefits to the people of Labrador, and the Province; and
- spin-off benefits for Labrador.

Hydro, through the implementation of its *Environmental Policy and Guiding Principles*, has a solid record of responsible environmental stewardship, including the thorough environmental assessment of all major undertakings. The company is confident that the environmental assessment of the Lower Churchill Hydroelectric Generation Project can now be undertaken in a timely, efficient, and effective manner.

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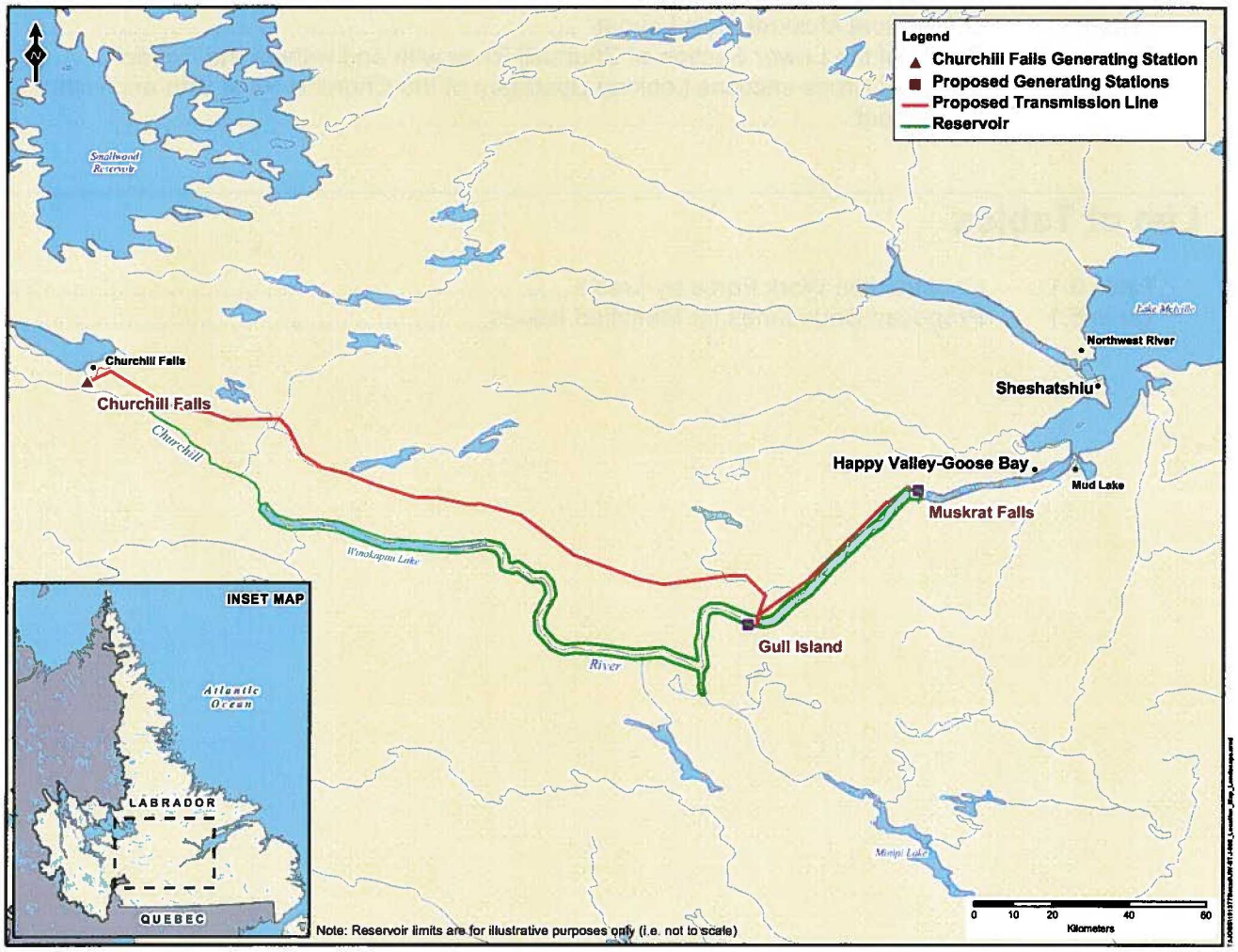
1.0 INTRODUCTION

Newfoundland and Labrador Hydro ("Hydro") is proposing to develop hydroelectric generating facilities with interconnecting transmission lines on the lower section of the Churchill River, Labrador (Figure 1.1). Generation facilities with a combined capacity of approximately 2,800 MW will be installed at Gull Island and Muskrat Falls. Interconnecting transmission lines will be installed between these generating sites and Churchill Falls. This undertaking is called the Lower Churchill Hydroelectric Generation Project (the "Project"). Gull Island and Muskrat Falls are approximately 100 km and 30 km southwest of Happy Valley-Goose Bay, respectively.

Figure 1.1 Location of Lower Churchill Project



The Project will undergo an environmental assessment in accordance with regulatory requirements and in compliance with Hydro policy. Hydro currently operates 10 hydroelectric facilities in Newfoundland and Labrador, each of which was assessed in compliance with the applicable environmental assessment requirements at the time they were developed. Hydro will apply its experience to the

environmental assessment of this Project. Potential adverse environmental effects that may result from the Project will be assessed so that selected mitigation measures can be applied to avoid or reduce adverse environmental effects and enhance benefits. Stakeholder groups and the interested public will have opportunities to ask questions and provide input throughout the environmental assessment.

In conducting environmental assessments, baseline information on the existing biophysical and socio-economic environments is usually collected over a one to two year period, and this information forms the basis for the prediction of environmental effects. Baseline information has been collected over the past 30 years for this Project, beginning with the initial proposal to develop the hydroelectric potential of the lower section of the Churchill River in the 1970s. A full federal government Panel Review was completed in 1980 to assess the environmental effects of the proposal. This involved the collection and analysis of environmental baseline data and the preparation of an Environmental Impact Statement ("EIS"). An extensive body of knowledge therefore exists on the surrounding environment. This, in combination with the fact that the effects of hydroelectric projects in general are well understood, means the Project can and will be planned so as to reduce its potential adverse environmental effects and optimize beneficial effects.

Since the Panel Review was conducted in 1980, land claims in this area of Labrador by the Innu of Labrador have been accepted for negotiation by the Governments of Canada and of Newfoundland and Labrador. Hydro and Innu Nation are working together through Process Agreements to undertake consultation within the Innu communities, to conduct negotiations toward an Impacts and Benefits Agreement ("IBA"), and to involve the Innu in the environmental and technical work being carried out for the Project and in planning for its environmental assessment.

The Project will provide benefits to the residents of Newfoundland and Labrador through job creation, the provision of power, procurement opportunities and long-term revenue generation. Benefits from royalties resulting from energy sales will be realized by all Labradorians and Newfoundlanders.

1.1 Purpose of the Project Registration and Description Document

The Project is subject to Part X of the Newfoundland and Labrador *Environmental Protection Act* ("*NLEPA*"), and the provisions of the *Canadian Environmental Assessment Act* ("*CEAA*"). An environmental assessment of the Project will be conducted to satisfy the requirements of both Acts.

This document:

- initiates the provincial and federal environmental assessment processes pursuant to the *NLEPA* and *CEAA*, respectively;
- describes the Project, the purpose of the Project and alternatives within the Project;
- describes the key elements of Hydro's Environmental Management System;
- describes Project features and design mitigations;
- provides a brief overview of environmental baseline studies; and
- provides an overview of potential Project-related environmental issues raised through previous initiatives.

1.2 Project Overview

Development of the hydroelectric potential of the Churchill River began in 1960 with the construction of the Twin Falls power plant. This plant was built to provide power to the iron ore mines at Labrador City and Wabush. Twin Falls was decommissioned in 1974 with the full commissioning of the Churchill Falls Generating Station (also referred to as the Upper Churchill Project). The 5,225 MW (upgraded to 5,428 MW in 1985) Churchill Falls Generating Station is one of the largest underground powerhouses in the world. In total, the site captures about two-thirds of the hydroelectric potential of the Churchill River. Consequently, most of the flow in the Churchill River has been regulated since the Churchill Falls Generating Station started operation in 1971. The Lower Churchill Hydroelectric Generation Project involves tapping the remaining hydroelectric potential of the Churchill River at Gull Island and Muskrat Falls (Figure 1.1).

The Project consists of a generating facility at Gull Island, a generating facility at Muskrat Falls, a 735 kilovolt (kV) transmission line between Gull Island and Churchill Falls, and a 230 kV transmission line between Muskrat Falls and Gull Island. The total installed generating capacity at Gull Island will be approximately 2,000 megawatts (MW). The planned total installed capacity at Muskrat Falls is approximately 800 MW.

The nine-year long construction period is scheduled to begin at Gull Island in mid-2009. First power is scheduled in mid-2014. Construction of Muskrat Falls will be initiated approximately three years following the start of the construction of Gull Island. A more detailed Project Description is provided in Section 3.

1.3 The Proponent

Name of Corporate Body: Newfoundland and Labrador Hydro

Address:
Hydro Place, 500 Columbus Drive
P.O. Box 12400
St. John's, NL
A1B 4K7

President and Chief Executive Officer: Edmund J. Martin

Principal Contact Person for Purposes of Environmental Assessment:
David Kiell
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Hydro is a Crown Corporation with a mandate to deliver reliable, least cost-energy to residents and industry in Newfoundland and Labrador. The installed generating capacity of 7,289 MW is the fourth largest of all utility companies in Canada and Hydro is the province's major energy provider. Every year, Hydro generates and transmits over 80 percent of the electrical energy consumed by Newfoundlanders and Labradorians.

As a Crown corporation, Hydro is owned entirely by the Province of Newfoundland and Labrador. Hydro is the parent company of the Hydro Group of Companies which includes Churchill Falls (Labrador) Corporation ("CF(L)Co."), and the Lower Churchill Development Corporation ("LCDC"), a non-operating company that holds the water rights associated with the Project. CF(L)Co. is owned 65.8 percent by Hydro and 34.2 percent by Hydro Québec. CF(L)Co. owns and operates the hydroelectric generating plant (5,428 MW), located in Churchill Falls, Labrador, as well as 1,250 km of distribution and transmission lines

Hydro generates, transmits and distributes electrical power to utility, industrial and retail customers. The primary power generating assets on the island of Newfoundland (the "Island") include:

- nine hydroelectric plants with a total installed capacity of 940 MW;
- one 490 MW oil-fired thermal generating plant; and
- four gas turbines with a total capacity of 150 MW.

Hydro also operates an interconnected electrical power system on the Island, a separate interconnected system in Labrador, and 26 isolated generation (56.4 MW) and distribution systems throughout rural areas of the province. The total lengths of the distribution and transmission lines on the Hydro system are 3,653 and 3,697 km, respectively.

Hydro is principally a wholesaler of electricity on the Island, where it sells the bulk of its power to Newfoundland Power (an investor-owned utility), and several industrial customers. Hydro also sells directly to over 35,000 residential and commercial customers in rural Newfoundland and Labrador.

Hydro established an Environmental Services Department in 1975 to provide environmental management expertise, advice and assistance on all aspects of the corporation's activities. Since that time, Hydro has demonstrated leadership in environmental assessment, environmental compliance and effects monitoring, environmental auditing, and environmental protection planning. Hydro's *Environmental Policy and Guiding Principles* is presented in Figure 1.2. Hydro has been recognized by such organizations as the Newfoundland and Labrador Association of Professional Engineers and Geoscientists and the National Hydropower Association for outstanding stewardship and environmental management. In 2002, the *Newfoundland and Labrador Environmental Award* was awarded to Hydro in the Business Category for "a business that has demonstrated the exemplary attitude and concern for the environment through sound environmental management policy, and has demonstrated action to prevent or reduce pollution".

Additional information can be obtained from the Newfoundland and Labrador Hydro web site at www.nlh.nl.ca.

Figure 1.2 Newfoundland and Labrador Hydro Environmental Policy and Guiding Principles

ENVIRONMENTAL POLICY AND GUIDING PRINCIPLES

The Newfoundland and Labrador Hydro Group of Companies will help sustain a diverse and healthy environment for present and future Newfoundlanders and Labradorians by maintaining a high standard of environmental responsibility and performance through the implementation of a comprehensive environmental management system.

The following guiding principles set out the Hydro Group's environmental responsibility :

PREVENTION OF POLLUTION

- implement reasonable actions for prevention of pollution of air, water, and soil and minimize the impact of any pollution which is accidental or unavoidable;
- use the Province's natural resources in a wise and efficient manner;
- use energy as efficiently as possible during the generation, transmission, and distribution of electricity, and the operation of its facilities, and promote efficient use of electricity by customers;
- maintain a state of preparedness in order to respond quickly and effectively to environmental emergencies;
- recover, reduce, reuse and recycle waste materials whenever feasible;

IMPROVE CONTINUALLY

- audit facilities to assess potential environmental risks and continually improve environmental performance;
- integrate environmental considerations into decision-making processes at all levels;
- empower employees to be responsible for the environmental aspects of their jobs and ensure that they have the skills and knowledge necessary to conduct their work in an environmentally responsible manner;

COMPLY WITH LEGISLATION

- comply with all applicable environmental laws and regulations, and participate in the Canadian Electricity Association's *Environmental Commitment and Responsibility Program*;
- periodically report to the Board of Directors, Executive Management, employees, government agencies, and the general public which we serve on environmental performance, commitments and activities;
- monitor compliance with environmental laws and regulations, and quantify predicted environmental impacts of selected activities on the environment;
- respect the cultural heritage of the people of the Province and strive to minimize the potential impact of Corporate activities on heritage resources.

Date: November 2, 2006 Approved by: _____

Version No. 2

1.4 Environmental Assessment Requirements

The Project is subject to the *NLEPA* and to *CEAA*. The potential environmental effects of the Project will be assessed in accordance with both of these Acts.

Under *NLEPA*, the Project is defined as an undertaking subject to Part X, pursuant to Section 34(1)(a) and 34(1)(d) of the *Environmental Assessment Regulations*.

> *34. (1) An undertaking that will be engaged in electric power generation and the provision of structures related to that power generation, including*
>
> *(a) the construction of dams and associated reservoirs where the area to be flooded is more than 50 hectares;*
>
> *(d) the construction of hydroelectric power developments with a capacity of more than one megawatt.*

Under *CEAA*, it is expected that Fisheries and Oceans Canada ("DFO") and Transport Canada will have federal regulatory responsibilities by virtue of *Law List Regulation* triggers that apply to the Project. These Responsible Authorities ("RAs") will ensure that an environmental assessment is conducted prior to the issuance of federal permits and authorizations for the Project.

The following *Law List Regulations* triggers may apply to the Project:

- issuance of authorization by DFO for work related to the construction of the hydroelectric generating facilities with the potential for harmful alteration, disruption or destruction of fish habitat pursuant to sub-section 35(2) of the *Fisheries Act*, and
- issuance of a permit by Transport Canada for the construction of the hydroelectric generating facilities pursuant to sub-section 5(1) of the *Navigable Waters Protection Act*.

The Project will require a Comprehensive Study level of environmental assessment pursuant to *CEAA*. Sections 4 (b), and 7 of the associated *Comprehensive Study List Regulations* specify that the following projects require a Comprehensive Study:

> *4. The proposed construction, decommissioning or abandonment of*
>
> *(b) a hydroelectric generating station with a production capacity of 200 MW or more.*
>
> *7. The proposed construction of an electrical transmission line with a voltage of 345 kV or more that is 75 km or more in length on a new right of way.*
>
> *8. The proposed construction, decommissioning or abandonment of a dam or dyke that would result in the creation of a reservoir with a surface area that would exceed the annual mean surface area of a natural water body by 1,500 hectares, or an expansion of a dam or dyke that would result in an increase in the surface area of a reservoir of more than 35 percent.*

Other federal authorities that may have an interest in the environmental assessment of the Project include Environment Canada, Health Canada and Natural Resources Canada.

Hydro will continue its on-going discussions and consultations with Innu Nation, and will conduct public and stakeholder consultations. Environmental baseline information is being collected, reviewed, and consolidated for the environmental assessment. The level of environmental assessment will be determined by the federal and provincial Ministers of Environment. The environmental assessment document will present the results of the environmental effects analyses, including an overview of the baseline environment, the nature and results of the scoping exercise, the prediction of environmental effects, an identification of proposed mitigation measures, an evaluation of predicted residual effects and their significance, an assessment of cumulative effects, and a proposed follow-up program.

1.5 Innu Nation Involvement

The Labrador Innu land claim has been accepted for negotiation by the federal and provincial governments. The negotiation of a Land Claim Agreement-in-Principle (the interim step before a Final Agreement) is ongoing between Innu Nation and the governments of Newfoundland and Labrador and Canada. The Project is located within the Labrador Innu Land Claim Area. Hydro and Innu Nation have put in place Process Agreements to provide for Innu-led consultations on the Project in the Innu communities, to conduct negotiations towards an IBA, and to facilitate the direct participation of Innu in the environmental and technical work being carried out for the Project.

Under the current Process Agreement (signed July 2006), Hydro and Innu Nation are continuing negotiations towards an IBA, which, once concluded, would define how the Labrador Innu might participate in the development. The specific nature and provisions of the IBA have yet to be finalized, but will include processes for continued consultation on the Project during construction and operations, as well as mechanisms for identifying and addressing the potential adverse effects of the Project on Innu and Innu communities, and for optimizing potential benefits.

Hydro and Innu Nation have established mechanisms for Innu-led consultations on the Project in the communities of Sheshatshiu and Natuashish. These consultations will provide an on-going means to inform Innu on the nature and status of the Project, and to find out what people think about the Project and its potential environmental effects.

A process has also been established to facilitate Innu involvement in planning, conducting and reviewing the environmental and technical work for the Project. A Task Force consisting of technical representatives from Hydro and Innu Nation is involved in designing and implementing the baseline environmental study program, and in planning for the environmental assessment. It is anticipated that the role and mandate of the Task Force will evolve to be the primary forum for Innu Nation involvement in the preparation of the environmental assessment.

An Innu Traditional Knowledge Committee of Innu elders has also been established to document and share Innu traditional knowledge for the environmental assessment. Traditional knowledge shared through this process will be discussed, considered and as appropriate, incorporated into the environmental assessment in a manner that will be agreed between Hydro and Innu Nation.

Each of these processes is designed to share information, both in terms of informing Innu Nation and the Innu communities about the Project, and in identifying and attempting to address any associated questions, concerns and issues. They will, therefore, serve as key sources of information for the environmental assessment.

2.0 SETTING

The following provides a description of the area within which the Project will be located. The material presented is based on currently available information. For example, community profile and population statistics are based on Community Accounts, an information system administered by the Government of Newfoundland and Labrador.

2.1 The Land

The headwaters of the Churchill River are located near the western boundary of Labrador, occurring within the upland plateau of interior Labrador before dropping sharply at Churchill Falls. The geological substructure of Labrador is primarily Precambrian bedrock of the Canadian Shield. Rocks are mainly metamorphic, in the forms of gneisses and granites. Some volcanic rock units occur in western Labrador. A belt of metasedimentary, metavolcanic, volcanic, metamorphic, and igneous rocks, (the "Labrador Trough") forms part of a broad arc trending north-northwest to south-southeast.

With the retreat of ice sheets following the last glaciation, the land mass previously underneath the ice sheets has been slowly rising. The valley of the Churchill River is deeply incised into the surrounding upland. The lower stretches are characterized by marine sediments including clays and silts in terraces and deposits above current sea level in the lower reaches of the river, including the vicinity of Muskrat Falls. Near Lake Melville, extensive deltaic sand deposits occur in the vicinity of Happy Valley-Goose Bay.

As the land slowly became exposed following glaciation, plant species extended their ranges northward. The terrestrial, freshwater, and marine ecosystems that subsequently developed in the Churchill River valley and watershed are the result of biological colonization, geography, and climate. Scientists have developed a national ecological classification scheme that divides the natural environments of Canada into regions termed "ecozones". The Churchill River watershed is located within the Boreal Shield and Taiga Shield ecozones. The Boreal Shield ecozone is typified by coniferous forest cover overlying the geological structure of the Canadian Shield and is the most widespread ecozone in Labrador. It is found more frequently in sheltered areas and particularly in the Churchill River valley. The Taiga Shield ecozone is sub-arctic and represents a transition between the boreal forest ecosystems to the south and Arctic ecosystems found further to the north. It is found more at higher elevations of the valley and in the upland areas of the watershed.

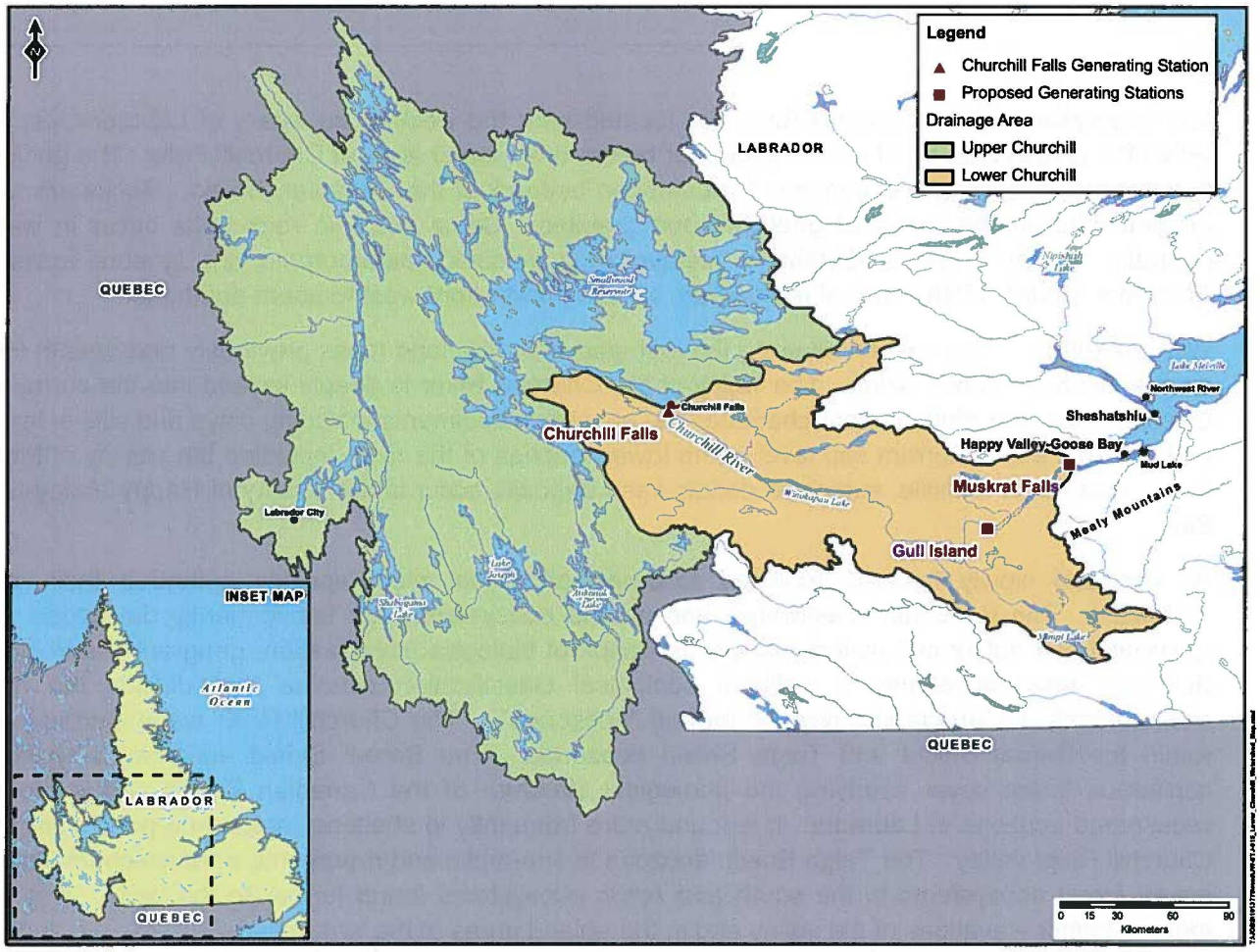
The climate in the Upper Lake Melville area tends to be relatively moderate, with temperatures at the mouth of the Churchill River, in Happy Valley-Goose Bay, ranging from a daily average of -17.3°C in January to 15.5°C in July. Temperatures become cooler upstream of the Upper Lake Melville area, and at higher elevations. The Churchill River valley typically receives approximately 1,000 mm of precipitation annually, 45 percent of which falls as snow.

2.2 The River Valley

The Churchill River is the largest river in Labrador. It was re-named in 1965, having been originally referred to as Grand River, and then the Hamilton River. The Innu name for it is Mishta-shipu. It drains a basin of approximately 92,500 km², and is approximately 856 km long from its headwaters near the

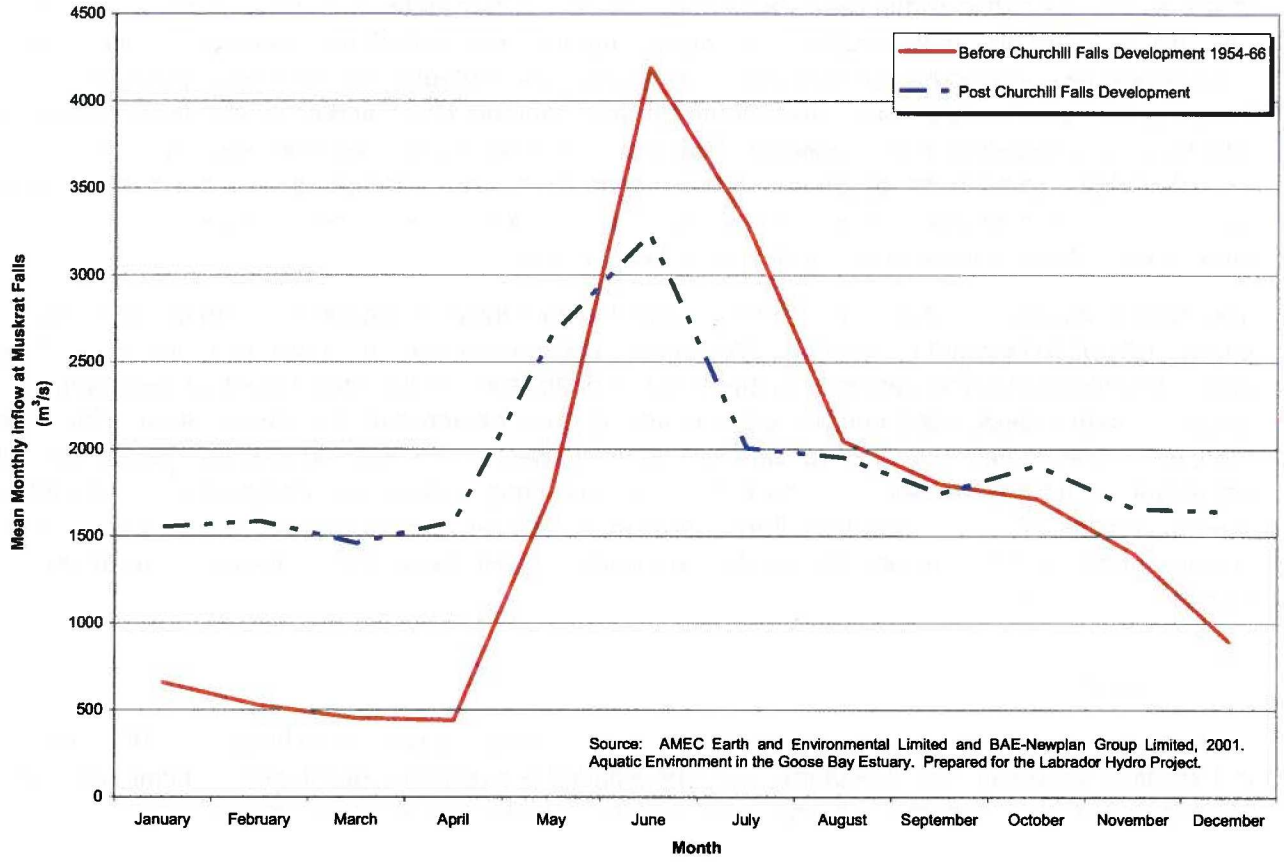
western Labrador boundary to Lake Melville. The lower Churchill River and Lake Melville formed in a trough aligned in a northeast-southwest direction, and the river runs in a general west to east orientation (Figure 2.1). The Mealy Mountains are directly adjacent to the trough on its southeastern side. The Churchill River empties into Lake Melville, which flows into the Labrador Sea. The valley created by the Churchill River experiences a boreal ecoclimatic regime, as compared to the taiga (sub-arctic) region that occurs at higher altitudes directly adjacent to the valley.

Figure 2.1 Project Setting



The hydrology of the Churchill River basin reflects the regional climate; runoff is strongly seasonal with high flows in the spring (typically peaking in May or June) and low flows in late winter. The average annual flow at Churchill Falls is 1,390 m^3/s. At Gull Island it is 1,780 m^3/s and at Muskrat Falls it is 1,840 m^3/s. Flows in the Churchill River are moderated by the operation of the Churchill Falls Generating Station which has been in place for more than 30 years. As an illustration of downstream flow effects, the highest average monthly flows at Muskrat Falls have decreased (June) and the lowest monthly flows have increased (April), compared to flows before the Churchill Falls Generating Station became operational. This has resulted in a less variable flow regime over the course of the year, both seasonally and monthly, as shown in Figure 2.2.

Figure 2.2 Average Monthly Flow at Muskrat Falls - Before Churchill Falls Plant Operation and Currently



River morphology is classified on the basis of sinuosity (straight or curved), number of channels, and stability (permanence of bar features, type and height of vegetation, development of bogs and fens, and sediment exposures.) The reach of the Churchill River from Gull Island to Muskrat Falls is a straight-to-sinuous, single-channel system. Downstream of Muskrat Falls, the Churchill River transitions from a wandering system to a braided system, with less stability and more multiple-channel reaches.

The lower Churchill River valley is located at elevations less than 400m. It lies within the boreal ecoclimatic region where microclimatic conditions in the valley allow boreal species to dominate over sub-arctic species, especially on south-facing slopes. Boreal plant species assemblages include large conifers such as white and black spruce and balsam fir, and larch. Most trees in Labrador do not exceed 10 m, but within the valley white spruce may exceed 15 m in height. Associated deciduous species and understory vegetation typical of the boreal forest include white birch, alder, mountain maple, dogberry, chuckley-pear, pin cherry, willow, balsam poplar, aspen, juniper, crowberry, moss heather, squashberry, mountain avens, partridgeberry, marshberry, bearberry, raspberry, Labrador tea, bog rosemary, sweet gale, blueberry, and bilberry.

The Churchill River and its valley support a wide variety of wildlife species that occur year-round, seasonally, or use the waterway as a travel route. Wildlife species that use the river and valley include beaver, porcupine, muskrat, mink, and otter. Large mammals that use the valley for shelter and/or as a

travel corridor include caribou, moose and black bear. Waterfowl species include the Common Loon, Canada Goose, and Black Duck.

Water quality is pristine within the Project area with low or non detectable trace metal concentrations. The pH is generally near neutral. However, nutrient concentrations (phosphorus and nitrogen compounds) are generally not detectable, indicating low potential for biological productivity. The following fish species have been documented in the Churchill River and/or its tributaries: brook trout; lake trout; lake whitefish; round whitefish; longnose and white sucker; northern pike; lake chub; burbot; and pearl dace; stickleback; sculpins; rainbow smelt; Arctic char and ouananiche (land-locked Atlantic Salmon). Sea-run Atlantic salmon and Arctic char are found downstream of Muskrat Falls, but only land-locked Atlantic salmon occur upstream of Muskrat Falls.

The federal *Species at Risk Act* ("*SARA*") and the provincial *Endangered Species Act* ("*NLESA*") contain lists of designated endangered, threatened, special concern, and vulnerable species in Canada and in Newfoundland and Labrador respectively. "Endangered" is the most sensitive designation. The range of several designated species extends into, or may extend into, the Project area. The eastern population of wolverine has been designated as endangered. Threatened species include the boreal population of woodland caribou. Three herds of woodland caribou are designated by *NLESA*: Lac Joseph, Mealy Mountain, and Red Wine. Species of special concern under *SARA*, and vulnerable species under *NLESA*, include the eastern population of Harlequin Duck, Barrow's Goldeneye, and Fernald's milk-vetch.

2.3 The People

Labrador has a cultural heritage stretching back 8,000 years. Today, an estimated 28,000 people live in Labrador, including both Aboriginal and non-Aboriginal residents, distributed in small communities scattered along the coast and in a few larger centres in central and western Labrador.

2.3.1 Pre-contact Cultures

The central interior of Labrador appears to have been occupied only by the "Indian" cultures (Maritime Archaic, Intermediate and Late Pre-contact). In the central interior, including the Churchill River valley, sites of the earliest Maritime Archaic period are present but are not common. The most intensive pre-contact occupation appears to have occurred in the Intermediate Period (beginning approximately 3,500 years ago), since most interior sites, including the Churchill River valley, date to this period. Thereafter, interior sites become somewhat less common in the Late Pre-contact period, while sites become more numerous on the Labrador coast. This may reflect an increasing reliance on coastal resources by Late Pre-contact people that continued until the arrival of Europeans on the Labrador coast.

2.3.2 Contemporary Society

The Innu were previously known as Montagnais or Naskapi Indians. They were traditionally a nomadic people, whose movements responded to the seasons and to the migrations of the animals they relied upon for existence. Physically, as well as spiritually, the Innu depended greatly on the caribou, a dietary staple. Much of the year was spent hunting, trapping and fishing such species as caribou, bear, beaver, porcupine, migratory waterfowl, small game such as partridge, muskrat and rabbits, and fish including salmon, char, trout, pike, and suckers. Various types of berries were also harvested in

season. This traditional way of life continued until the mid-20th century, when many Innu were settled into government housing and began to receive formal education. Innu continue to attach great importance to time spent in Nutshimit (the country). For many Innu, this is seen as an opportunity for cultural and physical renewal and as an opportunity to reaffirm the importance of the Innu connection with the land and each other.

Today there are two Innu communities in Labrador – Natuashish on the North Coast, and Sheshatshiu in the Upper Lake Melville region. In 1967, the Mushuau Innu were settled in Davis Inlet, on the eastern side of the Island of Iluikoyak. In the winter of 2002-2003 the Mushuau Innu resettled to the community of Natuashish on the mainland. As of 2003, there were approximately 580 Innu living in Natuashish and another 1,400 in Sheshatshiu. Small numbers of Labrador Innu also reside in Labrador City-Wabush, Happy-Valley-Goose Bay, St. John's and elsewhere.

The Labrador Innu land claim has been accepted for negotiation by the federal and provincial governments, and the negotiation of an Agreement-in-Principle is ongoing between Innu Nation and the governments of Newfoundland and Labrador and Canada. The Innu Nation Land Claim Area includes the Project area. It is the only land claim in the Project area that has been accepted for negotiation by both the federal and provincial governments.

The Inuit of Labrador are descended from the eastern Thule people, who arrived in northern Labrador between 1300 AD and 1450 AD. By the late 18th century the Inuit had established themselves along portions of the Labrador coast. The Inuit were a mobile people, but their harvesting efforts focused on the sea. Inuit hunted marine mammals and birds from kayaks in open-water season and from the ice in winter. They moved to summer camps in the adjacent hinterland when ice cleared to fish the inland waters for char and to hunt caribou in the late summer. As Europeans settled the Labrador coast, beginning with a Moravian mission in Nain in 1771 followed by Hudson's Bay Company and independent trading posts the Labrador Inuit became more sedentary and participated increasingly in the cod fishery and fur trade.

The Inuit of Labrador are primarily resident on the Labrador North Coast in the communities of Nain, Hopedale, Makkovik, Postville, Rigolet (approximately 2,600) and in the Central Labrador communities of North West River and Happy Valley-Goose Bay (approximately 1,900), with other Inuit residing in Cartwright, Labrador City, St. John's and elsewhere. With the effective date of the Labrador Inuit Land Claims Agreement on December 1, 2005, the Labrador Inuit established their own Nunatsiavut Government.

Non-aboriginal settlement in Labrador began in the 18th century, following the development of seal and cod fisheries and expansion of the fur trade. Mining in western Labrador, hydroelectric development at Churchill Falls and military operations at Goose Bay further spurred non-aboriginal settlement in the 20th century.

The Labrador Metis Association was established in 1985, and renamed the Labrador Métis Nation (LMN) in 1998. The LMN reports a membership of approximately 6,000 members. They live throughout Labrador and elsewhere, with concentrations in the Lake Melville area and along the southern coast from Cartwright to Mary's Harbour. The LMN has asserted a land claim in the region; however, this claim has not been accepted for negotiation by either the federal or provincial governments.

2.3.3 Regional Socio-economic Setting

Labrador has five general regions, based on Statistics Canada Census Consolidated Subdivisions: the North Coast, Labrador West, Upper Lake Melville, Labrador Straits, and East Coast. The Project is located in the Labrador West and Upper Lake Melville regions.

Happy Valley-Goose Bay is the largest community in the Upper Lake Melville region. The Upper Lake Melville region includes most of the Churchill River valley and south-central Labrador. It includes the communities of Happy Valley-Goose Bay, Mud Lake, North West River, Rigolet and Sheshatshiu. In 2001, it had a population of 9,960 (down 5.1 percent from 10,500 in 1996), and an unemployment rate of 14.5 percent. An Air Force base (5 Wing Goose Bay) has been operating at Happy Valley-Goose Bay since World War II.

Government agencies providing health care, transportation, and education services to central and coastal Labrador are located in Happy Valley-Goose Bay. The town is also benefiting from growth in mining and related activity, including the success of the Voisey's Bay Mine/Mill. However, it is also being negatively affected by declining demand for foreign military training. Other investments are needed to help the town and region diversify their economies and develop new enterprises. Considerable attention has been given over the past several years to using the assets at 5 Wing Goose Bay for alternative purposes.

Labrador West includes the communities of Labrador City-Wabush and Churchill Falls. In 2001, the region had a population of 10,285 (down from 11,195 in 1996), and an unemployment rate of 9.7 percent. The adjacent communities of Labrador City and Wabush are based on iron ore mining. Churchill Falls (population 645) was built by CF(L)Co. to operate and maintain the Churchill Falls Generating Station.

Land and resource use in the Project area is concentrated primarily near the adjacent communities. From the Upper Lake Melville area, trapping has evolved into a predominately part-time or recreational activity centered along the Labrador West to Happy Valley-Goose Bay section of the Trans Labrador Highway (TLH). Cabins are located adjacent to the Highway, with concentrations at crossings of tributary systems that flow into the mainstem of the Churchill River. Above Winokapau Lake a series of cabins occur along the river margins, accessed by boats travelling from Churchill Falls. Recreational, subsistence and leisure activities within the Project area include hunting, trapping, berry-picking and angling. Snowmobiling and boating tend to be associated with these activities. Some adventure tours occur along the length of the river between Churchill Falls and Happy Valley-Goose Bay; but there are no licensed outfitter camps established adjacent to the mainstem of the river. Wood harvesting, both commercial and domestic, is common near Upper Lake Melville communities. The completion of the Phase 3 of the TLH (Happy Valley-Goose Bay to Cartwright Junction) will open areas south of the mainstem to vehicle traffic and may result in a shift in resource harvesting patterns.

3.0 PROJECT DESCRIPTION

The Project consists of hydroelectric generating facilities at Gull Island and Muskrat Falls and interconnecting transmission lines between these facilities and Churchill Falls.

3.1 Rationale and Need

Hydro's core business is the generation and transmission of safe, reliable, least-cost power to residents, businesses and industries of the Province. The development of the Project will help to achieve this objective. The Churchill River is recognized as a significant, long-term, reliable source of renewable hydroelectric energy. The potential of this resource has yet to be fully developed. The existing Churchill Falls Generating Station is located 225 km upstream from the Gull Island site. This facility came into service in 1971, and currently generates an average of 34 TeraWatt hours (TWh) of energy per year. The generating facilities at Gull Island and Muskrat Falls will respectively produce an additional 11.9 and 4.8 TWh annually. Development of the untapped hydroelectric potential on the Churchill River will contribute benefits to the Province of Newfoundland and Labrador as a long-term renewable energy supply and a source of revenue, which is consistent with Hydro's mandate to deliver a Project that will maximize benefits for the Province. During construction, the Project will also make a strong contribution to the local and provincial economy through associated direct, indirect and induced employment, and business opportunities.

The Project will be developed to meet future power requirements in the province and will generate revenue from sales outside the province. The portion of the power that is in excess of provincial requirements will likely be exported, given the magnitude of the generating capacity relative to forecasted provincial load growth. There is considerable forecast demand for new electrical generation in eastern North America in the coming decades; therefore, it is anticipated that a ready market will exist for electric energy from the Project. Hydro intends to implement employment and contracting measures that will optimize economic benefits to residents of the Province from the Project.

3.2 Environmental Management

The number and diversity of environmental challenges facing large companies require a structured and consistent management approach. The Hydro Group has chosen the ISO 14001 Environmental Management System (EMS) standard developed by the International Organization for Standardization (ISO) to manage its environmental aspects. This decision has resulted in continual improvement of environmental performance, while fulfilling Hydro's mandate to provide customers with cost-effective and reliable power. Several of the Hydro generation facilities, including Churchill Falls, have been individually registered by an external auditor (Quality Management Institute – QMI) as compliant with the ISO 14001 standard.

The Project will be constructed and operated in accordance with the overall Hydro EMS. A project-specific EMS will be prepared and implemented that is consistent with Hydro's *Environmental Policy and Guiding Principles* (Figure 1.2).

3.2.1 Project Planning and Application

Integral to Hydro's overall EMS is the consideration of environmental issues at the earliest stages of Project planning and design. This approach, which also includes "designed-in mitigation", is a very effective planning tool. By using this approach in planning and design, the resulting mitigation measures are more likely to be effective because they have become integrated into the Project from the earliest stages. Further, the early identification of mitigation measures improves the accuracy of project cost and schedule definition. Discussed below are some examples to illustrate how Hydro has already incorporated the designed-in mitigation approach to the Project.

The Project has the potential to result in both beneficial and adverse effects on Innu society and culture. To increase benefits, Hydro and Innu Nation are working to find ways to involve the Innu in the early stages of the Project. For example, contractors conducting baseline environmental studies have included Innu assistants on their study teams. Where possible, Innu field assistants will also be included on engineering study teams. Training has been provided to Innu members of the study teams, including on-the-job training, mentoring, and more formal training such as in archaeological methods and techniques.

The routing of the transmission line will be determined through a comprehensive constraint mapping exercise. Alternative routes will be assessed using technical and environmental criteria. This approach will serve to reduce or avoid the interactions of the Project with sensitive environmental components.

One of the Project-environment interactions will be the environmental effects of the reservoir on shoreline habitat. To address this, Hydro has completed a detailed aerial imaging survey which will provide the ability to delineate the future reservoir shoreline and to identify natural features present along the river valley within the Project area. With this tool the Project team will be able to make precise predictions about the character of the reservoir perimeter (where delta formation will occur, where new wetlands will develop) and, as required, accurately locate candidate sites for mitigation measures.

In anticipation that the Project will affect fish habitat, Hydro has developed innovative methods for habitat quantification. These methods, developed with review input from scientists in DFO, will facilitate the decision-making process within DFO. In evaluating the environmental effects of the Project on fish and fish habitat, DFO will determine whether the undertaking will result in the Harmful Alteration, Disruption or Destruction ("HADD") of fish habitat, an action which may only occur if authorized by the Minister. In anticipation that a HADD will be identified by DFO, Hydro has already started a process to consider concepts for compensation measures within the Project area and, hence, incorporate such measures into the overall construction program schedule. This work is being undertaken well in advance of the environmental assessment.

The footprint of the Project will include areas of physical disturbance such as quarries. The inventory of available rock material adjacent to the two construction sites has taken into account the requirements for reducing the size of the Project footprint and the need for site rehabilitation. Favoured sites are locations that will be within the reservoir zone once the Project is in operation.

3.2.2 Environmental Protection Planning

Environmental protection planning has been an integral part of Hydro construction, operations and maintenance programs since the late 1970s. An Environmental Protection Plan (EPP) is important for consolidating environmental information in a format that provides sufficient detail for the implementation of environmental protection measures on site during construction. An EPP provides concise instructions to personnel regarding protection procedures and descriptions of techniques to reduce potential environmental effects associated with any construction activity.

The main objectives of Hydro's Standard EPP are to:

- consolidate information for planning;
- ensure environmental standards are current;
- provide details of Hydro's commitment to environmental protection and planning; and
- provide guidelines for field activities and decision making on environmental issues relevant to Hydro's construction, operations and maintenance activities.

An EPP has been developed and is being implemented for the Project environmental baseline studies. This EPP addresses issues relating to hunting and fishing, field policies, environmental orientation, storage and handling of fuel, waste disposal, vessel operation, encounters with wildlife, discovery of historic resources, spills, and forest fires.

Depending on construction sequencing, one or several activity-specific EPPs will be prepared and implemented for Project construction. Each EPP will be a field-useable document, addressing provisions that will reduce or avoid environmental effects associated with construction activities. As appropriate, each EPP will include items relating to vegetation clearing, grubbing and grading, storage and handling of fuel, blasting, quarrying, dust control, waste and sewage disposal, work in water, contingency plans for unplanned events such as spills, rehabilitation, and compliance monitoring.

3.2.3 Safety, Health and Environmental Emergency Response Plan

Given the complex nature of activities associated with the construction, operation and maintenance of a hydroelectric project, an accidental release or other unplanned event is a possible, but unlikely, event. Hydro proactively identifies potential emergency situations and develops response procedures, including Safety, Health and Environmental Emergency Response Plans (SHERP). The purpose of a SHERP is to identify Hydro's responsibilities in the event of an unplanned incident including the accidental release of oil or other hazardous material, on-site or during transportation, and to provide the information required for the effective response and reporting of such an incident. Hydro will conform to both provincial and federal legislation with the intent of meeting both its legal and corporate responsibilities.

The establishment and maintenance of emergency response procedures allows for:

- protection and maintenance of human health and safety;
- identification of the potential for accidents and emergency situations;
- planned response to accidents and emergency situations; and

- prevention and mitigation of potential environmental effects associated with accidents and emergency situations.

A SHERP was developed and is being implemented for environmental baseline studies. Depending on construction sequencing, one or several site/activity-specific SHERPs will be prepared and implemented for the Project. The Project-specific SHERP will address roles and responsibilities, personal protective equipment, materials storage, driving safety, working at heights, working near or over water, working near or on ice, vessel operation and safety, animal encounters, emergency response communications, spill response, personnel injury response, search and rescue, fire and explosion response, and vehicle/vessel accidents.

3.3 The Project

The Project consists of hydroelectric generating facilities at Gull Island and Muskrat Falls, and interconnecting transmission lines to the existing Labrador grid. The Project will be the subject of engineering design and marketing studies that will be conducted concurrently with the environmental assessment. As part of the environmental assessment, alternative means of carrying out the Project will be evaluated including its capacity, design, layout, and technology. The Project as currently planned is presented and, as with any project, will require optimization to reflect current market and business opportunities. Nevertheless, the Project will be very similar to previous concepts. Optimization will determine details such as the size and number of turbines within each powerhouse, and construction sequencing pending access to the south side of the river. Such changes and refinements will be relatively slight, and consistent with the normal process leading to final Project sanction.

The Gull Island facility will consist of a generating station with a capacity of approximately 2,000 MW and include:

- a dam 99 m high and 1,315 m long: and
- a reservoir 200 km² in area at an assumed full supply level of 125 m asl.

The dam will be a central till-cored, rock-fill, zone embankment. The reservoir will be 225 km long, and the area of inundated land will be 85 km² at full supply level. The powerhouse will contain four to six Francis turbines.

The Muskrat Falls facility will consist of a generating station that will be approximately 800 MW in capacity and will include:

- a concrete dam with two sections on the north and south abutments of the river, and
- a 107 km² reservoir at an assumed full supply level of 39 m asl.

The north section dam will be 32 m high and 180 m long, while the south section will be 29 m high and 370 m long. The north section will serve as a spillway in extreme precipitation events. The reservoir will be 60 km long and the area of inundated land will be 36 km² at full supply level. The powerhouse will contain four to five propeller or Kaplan turbines, or a combination of both.

The interconnecting transmission lines will consist of:

- a 735 kV transmission line between Gull Island and Churchill Falls; and,
- two 230 kV transmission lines between Muskrat Falls and Gull Island.

The 735 kV transmission line will be 203 km long and the 230 kV transmission lines will be 60 km long. Both lines will likely be lattice-type steel structures. The location of the transmission lines will be north of the Churchill River; the final route is the subject of a route selection study that will be included in the environmental assessment. The lines between Muskrat Falls and Gull Island may be on separate towers, or combined on double-circuit structures.

Conceptual illustrations of the Gull Island and Muskrat Falls generating facilities are presented in Figures 3.1 and 3.2. Typical transmission line tower structures are illustrated in Figure 3.3.

A general overview of the Project is presented in Figure 3.4.

Figure 3.1 Conceptual Illustration of the Gull Island Generating Facility

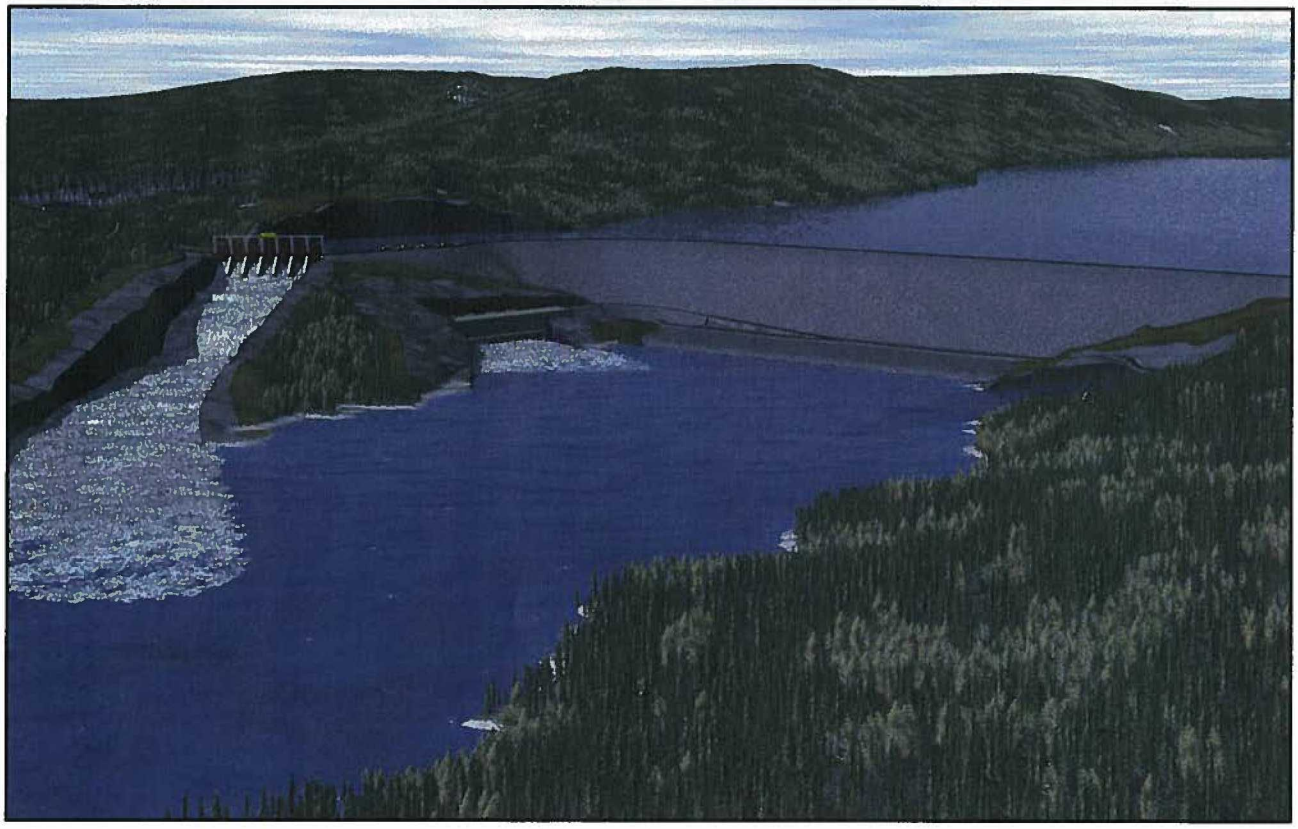


Figure 3.2 Conceptual Illustration of the Muskrat Falls Generating Facility

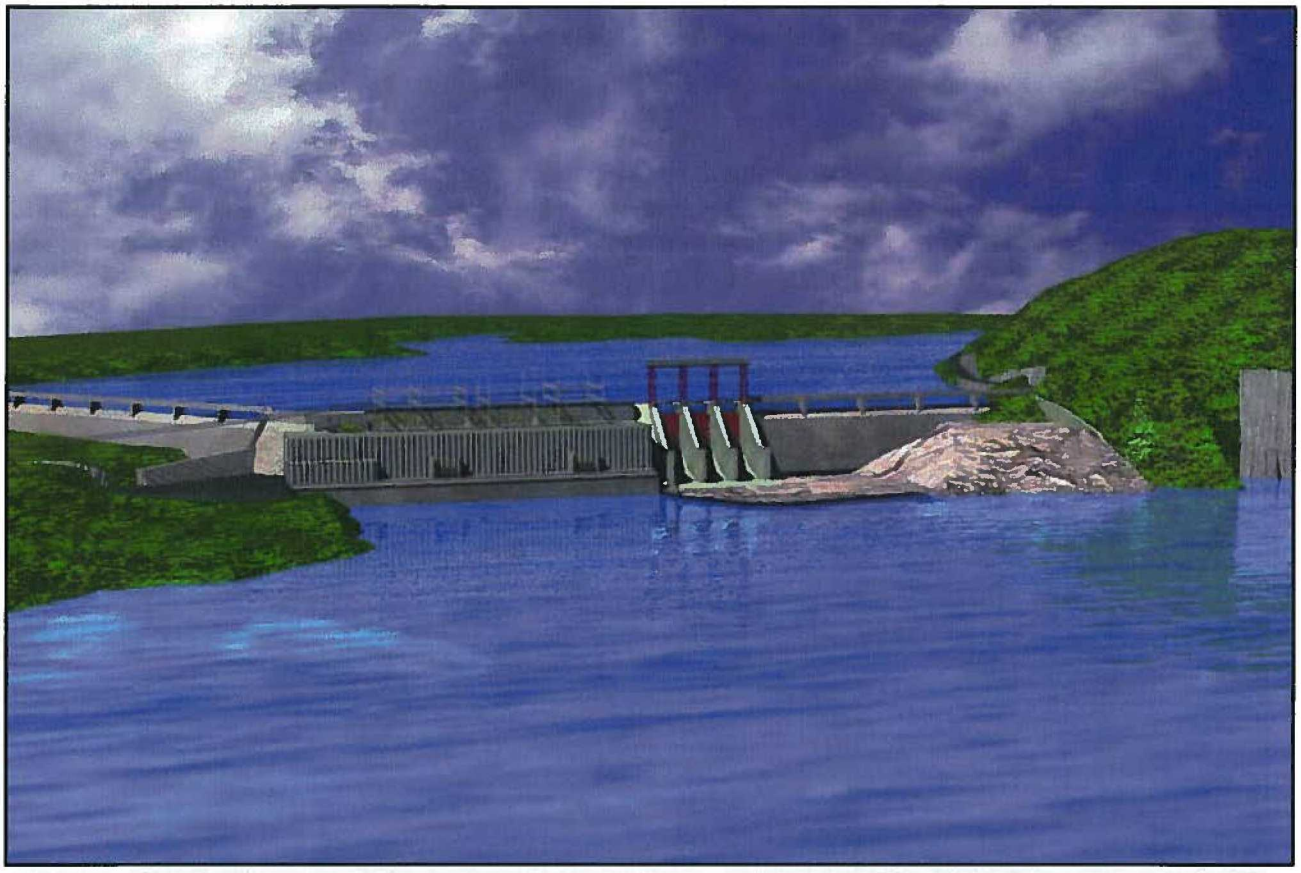


Figure 3.3 Typical Tower for 230 and 735 kV Transmission Line

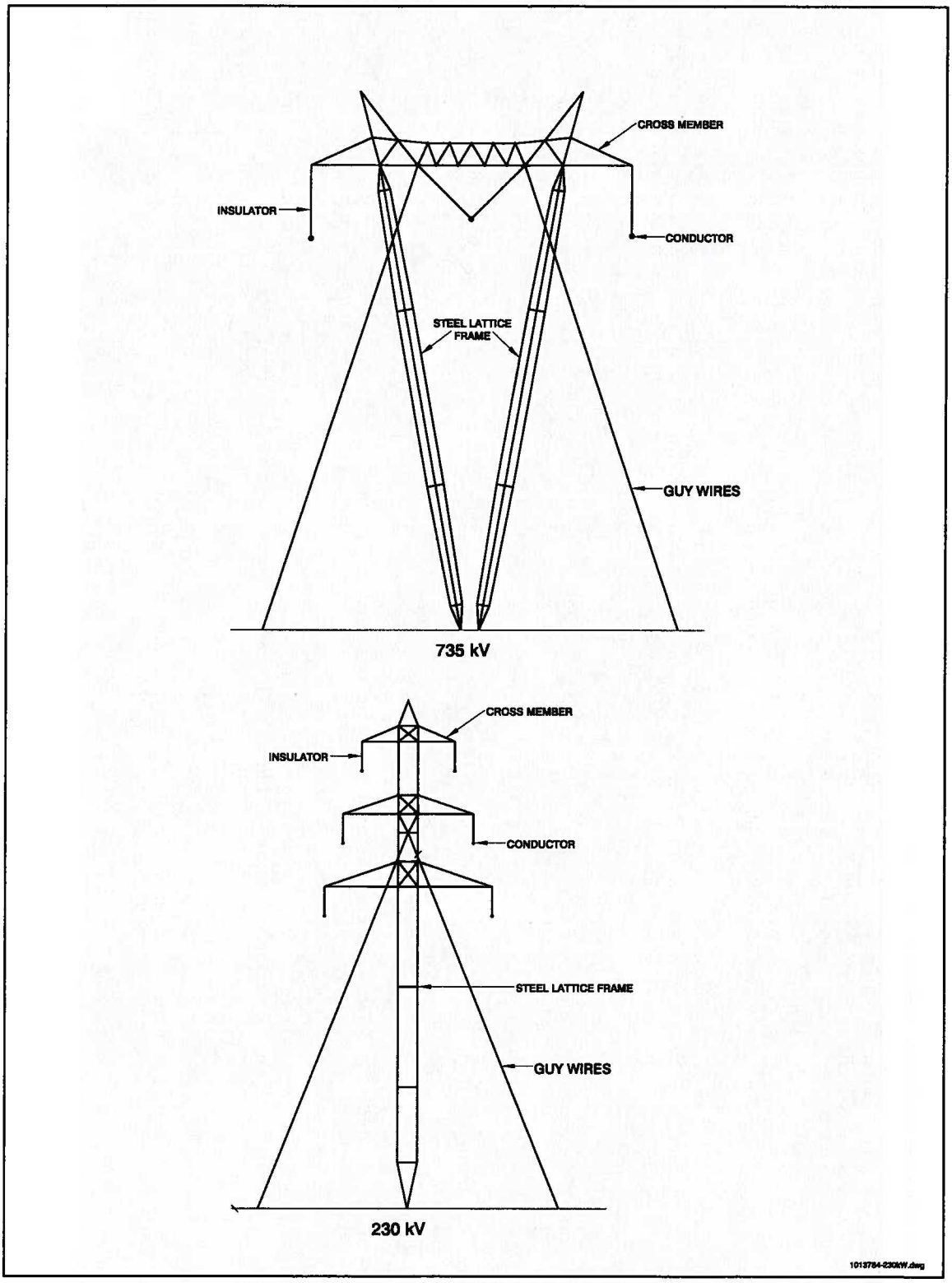
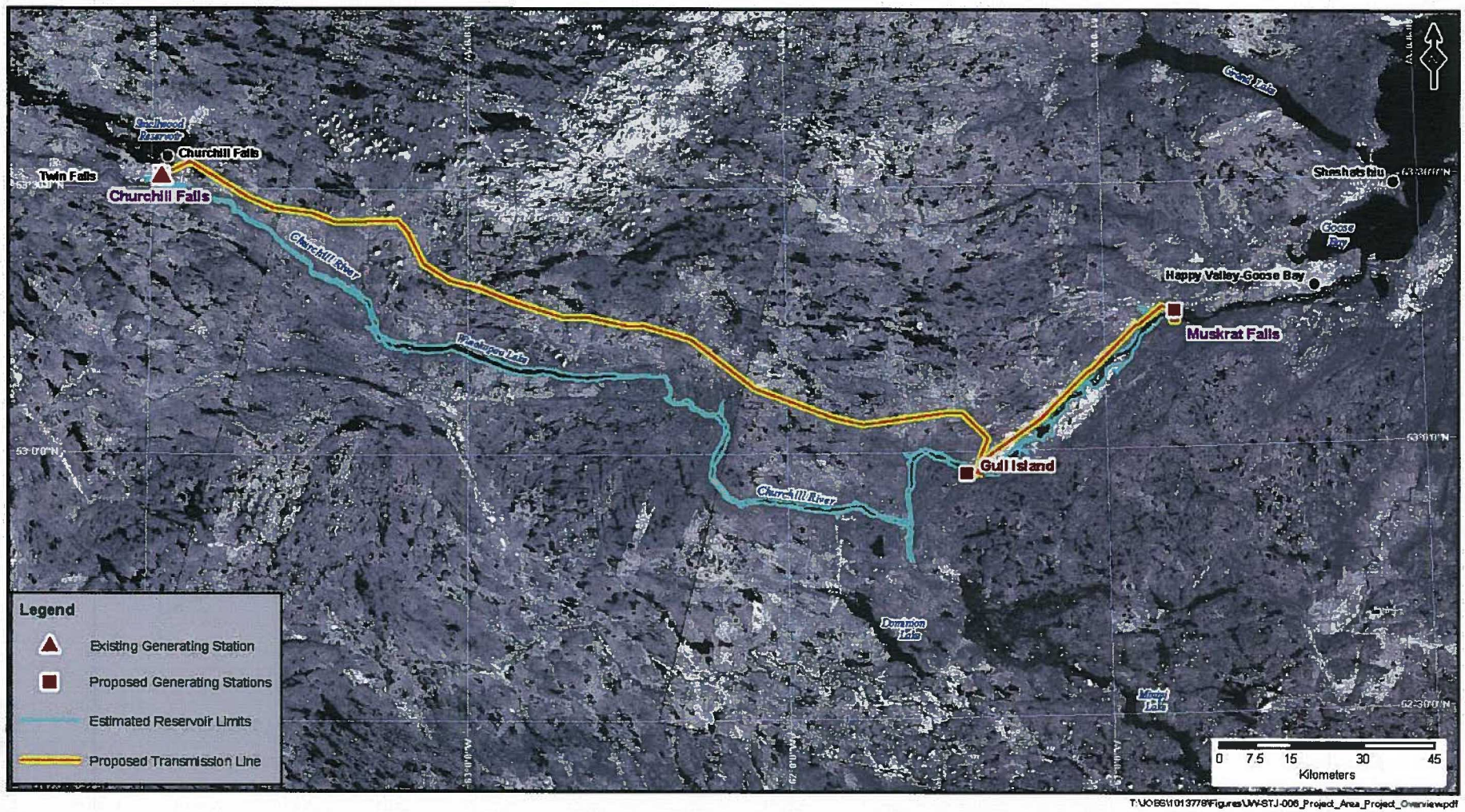


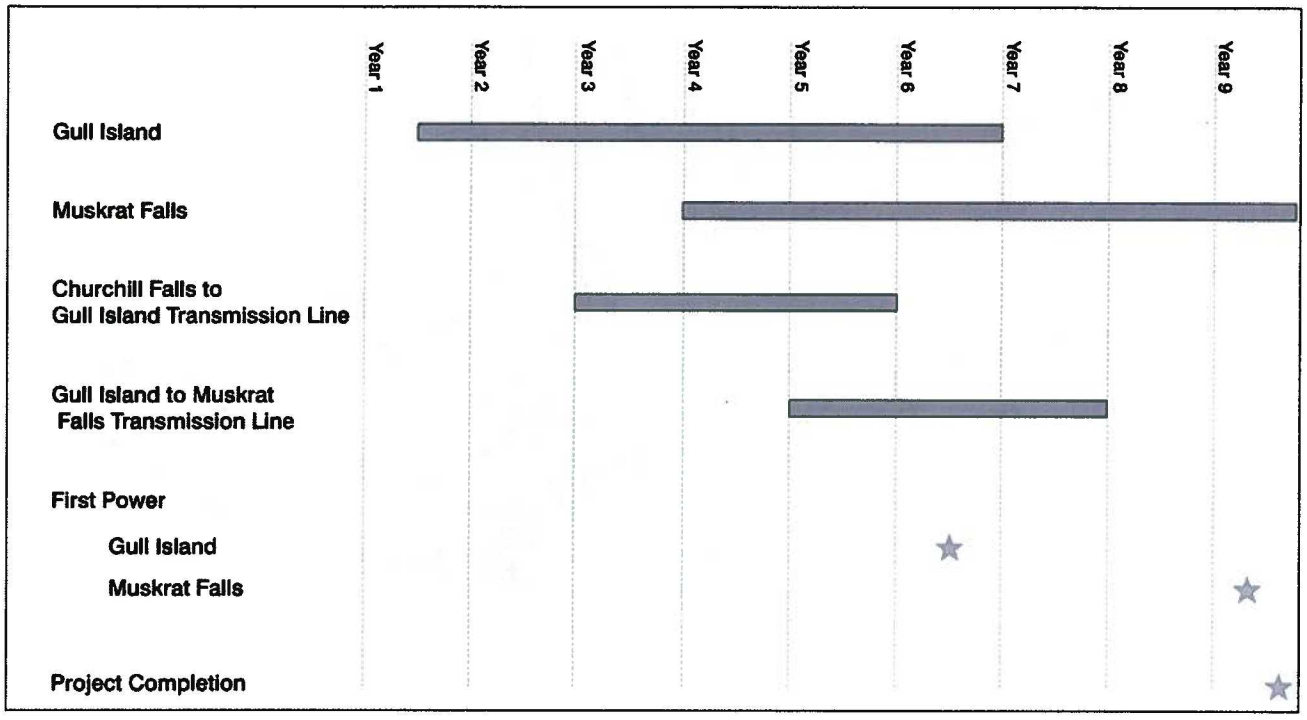
Figure 3.4 Limits of Proposed Reservoir and Transmission Line Corridor



3.4 Schedule

Construction is scheduled to begin in 2009 and will last approximately nine years. The Gull Island facility will be completed at the end of Year 6. The Muskrat Falls facility will be completed at the end of Year 9 at which time the Project will be fully operational. The interconnecting transmission lines will be constructed from Year 3 to Year 7. The construction schedule is presented in Figure 3.5.

Figure 3.5 Lower Churchill Hydroelectric Generation Project Construction Schedule



3.5 Facilities Components and Layout

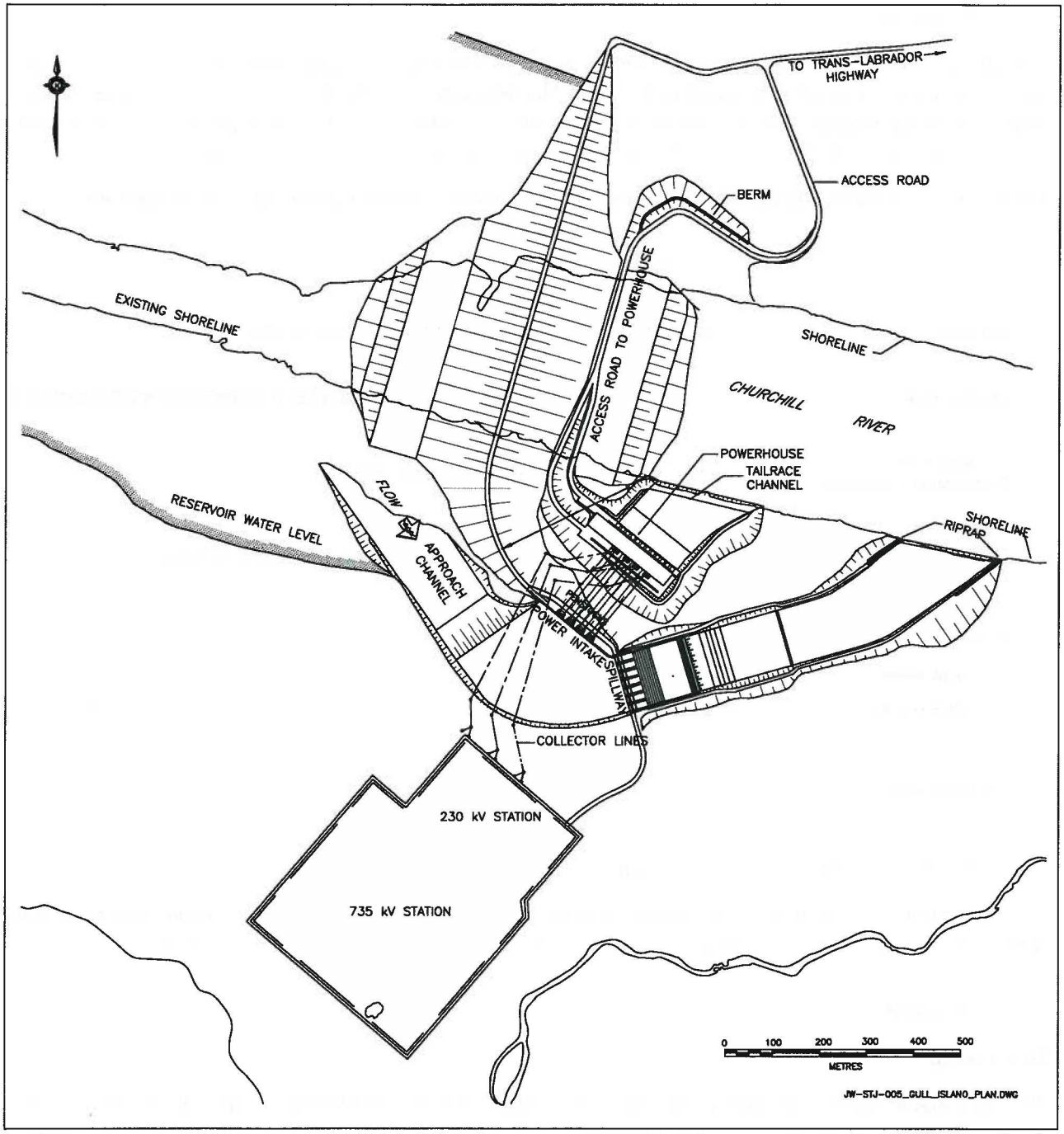
The description in this section is based on previous studies. A higher level of detail will be available from ongoing engineering studies prior to the completion of the environmental assessment.

3.5.1 Generation

Gull Island

The Gull Island facility includes construction of a dam on the Churchill River that will create a reservoir upstream of the structure. A conceptual layout of the facility is shown in Figure 3.6. Facilities will include a dam, spillway, and powerhouse. Water will be routed through an approach channel on the south bank of the river into intake and spillway structures. The powerhouse will be supplied with water through underground penstocks, from the intake. The 200 m long, 53 m wide powerhouse will be constructed at the foot of the dam.

Figure 3.6 Conceptual Gull Island Layout



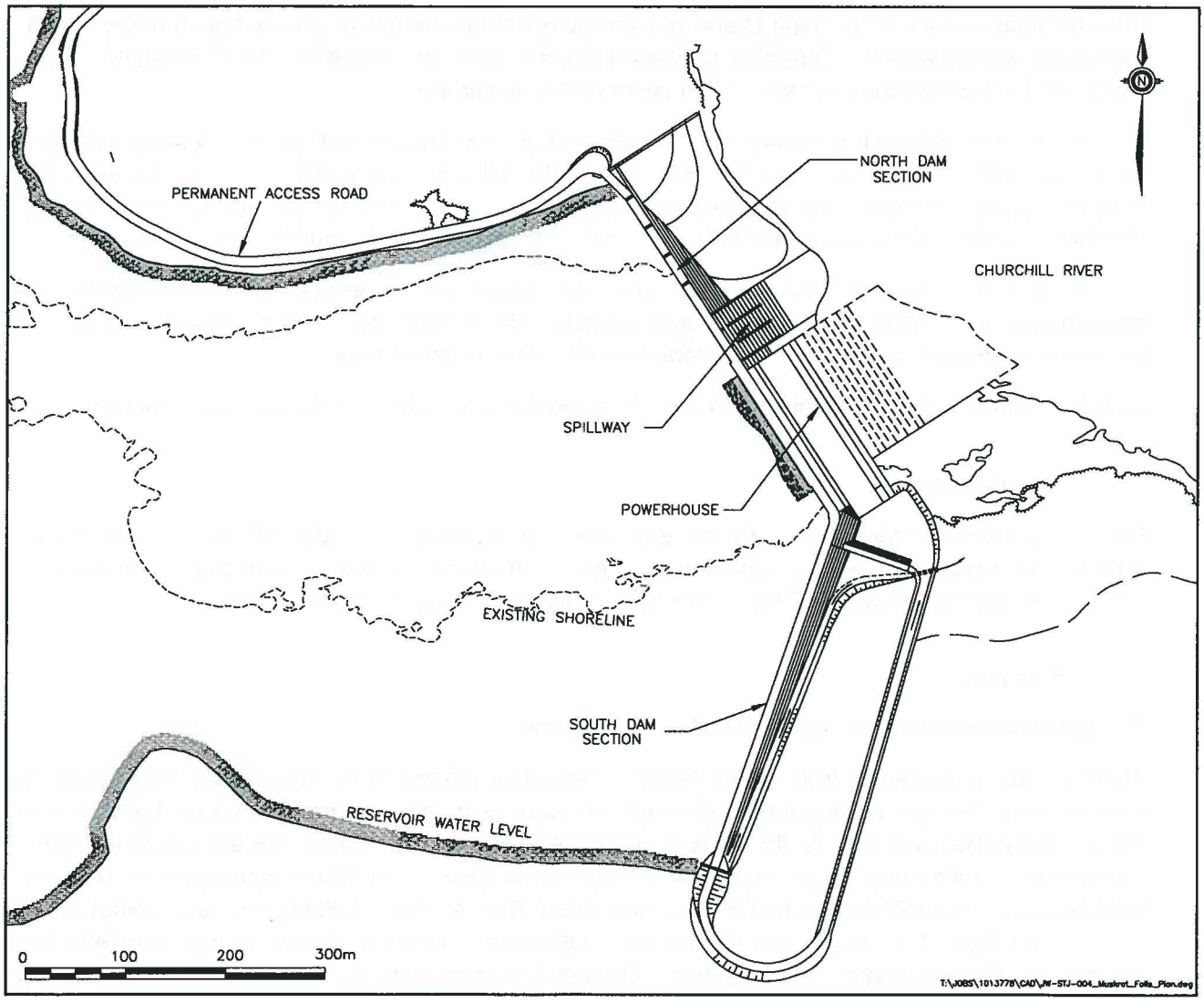
The rock fill dam will be constructed at the head of Grizzle Rapids, approximately 1.2 km upstream from Gull Lake. The river is approximately 470 m wide at the dam location. A net head of approximately 84 m will be obtained with an earth and rockfill dam 99 m in height. The dam will have a crest elevation of 129 m asl and a crest length of 1,315 m.

The 200 km² reservoir will have live storage of 580 million m^3. It will take approximately one month to fill and will be approximately 225 km long by 0.9 to 1.2 km wide, with a full supply level of 125 m asl. Inundation will be confined to the narrow river gorge between Gull Island and Churchill Falls and the total area of land that will be inundated, at full supply level, will be approximately 85 km².

Muskrat Falls

A general layout of the facility is shown in Figure 3.7. The powerhouse will be located in the dam at the centre of the river channel, with a gated spillway along the south bank of the Churchill River. The powerhouse will be 188 m long by 70 m wide. The concrete dam will consist of a north and south section with the powerhouse between the two. The north section will be approximately 180 m long and 32 m high, whereas the south section will be approximately 370 m long and 29 m high.

Figure 3.7 Conceptual Muskrat Falls Layout



The normal full reservoir level will be approximately 39 m asl, giving a gross head for generation of 36.1 m. The reservoir will extend to the Gull Island tailrace, and will be approximately 107 km², of which approximately 36 km² will be inundated land. It will take several days to fill the reservoir, which will have live storage of 0.5 million m^3.

3.5.2 Transmission

Associated with the generating facilities will be the following transmission components:

- two 230 kV transmission lines between Muskrat Falls and Gull Island; and
- one 735 kV transmission line from Gull Island to Churchill Falls.

Transmission lines will, for the most part, be constructed with guyed-vee type steel towers and require a cleared right-of-way of 50-80 m. It will take a total of five years to construct the lines.

The electrical output of the Gull Island powerhouse will be carried to power transformers, sited on a rock berm just upstream. Outgoing collector lines will carry the energy to the Gull Island switchyard, which will be located approximately 1 km south of the powerhouse.

The 203 km line between Gull Island and Churchill Falls switchyards will follow a relatively direct route, along the north side of the Churchill River generally following the existing 138 kV transmission line between Happy Valley-Goose Bay and Churchill Falls. The towers will be approximately 50 m high, with 500 m spans, and a clearance above ground of 18 m over roads and 14 m over other areas.

The 60 km line between Muskrat Falls and Gull Island will generally follow the existing 138 kV transmission line. The towers will be approximately 40 m high, with 380 m (average) spans, and a clearance above ground of 7.3 m over roads and 6.7 m over other areas.

Detailed routing will be determined through a comprehensive route selection process (Section 3.8.1).

3.6 Construction

Proven construction techniques will be employed for all aspects of the Project. Conventional civil construction equipment will be deployed. Except for the manufacture of specialized equipment (e.g., turbines, transformers) most of the construction activity will occur in the Project area.

3.6.1 Gull Island

The general layout at Gull Island is illustrated in Figure 3.6.

The site can be accessed from Happy Valley-Goose Bay via the TLH. An existing 10 km long access road from the TLH will be upgraded. One delivery route is to ship equipment through the port at Happy Valley-Goose Bay and then to the Project site by road. During the winter months, when the port is not operational, an alternate will be available through the Québec North Shore and Labrador Railway from Sept-Îles to an unloading/marshaling area near Ross Bay Junction, followed by approximately 370 km of road from Ross Bay Junction to Gull Island. Year-round vehicular access is also available from the Québec North Shore region (Baie Comeau), through Labrador City via the TLH, to the Gull Island site.

Electricity requirements during construction will be obtained from a local substation, which will be connected to the existing 138 kV transmission line on the north side of the Churchill River. Diesel backup generators will also be used.

To enable construction of the dam, the river will be diverted through twin tunnels driven through the rock on the north bank of the river. Following completion of the dam, these tunnels will be sealed with heavy gates and plugged with concrete.

The expected construction sequence at Gull Island will be:

- access;
- construction camp and site clearing
- diversion tunnels and cofferdams;
- main dam;
- spillway;
- intake, penstocks, and powerhouse;
- impounding; and
- rehabilitation.

Access

An existing 10 km long access road from the TLH will be upgraded to accommodate heavy-load construction vehicles. Temporary construction roads will be required to access work sites and quarries, including an access road from the construction camp area to the south bank of the river via a temporary bridge at the upstream end of Gull Lake. A testing protocol will be developed and applied to determine acid generation potential for exposed rock surfaces for all excavations.

Diversion Tunnels and Cofferdams

River diversion during construction will be carried out by passing flows through two tunnels excavated through the north bank with inlet and outlet channels. The river will be diverted by constructing cofferdams upstream and downstream of the dam foundation.

The cofferdams will be constructed of rock fill, with dumped and placed glacial till providing an impervious layer. Rock-filled groins, which will become part of the cofferdams, will be constructed to enable final closure of the river. The upstream cofferdam will have a crest length of approximately 555 m; the downstream cofferdam will have a crest length of approximately 450 m. The upstream cofferdam will be incorporated into the main dam.

Main Dam

The main dam will be an earth and rockfill zone embankment. Seepage through the dam will be controlled by a central impervious till core. Seepage beneath the dam, in the riverbed section, will be controlled by a concrete cut-off wall extending to bedrock and, along the north and south abutments, by a core trench carried down to bedrock.

Once the area between the cofferdams has been dewatered, excavation of the river bed will start for the main dam. The rate of construction of the dam will be governed by the rate of placing the till core. Work on the dam is scheduled to be completed in Year 5.

In Years 3 and 4, the dam rock fill will come primarily from excavation of the spillway and diversion tunnels. In Year 5, most rock fill will be drawn from rock stockpiles located on the south bank of the river. Very little quarrying is anticipated, since rock excavation balances well with the requirements for rockfill and crushed stone.

Spillway

The spillway will consist of concrete set in rock. The spillway includes an approach channel which will also serve to route flow to the power intakes, a vertical lift gate type spillway structure, and a long chute to dissipate kinetic energy and return the spilled flow to the river.

Work on the approach channel excavation will start in Year 1 with the removal of overburden. The initial rock cuts will start in the downstream area of the spillway and proceed toward the spillway and intake structures. Rock will be excavated from the approach channel and spillway. Most of the rock being excavated during this period will be stockpiled and used in constructing the main dam. Excavation will continue for three years. Concreting of the spillway structure will start in Year 4. Gates will be installed in Years 4 and 5.

The concreting for the spillway headworks will be completed in Year 4, to be ready for the start of gate installation. The concreting of the flip bucket and the downstream trailing walls will also be completed at this time. The downstream cofferdam will be breached and removed, ready for potential spilling in Year 5.

Intake, Penstocks and Powerhouse

The power intake will consist of 4 to 6 reinforced concrete bellmouth structures at the side of the unlined intake channel. The intake structures will be completed during the summer season of Year 4. The intake gates will be installed and tested, and trash racks will be installed in Year 5.

Each penstock will consist of a rock tunnel excavated between the intake and powerhouse. The upstream section will be concrete lined and the downstream section will be steel lined. Concreting of the penstocks and excavation for the powerhouse will be completed in Year 2. Penstocks will be excavated conventionally and no access adits will be required.

A cofferdam will be required to permit excavation in the tailrace area. This cofferdam will remain in place until Year 5, when it will be removed prior to flooding the tailrace.

Concreting of the powerhouse will follow standard methods. Concreting of the service bay will be completed in time to enable the structural steel and overhead crane to be erected and operational by Year 3. Turbine installation and completion of the powerhouse concrete work is scheduled for Year 4. Gates will be installed for the units, ready for breaching the tailrace cofferdam in Year 5.

Most of the rockfill and rock aggregate required for the Project will come from the structure excavations. Additional rock can be obtained from local sources. Impervious and granular materials will be excavated from local sources.

Impounding

The final construction step will involve the removal of the cofferdam, or plug, at the tailrace exit and concreting of the diversion tunnel plugs after the diversion closure gates have been dropped into place. Once impounding starts, the reservoir will reach the full supply level in approximately one month. After the diversion tunnel is closed, any excess flows will be passed through the spillway.

Rehabilitation

Rehabilitation of work site, quarries and borrow pits will be in accordance with Rehabilitation Plans which will address the following activities:

- limiting terrain, soil and vegetation disturbance to the absolute minimum required to complete the work;
- stockpiling overburden separately from any excess excavated rock and reserving it for use in future rehabilitation;
- stabilizing disturbed surfaces on an ongoing basis where possible to promote natural revegetation and limit erosion;
- dismantling and removing all surface infrastructure associated with work camps and source material areas;
- establishing permanent drainage patterns through contouring, which will also reduce erosion;
- encouraging natural revegetation of disturbed surfaces where applicable and conducting active revegetation where required and appropriate (i.e., soil and terrain conditions permitting);
- promoting natural revegetation of access roads;
- shaping any remaining excavated rock piles to maintain a natural slope and covering the top with topsoil and encouraging natural revegetation; and,
- conducting periodic inspections subsequent to decommissioning and abandonment of work camp and source material areas to measure the success of the rehabilitation measures.

3.6.2 Muskrat Falls

The general layout at Muskrat Falls is illustrated in Figure 3.7.

The site can be accessed from Happy Valley-Goose Bay using the TLH and an existing 3 km long access road which will be upgraded and extended. One delivery route is to ship equipment through the port at Happy Valley-Goose Bay and then to the Project site by road. During the winter months, when the port is not operational, an alternate existing route will be available through the Québec North Shore and Labrador Railway from Sept-Îles to an unloading/marshaling area near Ross Bay Junction, followed by trucking from Ross Bay Junction to Muskrat Falls. Year-round vehicular access is also available from the Québec North Shore region (Baie Comeau), through Labrador City via the TLH, to the Muskrat Falls site.

Electricity requirements during construction will be obtained from an existing local substation, which will be connected to the existing 138 kV transmission line on the north side of the Churchill River. A new transformer will be required for full construction power. Diesel backup generators will also be used.

The expected construction sequence at Muskrat Falls will be:

- access, construction camp, site clearing and excavation;
- diversion;
- intake/powerhouse;

- spillway and north dam section;
- south dam section;
- reservoir impounding; and
- rehabilitation.

Access

There is an existing 3 km access road from the TLH, which will be upgraded and extended an additional 1.8 km to the end of the north dam section. Various temporary construction roads will be required to access work areas or quarries. There may also be an access road to the south bank via the existing TLH causeway. Clearing and excavation of overburden material will be required at the construction site. A testing protocol will be developed and applied to determine acid generation potential for exposed rock surfaces for all excavations.

Diversion

The requirement for diversion tunnels is being assessed. With access to the south side of the river being available, a diversion tunnel may not be required. If diversion tunnels are required, they will run approximately east to west. Two 15 by 20 m inverted "U"-cross-section tunnels would be excavated on the north bank of the river. Due to restricted space between the intake channel and the south bank, the cofferdam would be made of two rockfill dykes with material in between.

Intake and Powerhouse

The intakes will be located directly adjacent to (upstream of) the powerhouse. Control gates will be located at the intake structure. Water will be conveyed in penstocks from the intakes to the turbines in the powerhouse. Control gates will be located at the intake structure.

The surface powerhouse will be approximately 188 m long and 70 m wide.

Spillway and North Dam Section

An overflow dam and constructed spillway will be designed to accommodate excess water flows. The spillway structure will be located between the north dam section (the overflow dam) and south dam section, abutting the dam section on the north side. The spillway concreting will start in Year 7 and be completed in Year 8.

The north dam section can be constructed before the spillway is completed. It will be built using roller compacted concrete (RCC).

South Dam Section

The south dam section will be a concrete gravity overflow structure founded on rock. The dam will extend from the service bay of the powerhouse to the south abutment. It will be constructed in Year 6. The outer downstream slope will be slightly steeper compared to the upstream slope.

Impounding

The final construction step will involve of the removal of the tailrace rockplug and the various cofferdams, and the construction and grouting of concrete plugs in the diversion tunnels (if required) after the diversion closure gates have been dropped into place and the water in the tunnels have

drained to the normal tailrace water level. After diversion tunnel closure, any excess flows will be released through the spillway. Filling the Muskrat reservoir will take several days.

Rehabilitation

The work site, quarries and borrow pits will be rehabilitated as described for Gull Island in Section 3.6.1.

3.6.3 Transmission Lines

The right-of-way will be cleared of all vegetation that exceeds 1 m at maturity. Clearing methods will be determined by the type of vegetation to be removed. Clearing specifications will take into account:

- location and identification of watercourse crossings along the right-of-way;
- widths and depths of watercourses;
- location and depth of wetlands;
- types of bridges and culverts required to cross watercourses;
- areas of commercially valuable timber and the method of cutting and storing the harvested timber;
- disposal of non-commercial timber and vegetation;
- required buffer zones along watercourses and at sensitive areas;
- special clearing requirements; and
- location of roads required to bypass zones of difficult access in the right-of-way.

An access road will be constructed along the cleared right-of-way, or as close to it as possible. Construction of the transmission line will include:

- distribution of components along the right-of-way;
- installation of foundations and guy anchors;
- pull-out testing of guy anchors;
- fabrication of guys;
- assembly of towers complete with guys, insulators and travelers;
- erection of towers, including the connection of the guys to the guy anchors;
- tensioning the guys;
- preparation of work sites for the conductor pulling and tensioning equipment;
- installation, sagging and clipping of shieldwires and conductors; installation of spacer-dampers;
- installation of counterpoise; removal of camps, bridges and culverts; and
- clean up and restoration of the right-of-way.

3.6.4 Construction Work Force

The projected peak construction workforce will be approximately 2,000. The estimated peak numbers of each trade over the construction phase of both generation facilities and transmission lines are listed in Table 3.1.

Table 3.1 Construction Work Force by Trade

NOC Code	Title	Peak #	NOC Code	Title	Peak #
212	Architecture and Science Managers	1	7219	Cont/Spvrs Others Construction	51
632	Accommodations Service Managers	12	7271	Carpenters	107
711	Construction Managers	31	7241	Electricians	39
721	Facility Operations Managers	10	7244	Electricians - Power Line and able	35
1111	Financial Auditors and Accountants	8	7246	Telecomms Installers/Repair	1
1121	Human Resources Specialists	6	7252	Steam/Pipefitters	41
1221	Administration Officers	3	7263	Metal Workers	28
1241	Administration Assistants	10	7264	Ironworkers	76
1411	General Office Clerks	16	7265	Welders	38
1432	Payroll Clerks	15	7281	Bricklayers	3
1471	Shipper and Receivers	11	7282	Cement Finishers	7
2131	Civil Engineer	38	7284	Plasterers	9
2132	Mechanical Engineers	2	7311	Millwrights/Mechanics	62
2133	Electrical Engineers	3	7312	Heavy Duty Equipment Mechanics	17
2121	Biologists and Related Scientists	2	7318	Elevator Mechanics	14
2154	Land Surveyors	4	7321	Motor Vehicle Technicians/Mechanics	32
2221	Biological Technicians	16	7351	Stationary Engineers and Operators	172
2234	Estimators	8	7371	Crane Operators	60
2253	Drafting Technicians	8	7372	Drillers and Blasters, Mining/Quarry	69
2254	Survey Technicians	26	7411	Truck Drivers	253
2263	Occupational Health and Safety Inspectors	8	7412	Bus Drivers	12
2264	Construction Inspectors	11	7414	Delivery Drivers	108
2271	Pilots, Flight Engineers	1	7421	Heavy Equipment Operators	145
3152	Registered Nurses	3	7452	Material Handlers	44
6242	Cooks	39	7611	Construction Trades Helpers/Labourers	464
6453	Food and Beverage Servers	5	8211	Supervisors, Logging and Forestry	25
7211	Spvrs Machinists	13	8231	Miners	7
7213	Cont/Spvrs Pipefitting	8	8241	Logging Machinery Operators	40
7214	Cont/Spvrs Metalworkers	21	8421	Chainsaw and Skidder Workers	60
7215	Cont/Spvrs Carpentry	37	8422	Silviculture and Forestry Workers	40
7216	Cont/Spvrs Mechanics	13	8616	Logging and Forestry Labourers	60
7217	Cont/Spvrs Heavy Construction Equipment	51			

3.6.5 Construction Camps

Accommodations for most of the construction labour force will be required. Therefore, construction camps are being planned at the Gull Island and Muskrat Falls sites. The construction camp at Gull Island will be developed in a previously cleared area approximately 5 km from the Gull Island site. The construction camp at Muskrat Falls will be located between the TLH and the Churchill River, on the west side of the access road. They will include living quarters and recreational, security and safety amenities. Accommodations will consist of dormitory units based on single occupancy rooms.

Transmission line construction crews will be accommodated at existing facilities in Churchill Falls and the Gull Island camp. One additional satellite construction camp will be required along the Gull Island

to Churchill Falls Transmission Line route. It will contain 8 to 12 person accommodation units, a kitchen diner and a recreation module.

3.7 Operation and Maintenance

The Project will be operated on a continuous basis, with a maximum of 3 m fluctuation in the reservoir water levels upstream from Gull Island, and a maximum of 0.5 m fluctuation in the reservoir upstream of Muskrat Falls.

The facilities will be operated for an indeterminate time and decommissioning is not contemplated. Gull Island will be operated at a full supply level of 125 m asl and Muskrat Falls will be operated at a full supply level of approximately 39 m asl. Regular maintenance will be scheduled to avoid complete shutdown.

A profile of the Churchill River from Churchill Falls to the mouth of Lake Melville is presented in Figure 3.8, showing the water elevation with and without the Project. A series of cross-sections are shown in Figure 3.9 to illustrate the extent of inundation within the river valley in relation to existing water levels.

Camp accommodations will be available for work crews. A small operational staff will work on a rotational basis; therefore, there will be no permanent accommodations at either site.

Transmission lines will be inspected on an annual rotational basis, with a portion of the line being inspected each year. The inspections will be done by air or from the ground on All Terrain Vehicles. Vegetation management will be conducted every 5 – 10 years.

Figure 3.8 Profile of the Lower Section of Churchill River with and without the Project

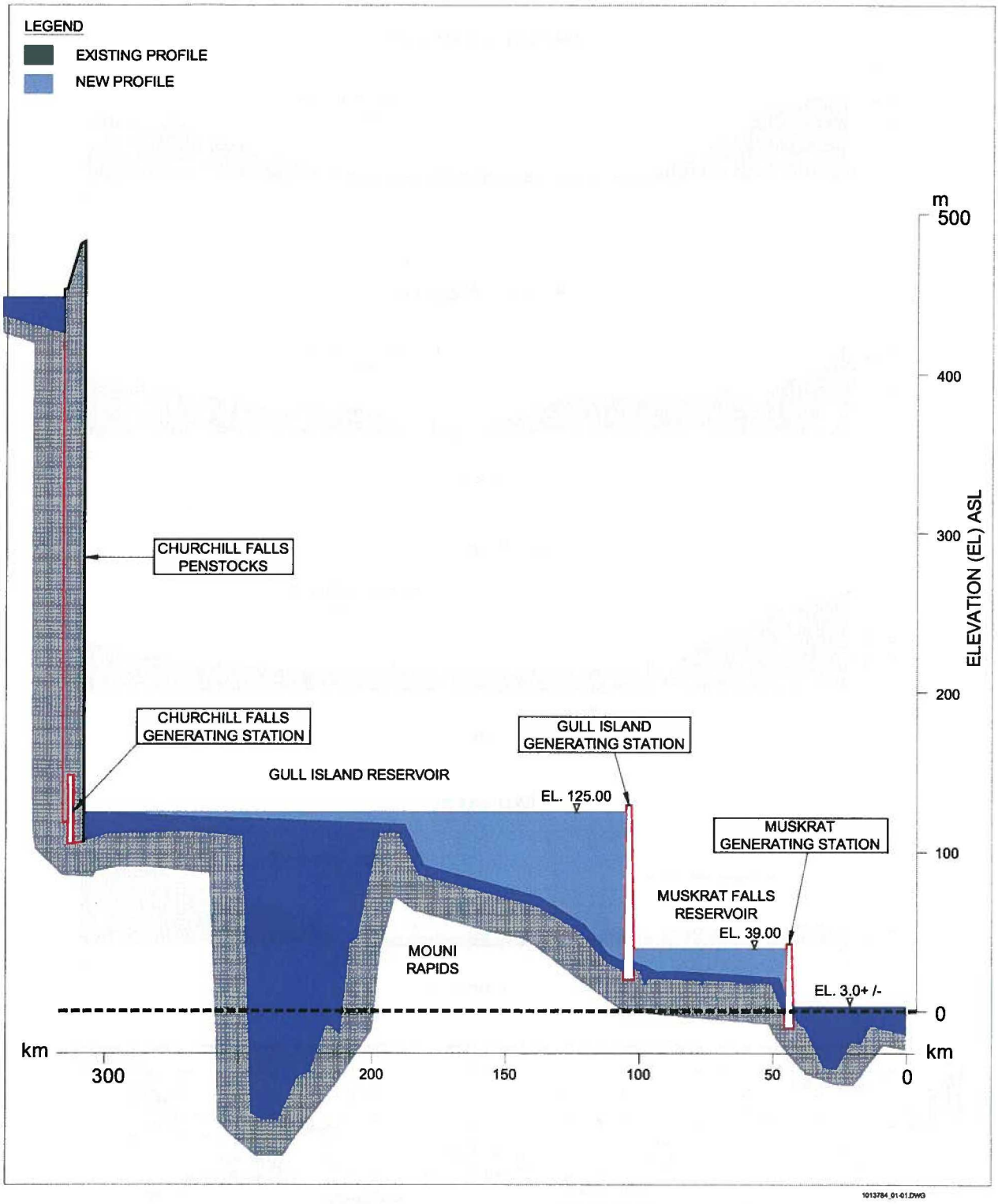
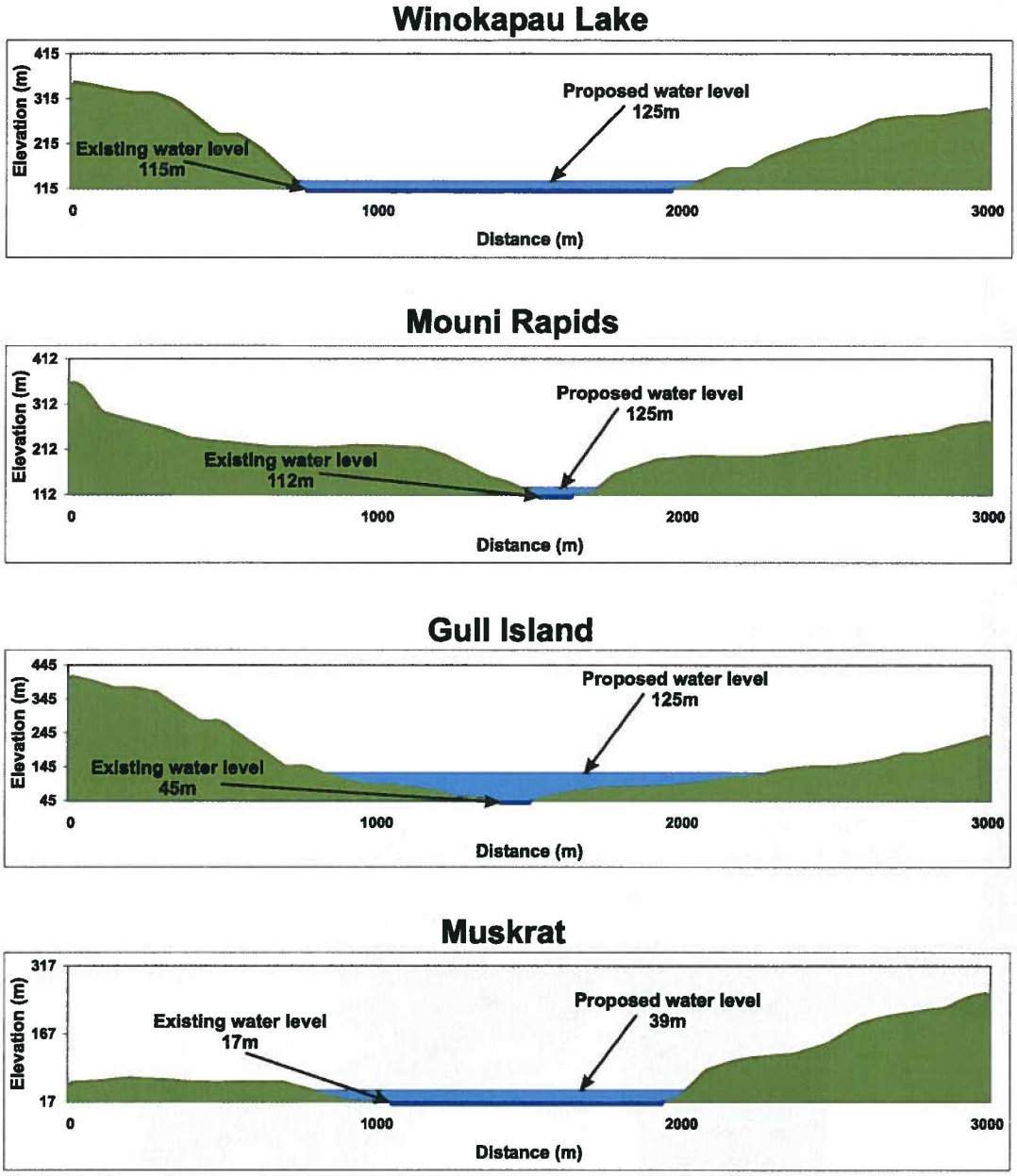


Figure 3.9 Selected Cross-sections Looking Upstream of the Churchill River with and without the Project



3.8 Alternative Means of Carrying out the Project

The overall objective of the Project is to develop and optimize energy production of the hydroelectric resources of the lower section of the Churchill River at Gull Island and Muskrat Falls. Hydro has extensively evaluated alternate sites, configurations, and operating regimes for the Project in the context of this objective, using technical and economic criteria. These evaluations will be confirmed in the market feasibility and engineering design studies that are being undertaken concurrently with the environmental assessment. Technical criteria include hydrotechnical and geotechnical constraints and constructability. Economic criteria include considerations such as capital cost, market requirements and the optimization of energy generation. Previous study has confirmed that the Gull Island and Muskrat Falls locations are the only technically and economically feasible sites for the facilities. As has been noted, there are a number of alternative means to construct the Project at the selected sites (e.g., diversion tunnels at the Muskrat Falls site, number of turbines at Gull Island). Alternatives for which a single technically and economically feasible option has not been determined will be examined in the environmental assessment.

Consistent with the requirements of *CEAA*, economically and technically feasible alternatives only will be considered in the environmental assessment.

3.8.1 Site and Route Selection

The site of a hydroelectric project is defined by a number of interrelated elements: abundant rainfall and consequent water flow; suitable geomorphological features that permit water to be contained and controlled; and sufficient head. Therefore, there is often limited choice for the location of powerhouses and dams and the configuration of reservoirs. The proposed facilities at Gull Island and Muskrat Falls have been reviewed several times in detailed engineering studies and the proposed locations for the generating facilities have not changed. There are no feasible alternatives for siting the generation facilities.

Transmission line routes are selected by evaluating technical, environmental, socio-economic, cultural and economic criteria. Corridors north of the Churchill River, approximately 5 to 10 km wide will be selected for the interconnecting transmission lines based on these criteria. Detailed route selection within the corridor will be conducted using the same criteria and reported in the environmental assessment. The results of resource inventories will be applied to the route selection process.

3.8.2 Gull Island

The Gull Island site has been the subject of many studies dating back to the mid-1960s, resulting in the finalization of the location at a site approximately 100 km west of Goose Bay between Gull Island Rapids and Grizzle Rapids, just upstream of Gull Lake on the Churchill River. Previous engineering feasibility has confirmed this is the only site where the generation of hydroelectric power is feasible. No other sites are being considered. The selected layout (spillway structure and powerhouse on the south bank and the tunnel diversion on the north bank) is preferred based on economic (e.g., cost and schedule) and technical (e.g., constructability, river morphology, geotechnical constraints) criteria. The reservoir full supply elevation of 125 m asl was selected in previous feasibility studies so the water level in the tailrace of the Churchill Falls Generating Station would not be affected.

3.8.3 Muskrat Falls

The Muskrat Falls site has been the subject of many engineering studies dating back to 1965. Similar to the Gull Island site, this is the only site where the generation of hydroelectric power has been determined to be feasible. No other sites are being considered. Various development lay-outs have been examined since the mid-1960s. The preferred alternative of previous studies was chosen based on technical and economic criteria. Road construction in the region has led to an expanded system and a new bridge across the Churchill River approximately 20 km downstream of the Muskrat Falls site. This results in the possibility of accessing the south shore of the river at the start of construction. Such access may preclude the need for diversion tunnels during construction. The reservoir elevation of 39 m asl has been planned so that the water level of the Gull Island tailrace will not be affected.

3.9 Emissions and Discharges

Potential emissions and discharges during construction will be limited to those for a typical construction project, i.e., vehicle and equipment air emissions (contaminants and noise), and site runoff with suspended solids. During operation, there is little potential for unplanned emissions and discharges associated with the Project.

3.9.1 Construction

Emissions and discharges will result mainly from the operation of quarries and borrow pits, motor vehicles and heavy equipment and the campsite. Hydro's EMS will be implemented to manage and control construction waste, discharges, and emissions. Site and activity-specific EPPs and SHERPs will be developed and implemented to manage waste materials, pollutants, and health and safety. All Hydro and contractor staff will comply with provisions of the EPP and SHERP.

Borrow operations can result in the generation of fine (silt) material, which can enter watercourses. Drainage will be controlled to reduce the flow of water through borrow areas. Vegetated buffer zones will be maintained around borrow operations. Rock crushing and gravel washing operations will include holding lagoons to precipitate suspended particles.

The handling and use of fuels, oil and lubricants will be carefully controlled. A dyked fuel storage depot will be established at each site for bulk petroleum products. Contractors will be responsible for transportation of their own fuel from the site depot.

Batch plants for concrete production will be established at each site, and will be located and operated in accordance with applicable guidelines and conditions of permits. The batch plants will be set back a minimum of 50 m from water bodies. Measures will be implemented to prevent the entry of silt-bearing drainage or wash water to freshwater bodies. These will include constructed sediment ponds and/or installation of silt curtains, and will include pH adjustment, if necessary.

Engine exhausts will generate air emissions whose makeup will depend on the type of emission control devices and nature of the fuel. Both diesel and gasoline powered equipment and vehicles will be used on site. Other air emissions include heated air produced by machinery used to dry till and for heating of work areas. Project emissions will include particulate matter, the by-products of combustion of hydrocarbon fuel, and noise.

The maintenance and feeding of the work force will produce garbage, which will be sorted prior to disposal on a daily basis. Non-food will be disposed in an approved landfill site. To reduce the incursion of nuisance bears, a bear management plan will be prepared and implemented by Hydro. It will include awareness education as well as measures to ensure the proper handling, storage and disposal of all food wastes. Sanitary waste will be treated in accordance with applicable legislation.

3.9.2 Operation

The operation of the Project will result in the production of almost no waste material. Water passed through the turbines will be returned immediately to the river without the addition of pollutant or other waste material. A small-scale sewage system will be incorporated into each plant for the workers.

Cooling Water

A small volume of heated cooling water (16C° above ambient) will be produced from some of the moving parts. The quantities of discharged cooling water will be minimal in relation to the volume of water to be passed through the powerhouse.

Drainage

Oil-water separators equipped with alarms will be installed at each powerhouse. All seepage and leakage from the turbine and separator pits will enter floor drains that will discharge into the separators. Clean drain water will discharge into the tailrace.

Fire Protection System

Fire protection for the generators and governors will be a sprinkler system with water supplied from the penstock. Fire hoses will be provided in the powerhouse on each floor and in the service bay. Dry chemical and CO_2 extinguishers will be provided as necessary to meet service areas and control room needs. Fire pumps and a jockey pump with pressure control systems will be connected to the station service and backed up by a diesel generator. Inergen fire protection will be provided in the terminal, communication and battery rooms.

Domestic Water

Domestic water for both facilities will come from the penstocks or from artesian wells. The system will include water treatment if appropriate.

Sanitary Systems

Sanitary waste will be disposed in accordance with applicable legislation. All relevant permits will be obtained (Appendix B).

Oil Storage and Handling

Limited oil storage handling facilities will be provided for make-up oil to be used in the turbine/generator bearings and governors. Oil will be handled by barrel or by a portable tank. Clean and dirty oil tanks and oil purifying filter units, with oil handling pumps, will be provided. The filtering units will be portable, and may be used at any unit as well as in the oil storage areas. Clean and used oil tanks will also be provided for transformer oil purifying.

Vegetation Management

An integrated Vegetation Management Program will be prepared and implemented for control of vegetation along the right-of-way for the transmission lines. Vegetation will be controlled manually, or by application of vegetation-control agents or a combination of the two. All vegetation management activities will be undertaken subject to approval from the Department of Environment and Conservation and in compliance with the *Pesticides Control Regulations*. As is standard practice, Hydro will provide public notification and conduct an evaluation of environmental sensitivities where herbicides are to be used. Vegetation control personnel will be trained and qualified.

3.10 Potential Resource Conflicts

Current resource use within the Project area includes trapping, hunting, wood cutting, and recreational activities such as boating, berry-picking, and angling. Tourism is being promoted and outfitters operate in the region. The construction phase of the Project will interact with these resource uses where they occur within the Project footprint.

For safety and security purposes, access to the generating facilities will be restricted during operations. Potential resource conflicts may result from restricted access at the footprint of the two generating facilities. Other resource conflicts may result from changes to the flow regime of the lower Churchill River through creation of reservoirs, and changes in wildlife travel patterns related to transmission line corridors. Potential effects will be addressed in the environmental assessment.

3.11 Approvals and Permits

A list of permits, authorizations, and approvals that may be required for the Project is presented in Appendix B.

4.0 EXISTING INFORMATION

CEAA provides for the inclusion of existing environmental assessment studies in the conduct of new environmental assessments, as appropriate. Dedicated studies for a proposed hydroelectric development at Gull Island and Muskrat Falls were first conducted in 1978-1979, in support of an environmental assessment Panel Review. Further studies for a proposed hydroelectric development at Gull Island and Muskrat Falls were conducted in 1998, and for Gull Island only in 1999 and 2000 in anticipation of an environmental assessment for the Churchill River Power Project. In addition, there have been numerous studies and data collection efforts in the general vicinity of the Project, some of which include relevant descriptive material.

4.1 Lower Churchill Project - Panel Review 1979-80

An EIS was prepared for the Lower Churchill Hydroelectric Development under the Federal Environmental Assessment and Review Process, and in accordance with requirements of Newfoundland and Labrador. The process included the appointment of a federal-provincial Panel. The development was presented as two projects – Generation (Gull Island and Muskrat Falls) and Transmission (HVDC interconnection to the Island of Newfoundland), as proposed by the LCDC. The Panel issued guidelines in 1979. Twenty-nine component studies were prepared from 1979 to 1980 (Appendix A), as supporting documents to the EIS, which was formally submitted to the Panel in April 1980. LCDC also conducted a public consultation program, holding public meetings in nine communities and establishing a Liaison Committee in Happy Valley-Goose Bay. Formal Panel Hearings were held in the fall of 1980. The Panel considered a wide array of issues, most of which remain relevant. Specific recommendations were made to address the potentially adverse environmental effects. Overall, the Panel recommended that the project be approved. The project was released (with conditions) from environmental assessment in December 1980; however, it did not proceed at that time due to energy marketing and project economics.

4.2 Lower Churchill Project - 1991

A renewed effort to develop the Lower Churchill was initiated in 1990 and resulted in a registration of the undertaking in 1991 in accordance with the Newfoundland *Environmental Assessment Act*. A comprehensive review of existing information was conducted; however, there were no baseline studies undertaken at that time. The project did not proceed due to market conditions.

4.3 Churchill River Power Project - 1998 to 2001

The Labrador Hydro Project ("LHP") office was established in 1998 to plan and develop the Churchill River Power Project ("CRPP"). Several configurations were considered including diversions from within Quebec to the upper Churchill River watershed, and generating facilities at Gull Island and Muskrat Falls. The LHP mandate included environmental assessment planning, project engineering and economics, negotiations with Innu Nation, Innu consultation, and baseline data collection. Hydro Quebec was a joint partner at the initial planning stages of CRPP, but later withdrew from this arrangement. Through Process Agreements, Innu Nation conducted a community consultation

process, negotiated towards an IBA, and participated in a joint Task Force on project (including environmental) planning. The project did not proceed due to energy marketing and project economics.

Thirty-five baseline studies were conducted from 1998 to 2000 in support of the CRPP (Appendix A).

4.4 Other Relevant Studies

Several large environmental assessments have been completed in Labrador. Some of the associated component studies (baseline and monitoring) provide information that is relevant and can be used for characterizing the Project area.

The Department of National Defence ("DND") conducted an environmental assessment of low-level flight training based at 5 Wing Goose Bay, Labrador. The Institute for Environmental Monitoring and Research ("IEMR") has been responsible for on-going monitoring studies that were prescribed as a condition of release from the environmental assessment. These studies include the assessment of the behaviour and distribution of animal and bird species, some of which occur in the Project area. Social and economic effects on the Upper Lake Melville region have also been studied.

The Trans Labrador Highway ("TLH") has been planned and constructed in three phases, each of which has gone through environmental assessment. The recent TLH Phase 3 (Cartwright to Happy Valley – Goose Bay) environmental assessment included a series of biophysical, archaeological and socio-economic studies including Aboriginal and non-Aboriginal resource and land use. The geographic extent of these studies included a portion of the Project area,

While the Voisey's Bay Mine/Mill site is distant from the Project area, the Upper Lake Melville area serves as an important connection point for that project. Consequently, socio-economic studies included this region as well as a part of the Labrador Innu Land Claim Area. Other relevant studies included migratory species and large mammals, whose range extends to the Project area, and regional Ecological Land Classification.

5.0 ISSUES

An issue scoping exercise for a previous proposal to develop the hydroelectric potential of the lower Churchill River was conducted during the federal environmental assessment in 1979-1980. More recently, Hydro also undertook issues scoping in 1998 to 2001, which involved technical experts, government agencies, and Innu Nation. Issues have also been identified through media reports and other meetings related to the Project, and through provincial energy planning. These current and past efforts have served to identify the scope of studies currently underway.

5.1 Issues Identification

Hydro has a good understanding of the potential issues related to the Project. These are described below. It is expected these will be further refined and addressed through the environmental assessment process.

5.1.1 Labrador Innu Society and Culture

The Project is located within the Land Claim Area of the Labrador Innu and has the potential to result in both beneficial and adverse effects on Innu society and culture. Hydro is working with Innu Nation and Innu communities to engage them in the construction and operation phases of the Project. Potential effects of the Project on Innu society and culture, land use, economy, labour force and health will be considered in the environmental assessment.

5.1.2 River Flow

Hydrological changes, (*i.e.*, the changes in water volume and velocity) will result from the Project and could affect processes of ice formation and break-out, water quality, sediment transport and riverbed movements (including bank stability, slumping and sand bar movements). Such physical changes could affect areas within the reservoirs as well as extending to the mouth of the Churchill River. Secondary concerns would include effects on boat and snowmobile travel, riparian vegetation development, estuary mixing phenomena, and river shoreline erosion.

5.1.3 Fish and Fish Habitat

Fish and fish habitat will be affected by the planned development of the Project reservoirs, and possibly through construction practices. The array of species currently present in the mainstem and accessible tributaries fulfill all their lifecycle needs within the Project area. The Project will change the quantity of aquatic habitat through inundation, and may affect habitat character through alterations in water velocity. Productive fish habitat which will be altered, disrupted or destroyed as a consequence of the Project will be the subject of compensation to meet the requirements of the "No Net Loss" policy as established by Fisheries and Oceans Canada. Any acceptable compensation plan will need to take into account the value placed on the fish resource by users of that resource, including Aboriginal people, and recreational fishers.

5.1.4 Terrestrial Habitat, Wildlife and Birds

Reservoir formation will result in the inundation of terrestrial habitat along the length of the lower Churchill River valley, especially downstream of Winokapau Lake (see Figure 3.9). The riparian zone within the relatively sheltered river valley provides habitat for many terrestrial species including waterfowl, raptors, songbirds, small mammals, furbearers, and large mammals. The habitat of the Churchill River valley serves a variety of lifecycle needs, including breeding, nesting, feeding, migration, and over-wintering. The new shoreline will take some time to develop, and there will be a loss in the total available terrestrial habitat. The temporal and spatial features of these changes will need to be understood at the population level to predict effects on wildlife and birds, and to identify possible mitigation measures. Terrestrial resource harvesting may also be affected.

5.1.5 Mercury

Reservoir formation will change the natural patterns of mercury uptake into the aquatic environment. The potential food chain pathways include accumulation in fish species and consequent human consumption. Predictive models are available and will be employed to identify the extent, levels and duration of mercury uptake through the food chain as a consequence of reservoir formation and operation.

5.1.6 Reservoir Preparation

Inundation will remove access to the forest resources and other terrestrial vegetation within the newly formed reservoirs. Inundation of vegetation will be of concern with respect to aesthetics, resource use of the waterway and valley, recovery of wood fibre, the sequestration and release of carbon dioxide, and mercury uptake. A selection of reservoir preparation strategies may address these concerns, but each has its own economic, technical and environmental considerations which need to be evaluated to select the most appropriate mitigation measures.

5.1.7 Vegetation

The Project will affect vegetation within the limits of the reservoir, along the newly developed shorelines, within the construction areas footprint around the generation sites, and along the transmission routes. In addition to providing wildlife habitat, these areas support a variety of vegetation types and plant species, some of which are consumed or used by people, and some which are regarded as having intrinsic value related to scarcity, uniqueness or other considerations.

5.1.8 Historic Resources

Inundation and construction activities will or have the potential to disturb or destroy archaeological sites and other historic resources in the Project area. Historic resources are protected under provincial legislation and valued by Aboriginal and other people in the province. For Aboriginal people, archaeological sites represent the physical archives of their history. The Churchill River valley has been extensively surveyed over four field seasons to locate and identify historic resources that will or may potentially be affected by the Project. Key issues will be to determine the precise interactions between the Project and historic resources gather and record information contained in archaeological

sites that would be lost as a result of the development, and to develop mitigation and protection measures for implementation in the event an historic resource is discovered.

5.1.9 Communities and Infrastructure

The Project, through construction and operation, will have a direct effect on proximate communities and Project workers. The Project demand for labour, goods and services will provide employment and business opportunities for the local region, as well as Labrador, the Province and, to a lesser extent, the country. These effects will be most noticeable during the nine-year construction phase. Economic effects will include secondary (spin-off) employment, as well as other secondary effects which may result from the injection of a large labour force into an area. Upon the completion of construction, there will be a downturn, commonly referred to as a "boom-bust" phenomenon. Local community infrastructure and public services will experience increased demands as a consequence of this heightened level of economic activity. Effects will extend to a range of community features, including education, health services, law enforcement, recreation, leisure and culture.

5.1.10 Climate Change and Greenhouse Gases

The Project has the potential to contribute positively to the reduction of greenhouse gases, and thereby act as a factor which reduces climate change. Nevertheless, some aspect of the Project will generate greenhouse gases (e.g. construction equipment, the new reservoirs). These will need to be quantified and incorporated into the overall calculation of the greenhouse gas balance achieved by the Project.

5.1.11 Employment and Contracting Policies

Employment and contracting with respect to the Project is of interest to Aboriginal groups, governments, and public interest groups. Hydro will consider and establish policies, practices and initiatives regarding employment and contracting opportunities for Aboriginal people, women, persons with physical disabilities, visible minorities and their businesses. Employment policies will address such topics as information and communications, employee recruitment and selection, employee development, and workplace environments. Contracting policies will address such topics as contractor development, procurement processes and requirements, and the provision of information about Project requirements. Effective monitoring and feedback mechanisms will be put in place for employment and business equity. In the Labrador context, special efforts will be made to address cultural awareness and barriers to employment and business for Innu, and in particular, Innu women.

5.2 Treatment of Issues

There are a number of concepts that have been developed to capture and address important environmental issues. It is anticipated the environmental effects analyses of the identified issues and concerns will need to take place in the context of these concepts. These are presented and discussed below.

5.2.1 Sustainability Assurance

Sustainable development refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The Lower Churchill

Hydroelectric Generation Project will create a renewable, sustainable energy source; however in doing so, there will be a permanent loss of valley habitat and attendant effects on the environment. Hydro will address the identified environmental issues associated with the Project in the context of Sustainability Assurance and in a manner consistent with the principles of Sustainability Assurance as it applies to electric power generation.

5.2.2 Biological Diversity

Biological diversity or biodiversity refers to the total variety of all living things in an area or region. The concept includes genetic diversity among and within species, species diversity of life forms present in a specific region, and diversity of ecosystems in a region. The objective of biodiversity conservation can be addressed at all stages of environmental planning and impact assessment.

One important aspect of biodiversity is the preservation of species at risk. In Canada and Newfoundland and Labrador, legislation has been developed to address this concern. The *Species at Risk Act* ("*SARA*") prohibits the killing, harming, harassing, capturing or taking species at risk (Schedule 1 of the Act), and the destruction of their critical habitats or residences. Similarly, the provincial *Endangered Species Act* ("*NLESA*") prohibits the disturbing, killing, capture, possession or trading of designated species, or their residences. In developing its program of baseline studies, Hydro has incorporated consideration of *SARA* and the provincial *NLESA* by conducting surveys to identify the presence of species at risk in the Project area.

5.2.3 Precautionary Principle

This principle was defined in the 1992 Rio Declaration on Environment and Development. Hydro will apply appropriate and cost-effective actions to prevent serious or irreversible damage as a consequence of the Project. The lack of full scientific certainty regarding the probability of effects occurring will not be used as a reason for postponing mitigation measures.

5.2.4 Adjacency

People who reside close to a major undertaking are more likely to experience adverse environmental effects. For this reason, special efforts may be justified in order to deliver benefits to these people. As appropriate adjacency policies are defined, Hydro will apply these to the Project.

5.2.5 Traditional Knowledge

Aboriginal people have knowledge and an understanding of the environment that can provide an important perspective in the collection of baseline data, prediction of environmental effects and development of mitigation measures to address environmental effects. Aboriginal people and communities are the owners of this knowledge (often called Traditional Knowledge or Traditional Environmental Knowledge) and, as such, must participate in its collection and use in an environmental assessment. Hydro and Innu Nation have developed and initiated a process to discuss, document and consider Labrador Innu traditional knowledge in planning and conducting the environmental assessment of the Project. As appropriate, Innu traditional knowledge obtained through this process will be incorporated into the environmental assessment document in a manner that will be agreed between Hydro and Innu Nation.

5.3 Regulatory Compliance

Many issues of concern are addressed through law, regulation and public policy. In varying degrees this dictates the requirements for information collection and level or type of mitigation measures required. As a means of cross-reference, Hydro has developed a comprehensive list of regulatory permits and approvals associated with the Project (Appendix B).

The *Fisheries Act* prohibits the harmful alteration, disruption or destruction of fish habitat without the authorization of the Minister. Consequently, DFO has developed principles, policies and procedures to be followed as a prerequisite to any such approval. Hydro has been proactive in generating the required information and in anticipating the requirement for a Fish Habitat Compensation Plan. Thus, Hydro anticipates it will be able to describe a strategy to achieve fish habitat compensation as a component of the environmental assessment document.

Historic resources are protected in accordance with the Newfoundland and Labrador *Historic Resources Act*. The Regulations under the Act set standards for the conduct of archaeological surveys and require permits to be held by qualified archaeologists in the conduct of such surveys. When historic resources and artifacts are discovered, the legislation prescribes the procedures for recovery, archiving and preservation. Hydro is working cooperatively with the Provincial Archaeology Office in the conduct of archaeological surveys within the Project area.

Hydro has been diligent in complying with all identified regulatory requirements and processes associated with the work completed to date. All future regulatory compliance will be carried out in the context of a comprehensive series of EPPs described in Section 3.2.2.

5.4 Boundary Definition

The environmental assessment will need to define temporal, spatial and administrative boundaries that will apply to the Project and relate to the issues of concern. Precise biophysical boundaries can be identified; socio-economic boundaries will be larger, and less precise. The discussion below will assist in defining these boundaries.

The biophysical zone of influence of the Project will be generally confined to the footprint of the generating sites and their associated reservoirs during construction and operations. During operation, water flow in the river downstream of Muskrat Falls will not differ greatly from the current pattern. There may, nonetheless, be changes in river ice during break-up, since ice above Muskrat Falls will no longer pass downstream, but will melt in place. Upstream interactions are not contemplated beyond the tailrace at Churchill Falls Generating Station. Thus the boundaries with respect to biophysical issues will generally lie within the watershed of the lower Churchill River.

The communities which will be most affected by the Project are those in the Upper Lake Melville area – Happy Valley-Goose Bay, Sheshatshui, Northwest River and Mud Lake. Natuashish is distant from the Project area, but as an Innu community will likely feel environmental effects from the Project and will therefore be included within study area boundaries. The community of Churchill Falls includes recreational users of the watershed several of whom have cabins along the river.

The temporal boundaries of the Project will extend over a decade for construction and over an indeterminate timeframe during operations.

A summary presentation on the temporal, spatial and administrative boundaries as applicable to each of the identified issues is presented in Table 5.1.

Table 5.1 Proposed Boundaries for Identified Issues

Issue	Spatial Boundaries	Temporal Boundaries
Hydrology	Lower section of Churchill River from Churchill Falls to mouth of river	Life of Project
Fish and Fish Habitat	Lower section of Churchill River from Churchill Falls to mouth of river	Life of Project
Terrestrial Wildlife and Birds	Area adjacent to lower section of Churchill River; area cleared for transmission lines Spatial boundaries for game species will consider their respective management area. For example: ▪ Black Bear – Labrador South Black Bear Management Area ▪ Caribou – in accordance with Labrador Caribou Management Areas ▪ Furbearers – Labrador Eastern Furbearer Zone	Life of Project
Vegetation	Area adjacent to lower section of Churchill River; area cleared for transmission lines	Life of Project
Mercury	Reservoirs	10 to 20 years
Reservoir Preparation	Reservoirs	Construction phase
Historic Resources	Area to be inundated; areas to be cleared at generation sites and along transmission line rights-of-way	Construction phase
Communities and Infrastructure	Happy Valley-Goose Bay, Sheshatshui, Northwest River, Mud Lake, Natuashish, Churchill Falls	Life of Project
Innu Society and Culture	Lower section of Churchill River from Churchill Falls to mouth of river Transmission line rights-of-way	Life of Project
Employment and Contracting	Labrador	Life of Project
Climate Change and Greenhouse Gasses	Labrador	Life of Project

5.5 On-going Activities

Hydro has several initiatives in progress with respect to the environmental assessment, some of which are described below.

5.5.1 Innu Nation Consultation and Involvement

Hydro and Innu Nation have put in place various consultation processes and mechanisms for the Project (as described in detail in Section 1.5). These are established and implemented through Process Agreements signed between Hydro and Innu Nation, and are important means of ongoing communication and cooperation. Under the current Process Agreement, processes have been established to conduct Innu-led consultations on the Project in the communities of Sheshatshiu and Natuashish, to conduct negotiations towards an IBA which would define how the Innu might participate in and benefit from the Project, and to facilitate the direct participation of Innu in the environmental and technical work being carried out for the Project and in planning for and conducting its environmental assessment.

Each of these processes is designed to share information, both in terms of informing Innu Nation and the Innu communities about the Project, and in identifying and attempting to address questions, concerns and issues in the environmental assessment.

5.5.2 Environmental Baseline Studies

A broad program of environmental baseline studies are currently under way with respect to ecological land classification, aquatic and terrestrial habitat, wildlife, water/sediment quality, hydrology, historic resources, and socio-economic studies. As results become available, these will be incorporated into the environmental assessment.

5.5.3 Public Consultation

Public consultation will be an integral part of the environmental assessment of the Project. There will be opportunities at all stages for interested parties to bring forward their views and ask questions about the Project. The public consultation program will extend beyond the Project site in Labrador to the rest of the Province. The basic objectives of Hydro's public consultation program will be to provide timely and accurate information to interested stakeholders, and obtain feedback that will identify issues and concerns, and thereby focus the environmental assessment.

Hydro will consult with:

- persons or groups possessing data and information relevant to the Project, including government regulatory agencies, public groups, and individuals;
- those involved in decision-making associated with the Project; and
- those who may be affected by the Project through physical, social, cultural or economic changes.

Hydro is currently engaged in public consultation and issues scoping through ongoing discussions with government regulators, resource agencies, and researchers regarding the 2006 field programs. Consultation will continue with these groups, in addition to other stakeholders throughout the environmental assessment.

A variety of materials and approaches will be used to ensure full opportunity for all interested parties in Newfoundland and Labrador to participate in the environmental assessment. For example, open houses, key informant workshops, and directed stakeholder meetings or focus groups will be conducted at various locations; the Project website (www.nlh.nl.ca) will provide information on an ongoing basis; and Hydro will be available to make presentations to interested groups. Questions and concerns will be recorded at each interface, and Hydro will follow up as appropriate.

6.0 CORPORATE COMMITMENT

The Lower Churchill Hydroelectric Generation Project will include generation facilities at Gull Island and Muskrat Falls with an approximate total installed capacity of 2,800 MW, and interconnecting transmission lines to Churchill Falls. Hydro will secure funding for the Project. Given the Project's greenhouse gas reduction potential and its contribution to Canadian electricity supply, it is clearly in the national interest. Federal support for the Project was requested in the fall of 2005, and discussions with the federal government will continue over the coming months.

Hydro is anticipating that an environmental assessment will be required for this Project, with full opportunity for public and stakeholder review. Hydro is committed to completing a full and comprehensive environmental review in compliance with provincial and federal legislation. Potential environmental effects will be predicted using the extensive environmental baseline data collected over the last 30 years. Mitigations or optimization measures will be proposed to reduce the magnitude of adverse effects and enhance benefits. Follow-up monitoring will be designed and implemented.

The Project will follow the overall Hydro Environmental Management System to ensure it will be constructed and operated in a safe and environmentally-responsible manner. Environmental criteria will be incorporated into the Project design and construction sequencing through the preparation of Environmental Protection Plans and Safety, Health, and Environmental Emergency Response Plans.

Hydro will continue to work with Innu Nation to undertake consultation, conduct negotiations towards an Impacts and Benefits Agreement, and directly involve the Innu in associated environmental and technical work and in the environmental assessment of the Project

Hydro will ensure there are opportunities for interested parties to bring forward their views and ask questions about the Project, including relevant government departments, Aboriginal groups, stakeholder organizations and the interested public. Issues and concerns raised through scoping and consultation will be used to focus the environmental assessment.

The Project will provide benefits to the residents of Labrador and Newfoundland through job creation, provision of electrical power, and revenue generation. The development of a comprehensive environmental assessment will contribute significantly to that objective.

Signature

2006 11 30

Date

Name: Edmund J. Martin
Position: President and CEO

7.0 GLOSSARY

asl	Above sea level
Baseline Data	Information collected on the surrounding environment, typically before a project begins. Also called baseline information.
Baseline Study	Research conducted in the area/region typically before a project or development begins.
Bedrock	A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.
Boreal	Northern regions, but not arctic; related to, or comprising the northern biotic area characterized by dominance of coniferous forests.
CEAA	*Canadian Environmental Assessment Act*
CF(L)Co	Churchill Falls (Labrador) Corporation
CO_2	Carbon dioxide
Cofferdam	A barrier, usually temporary, constructed to exclude water from an area that is normally submerged. They are used to allow construction of the foundation of permanent dams, bridges, and similar structures. When a project is completed, the cofferdam is not needed and may be demolished or removed. They are commonly made of wood, concrete or steel sheet piling.
Coniferous Forest	Forest characterized by cone-bearing, needle-leaved trees such as spruce and pine.
Crown Corporation	A commercial company owned by the government, controlled and partially operated by civil servants.
DFO	Fisheries and Oceans Canada
Diversion Tunnels	Underground passageways used to re-route flowing water around a construction site.
DND	Department of National Defense
Ecosystem	A naturally occurring group of organisms (plant, animal and other living organisms) living together with their environment, functioning as a unit.
Ecozone	An ecological unit that can be distinguished by climate, landforms, soil units, plant formations and land use systems. An ecozone can be broken down into ecoregions.
Endangered	Description of a species that is in danger of extinction within all or part of its range (the region to which it is native).

Environmental Assessment	A planning process to predict the environmental effects of a proposed development before it is carried out.
Environmental Impact Statement (EIS)	A document which describes a proposed development or activity, predicts the possible or certain impacts of the activity on the environment, and outlines safeguards to mitigate or control environmentally destructive impacts.
NLEPA	Newfoundland and Labrador *Environmental Protection Act*
EPP	Environmental Protection Plan
NLESA	Newfoundland and Labrador *Endangered Species Act*
Flip bucket	A common addition to a spillway used to help discharge flow away from a hydraulic structure into a plunge pool to dissipate energy.
Follow-up	A program designed to verify the accuracy of the environmental assessment of a project, and determine the effectiveness of measures taken to mitigate the adverse environmental effects of a project.
Furbearer	Mammals hunted or trapped primarily for fur.
GBDF	Goose Bay Diversification Fund
Glaciation	Having been covered with a glacier or subject to glacial epochs.
Granite	Common, coarse-grained, light-colored, hard igneous rock consisting mainly of quartz, orthoclase or microcline, and mica, often used in monuments and for building.
Habitat	The place where an animal or plant lives, often characterized by some physical condition (e.g., stream habitat).
Head	The vertical distance between the surface of a reservoir and the surface of a river immediately downstream from the dam.
Hydrology	The study of the occurrence, circulation, distribution, and properties of water bodies including oceans, lakes, rivers and streams.
Hydro	Newfoundland and Labrador Hydro
IBA	Impacts and Benefits Agreement
IEMR	Institute for Environmental Monitoring and Research
ISO	International Standardization Organization
ISO 14001	The international standard for environmental management.
km	Kilometre
km^2	Square kilometre

kV	Kilovolts
l	Litre
LCDC	Lower Churchill Development Corporation
LMN	Labrador Metis Nation
m	Metre
m^3	Cubic metre
m^3/s	Cubic metre per second
Mitigation	A procedure designed to reduce the possible harmful effects of a project or activity on the environment. Also mitigative or mitigating measure.
MW	Megawatt
Operations Phase	The period following first power production until cessation of all activity.
Penstock	A pipeline that delivers water from a reservoir or a dam to a turbine.
Precambrian	A division of geological time older than approximately 600,000,000 years ago.
The Project	Lower Churchill Hydroelectric Generation Project
QMI	Quality Management Institute
RA	Responsible Authority
Reservoir	A pond, lake, or basin, either natural or artificial for the storage, regulation and control of water.
Roller Compacted Concrete (RCC)	A low slump concrete mix that is compacted in place with heavy construction equipment (trucks, bulldozers, compactors). Concrete forms are not required. Common for dam construction and other applications.
SARA	*Species at Risk Act*
Sediment	Particulate matter that can be transported by water, which eventually is deposited as a layer of solid particles on the bed or bottom of a body of water.
SHERP	Safety, Health and Environmental Emergency Response Plans.
Silt	A particle smaller than a very fine sand grain and larger than clay having a diameter in the range of 0.004 mm to 0.0625 mm.
Spillway	A channel that carries excess water from a reservoir over or around a dam or other obstruction.
Stakeholder	A person or group with an interest or concern with respect to a project or issue.

Tailrace	A watercourse that carries water away from a mill, waterwheel or turbine.
TLH	Trans Labrador Highway
Transmission Line	The wires and structures that conduct electricity.
Trash racks	Grate-like protection for water intakes, channels and penstocks against debris, vegetation, or trash.
TWh	TeraWatt Hour; equivalent to 1,000,000 MW hours.
Waterfowl	Freshwater aquatic birds, such as ducks or geese.
Watershed	The region or area drained by a river or stream; drainage area.
Wildlife	Undomesticated animals living in the wild, including those hunted for food, sport, or profit.

APPENDIX A

List of Existing Information/Previous Studies

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APPENDIX B

List of Permits, Authorizations and Approvals

List of Permits, Approvals and Authorizations that May be Required for the Lower Churchill Project

Government of Newfoundland and Labrador			
Activity	Approval/Certificate/ License/Permit/Inspection	Legislation	Regulating Agency
Project Construction/Commencement	Release from the Newfoundland and Labrador *Environmental Protection Act*, Part X, Environmental Assessment	Newfoundland and Labrador *Environmental Protection Act*, SNL 2002 c.E-14.2, Part X, Environmental Assessment	Environmental Assessment Division, Department of Environment and Conservation
Establishment of Work Camps	Septic System Commercial – Certificate of Approval for septic systems > 4,500 L per day - in an unserviced area and not covered under a Municipality	Newfoundland and Labrador *Health and Community Services Act*, SNL 1995 c.P-37.1; Sanitation Regulations 1996	Department of Health and Community Services
	Letter of Approval – Septic System	Newfoundland and *Labrador Health and Community Services Act*, SNL 1995, c.P37.1, Sanitation Regulations	Department of Health and Community Services
	Certificate of Approval for Commercial Building under National Building/Fire/Life Safety Code	*Fire Prevention Act*, SNL 1991 c.34, and the National Fire Code of Canada 1990	Department of Municipal Affairs (Office of the Fire Commissioner)
	Certificate of Approval for Buildings Accessibility Design Registration or Exemption Registration	Newfoundland and Labrador *Occupational Health and Safety Act*, RSNL 1990 c. 0-3	Department of Government Services
	Temporary Food Establishment Application	Newfoundland and Labrador *Food and Drug Act*, RSNL 1990 c.F-21, Food Premises Regulations	Department of Health and Community Services, Disease Control and Epidemiology Division
	Building Accessibility	*Building Accessibility Act*, RSNL 1990 c.R-10, Building Accessibility Regulations	Department of Government Services
Land Requirements	Crown Lands - Crown Land Lease/License/Permit	Newfoundland and Labrador *Lands Act*, SNL 1991 C.36	Department of Environment and Conservation
	Notice of Intent for Reservation of Shoreline	Newfoundland and Labrador *Lands Act*, SNL 1991 c.36	Department of Environment and Conservation
Waste Management Related to Construction Activities	Waste Oil - Handling and Disposal	Newfoundland and Labrador *Environmental Protection Act*, SNL 2002 c.E-14.2Used Oil Control Regulations	Department of Environment and Conservation
Garbage Disposal/Waste Management	Waste Management System, Certificate of Approval	Newfoundland and Labrador *Environmental Protection Act*, SNL 2002 c.E-14.2, Waste Disposal and Litter	Department of Environment and Conservation
Access Roads	Bridges, Certificate of Approval, Application for Environmental Permit to Alter a Body of Water	Newfoundland and Labrador *Water Resources Act* SNL 2002 c. W-4.01 Section 48	Department of Environment and Conservation
	Culvert Installation, Certificate of Approval, Application for Environmental Permit to Alter a Body of Water		
Access Roads (cont.)	Certificate of Approval for Stream Fording, Application for Environmental Permit to Alter a Body of Water		
	Permit for Access off any Highway	Newfoundland and Labrador *Urban and Rural Planning Act*, SNL 2000 c.0-8, Highway Sign Regulations	Department of Municipal Affairs

Government of Newfoundland and Labrador			
Activity	Approval/Certificate/ License/Permit/Inspection	Legislation	Regulating Agency
Construction of Dams	Dams and Appurtenant Structures, Certificate of Approval	Newfoundland and Labrador *Water Resources Act* SNL 2002 c. W-4.01 Section 48	Department of Environment and Conservation
Construction of Generating Facilities	Water Resources - Water Course Alterations Certificate of Environmental Approval to Alter a Body of Water	Newfoundland and Labrador *Water Resources Act* SNL 2002 c. W-4.01 Section 48	Department of Environment and Conservation
	Construction (Site Drainage), Certificate of Approval		
Stream Crossings/Fording	Water Resources - Water Course Crossings, Certificate of Environmental Approval		
Fuel Storage	Fuel Storage & Handling - Temporary Storage Remote Locations	Newfoundland and Labrador *Environmental Protection Act*, SNL 2002 c.E-14.2, Storage and Handling of Gasoline and Associated Products Regulations, 2003	Department of Environment and Conservation
	Fuel Storage & Handling - A Permit Flammable & Combustible Liquid Storage & Dispensing (above or below ground) & for Bulk Storage (above ground only)	Newfoundland and Labrador *Environmental Protection Act*, SNL 2002 c.E-14.2, Storage and Handling of Gasoline and Associated Products Regulations, 2003, and *Fire Prevention Act*, SNL 1991 c.34	Department of Environment and Conservation and Department of Municipal Affairs (Office of the Fire Commissioner)
Potable Water Supply	Water Resources - License to Drill Water Wells	*Water Resources Act*, SNL 2002 c.W-4.01, Well Drilling Regulations	Department of Environment and Conservation, Water Resources Division
Water Supply for Camp / Work Site	Water Resources - General Application for Water Use Authorization - for all beneficial uses of water from any source - Application for Permit for Using Ground Water for Non-Domestic Uses	Newfoundland and Labrador *Water Resources Act*, SNL 2002 c.W-4.01	
Water Use	Water Use Authorization	Newfoundland and Labrador *Water Resources Act*, SNL 2002 c.W-4.01	Department of Environment and Conservation, Water Resources Division
	Approval for Water Supply System		
Construction Activities	Operating Permit/Fire Season - Crown or private land for a company or individual to operate during forest fire season	Newfoundland and Labrador *Forestry Act*, RSNL 1990 c.F-23, Forest Fire Regulations	Department of Natural Resources, Forest Resources Division
	Permit to Cut Crown Timber - A permit is required for commercial or domestic cutting of timber on Crown Land	Newfoundland and Labrador *Forestry Act*, RSNL 1990 c.F-23, Cutting of Timber Regulations	
	Permit to Burn	Newfoundland and Labrador *Forestry Act*, RSNL 1990 c.F-23, Forest Fire Regulations	
	Letter of Advice to New Construction Project or Industrial Enterprise	Newfoundland and Labrador *Occupational Health and Safety Act*, RSNL 1990 c.0-3	Department of Government Services

Government of Newfoundland and Labrador			
Activity	**Approval/Certificate/ License/Permit/Inspection**	**Legislation**	**Regulating Agency**
Borrow Pits and Rock Quarries	Quarry Development Permit - A permit is required to dig for, excavate, remove and dispose of any crown quarry material	Newfoundland and Labrador *Quarry Materials Act*, SNL 1998 c.Q-1.1	Department of Natural Resources, Mines and Energy Division
Control of Nuisance Wildlife	Control of Nuisance Wildlife Black Bear Protection Permit/Permit to Destroy Problem Animals	Newfoundland and Labrador *Wildlife Act*, RSNL c.W-8, Wildlife Regulations	Department of Natural Resources, Forest Resources Division
Highway Signage	Signs, Highway Services Fingerboard Signs, Approval	Newfoundland and Labrador *Urban and Rural Planning Act*, SNL 2000 c.U-8, Highway Sign Regulations	Department of Municipal Affairs
Temporary Diesel Generation and Permanent Emergency Diesel Generation	Permit to Operate Temporary Diesel Generator	Newfoundland and Labrador *Environmental Protection Act*, SNL 2000 c.E-14.2, Air Pollution Control Regulations	Department of Environment and Labour, Pollution Prevention Division
Government of Canada			
Project Commencement	Release	*Canadian Environmental Assessment Act*	Canadian Environmental Assessment Agency Minister of Environment
Watercourse Alteration / Diversion	Permit for Construction within Navigable Waters	*Navigable Waters Protection Act*	Transport Canada
Instream Activities	Fish Habitat Authorization for Works or Undertakings Affecting Fish Habitat	*Fisheries Act*	DFO
	Application for a Water Lease		Transport Canada
Storage of Explosives	Magazine License, Temporary		Natural Resources Canada
Handling and Transportation of Dangerous Goods	Permit to Transport	*Transport of Dangerous Goods Act*	Transport Canada
Accidental Hazardous Material Spill	Reporting Mechanism / response	Guidelines for Reporting Incidents Involving *Dangerous Goods, Harmful Substances, and/or Marine Pollutants. TP9834E. under* the *Canada Shipping Act*	DFO - Canadian Coast Guard
Communications	Application for License to Install and Operate a Radio Station in Canada	*Radiocommunication Act*	Industry Canada, Communications
Municipal Government			
Waste Disposal	Approval to dispose waste in municipal landfill		Relevant municipality

Lower Churchill Hydroelectric Generation Project

Environmental Impact Statement

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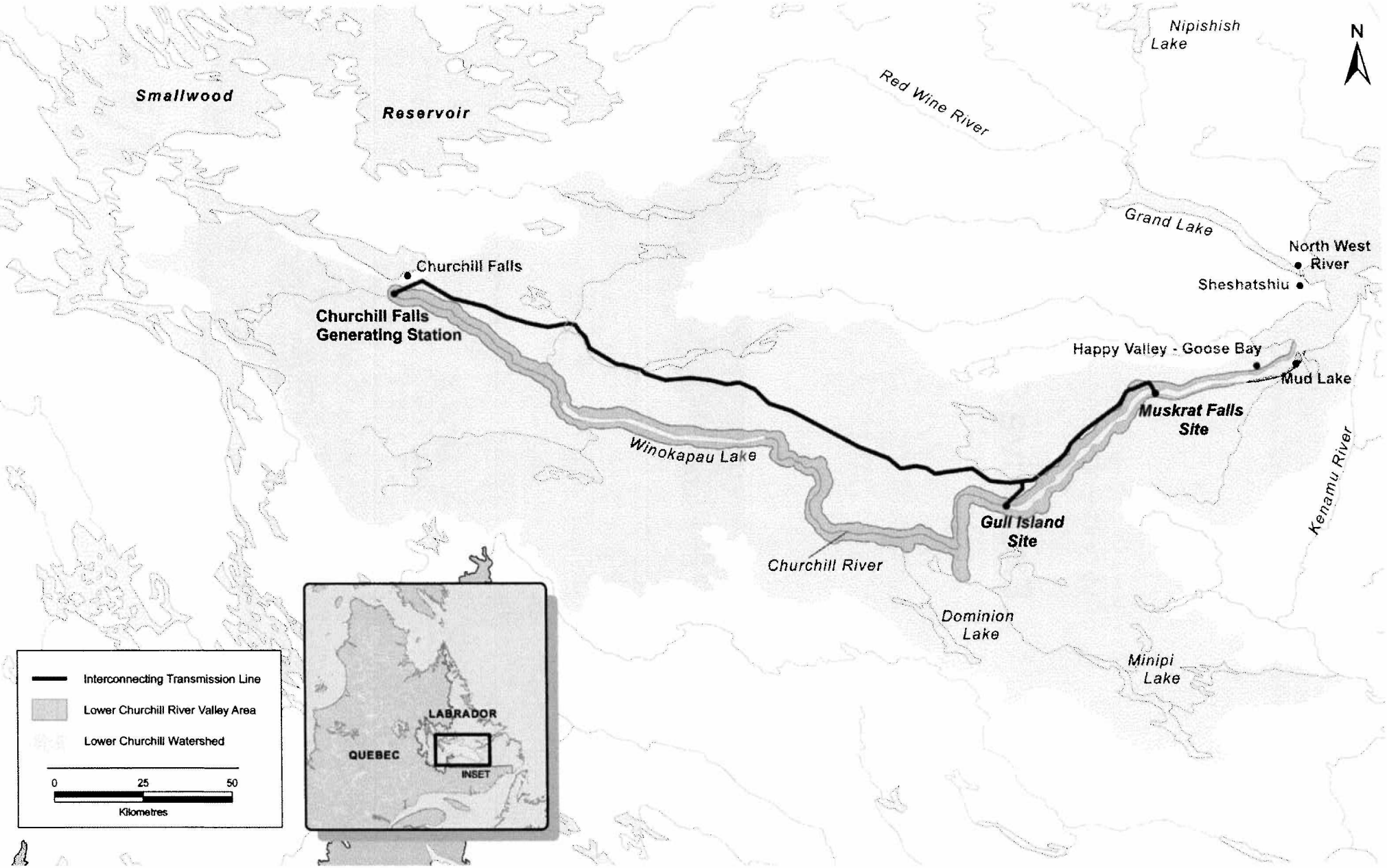
nalcor energy


Nipishish Lake
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Smallwood
Reservoir
Red Wine River
Grand Lake
North West River
Churchill Falls
Sheshatshiu
Churchill Falls Generating Station
Happy Valley - Goose Bay
Mud Lake
Muskrat Falls Site
Winokapau Lake
Kenamu River
Gull Island Site
Churchill River
Dominion Lake
Minipi Lake
Interconnecting Transmission Line
Lower Churchill River Valley Area
Lower Churchill Watershed
0
25
50
Kilometres
LABRADOR
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1.0 INTRODUCTION

Newfoundland and Labrador has an immense and diverse energy warehouse. In 2007, guided by a long-term Energy Plan to manage these energy resources, the Government of Newfoundland and Labrador created a new provincial Crown corporation, branded "Nalcor Energy" in 2008. Nalcor Energy is the Project proponent.

Nalcor Energy encompasses the subsidiary Crown corporation Newfoundland and Labrador Hydro. Planning for the Lower Churchill Hydroelectric Generation Project, also referred to as the Project, was originally undertaken by Newfoundland and Labrador Hydro. The development of the hydroelectric potential of the lower Churchill River located in central Labrador is now being lead by Nalcor Energy. The Project will consist of the development of two hydroelectric generation facilities; one at Gull Island (2,250 megawatt (MW)) and the second at Muskrat Falls (824 MW), interconnecting transmission lines and the construction of associated dams and reservoirs. The location and key components of the Project are shown in Figures 1-1 and 1-2.

An Environmental Impact Statement (EIS) has been prepared by Nalcor Energy and its consultants as part of a joint federal-provincial environmental review of the Project, which is required before any approvals for Project development can be granted. The major findings and conclusions of the EIS are presented in this Executive Summary.

1.1 Regulatory Context

The Project is in the process of undergoing an extensive and rigorous environmental review, to meet the requirements of both the Government of Newfoundland and Labrador and the Government of Canada. Provincial environmental assessment requirements are set out in the Newfoundland and Labrador *Environmental Protection Act* (*NLEPA*), while federal government requirements are found in the *Canadian Environmental Assessment Act* (*CEAA*).

The environmental assessment process was initiated in December 2006, prior to the creation of Nalcor Energy, by Newfoundland and Labrador Hydro (Hydro). Hydro filed the Project Registration/Description Document with both governments. Upon review of the Registration and consideration of comments received from the public, the provincial Minister of Environment and Conservation determined that an EIS was required. The federal Minister of the Environment, who is responsible for the Canadian Environmental Assessment Agency, subsequently announced that the Project should undergo an environmental assessment by an independent review Panel. The two governments have decided to coordinate the two assessments through a Joint Review Panel.

The Joint Review Panel will hear and consider all the information, comments and advice presented about the Project and the EIS by all participants, and will decide if they have enough information to assess the environmental effects of the Project. If they determine that the information is adequate, the Panel will hold public hearings and will make recommendations to the respective Ministers regarding whether the Project should proceed, and if so, what conditions and mitigations would be required. This process helps to address all issues, options and viewpoints which have been considered.

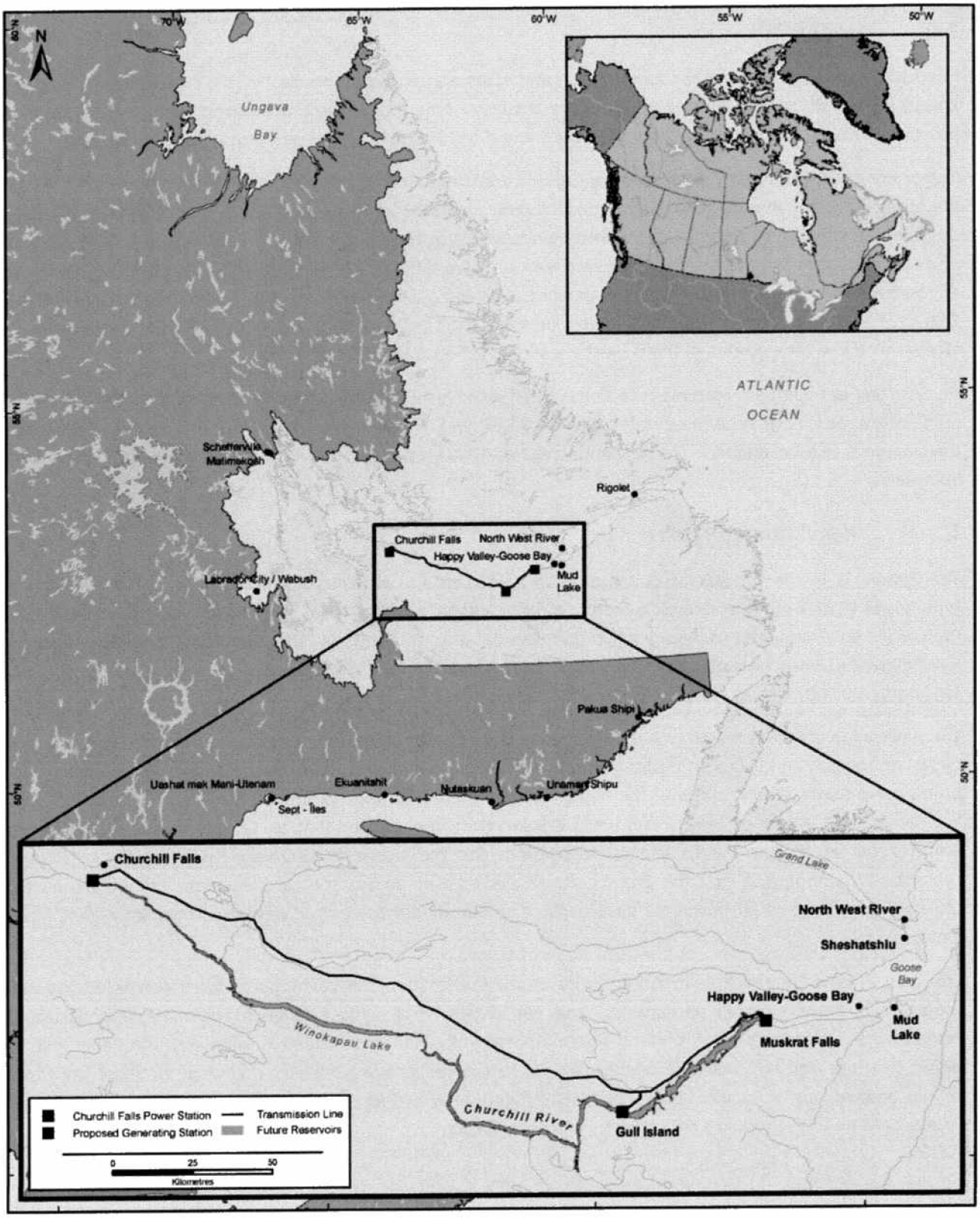

Figure 1-1 Project Location

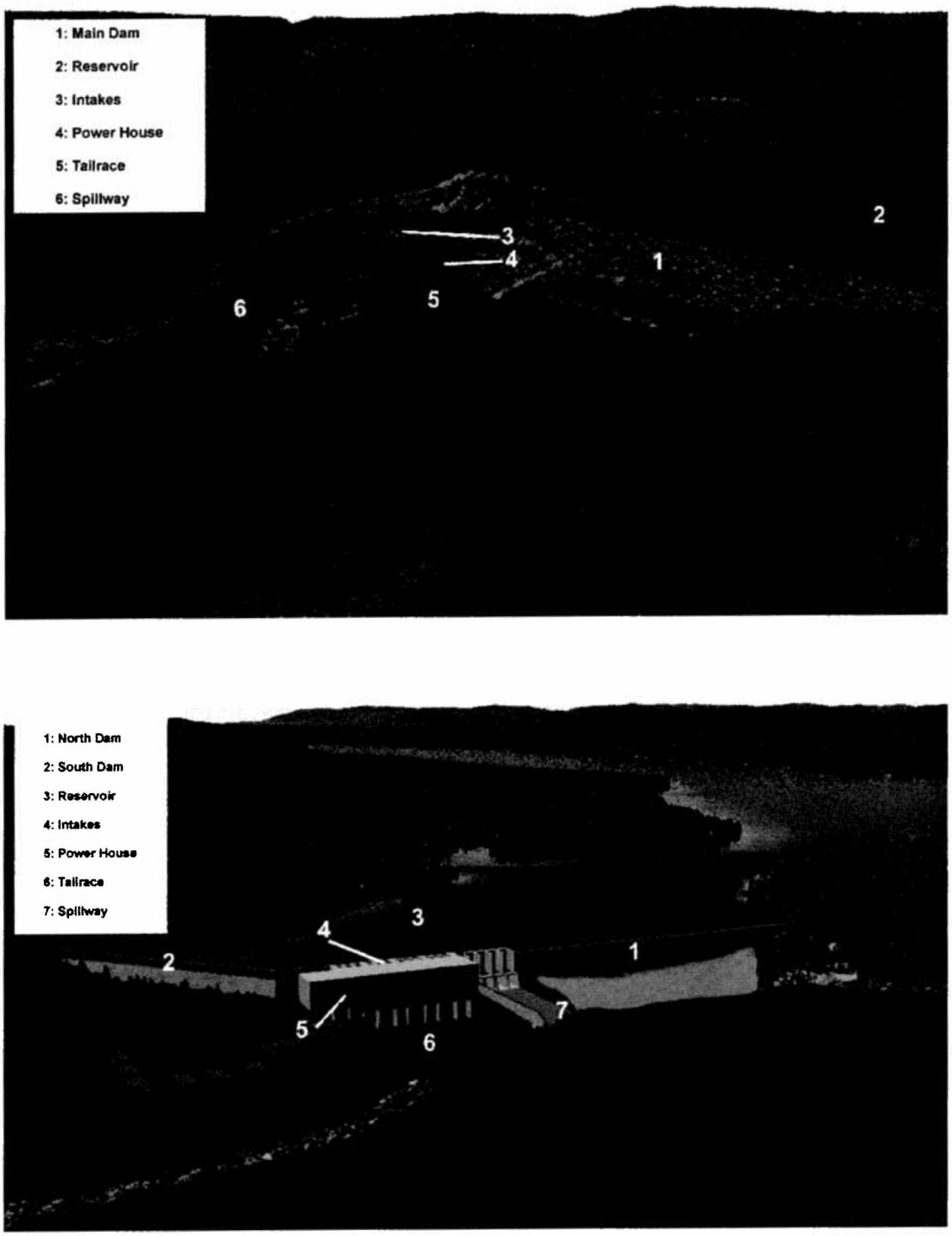

Figure 1-2 **Conceptual Illustrations of the Gull Island (top) and Muskrat Falls (bottom) Generation Stations**

To guide the environmental assessment process, the federal and provincial governments have issued joint EIS Guidelines. These describe the scope of the Project to be assessed, as well as the scope of the assessment itself. The Guidelines describe in detail those aspects of the Project that require consideration in the EIS, as well as the specific components of the environment and potential issues to be considered. In response to these government requirements, Nalcor Energy has produced a comprehensive and well-researched EIS. Thus, the Project, upon release, can proceed with minimum adverse effects on the land, its resources and its people, while maximizing the benefits for the environment and the citizens of the Province.

1.2 Organization of the Executive Summary

This Executive Summary has been organized to reflect the general content and organization of the EIS. In addition to this Executive Summary, the full Project EIS is composed of a detailed Project Description (Volume IA), a Biophysical Assessment (Volume IIA and IIB), and a Socio-economic Assessment (Volume III). The Project Description volume provides details of the Project. The second and third EIS volumes describe the many and varied physical, biological, economic and social factors that might interact with the development of the Project, and assess the potential environmental effects of the Project on these elements.

This Executive Summary provides a description of the Proponent (Section 2) and the Project (Section 3), including the rationale and need for the Project, schedule and workforce, key Project components, construction and operation activities and planned environmental management approaches. Section 4 provides an overview of the consultation and issues scoping process that has occurred in support of this assessment, while Section 5 outlines the environmental assessment approach and methods used.

Section 6 includes a description of the regional setting for the Project focusing on the lower Churchill River watershed and communities of the Upper Lake Melville area. The potential effects of the Project on the biophysical environment are provided in Section 7 including an overview of effects management, residual environmental effects, monitoring and follow-up and cumulative environmental effects. In a similar manner, the socio-economic effects assessment is overviewed in Section 8. Section 9 summarizes the main conclusions of the EIS focussing on key elements in the EIS including the Precautionary Principle, sustainability, ecological integrity and biodiversity and benefits for future generations.

2.0 THE PROPONENT

Nalcor Energy's foundation is built on its core business: the generation and transmission of electrical power. Nalcor Energy makes a strong commitment to provide safe, reliable and dependable electricity to its utility, industrial, residential and retail customers. Beyond its core business, Nalcor Energy has expanded into the broader energy sector, including oil and gas, wind energy, and research and development. Nalcor Energy is leading the development of the Province's energy resources and is focussed on environmentally responsible and sustainable growth.

Nalcor Energy has five lines of business (Figure 2-1).

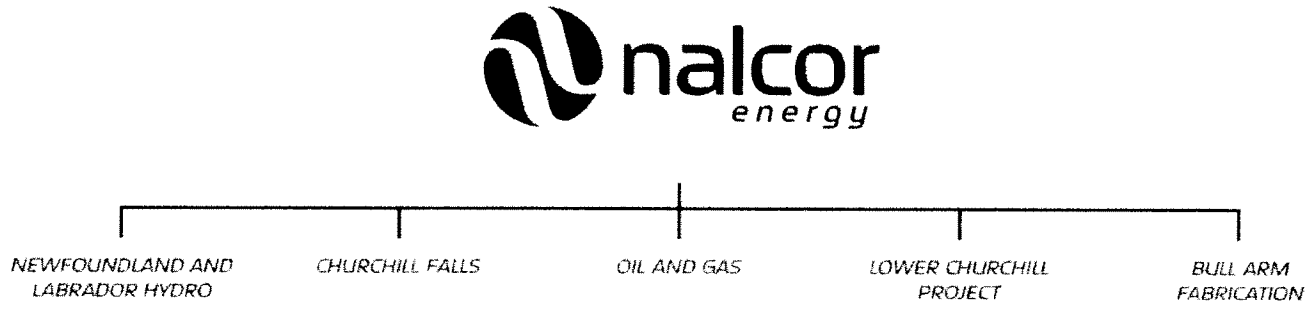

Figure 2-1 Nalcor Energy Corporate Structure

The *Energy Corporation Act* authorizes Nalcor Energy to invest in, engage in and carry out activities in all areas of the energy sector (except nuclear) within the Province and, with approval, outside the Province, including:

- development, generation, production, transmission, distribution, delivery, supply, sale, export, purchase and use of energy from wind, water, steam, gas, coal, oil, hydrogen or other products used in power production;
- exploration for development, production, refining, marketing and transportation of hydrocarbons and products made from hydrocarbons;
- manufacturing, production, distribution and sale of energy-related products and services; and
- research and development.

Nalcor Energy's vision is to build a strong economic future for successive generations of Newfoundlanders and Labradorians. Nalcor Energy's employees share a set of common values. Nalcor Energy is a proud, diverse energy company, whose people are committed to a bright future for Newfoundland and Labrador, united by core values:

- **Open Communication** - Fostering an environment where information moves freely in a timely manner;
- **Accountability** - Holding ourselves responsible for our actions and performance;
- **Safety** - Relentless commitment to protecting ourselves, our colleagues, and our community;
- **Honesty and Trust** - Being sincere in everything we say and do;
- **Teamwork** - Sharing our ideas in an open and supportive manner to achieve excellence;
- **Respect and Dignity** - Appreciating the individuality of others by our words and actions; and
- **Leadership** - Empowering individuals to help guide and inspire others.

2.1 Commitment to the Environment

An Environmental Services Department was established in 1975. Since that time, the corporation has demonstrated leadership in managing the environmental aspects of its activities and will continue to do so under Nalcor Energy. Through the 1970s and 1980s, Hydro (now a subsidiary of Nalcor Energy) was an innovator both provincially and nationally with respect to environmental assessment, environmental compliance and effects monitoring, environmental auditing and environmental protection planning. Hydro has confirmed its leadership role in environmental management by adopting the stringent International Organization for Standardization (ISO) 14001 standard for its Environmental Management System (EMS) at its facilities. ISO certification is a demonstration of a high level of commitment to the policy and practice of environmental management, including review and audit.

Environmental Policy and Guiding Principles (Policy) were established by Hydro in 1997 and updated in 2006. This Policy has been adopted by all lines of business of Nalcor Energy and is provided below.

ENVIRONMENTAL POLICY AND GUIDING PRINCIPLES

The Newfoundland and Labrador Hydro Group of Companies will help sustain a diverse and healthy environment for present and future Newfoundlanders and Labradorians by maintaining a high standard of environmental responsibility and performance through the implementation of a comprehensive environmental management system.

The following guiding principles set out the Hydro Group's environmental responsibility:

PREVENTION OF POLLUTION

- implement reasonable actions for prevention of pollution of air, water, and soil and minimize the impact of any pollution which is accidental or unavoidable;
- use the Province's natural resources in a wise and efficient manner;
- use energy as efficiently as possible during the generation, transmission, and distribution of electricity, and the operation of its facilities, and promote efficient use of electricity by customers;
- maintain a state of preparedness in order to respond quickly and effectively to environmental emergencies;
- recover, reduce, reuse and recycle waste materials whenever feasible;

IMPROVE CONTINUALLY

- audit facilities to assess potential environmental risks and continually improve environmental performance;
- integrate environmental considerations into decision-making processes at all levels;
- empower employees to be responsible for the environmental aspects of their jobs and ensure that they have the skills and knowledge necessary to conduct their work in an environmentally responsible manner;

COMPLY WITH LEGISLATION

- comply with all applicable environmental laws and regulations, and participate in the Canadian Electricity Association's *Environmental Commitment and Responsibility Program*;
- periodically report to the Board of Directors, Executive Management, employees, government agencies, and the general public which we serve on environmental performance, commitments and activities;
- monitor compliance with environmental laws and regulations, and quantify predicted environmental impacts of selected activities on the environment;
- respect the cultural heritage of the people of the Province and strive to minimize the potential impact of Corporate activities on heritage resources.

The Policy is based on the principle of sustainable development, which espouses an appropriate balance among environmental, economic, and social aspects of its business. Specifically, as required by the ISO 14001 standard, the Policy commits to prevention of pollution, compliance with legal and other requirements, and continual improvement of environmental performance.

Hydro has been recognized by such organizations as the Newfoundland and Labrador Association of Professional Engineers and Geoscientists and the National Hydropower Association for outstanding stewardship and environmental management. In 2002, the provincial Department of Environment and Conservation selected Hydro for the *Newfoundland and Labrador Environmental Award* in the Business Category for "*a business that has demonstrated the exemplary attitude and concern for the environment through sound environmental management policy, and has demonstrated action to prevent or reduce pollution*".

As part of its commitment to environmental stewardship, Nalcor Energy participates on the Labrador Woodland Caribou Recovery Team. Nalcor Energy's operations at Churchill Falls and the associated transmission, as well as the Project, are within the range of the sedentary Lac Joseph and Red Wine Mountains (RWM) Caribou herds, both considered threatened under federal and provincial legislation. Additionally, Nalcor Energy:

- relocates and monitors active Osprey nests;
- has successful flow maintenance agreements and fish habitat compensation programs at many of its hydroelectric facilities (Granite Canal, Grey River, Upper Salmon and Hind's Lake); and
- has a flora assessment program in the limestone barrens habitat on the Northern Peninsula.

Further to the commitment to environmental stewardship, Nalcor Energy is a sponsor of the Conservation Corps of Newfoundland and Labrador Green Teams in Labrador and on the Island. The Green Teams promote conservation through a program involving youth in research and public awareness initiatives. Nalcor Energy has supported the Nature Conservancy of Canada for a number of years. The Company has also initiated public awareness programs about energy conservation through its HYDROWISE program and Save Energy events throughout the Province, and has also supported the Suzuki Nature Challenge.

Nalcor Energy also has cooperative research initiatives with:

- Memorial University of Newfoundland and Labrador (MUN) on greenhouse gas (GHG) and climate change;
- University of Waterloo on remote radio telemetry, habitat selection and swim performance of Atlantic salmon;
- Department of Fisheries and Oceans – Science on mercury monitoring, instream flow modelling, and habitat selection;
- Joint initiative with Hydro-Québec on GHG emission monitoring on northern reservoirs;
- provincial Wildlife Division;
- Institute for Environmental Monitoring and Research (IEMR) on monitoring of the RWM Herd and other wildlife; and
- provincial Water Resources Division on hydrometric stations and Real Time Water Quality Monitoring Network.

The Project has established an Environment and Aboriginal Affairs group, dedicated to the environmental assessment, environmental planning and environmental management of the Project. This department is made up of a team of experienced environmental and engineering professionals whose mandate is for the Project to be constructed in a sustainable way with protection of the environment being a priority.

2.2 Commitment to Consultation

Nalcor Energy is committed to full and open consultation as a means of enabling meaningful dialogue with the people and groups who have an interest in the Project. Consultation is an opportunity for Nalcor Energy to share Project information and to receive information and comments from the public.

Meaningful consultation can only take place if the public has a clear understanding of the Project as early as possible in the review process. Therefore, Nalcor Energy adheres to the following guiding principles for its public participation program:

- providing up-to-date information describing the Project to the public and the communities most likely to be affected by the Project;
- involving the main interested parties in determining how best to deliver information;
- delivering programs and information in a timely manner;
- being responsive to public input and concerns and taking these into account during Project design and planning;
- recording accurately and responding appropriately to public concerns raised;
- identifying and using effective means to provide accurate and complete information; and
- conducting public meetings/consultations in accordance with applicable regulatory requirements and guidelines.

The approach to public consultation taken by Nalcor Energy is based on the premise that public participation is a fully integrated and iterative process, which will continue beyond the environmental assessment process and extend throughout all Project phases.

2.3 Commitment to Labrador

Jobs and business activity from the construction and operation of the Project are the first and most tangible benefits. A substantial portion of the jobs and business spin-offs will logically occur in Labrador. Nalcor Energy will focus efforts on realizing benefits to Labrador through training opportunities and supplier development and providing first consideration for employment on the Project to qualified Labrador residents.

The Project is developing an overall Benefits Strategy and an Adjacency Policy, which will also be followed by contractors. First consideration for employment will be given to qualified workers who are adjacent to the resource. Newfoundland and Labrador businesses will have full and fair opportunities to participate in the Project, understanding that price, quality and delivery will be evaluated on a competitive basis. Nalcor Energy will communicate all Project opportunities to the people of Labrador and throughout the Province.

In acknowledging the importance of training to realize maximum benefit of the Adjacency Policy, Nalcor Energy has and will continue to work with governments, Aboriginal groups, women's organizations, training institutions, and labour organizations. Topics of discussion include the Project's labour requirements, identifying existing or anticipated gaps in the labour supply pool, and exploring and discussing potential approaches for addressing potential gaps.

A diverse workforce is a planned feature of the Project. Nalcor Energy will encourage Aboriginal people, women, visible minorities, and persons with disabilities to participate in the Project. To this end, a Diversity Plan will be prepared and implemented. The Project will also build on Nalcor Energy's existing Community Investments Program with local initiatives. The Project has already started local contributions through the use of donations to local initiatives as incentives for meeting and workshop participants to provide feedback through exit surveys.

All Aboriginal groups will be encouraged to participate actively in the Project. An Impacts and Benefits Agreement (IBA) is being negotiated with Innu Nation that, once concluded, will define how the Labrador Innu will participate in and benefit from the Project.

3.0 THE PROJECT

Nalcor Energy is proposing to develop two hydroelectric generation facilities, including construction of associated dams and reservoirs, on the lower Churchill River in central Labrador. One will be located at Gull Island and one at Muskrat Falls. The Project also includes transmission lines between Muskrat Falls and Gull Island and from Gull Island to the existing Churchill Falls facility. Project construction will be a major undertaking, which will require a large effort, including materials supply and transportation, support infrastructure, equipment and labour. Temporary access roads will be required, construction camps built and partial clearing will take place in reservoir areas.

The reservoir flooding required for the Project is 126 km^2, approximately 5 percent of the 2,500 km^2 occupied by the Smallwood Reservoir at Churchill Falls. The Project will produce 16.7 terawatt-hours (TWh) per year which is approximately 50 percent of the energy generated at Churchill Falls. A more detailed description of the Project is provided below.

3.1 Rationale and Need for the Project

Nalcor Energy has been given the mandate by the Province to develop the Lower Churchill Hydroelectric Generation Project for the benefit of residents of Newfoundland and Labrador. The Project is needed to:

1. address the future demand for hydroelectric generation in the Province;
2. provide an electric energy supply for sale to third parties; and
3. develop the Province's natural resource assets for the benefit of the Province and its people.

The Churchill River is recognized as a significant, long term, reliable source of renewable hydroelectric energy, which has yet to be fully developed. The existing Churchill Falls Power Station is located 225 km upstream from the Gull Island site. This facility came into service in 1971, and it currently has an installed capacity of 5,428 MW and generates an average of 34 TWh of energy per year. Development of the untapped hydroelectric potential on the Churchill River will contribute benefits to the Province as a long term renewable energy supply and a source of revenue. During construction, the Project will also make a strong contribution to the local and provincial economy through associated direct, indirect and induced employment, and business opportunities.

The Project will contribute to GHG emissions reduction, not only within the Province, but also nationally and internationally. Renewable electricity from the lower Churchill River will potentially eliminate the need for the thermal generating station at Holyrood. As well, excess electricity from the Project has the potential to displace existing fossil-fuel generation in export markets. The Project has a generation capacity of 3,074 MW of renewable power. It is anticipated that 800 MW will be required to meet provincial needs, including replacement of Holyrood as well as load growth and from industrial development. The remaining capacity will be available both to meet the needs of new large-scale industrial developments that may decide to locate within the Province because of the availability of power, and for export to customers and markets in northeastern North America.

It is anticipated that the demand for new electrical generation in eastern North America in the coming decades will provide a ready market for the excess electrical energy generated by this Project. Within Canada, Ontario plans to retire coal fire plants by 2014 and retire or refurbish over the next two decades nuclear facilities that have reached the end of their service. This will necessitate the development of approximately 24,000 MW of new generation to meet Ontario's needs. New Brunswick is heavily reliant on fossil-fuels, with 64 percent of the 4,175 MW of total generating capacity coming from fossil-fuel generating sources. In Nova Scotia the peak load

is currently in the range of 2,200 MW and the annual load growth is estimated to be 1.7 percent. Eighty-eight percent of Nova Scotia's electricity comes from fossil fuels. The National Energy Board (NEB) is forecasting that growth demand for energy in Canada will continue to grow from 2010 to 2020 by 14 percent, or 82 TWh.

Within the United States demand growth in the State of New York is projected to be 1.2 percent annually. In New England the summer peak load will grow from 29,940 MW to 31,373 MW, an annual average growth rate of approximately 1 percent between 2012 and 2017.

3.1.1 Benefits of Hydroelectricity

The Newfoundland and Labrador Energy Plan (Energy Plan) sets out government policies, plans for energy development and management in this Province and stresses the important role of hydroelectric energy generation. Not only is this resource recognized for its economic and social potential, but also for its capacity to help reduce GHG emissions, which is of global concern.

The environmental value of renewable energy sources such as hydro-generated electricity is recognized far beyond the provincial Energy Plan. Several international agencies, such as the World Summit for Sustainable Development, the Intergovernmental Panel on Climate Change (IPCC) and the United Nations Symposium on Hydropower and Sustainable Development, have recently highlighted sustainable hydroelectric generation as a key instrument for lowering emissions and as a vital component of a cleaner, renewable energy future. Because the electricity-generating turbines in hydropower developments are turned by flowing water, rather than by coal- or oil-fired steam (as in thermal power plants), there are virtually no emissions. For example, a typical hydro plant development releases less than 2 percent of the emissions of a comparable coal-fired plant and just 5 percent of the emissions of a natural gas-fired plant (Figure 3-1).

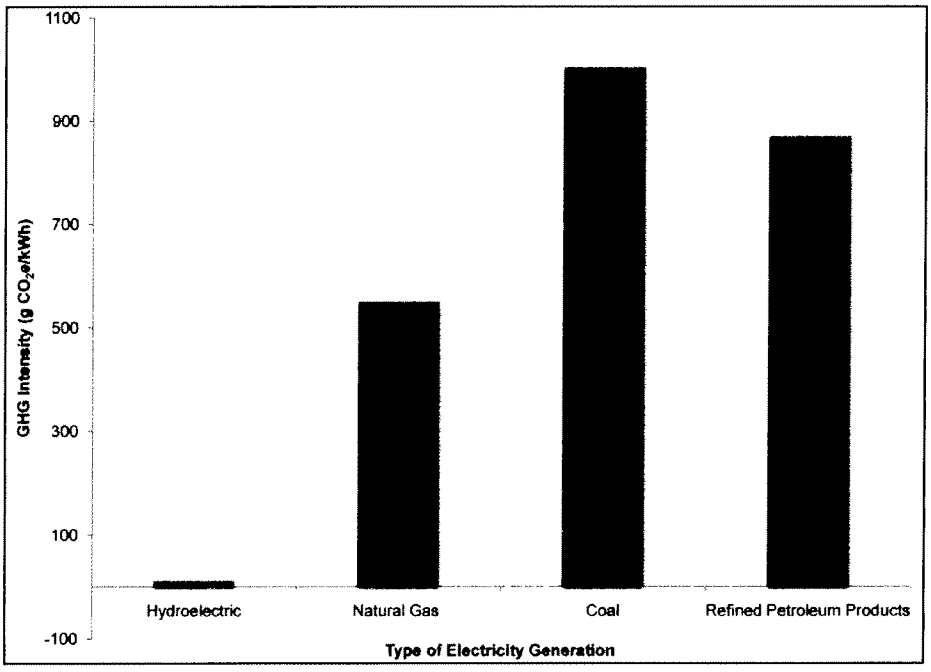

Figure 3-1 Comparison of Greenhouse Gas Emission Intensities for the Project and Competing Forms of Electricity Generation

Considering that an average Canadian automobile produces about 5 tonnes of GHG annually, the GHG displacement potential of the Project is equivalent to taking 3.2 million vehicles off the road forever.

3.1.2 The Lower Churchill River Potential and Benefits to the Province

The lower Churchill River is one of the most attractive undeveloped hydroelectric projects in North America, and it is specifically recognized in the Energy Plan as a priority for investing in sustainable energy assets. Together, the Gull Island and Muskrat Falls sites have the potential to supply more than 3,000 MW of power, and provide 16.7 TWh of electricity every year. This represents about half of the energy presently produced from the Churchill Falls Power Station (34 TWh).

Another important benefit that will begin to flow immediately from the Project is employment. This includes skilled work in design, site preparation, construction, project management, quality and environmental control, operations and the associated work and services to supply equipment and materials, as well as the needs of the workers. To ensure that economic benefits are maximized (to Labrador specifically and the Province generally), Nalcor Energy is developing a targeted industrial benefits strategy.

The total potential direct and indirect (spin-off) employment from the Project ranges from a low of 34,000 person-years of employment to a high of 82,000. Employment directly and indirectly resulting from the Project is estimated to be 34,000 person-years. If other large-scale industrial developments occur as a result of the Project, the person-years of employment will be as high as 82,000.

In addition to revenues from the sale of lower Churchill River electricity, the Project will greatly increase the amount of power available for a variety of economic developments in Labrador and on the Island. Access to a secure and reliable supply of energy will create a long-term strategic advantage for further development within the Province. The fact that the power is renewable will have further appeal to many companies that are becoming increasingly aware of the value of reducing GHG emissions and adding environmental stewardship to their corporate identities and practices.

3.2 Schedule and Workforce

Work on the two generation sites is expected to require a capital investment of approximately $6.5 billion (in 2008 dollars) over 10 years, and will generate more than 15,000 person-years of direct employment during the construction phase, with a peak of over 2,000 workers in Year 6 (Figure 3-2).

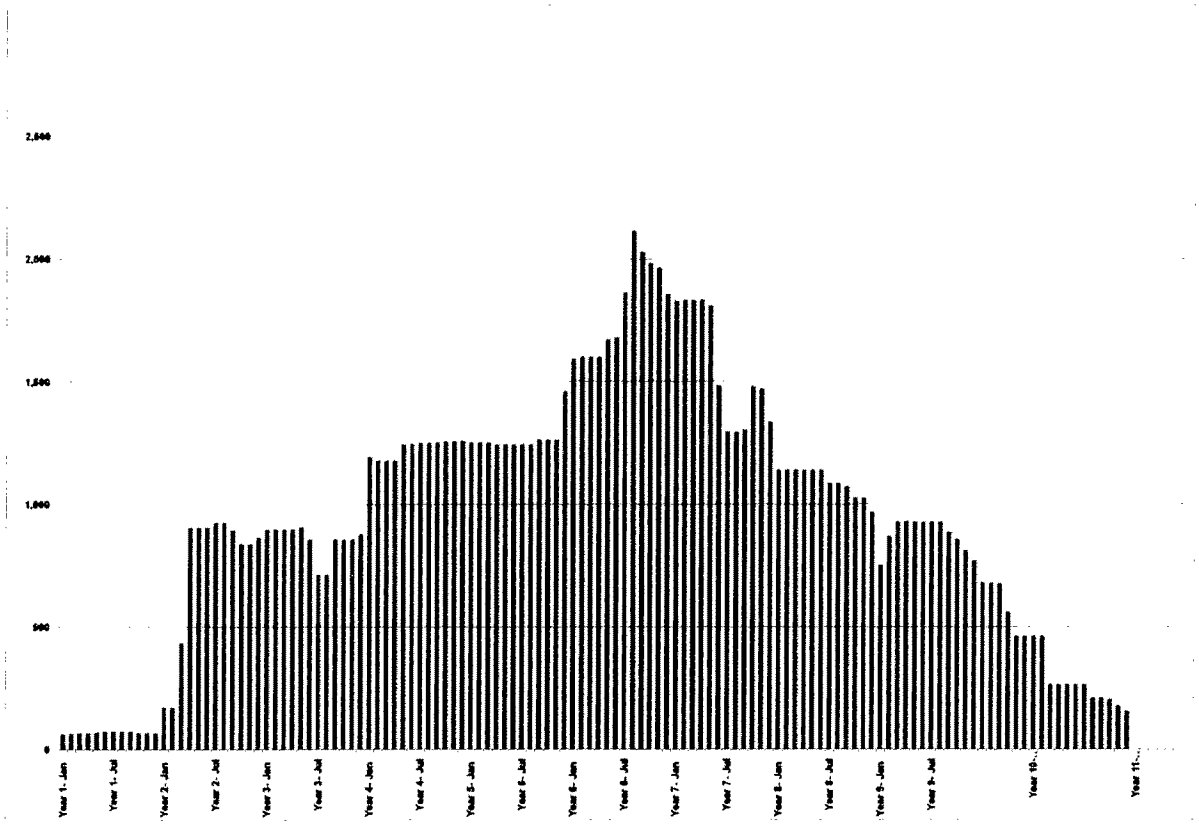

Figure 3-2 Total Construction Workforce for Gull Island and Muskrat Falls

3.3 Gull Island Facility Overview

The Gull Island Generation Facility will have a generation capacity of 2,250 MW and consist of

- a powerhouse containing five Francis turbines;
- a concrete-faced and rock filled dam, 99 m high and 1,315 m long; and
- a reservoir 232 km long, inundating an area of 85 km^2 at full supply level (FSL).

The other main components will be:

- the approach channel;
- the intake and penstocks (directing the water to the generator-turbines);
- the tailrace channel (allowing water to return to the river after it has passed through the turbines);
- the spillway (to let water bypass the turbines during high flow events); and
- the main power transformers and switchyard (raising the generation voltage up to 735 kV) (Figure 3-3).

The facility will be connected by access road to the Trans Labrador Highway (TLH). For security, all areas around the powerhouse will be fenced where practical and entrances to structures and buildings will be restricted. Sensitive areas will be equipped with remote cameras. The site will also include warning signs as required. A construction accommodations complex will be built for up to 2,000 workers.

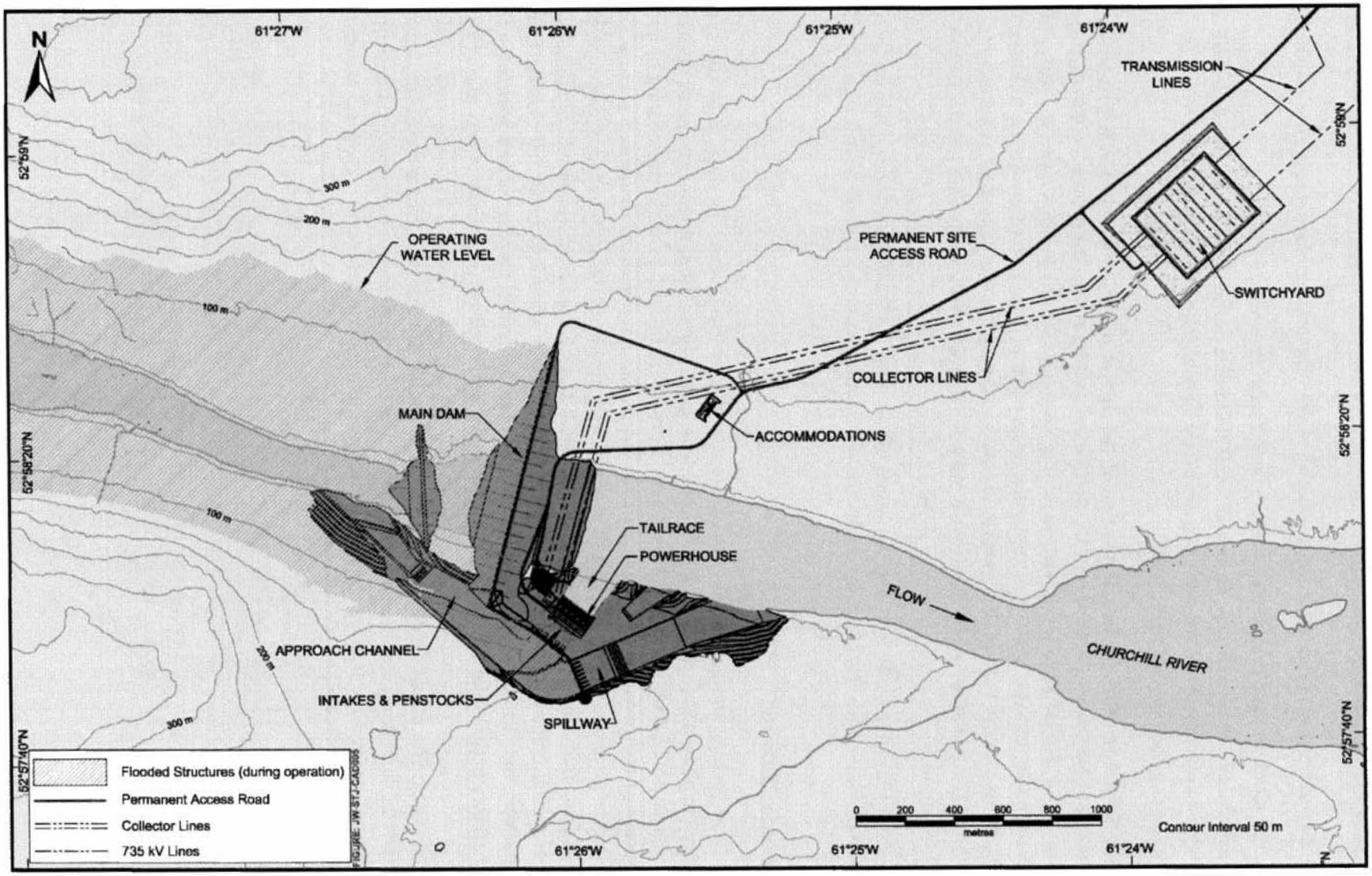

Figure 3-3 Gull Island Facility Layout

3.4 Muskrat Falls Facility Overview

The Muskrat Falls Generation Facility will have a capacity of 824 MW. The main components (Figure 3-4) include:

- the powerhouse, with four fixed propeller or variable-pitch Kaplan turbines;
- a concrete dam with two sections on the north and south abutments of the river; the south section dam will be 29 m high and 325 m long, while the north section will be 32 m high and 432 m long; and
- a reservoir 59 km long, inundating 41 km^2 at FSL.

Like the Gull Island Generation Facility, the construction of the dam at the Muskrat Falls site will result in the formation of a reservoir. However, the Muskrat Falls Generation Facility will be different from the Gull Island Generation Facility in that the facility will not have penstocks; the approach channel will direct the water from the reservoir into the power intakes, where concrete spiral cases will distribute water through the turbines. The water will then discharge into the tailrace. The passage of flows in excess of power generation requirements will be through a spillway. The facility will also have transformers and a switchyard, which will raise the generation voltage to 230 kV.

Access to the Muskrat Falls site will be from the south side of the river, via Black Rock Bridge, which is located 8 km west of Happy Valley-Goose Bay. A construction accommodations complex will be built for up to 1,000 workers.

3.5 Reservoir Clearing

The planned reservoir clearing strategy for the Project involves the removal, where feasible, of all trees that extend into an area 3 m above FSL to 3 m below low supply level (LSL). This strategy is known as partial clearing. Since many of the trees to be cleared range in height from 15 to 18 m, this will result in the clearing of a ring around the perimeter of the reservoir that could, in some areas, be more than 20 m vertical distance. This approach minimizes the generation of floating debris over time resulting from the stabilization of new shoreline and ice damage to trees that remain below minimum flood level. Due to the configuration and topography of the Churchill River valley, implementing this partial clearing option will essentially mean full clearing of the Muskrat Falls Reservoir and the upper portion of the Gull Island Reservoir. Clearing of the perimeter ring described above will only occur in the lower reaches of the Gull Island Reservoir (i.e., the area between 119 and 128 m above sea level). The environmental assessment has been based upon a maximum cleared width of 15 m from the shoreline at FSL. The actual cleared width will be dictated by the reservoir preparation plan that will consider safety, terrain, biophysical and access requirements. This clearing strategy could result in the clearing of about 70 percent of the flooded forest vegetation present within the two reservoirs. Figure 3-5 shows the extent of reservoir clearing at Gull Island, as an example.

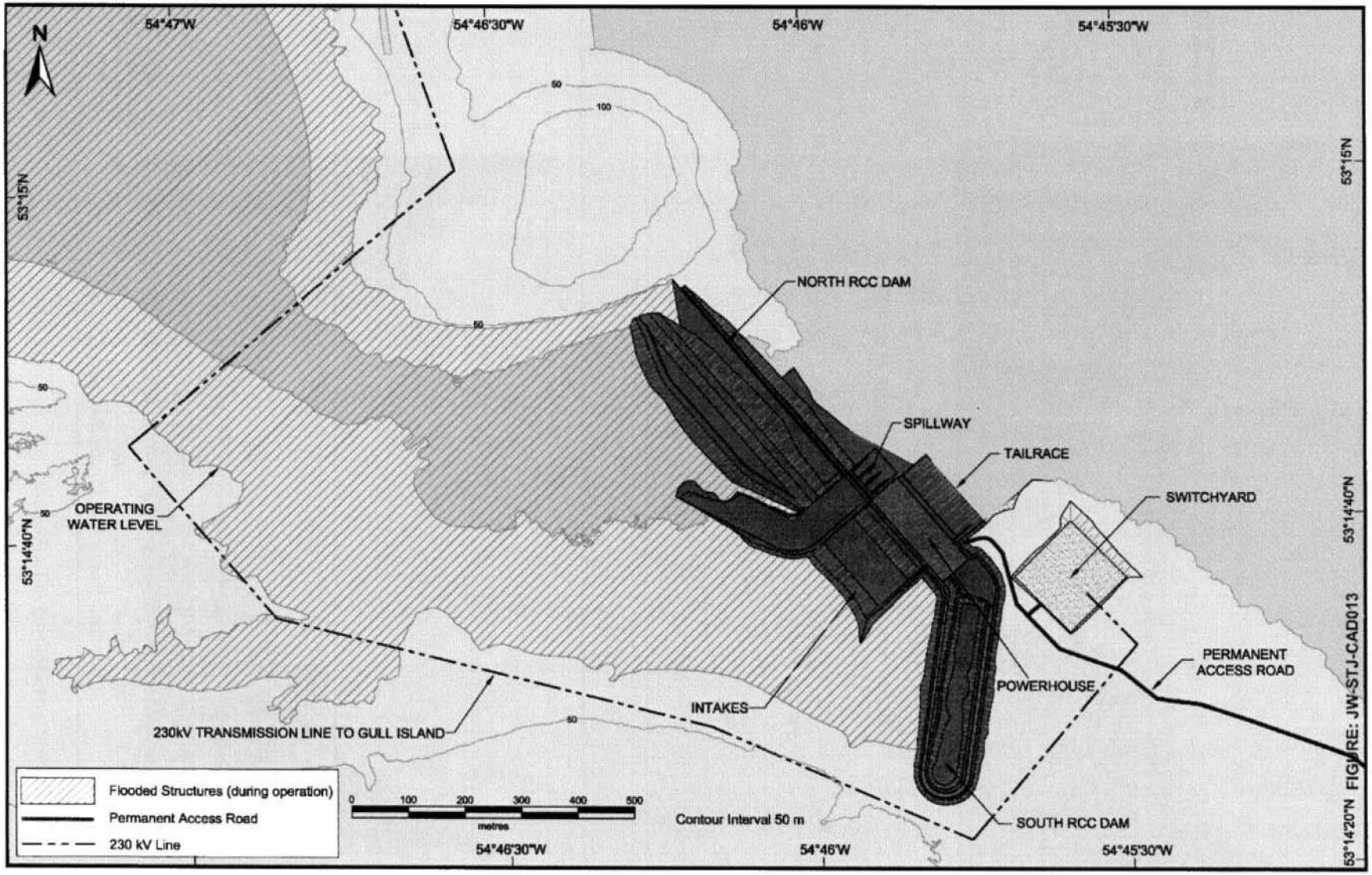

Figure 3-4 Muskrat Falls Facility Layout

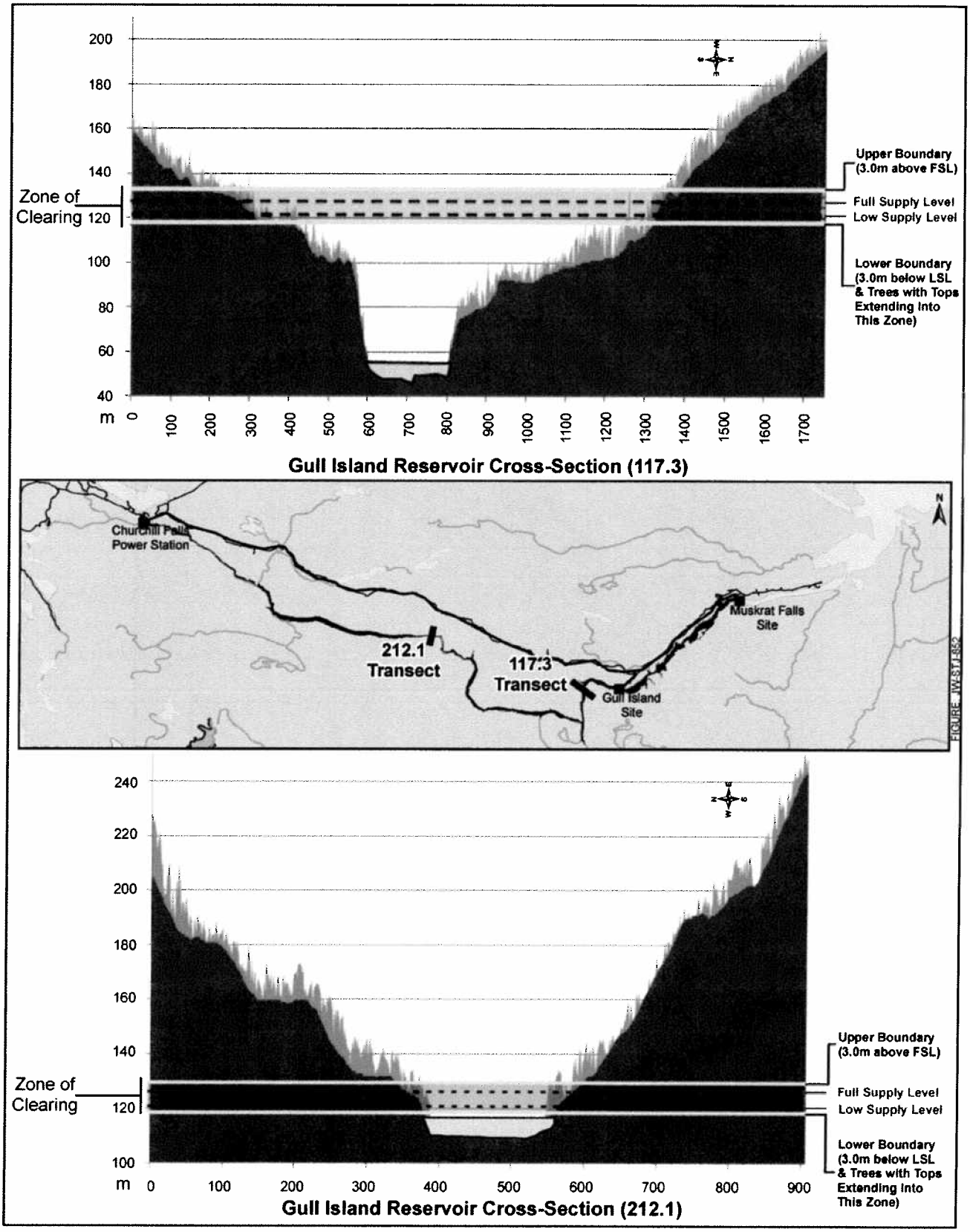

Figure 3-5 Extent of Reservoir Clearing at Gull Island

3.6 Transmission Line

The transmission line (Figure 3-6) will consist of

- a 203 km-long 735 kV section between Gull Island and Churchill Falls; and
- a 60 km-long double-circuit 230 kV section between Muskrat Falls and Gull Island.

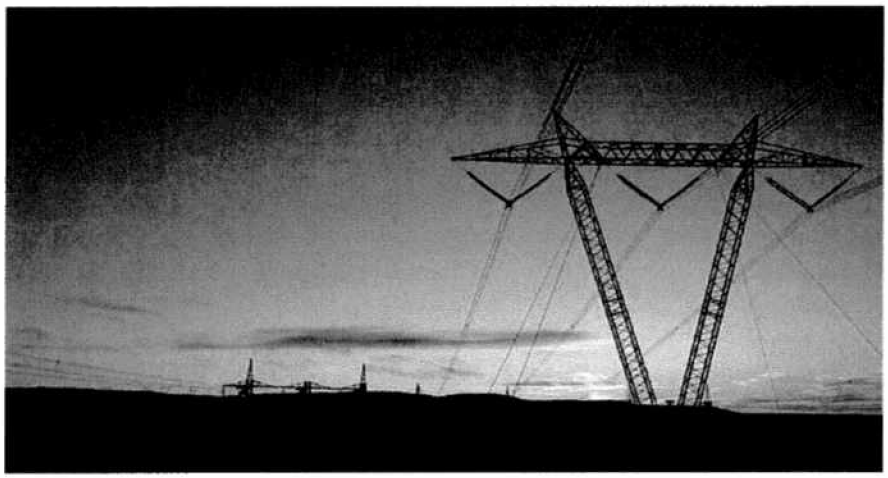

Figure 3-6 Typical 735 kV Single Circuit Structure Tower

The transmission line structures from Gull Island to Churchill Falls will be lattice steel type towers approximately 50 m high with an average span of 500 m between each tower. The line will have a ground clearance of 18 m over roads and 14 m over other areas, in accordance with design standards for this voltage class transmission line.

The structures from Muskrat Falls to Gull Island will also be lattice steel type tower. Each structure will carry two circuits (called a double circuit configuration). These towers will be approximately 40 m high and have an average span of 380 m between each tower. The line will have a ground clearance of 7.3 m over roads and 6.7 m over other areas, in accordance with design standards for this voltage class transmission line.

The location of the transmission line will be north of the Churchill River and will parallel, as much as possible, the existing 138 kV transmission line that runs between Happy Valley-Goose Bay and Churchill Falls. The new transmission line right-of-way will be generally 80 m in width, in addition to the existing transmission line right-of-way.

The right-of-way clearing involves removal of vegetation that exceeds 1 m height at maturity. Effort will be made to minimize the unnecessary removal of low growing vegetation with due consideration for the safety, reliability and maintenance of the transmission lines.

3.7 Operation

While maintenance personnel will be stationed in Happy Valley-Goose Bay, Nalcor Energy will operate the Gull Island and Muskrat Falls Generation Facilities remotely from St. John's at its existing Energy Control Centre (ECC). The generation facilities will be constructed so that the operation of all plant equipment can be monitored by ECC staff. ECC staff will also have access to telemetry data from the generation facilities and will have the ability to remotely start and stop equipment.

In order to maximize power and energy output, Gull Island Reservoir will be operated as close to FSL (125 m) as possible. Both lower Churchill reservoirs will be operated in concert with the existing facilities at Churchill Falls so as to maximize efficiency of all generation facilities on the Churchill River, as required by the water management provisions of the *Electrical Power Control Act and Regulations*. With coordinated operation of the three facilities (Churchill Falls, Gull Island and Muskrat Falls), fluctuations in water level in the lower Churchill reservoirs will be minimized, to the extent possible.

At Gull Island, daily drawdowns in the order of several centimeters are likely, and weekly drawdowns of up to one metre could take place. On occasion, the full 3 m drawdown may be used when flow from Churchill Falls is reduced. The reservoir will also be drawn down each spring so that the substantial inflows that result from melting snow in the spring can be captured. During severe flood events, the reservoir level may rise up to a maximum flood level of 127 m.

As with Gull Island, Muskrat Falls will also be operated as close to FSL (39 m) as possible. Daily fluctuations of several centimetres and weekly fluctuations of up to 0.5 m are anticipated. During severe flood events, the reservoir level may rise up to a maximum flood level of 44 m.

There are no plans for decommissioning the facilities, so this is not considered in the EIS. Hydroelectric facilities have very long operating lives. For example, the Province's first major hydroelectric facility, at Bay D'Espoir, is still operating after more than 40 years in service, and will continue to do so into the future, with the appropriate maintenance and upgrading. Temporary roads, camps and other construction infrastructure will be removed at the completion of construction and once site rehabilitation has been undertaken.

3.8 Environmental Management

Nalcor Energy's approach to effects management is multi-faceted, using various methods, standards and design phases to develop a Project with reduced potential for adverse environmental effects and enhancement of Project benefits. These include:

- compliance with regulatory requirements and internal corporate requirements;
- designed-in mitigation/Project features that inherently reduce adverse environmental effects, while also serving important technical and/or cost requirements;
- Valued Environmental Component (VEC and see Section 4.4 for detailed discussion) and/or Project-specific mitigation that has been identified through this EIS to reduce the potential for specific adverse environmental effects, and compensation/enhancement that is intended to address specific adverse environmental effects of the Project that cannot be avoided or to enhance Project benefits;
- implementation of an Environmental Protection Plan (EPP); and
- development of a Safety, Health, and Environmental Emergency Response Plan (SHERP).

Each of these approaches is described more fully below.

3.8.1 Compliance with Regulatory and Corporate Requirements

Nalcor Energy will fully comply with all provincial and federal regulatory requirements applicable to the construction and operation of the Project. Compliance will be facilitated through a program of environmental compliance monitoring, including on-site environmental monitors. Examples include compliance with respect to blasting, handling, storage and disposal of fuel and other hazardous materials, development of emergency response plans and control and discharge of Project effluents.

Nalcor Energy has adopted Hydro's corporate Environmental Policy and Guiding Principles and its EMS meets the requirements of ISO14001:2004 (Environment). Environmental protection measures and mitigation associated with this Project will be required to meet the same high corporate standard. The EMS includes monitoring of environmental performance and integrates environmental management into the company's daily operations, long term planning and other quality management systems.

Compliance with regulatory and corporate requirements is fundamental to the Basis of Design (BOD) for the Project. The BOD contains the fundamental criteria, principles, and/or assumptions for the Project design. The design for the Project is based upon the following principles.

- maintaining consistency with all applicable standards, codes, legislation, acts and regulations;
- employing fail safe design principles;
- designing all assets and systems to promote safety, reliability, efficiency and reducing environmental effects;
- observing good utility practice;
- designing environmental mitigation and rehabilitation before issuing construction contracts for tender;
- employing principles of life cycle cost analysis;
- respecting local climatic/service conditions such as ambient temperature, elevation, humidity and wind throughout the Project;
- considering only proven technology; and
- remotely operating and monitoring all hydroelectric plants and transmission systems from the ECC.

3.8.2 Designed-in Mitigation/Key Project Features

Consideration of environmental issues at the earliest stages of project planning and design is integral to Nalcor Energy's overall EMS. This approach facilitates the use of designed-in mitigation, a very effective planning tool. The early identification of mitigation measures not only serves to avoid or reduce negative environmental effects but also improves the accuracy of Project cost and schedule definition. Designed-in mitigation involves the consideration of alternative Project design, construction techniques and timing. Initially, the potential alternatives are evaluated based on technical, economic and environmental feasibility.

In addition to designed-in mitigation, there are a number of Project features that inherently reduce the Project's potential for adverse environmental effects, while also serving important technical and/or economical considerations. Examples of these features, along with designed-in mitigation, are described below.

Reservoir Clearing: Three strategies were considered for the clearing of the Gull Island and Muskrat Falls reservoirs: minimal clearing; partial or selective clearing; and complete clearing. Considering technical and economic factors, the partial (selective) clearing option was determined to be the preferred strategy. Partial clearing involves the removal, where feasible, of all trees that extend into an area 3 m above FSL level to 3 m below LSL. This approach minimizes the generation of floating debris over time resulting from the stabilization of new shoreline and ice damage to trees that remain below minimum flood level. This clearing strategy could result in the clearing of up to 70 percent of the flooded forest vegetation present within the two reservoirs. The extensive work program associated with removing vegetation from the two reservoirs addresses several objectives, including:

- supporting hydroelectric plant operations by reducing the occurrence of floating debris at intakes;
- rendering the reservoirs navigable for existing and anticipated boat traffic;
- improving shoreline and riparian zone habitat quality;

- improving fish habitat quality, especially for shallow water and nearshore areas; and
- making the merchantable timber resource available to other users.

The extent of reservoir preparation (as described throughout this EIS) may be modified due to limiting factors that will be encountered in the field. Safety and technical considerations may determine that reservoir clearing in certain areas cannot be achieved (e.g., steep slopes adjacent to Winokapau Lake). Areas not cleared because of these limiting factors will not change the results of the effects assessment. In addition, operational procedures and methods will be implemented to deal with any potential issues (e.g., trash and debris removal requirements) that could result from any area not cleared.

Currently Regulated River: As the Churchill River is currently regulated through the existing generation facility, the natural flow variability has been reduced. This alteration of flow forms part of the baseline compared to natural conditions, flows in the Churchill River are now higher in winter and lower in late spring and summer. This has resulted in a less variable flow regime over the course of the year, both seasonally and monthly. As the storage is upstream from the Project, there will be minimal changes to downstream flow.

Operating Regime: As discussed in Section 3.7, the operating regime will result in minimal reservoir fluctuations. Minimal fluctuations in reservoir levels will have benefits for the environment, helping to establish the riparian zone and minimizing drawdown.

Transmission Line Route Selection: Two potential 1-km wide corridors were identified as possible alternatives for the transmission lines. One alternative is located next to the existing transmission line from Churchill Falls to Happy Valley-Goose Bay (Option 1), and the other is a line originally proposed in the late 1970s and re-evaluated in 1999 (Option 2). Engineering and environmental data are available for both corridors. A mapping study was completed which evaluated technical, economic and environmental constraints along the alternative corridors. The environmental constraints included sensitive terrestrial habitat (e.g., bogs), sensitive aquatic habitat (e.g., stream crossings), land use (e.g., cabins) and cultural heritage resources (archaeological sites). Using avoidance as the principal mitigation, the studies balanced technical and economic matters when selecting routes to avoid or minimize environmental constraints. Both alternatives were determined to be technically and economically feasible. The use of the existing access trails and travel routes associated with the existing transmission line for Option 1 will minimize habitat fragmentation and will result in a reduced need for new terrain disturbance and new stream crossings. Therefore, Option 1 was selected.

Other Designed-in Mitigation: There are a number of other decisions that were made early in the Project planning process to mitigate potential adverse effects of the environment. For example, the Project will use existing transportation infrastructure to the maximum extent possible. In particular, existing roads, bridges, railways and wharfs will be used where possible to minimize costs, but this will also minimize the requirement for additional habitat disturbance. As well, where possible, Project access roads, spoil areas, borrow pits and quarries will be located within the flood zone; this will again serve to reduce the requirement for surficial disturbance as a result of the Project. Temporary bridges on access roads will have a five-year design life so that they must be removed when construction is complete. As well, there will be no open burning of cleared vegetation. The cultural significance of the Muskrat Falls knoll was considered along with technical and economic feasibility in the selection of layout alternatives for Muskrat Falls. The design selected had the least overall interaction because diversion tunnels were not required through the rock knoll. Following construction, infrastructure not required for operation will be removed and the sites will be rehabilitated. This includes areas such as the accommodations complexes, access roads and quarry and borrow pits.

3.8.3 VEC and Project-Specific Mitigation, Compensation and Enhancements

In addition to the designed-in mitigation, mitigation measures have also been identified in response to the identification and assessment of specific Project effects. This includes measures such as relocating active beaver colonies within the areas to be flooded and creating new fish habitat within the new shore zone of the reservoirs. A full listing of these mitigation measures is provided later in this document in Section 7.2 for the Biophysical Environment and Section 8.2 for the Socio-economic Environment. In addition to mitigation measures, these sections also include a listing of proposed compensations and enhancement/optimization measures. Compensation has been proposed where certain adverse Project effects are considered unavoidable, such as flooding of trap lines or where required by government, such as compensation for any alteration, disruption or destruction of fish habitat. For the socio-economic environment, in particular, there are many measures proposed to enhance or optimize potential Project benefits. For instance, there are a variety of measures planned to increase the opportunity for local residents and companies to fully benefit from Project employment and servicing contracts.

3.8.4 Environmental Protection Planning

All of the above environmental protection procedures, regardless of whether they are in response to regulatory requirements, designed-in mitigation or developed to meet a VEC-specific issues, will require implementation in the field. In other words, contractors responsible for Project construction will need to be aware of the commitments contained in this EIS and how they will be specifically implemented. The EPP will consolidate all of this environmental information in a format that provides sufficient detail for the implementation of environmental protection measures on site. The main objectives of Nalcor Energy's EPP are to:

- consolidate information for planning;
- provide details of Nalcor Energy's commitment to environmental protection and planning;
- provide site specific environmental protection measures; and
- provide guidelines for field activities and decision making on environmental issues relevant to Nalcor Energy's construction, and operation and maintenance activities.

An EPP will be developed for the construction and operation and maintenance phases of the Project as outlined in the EIS.

3.8.5 Safety, Health and Environmental Emergency Response Plans

Given the complex nature of activities associated with the construction, operation and maintenance of a hydroelectric project, an accidental release or other unplanned event is possible. While the EPP addresses routine activities, separate plans are required to address response requirements for emergency situations. Nalcor Energy has in place a Corporate Emergency Response Plan (CERP) which establishes a formal process for the provision of corporate based support activities such as engineering, safety and health to operational facilities in times of emergencies.

The Project will build upon the CERP and Nalcor Energy will proactively identify potential emergency situations and will develop response procedures, including a SHERP. The purpose of a SHERP is to identify responsibilities in the event of an unplanned incident (including dam failure or the accidental release of oil or other hazardous material), and to provide the information required for effective response and incident reporting. The establishment and maintenance of emergency response procedures allows for:

- protection and maintenance of human health and safety;
- identification of the potential for accidents and emergency situations;
- planned response to accidents and emergency situations; and
- prevention and mitigation of potential environmental effects associated with accidents and emergency situations.

4.0 CONSULTATION AND ISSUES SCOPING

Environmental assessment examines interactions between a proposed undertaking and the natural and human environment. Key to this examination is the identification of issues and concerns related to these interactions by interested parties. This process is referred to as issues scoping and relies on a program of consultation whereby the interested public learns of the Project and documents areas of concern either through contact with Nalcor Energy or with designated representatives of the provincial and federal governments. To this end, Nalcor Energy has a consultation program directed at the general public, interested groups and organizations and Aboriginal groups in Labrador and throughout the Province.

4.1 Stakeholder Consultation

Nalcor Energy has informed and consulted with residents, local communities, community organizations, interested regional and national organizations, resource users, other stakeholders, government agencies and the general public as part of Nalcor Energy's commitment to ongoing dialogue. A Project office has been opened in Happy Valley-Goose Bay to provide easily accessible information to local residents.

From November 2005 to December 2008, the Project Team has conducted sustained and timely communication with residents in the area that may be affected by the Project. The information provided has included Project updates, baseline study descriptions, permits and regulations, mitigation and effects management strategies and schedules. This has provided stakeholders with the information necessary to identify and discuss aspects of the Project that may affect them.

As a general approach, the scale and effort of public participation increases with proximity to the Project. Therefore, consultation efforts focused on communities in the Upper Lake Melville area (Happy Valley-Goose Bay, Sheshatshiu, North West River, Mud Lake and Rigolet), Churchill Falls, western Labrador and Natuashish and, to a lesser extent, St. John's.

Nalcor Energy has used a variety of consultation methods to date designed to best suit both the purpose of the specific consultation effort and the parties being consulted. Methods have included open house meetings, one-on-one meetings, technical workshops, Project website, electronic news notifications, Project newsletter, information sheets, speeches and press releases. Technical workshops have been held to discuss specific issues such as methylmercury, energy alternatives, training and employment. Nalcor Energy plans to conduct additional focussed workshops in accordance with public interest.

As follow-up to a series of open house meetings that have been held, a second series will be organized to share updated information with the public following EIS submission. Nalcor Energy also plans to continue individual stakeholder meetings, including with government agencies.

4.2 Aboriginal Consultation

The Project is located in central Labrador, an area presently under land claims negotiation between Innu Nation and the provincial and federal governments. Nalcor Energy has been working directly with Innu Nation regarding the environmental assessment of hydroelectric development on the lower Churchill River since 1998. More recently, Nalcor Energy has actively engaged in discussions about the Project with other Aboriginal groups.

4.2.1 Labrador Innu

Labrador Innu are resident primarily in two communities: Sheshatshiu in central Labrador and Natuashish on the Labrador North Coast. The Sheshatshiu Innu and the Mushuau Innu of Natuashish comprise separate Bands, with each community on a Reserve with an elected Chief and Council. These communities are collectively represented by Innu Nation, an elected political organization, that represents Innu in aspects of governance, including consultation and negotiations with Nalcor Energy on the Project.

In September 2008, the Province and Innu Nation signed the Tshash Petapen (New Dawn) Agreement. The Agreement resolves key issues related to the land claims (Innu Rights Agreement), Innu redress for the upper Churchill hydroelectric development and the lower Churchill (Project) IBA.

Consultation with Innu Nation in association with the proposed development of the hydroelectric potential of the lower Churchill River was initiated in 1998 through 2001, and resumed in 2005. Nalcor Energy and Innu Nation have developed and implemented a process for consultation in the communities of Sheshatshiu and Natuashish. An Innu Community Consultation Team was established in 2000 through funding and resources provided by Nalcor Energy to provide information and conduct ongoing consultation in the Innu communities related to the Project until mid-2008.

The Innu Community Consultation Team participated directly in discussions with Nalcor Energy, conducted reviews of the Project's environmental and engineering work, and consulted with Innu on these matters. The Innu Community Consultation process has also served as a forum for Innu Nation to consult with its membership during IBA negotiations.

Innu Nation officials and members participated in public open houses that were held in North West River, Sheshatshiu, Natuashish and Happy Valley-Goose Bay in 2007 and 2008. These open houses were held to seek public input respecting the Project for consideration in Project planning and the environmental assessment.

4.2.2 Labrador Inuit

Labrador Inuit are primarily resident in Nunatsiavut (the communities of Nain, Hopedale, Makkovik, Postville and Rigolet on the Labrador North Coast) and in the central Labrador communities of North West River and Happy Valley-Goose Bay, with other Inuit residing in Cartwright, Labrador City, St. John's and elsewhere. There are approximately 5,000 Labrador Inuit beneficiaries.

The Labrador Inuit Land Claims Agreement (Agreement) came into effect on December 1, 2005. This Agreement sets out the details of land ownership, resource-sharing and self-government within the area covered by the Agreement in Northern Labrador. The Agreement establishes the Labrador Inuit Settlement Area (LISA), in Northern Labrador and the adjacent coastal zone. Within the LISA, Labrador Inuit owned-land is referred to as Labrador Inuit Lands (LIL). The Agreement provided for the establishment of a regional Inuit government, referred to as the Nunatsiavut Government, which primarily has law-making authority over Inuit on LIL and Inuit rights throughout the LISA.

Although the Project's physical footprint does not include the lands under Nunatsiavut Government jurisdiction, Nalcor Energy has consulted with Nunatsiavut Government and invited Nunatsiavut Government representatives to Project open houses and to Nalcor Energy's series of technical workshops. An open house was held in Rigolet, a community within Nunatsiavut in September 2008 to address concerns that Project features might interact with Lake Melville.

4.2.3 Labrador Métis

The Labrador Métis Nation (LMN) comprises 6,000 members, who live throughout Labrador and elsewhere, with concentrations in the Upper Lake Melville area and along the southern coast of Labrador from Cartwright to Mary's Harbour. The Labrador Métis Association was established in 1985, and renamed the LMN in 1998. The LMN has asserted a land claim in the region that overlaps the lower Churchill River; however, this claim has not been accepted for negotiation by either the federal or provincial governments.

Nalcor Energy initiated discussions with the executive of the LMN in the spring of 2007. The LMN chose not to participate in some discussions and various consultation opportunities but, more recently, a series of meetings have been held to exchange information about the Project, the environmental assessment and possible LMN interests. These meetings have provided a basis for continued and ongoing Project-related discussions and consultation.

4.2.4 Quebec Innu

There are also Innu (not considered part of Innu Nation) who reside in 10 Innu communities in Quebec. The land claim areas of seven Quebec Innu communities extend into Labrador and are currently in various stages of comprehensive land claims negotiations with the Governments of Canada and Quebec. In accordance with the EIS Guidelines, Nalcor Energy has offered to meet with Quebec Innu groups in order to provide information about the Project and to allow Quebec Innu an opportunity to express their concerns and interests in relation to the Project. A number of these meetings have been held and the information shared is intended to enable the Quebec Innu to participate more effectively in the environmental assessment process.

4.3 Issues Identification

Key issues identified through consultation with the public, including Aboriginal groups, have been considered in Project design and planning and in the development of guidelines, policies and programs, as well as the identification of topics to be addressed in this EIS.

As one example of issues identification and follow-up, a meeting in Mud Lake provided a useful interchange that focused on travel across the lower Churchill River between that community and Happy Valley-Goose Bay. Nalcor Energy then directed its consultants to incorporate into their modelling studies a close examination of ice freeze-up and break-up timing during Project operations (how operation of the generation sites may influence downstream hydrology). As well, a resident of the community provided a long term record of freeze-up and break-up dates, which served to improve the quality of baseline data.

The issues most often identified in the public consultation process, to date, helped to determine the scope of the assessment and include:

- environmental assessment process;
- environmental effects to fish and fish habitat;
- involvement of Innu Nation and other Aboriginal groups;
- environmental effects on climate change;
- environmental effects on terrestrial and aquatic ecosystems;
- environmental effects on resource users;
- opportunity for input; and
- effects on socio-economic conditions.

Each of these issues has been considered and addressed by Nalcor Energy within this EIS, where appropriate. As well, Nalcor Energy plans to continue a dialogue through further meetings and discussions, and using the identified range of consultation mechanisms.

A separate detailed list of the issues identified through Aboriginal consultation includes:

- consultation regarding the Churchill Falls project;
- meaningful consultation;
- availability of Project information;
- Project effects on the Innu spiritual connection to the land;
- the effects of wage employment on traditional values;
- availability of country foods (e.g., loss of access, contamination);
- effects of employment on social problems such as alcohol and drug addiction;
- improved communication on the benefits of the Project to Innu;
- long term benefits; and
- training and employment.

4.4 Selection of Valued Environmental Components and Key Indicators

Biophysical and socio-economic VECs were selected primarily based on the consultation program and also on field programs, professional judgement and experience of the Study Team, as well as the requirements of the EIS guidelines. VECs are biophysical and socio-economic components that are valued by society and can be indicators of environmental change. Each of the VECs is important to the public and Aboriginal groups in terms of use, culture, or provision of conditions to support a healthy ecosystem.

To focus the environmental effects analyses, Key Indicators (KIs) were also chosen for each VEC, if appropriate. A KI is a sub-component of a VEC, and it provides a means to assess environmental effects on a VEC in more detail. The selected biophysical VECs and associated KIs are presented in Table 4-1. The socio-economic VECs and KIs are presented in Table 4-2.

Table 4-1 Biophysical Valued Environmental Components and Key Indicators

Valued Environmental Component	Key Indicator
Atmospheric Environment	Climate Air Quality
Aquatic Environment	Fish and Fish Habitat
Terrestrial Environment	George River Caribou Herd Red Wine Mountains Caribou Herd (Species of Concern) Moose Black Bear Marten Beaver Porcupine Waterfowl (Canada Goose and Surf Scoter) Raptors (Osprey) Upland Birds (Ruffed Grouse) Forest Songbirds (Wetland Sparrows) Harlequin Duck (Species of Concern) Other Species of Concern

Table 4-2 Socio-economic Valued Environmental Components and Key Indicators

Valued Environmental Component	Key Indicator
Economy, Employment and Business	Economy Employment Business
Communities	Physical Infrastructure and Services Social Infrastructure and Services Community Health
Land and Resource Use	Land and Resource Use is assessed at VEC level
Cultural Heritage Resources	Historic and Archaeological Resources

5.0 THE ENVIRONMENTAL ASSESSMENT PROCESS AND METHODOLOGY

As the Project proponent, Nalcor Energy was responsible for preparing this EIS under both the provincial and federal processes, and for ensuring that the scope and relevant guidelines were followed. To help prepare the documents, Nalcor Energy assembled an expert team of specialists in the wide variety of areas that the assessment scope identified. These included engineers, design specialists, biophysical and social scientists, health and safety specialists, managers, environmental analysts, writers and technical review teams. Many of these people have had considerable experience preparing successful environmental assessments for similar regulatory processes. Together this team accessed the best and most up-to-date science from around the globe, identified and considered best practice and mitigation measures from many jurisdictions, and reviewed the store of existing information about the Labrador environment and the issues that need to be considered.

The approach and methods used in the environmental assessment for the Project are compliant with the requirements of the *CEAA*, the *NLEPA* and Regulations, and the EIS Guidelines.

The environmental assessment focuses on issues of concern or potential environmental effects that have been identified based on expected Project-environment interactions. Examples of issues of concern or environmental effects for Terrestrial Environment KIs are change in habitat, abundance and distribution of populations, and change in health. Examples of issues or environmental effects for Communities KIs are change in ability to deliver physical infrastructure and services, change in ability to deliver social infrastructure and service, and change in health determinants. The assessment is organized around these identified issues of concern or potential environmental effects.

Aboriginal knowledge was an important consideration in the preparation of the EIS. Aboriginal, traditional and community knowledge has been incorporated in the assessment of relevant VECs or KIs. Sources of Aboriginal traditional and community knowledge include an Innu Traditional Knowledge Committee (ITKC) report and information gathered through informant interviews for Land and Resource Use.

This environmental assessment was developed in consideration of sustainable development and the Precautionary Principle. As required by the EIS Guidelines, the EIS demonstrates that Project activities were assessed and mitigation measures were discussed in a precautionary manner considering any potential for serious or irreversible damage to the environment, especially with respect to ecological functions and integrity, and ability to maintain biological diversity. Assumptions about the environmental effects of the proposed actions are explained, as well as approaches to reduce or avoid adverse environmental effects. The EIS identifies proposed mitigation and follow-up and monitoring activities, particularly in areas where scientific uncertainty exists in the prediction of environmental effects.

Because planning for the development of the lower Churchill River dates back more than 30 years, the EIS team was able to take advantage of an extensive existing body of knowledge about Project issues of concern and how the Project might affect the environment. In addition to these earlier sources, Nalcor Energy commissioned additional background studies and technical reports specifically for this current EIS. In all, more than 90 studies were completed, covering the full range of relevant subject matter. These studies cover a lengthy timeframe and provide a substantial storehouse of information, which has been incorporated into the three EIS volumes.

The Study Team, in preparing the environmental effects predictions, was able to employ an extensive database in the analysis of interactions. While professional judgement is still an important ingredient in making effects predictions, the Study Team relied extensively on state-of-the-art predictive models as listed in Table 5-1.

Table 5-1 Predictive Tools and Database Technologies used in the Environmental Impact Statement

Predictive Tools	Database Technologies
• Oceanographic - MEFL3D • Ice Dynamics - HEATSIM, ICESIM • River Hydraulics - HEC-RAS • Methylmercury Model • Water and Sediment Transport - SRH-ID, HEC-RAS • Bank Stability Model • Sediment Plume Dispersion - FLOW-3D • Salt Water Intrusion - DHI MIKE 3 MODEL • Noise Dispersion - US Department of Transportation Traffic Noise Model (TNM) • Economic Effects • GHG Emissions - IPCC TIER 1, 2 and 3 • Digital Elevation Modeling • Ecological Risk Assessment • Hydraulic Production Models • Water and Sediment Quality Model	• Geographic Information System • Light Intensity Detection and Radar (LiDAR) • Real Time Water Quality Monitoring Network • Hydrometric Stations • Three-Dimensional Imaging • Ecological Land Classification

5.1 Innu Traditional Knowledge

Throughout the planning and research for the environmental assessment, Nalcor Energy has and continues to work closely with Innu Nation. A joint Innu Nation/Nalcor Energy Environmental and Engineering Task Force was established in 2006 to discuss and plan the assessment. It was recognized that Innu Traditional Knowledge (ITK) is an important contribution to understanding the environment in which the Project would be built and operated; consequently, the Task Force put in place an ITKC. The ITKC was established to discuss, document and share ITK for consideration in the EIS. The ITKC comprised Innu Elders and a Researcher/Facilitator, and was in place from July 2006 until mid-2007. The Committee met regularly over that period, to discuss and share Innu information and perspectives. While sponsored by Nalcor Energy, the approach and methodology used to collect ITK was developed by the Innu themselves. The ITK documented through this process was provided by Innu Nation as a separate report entitled *Innu Kaishitshissenitak Mishta-shipu, Innu Environmental Knowledge of the Mishta-shipu (Churchill River) Area of Labrador in Relation to the Proposed Lower Churchill Project*. The document is included in the EIS as a distinct appendix (Volume IB, Appendix IB-H) and, as relevant and appropriate, referred to throughout the EIS, according to a protocol developed between Nalcor Energy and Innu Nation. The types of Information in the ITKC Report include:

- factual/rational knowledge about the environment;
- factual knowledge about past and current use of the environment;
- values about how things should be and what is proper to do in relation to the environment; and
- Innu cosmology by which information about the environment is organized.

In general, ITK has been used in the assessment in the following ways:

- considered in alternatives selection;
- incorporated into description of existing environment;
- considered in development of effects management measures;
- considered in the analysis of environmental effects; and
- considered in development of monitoring and follow-up programs.

Compilation of ITK and the extensive research and field surveys for cultural heritage resources for the EIS have enhanced the overall database and understanding of historical and contemporary use of the Churchill River and surrounding landscape.

5.2 Local Knowledge

Local knowledge augments available statistical and/or officially collected information to provide both a qualitative and quantitative context for the assessment. Local knowledge was obtained through:

- focus groups;
- interviews and discussions with representatives of public and private training groups;
- technical workshops;
- community meetings such as the meeting in Mud Lake, which provided access to important information regarding ice formation and break-up; and
- open houses and focused face-to-face or telephone surveys.

Nalcor Energy believes that sustained communication with residents in the area that may be affected by the Project is a priority. Nalcor Energy also believes that the communities and businesses of Upper Lake Melville area, Churchill Falls and western Labrador, and the Province in general, should have timely and accurate information about the Project. Collection and maintenance of local knowledge will be an ongoing feature of the Project. A drop-in storefront Community Information Centre is scheduled to open in Happy Valley-Goose Bay in 2009. The centre will provide an accessible and inclusive resource that will demonstrate Nalcor Energy's commitment to provision of timely and accurate Project information. The centre will also seek to receive feedback on the Project through dialogue with the interested public. Local knowledge will be an important input to the Project's EPP and will be used in the development of monitoring and follow-up programs

5.3 Assessment Methods

With the early identification of issues, the availability of local and traditional knowledge, the extensive background data available coupled with state-of-the-art predictive tools and technologies the Study Team was able to make accurate, albeit conservative, predictions regarding the interactions of the Project with the biophysical and socio-economic environment. The steps used to arrive at these predictions for each VEC and/or KI are described as follows:

- Appropriate spatial and temporal boundaries were established to help focus the assessment. Boundaries included an Assessment Area, which is the spatial extent within which the significance of Project environmental effects are determined as well as ecological and socio-economic boundaries, and administrative and technical boundaries;
- Existing conditions were described using the information sources and models described above;
- Criteria were developed for describing potential effects including nature, magnitude, geographical extent, timing, frequency, duration, reversibility, ecological context and level and degree of certainty of knowledge. Where applicable, biological diversity (i.e., species richness) and environmental protection goals and objectives are also considered;
- Using the criteria listed above, the definition of a significant residual adverse environmental effect was provided; this is the threshold beyond which any changes or environmental effects resulting from the Project were considered to be significant;

- Potential interactions between all Project activities and components and all identified VECs and KIs were identified using an interactions matrix;
- Measurable parameters were identified which are a measurable aspect of a VEC or KI that can be quantified and compared against a baseline value or condition;
- Environmental effects were assessed for each of the Project phases (i.e., construction and operation and maintenance), for accidents and malfunctions, and specifically for each Project activity. Included within the assessment of each environmental effect was the identification of proposed environmental effects management, which includes planned mitigation and optimization measures;
- Residual adverse, and in some cases positive, environmental effects were rated as **significant** or **not significant** according to the significance definitions developed for each VEC or KI. Any significant adverse effects were further qualified based on the likelihood of the effect occurring and the capacity of a renewable resource affected to meet the needs of present and future generations;
- The cumulative environmental or socio-economic effects of the Project in combination with the effects of other past, ongoing and reasonably foreseeable future projects and activities were assessed; and
- The need for any monitoring and follow-up was identified, focusing in particular on any effects with a high level of uncertainty in keeping with the Precautionary Principle.

6.0 REGIONAL SETTING

The Project is located in the Churchill River watershed, which covers an area of 92,355 km^2 in central Labrador (Figure 6-1), extending from beyond the Smallwood Reservoir in the west to Lake Melville in the east. The Churchill River flows into Lake Melville that, in turn, flows into the Labrador Sea.

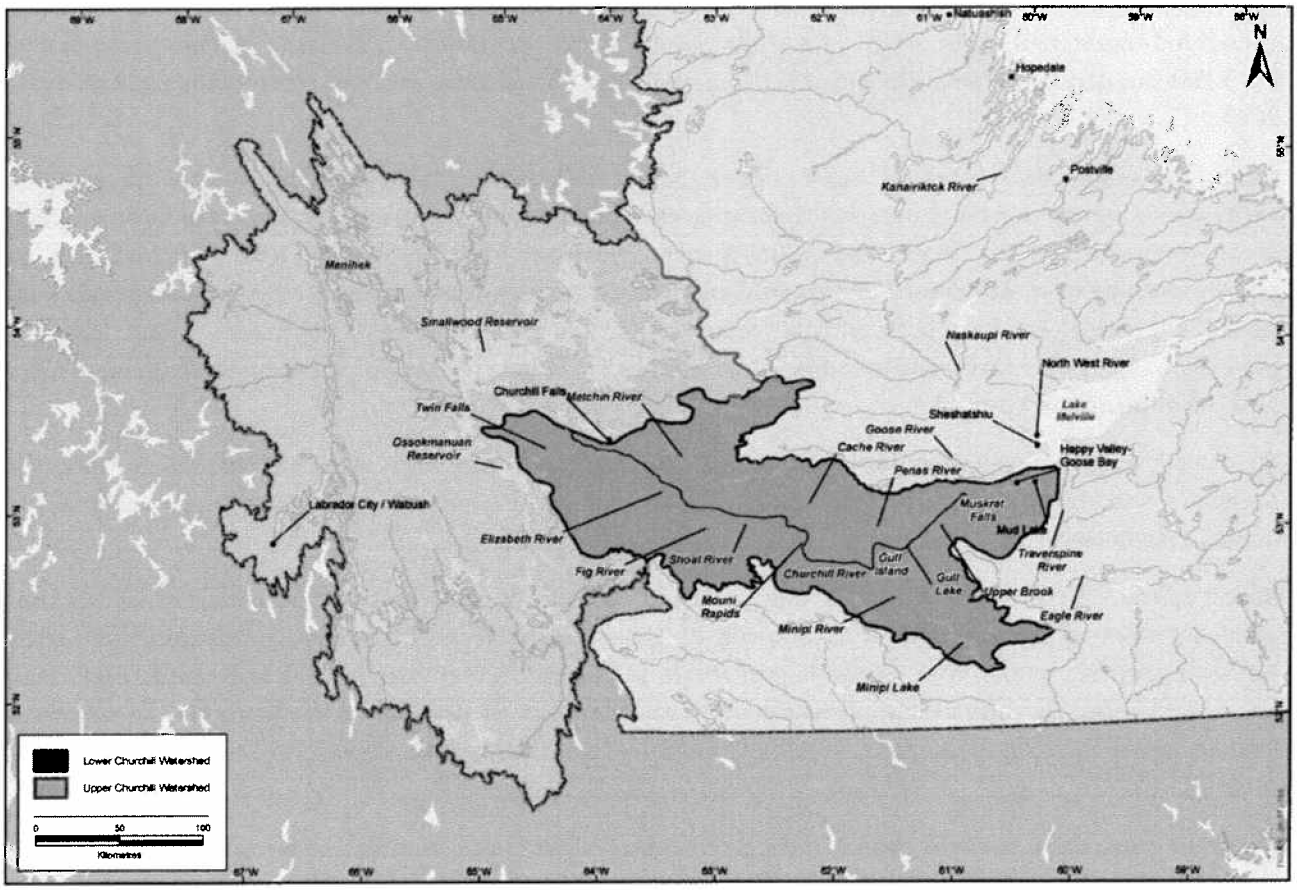

Figure 6-1 Central Labrador and the Churchill River Watershed

6.1 Ecological Setting

The land area of Labrador is approximately 295,000 km^2, with most of this being wilderness. The climate influences the landscape with intense, low-pressure weather systems characterizing the fall, winter and early spring seasons, and strong winds and heavy snowfall and rainfall are common along the Churchill River valley. Occurrences of fog and strong winds decrease with distance inland from the coast. The lower Churchill River valley and associated watershed is an area of transition between Arctic and sub-Arctic climates. Vegetation in the river valley is typical of Boreal and Taiga ecosystems which are adapted to nutrient-poor conditions and extremes in weather. Black spruce coniferous forest is by far the most common habitat in the watershed; in some areas, it is intermixed with balsam fir, tamarack and hardwood species, most notably trembling aspen, white birch and heartleaf birch. Feathermoss, sphagnum moss and cladina lichen are the most common ground cover in these forests. The landscape also includes extensive bogs and fens.

6.1.1 Wildlife

Caribou is the most important wildlife resource in Labrador, supplying an important source of food, cultural, recreational and economic benefit for residents and non-residents. The George River (GR) Caribou Herd, estimated at 296,000 individuals, is a migratory population that ranges approximately over 900,000 km^2 of Labrador and northern Quebec. In recent years, part of this Herd has wintered within the lower Churchill River valley near Winokapau Lake. Of greatest concern within the lower Churchill River watershed is the RWM Herd, considered threatened under Schedule 1 of the *Species at Risk Act* (*SARA*). This Herd was considered stable in the 1980s but declined dramatically to 151 animals by 1997, with a further decrease to less than 100 animals by 2003.

Other large mammals in Labrador include moose, which are known to congregate in the lower Churchill River valley during winter, and black bear, which is the largest predator in the watershed. A variety of furbearers occur in the lower Churchill River watershed including wolf, coyote, red fox, lynx, marten, weasel, ermine, mink, river otter, snowshoe hare, Arctic hare, red squirrel and beaver. Porcupine are currently increasing in Labrador after several decades of apparent scarcity. Small mammals include red-backed vole, which occurs most frequently, meadow vole, masked shrew and meadow jumping mouse. The little brown bat and northern long-eared bat are also known to occur in Labrador.

The main groups of birds expected to occur in the lower Churchill River valley include raptors, waterfowl, forest songbirds, shorebirds and upland game birds. Species may be resident year round or migrate seasonally and occupy essentially all habitats.

Raptor species in the region include Osprey, which in Labrador tend to nest near waterbodies, at the top of dominant white or black spruce, or occasionally on large rocks. Cliff-nesting species in this watershed include Golden Eagle, Red-tailed Hawk, Rough-legged Hawk, Merlin, and Great Horned Owl. Red-tailed Hawk, Merlin and Great Horned Owl also nest at or near the tops of trees, as do Sharp-shinned Hawk and Northern Goshawk. Bald Eagle typically build their nests in large, mature trees but, in Labrador, they also use large rocks for nest sites.

Given the expanse of wetland habitat throughout Labrador, the large numbers of waterfowl that breed here contribute substantially to the fall flight along the Atlantic Flyway. Waterfowl in central Labrador can be subdivided into an early-nesting group, comprising dabbling ducks and geese, and a late-nesting group, comprising sea ducks and diving ducks. The most common of the early-nesting waterfowl in the watershed are Canada Goose, American Black Duck and American Green-winged Teal. These species are associated with marshes and other well-vegetated wetlands. They may stage briefly in spring, but quickly move on to breeding sites.

Late-nesting waterfowl most commonly found breeding along the lower Churchill River are Common Goldeneye and Common and Red-breasted Merganser. Several tributaries of the lower Churchill River support Harlequin Duck. The eastern population found in Nunavut, Quebec and Atlantic Canada was designated as a Species of Special Concern by *SARA* in 2001. Other species breeding in the watershed are Lesser and Greater Scaup, Ring-necked Duck and Surf Scoter. The status of Barrow's Goldeneye, designated as a Species of Special Concern by *SARA* in 2000, is unclear, but breeding has not been confirmed in the watershed. All these species are typically associated with relatively deep open water, although many nest among vegetation in relatively shallow wetlands. Most of these species stage in spring along open parts of the lower Churchill River prior to dispersing to breeding sites.

Songbirds in the watershed include members of the flycatcher, corvid, thrush, warbler, finch and sparrow families. Collectively, they occupy the full range of terrestrial habitat from riparian areas to burns to mature forest. Species of special status include Rusty Blackbird (Species of Special Concern according to the Committee On The Status of Endangered Wildlife in Canada (COSEWIC)), Olive-sided Flycatcher (Threatened according to COSEWIC) and Grey-cheeked Thrush (Vulnerable according to the Newfoundland and Labrador *Endangered Species Act* (*NLESA*)). While not considered a songbird, Common Nighthawk (threatened according to COSEWIC) also breeds in this watershed.

Upland game birds occupy a wide variety of habitats throughout Labrador - Spruce Grouse, Ruffed Grouse, Willow Ptarmigan and Rock Ptarmigan. All these species are hunted by residents who often collectively refer to them as partridge.

6.1.2 Fish and Fish Habitat

Twenty-two fish species use freshwater habitat in the Lake Melville area for at least a portion of their life history. Seventeen fish species have been recorded in the Churchill River above Muskrat Falls. The dominant species in the main stem above Muskrat Falls are longnose sucker, white sucker, lake whitefish (normal and dwarf form), brook trout, ouananiche and northern pike. Arctic char have been recorded in lakes on the plateau (e.g., Minipi and Dominion lakes) but have not been recorded in the main stem of the Churchill River or in any tributary below obstructions (e.g., falls). Anadromous Atlantic salmon do not occur above Muskrat Falls. In general, total standing stock and productivity are low and typical of northern watersheds, reflecting low nutrient input, as well as the key limiting conditions imposed (on stream systems in particular) by winter freezing temperatures and reduced surface flow.

Most of the lower Churchill River itself flows over bedrock and coarse sediment comprising boulders and rubble, with occasional gravel and finer material. The river lies within a well defined channel throughout much of its length from the Churchill Falls tailrace to the confluence of the Minipi River. The gradient is generally moderate to steep (for a large river), except along a deep fault that forms a deep, narrow lake (Winokapau Lake). Generally, the riverbed and banks are stable. The shoreline areas are reflective of the effects of ice pans washing downstream in the spring, especially in areas of high gradient and rapids. This acts to scour riverbanks of any perennial vegetation, leaving a zone that is either devoid of growth or hosting only seasonal riparian grasses and shrubs.

The valley downstream of the Minipi River confluence changes in character with thick (100 to 150 m deep) deposits of marine sediments. These fine clay and sand materials have been eroded by the river with the result that much material has been moved downstream to form the delta at the mouth, as well as producing a moving pattern of shoals and sandbars that turn the river into a braided, wandering channel below Muskrat Falls.

6.2 Socio-economic Context

Labrador has a rich cultural history and a diverse socio-economic environment, ranging from small coastal communities, to the Upper Lake Melville government and services centre, to areas of intense mining activity in western Labrador and at Voisey's Bay. In 2006, 26,364 people lived in 32 communities across Labrador. The two largest population clusters are Upper Lake Melville, which includes the communities of Happy Valley-Goose Bay, Sheshatshiu, North West River and Mud Lake; and Western Labrador, which includes the communities of Labrador City and Wabush. The other Labrador communities are scattered along the coast. The total population of Labrador has been declining since 1991 and, without any major changes to the economy, is expected to show a further slight decrease over the next decade. Approximately one-third of Labrador residents are of Aboriginal descent, including Innu, Inuit and Métis.

6.2.1 Recent History

In contemporary times, a number of development projects have taken place in Labrador, resulting in substantial changes to the traditional ways of life of its people. The construction of the military base at Happy Valley-Goose Bay in the early 1940s marked an important turning point in existing land and resource use and settlement and subsistence patterns, by offering steady, wage employment to many Aboriginal and non-Aboriginal residents of the Upper Lake Melville area and beyond. As a result of the shift to wage employment, fewer people travelled to the interior to partake in traditional activities, such as hunting and trapping. Of those who continued with this land use pattern, they did so for shorter periods of time. A second key event that occurred in the Recent Period and resulted in substantial changes to existing cultural and social patterns was the settlement of Innu in the communities of Sheshatshiu and Utshimassits (Davis Inlet) in the 1960s. This change, put in place by the Government of Newfoundland and Labrador, resulted in less use of the Labrador interior and an alteration of traditional Innu harvesting patterns. The Mushuau Innu resettled from Davis Inlet to Natuashish in 2002 and 2003.

Other recent developments in the region include construction of the Churchill Falls Power Station and production of mining deposits at Labrador City. Both these projects have brought substantial economic benefits to the region and the Province. The TLH Phase I improved access to the interior, which has further affected the nature and intensity of land and resource use in the lower Churchill River area by Labrador residents. In 1996, a Regional Government Service Centre was established in Happy Valley-Goose Bay, serving as a hub for administration of Government services in central and northern Labrador, and creating jobs for residents in the town. Most recently, the Voisey's Bay Mine/Mill Project on the Labrador north coast near Nain has resulted in considerable business and employment opportunities to Labrador. Happy Valley-Goose Bay serves as a pick-up area and administration centre for the mine/mill. Since the start of operations, the majority of employees have been from Labrador and most of these are Inuit or Innu.

6.2.2 Communities

Located at the mouth of the Churchill River near Lake Melville, Happy Valley-Goose Bay has a population of 7,572 and is the largest community in Labrador. It is the centre of economic activity for central Labrador, as well as the north, southeast and Labrador Straits regions, providing government, health and post-secondary education facilities for the region. The economy has traditionally been related to the operation of the military base around which the community developed. The base, now known as 5 Wing Goose Bay, has been the primary employer in the Upper Lake Melville area since the 1940s and, with current employment levels of 400 civilians and 100 military personnel, the base continues to play a major role in the regional economy. Additionally, the local retail and service sector has developed over the past 60 years. The Happy Valley-Goose Bay economy is primarily wage-based but many area residents, particularly in the smaller communities of the Upper Lake Melville area, continue to pursue subsistence land use activities for cultural reasons and to supplement their income.

Mud Lake, North West River and Sheshatshiu are located close to Happy Valley-Goose Bay, near Lake Melville, and have a combined population of 1,604. Government services, including health care, education and social services, are the main employers of the residents of these communities, many of whom work in Happy Valley-Goose Bay. North West River and Sheshatshiu are connected to Happy Valley-Goose Bay by road. Sheshatshiu is an Innu community with Federal Reserve status and is managed by a Band Council.

Churchill Falls is located approximately 300 km west of Happy Valley-Goose Bay and the community is operated by, and most residents are employed by, Nalcor Energy-Churchill Falls. Although there is a small service sector, the Churchill Falls Power Station is at the centre of the community's economy.

6.2.3 Land Use

Land and resource use activities throughout Labrador include hunting and trapping, angling, wood harvesting, berry picking, snowmobiling and boating. Both Aboriginal and non-Aboriginal persons are active land and resource users and this use occurs for traditional and recreational purposes. For residents of the Upper Lake Melville area and Churchill Falls, this activity is generally focused on the areas adjacent to the TLH Phase I between Happy Valley-Goose Bay and Churchill Falls. It also takes place around Grand Lake and many of the former homestead communities near Upper Lake Melville. For both Aboriginal and non-Aboriginal persons in central Labrador, land use activities take place throughout the year. Residents of western Labrador also travel to central Labrador for recreational reasons.

Innu land and resource use for subsistence and traditional purposes is widespread; however, current use, including the establishment of camps and the opportunistic harvest of caribou, porcupine, beaver, ptarmigan and other species, is focused on areas adjacent to the TLH Phase I between Happy Valley-Goose Bay and Churchill Falls. Other areas used include the area south of Lake Melville, particularly along the Eagle River and its tributaries.

An important element of land and resource use is the tourism industry, particularly in central Labrador. The Central Labrador Economic Development Board reports that at least 25 percent of its businesses have self-identified as tourism related. Tourism is expected to increase in the region, with the pending establishment of the proposed Mealy Mountains National Park.

7.0 THE BIOPHYSICAL ASSESSMENT

7.1 The Biophysical Environment and Effects

The Biophysical Assessment (Volume IIA and Volume IIB) considers aspects of the natural environment (land, air, water, plants and animals) in which the Project will occur. During the many community and Aboriginal consultations held to date, one common theme, especially amongst Innu, has been concern as to the legacy from the Project, for those living in the area as well as for the residents of the Province and for society in general. To understand how the Project will affect individual components of the environment, such as wildlife or fish populations, it is first necessary to understand how the Project will alter the landscape. Based on the many studies and models employed in preparation of the EIS the following section answers these questions.

The lower Churchill River will be changed by the Project, both in terms of gradient and depth. During construction, the reservoirs will, where feasible, be cleared of vegetation, almost entirely for Muskrat Falls Reservoir, and along a band throughout the Gull Island Reservoir. In the area to be flooded for the reservoirs, approximately 70 percent of the vegetation within the area to be flooded will be removed. This will create a zone that extends from well below the water level to the shoreline and, in some locations, back from the water's edge up to a maximum, in some cases, of 15 m horizontal distance. The water surface, shoreline and riparian areas will develop in a manner similar to that at present. Along the shoreline and back from it, the ground will consist of stumps and low vegetation. Within approximately seven years following the start of operations, shrubs and young trees will have grown back along the shorelines. Small shrubs and bushes (flood-tolerant species) will be present in a relatively narrow zone one to two metres wide along the shoreline.

At selected locations, the re-growth will differ. At the new mouths of many large tributaries, new deltas will evolve with gravel shoals and shallows, which will provide habitat for fish as well as some plants, waterfowl and wildlife. One area of the reservoir will be prepared by Nalcor Energy to encourage the establishment of hardwood vegetation such as Ruffed Grouse habitat. At other locations, Nalcor Energy will encourage areas of wetland habitat (riparian marsh) to be available for associated species such as wetland sparrows. These species have specialized habitat requirements that are focused on locally uncommon habitats in the Assessment Area.

Within each reservoir, water velocity will be reduced and laminar (smooth surface) flow will occur more frequently. None of the rapids will be present any more, but visible currents will occur between the Churchill Falls Power Station tailrace and Winokapau Lake, as well as below Winokapau Lake. The reduction in current velocity is a direct function of the increased depth of water. The deepest water will be found at the face of the Gull Island dam. Because it will be wider, Muskrat Falls Reservoir will be relatively slow moving.

Ice will cover most of the reservoirs each winter, except in the few areas with high velocity flows, at the mouths of major tributaries and at each tailrace. The ice cover will be stable and thick. Ice melt will occur earlier than surrounding areas. During spring runoff, the moderated flow and low velocities (relative to existing conditions) will mean that most ice will melt in place so that there will be little, if any, ice scour along the banks. Freeze-up along the river downstream of Black Rock Bridge will be approximately two weeks later than at present (December). Breakup will be delayed approximately one to two weeks than at present (May).

At the new water level, the forces of wind will act on the shoreline to create waves that can act on erodible soils to undercut banks and produce failures that eventually create a new beach at the waterline. The higher water levels of the two reservoirs will mean that the gradient for groundwater will be lower as it drains to the river. Thus, the larger scale slumps which characterize the area below Gull Lake will now occur less frequently. At a smaller scale, the new shorelines will produce beach areas by eroding along the steep sandy banks.

Within the Gull Island Reservoir, the development of new beach sections along the shoreline will occur slowly and will be confined to areas with sands and clays present along the banks. Within the Muskrat Falls Reservoir, with its fine sand and clay banks, the new shoreline will be relatively active as a result of wave-induced erosion leading to small failures that will form a beach in a manner equivalent to the pattern of erosion that is now witnessed. However, large slumps will be less common.

Downstream of the reservoirs in the section of river to the mouth, the flow pattern will be unchanged; however, there will be notable differences in the ice regime and breakup pattern due to the increased temperature of the water and absence of an ice dam that is now present each year in the pool below Muskrat Falls. In addition, the river will tend to flow deeper and meanders will be reduced over time as a result of the removal of suspended solids from the water. The water in the river will spend more time within the two reservoirs and hence will warm up a small but measurable amount so that, when discharged at the dam, the downstream area will take a little longer to freeze each fall. As well, ice pans and frazil ice will not pass below the dam, so there will not be a source for river blockage. At the river mouth, the noticeable changes will occur in fall and spring. Freeze up will be delayed each year by approximately 10 days. In the spring, the melt will start approximately one week later.

The new reservoirs will have well-developed riparian vegetation with a narrow band of water-tolerant species, and a narrow beach area generally. For animals approaching the river, there will be ready access to the shores, such that entry and exit will not be impeded because cleared trees will have been removed during the reservoir preparation. The stable ice cover in winter will facilitate travel along or across the water bodies. The process of beach development will occur throughout the two reservoirs, but will be of low intensity (almost imperceptible) in Gull Island Reservoir. At Muskrat Falls Reservoir, shoreline erosion will be greatly moderated; however, less so on the south side, where wave action will result in continued slumps. Overall, the rate of slides and slumps will be reduced from the current rate, especially once beaches develop in an estimated 10 to 15 years.

The new reservoirs will provide water areas that can be accessed by people (e.g., recreational boating) and wildlife (e.g., caribou that move across the valley). In summer, the stable water levels, clear shoreline and lower water speed will make such passage easier. In winter, the ice cover will have the same effect. The before and after views of the Gull Island Reservoir at the confluence of the Cache River are illustrated in Figure 7-1.

Given the above changes in the landscape of the lower Churchill River Valley, the potential environmental effects of the Project that were assessed for the biophysical environment include:

- change in climate;
- change in air quality;
- change in habitat, distribution, health, or abundance of fish and wildlife populations; and
- fish and wildlife mortality.

7.2 Effects Management

Nalcor Energy is committed to following best practices in the construction, operation and maintenance of the Project. As such, Project- and phase-specific EPPs will be developed so that all aspects of environmental protection planning are incorporated into all phases of the Project. Nalcor Energy will implement mitigation measures to limit environmental effects on the biophysical environment (Table 7-1).

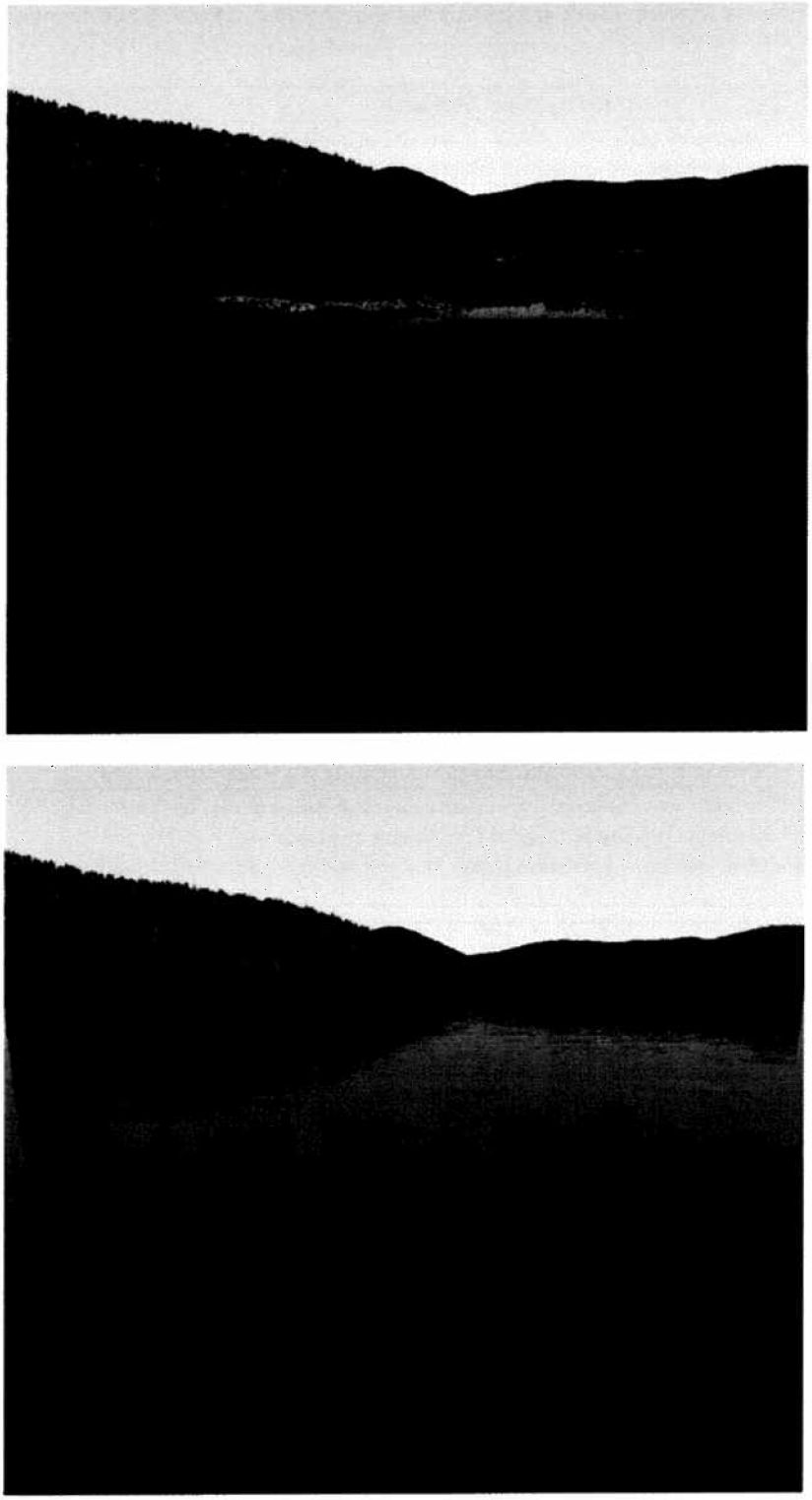

Figure 7-1 Profile and Viewscape of Cache River Before (top) and After (bottom)

Table 7-1 Specific Environmental Effects Management Measures for Biophysical Valued Environmental Components

VEC	Effects Management Measures
Atmospheric Environment	• conduct work according to regulations, guidelines, the EPP and codes of good practice • maintain emergency preparedness plans and implement in the event of an accident or malfunction • prohibit burning of slash or debris • rehabilitate work areas and access roads no longer required in accordance with the EPP to encourage formation of natural conditions • maintain vehicles and other equipment in good working order, comply with federal emissions and efficiency standards • control emissions of dust, vehicle emissions, and thereby GHG by posted speed limits • use dust suppressants where and when needed; dust-control measures implemented during windy conditions • implement anti-idling policy regarding vehicle operation
Aquatic Environment	• no harvesting policy for Project personnel • environmental awareness training and regular briefings for all personnel • oversee EPP using environmental monitors • locate construction and reservoir clearing roads within the reservoirs where possible • control siltation, erosion and runoff in accordance with standard practices and guidelines from federal and provincial governments • apply herbicides by hand from the ground, if used • implement blasting activities in compliance with all government laws and regulations • reduce or avoid fording activities • handle fuel and hazardous material consistent with provincial regulations • remove vegetation to moderate nutrient release into the aquatic ecosystem • implement measures to facilitate or create development of habitat consistent with the *Fisheries Act*
Terrestrial Environment	• no harvesting policy and no harassment of wildlife, and no possession of firearms or pets by Project personnel • implement environmental awareness training and regular briefings for all personnel • oversee EPP using environmental monitors; use existing roads, quarries and other disturbed areas where possible • restrict access to temporary roads and work areas; post speed limits • locate construction and reservoir clearing roads within the reservoirs where possible • maintain vehicles and other equipment in good working order, with mufflers and regularly inspected • rehabilitate work areas and access roads no longer required in accordance with the EPP to encourage formation of natural conditions • undertake blasting in accordance with permits and standard procedures • handle liquid waste treatment in accordance with provincial regulations; solid waste stored in bear-proof containers and recycling program implemented. Temporary camps will also have approved waste management systems • handle fuel and hazardous material consistent with Provincial regulations • apply herbicides by hand from the ground, if used • remove trees during reservoir preparation such that surface will provide unimpeded access for wildlife • reduce risk of disturbance to avifauna nests through avifauna environmental management plan • continue participation as member of the Labrador Woodland Caribou Recovery Team and support research and other management initiatives • avoid disturbing and/or clearing sensitive wildlife areas during reservoir preparation • relocate active Beaver colonies within reservoirs prior to impounding • replace physically disturbed Osprey nests with artificial platforms. Restrict activities within 200 m of active nests • clear vegetation at FSL to encourage development of a new riparian zone • create conditions for establishing the formation of hardwood forest at selected locations in the Muskrat Falls Reservoir • encourage formation of riparian marsh wetland at selected locations in the watershed • leave riparian vegetation in place at selected areas during reservoir preparation • use existing right-of-way corridors for construction of transmission line where possible • schedule activities related to transmission line construction around sensitive periods (areas)

7.3 Residual Environmental Effects

7.3.1 Atmospheric Environment

With respect to Climate and Air Quality, the Project could result in changes in GHG emissions both during construction and operation and changes in air quality relative to the existing baselines. The Project will generate GHG during construction as a consequence of engine exhaust from the various equipment and vehicles needed to move material and construct the facilities. During operation and maintenance, the reservoirs will generate GHGs at a level comparable to or lower than natural water bodies. The GHG emissions were analyzed in detail and found to be "low" as defined by the national guidance for environmental assessments. Overall, the Project will result in a net benefit from a GHG perspective, producing electricity with substantively lower emissions compared to other forms of electricity generation.

The air contaminant emissions from the Project will not result in ambient air quality concentrations that exceed either provincial or federal standards and objectives. During construction, vehicles and equipment will comply with federal vehicle emissions and energy efficiency standards, there will be no burning of slash or debris, dust suppressants will be applied where required and feasible, equipment maintenance schedules will be followed and, during windy conditions, dust control measures will be applied to Project activities, where needed. Activities involving fuel combustion will comply with regulatory requirements for vehicle emissions and fuel quality. These measures, along with a policy to limit non-essential idling of vehicles, will be established through appropriate leasing or purchasing agreements and maintenance schedules. Environmental effects are rated as **not significant** for the Atmospheric VEC.

7.3.2 Aquatic Environment

The Project will result in the loss of 126 km^2 of terrestrial habitat, or approximately 12 percent of the area comprising the lower Churchill River valley. This habitat is not lost in absolute terms, but will be flooded. The experience of reservoirs on the Ungava Peninsula (Labrador and Quebec), Island of Newfoundland and elsewhere demonstrates that, even in the absence of any mitigation measures, such areas become productive fish habitat. The action of preparing the new shallow water areas and riparian zones will further enhance the quality of such habitat. In addition, studies completed over the past 30 years confirm that the existing fish habitat is less than ideal because of the relatively high velocities in much of the river. While fish species have adapted to the existing velocity conditions, the altered and created habitat within the Gull Island and Muskrat Falls reservoirs will be slower and more similar to preferred habitats of most species.

In addition to the anticipated surge in nutrient input associated with impoundment, the changes in the physical features of the lower Churchill River will improve the suitability of habitat for most of the species present. Fish and fish habitat will adjust to the changes associated with the creation of the Gull Island and Muskrat Falls reservoirs. Water management and reservoir operating regimes will stabilize shoreline habitat and habitat use by maintaining water level fluctuations within or less than existing conditions. The result will be a net gain of productive fish habitat. The EPP will incorporate all procedures consistent with legislation and best practices to reduce environmental effects of the Project on the Aquatic Environment. The environmental effect of the Project on the Aquatic Environment is subsequently considered as **not significant** during construction and positive during operation and maintenance.

7.3.3 Terrestrial Environment

As with other aspects of the biophysical environment, Nalcor Energy will establish a series of contract specifications, policies and other measures to reduce environmental effects on the Terrestrial Environment. These include mitigation measures related to site personnel and environmental awareness, surface disturbance, access roads, noise, rehabilitation, blasting, waste management, construction camps, hazardous materials, operation of quarries and borrow pits and transmission line maintenance.

The environmental effects to the 14 KI species or species groups will vary, depending on the nature of the population. The primary environmental effects are due to alteration in habitat, and increased hunting or trapping pressure. The impoundment associated with the Project will affect 12 percent of the land area of the lower Churchill River valley. For most species, alternate habitat is available throughout the lower Churchill River watershed to accommodate displaced animals. For those species where preferred habitat is limited in distribution and abundance (e.g., riparian marsh wetland, deciduous hardwood), effects management measures to develop adequate alternate habitat will be implemented. To further reduce effects of habitat fragmentation, the number of access roads will be limited. As a result, the Project will not jeopardize the sustainability of the wildlife populations in the area.

The impoundment of the reservoirs will expose the soils to water and the mercury in the soil will enter the aquatic food chain. The existing levels in fish will increase for a period of up to 15 years, after which time they will begin to return to background levels. The existing levels of mercury in fish of the lower Churchill River has been measured and modelling has been used to predict the rate and eventual levels that will be reached in fish. An ecological risk assessment identified the pathways and receptors for mercury accumulation. One important pathway is through fish to Osprey. As a top predator with a fish diet, projections for these birds can serve to indicate the level of concern in the ecosystem generally. Results confirm that, while levels of mercury in fish will become elevated, there will not be a significant environmental effect on Osprey, and by inference to other receptors in the food chain.

In some locations, there will be increased mortality on wildlife from vehicle collisions and there will also be increased mortality as a result of increased harvesting pressure by hunters on certain species. Several mitigation measures, such as establishing the rules of the road, posting speed limits on Project access roads and working with local authorities on issues related to speeding on the TLH, will be implemented. Overall, effects of the Project on the Terrestrial Environment are adverse, but considered **not significant**.

7.3.4 Accidents and Malfunctions

The environmental effects of accidents and malfunctions were also assessed. While the focus of Nalcor Energy is on prevention and preparedness, selected worst-case scenarios were nonetheless considered for the range of Project activities and features that could fail with important environmental consequences. Accidental scenarios that met this criterion were developed for dam failure and forest fire caused by the Project. In both cases, **significant** adverse environmental effects may result, although the event is not likely. Nalcor Energy will focus on the prevention of accidents and malfunctions through the implementation of the EMS, Forest Fire Prevention Plan and adherence to stringent dam design requirements. Contingency Plans and Emergency Preparedness Plans will also be developed.

7.4 Biophysical Cumulative Environmental Effects

Cumulative environmental effects that may result from the Project in combination with other projects and activities were also assessed. With the application of Project-specific effects management measures, and with

appropriate planning and enforcement by relevant government agencies, the cumulative environmental effects will be **not significant**, with the exception of the RWM Herd.

The RWM Herd is listed as threatened under the *NLESA*, and also under *SARA* (Schedule 1). The Herd, numbering fewer than 100 animals, has been declining due primarily to illegal hunting and predation. There is additional pressure from a number of other activities including forest harvesting, mineral exploration, paving and expansion of the TLH. While the residual effects of the Project are not significant, the potential effects of these other influences is significant, with or without the development of the Project. Given the low population size and ongoing natural and anthropogenic influences, the future of this Herd is uncertain. Nalcor Energy will continue its active participation on and support for the Labrador Woodland Caribou Recovery Team, including related research, with the aim of advancing understanding of population dynamics and limiting factors.

7.5 Monitoring and Follow-up

Monitoring and follow-up programs are designed to verify environmental effects predictions made during the environmental assessment, and to assess the effectiveness of the implemented mitigation measures. Monitoring and follow-up programs are proposed in the EIS, with details to be developed in consultation with government, Innu Nation and other stakeholders prior to Project initiation. Compliance monitoring includes:

- real time water quality monitoring;
- Nalcor Energy site environmental monitor positions; and
- contractors site environmental monitor positions.

The EIS has also identified the following programs to monitor specific predicted adverse effects on the biophysical environment:

- reservoir GHG emissions;
- methylmercury in fish;
- habitat compensation areas;
- reservoir fish to determine if no net loss of productive fish habitat is achieved;
- Labrador Woodland Caribou Recovery Team support;
- Moose seasonal movements to examine change in moose abundance and distribution in areas adjacent to the Project footprint;
- Black Bear seasonal movements (including human-bear interactions, denning activity near quarries, and other sites) to examine change in bear abundance and distribution in areas adjacent to the Project footprint;
- forest songbirds - transect surveys to determine success of compensation measures (e.g., creation of wetland habitat);
- waterfowl - river surveys to determine use of ashkui by dominant waterfowl species (e.g., Surf Scoter); and
- furbearers - transect surveys and trapping data to examine change in abundance and distribution in areas adjacent to the Project footprint; Beaver colony surveys to determine if relocated colonies are successful.

Monitoring programs focus on those areas where management measures are required to prevent significant environmental effects. In other words, the effectiveness of the various measures will be assessed to allow for adjustment/adaption of the mitigation if required. Reporting requirements will vary by program, depending on the nature of the study subject and the needs of relevant agencies.

8.0 THE SOCIO-ECONOMIC ASSESSMENT

8.1 The Socio-economic Environment and Effects

The Socio-economic Assessment of the EIS (Volume III) includes aspects of people, their culture, society and economy (including employment and business), which might be affected by the Project. This includes their communities, their current use of land and resources, and pre-history as reflected in the archaeological record. There are four VECs assessed, including Economy, Employment and Business, Communities, Land and Resource Use and Cultural Heritage Resources.

Generally, the 10-year construction period will see substantial direct, indirect and induced work for provincial residents and companies. This will also benefit the provincial and national economy through increased income, sales and business taxes. Overall, it is estimated that construction will enhance the provincial income by over $1.5 billion. Construction-related training and experience will also expand the capabilities of Newfoundland and Labrador workers and companies, increasing their ability to compete for work on subsequent construction projects, within and beyond the Province.

The scale of the employment, business and related benefits during Project operation and maintenance will be much more modest, but of much longer duration, than those during construction. For those who do gain direct operation and maintenance employment, this can represent a career and not just several years work. However, the largest and most widely spread economic and social benefit will result from the income from power sales, which will make an important long term contribution to the provincial economy.

The Project will further contribute to the economic and social transformation already underway because of offshore petroleum, mining and minerals processing activity. These have been shown to be sustainable in that that they are diversifying the Province's economic base, adding new industrial sectors, increasing expenditures on education, training and research and development, opening national and international export markets, and increasing business confidence and entrepreneurship.

The economic and social benefits will accrue to different areas of the Province and different social groups. For example, while there will be substantial economic benefits to the St. John's area and rural Newfoundland, it is estimated that a substantial amount of the provincial share of Project construction incomes will be earned by workers and companies operating in Labrador. Nalcor's efforts to provide information in advance regarding contracting opportunities and commercial requirements will provide local businesses with the information necessary to prepare for contracting opportunities and maximize their participation in the Project.

The opportunities will include employment and business for women and Aboriginal people. The Project will have an equity plan designed to assist women in accessing and retaining employment opportunities. An IBA is being negotiated with Innu Nation, which will define how Labrador Innu will participate in and benefit from the Project. Specific provisions will address Project-related employment and business opportunities. As a consequence, these groups will have opportunities for employment, increased income and quality of life.

Based on the above, the following potential effects of the Project on the socio-economic environment have been assessed:

- change in incomes and government revenues;
- change in employment levels;
- change in business activity;

- change in ability to deliver physical or social services and infrastructure;
- change in status of health determinants;
- change in land and resource use; and
- loss or disturbance of historic and archaeological resources.

8.2 Effects Management

Nalcor Energy is committed to following best practices in the construction, operation and maintenance of the Project. Nalcor Energy will also develop Project- and phase-specific benefits plans, training plans, human resource plans and continue to consult with Innu Nation so that appropriate socio-economic planning is incorporated into the Project. The Project has benefited greatly from the close liaison between those responsible for the design of the Project and those responsible for predicting its environmental effects. It has also benefited from consultation with regulators, stakeholders and Aboriginal groups.

Throughout its planning, Nalcor Energy has considered potential environmental effects and incorporated Project design changes and/or identified additional measures to reduce or eliminate adverse Project socio-economic and environmental effects. In addition, Nalcor Energy will implement the following major socio-economic effects and environmental management measures:

- hiring and procurement policies will be developed to provide further opportunities to Labrador and the Province;
- all work will be conducted according to regulations, guidelines, the EPP and codes of good practice;
- emergency preparedness will be maintained and implemented in the event of an accidental event; and
- regular communications regarding upcoming and ongoing Project activities.

In addition to the Project effects management measures listed above, Nalcor Energy will also apply effects management measures specific to each of the VECs (and/or their KIs as appropriate) (Table 8-1).

Table 8-1 Specific Effects Management Measures for Socio-economic Valued Environmental Components

Valued Environmental Component	Effects Management Measures
Economy, Employment and Business	• adopt an Industrial Benefits Planning strategy • apply measures required as part of an IBA, currently under negotiation between Nalcor Energy and Innu Nation • develop an engagement and benefits strategy • support the Innu Nation to develop an Innu Training Plan • include Newfoundland and Labrador benefits as selection factors in awarding Project contracts • hire an Innu Employment Training Coordinator • establish an on-site Innu Liaison position • provide Project employment and training information in Innu-aimun • provide access to an Employee Assistance Program • establish a workplace improvement committee • require construction contractors to draw labour from qualified local sources • establish collective agreements with relevant labour organizations • provide information and updates on Project employment requirements and opportunities to local, regional and provincial groups and organizations • develop a human resources plan for women's employment

Table 8-1 Specific Effects Management Measures for Socio-economic Valued Environmental Components (cont.)

Valued Environmental Component	Effects Management Measures
Economy, Employment and Business (cont.)	• advance gender diversity on the Project • provide competitive wages and benefits and a progressive and respectful work environment • encourage preconstruction training initiatives • work with contractors for adequate workplace training • work with contractors to implement apprenticeship programs • offer technical expertise and assist in coordination of training • establish a Labrador Business Opportunities Committee and a full-time coordinator position in Labrador • maintain a work environment that facilitates the achievement of career goals • encourage journeypersons to participate in post-journeyperson training • provide on-the-job training opportunities during the construction phase • maintain a labour demand profile in support of identifying gaps, and make it available to training and education agencies and institutions • communicate with academic institutions and students about career options • participate in activities to raise the profile of the skilled trades • contribute to student achievement awards and provide work term placement opportunities on the Project • develop a contracting policy that provides companies within the Province with full and fair opportunities to compete on the supply of goods and services • provide information on the scope of work for the Project as early as possible • organize supplier information sessions throughout the Province with an emphasis on Labrador • develop an inventory of Labrador and Newfoundland supplier capabilities • communicate and educate suppliers on the qualification and bidding process • require benefits information as part of the bid solicitation process
Communities	• develop a Project-wide safety culture to achieve world class safety performance • liaise with relevant federal, provincial and local government agencies, and relevant transportation, health, education and other community and regional agencies, in the planning process and during Project construction and operations • maintain a community information centre in Happy Valley-Goose Bay to provide ongoing Project information to all stakeholders • establish high-quality self-contained accommodations complexes at the construction sites to insulate the Upper Lake Melville area from potential adverse community effects • provide self-contained accommodations complexes with respect to water supply, sewage systems and communications • provide on-site paramedic and emergency response facilities and services at accommodations complexes • restrict non-worker access to accommodations complexes • provide all employees with cultural sensitivity training • promote healthy lifestyles through workplace programs • adopt a zero tolerance policy towards alcohol and other drug abuse • control the availability of alcohol in accommodations complexes • provide basic counselling service and workplace referrals • provide access to an Employee Assistance Program that includes stress management counselling, using community-based Aboriginal counsellors • provide, where feasible, flexible work schedules to accommodate work and family life balance • adopt a SHERP to reduce the likelihood of accidents • work with relevant government agencies in their determination of the requirements for and the extent of fish consumption advisories

Table 8-1 Specific Effects Management Measures for Socio-economic Valued Environmental Components (cont.)

Valued Environmental Component	Effects Management Measures
Land and Resource Use	• restrict access to Project roads and work areas during construction • remove stream crossings along access roads as construction and reservoir preparation is completed • implement a compensation program for flooded trap lines to trappers with demonstrated continuous and successional use • prepare reservoirs through clearing of timber and removal of vegetation to reduce adverse aesthetic effects • clear riparian zone around the perimeter of the reservoir to enable access to the shoreline and/or reservoir and enable safe navigation of the reservoir • clear riparian zone to provide habitat for furbearers and other hunted/trapped game • establish new boat launches to replace access points lost due to the Project • maintain access to portage routes at Gull Island and Muskrat Falls • develop snowmobile trails equal to the amount inundated • work with guides so that boat traffic and guided tours can continue with minimal interruption • a no harvesting policy for Project employees, and firearms will be prohibited on-site • subject to reasonable Project requirements, provide flexibility in work schedules and rotations, job-sharing and leave provisions to enable employees to engage in traditional activities • provide country foods at the accommodation complexes, where reasonable and commercially available • notify commercial and other users about planned Project activities • apply measures required as part of an IBA, now under negotiation between Nalcor Energy and Innu Nation • monitor ice conditions and issue public advisories on the condition of ice • relocate and re-establish Canada yew, where inundated, above the FSL
Cultural Heritage Resources	• implement systematic data recovery • obtain additional field recording • implement systematic field recording • conduct subsurface sampling • develop a Historic and Archaeological Resources response plan in the EPP to be applied if Historic and Archaeological Resources are discovered • consult with local stakeholders to determine the level of mitigation for historic tilts

8.3 Residual Environmental Effects

8.3.1 Economy, Employment and Business

The Project will involve expenditures totalling approximately $6.5 billion (in 2008 dollars) over a 10-year construction period, with additional expenditures and activity during the operation and maintenance phase. Most of these expenditures will occur within the Province, resulting in substantial employment, business and other benefits. The Project will therefore generate positive residual income, revenue, employment and business at all geographical scales, resulting in **positive** socio-economic effects for Economy, Employment and Business. Within the Province, most of these benefits are expected to occur in Labrador.

8.3.2 Communities

Project expenditures will result in activity, employment, business and income that will affect the Province, Labrador and, especially, the communities of the Upper Lake Melville area. They will also have a range of secondary effects through, for example, some in-migration of workers and their families. There will be no adverse significant residual socio-economic effects if appropriate action is taken to address current physical

infrastructure and health service limitations. Instead, these improvements will benefit all users and represent positive residual effects from the Project. Therefore, the residual adverse socio-economic effects on Communities are **not significant**.

8.3.3 Land and Resource Use

Although the Project will result in local shifts of land and resource use patterns, activities will be able to continue at existing levels. Specific effects management measures have been proposed to reduce adverse environmental effects so that customary commercial, recreational and traditional activities will be able to continue in the long term. The primary environmental effects include increased navigability, a net increase in fish and angling success, a small increase in access, and a local loss of some wildlife habitat and hunting and trapping areas. The finalization and implementation of the IBA will address adverse environmental effects for Innu land and resource use.

It is anticipated that Health Canada will develop consumption level advisories in areas where mercury levels in fish may be elevated compared to baseline. This can be expected to occur in the new reservoirs, and consumers will be cautioned to limit their intake. Results from surveys indicate that fishing and consumption levels are presently low. Monitoring will be conducted to determine the mercury levels in fish. The residual adverse environmental effects on Land and Resource Use are **not significant.**

8.3.4 Cultural Heritage Resources

Forty-four historic and archaeological sites will be disturbed or lost as a result of the Project. However, through the proposed data recovery and field recording programs, information and material from these sites will be recovered and archived. The residual adverse environmental effects on Cultural Heritage Resources are **not significant.**

8.3.5 Accidents and Malfunctions

The environmental effects of accidents and malfunctions were also assessed. While the focus of Nalcor Energy is on prevention and preparedness, selected worst-case scenarios were nonetheless considered for the range of Project activities and features that could fail with important environmental consequences. Accidental scenarios that met this criterion were developed for dam failure and forest fire caused by the Project. In both cases, **significant** adverse socio-economic and environmental effects may result, although the event is highly unlikely. Nalcor Energy will focus on the prevention of accidents and malfunctions through the implementation of the EMS, Forest Fire Prevention Plan and adherence to stringent dam design requirements. Contingency Plans and Emergency Preparedness Plans will also be developed.

8.4 Socio-economic Cumulative Environmental Effects

Cumulative environmental effects on the socio-economic environment that may result from the Project in combination with other projects and activities were also assessed for the socio-economic environment. With the application of Project-specific effects management measures, and with appropriate planning and enforcement by relevant government agencies, the cumulative effects on the socio-economic environment will be **not significant**.

Cumulative socio-economic and environmental effects are expected to be primarily positive. Each project will potentially increase incomes, government revenue, employment and business opportunities. There may be some negative socio-economic effects to some firms and consumers if labour demand drives up the cost of

labour and results in shortages of labour in some sectors, but overall the cumulative benefits from several projects are expected to outweigh any adverse effects.

Other projects that bring workers into the region could have cumulative socio-economic effects on infrastructure and services and on community health. However, with the implementation of appropriate management strategies, all users will benefit. With respect to Physical and Social Infrastructure and Services, Nalcor Energy will continue to liaise with local authorities and service providers, providing Project updates and information as requested by these agencies. Appropriate management strategies to address any demands on security in particular will be developed and implemented.

With respect to Land and Resource Use, there is potential for cumulative environmental effects related to increased access. While some of the projects and activities considered are partially or wholly outside the Assessment Area, the potential regional changes in access within the region have the potential to contribute to cumulative environmental effects related to access within the Assessment Area. It is difficult to predict with certainty how users will choose to respond to alternative access options. However, as resource use patterns adapt over time, government regulations and management mechanisms will be used to reduce or remove any resulting stresses on fish or wildlife populations. Positive socio-economic effects are also expected with increased access to areas previously considered inaccessible.

8.5 Monitoring and Follow-up

Monitoring and follow-up programs are designed to verify environmental effects predictions made during the environmental assessment, and to assess the effectiveness of the implemented mitigation measures. Monitoring and follow-up programs are proposed in the EIS, with details to be developed in consultation with government, Innu Nation and other stakeholders prior to Project initiation. These programs include:

- expenditures by amount, type, location and contractor;
- employment in terms of number employed, location of primary residence, occupational category, gender and Aboriginal status;
- business expenditures and contract awards;
- liaison with infrastructure and service providers and, as necessary, with other users;
- evaluation of effects management strategies (e.g., effectiveness of training programs, cultural sensitivity arrangements);
- participant in Community Health planning processes;
- ice monitoring; and
- pre-construction Stage 1 Historic Resources Overview Assessment.

9.0 CONCLUSIONS OF THE ENVIRONMENTAL IMPACT STATEMENT

The EIS presents a rigorous and comprehensive assessment of the potential adverse environmental effects of the Project on the biophysical and socio-economic environments of the lower Churchill River area. As required by the EIS Guidelines, the assessment has been conducted in consideration of the Precautionary Principle, sustainability and ecological integrity and biodiversity, while also identifying means to maximize benefits to the current and future residents of Labrador.

9.1 Sustainability

Sustainable development seeks to meet the needs of present generations without compromising the ability of future generations to meet their own needs. Development of the untapped hydroelectric potential on the Churchill River will contribute sustainable benefits to the Province as a long term renewable energy supply. In the planning and design of the Project, Nalcor Energy has considered the following objectives:

- the preservation of ecosystem diversity, including the capability of natural systems to maintain their structures and functions;
- the respect for the right of future generations to the sustainable use of renewable and non-renewable resources; and
- the attainment of durable and equitable social and economic benefits.

Nalcor Energy is planning to apply effects management measures to reduce adverse environmental effects on animal and plant species such that renewable resources are not likely to be significantly adversely affected by the Project. Environmental effects to game species such as Caribou, Moose, Black Bear, waterfowl, furbearers and other non-game species will be mitigated to promote the sustainability of these populations.

In the case of fish populations, there will be a net increase in habitat and habitat utilization as a result of the reservoirs and the fish habitat mitigation to be implemented. Mercury levels in fish are anticipated to increase initially, reaching peak levels in 10 to 15 years and then declining to baseline levels within 35 years. Mercury levels in fish will be monitored as will baseline exposure levels in the local resident population. Fish will still be safe for consumption within limits to be developed. Consumption advisories will be issued as appropriate.

With regard to the timber resource, a 5-Year Operating Plan for Forest Management District 19A in the lower Churchill River valley considers requirements for reservoir clearing and preparation. In the event that clearing is initiated during the period covered by the Operating Plan, clearing efforts will be shifted and focussed in the reservoir. In this way, merchantable timber will be cleared for use.

When the Project is operational, the potential for boat and snowmobile travel will increase as a result of reduced flows and increased ice cover. Although the lengths of permanent access roads are limited, there will be some increased access, which will, in turn, result in a shift in land and resource use patterns. Only small populations of valued plant species are known to exist (i.e., Canada yew) and those that will be inundated will be transplanted to an area suitable for re-establishment.

Through effects management measures for both biophysical and socio-economic environments, the application of Best Practices, and the development of an IBA with Innu Nation, renewable resources will be available for use by current and future generations. Furthermore, the Project will play an essential role in the sustainable development of Newfoundland and Labrador by providing the Province with a long term stable supply of renewable energy. In conjunction with the existing Churchill Falls Power Station, this Project will provide a foundation of renewable energy to support the Province's economy for generations to come.

9.2 Application of the Precautionary Principle

The Precautionary Principle is defined as: *"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."* In considering the predicted residual environmental effects of the Project, Nalcor Energy has applied the Precautionary Principle to identify and commit to effects management measures, including those for which full scientific certainty of their effectiveness may be lacking.

As called for in the EIS Guidelines, Nalcor Energy has examined the Project in a careful and precautionary manner. Within the environmental effects assessment, Nalcor Energy has described the approaches to reduce or avoid these environmental effects. The level and degree of certainty of knowledge associated with environmental effects predictions is stated for each environmental effects prediction. As well, the criteria to be applied in design of monitoring and follow-up programs will include the level and degree of certainty of knowledge.

An example of this application is the habitat mitigation for Wetland Sparrows. Wetland Sparrows are uncommon in Labrador but associated with the riparian marsh habitat of the lower Churchill River valley. Through the Ecological Land Classification mapping for the Project, and confirmatory surveys, a detailed understanding of the niche occupied by these species has been provided. Much of this preferred habitat will be lost to inundation; however, enough will remain above the reservoir water levels to assure sustainability of the affected populations. The creation of riparian marsh wetland habitat preferred by Wetland Sparrow is not a proven technique, although active research is under way. Nalcor Energy proposes to use experimental field techniques to develop replacement habitat within the same watershed. Monitoring and adjustment will be important features of this work. Thus, Nalcor Energy will apply measures to reduce environmental degradation of habitat for Wetland Sparrow (and other species associated with riparian marsh) even in the absence of full scientific certainty as to its ecological effectiveness.

9.3 Biodiversity

The residual adverse environmental effects of the Project on the biophysical VEC's KIs during construction and operation and maintenance are predicted to be **not significant**. The number and variety of organisms found within a specified geographic region is an appropriate definition of biological diversity within the context of this Project and the lower Churchill River watershed. The ability of the assessed populations to remain viable will not be compromised as a result of the Project. Although adverse environmental effects will occur, they will be managed and/or monitored accordingly and biological diversity will not be compromised by the Project. In fact, the environmental effect on Fish and Fish Habitat is predicted to be positive, as there will be a net gain in productive fish habitat. Adverse environmental effects to terrestrial wildlife and plant species will be mitigated through the creation of areas of hardwood habitat for Ruffed Grouse, areas of wetland habitat for Wetland Sparrows, and transplanting Canada yew specimens for the purpose of re-establishment. In these ways, the population and distribution of these species and others associated with those habitats will be increased, sustainability or resources enhanced and biological diversity maintained in the watershed.

Project environmental effects to the RWM Herd will also be managed. The RWM Herd that occurs within the lower Churchill River watershed has been in decline in recent years due to a variety of pressures. There has been an increase in predation pressure, primarily from wolves, and the Herd has also been affected by illegal hunting. Despite the protected status of this threatened population and enforcement and education activities, individual caribou continue to be poached in Caribou Management Zones that are closed to hunting. While the residual effects of the Project on RWM Herd are **not significant**, the potential cumulative effects of other influences is

significant with or without the development of the Project. Nalcor Energy is committed to continuing its active participation on the Labrador Woodland Caribou Recovery Team, supporting ongoing monitoring and research, and implementation as appropriate of all recommended Project related protection measures.

9.4 Future Generations and Benefits

The Project will provide long term sustainable economic and social benefits for the people of Newfoundland and Labrador. With the application of design features and effects management measures tailored for the Project, significant adverse environmental and socio-economic effects will be avoided, and positive environmental and socio-economic effects will be enhanced. Consistent with the concept of sustainable development articulated in the EIS guidelines, the Project will meet the needs of present generations without compromising the ability of future generations to meet their own needs.

9.5 Overall Conclusions

The EIS provides a thorough and comprehensive assessment of the potential environmental and socio-economic effects of the Project using methods and approaches fully compliant with the requirements of the federal and provincial governments and the EIS Guidelines. Using defined and established criteria, the significance of these effects after the application of mitigation and effects management measures have been determined for all VECs and KIs. Effects management includes designed-in mitigation, as well as Project-specific measures to reduce adverse environmental effects, or to maximize positive effects. Based on the rigorous application of effects management and careful Project design, there are no significant adverse environmental effects predicted from Project construction and operation and maintenance. There are positive effects on the socio-economic environment as a result of the Project. A significant cumulative environmental effect is predicted for the RWM Herd, and Nalcor Energy is committed to working with relevant government agencies so that the overall effect of the Project on the sustainability of this Herd is minimized. Significant adverse environmental and socio-economic effects could also result from the highly unlikely event of a dam failure or forest fire caused by the Project. Nalcor Energy will focus on the prevention of accidents and malfunctions through the implementation of the EMS, Forest Fire Prevention Plan and adherence to stringent dam design requirements. Contingency Plans and Emergency Preparedness Plans will also be developed.