INTERIM INDEPENDENT ENGINEER'S REPORT

LOWER CHURCHILL PROJECT

NOVEMBER 29, 2013

Prepared for:

Government of Canada

Prepared by:

MWH Americas, Inc.
Suite 1580
One Bentall Centre
505 Burrard Street, 15th floor, Box 17
Vancouver, British Columbia - V7X 1M5

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LIST OF ACRONYMS AND ABBREVIATIONS

A	amperes
AACEI	Association for Advancement of Cost Engineering International
AAE	Average Annual Energy
AAQM	ambient air quality monitoring
AC	alternating current
ADSS	all-dielectric self-supporting
AFUDC	allowance for funds used during construction
BC	British Columbia
CEA	Canadian Electricity Association
CEAA	Canadian Environmental Assessment Act
CEPA	Canadian Environmental Protection Act
CF	Churchill Falls
CIGRE	International Council on Large Electric Systems
CPI	Consumer Price Index
CPM	Critical Path Method
CWIP	construction work in progress
cms	cubic meters per second
DAFOR	derate adjusted forced outage rate
DAUFOP	derate adjusted utilization forced outage probability
DC	direct current
DFO	Department of Fisheries and Oceans - Canada
DG3	Decision Gate 3
DSCR	debt service coverage ratio
EA	Environmental Assessment
ECC	Energy Control Centre
EEM	environmental effects monitoring
EIS	Environmental Impact Statement
El.	elevation
EPA	Environmental Protection Act
EPC	Engineering, Procurement, and Construction
EPCM	Engineering, Procurement, and Construction Management
FLG	Federal Loan Guarantee
FSL	full surface level
GADS	Generating Availability Data System
Government	Federal government of Canada
GPS	global positioning system
GSU	generator step-up
HADD	harmful alteration, disruption, or destruction
HHRA	human health risk assessment
HVac	High Voltage Alternating Current
HVdc	High Voltage Direct Current
IBA	Impacts and Benefits Agreement
ICBF	incapability factor
IDC	interest during construction
IE	Independent Engineer
IER	Independent Engineer’s Report
IFIM	instream flow incremental methodology
IPS	Integrated Project Schedule
IR	information request

LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

KA	kiloamps
Km	kilometer
kV	kilovolt
LC	Lower Churchill
LCC	Line Commutated Converter
LCP	Lower Churchill Project
LD	liquidated damage
Lease	Water Lease Agreement
LIL	Labrador Island Link
LOA	leave of absence
LRA	liquidity reserve
LTA	Labrador Transmission Assets
LTAP	Labrador Transmission Assets Project
MAF	Mean Annual Flow
MF	Muskrat Falls
MFGS	Muskrat Falls Generating Station
MI	mass-impregnated
ML	Maritime Link
MOF	maintenance outage factor
msl	mean sea level
MVA	megavolt amperes
MVAR	megavolt ampere reactive
MW	megawatt(s)
MWc	megawatts continuous
MWH	MWH Canada, Inc.
MWhour	megawatt hour
NAERC	North American Electric Reliability Corporation
Nalcor	Nalcor Energy
Nalcor/MWH Agreement	agreement between Nalcor and MWH to prepare the IER
NEHRP	National Earthquake Hazards Reduction Program
NLH	Newfoundland and Labrador Hydro
NWPA	Navigable Water Protection Act
O&M	operations and maintenance
OHGW	overhead ground wire
ONAF	oil filled unit that has natural convection flow in the tank and utilizes has fans added for forced air external cooling
ONAN	oil filled unit that has natural convection flow in the tank and utilizes natural air convection cooling externally
OPGW	optical ground wire
P&C	Protection & Control
P50	50 percent
PGA	peak ground acceleration
PM	project manager
PMF	Probable Maximum Flood
PMI	Project Management Institute
PMP	Probable Maximum Precipitation
POF	planned outage factor
PSSE	Power System Simulator for Engineering

LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

PSU	practical salinity units
pu	per unit
P-WEPP	Project-Wide Environmental Protection Plan
RCC	roller compacted concrete
RFP	Request for Proposal
SARA	Species at Risk Act
SNC-L	SNC-Lavalin
SOBI	Strait of Belle Isle
SOW	scope of work
TRO	Transmission and Rural Operations
TWH	terra-watt hours
var	volt amperes reactive
VEC	valued environment component
VHF	very high frequency
Vista DSS	Vista Decision Support System
WA	Washington
WBS	work breakdown structure
WMA	Water Management Agreement

SECTION 1

MUSKRAT FALLS GENERATING STATION AND LABRADOR TRANSMISSION ASSETS

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SECTION 1

MUSKRAT FALLS GENERATING STATION AND LABRADOR TRANSMISSION ASSETS

1.1 INTRODUCTION

The Lower Churchill Project (LCP) is a proposed large, important energy generating and transmission facility of regional and national significance to Newfoundland and Labrador, Nova Scotia, and the federal government of Canada (Government). When completed, the LCP will have a capacity to generate and transmit more than 824 megawatts (MW) of electricity at an initial capital cost of approximately $6.2B[1].

The purpose of this report is to provide Independent Engineer's (IE) opinions to support the financing of the LCP using long-term bonds that will be guaranteed by Canada's best-in-the-world credit worthiness, rated AAA. To that end, this report presents professional opinions that the estimated construction and operations costs are reasonable, that the estimated construction schedule is reasonable, and that projected financial results of operations will generate sufficient net revenues to repay the debt, including revenues to meet debt service coverage requirements as well as to properly operate and maintain the LCP facilities.

Nalcor Energy (Nalcor) selected MWH Canada, Inc. (MWH) to prepare this Independent Engineer's Report (IER) and additional services pertaining to construction monitoring and long-term monitoring services after the LCP has been placed in commercial operation. MWH has no financial ties to Nalcor aside from the agreement to prepare this report (Nalcor/MWH Agreement). MWH has no fiduciary relationship with other firms involved with the LCP or interest in the sale of bonds to finance the LCP.

1.2 PROJECT DATA AND COMMUNICATIONS PROTOCOLS

1.2.1 Contacts

The Nalcor/MWH Agreement was signed on August 27, 2012. A kickoff meeting was held on September 13 and 14, 2012 in St. John's, Newfoundland. Nalcor selected Mr. Lance Clarke, Project Commercial Manager, LCP to be MWH's principal contact during the duration of the IE's review and preparation of the IER. Mr. James Meaney, CFA, General Manager Finance, was also designated as another principal contact. Additionally, Mr. Ross Beckwith, Nalcor's Commercial Coordinator, was also designated as a contact for discussions. Mr. Peter Madden has been the day-to-day contact for MWH. For all issues pertaining to the Nalcor/MWH Agreement, Mr. Nikolay Argirov, MWH Vice President, has been the principal Nalcor contact.

[1] The reader is advised that within this report, all dollars given are Year-2012 and Year-2013 Canadian Dollars, depending on the award date

Rey Hokenson is MWH's day-to-day contact and is the project manager (PM) for this assignment.

1.2.2 Project Schedule

The Project Milestone Schedule for the preparation and award of the numerous contracts that will be prepared by Nalcor and the Engineering, Procurement, and Construction Management (EPCM) Consultant is given in Appendix A. The IE's Execution Plan has been tailored to accommodate the Project Milestone Schedule.

1.3 PROJECT DESCRIPTION

The history of the LCP dates to the early 20th century when it was envisioned that a series of hydroelectric projects would be developed on the Hamilton River (now the Churchill River). During the mid-1960s an earnest effort was made to plan for the development of this valuable resource when Labrador and Newfoundland were in need of power. At that time electricity demand was growing by more than 10 percent per year. The plan was to construct the first project, Churchill Falls, on the Churchill River upstream of the LCP for supplying power to Newfoundland Island in 1972, and then to construct the LCP following completion of the 5,428 MW Churchill Falls Generating Station. The Churchill Falls Project commissioned its first unit in 1971 to feed power to Newfoundland. The Churchill Falls Project provides about 65 percent of the power available from the Churchill River, with the remaining 35 percent coming from two proposed power stations, Gull Island and Muskrat Falls. Muskrat Falls has been sized to provide 824 MW, while Gull Island has been sized to provide 2250 MW.

The first phase of the LCP includes the Muskrat Falls Generation facility, the Labrador Transmission Assets and the Labrador Island Link. The subsections following this general description more fully describe the LCP features and the full description of components of the project is found in Appendix E.

Phase I development also provides for construction by Emera, a large energy and service company based in the northeastern United States and Canada, of a new maritime transmission link between Newfoundland and Nova Scotia employing two 180-kilometer (km)-long subsea cables that allows LCP power to be used in Nova Scotia. The Emera project is not intended to be included in this review by the IE; it is covered in a separate IER. The second phase of the LCP is construction of Gull Island.

1.3.1 Muskrat Falls Generating Station

The Muskrat Falls Generating Station (MFGS) consists of several primary components: a powerhouse with an integral intake structure; a vertical-gated auxiliary spillway; an overflow service spillway fitted to the north roller compacted concrete (RCC) dam; a south rock-fill embankment dam; a project switchyard; and protective works located in the left abutment (North Spur) to control seepage. The MFGS will be serviced by a new 21-km access road that

connects the project to Highway 510, south of the Churchill River bridge crossing and by a road that connects the north abutment area to Highway 500, Trans-Labrador Highway to Churchill Falls. The powerhouse substructure is reinforced concrete with a structural steel superstructure. The reinforced concrete intake structure, integral with the powerhouse, will be fitted with three service gates and three bulkhead gates, located upstream of the service gates, for each of the four intake bays. The installed capacity of the powerhouse will be 824 MW with each of the four generating units rated at 229 megavolt amperes (MVA) with a 0.9 Power Factor at 39 meters net head.

The spillway consists of two components: (1) a reinforced concrete five-bay structure, fitted with 10.5-meter-wide by 22-meter-high vertical lift gates, and (2) a 425-meter-long, ogee-shaped overflow RCC spillway. The spillway sections acting in combination can pass the Probable Maximum Flood (PMF) of 25,060 cubic meters per second (cms) at El. 45.1. The overflow spillway is normally used to pass flows that exceed the powerhouse hydraulic capacity of 2,660 cms.

The protective works located in the left abutment include a slurry wall constructed to bedrock to control seepage from the reservoir and local groundwater, and include shoreline bank protection to prevent erosion from ice heave and abrasion, and wind-induced waves.

The Muskrat Falls powerhouse and switchyard will be connected to the Trans-Labrador Highway by an access road located on the south side of the Churchill River (Appendix F).

1.3.2 Labrador Transmission Assets Project

Near the powerhouse, the Muskrat Falls switchyard will be constructed to transmit power via four 315 kV HVac overhead transmission lines to the 350 kV HVdc converter station, two feeders will be connected to the converter transformers, and two feeders will connect to the filters. These lines are part of the Labrador Transmission Assets Project (LTAP). Each of these lines is to have a capacity of 900 MW (Appendix G).

The Muskrat Falls switchyard will also connect to the Churchill Falls switchyard that will be extended to accommodate the interconnection from Muskrat Falls to Gull Island. Two 315 kV HVac lines between Muskrat Falls and Churchill Falls will be used. Again, each line will have the capacity of 900 MW that will allow the Muskrat Fall power station entire plant load to be transmitted on one line. The lines will be carried on lattice steel towers with self-supported angles and dead-ends and with guyed suspension towers. One transmission line shall have one OPGW and the second shall have two OHGW.

1.3.3 Labrador Island Link Project

The Labrador Island Link Project (LIL) will consist of a converter station located at Muskrat Falls, a transmission link from Muskrat Falls switchyard to the SOBI, a transition station at the Labrador side of the SOBI from the transmission line to a submarine cable, a submarine cable

under the SOBI, a transition station on the Newfoundland side of the SOBI from the submarine cable to an overhead transmission line, a transmission line from the SOBI to Soldiers Pond, and a converter terminal station located at Soldiers Pond, west of St. John's. The transition station (compound) at Shoal Cove will include provision for the submarine cable termination system and associated switching equipment. Also included will be control, protection, and monitoring and communication equipment (Appendix G).

The converter stations at Muskrat Falls and Soldiers Pond will be designed as automated, remotely controlled facilities. The direct current (DC) system will be a point-to-point +/- 350 kV Line Commutated Converter (LCC) bi-pole from Muskrat Falls to Soldiers Pond. During a converter pole outage, the HVdc system will immediately and automatically reconfigure to operate as a monopole, with a metallic return without interruption to the service using shoreline pond electrodes installed at L'Anse au Diable in Labrador and Dowden's Point on the east side of Conception Bay.

This project also includes a 350 kV HVdc, 900 MW submarine cable system that will extend from Forteau Point, Labrador to Shoal Cove, Newfoundland across the SOBI. The offshore component will consist of three submarine HVdc mass-impregnated (MI) cables; one of the cables will be used as a spare. Each of the cables will be installed on the seafloor with approximately 150 meters of separation and all within a 500 meter wide by 34 km long corridor. Each of the cables will carry 450 MW with a rated capacity of 100 percent overload for 10 minutes and 50 percent overload for continuous operation. The water depth along the subsea transmission corridor varies between 60 meters to 120 meters. The cables will be protected along the length by a rock berm and the route was selected to avoid iceberg contact. The undersea cables will extend through steel pipe encasements in bored holes to protect the cables in the heavy ice and surf zones. The cables will be trenched underground to a depth of about 2 meters to two transition compounds that will be located approximately 1 km from the land entry locations. The transition compounds contain the cable terminations, switch gear and transition to the overhead line transmission system.

A shoreline pond electrode system will be located on the Labrador side of the SOBI. A shoreline pond electrode system will be located on the east side of Conception Bay near Soldiers Pond; the electrode line is 10 km long from Soldiers Pond to Conception Bay. The electrode ponds allow the transmission system to operate as a monopole system if one of the conductors is not functioning.

The switchyard at Soldiers Pond will interconnect eight 230 kV HVac transmission lines (four existing transmission lines looped in), and the synchronous condensers and the Soldiers Pond Converter Station. The upgrade at Soldiers Pond will include three new 175 megavolt ampere reactive (MVAR) high-inertia synchronous condensers, 230 kV and 138 kV circuit breaker replacements, and replacement of conductors and reconstruction of eight transmission lines entering and leaving the switchyard.

Information pertaining to the Maritime Link Transmission Project to be constructed and financed by Emera will be found in a separate report prepared for the Government responsible for its financing.

1.4 REVIEW OF CONSTRUCTION PROGRESS

Currently there are only two major construction contracts under way. The contract dealing with the southerly access road is completed. Of about 21 km of access road to be built, MWH understands that it is also completed. Additionally, the Bulk Excavation Contract has has reached 95 percent. The first scheduled excavation blast occurred during early February 2013.

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SECTION 2

SITE VISIT

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SECTION 2

SITE VISIT

2.1 SITE VISIT

A site visit was undertaken by MWH. The North Spur and the main Muskrat Falls excavation area were seen. Results were favorable.

2.2 GENERAL

Two members of MWH, as part of the IE's team, attended a project briefing and participated in a site visit to the Muskrat Falls project during September 24-26, 2013. The project briefing was carried out by project designers and supervisory staff in the SNC-Lavalin (SNC-L)/Nalcor project offices in St. John's on September 24, 2013. SNC-L has an EPCM Agreement with Nalcor and currently is providing the design services for Muskrat Falls. The date of the EPCM Agreement is February 2011. SNC-L works with Nalcor in an Integrated Project Team to manage this project. (Refer to Section 4.) The briefing presentations covered the main aspects of the safety programs, geotechnical and civil design, field conditions, and site facilities and construction progress of the powerhouse and spillway excavations and cofferdam construction.

Site visits to the Muskrat Falls project were made on September 25 and 26, 2013. The site visit included tours of the North Spur, cofferdams, spillway, and powerhouse/tailrace channels and the project infrastructure. Most of the project construction work viewed was being completed as part of ongoing work associated with Contract CH0006. These visits were guided by Nalcor and SNC-L. Separate discussions were held about blasting, geology, and rock slope stability with the project geology/geotechnical engineering team.

Principal observations and comments on the active geotechnical and civil construction and design works are presented in the following subsections. Photographs taken during the site visit are included in Appendix H[2].

2.3 NORTH SPUR

2.3.1 General

The North Spur is a 1000 m long, 500 m wide and 45 m to 60 m high ridge that connects the Muskrat Falls rock knoll to the north bank of the river (Photograph 3). When the reservoir is impounded this feature will form a natural dam and become a major part of the river impoundment. At the Spur location, the soil stratigraphy can be summarized as follows:

- 10-15 m of fine-to-medium sand deposit

[2] All photographs referenced in the following sections are contained in Appendix H.

- 30-40 m of stratified intermediate sandy-silt and upper sensitive clay deposit
- 50-60 m of lower non-senstivie clay deposit
- Up to 200 m sandy-gravely-silty lower aquifer deposit

The upstream and downstream slopes of this feature are subject to ongoing river erosion and mass wasting. This has contributed to local slope over-steepening of the slope, which triggers rotational sliding on both the downstream and upstream sides of the spur. Past studies indicate multiple small to large slide events have occurred during the recent centuries. A significant landslide took place on downstream slope of the North Spur in 1978 (Photographs 4 and 5). During 1980 it was determined that the natural mass wasting processes, could be arrested by controlling the water table with a pumped well system. A line of pumped wells was installed in the centre of the spur 1981 and continues to operate to present times.

2.3.2 Site Visit Observations

A brief site visit was made on September 24 to the plateau on top (Photograph 4) and the scarp of the 1978 slide (Photograph 5). The drilled wells were viewed and found to be in good condition. These are currently in operation. The slide is covered with vegetation indicating no significant activity for at least the past 25 years. As can be seen in photos, fine to medium sand is exposed in the crest of the slide scar. Large tilted and eroded blocks of cohesive soil could be seen at the toe (Photograph 6), adjacent to the river shoreline.

2.3.3 Stabilization Works

After reservoir impoundment, long term seepage and slope stability characteristics of the spur should be similar to a modern dam. Measures are needed to (a) control piezometric levels (b) control seepage across the weir and (c) stabilize the upstream and downstream slopes. The following measures are planned:

- Flatten both the upstream and downstream slopes to increase the overall safety factor against sliding failures.

- Rockfill and rip rap slope erosion protection will be placed on all areas of the upstream and downstream slopes. Stabilizing fill will be placed in selected areas of the downstream slope to improve local toe stability and reduce potential for retrogressive failures in sensitive marine clays of the Upper Clay unit.

- Construct an impervious fill blanket at the upstream slope and install a cut-off wall at the base of the blanket. This combined barrier will block water seepage into the spur from the reservoir. The cut-off wall (plastic cement slurry wall) will be connected to the impervious lower clay formation that extends beneath the river level.

- Construct a second cut-off wall across the north end of the spur to cut off seepage from the high ground north of the river. The upstream end of this wall will be connected to the cutoff wall of the upstream slope

- Construct toe relief drains and a major drainage trench for further lowering of the water table.

- Carry out long term monitoring of the piezometric conditions within the spur during operation of the reservoir. It is planned to augment the existing network of 29 piezometers with 15 additional ones. All piezometers will be instrumented with electronic sensors. Data will be recorded on a continuous basis and transmitted to NALCOR's headquarters in St John's.

Current plans are to continue operation of the dewatering wells for about two years after the reservoir is impounded. The situation will be studied during that time and, if warranted by piezometric conditions, the dewatering system may eventually be discontinued.

2.3.4 Comments

The stabilization works have been designed in accordance with currently accepted geotechnical design practices and will effectively stabilize the north spur when the reservoir is impounded. The upstream impervious blanket and the plastic cement slurry cut-off walls will control seepage and piezometric levels in the spur. Slope flattening excavations and the placement of lower slope weighting berms will enhance slope stability. Erosion control blankets of rockfill and rip rap will be placed on the upstream and downstream slopes to prevent natural erosion that would contribute to slope degradation and instability over time. The planned long term monitoring program is an important component of the works which will ensure safe operation of the reservoir and detect on a timely basis any anomalous behavior that may affect safe operations.

The IE has reviewed various aspects of the geotechnical designs and planned works. Detailed and rigorous investigations and laboratory testing of samples have provides accurate geotechnical and hydrogeological data. Limit Equilibrium stability analyses have been carried out for the final slopes. Various materials assessments have been done to determine gradations of the various fill materials that will be used. These works have been augmented by a seismicity study, 2D seepage analysis and reservoir landslide generated wave height studies. All of this work has been carried out to a high standard.

Geotechnical design work continues at the time of writing and the final design report has not yet been issued. The recently issued "Cold Eye Review of Design and Technical Specifications, North Spur Stabilization Works" by Hatch has indicated that, among other things, additional investigations and analyses are recommended to further enhance the design parameters for the sensitive clays and the overall seepage analysis assessment of the spur. The recommended work includes further investigations of the properties of the sensitive clays with respect to cyclic softening, more detailed stability analyses to assess the impact of earthquake ground motions and further seepage analyses. The IE was advised that Nalcor is following the recommendations provided by the Cold Eye reviewers. The IE has not yet been advised of details of the planned work.

The IE agrees with the Cold Eye recommendations and understands that work is proceeding on them. This supplementary work will further enhance confidence in the current design and should not result in any significant modifications to the planned work.

2.4 COFFERDAMS

2.4.1 General

Construction work was in progress on the RCC cofferdam (Photographs 7, 8, and 9) and on fill cofferdams No. 1 and No. 2 (Photographs 10 and 11). At the time of the site visit, the RCC cofferdam was approximately 40 to 50 percent complete and the fill cofferdams were about 20 percent complete. These structures are scheduled for completion by the first week of November, 2013. The RCC structure has reportedly now been completed as of October 31, 2013. A discussion of these structures is given in the following sections.

2.4.2 RCC Cofferdam

The RCC cofferdam is well advanced, as can be seen on the photographs. As decided by the contractor, this structure is being constructed in three separate sections, which will then be joined together into one continuous structure. Photographs 7 and 8 show the upper levels are being formed in layers with wooden formworks.

The RCC properties are judged to be satisfactory and detailing of the structures is satisfactory. It is understood that the RCC mixture currently being used has a 28-day strength of 12 MPa. The tops of the two higher sections are still a few meters below the planned crest level of El. 21 m for this phase of the work.

Photographs 9a, 9b, and 9c show details of the pre-formed vertical joints (contraction joints). These joints are being constructed by inserting plastic sheeting into the RCC at every other lift that will perform as joint initiators. As can be seen on Photograph 9c, water-stops are being installed at the upstream end of each joint to reduce leakage, which is typical for this type of construction.

2.4.2.1 Aggregate Production and Concrete Production

The crushers and screeners are located in the west end of Laydown Area A. The batch plant is located in the west end of Laydown Area B. Haul trucks transported aggregates from the crusher to Laydown Area B for stockpiling west of the batch plant. The three required aggregate sizes produced as per RCC mix design requirements were: group 1 (0-10 mm), group 2 (10-20 mm), and group 3 (20-40 mm). The aggregates were separated into stockpiles based on their respective group.

Aggregates were produced by crushing rock provided from the powerhouse and spillway excavation. The crusher set-up includes a Primary Jaw crusher, a Cone crusher, an Oval Stroke Screen deck, and a Vibrating Grizzly Feeder. A diesel generator CAT C15 ATAAC of 725 kW

provided power to the crusher. Dust suppression operations for the crusher required the use of a water tank that provided up to 2000L of water over 24 hours of operation. One CAT 980H loader was used to take aggregates from the belts and load trucks. One CAT 988H loader was used to feed the crusher jaw. Three types of aggregates were produced simultaneously at an average rate of 3000t per shift. Average daily production time was 20 hours (2 x 10 hour shifts).

The concrete batch plant produced Roller Compacted Concrete as well as Conventional Concrete for Dental, Bedding, Dry pack and Grout for GERCC. The concrete batch plant consists of: an RCC batch plant, a mobile silo, an aggregates and cement feeder, and four horizontal silos (cement pigs) for a total of 650t. A diesel generator CAT C15 ATAAC of 500 kW provided power to the batch plant. One CAT 950G loader was used to feed the batch plant with aggregates. Two ready-mix trucks were used to transport the Conventional Concrete. A water tank with enough capacity to ensure a 20 hour production was set up near the batch plant. The batch plant has the necessary set-up for discharging into ready-mix trucks as well as into rock trucks. RCC was transported from the batch plant to the point of placement in CAT 740 articulated haul trucks and 769 CAT rigid frame trucks.

2.4.3 Embankment Cofferdams

Fill placement was being placed for Cofferdam No. 2, near the downstream end of the RCC cofferdam and at Cofferdam No. 1 at the upstream end. The impervious core consists of compacted grey, silty-sand till. Pit-run sandy gravel is being placed in the upstream transition zone and blasted rockfill is used in the upstream and downstream shell. The rock fill consists of equal-dimensional, sound gneiss particles. As can be seen in the photographs, the zoning of the dam is well-controlled laterally and vertically. Visually, the fill properties are satisfactory and appropriate compaction methods are being employed in MWH's opinion.

2.5 POWERHOUSE/TAILRACE AND SPILLWAY EXCAVATIONS

2.5.1 General

Excavation of the power intake/powerhouse/tailrace channel is more than 85 percent complete, according to Nalcor. Blasting of the spillway channel is completed, although the downstream end and has not yet been mucked. These works are generally on schedule and the powerhouse/tailrace channel will be substantially completed by the end of October 2013. Photographs 2 to 19 show various aspects of the powerhouse/tailrace excavation and some details of the spillway excavation are shown on Photographs 20 to 23. Groundwater inflow into the two major excavations is very low and easily handled by part time pumping.

2.5.2 Rock Conditions – General Description

The excavations are in granitic gneiss bedrock. The rock is very strong, competent, and generally fresh and has a gneissic foliation that is inclined towards the south. There is a distinct color layering parallel to the foliation (Photographs 13, 14, and 15). In slightly weathered rock (right abutment) near the ground surface (approximately 3 to 5 m depth below the top of rock),

these layers are relatively loose and give the rock a slabby appearance. At depth, the effect of this fabric is less distinct and the rock mass has a more homogeneous, massive character. The gneiss is intruded by a number of very strong, crystalline granite dykes and veins (Photograph 19). A number of thin (10 to 30 cm wide) schistose to homogeneous amphibolite layers can be seen in the south wall of the spillway (Photographs 20 and 21) and in other locations of the excavations. Some of these layers form distinct weakness planes of soft, fissile material that extend for 50 m or more along the excavation walls.

The rock mass is broken by a few sets of discontinuities. Site geologists have identified three prevalent joint sets that are developed throughout both excavations:

Set No.	Dip/Dip Dir. (deg)
S1	32/184
S3	51/077
S4	80/303

Discontinuity set S1 is generally parallel to foliation. Individual S1 joint planes can run for 50 m or more in some cases. Sets S3 and S4 cut across the foliation and persist for lengths of up to 10 or 15 m in many areas. Other secondary joint sets are developed at a number of locations. Joint spacing generally varies from 10 cm to more than 100 cm. Joint surfaces are generally planar to slightly wavy and slightly rough. Some altered surfaces were noted but silt/clay infillings appear to be rare.

2.5.3 Powerhouse and Spillway Channels Blasting

Blasting for rock excavations is being carried out in a competent fashion in MWH's opinion. Careful, controlled blasting techniques (no explosives in the control line holes) are used in the concrete structures areas (Photographs 13, 15, and 18a). Presplit blasting is employed to form final walls in the open channels of the tailrace, intake, and spillway (Photographs 13, 16, and 18a). General characteristics are as follows:

- All holes and faces are vertical
- In open channel areas there is a 0.75 m wide bench every 10 m vertical distance
- In the line drilled concrete structures areas there is a 0.75 m bench every 20 m vertical distance
- Powder factor ranges from about 0.8 to about 1.1 kg/m^3
- Vibration monitoring is carried out for all blasts

Blast hole spacing and loading vary depending upon location. However, the site staff personnel indicate these typical patterns apply:

Table 2-1

TYPICAL BLAST PATTERNS (varies from place to place)

Blast Hole Type		Line Drilled Areas (Concrete Structure Areas)	Presplit Blasted Faces (Open Channel Areas)
Control Line Holes		Unloaded 6.5 in. holes, spaced 240 mm co; 20 m deep	Lightly loaded 3.5 in. holes spaced 750 mm cc; 10 m deep
Buffer Holes	First row	Lightly loaded 3.5 in. holes, burden of 0.75 m from presplit line, spacing 1.5 m cc	Lightly loaded 3.5 in. holes, burden of 0.75 to 1.0 m from presplit line, spacing 1.5 m cc
	Second row		Lightly loaded 4.5 in. holes, burden of 1.5 m to 2.5 m from presplit holes, spacing 2.5 m
Production Holes		6.5 in. holes, located 1.5 m from buffer row Blast hole spacing varies from 4.50 x 4.50 m to 4.75 x 4.75 m	6.5 in. holes, spaced 3.00 m burden from buffer row Blast hole spacing varies from 4.50 x 4.50 m to 4.75 to 4.75 m

During the site visit, MWH observed that:

- Most of the line-drilled walls have about 85 percent to 95 percent half-barrel traces and overbreak is minimal (Photographs 15, 16, and 18b).

- The presplit walls are also very good with an estimated 75 percent to 90 percent half-barrel traces (Photographs 16, 17, 18b, and 20). Photograph 16 shows a good comparison between line-drilled and presplit blasted faces at the same location.

- No significant rock mass blast damage (i.e., cracking, block loosening, etc.) could be seen in any of the walls.

- A few areas of localized overbreak were noted in the walls of the spillway and powerhouse/tailrace excavations. For example, a few of the areas of shallow overbreak can be seen in the line-drilled lower north slope of the powerhouse excavation in Photograph 15. Photograph 16 shows detail of an overbreak feature in the presplit wall on the north side of the tailrace excavation. Photograph 19 shows localized overbreak on an outside corner on the south side of the powerhouse excavation. In almost all cases, the overbreak is triggered by shallow block sliding or toppling along natural discontinuities adjacent the face. None of these features are serious concerns but they serve to show the influence of natural discontinuities on the blasting results.

- Observations made during the site visit indicate that the blasting program is well executed and the amount of overbreak is well within the normal standard for this type of work. It is noted that the use of line drilling for the final face control in the concrete structure areas, is very conservative for a rock mass of this quality.

2.5.4 Slope Stability and Rock Support

The rock mass contains numerous natural discontinuities that can trigger block sliding and rock falls in the vertical rock faces. These failures are preventable if the hazardous features are identified on a timely basis and supported with appropriate rock support, usually rock bolts.

The SNC-L site geologists have prepared detailed geology maps of all permanent rock faces on a blast-by-blast basis. The mapping is used in out slope stability analyses and as input for rock support design of permanent rock faces. Based on records seen on September 26 in the site office, the site geological and geotechnical work is being performed to a high standard.

The intent of slope and rock support designs is to ensure permanent slope stability in the areas of the concrete structures and the open channels. In the area of the concrete structures, all rock loads are to be taken up by the rock support and none will act on the various concrete structures. Numerous rock bolts have been installed to stabilize the rock faces. It is understood that pattern rock bolts, have been installed throughout the concrete structure areas as well as in some areas of the open cut spillway and tailrace channels. Spot bolting has been installed in other areas to stabilize individual geological features. Rock bolts are fully grouted, tensioned hollow core assemblages. Bolt lengths of 4m, 6m and 9m have been used and pattern rock bolts spacing varies from 2m x 2m to 3m x 3m.

Wire mesh has been draped over all vertical rock faces as a safety measure. This will be removed at the completion of the project. The rock bolts are visible in some areas but the wire mesh makes it difficult see all of the areas which have been rock bolted.

A review of the excavations and the geology indicates the following as given in Table 2-2:

Table 2-2

GEOLOGY SUMMARY

Location	Description
North Walls	The North Walls of the Spillway and Powerhouse/Tailrace excavations, which are undercut by the south dipping S1 foliation joints, are susceptible to block sliding (see shallow block sliding along S1 joint planes in Photographs 15 and 16). There is potential for relatively deep seated sliding along north wall S1 planes. The project designers and onsite geotechnical staff have evaluated this slope on a blast by blast basis. Rock bolts, both pattern support and spot bolting, have been installed as required and no deep seated or shallow instability was obvious.
South Walls	The jointing in the South Walls is generally favorable for overall South Wall stability. However there have been some very shallow rock fallouts along steeply inclined to vertical joints in this wall (see Photographs 18b and 19). Despite this, however, there appears to be very potential for deep seated sliding along the south walls. Pattern and spot rock bolts have been installed to stabilize the face in many areas.
East Facing Faces	The S3 joint set, which is is inclined 51 degrees towards the east, undercuts and destabilizes east facing rock faces. To date no permanent east facing slopes have been cut but this joint set is prominently displayed in temporary excavations. There is concern for the upcoming excavation of the bull noses between the generator units. Sliding along J3 joints could cause significant overbreak in this area if it is not controlled. Temporary pre-support, in the form of vertical dowels will be installed before excavation is carried out to preserve the integrity of these features. Permanent support, consisting of tensioned, grouted rock bolts will be installed sub-horizontally once the rock faces have been exposed. This is a sound plan, provided it is combined with very carefully executed blasting.
Foundation Base of Concrete Structures	Foundation conditions for water retaining concrete structures in the powerhouse intake and spillway channel are good. The rock mass is strong and the shear strength of concrete/rock interface will be high. The geological mapping indicates that no systematic sets of sub-horizontal discontinuities are present. This was verified by observations made during the September 25/26 site visits. This indicated that there is very little likelihood for the presence of rock mass sliding planes below the foundations of the structures. This should be verified by geological inspections of the final foundations.

The slope control program appears to be satisfactory. However details of rock support design could not be reviewed during the September 25-26 site visit because of limited time. Additionally, the exact extent of rock bolting in the excavation walls was not clear to MWH. The site staff do not have a single plan showing areas of pattern bolting and spot bolting, nor is there a single document summarizing rock bolt patterns and support loads for various areas, as is normal for a project of this scope. All of this information is available on individual blast faces maps and data sheets, but no compilation has been done. Thus it is not possible to comment

on whether sufficient rock support has been installed. In MWH's opinion, this compilation should be performed.

Visual inspections of the rock faces during the September 25-26 site visit were impeded by the ubiquitous wire mesh on the rock faces. This mesh obscures the face and makes it difficult to determine where pattern rock support was installed. It appears that the entire areas of the concrete structures are supported by pattern rock bolts (yellow and red painted bolt heads as seen on Photographs 18 and 19). However, MWH was unable to visually determine the extent of rock bolting in much of the tailrace channel. In particular, the extent of pattern bolting in the high north face of the tailrace could not be assessed visually. Theoretically, the North Face should require more support because of the prevalent J1 joints. This could not be confirmed during the site visit and there was insufficient time to go through the rock support and face mapping records present on site.

2.5.5 Erosion of Unlined Spillway Channel

It is understood that flow velocities in the final Spillway channel will be over 20 m/s. This level of flow can cause serious erosion in the rock mass of an unlined spillway if the rock mass has insufficient resistance to erosion. Erosion hazard is more influenced by the properties of the discontinuities than by the strength of the rock material.

The project designers plan to install a concrete lining in the upstream end of the channel, downstream of the gate structures. Most of the downstream end of the spillway channel has not yet been excavated and rock mass conditions have not yet been determined in this area. To date no decision has been made to line the downstream area pending exposure and evaluation of the rock mass in this area. Geological site staff intend to carry out an engineering geology rock mass evaluation of the excavation once the lower benches have been excavated to allow completion of the geologic mapping. This work will include an assessment of the Annandale Erodibility Index and computations of scour potential. Appropriate concrete lining will be designed and constructed if required. The IE endorses this approach.

2.6 RIVER DIVERSION

River closure is scheduled to take place in 2016. During the construction of the RCC overflow spillway, the Churchill River will be diverted through the gated spillway. For this purpose, the five bays of the gated spillway will initially be constructed without rollways and the gates will be closing on an invert set at El. 5.0 m. The river will be closed by groins built with rock from the excavation and selected material designed to withstand the river flow velocities. The optimum river closure sequence should correspond, to the extent practicable, to the size of the rock that is available on the site.

A closure scheme of two parallel groins has been selected. The scheme has been studied with a physical model at the NHC laboratory in Edmonton, Alberta (Patarroyo et al, 2013). The results of this study have been used to calibrate a numerical model which could then be used to

understand the implications of any changes to the location and alignment of the cofferdam as the design is finalized.

The closure will use rock from the Bulk Excavation. The studies have identified the sizes and quantities of rock that would be required so that the contractor could be directed to stockpile this rock for use later in the Project.

MWH requested further information from Nalcor on the sizes of rock required for river closure and was supplied the following information:

- Dump Rockfill corresponds to an average size block (D50) of 200 mm;
- Class 1 material corresponds to D50 of 500mm with gradation of 300-1,000 mm;
- Class 2 material corresponds to D50 of 1,100 mm with gradation 1,000-1,200 mm; and
- Class 3 material corresponds to Dmin of 1,300 mm.

The river closure will take place following the passage of the spring freshet when the flow in the river falls to1800 m3/s or lower. This means that most likely closure cannot begin until July. Figure 5 show the results of numerical modeling of the closure. The closure will be made with the top of the closure groins at El 15 m, which is required for the estimated 1/20 year flood for the July/August season. As soon as closure is complete, the upstream groin will be raised by 2 m to provide protection against the 1/20 summer/fall flood which could occur during the completion of the construction. The cofferdam must be completely finished by the end of October 2016, to allow for impoundment of the diversion head pond to El 25 m prior to the start of freeze up in order to facilitate the creation of a stable thermal ice cover and therefore reduce the risk of frazil ice accumulation and downstream ice damming .

2.7 CIVIL DESIGN ASPECTS

As noted previously, the MWH team that visited the Project site did not have the opportunity to visit many of the other sites of the three projects, other than at MF. MWH requested photographs of areas of the projects that depict some of the work that has been ongoing since construction started at the Project.

Of particular interest was the two marshaling yards where materials will be received by Nalcor and stored for contractors until the material are released to the contractors. MWH was advised that Nalcor has re-assessed the size of the yards and has increased both yards to better accommodate the materials that are expected to be stored in the yard prior to award of the construction contracts and the loading and unloading activities. Photographs of both marshaling yards have been included in Appendix H to give the reader a clear impression of the size of the yards and the preparation efforts to prepare a level, well-drained surface that have been ongoing for several months.

Photographs were also received of the site preparation that has started on preparing the Soldiers Pond Station area for project structures. Additionally, the Shoal Cove Station area photos showing ongoing work were reviewed. These photos were not included with the report since they are general in nature and lack descriptive titles and a photo location map. Photographs were also received of right-of-way clearing for portions of the transmission lines. Clear-cutting of all vegetation is observable for the line that parallels the existing line. These photographs were also not included with this report, but are available from Nalcor.

Nalcor advised the MWH team that work is progressing well for site preparation and they did not report any issues of a general nature or a specific nature that have occurred to date.

2.8 INFRASTRUCTURE AND SCHEDULE

The following observations pertaining to the project's infrastructure are furnished based on MWH's observations:

- Site camps and infrastructure are adequate to handle the planned construction works.
- The Camp conditions, with only 300 beds, were very tight at the time of the site visit. However new camp facilities are being constructed and there will be accommodations for almost 1,000 persons by November.
- Roads are generally good, and are up the normal standard for a hydroelectric construction site.

The following observations pertaining to the project schedule are as follows:

- Schedule achievements are satisfactory.
- Construction work will continue throughout the winter.
- The major works (CH0007) will be covered by large weatherproof shelters to enable civil works construction during winter conditions.

2.9 SUMMARY OBSERVATIONS

The following observations made during the September 2013 site visit by the MWH Team members are summarized below.

- The planned North Spur remediation measures, as presented by design staff in St John's during the site visit, are appropriate to stabilize the slopes, arrest natural mass wasting and to control seepage and piezometric pressures after impoundment of the reservoir.

- Cofferdam construction is proceeding satisfactorily. Work on the RCC and Fill cofferdams, as viewed during the site visit, show satisfactory work by the contractor and supervisory staff that appears to exceed usual practice.

- The large rock excavations for the Powerhouse/Tailrace and the Spillway channels are more than 90 percent complete. The blasting quality exceeds normal practice, in MWH's opinion. The line drilled and pre-spit permanent faces have very little overbreak and blasting damage is minimal.

- The final rock slopes have been supported by rock bolts in many areas. The design intends that all permanent rock slopes have long term stability against rock falls and sliding failures. In particular, no rock loads will be carried by concrete structures. In general, pattern rock bolts have been installed in the areas of the concrete structures and in much of the open channels.

- Foundation conditions for water-retaining concrete structures in the Powerhouse, Intake, and Spillway channel appear to be satisfactory. The rock mass is strong and the shear strength of concrete/rock interface is expected to be high, in MWH's opinion. The geological mapping to date indicates that no systematic sets of subhorizontal discontinuities are present.

- Due to high flow velocities that are projected to occur during the operation of the spillway channel, the potential for rock erosion is high and will require mitigation. Nalcor has decided to install a concrete lining in the upstream end of the channel, but the decision for the downstream channel will be decided when the rock, which is presently covered by blasted muck, can be inspected. It is intended to classify the rock with the Annandale erodibility index. This procedure is a useful tool for assisting in the decision to line the channel.

- Site camps and infrastructure appear to be adequate to handle the planned construction works. The camp conditions, with only 300 beds, were very tight at the time of the site visit. However, additional camp facilities are being constructed and there will be accommodations for almost 1,000 persons by November 2013. Roads are generally satisfactory, and are generally up the normal standard for a hydroelectric construction site.

- Schedule achievements are satisfactory. Construction work will continue throughout the winter. The major works will be covered by large weatherproof shelters to enable civil works construction during winter conditions.

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SECTION 3

PROJECT DESIGN AND PROJECTED PERFORMANCE

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SECTION 3

PROJECT DESIGN AND PROJECTED PERFORMANCE

3.1 PROJECTED PROJECT PERFORMANCE

In the following paragraphs of this section we have included our comments based on the review of the information furnished to MWH that summarizes our observations to date (November 2013). Additional information has been requested of Nalcor to allow us to complete our review and to allow us to form our final opinions pertaining to some of the subjects included herein. Although MWH must wait for award of contracts to complete its review, which is usual for mega-projects at the current stage of development, in our opinion, the expected project performance will be achieved assuming the Integrated Project Team will continue to closely manage the projects.

3.2 PROJECT HYDROLOGY

3.2.1 Spillway Design Flood

For high hazard potential critical structures where loss of life and substantial damage would occur if a dam breach occurred during a flood event or a sunny day event[3], international standards and those of Canada required that the spillway be designed to pass the probable maximum flood (PMF). This flood is derived using stochastic methods that estimate the probable maximum precipitation (PMP) in the watershed and then apply this precipitation to the watershed to derive the runoff associated with the PMF. Consultants involved in this effort found that for the Muskrat Falls Project site, the PMF is 29,750 cms. This flood was used to size the capacity of the gated spillway (16,750 cms) and the RCC dam (13,300 cms). Reservoir flood routing studies using the reservoir volume curve and the hydrograph for the PMF determined the resulting maximum flood elevation of the reservoir during a PMF event to be El. 45.1 mean sea level (msl). From this elevation, the deck elevation of the power station was established, considering freeboard requirements.

3.2.2 Ice Effect on Tailwater Elevation

Ice affects water elevation since water is forced to flow beneath it which results in higher frictional resistance than that generated by an open water surface. A higher water surface elevation for a given flow occurs to overcome the additional resistance. Nalcor performed studies that indicate that ice can expect to form at the site during the months from November to May. The studies indicate, for example, that for a plant discharge of 2,500 cms, the tailwater is 2.0 meters higher when ice cover is present than during the ice free period. This ice-cover condition affects the rated head on the generating units by about 5 percent, and therefore, it

[3] A sunny day event is assumed to be a day when average flow is occurring under the normal reservoir El. 39.0 and normal tailwater with no rainfall.

must be taken into consideration when computing the power output of the hydroelectric plant. Two tailwater curves were derived for open water and for ice cover which were used in the energy generation model (Vista Decision Support System™ (Vista DSS™)) where the model employs an adjustment factor to shift the curves to accommodate the conditions that are being modeled.

3.2.3 Power Generation

Two models have been used during the derivation studies associated with determining the power generation from the Muskrat Falls (MF) power plant. Both models used a monthly time resolution (time-step). The Vista DSS™ model employs different software and is the preferred model to use for the LCP. It uses a more detailed time resolution and a much more detailed representation of the system. The Water Management Agreement (WMA) for the Churchill River prescribes that the operation of the Churchill Falls project and the LCP must be coordinated as prescribed by the Independent River Operator and includes provisions for banking energy in the seasonal reservoirs at Churchill Falls. The Vista DSS™ is reported to accommodate these requirements since it is able to route the release Churchill Falls flows that arrive at Muskrat Falls about three days later. MWH has not independently verified these results, but other commercially available software, such as the suite of programs available from the U.S. Army Corps of Engineers would allow comparisons to be made if there is a requirement to do so.

The firm energy capability for the Project is defined as “the maximum annual energy that can be supported by Muskrat Falls during the critical (dry) hydrologic sequence, assuming coordinated operations between the Muskrat Falls and the CF(L) Co’s facilities, as specified in the WMA and while meeting all of CF(L)Co’s obligations from prior agreements.” We note that for each system, the definition of firm energy is specifically defined for it. International standards sometimes require an assessment that looks at the energy that is available for 95 percent of the time or 98 percent of the time, for example. In the analysis, the critical period was determined, and for this period detailed chronologic simulation was performed to determine the firm energy capability of Muskrat Falls. The load demand on the Churchill Falls plant was determined based on contractual obligations and by considering the full range of hydrologic variability according to the reports furnished to MWH. Excess sales opportunities were also determined, as according to information furnished us, and both load and excess sales were inputted to the firm energy and Average Annual Energy (AAE) analyses.

The AAE for the Project is defined as

> the increase in the average annual generation that can be expected from the Churchill River with the addition of Muskrat Falls, again reflecting the benefits of coordinated operations with the CF(L)Co facilities. The average annual energy is estimated by simulating operations over long periods (of time, sic) and the range of hydrologic conditions, as defined by the available hydrology.

The AAE was determined by performing a series of long-term analyses, using a range of Muskrat Falls load demands which were higher and lower than the firm energy demands. The simulations used 30-years of record; the simulations were reported to be repeated "54 times with a different hydrological sequence each time". The period of hydrologic record was from 1957 to 2010 where data was used (a period of 53 years). Normally, we advise that the period of record must be at least 30 to 35 years of record before these studies are meaningful, and normally like to use 50 years of record if it is available in determining AAE.

The energy runs also made use of computed headloss equations, relating the losses to the flow squared, and to the guaranteed efficiency of the turbines and generators as it relates to rated head and discharge. This information is presented in one of the documents furnished to the IE that was prepared by Nalcor's consultant, Hatch Energy. Nalcor's support data is also included in the hydraulic design criteria that specifically identify the equations used to compute the headloss. A loss that is typically omitted, or incorrectly derived, is the loss at the exit of the draft tube; MWH verified that this was included. The IE has not independently confirmed the values used, nor has it separately confirmed the calculated power and energy from the project, however, the procedures followed are typically used in the power generation model.

We were advised that at full head and flow, 0.47 meters of head loss was derived and included in power estimates. An equation was developed for headloss and a coefficient determined based on these parameters for other flows and heads.

Based on the plots that relate the guaranteed efficiency of the turbine and generator, as noted above, these guaranteed values were used in the model to compute the power. We believe that the guarantee value is that value prescribed in the turbine and generator generating equipment Request for Proposal (RFP), and not the actual value that Andritz committed to furnish in the contract as their guarantee value. Nalcor advised the model values are a "little higher" than the guarantee values. Normally, the final energy computations are performed using the equipment manufacturer's guaranteed values to determine the values of power that are used in the financial pro forma.

When the generating units are shut down, Nalcor indicated flow will be released at the gated spillway structure. This release, depending on river flows, may remove water from storage. The reservoir will be maintained between El. 39.0 and El. 38.5 msl.

The results of the power generation runs performed by a consultant (Hatch) are given in Table 3-1, below.

Table 3-1

FIRM ENERGY AND POWER AND

AVERAGE ANNUAL ENERGY AND POWER

PROJECT	STUDY	FIRM ENERGY (TWH/YEAR)	FIRM POWER (MWc)	AVERAGE ANNUAL ENERGY (TWH[1]/YEAR)	AVERAGE ANNUAL POWER (MWc[2])
MUSKRAT FALLS	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		[redacted]	[redacted]	[redacted]	[redacted]
		[redacted]	[redacted]	[redacted]	[redacted]

NOTES:
1. TWH is terra-watt hours or $1x10^{12}$ watts (or $1x10^{9}$ kilowatts).
2. MWc is megawatts continuous.

[redacted]

3.2.3.1 [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3.2.4 Diversion Flood Assumed for Construction and Ice Affects

To enable cofferdam heights to be determined, Nalcor selected a return period flood of 20-years recurrence interval. Normally for larger projects where excavations are open for about one year while concrete is being placed, a 20-year to 25-year recurrence interval is selected as the minimum value for which the contractor must provide protection. Risks associated with floods with recurrence levels higher than this value are then either assigned to the Owner as their responsibility or to the contractor depending on contract language. For embankment structures, usually a longer period than 20-year return period for important structures is prescribed. For construction that takes longer than one year of cofferdam use, recurrence intervals of longer period are prescribed and costs of increased cofferdam sizes are paid for by the Owner. Determination of the value to use should be based on economics, balancing the cost of higher and larger cofferdams with the loss or damage of the structures being constructed and the cofferdam, cofferdam rebuilding, clean-up costs, environmental mitigation costs and fines, and lengthening of the contract schedule which delays power production, and higher interest during construction payments on construction loans. Once the recurrence interval is selected, the water surface elevation is determined from hydraulic studies associated with the construction flood discharge, and the freeboard (elevation distance between the flood level and cofferdam crest) is determined to establish the crest elevation of the cofferdam.

In the case of Muskrat Falls, another important consideration was required since ice jams are known to occur almost every year downstream of the dam and power station complex site. Historically data is available that allows a determination of water level flood elevation that occurs during an ice jam. Selecting the elevation that corresponds to a recurrence interval of 40-years for an ice jam event was then determined and compared to the elevation established from a 20-year return period flood; in this case, the ice jam elevation controlled the design of the RCC cofferdam (No.3) and establishes its height.

3.3 EXPECTED PERFORMANCE OF MAJOR SYSTEMS

Based on our current understanding of the LCP and Nalcor's contracting philosophy, which we have observed in reviewing the RFPs and the Contracts reviewed to date (November 2013), only tier-one fabricators, suppliers and installers of equipment and systems, along with tier-one contractors are being solicited to propose on the work. Tier one companies are assumed to be top-level and among the largest and most well-known companies of their type and are among the most important members of a supply chain to supply to an original equipment manufacturer. This philosophy in turn generates competitive responses from these firms who supply the utility-grade equipment required of the specifications. This equipment and systems meet, in our opinion, the intent of the contract's quality requirements and the technical conditions. We,

therefore, are currently of the opinion, and with our monitoring of the work during Phase II and thereafter, expect that the performance of major systems and sub-systems will be satisfactory.

3.4 MAJOR SYSTEMS COMPATIBILITY AND COMPLETENESS

We currently (November 2013) have only three contracts available to form a preliminary opinion pertaining to the compatibility of major systems and completeness. These contracts are as follows: CH0030, LC-SB-003, and CH0007.

Contract CH0030 involving the turbines, generators, and associated controls for this equipment is being provided by Andritz Hydro, a tier-one company. Andritz has provided numerous equipment packages for major hydro projects like this, and several recent ones that MWH has direct knowledge of, being the Owner's Engineer. Based on what has been reviewed to date, without viewing the fabrication, assembly, installation, and start-up and testing, we expect that the hydro-generating package will perform as designed and expected. Since the responsibility of the system compatibility and completeness lies with Andritz, following the technical provisions of the contract documents, we expect this package will be satisfactory.

Contract LC-SB-003 involving the Engineering, Procurement, and Construction (EPC) form of contract delivery for the submarine cable(s), which is directly managed by Nalcor is being provided by one of the three leading designers, fabricators, and installers of submarine cables, Nexans Cable. Based on information known to MWH, Nexans has completed many subsea cable projects, which are judged to be more difficult than the SOBI cable crossing. Therefore, MWH is of the current opinion that their system will be compatible with the land-based transmission systems and their system, and in itself will perform satisfactorily and will be completed, as specified.

Contract CH0007, involving the construction of Intake and Powerhouse, Spillway and Transition Dams, will be performed by Astaldi Canada Inc., based in Toronto. Astaldi's parent company is based in Italy and they have offices in the United States, Latin America, and the Middle East. MWH has direct working experience with Astaldi's Latin America company as Owner's Engineer on much smaller hydroelectric projects with less severe weather conditions than prevailing conditions at Muskrat Falls. All contractors will require Nalcor management oversight.

3.5 OPERATING HISTORY OF MAJOR EQUIPMENT

The following Table 3-2 lists major equipment that the IE has reviewed or will review during the Phase I work and comments germane to its operating history.

Table 3-2

OPERATING HISTORY OF MAJOR EQUIPMENT

ITEM NO.	CONTRACT	EQUIPMENT	REMARKS PERTAINING TO HISTORY	COMMENTS
1	CH0030	TURBINES	ANDRITZ WILL MANUFACTURE THE TURBINES; ANDRITZ HAS MANUFACTURED OVER 2000 KAPLAN TURBINES WITH OVER 39 BEING IN THE 8-9.5 METER SIZE RANGE	SATISFACTORY
2	CH0030	GENERATORS	ANDRITZ WILL MANUFACTURE THE GENERATORS USING COMPONENTS FROM THEIR WORLDWIDE FACTORIES. ANDRITZ HAS MANUFACTURED OVER 200 GENERATORS IN THE SAME SIZE RANGE 204 MW.	SATISFACTORY

Table 3-2 (cont'd)

OPERATING HISTORY OF MAJOR EQUIPMENT

ITEM NO.	CONTRACT	EQUIPMENT	REMARKS PERTAINING TO HISTORY	COMMENTS
3	CH0030	GOVERNORS	HEMI CONTROLS WILL MANUFACTURE THE GOVERNOR CONTROL SYSTEM. HEMI HAS NOT MANUFACTURED GOVERNORS FOR HYDRAULIC TURBINES FOR KAPLAN-TYPE TURBINES IN THIS SIZE RANGE.	IN MWH'S OPINION, CAREFULLY MONITORING OF THIS EQUIPMENT WILL BE REQUIRED, INCLUDING THE DESIGN AND WITH TRIAL SHOP TESTING OF THE UNITS BEFORE SHIPMENT AND WHEN INSTALLED IN THE FIELD.
4	CH0030	STATIC EXCITATION	ABB WILL MANUFACTURE THE STATIC EXCITATION SYSTEM. ABB HAS MANUFACTURED OVER 25 EXCITATION SYSTEMS FOR HYDRO GENERATORS OF THE SAME SIZE OR LARGER RANGE AS THE LOWER CHURCHILL UNITS	SATISFACTORY

Table 3-2 (cont'd)

OPERATING HISTORY OF MAJOR EQUIPMENT

ITEM NO.	CONTRACT	EQUIPMENT	REMARKS PERTAINING TO HISTORY	COMMENTS
5	LC-SB-003	SUBMARINE CABLE	NEXANS HAS MANUFACTURED 2,500-3,000 KM OF MASS IMPREGNATED INSULATED CABLE FOR HVdc SUBMARINE CABLE. NEXANS HAS EXISTED AS A COMPANY FOR 35-YEARS	SATISFACTORY
6	PH0014	GENERATOR STEP-UP TRANSFORMER		CONTRACT NOT YET AWARDED
7	CD0502	CIRCUIT BREAKERS		CONTRACT NOT YET AWARDED
8	PH0016	GENERATOR CIRCUIT BREAKERS		CONTRACT NOT YET AWARDED
9	CDO501	CONVERTER TRANSFORMERS		CONTRACT NOT YET AWARDED
10	CD0501	THYRISTOR VALVES		CONTRACT NOT YET AWARDED

3.6 ELECTRICAL INTERCONNECTIONS BETWEEN PROJECTS

3.6.1 General

MWH reviewed the following studies to ascertain if the electrical interconnections between the project provided security as required by the basis of design and good utility practice: stability studies; load flow and short-circuit studies; and the Churchill Falls-Muskrat Falls transmission link study. In addition, MWH reviewed a set of one-line diagrams to determine that the electrical transmission network is complete.

3.6.2 Load Flow and Short-circuit Studies

The studies were carried out by Nalcor to access the steady-state performance of the Newfoundland and Labrador power system with the HVdc interconnections between Muskrat Falls and Soldiers Pond (Island Link) and between Bottom Brook and the Nova Scotia (Maritime Link) power system. The design provided for a DC voltage level of +/- 350 kV and a nominal bipole rating of 900 MW, and for the Maritime Link a DC voltage level of +/- 200 kV and a nominal bipole rating of 500 MW. In addition to the nominal ratings given, the design requires a 10-minute overload capability of 200 percent and a continuous overload capability of 150 percent, both in the mono-polar mode on the Island Link. This will enable the Island system to sustain a permanent pole outage on the Island Link without having to shed load. The Maritime Link is required to have a 500 MW continuous capability in bipolar mode in both directions.

The studies were designed to provide the following information:

- Quantify the operating modes in both the normal and outage conditions;
- Define the overload requirement for the Island Link;
- Define the limits for the Maritime Link export levels;
- Assess the reactive compensation requirements in the Island system under various load conditions;
- Determine the maximum and minimum short circuit levels that would occur at the converter station AC busses at Muskrat Falls, Soldiers Pond and Bottom Brook; and
- Identify system conditions that will result in overloads or under-voltages that will require mitigating measures on the AC systems in Labrador and the Island.

Based on the review of the studies, the design appears to be satisfactory to achieve the objectives of the study and to define the limits on the particular study goals.

3.6.3 Stability Studies

The report reviewed by MWH outlined the results of the stability studies carried out to examine the dynamic performance of the AC and DC systems including the HVdc interconnections between Muskrat Falls and Soldiers Pond (Island Link) and between Bottom Brook and the Nova Scotia power system (Maritime Link). In addition to the voltage levels discussed in 3.6.2, the Island Link will normally be a uni-directional from Labrador to Newfoundland, but the system can operate in the reverse direction. The Maritime Link is required to have a 500 MW continuous capability in the bipolar mode in both directions. The studies were designed to determine the dynamic performance of the AC/DC systems following major faults on either the AC or DC systems.

The objectives of the studies were as follows:

- Verify that the interconnected systems of Newfoundland and Labrador with interconnections into Quebec and Nova Scotia can operate satisfactorily through a wide range of faults resulting in outages on the transmission network;

- Determine the requirements of the control functions that will be required on the Island and Maritime DC links;
- Determine the requirements for additional equipment in the form of static volt amperes reactive (var) compensators and synchronous condensers that would be required at or near the converter stations to ensure satisfactory dynamic performance;
- Verify that load shedding on the Island will not occur for the range of fault cases examined; and
- Determine any operating requirements that must be applied to the Island and Maritime DC links to ensure stable operation.

The criteria selected for the study were taken from the Newfoundland and Labrador Hydro (NLH) Transmission Planning Manual and are given below to demonstrate that the project systems will function satisfactorily within the existing system:

- The system will be able to sustain a single contingency loss of any transmission element without loss of system stability;
- The system is able to sustain a successful single pole reclose for a line to ground fault;
- Multi-phase 230 kV faults will be cleared in a maximum clearing time of six cycles;
- Load shedding should not occur for the loss of the largest generator in Newfoundland;
- Load shedding will not occur for the temporary loss of a pole or bipole of an HVdc link;
- The system response should be stable and well damped;
- Post-fault recovery voltages on the AC system shall be:
  - Transient under-voltages following fault clearing should not drop below 0.7 per unit (pu); and
  - The duration of voltage below 0.8 pu following fault clearance should not exceed 20-cycles;
- Post-fault frequencies should not drop below 59 Hz; and
- Under-frequency load shedding should be minimized.

The report discusses the slight modifications that were necessary to accommodate the models used in the Power System Simulator for Engineering (PSSE) program following International Council on Large Electric Systems (CIGRE) documents and discussions with Nalcor pertaining to load shedding. In general, the studies showed that they satisfactorily achieved the objectives and could be considered to be satisfactory in meeting the design.

3.6.4 Dynamic Performance of the Churchill Falls/Muskrat Falls System Study

MWH reviewed the results of the studies carried out to determine the relative capabilities and performance of the transmission link between Churchill Falls and Muskrat Falls for two considered transmission voltages: 315 kV and 345 kV; this link would replace the existing 138 kV line from Churchill Falls that supplies Happy Valley. The study demonstrated that a cost savings of between $10M to $14M could be expected by using the 315 kV systems without sacrificing dependability and thus it was adopted.

3.6.5 One-Line Diagrams

MWH reviewed the one-line diagrams furnished by Nalcor to assess the general arrangements of the electrical systems associated with the projects and to determine if the entire network would be able to function as required by the design criteria.

The following one-line diagrams were reviewed:

- 230 kV Soldiers Pond Terminal Station (AC Substation)
- Muskrat Falls HVdc Transmission System, Overall Single Line Diagram, 315 kVac and 350 kVdc Transmission System (seven single line diagrams)
- 735-315 CF Switchyard Extension, Single-Line Diagram, 735-315 kV Substation
- 315-138 kV Muskrat Falls Switchyard, single-Line diagram, 315-138 kV Switchyard

These one-line diagrams are included in Appendix B.

Based on our general review, the single line diagrams indicate the electrical configuration and the intended protective elements in a clear fashion, and are believed to be satisfactory to meet the design requirements.

3.7 TECHNICAL CRITERIA CONSISTENCY

We currently reviewed a limited number of contract documents and the RFPs that are available to opine on the technical criteria consistency. An example is contract CH0030 for the turbines and generators and comparing certain provisions of this contract pertaining to the water conveyance passageways with the finishes required of the concrete surfaces required in CH0007 to cite a technical consistency example. We find that the criteria are consistent and have been accepted by the equipment supplier as being adequate, assuming that the passageway surfaces will actually be constructed, as required.

We also note that provisions have already been made by Nalcor to ensure that the turbine and generator components will fit within the pit dimensions used in the RFP/bid documents for CH0007 since they obtained early-on, dimensional requirements from each of the three bidders for CH0030 to help them plan the layout of the power station for Muskrat Falls and included in the drawing package in the CH0007 RFP.

We further note that for contract CH0006, Bulk Excavation, the provisions for excavation have been carefully coordinated with the drawings and contract language found within RFP CH0007, in our opinion, to accommodate a smooth transition between the contract work when it is accepted by Nalcor and transferred to the contractor for CH0007.

We also noted in contract CH0006 that dewatering of the excavation would be occurring after the contractor was granted substantial completion. Nalcor was questioned about this matter and they indicated that they would be responsible for this system that would be furnished to the contractor for CH0007 to allow it to construct the substructure of the power station, intakes and

transition structure within its contract. The IE was pleased with Nalcor's response and finds it should allow the smooth transition between contracts to be promulgated.

3.8 EXPERIENCE AND CAPABILITY OF MAJOR PROJECT PARTICIPANTS

Nalcor has advised the IE that for all of the major contracts that are currently under design or that have been awarded, a careful screening process was conducted to allow only tier-one contracting groups and suppliers the opportunity to propose on the work. Of the contracts that we have reviewed wherein we have been apprised of the bidders who proposed on the work, we are of the opinion that careful consideration and due diligence to screen prospective bidders has been conducted and that supports Nalcor's philosophy and statements made to the IE.

Nalcor also selected a Canadian Engineering firm that has not only prepared numerous designs for hydroelectric projects and other projects in Canada, but worldwide. Following Nalcor's philosophy of project development and management, Nalcor shortlisted only tier-one engineering firms to propose on the EPCM services that were awarded to SNC-Lavalin (SNC-L). Work is currently ongoing with SNC-L transferring key hydroelectric specialists to St. John's but also performing work in several of their other offices in Canada.

Nalcor has also engaged very experienced consultants who have been employed on mega projects in Canada and internationally to assist permanent staff, but who work solely on the LCP and hold key positions of management on this project. The guidance the Nalcor team provides to its EPCM contractor, and to the contractors it has engaged, should allow early detection and resolution of any issues that may or will occur during the construction of the LCP.

Additionally, Nalcor has engaged an Advisory Board (Board) of senior engineers to review project aspects and independently opine on their findings directly to Nalcor. The Board meets as often as required by project needs and will be active throughout the construction period. MWH personally knows these individuals they are qualified to provide sound opinions for the Integrated Project Team to consider.

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SECTION 4

CONSTRUCTION PLAN AND SCHEDULE

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SECTION 4

CONSTRUCTION PLAN AND SCHEDULE

4.1 EPCM (ENGINEERING, PROCUREMENT, AND CONSTRUCTION MANAGEMENT) CONTRACT REVIEW

We note that Nalcor advised MWH that they have revised a pure EPCM Model to an Integrated Project Team Model. The following subsections discuss this Agreement.

4.1.1 Responsibilities of Parties

The EPCM Services Agreement (EPCM Agreement) for the Muskrat Falls Hydroelectric Development between Nalcor and SNC-L is a well prepared and comprehensive contract that places the responsibility for design of a successful project on SNC-L, in MWH's opinion. The effective date of the Agreement is February 1, 2011.

Late in 2012, Nalcor made a strategic decision to adjust its organizational model as it moved through Decision Gate 3 (DG3). At this decision point, the bulk of strategic front-end deliverables that were the focus of Nalcor (i.e., environmental approvals) had been achieved, while the LCP was transitioning from the engineering and procurement phase into the construction phase. A change in the working organizational model was also considered by Nalcor to be key to ensure clarity on roles and responsibilities, while fully leveraging the collective organization resources to achieve priority activities.

Leveraging the strength of Nalcor's Owner's Team, combined with the significant resources of SNC-L as EPCM Consultant, the execution model has transitioned from a pure EPCM model to an Integrated Project Team Model, or Option 2 to Option 1 in Figure 4-1. The mantra, according to Nalcor, is "One Team. One Vision." The organizational model shift is viewed as a key enabler of team effectiveness, which is considered imperative for delivery of this megaproject.

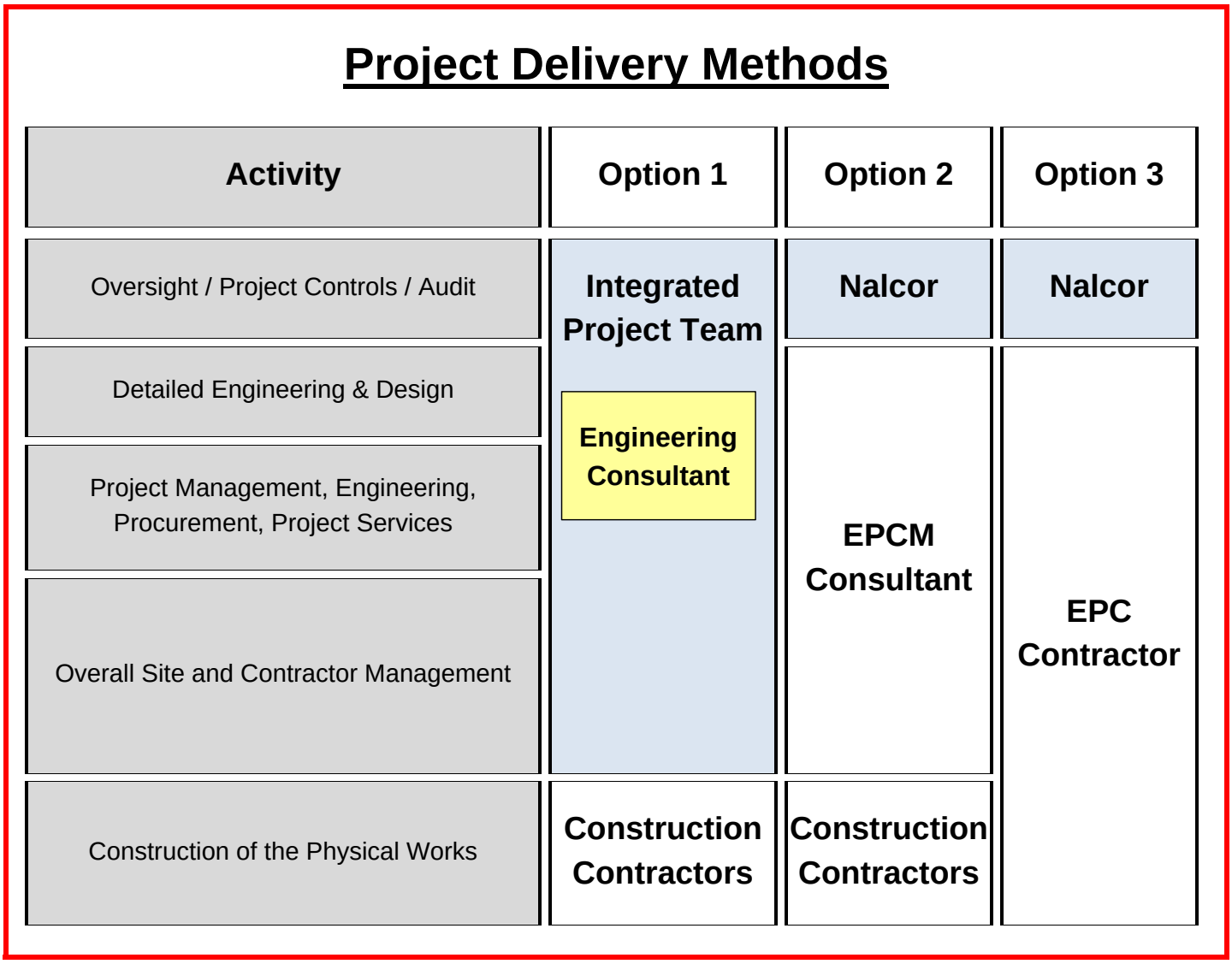

Figure 4-1 Project Delivery Methods[4]

This Integrated Project Team, or Project Delivery Organization, consists of Nalcor and SNC-L resources as well as various third party consultants, including Hatch, AMEC, Stantec, and independent consultants. Broadening the potential sourcing base for resources has facilitated the ability to secure scarce PM and Construction Management resources within Labrador/Newfoundland's heated resource-based economy. Nalcor advised MWH that within this Integrated Project Delivery Organization a Nalcor person can report to a SNC-L person, and vice versa. The objective is to avoid duplication, fully leverage available resources, right-size the project team, and ensure an organizational structure that supports empowerment, accountability, and delegation of authority, according to Nalcor.

[4] Figure 4-1 Project Delivery Methods was furnished to MWH by Nalcor for use in the IER.

Nalcor contends that strong project governance and leadership is achieved by the establishment of an Integrated Management Team that is led by a Project Director. The Nalcor Project Director reports to the LCP VP and Executive Committee. Figure 4-2 gives the high-level organization and governance structure for the LCP.

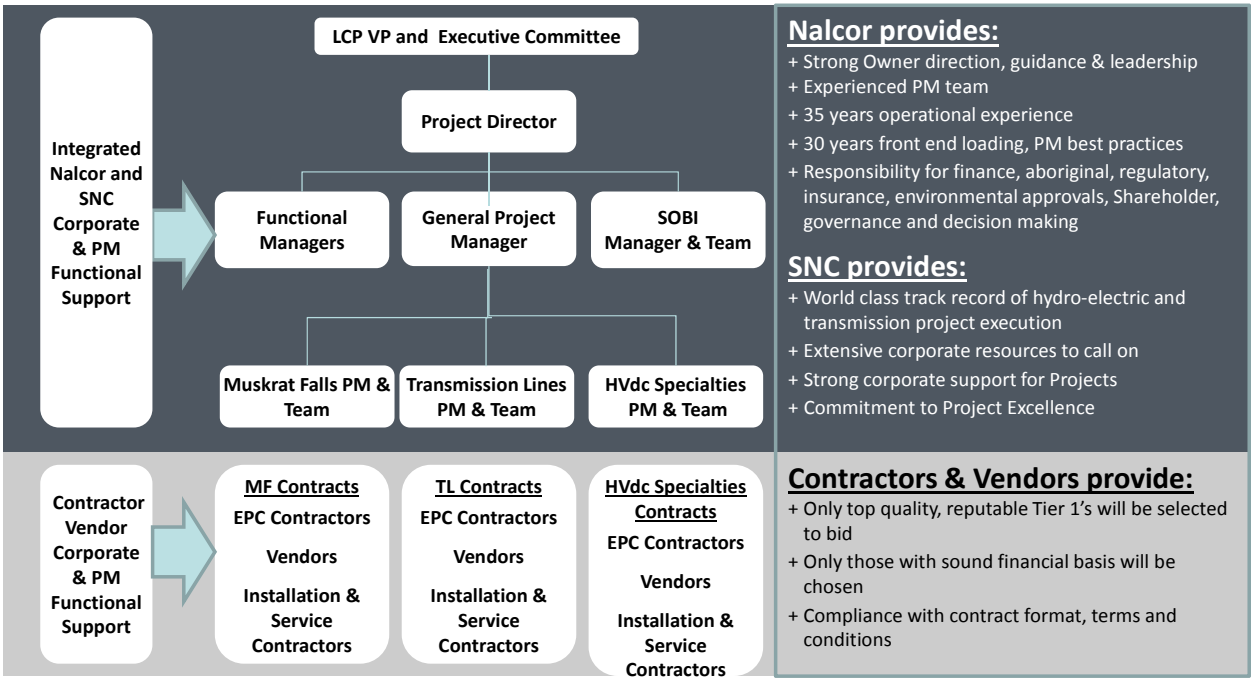

Figure 4-2 LCP Organization and Governance[5]

Consistent with the premises stated within the Overarching Contracting Strategy, this Project Delivery Organization is the Integrator of all contractor works. The Project Delivery Organization must fulfill all obligations that were previously defined for each of Nalcor and for SNC-L as EPCM Consultant.

Within the model, SNC-L remains solely responsible for the completion of all engineering and design, and for assurance of the quality of all engineering with standard engineering practice as previously stated in Section 4.1.2. The SNC-L Senior Manager has accountability to ensure SNC-L's engineering and design practices are upheld.

Nalcor has advised MWH that the Project Delivery Organization relies heavily on the processes and systems offered by SNC-L, in particular as it relates to project control. SNC-L's project management enterprise system, PM+, has been implemented on the LCP. To that effect, SNC-L provides a substantive resource base to support the Project Delivery Organization.

[5] Figure 4-2 LCP Organization and Governance was furnished to MWH by Nalcor for use in the IER.

As can be seen in the organization figure, the organizational design consists of three PMs reporting to a General PM. A deputy PM supports each PM, while overall delivery, including scope, cost, and schedule management, of a particular project component or physical area, is the responsibility of the Area Managers. Reporting to each Area Manager are Package Leaders (i.e., sub-Area Managers), package engineers, and contract administrators. This Area-based management approach has remained consistent since the engagement of SNC-L in early 2011, and underpins the overall delivery strategy.

The Marine Crossings Team, responsible for the SOBI work, is led by a designated PM who reports directly to the Project Director, but maintains day-to-day working relationships with the three Component PMs and all functional managers.

Figure 4-3[6] presents the organizational chart for the Integrated Management Team reporting to the Project Director.

[6] Figure 4-3 Integrated Management Team Organization Chart was furnished to MWH by Nalcor for use in the IER.

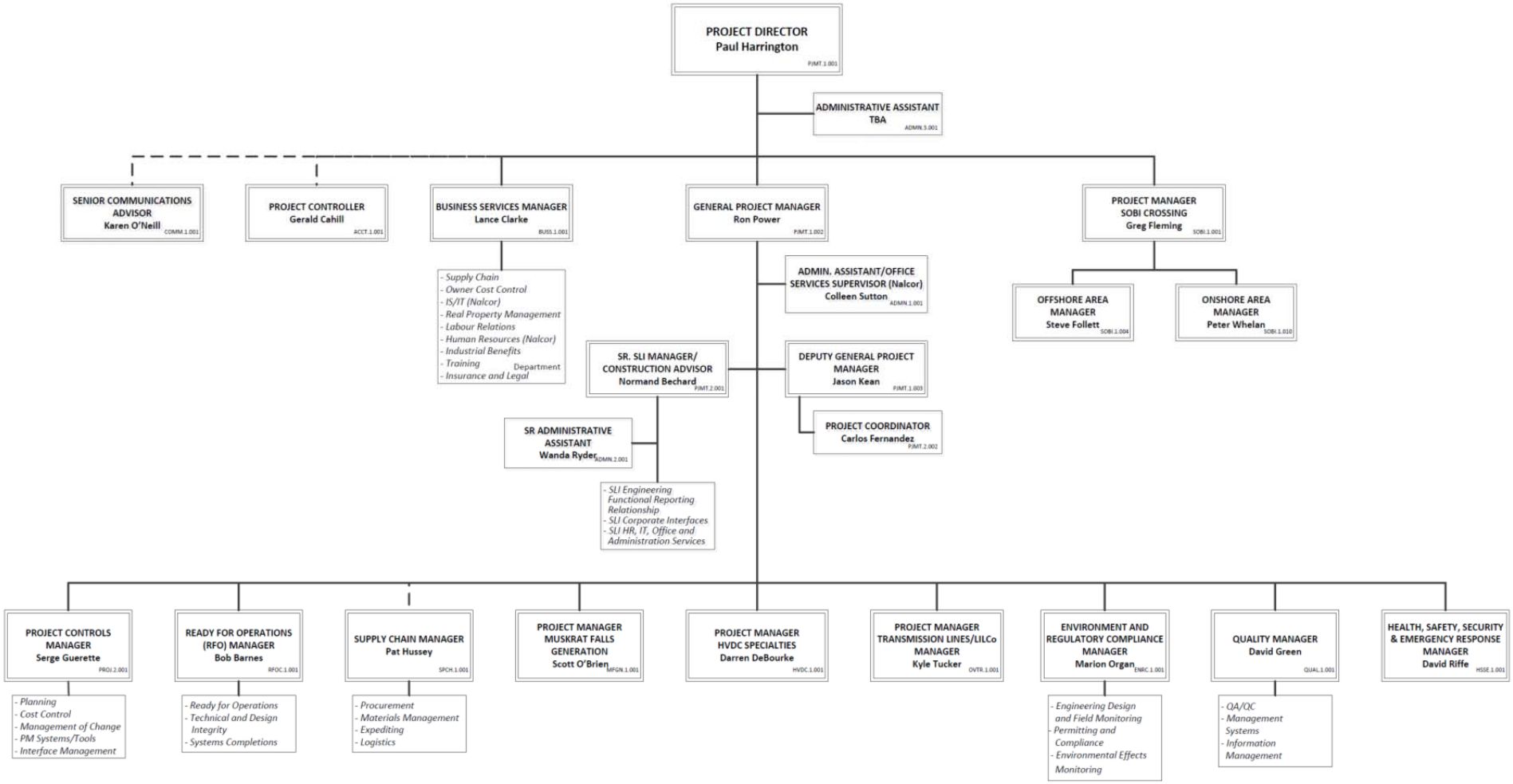

Figure 4-3 Integrated Management Team Organization Chart

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4.1.2 Scope of Work Requirements

Nalcor has included in Exhibit 6 of the Agreement with SNC-L, a listing of documents that define the previous work performed for the LCP and details the studies conducted for the LCP that are available and set out to guide SNC-L in their work. SNC-L is responsible for all of the work for the design, and for the assurance of the quality of all engineering with standard engineering practice, provides some of the personnel and tools (software) for project control (PM+), and resources for the construction management services for the power station and transmission system except the work associated with the high voltage DC cable procurement and installation for the SOBI crossing, which Nalcor is administrating (Contract LC-SB-003).

SNC-L will provide the design and specification development for the over 110 contracts that are the responsibility of the Integrated Project Delivery Organization to issue and administer for the work. Key contracts include:

CH0006 – Bulk Excavation

CH0007 – Muskrat Falls Complex [Intake & Powerhouse, Spillway & Transition Dams]

CH0030 – Turbines and Generators Design, Supply and Install Agreement

PH0014 (RFP) – Generator Step-Up Transformers

CD0501 (RFP) – Converters and Cable Transition Compounds

CT0327 – 350 kV HVdc Transmission Line---Section 1

CT0346 – 350 kV HVdc Transmission Line—Section 2

PH0016 (RFP) – Generator Circuit Breakers

CD0502 – Construction of AC Substations

A list of the other contracts is provided in Appendix D of this report for ease of reference by the reader.

Nalcor, through the Integrated Project Delivery Organization, is responsible for obtaining any necessary license, permit, or approval for the work, while SNC-L provides relevant technical input to obtain these permits.

4.1.3 Liability

SNC-L is responsible and assumes weather risk up to and including 20-year return period storm events.

The EPCM Agreement provides for the following protection of Nalcor:

1. A Parent Company Guarantee
2. A Letter of Credit equal to 5 percent of the Agreement Price [redacted]
3. Professional Errors and Omissions Liability Insurance [redacted]
4. Commercial Liability Insurance [redacted]
5. Project-specific Commercial General Liability Insurance [redacted]
6. Automobile Liability Insurance [redacted]
7. Any Reconstruction Costs incurred by Nalcor [redacted]

SNC-L's Limit of Liability was fixed at [redacted] percent of the Agreement Price (Section 27.2), or [redacted]

When a change is required, as ordered by Nalcor, SNC-L has 14 days to respond to the request and is required to furnish a budget and schedule.

The compensation for changes entitles SNC-L to obtain additional compensation for reimbursable costs and additional fixed fees incurred in relation to the Change Order or Change Request. Changed conditions are clearly detailed in Section 23 of the EPCM Agreement, in MWH's opinion.

4.1.4 Communication and Interface Requirements

The EPCM Agreement provides throughout the text in different sections, information pertaining to how the parties will be communicating. Several of these sections are discussed hereafter.

Section 11 allows for Nalcor to conduct performance reviews of SNC-L's work periodically. Nalcor decides if a Performance Report is required and is delivered after the review has been completed. The Performance Report would describe any actions that Nalcor directs to remedy any failure in the performance of the Services that is apparent from the review. SNC-L is required to comply and remedy the issues found.

Section 31 discusses Public Communications and the constraints placed on SNC-L regarding communicating project information to the public without the written consent of Nalcor. SNC-L is restricted from addressing any media questions, and must revert to Nalcor for any communications that would take place.

Section 32 clearly spells out, in MWH's opinion, the requirement of the parties regarding how they communicate with each other as to the following when giving a notice (communication): it must be written; it must be addressed to Representative for the Party to whom the notice is addressed; when issued by Nalcor, it must be signed or authorized by a company representative, a director or company secretary, or duly authorized representative; where given by SNC-L, it must be signed or authorized by SNC-L's Representative, a director or company

secretary, or duly authorized representative, and be delivered by post, by hand or facsimile to Party; it must be sent or delivered to the specified numbers and addresses in the EPCM Agreement. This section also requires that electronic mail can be used for day-to-day communication, but shall not be used to give notice for Claims, Application for Payments, and termination. It further notes that verbal communication will not constitute formal communications or notice under the EPCM Agreement.

Exhibit 5, Coordination Procedures, spells out numerous details regarding how the parties must coordinate their respective work through different management practices: Technical Interface; Health and Safety; Quality; Procurement; Contracting and Materials; Cost; Project Change; Risk; Construction; Project Completions; Invoicing and Payment; Province Benefits Obligations and Reporting; Information; Regulatory and Environment; and Schedule Management. MWH's opinion is that Exhibit 5 clearly outlines the responsibilities of both parties regarding how they must communicate as required by the EPCM Agreement. With the transition to an Integrated Project Delivery Organization, the formal coordination methods described in Exhibit 5 have become practically superseded since the team is working under a model that reflects a combined Nalcor/SNC-L management system.

Under the Integrated Project Team Model, we anticipate that the communication and interface requirements will work more effectively.

4.1.5 Dispute Resolution Provision

Defects in the Services are required to be rectified by SNC-L as given in Section 26 of the EPCM Agreement. When an issue arises, Section 28 of the EPCM Agreement would be implemented (Section 28 Dispute Resolution).

Disputes, claims, differences of opinion are handled by the following procedures as given in the EPCM Agreement: Party notifies other Party in writing within 30 days of the dispute; within 30 days, Parties shall attempt to resolve differences through the Project Change Management Process as given in Exhibit 5, Sections 8 and 9 of the EPCM Agreement; if not resolved through the process, Parties shall meet at the following levels: Senior Project Managers within 15 days of receipt of dispute; if not resolved by Senior Project Managers, then Project Sponsor level would be required to be involved within 15 days of the Senior Project Managers' meeting to discuss; if the dispute is not resolved by the Project Sponsor-level individuals, then the issue is addressed by the Chief Executive Officers of Nalcor and SNC-L with 30 days of the meeting of the Project Sponsors; if the dispute is still not resolved within 120 days from the delivery of the dispute to the other Party, the Party filing the dispute may take whatever action is deemed appropriate pursuant to the EPCM Agreement.

Based on MWH's review of the resolution process, as described above, it is our opinion that the dispute resolution procedure is satisfactory and appropriate. Furthermore, under the Integrated Project Team Model, issues will probably be identified earlier and resolved more quickly in MWH's opinion.

4.1.6 Ability to Integrate Each Project with Other Projects

Because Nalcor, through the Integrated Project Delivery Organization, has overall responsibility for all of the projects including the SOBI cable procurement and installation, and has the organizational structure and authority to monitor the different contracts, and with the aid of their critical path schedule will be able to observe where interface issues may arise during the work, MWH is of the opinion that the EPCM Agreement provides the safeguards necessary to achieve successful integration of the meshing contracts.

The relevant Area Construction Manager, who reports to both the Construction Manager and the Area Manager, would be the individual who would identify delays or issues. The Area Construction Manager, in collaboration with the Site Controls Manager, would develop an appropriate specific strategy to address the issue(s) and develop the implementation plan to facilitate the corrections.

The Integrated Planning and Scheduling Team track and monitor the critical and subcritical paths within the three projects, including the SOBI work. The Planning and Scheduling Team also monitors and tracks the critical and subcritical paths for the combination of the projects--interfacing and completions (Ready for Operations) activities. This team also monitors, tracks, and analyzes the contractor-supplied schedules, which include the critical and subcritical paths including key interfaces between each of the contract packages. This activity, according to Nalcor helps ensure the visibility of all internal and external interfaces under the responsibility of the team.

The integration of the SOBI crossing work and the HVdc Specialties-work, for which SNC-L is performing the design, is led by Nalcor's Project Engineer (Drover) with the Marine Crossings Team. Nalcor utilizes the interface management system that is guided by Nalcor's Change and Technical Interface Coordinator (Gillis) for all three components of the LCP for which SNC-L is responsible for the design, but mostly with the Nalcor Project Manager HVdc Specialties and the Nalcor Project Manager Overland Transmission. Regular bi-weekly interface meetings between these parties occur to address open interfaces. There are a defined number of interfaces that are well understood, and as a result personnel from both the Onshore and Offshore functions of the Marine Crossing Team are deeply involved with the interfaces as well. MWH concurs that the system to promulgate a successful interface of the work should be able to address the rather limited number of instances where an interface issue would occur and is suitable for its intended purpose of expediting solutions to any issues that may occur during design and construction.

The Procurement Team is responsible for establishing contracts and facilitating the delivery of the system. The quality assurance function provides the necessary level of shop surveillance to minimize the likelihood of an unforeseen event occurring. The LCP's overall quality assurance program combined with logistics functions is expected to work to minimize losses during shipment or damage to components being shipped.

4.2 BULK EXCAVATION CONTRACT REVIEW – CH0006

The Bulk Excavation Contract was started on November 9, 2012, shortly before Nalcor received notification that the LCP received Government Sanction on December 17, 2012, since a further delay due to waiting for the full Sanction would have severely delayed the start of the contract and the entire project. Contract CH0006 was awarded to a group of four contractors including the following firms, each of which is well known in Canada: HT O'Connell, EBJ, Nielson, and Kiewit. The current contract amount that was agreed to by the parties is [redacted] (Rev 3). The reader is advised that within this report, all dollars given are Year-2012 and Year-2013 Canadian Dollars, depending on the award date. The Contract Substantial Completion Date is December 31, 2013.

Since the IE, by its Agreement, is only required to review certain contracts out of the 113 separate contracts identified (April 2013) that Nalcor and MWH believe are the main contracts that need to be reviewed as part of the IE's technical and environmental evaluations, MWH has developed a standard format that addresses the questions contained in the Agreement task descriptions to standardize its responses. Since additional information is also specifically requested in other sections of the IER, some information may be repeated or expanded, as required by the Agreement.

Since contract CH0006 will reach substantial completion on November 30, 2013, a brief summary will be provided. All of the work has been completed satisfactorily and conformed to industry standards. The terms of the contract made it possible to achieve a successful job since penalties and performance guarantees (bonds, LDs) were adjusted to accommodate a reasonable price. MWH's site visit has verified that the work was satisfactory.

4.3 CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS CONTRACT REVIEW – CH0007

To date, MWH has only been furnished the RFP to solicit bids for Contract CH0007 and a portion of the contract. Based on our review of these documents, we find that many of the subjects that we are required to comment on are not sufficiently addressed, requiring more information that has not yet been proposed by the contractor, such as the contractor's CPM and the Transportation Plan. Nalcor initially requested MWH to review the RFP in lieu of the actual contract since the contract signing was expected to be June 4, 2013, the expected award date of the contract. The actual award date of the Limited Notice to Proceed is September 24, 2013.

This is the largest single contract to be awarded for the Project, and as such, it will have a significant bearing on overall success of the Project. The IE has evaluated the qualifications of Astaldi in terms of their capability to perform according to the terms of their contract with respect to quality, schedule, and budget, and finds that they have the capacity to perform adequately. Astaldi's parent company is based in Rome, Italy, whereas Astaldi Canada, Inc. is based in St. John's, Newfoundland. They reportedly have a current construction backlog of approximately $10B. Because of the large scope of Astaldi's role on the Project, and considering other global

work commitments, close monitoring and supervision is advised to ensure their timely performance. In addition to the work they will self-perform, Astaldi has 28 different subcontractors and material suppliers supporting them on this contract. Successful performance will require significant attention to detail throughout construction as well as exemplary management oversight. Nalcor has indicated that they are aware of the importance of this contract and they have a monitoring and control program in place to ensure contract requirements are met.

Based on MWH's review of Contract CH0007, Construction of Intake & Powerhouse, Spillway & Transition Dams; Contract CH0030, Turbines & Generators Design, Supply and Install Agreement; and Contract LC-SB-003, Strait of Belle Isle Submarine Cable Design, Supply, and Install Contract we have prepared summary tables that list items that were requested to be specifically reviewed and commented on by the IE. The summary tables, for the most part are nearly complete, lacking only those items that are either waiting contract completion or require a contractor to submit an appropriate plan to Nalcor. The IE finds good consistency in the contract documents for all of the contracts we have reviewed and the RFPs that we have also reviewed (Contract PH0014, Generator Step-up Transformers; Contract CD0501, Converters & Cable Transition Compounds; Contract PH0016, Supply of Generator Circuit breakers; and Contract CD0502, Construction of AC Substations). This is expected to allow the contracts to be managed more easily and effectively and should allow smooth interfacing among the contracts, where required. MWH is pleased to see that this process has been followed in the documents we have reviewed and is in accordance with Nalcor's Contract Strategy Plan.

Based on the review of Contract CH0007, we have prepared the following table to aid the reader in its assessment of what the IE has been able to conclude to date (November 2013).

Table 4-1

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
1	QUALIFICATIONS OF CONTRACTOR		NALCOR REQUIRED TO FURNISH THE COMPLETE CONTRACT FOR CH0007; ALSO CONTRACTOR EVALUATION FOR MWH REVIEW	SATISFACTORY

TABLE 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
2	QUALIFICATIONS OF SUBCONTRACTORS	SUBCONTRACTORS ARE COVERED UNDER ARTICLE 6	SUBCONTRACTOR S' NAMES HAVE BEEN SUBMITTED OR FURNISHED TO MWH. NALCOR REQUIRED TO FURNISH SUBCONTRACTOR EVALUATIONS FOR REVIEW.	NOT ALL SUB-CONTRACTORS ARE KNOWN TO MWH. ONLY 11 OUT OF 28 FIRMS (SOLUTION 1) KNOWN TO MWH; THESE FIRMS ARE SATISFACTORY. OTHER CONTRACTORS AWAITING CONTRACT COMPLETION.
3	COMPLETENESS	CONTRACT APPEARS TO BE COMPLETE		SATISFACTORY
4	CONTRACTS PERFORMED INDEPENDENTLY	WE REQUIRED A CRITICAL PATH METHOD (CPM) SCHEDULE TO OPINE	P6 CPM REQUIRED. NALCOR BELIEVES THAT CONTRACTOR CAN ACHIEVE ALL CONTRACT WORK IN 5.25 YEARS.	AWAITING CONTRACT COMPLETION.
5	CONTRACTOR'S AND OWNER'S RESPONSIBILITIES	ARTICLE 2 LISTS THE GENERAL REQUIREMENTS OF THE CONTRACTOR; ARTICLE 3 LISTS THE CONTRACTOR'S WORK OBLIGATIONS; OWNER'S RESPONSIBILITIES COVERED UNDER ARTICLE 10; ENGINEER'S RESPONSIBILITIES UNDER ARTICLE 11	EXHIBIT 9 MILESTONE SCHEDULE IS MISSING FROM THE CONTRACT. NALCOR REQUIRED TO FURNISH EXHIBITS TO MWH.	ROLES OF CONTRACTOR AND OWNER ARE CLEARLY DEFINED. SATISFACTORY

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
6	GUARANTEES, WARRANTIES	ARTICLE 7 COVERS PERFORMANCE SECURITY; UNDER PART 1, APPENDIX A2, 7. PERFORMANCE SECURITY, PERFORMANCE BONDS AND LABOR AND MATERIAL PAYMENT BONDS ARE NOT REQUIRED. A PARENTAL GUARANTEE IS REQUIRED BY 7.4 AND AN LC OF 10% OF CONTRACT PRICE IS REQUIRED AS GIVEN IN ARTICLE 7 AT 7.6. UNDER ARTICLE 17, CONTRACTOR WARRANTIES WORK FOR 3 YEARS	LC OR PAYMENT BOND AMOUNT IS JUDGED TO BE TOO SMALL FOR THIS CONTRACT. NOTED OUR OPINION TO NALCOR FOR FURTHER CONSIDERATION. A MINIMUM AMOUNT OF ABOUT 20 TO 30% WOULD BE REASONABLE WE BELIEVE AFTER HOLDING DISCUSSIONS WITH GOVERNMENT TO SOLICIT THEIR OPINIONS. PAYMENT FOR THE LETTER OF CREDIT AND PARENT GUARANTEE IS ON A PRO-RATED MONTHLY INSTALLMENT OVER THE PERIOD OF THE AGREEMENT, NORMAL FOR SUCH LARGE CONTRACTS. NALCOR HAS EXPLAINED THE REASONING BEHIND THEIR DECISION – ENSURE THEY HAVE SEVERAL BIDDERS IN FOLLOW-UP	SATISFACTORY

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
			RESPONSES FROM TIER ONE CONTRACTORS BY REMOVING PROVISION OF PERFORMANCE BONDS AND LIMIT LC TO 10%. THE FINAL LC/BOND IS [redacted]; ABOUT 25% OF CONTRACT VALUE. NALCOR HAS FOLLOWED A DETAILED RISK ASSESSMENT INVOLVING FINANCIAL ADVISORS, INSURANCE SPECIALISTS, AND LEGAL COUNSEL TO ARRIVE AT A BEST VALUE FOR PROJECT SECURITY. THEY ARE CONFIDENT THEY HAVE PROVIDED SUB-STANTIATION OF THEIR WORK. BASED ON NALCOR'S ASSESSMENT, MWH BELIEVES THIS TO BE A REASONABLE DECISION AS TO THE VALUES THAT ARE USED IN THE CONTRACT. MWH HAS RECOMMENDED THAT NALCOR	

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
			REASSESS THE NEED TO ALSO HAVE THE CONTRACTOR PROVIDE A LABOUR AND MATERIALS BOND.	
7	CHANGE ORDERS	ARTICLE 14 PROVIDES FOR CHANGES IN WORK; ONLY OWNER CAN MAKE A CHANGE. NO OVERHEAD AND PROFIT PERCENTAGES ARE GIVEN IN THE CONTRACT ON PAGE 41. ARTICLE 31 COVERS DISPUTE RESOLUTION.	REQUIRE A COMPLETE, FILLED-IN CONTRACT. AWAITING CONTRACT COMPLETION.	SATISFACTORY
8	TRANSPORTATION PLAN	ARTICLE 22 LISTS SITE AND TRANSPORTATION CONDITIONS; AT 22.7, CONTRACTOR ASSUMES ALL RISK ASSOCIATED WITH RIVER AND WEATHER CONDITIONS AT THE SITE; IT NEGLECTS TO NOTE THAT THE OWNER PROVIDES THE REQUIREMENT FOR A 1:40 YEAR RETURN PERIOD FLOOD FOR DESIGN OF COFFERDAMS FOR ICE JAM EVENTS AND 1:20 FOR FLOODS AND A	WE REQUIRE THE TRANSPORTATION PLAN TO BE FURNISHED BEFORE WE CAN OPINE.	AWAITING CONTRACT COMPLETION.

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		MINIMUM HEIGHT FOR THE ICE JAM DISCHARGE EFFECTS ELEVATION.		
9	LOGISTICS/STORAGE OF MATERIALS	TRANSPORTATION IS COVERED UNDER ARTICLE 22; STORAGE IS ACTUALLY COVERED UNDER PAY ITEM FOR SITE INSTALLATION; THE CONTRACT IS SILENT ON THE AMOUNT OF STORAGE REQUIRED WHICH MAY BE SHOWN ON THE DRAWINGS WHICH WE DO NOT HAVE.	CURRENTLY, INFORMATION IS LACKING TO FORM AN OPINION; WE NEED THE TRANSPORTATION PLAN; THE WAREHOUSING AND STORAGE PLAN; THE TRACKING PLAN FOR ITEMS IN WAREHOUSES.	AWAITING CONTRACT COMPLETION.
10	CONFORMS TO INDUSTRY STANDARDS	WE REQUIRED THE CONTRACT DOCUMENTS BEFORE AN OPINION CAN BE GIVEN.	NALCOR TO SUPPLY THE CONTRACT. COMPLETE CONTRACT EXPECTED OCTOBER 31, 2013. THE FULL AGREEMENT WILL BE REVIEWED BY NALCOR TO ENSURE THE FULL CONTRACT AGREES WITH INDUSTRY STANDARDS.	SATISFACTORY

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
11	COMPENSATION TERMS	PART 2, EXHIBIT 2—ATTACHMENT 1 CONTAINS MEASUREMENT AND PAYMENT PROVISIONS. IT ALSO INCLUDED PROVISIONS FOR FIXED LUMP SUMS AND UNIT PRICES WORK AND INCLUDES PROVISIONS FOR INFLATION. A MONTHLY FORECAST SCHEDULE IS REQUIRED.		SATISFACTORY
12	GUARANTEES & LIQUIDATED DAMAGES	LDS ARE GIVEN IN PART 2, EXHIBIT 2, OPTION 2, SECTION 13, LIQUIDATED DAMAGES FOR DELAY AND PERFORMANCE INCENTIVES. ALSO GIVEN IN ARTICLE 26 WHICH LIMITS THE TOTAL AMOUNT OF	WE HAVE INCLUDED SAMPLE COMPUTATIONS IN APPENDIX I.	SATISFACTORY
		LDS TO 5% OF THE CONTRACT PRICE. SECTION 13 GIVES LDS FOR KEY PERSONNEL REMOVAL WITHOUT PROPER NOTIFICATION.		

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
13	PERFORMANCE BOND, LDS, BONUS, BUYDOWN/OUT	PERFORMANCE SECURITY EXHIBIT 14, IS [redacted] UNTIL FINAL COMPLETION CERTIFICATE HAS BEEN ISSUED; AND [redacted] DURING THE WARRANTY PERIOD DISCUSSED IN ARTICLE 17.	SOME OF THE INFORMATION HAS BEEN FURNISHED..	SATISFACTORY
14	COMPLIANCE CONTRACTS, PERMITS, PERFORMANCE	A SITE-SPECIFIC ENVIRONMENTAL PLAN IS REQUIRED; NALCOR WILL FURNISH ALL PERMITS REQUIRED BY OWNER TO BE OBTAINED; CONTRACTOR RESPONSIBLE FOR OTHERS. CONTRACTOR MUST FOLLOW THE OWNER-FURNISHED PERMITS.	A LISTING OF CONTRACTOR-FURNISHED PERMITS NEEDS TO BE REVIEWED BEFORE AN OPINION CAN BE GIVEN. MWH IS NOT REQUIRED BY GOVERNMENT TO GIVE OPINION.	NO OPINION WILL BE FURNISHED BY IE.
15	GUARANTEE OF EQUIPMENT	NOT APPLICABLE		NO OPINION REQUIRED
16	CONSTRUCTION SCHEDULE	CRITICAL PATH SCHEDULE AND EXECUTION PLAN ARE REQUIRED TO BE FURNISHED	55 MONTHS TO COMMISSION FIRST UNIT PLUS 8 MONTHS TO COMMISSION REMAINING 3 UNITS IS WITHIN RANGE OF 5 TO 7 YEARS FOR LARGE HYDRO PROJECT.	SATISFACTORY AWAITING CONTRACT COMPLETION.
17	AGREED TO SCHEDULE REVIEW; ADEQUATE PROVISIONS	CRITICAL PATH SCHEDULE IS REQUIRED FOR REVIEW		AWAITING CONTRACT COMPLETION

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
18	CRITICAL PATHS	MILESTONE DATES REQUIRED; CPM SCHEDULE REQUIRED; SUBSTANTIAL COMPLETION DATE REQUIRED	MORE INFORMATION IS REQUIRED TO ALLOW AN ASSESSMENT TO BE PERFORMED BY THE IE	AWAITING CONTRACT COMPLETION.
19	LIKELIHOOD OF ACHIEVING MILESTONES	MILESTONE DATES REQUIRED; CPM SCHEDULE REQUIRED; SUBSTANTIAL COMPLETION DATE REQUIRED	SEE 18, ABOVE.	AWAITING CONTRACT COMPLETION.
20	SUBSURFACE CONDITIONS	ARTICLE 23 PROVIDES PROTECTION TO THE CONTRACTOR IF IT ENCOUNTERS UNFORESEEN GEOLOGICAL OR GEOTECHNICAL CONDITIONS, INCLUDING GROUND WATER WHICH IT BELIEVES WILL IMPACT THE PROJECT SCHEDULE. ARTICLE 14, IF ACCEPTABLE TO THE OWNER WILL ALLOW A CHANGE TO BE MADE TO THE CONTRACT		SATISFACTORY

The reader should be aware of the fact that the IE can only give opinions once it has sufficient information to review to be reasonably certain that there will be no changed conditions that would negate its opinion or observation. Opinions can be expressed in a manner that will qualify the IE's knowledge at the time of making an opinion that is a 'forecast' of what the IE believed to be reasonably expected. Because many of the contracts that the IE will be reviewing will be released later during 2013 and early 2014 after Financial Close unless waived by Government,

released later during 2013 and early 2014 after Financial Close unless waived by Government, there are "gaps" in this document that will be required to be completed after Financial Close.

4.4 TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT – CH0030

Contract CH0030 was awarded on December 31, 2012, and is scheduled to be substantially complete by March 23, 2017, when commissioning the Muskrat Falls Powerhouse is planned to occur. The contract was awarded to Andritz Hydro Canada Inc. whose parent company, Andritz Hydro is an internationally known, tier-one company that supplies hydrogenerating equipment. Most of the components for the turbine will be fabricated and assembled in China at companies that Andritz Hydro has an interest in and which are able to use the technologies developed by Andritz in their design, manufacturing, and assembly processes.

Table 4-2

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
1	QUALIFICATIONS OF CONTRACTOR	ANDRITZ HYDRO CANADA INC., REGISTERED IN NEW BRUNSWICK, AND ITS PARENT COMPANY, ANDRITZ, IS A TIER-ONE SUPPLIER OF TURBINES AND ASSOCIATED EQUIPMENT		SATISFACTORY
2	QUALIFICATIONS OF SUBCONTRACTORS	ALMOST ALL OF THE SUB-CONTRACTORS AND SUB-SUPPLIERS ARE UNKNOWN TO MWH AND FOR THE TURBINES WHICH WILL BE MANUFACTURED IN TIANBAO, CHINA. ABB WILL	IT IS NOT CLEAR WHERE THE GENERATORS WILL FIRST BE ASSEMBLED AND TESTED TO ENSURE THAT ALL COMPONENTS WILL BE READY FOR ASSEMBLY IN THE FIELD; WE	ANDRITZ IS A SATISFACTORY CONTRACTOR. HOWEVER, MWH IS UNABLE TO OPINE ON THE SUB-CONTRACTORS BEING USED TO SUPPLY THE MAJOR COMPONENTS OF

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		SUPPLY THE STATIC EXCITATION SYSTEM; THE DIGITAL GOVERNOR WILL BE SUPPLIED BY AH HEMI CONTROLS; THE ROTOR POLES WILL BE FROM AH BHOPAL, INDIA; THE STATOR BARS & CONNECTIONS WILL BE FURNISHED BY AH LACHINE, CANADA; THE STATOR PUNCHINGS FROM AH WEIZ, AUSTRIA (AH=ANDRITZ HYDRO)	MUST SURMISE THAT THIS WILL NOT BE DONE AND THAT ANY MODIFICATIONS WILL REQUIRE FIELD MACHINING TO ALLOW PARTS TO FIT PROPERLY IF THERE ARE ANY ISSUES ENCOUNTERED. SINCE THE TURBINE IS AT A SIZE LIMIT FOR THE LARGEST DIAMETER BEING SUPPLIED, AND IN THE 9 METER CLASS, VERY CAREFUL MONITORING OF ALL WORK SHOULD BE REQUIRED.	THE TURBINES AND OF CERTAIN COMPONENTS OF THE GENERATORS SINCE WE HAVE NO EXPERIENCE IN DEALING WITH THEM. WE REQUIRE THE FOLLOWING: EXPERIENCE RECORD OF SIMILAR PROJECTS; COMPANY BROCHURES; LIST OF MAJOR EQUIPMENT USED IN THE MANUFACTURING PROCESS; COMPANY ORGANIZATION CHART; ISO CERTIFICATION PROOF; ANDRITZ PAST EXPERIENCE WITH THE SUPPLIER. NALCOR ADVISED THAT AH OWNS OR IS A PRINCIPAL SHAREHOLDER IN MANY OF THE COMPANIES AND INTENDS TO MONITOR THEM CLOSELY.

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
				NO OPINION ON THE SUBCONTRACTORS WILL BE FURNISHED BY MWH.
3	CONTRACTS PERFORMED INDEPENDENTLY	WE DO NOT HAVE A CPM SCHEDULE (P6) TO FULLY UNDERSTAND THE IMPACT OF DELAYS ON OTHER CONTRACTORS, BUT BELIEVE THAT FOR THE EMBEDDED ITEMS FOR THE TURBINE, A SUBSTANTIAL IMPACT TO THE POWERHOUSE CONTRACTOR COULD OCCUR. SINCE MOST OF THE MANUFACTURING WILL OCCUR IN CHINA, NECESSITATING OCEAN SHIPMENTS AS WELL AS LAND TRANSPORT, MONITORING VERY CLOSELY WILL BE VERY IMPORTANT. FIT-UP IN THE FIELD WILL DEPEND ON THE WORK PLAN THAT WE CURRENTLY DO		MWH WILL NOT BE ABLE TO OFFER AN OPINION UNTIL WE BETTER UNDERSTAND HOW THE EQUIPMENT WILL BE HANDLED AND REQUIRE SUPPORT DATA INCLUDING THE P6 CPM NALCOR ADVISES THE INTEGRATED PROJECT SCHEDULE WILL BE AVAILABLE END OF 2013. THUS, IT WILL PROBABLY NOT BE AVAILABLE BEFORE FINANCIAL CLOSE. NO OPINION WILL BE GIVEN BY MWH.

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		NOT HAVE FOR REVIEW		
4	CONTRACTOR'S AND OWNER'S RESPONSIBILITIES	IN SCOPE OF WORK, 2.7 DEALS WITH OWNER'S RESPONSIBILITY OF SUPPLY; EXHIBIT 11 ALSO IS A NALCOR SUPPLY REQUIREMENTS; EXHIBIT 9 IS ANDRITZ WORK AND MILESTONE SCHEDULE		SATISFACTORY
5	GUARANTEES, WARRANTIES	EXHIBIT 1, APPENDIX B DISCUSSES GUARANTEES; IN THE TECHNICAL SPECIFICATIONS, SECTION 2.3 GUARANTEES ARE DISCUSSED; ALSO IN THE TS UNDER 2.4 DISCUSS THE WARRANTIES	THE GUARANTEES AND WARRANTIES ARE TYPICAL FOR UNITS EXCEPT FOR THE DIMENSIONABLE STABILITY AND CRACKING ONES; IN OUR OPINION THESE ARE AN APPROPRIATE ADDITION TO THOSE WE NORMALLY REVIEW	SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
6	CHANGE ORDERS	CHANGE ORDERS ARE DISCUSSED IN SEVERAL LOCATIONS OF THE CONTRACT DOCUMENTS. IN EXHIBIT 2, SECTION 4 CHANGE IS DISCUSSED; IN SCOPE OF WORK, ARTICLE 3, AT 3.19 CHANGE ORDER IS DISCUSSED; AND IN EXHIBIT 3, SECTION 7, CHANGE ORDERS ARE DISCUSSED,	WE BELIEVE THAT IN THE DEFINITIONS, THE AREAS IN THE CONTRACT DOCUMENTS WHERE CHANGE ORDER IS DISCUSSED SHOULD BE LISTED FOR THE PARTIES' QUICK REFERENCE.	SATISFACTORY
7	TRANSPORTATION PLAN	ARTICLE 2.2.6 DISCUSSES LOGISTICS, ARTICLE 7.7.3 AND 7.7.4 DISCUSS THE TRANSPORTATION REQUIREMENTS; AND APPENDIX A15, LOGISTICS AND TRANSPORTATION STRATEGY	WE REQUESTED CLARIFICATION ON ANY LOAD RESTRICTIONS TO THE BRIDGE DOWNSTREAM OF THE PROJECT AND RECEIVED IT. APPENDIX A15 INDICATES THAT THIS BRIDGE IS ADEQUATE. WHAT IS ITS LOAD RESTRICTION AND WHAT IS THE WEIGHT AND HEAVIEST PIECE OF EQUIPMENT THAT WILL BE TRANSPORTED OVER IT? NALCOR	NO FORMAL PLAN WAS GIVEN, BUT APPENDIX A15 SUFFICES FROM OUR PERSPECTIVE AT THIS TIME TO ALLOW US TO OPINE. SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
			FURNISH ANSWER ON EQUIPMENT WEIGHTS.	
8	LOGISTICS/STORAGE OF MATERIALS	THE TS IN 1.6.3 DISCUSSES SHIPPING; IN EXHIBIT 1, SECTION 7, COVERS STORAGE, PRESERVATION AND PREPARATION OF MATERIALS; ARTICLE 22, SITE & TRANSPORTATION ROUTE CONDITIONS	IT WOULD BE DESIRABLE TO HAVE REQUIRED A SYSTEM TO INVENTORY VIA ELECTRONIC MEANS ALL EQUIPMENT AND NOTE LOCATION WITHIN STORAGE BUILDING FOR EASE IN LOCATING DURING THE WORK.	SATISFACTORY
9	CONFORMS TO INDUSTRY STANDARDS	CONTRACT APPEARS TO CONFORM TO INDUSTRY STANDARDS AND IN SOME AREAS, IN OUR OPINION, EXCEEDS INDUSTRY STANDARDS		SATISFACTORY
10	COMPENSATION TERMS	EXHIBIT 2, SECTION 2 LISTS MILESTONE PAYMENTS; APPENDIX B TO EXHIBIT 2 IS THE MILESTONE PAYMENT SCHEDULE; EXHIBIT 2, SECTION 8 IS	TERMS APPEAR TO BE WELL EXPLAINED AS GIVEN IN APPENDIX B. PRICE IS COMPETITIVE BUT IS EXPECTED FROM PRODUCTS	SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		THE CONTRACT PRICE	CURRENTLY BEING PRODUCED IN CHINA	
11	GUARANTEES & LIQUIDATED DAMAGES	EXHIBIT 2, SECTION 7 DISCUSSES LDS; EXHIBIT 1, APPENDIX B, DISCUSSES PERFORMANCE GUARANTEES; TD, SECTION 2.3 GUARANTEES	A SAMPLE COMPUTATION WOULD BE HELPFUL IN EXPLAINING HOW THE GUARANTEE PENALTIES AND LDS WILL BE APPLIED AND SHOWING HOW THE LIMITATIONS ON PENALTIES WILL BE USED TOO. WE PLAN TO INCLUDE SAMPLE COMPUTATIONS IN APPENDIX I. NALCOR ADVISED THAT SAMPLE COMPUTATIONS WILL BE FURNISHED; THE COMPUTATIONS ARE INCLUDED IN APPENDIX I. REQUIRES FURTHER REVIEW.	SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
12	PERFORMANCE BOND, LDS, BONUS, BUYDOWN/OUT	ARTICLE 35 DISCUSSES THE PERFORMANCE GUARANTEES; ARTICLE 36 DISCUSSES LIQUIDATED DAMAGES; ARTICLE 37 DISCUSSES PERFORMANCE TESTING. NOTE THAT SOME OF THE FORMULAS RELATE TO KILOWATT HOURS AND THAT THE FORMULAS FOR THE LDS ARE IN MEGAWATT HOURS — THEY SHOULD BE CONSISTENT	PERFORMANCE BOND REQUIRED FOR 50% OF CONTRACT PRICE; A BUYOUT PROVISION IS PROVIDED FOR A SITUATION WHERE PITTING OCCURS AGAIN AFTER THE FIRST 40,000 HOUR PERIOD-TERMS ARE NOT DESCRIBED THAT REQUIRE ATTENTION. NO BONUS PROVISIONS ARE PROVIDED WITHIN THE CONTRACT WHICH IN SOME	WE FIND THAT THESE CONDITIONS WOULD NOT NORMALLY ALIGN WITH NORMAL INDUSTRY STANDARDS. HOWEVER, SINCE ANDRITZ ACCEPTED THEM, THEY WILL APPLY TO THIS CONTRACT SINCE THEY WERE CONSIDERED WHEN THE CONTRACT TERMS WERE NEGOTIATED. SATISFACTORY
			COURT SYSTEMS LEADS TO DIFFICULTIES WHEN LDS ARE BEING ASSESSED. NALCOR ADVISED THAT THIS WOULD APPLY TO CANADA EXPERIENCE. LC OF 15% OF CONTRACT PRICE IS REQUIRED.	

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
13	COMPLIANCE CONTRACTS, PERMITS, PERFORMANCE	EXHIBIT 1, ITEM 13; EXHIBIT 6, ENVIRONMENTAL AND REGULATORY COMPLIANCE REQUIREMENTS; ARTICLE 15, HEALTH, SAFETY AND ENVIRONMENTAL PROTECTION	IT WOULD BE BEST TO PROVIDE A COMPLETE LIST TO THE CONTRACTOR FOR EASE OF REFERENCE, IN OUR OPINION; ON THE LIST THOSE PERMITS AND ITEMS REQUIRED FOR THE CONTRACTORS ATTENTION SHOULD BE HIGHLIGHTED	SATISFACTORY
14	GUARANTEE OF EQUIPMENT	AS DISCUSSED IN 12 ABOVE, GUARANTEES ARE GIVEN	DURING OUR DISCUSSIONS IN ST. JOHN'S, THE LDS WERE NOT DESCRIBED TO SUFFICIENTLY ADDRESS MWH'S REMARKS HEREIN. WE WOULD LIKE TO REVIEW SAMPLE COMPUTATIONS FOR EACH OF THE GUARANTEES AS TO THE AMOUNTS BEING REASONABLE. NO OPINION CAN BE GIVEN AT THIS TIME. REQUIRES	SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
			FURTHER REVIEW.	
15	CONSTRUCTION SCHEDULE	MILESTONES ARE GIVEN IN EXHIBIT; WE REQUIRE A P6 CPM	WE REQUIRE A P6 CPM BEFORE WE CAN OPINE. NALCOR ADVISES SCHEDULE WILL BE INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION CAN BE GIVEN AT THIS TIME. NALCOR ADVISES AN IPS WILL BE AVAILABLE END 2013.
16	SCHEDULE REVIEW; ADEQUATE PROVISIONS		WE REQUIRE A P6 CPM BEFORE WE CAN OPINE. NALCOR ADVISES SCHEDULE WILL BE INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION CAN BE GIVEN AT THIS TIME.
17	CRITICAL PATHS	WE REQUIRE A P6 CPM SCHEDULE	NALCOR ADVISES SCHEDULE WILL BE INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION CAN BE GIVEN AT THIS TIME.

As noted previously in the discussion following Table 4-2, we have included a discussion of how we believe we can accommodate any items that remain "blank" or are as yet undesignated, that

leave gaps in the table because we either do not have a contract to review, or that have not been addressed by Nalcor to allow the IE to inform the reader as to our current position regarding the review of CH0030 documents.

4.5 STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY, AND INSTALL CONTRACT – LC-SB-003

Contract LC-SB-003 was awarded with a start date of December 12, 2012, and with a given substantial completion date of November 28, 2016. The early start of this contract was necessitated by the advantage Nalcor realized in favorable market conditions for the subsea cable as well as being able to schedule the manufacture of the cable early by reserving the manufacturing facilities in Japan to fabricate the cable and appurtenances associated with it. Nexans Cable is one of the three cable companies in the world that has the required experience in manufacturing and installing subsea cables, and coupled with Nippon High Voltage Cable Corp.'s experience in manufacturing subsea cables, has been critical to assuring a successful project in the opinion of Nalcor.

Listed below in Table 4-3 are the current findings and opinions of MWH pertaining to contract LC-SB-003

Table 4-3

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
1	QUALIFICATIONS OF CONTRACTOR	NEXANS CABLE IS A TIER ONE SUPPLIER AND INSTALLER OF SUBSEA CABLES		SATISFACTORY
2	QUALIFICATIONS OF SUBCONTRACTORS	ARTICLE 6 DISCUSSES SUB-CONTRACTORS; EXHIBIT 3 LISTS NIPPON HIGH VOLTAGE CABLE CORP AS THE MANUFACTURER OF THE CABLE.	DISCUSSION ON JAN.4, 2013, NOTED NIPPON AND NEXANS IN JV TO MANUFACTURE CABLE. AUDIT CONDUCTED APRIL-MAY, 2012 AND WAS SATISFACTORY	SATISFACTORY

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
3	COMPLETENESS	NO CONSTRUCTION DRAWINGS WERE INCLUDED WITH CONTRACT; EXHIBIT 5 REFERS TO LOCATION PLAN DRAWINGS INCLUDED IN EXHIBIT 6—COMPANY SUPPLIED DATA	NALCOR REPORTED THEY ISSUED PERFORMANCE SPECIFICATIONS. MWH REQUIRES DRAWING REVIEW TO VERIFY DESIGN; CORRIDOR SELECTED BY MAY 2013. RECEIVED AUGUST 19, 2013.	SATISFACTORY
4	CONTRACTS PERFORMED INDEPENDENTLY	NEXANS IS EXPECTED TO WORK CLOSELY WITH NALCOR ON THIS PROJECT THAT IS MANAGED BY NALCOR. THEY ALSO INDICATE THEY WILL BE WORKING CLOSELY WITH NIPPON.	INTERFACE AT SHORE NEEDS TO BE DISCUSSED AND SHOWN ON CPM SCHEDULE	TENTATIVE: SATISFACTORY MWH WAITING TO RECEIVE CPM TO ALLOW OPINION TO BE EXPRESSED.
5	CONTRACTOR'S AND OWNER'S RESPONSIBILITIES	CONTRACTOR'S RESPONSIBILITIES ARE GIVEN IN ARTICLES 2, 3, AND 4 OF THE CONTRACT; NALCOR'S ARE COVERED UNDER ARTICLE 10		SATISFACTORY

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
6	GUARANTEES, WARRANTIES	ARTICLE 17, WARRANTIES, PROVIDES FOR 36 MONTHS; CAN BE EXTENDED 36 MONTHS IF FAILURE OR REPAIR REQUIRED OF PART OR SYSTEM.	GUARANTEES ARE NOT MENTIONED. NALCOR ADVISED THAT ONLY THE WARRANTY OF 36 MONTHS APPLIES WHICH EXCEEDS INDUSTRY STANDARDS BY AT LEAST 12 MONTHS	SATISFACTORY
7	CHANGE ORDERS	ARTICLE 26 PROVIDES FOR CHANGES ORDERED BY NALCOR; ARTICLE 39 COVERS DISPUTE RESOLUTION	EXHIBIT 4, SECTION 11 DISCUSSES CHANGE ORDERS	SATISFACTORY
8	LOGISTICS/STORAGE OF MATERIALS	EXHIBIT 1A SCOPE OF WORK, SECTION 7 CONTAINS REQUIREMENTS FOR STORAGE, PRESERVATION AND PREPARATION. IT WOULD ALSO BE EXPECTED TO BE FURNISHED UNDER 0.5.2 EXECUTION PLAN AND EXHIBIT 4, SECTION 14	MWH REQUIRES ADDITIONAL INFORMATION SINCE NO PARTICULAR INFORMATION IS FURNISHED. NALCOR ADVISED MWH THAT STORAGE WILL BE LOCATED AT THE PORTS. 10.1.9 LOGISTIC PRECEDENT'S LIST OF KEY ITEMS TO BE SHIPPED.	TENTATIVE: SATISFACTORY. WAITING TO RECEIVE THE EXECUTION PLAN. FURTHER DETAILS STORAGE – NOT INCLUDED.

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
9	CONFORMS TO INDUSTRY STANDARDS	CONTRACT APPEARS TO BE GENERALLY COMPLETE		SATISFACTORY
10	COMPENSATION TERMS	PART 2, EXHIBIT 2 COVERS COMPENSATION	THE BREAKDOWN OF ITEMS AND THE UNITS OF MEASURE APPEAR TO BE ADEQUATE FOR THIS CONTRACT	SATISFACTORY
11	GUARANTEES & LIQUIDATED DAMAGES	LDS ARE GIVEN IN EXHIBIT 2, SECTION 7; REQUIRE [redacted] FOR MISSING MILESTONE GIVEN IN SECTION 4 AND EXHIBIT 11-MILESTONE SCHEDULE	NALCOR ADVISED THE BARGE STANDBY RATE OF [redacted] WAS USED FOR DELAYS. THE RATE WILL BE ASSESSED AS A PORTION OF A DAY TO THE NEAREST HOUR.	SATISFACTORY
12	PERFORMANCE BOND, LDS, BONUS, BUYDOWN/OUT	PERFORMANCE BOND COVERED IN ARTICLE 7 AMOUNTING TO 50% OF THE CONTRACT PRICE; LC OF 15% OF CONTRACT PRICE	NO COMPANY GUARANTEE WAS REQUIRED	SATISFACTORY

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
13	COMPLIANCE CONTRACTS, PERMITS, PERFORMANCE	IN PART 1, SECTION 0.7, 10. ENVIRONMENTAL, THERE ARE REQUIREMENTS FOR A PROGRAM. IT IS NOT SPECIFIC WITH RESPECT TO PERMITS; PERMITS ARE TO BE OBTAINED BY NALCOR; OTHER PERMITS FOR THE WORK VESSEL WOULD NORMALLY BE THE RESPONSIBILITY OF NEXANS. EXHIBIT 1A, SCOPE OF WORK, SECTION 2.2, TABLE 2.2 LISTS THE CONSENTS, AUTHORIZATION AND PERMITS. THE TEXT FURTHER STATES THAT THE CONTRACTOR	SINCE NEXANS IS A FOREIGN CONTRACTOR, SOME OF THE RESPONSIBILITIES PLACED ON THEM MAY BE UNFAMILIAR TO THEM, LEAVING ROOM FOR AN INCOMPLETE RESPONSE AND DELAY OR OMISSION CAUSING A DELAY. NALCOR ADVISED ON AUGUST 19, NO ADDITIONAL PERMITS HAVE BEEN IDENTIFIED BY NEXANS.	GOVERNMENT ADVISES MWH DOES NOT HAVE TO OPINE ON PERMITS.

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		SHALL OBTAIN AND MAINTAIN ALL OTHER AUTHORIZATIONS, PERMITS, DISPENSATIONS, CONSENTS AND LICENSES, REQUIRED BY APPLICABLE LAWS TO ENABLE IT TO PERFORM THE WORK THAT CAN BE OBTAINED IN THE CONTRACTOR'S NAME.		
14	GUARANTEE OF EQUIPMENT	GUARANTEES ARE NOT FURNISHED; WARRANTY OF WORK AND MATERIAL FOR 36 MONTHS, AND AFTER REPAIR, ANOTHER 36 MONTHS OF SERVICE	WARRANTY PERIOD REVISED DOWN TO 36 MONTHS FROM ORIGINAL PROPOSED 60 MONTHS. NO GUARANTEES ARE PROVIDED. TYPICALLY, INDUSTRY REQUIRES ONLY ONE OR TWO YEARS. TESTING WILL OCCUR BEFORE AND AFTER PLACING THE ROCK FILL PROTECTION.	SATISFACTORY

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
15	CONSTRUCTION SCHEDULE	MILESTONES FURNISHED IN PART 2, EXHIBIT 11, MILESTONE SCHEDULE; P6 CPM SCHEDULE IS REQUIRED TO BE FURNISHED	MWH REQUIRES A P6 CPM SCHEDULE MWH AWAITING TO REVIEW THE P6 CPM. NALCOR ADVISED THAT THE SCHEDULE IS A DELIVERABLE OF THE PROJECT CONTRACTOR AND WILL INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION WILL BE GIVEN BY MWH AT THIS TIME.
16	SCHEDULE REVIEW; ADEQUATE PROVISIONS	MWH REQUIRES P6 CPM SCHEDULE TO REVIEW	MWH AWATING TO REVIEW THE P6 CPM. NALCOR ADVISED THAT THE SCHEDULE IS A DELIVERABLE OF THE PROJECT CONTRACTOR AND WILL INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION WILL BE GIVEN BY MWH AT THIS TIME.

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
17	CRITICAL PATHS	MWH REQUIRES P6 CPM SCHEDULE	MWH AWAITING TO REVIEW THE P6 CPM. NALCOR ADVISED THAT THE SCHEDULE IS A DELIVERABLE OF THE PROJECT CONTRACTOR AND WILL INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION WILL BE GIVEN BY MWH AT THIS TIME.

4.6 GENERATOR STEP-UP TRANSFORMERS – PH0014

The work for Contract PH0014 consists of the design, fabrication, shop testing, packaging, delivery, and warranty for 175/230 MVA ONAN/ONAF generator step-up transformers complete with 315 kV lightning arresters and accessories and one spare generator step-up transformer. The IE is awaiting contract issuance and award.

4.7 CONVERTERS & CABLE TRANSITION COMPOUNDS – CD0501 (RFP)

The work under this RFP consists of the study, design, factory testing, supply, construction, installation, site testing, and commissioning of the HVdc link stations at Muskrat Falls and Soldiers Pond Converter Stations, and Forteau Point and Shoal Cove Cable Transition compounds. This work further includes the following components:

- Completely operational ±350 kV, 900 MW bipolar HVdc system, including the necessary communications interface equipment and the associated HVac equipment;
- Overall project management; studies; design; engineering; training; manufacture; factory testing; supply; delivery to site, loading and unloading; storing; preserving; handling and moving into final position; installation; testing; commissioning; and placing into successful commercial operation and warranty;
- Civil works, including buildings and foundations;

- Two HVdc converter stations based on Line Commutated Conversion technology; one at Muskrat Falls next to the power station and the other at Soldiers Pond interconnecting with the Newfoundland power network; and

- Two Cable transition compounds; one at Forteau Point and the other at Shoal Cove.

The IE is awaiting contract issuance and award.

4.8 GENERATOR CIRCUIT BREAKERS – PH0016 (RFP)

The work under this RFP consists of the design, fabrication, shop testing, packaging, and supply of four 24 kV, 12,000 A, 80 KA interrupting capacity generator circuit breakers complete with the control panels for each of the LC turbine/generator units. At this time, MWH has only had the opportunity to review the RFP that was issued for this work. The IE is awaiting contract award.

4.9 CONSTRUCTION OF AC SUBSTATIONS – CD0502

The RFP for Contract CD0502 was issued on July 16, 2013, and is scheduled to be closed on October 10, 2013. Contract award is expected on December 15, 2013, and the contract forecasted completion date is November 30, 2016. The value of the contract has not been furnished to MWH, since it combines contracts and it is now an EPC contract. The IE is awaiting contract award.

4.10 GUARANTEES AND LIQUIDATED DAMAGES (LDs)

Included with the contract summaries as provided in Section 4 of the report are provisions established by our Agreement with Nalcor Energy for the respective contracts. For the contracts that we are expected to review, we have tabulated the results found during our reviews into Table 4-4, below, for easy reference (see also Appendix I, Liquidated Damages Calculations).

Table 4-4

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
1	CH0006 (MF) CONTRACT	6	NO GUARANTEES 3 YEAR WARANTY	IE REQUIRES TIME TO OBSERVE PERFORMANCE	SATISFACTORY
		12	NO GUARANTEES NO LDS	IE REQUIRES TIME TO OBSERVE PERFORMANCE	SATISFACTORY

Table 4-4 (cont'd)

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
		13	NO PERFORMANCE BOND OR PAYMENT BOND REQUIRED	IE REQUIRES CLARIFICATION FROM NALCOR AS TO WHAT PERFORMANCE SECURITY EXISTS OTHER THAN HOLDBACK PERCENTAGE OF PAYMENTS. NO IE OPINION UNTIL MWH RECEIVES NOTICE FROM NALCOR THAT NO BONDS WILL BE NECESSARY AT PROJECT CLOSING. WE CURRENTLY UNDERSTAND NO BONDS WILL BE REQUIRED BY NALCOR. [redacted]	SATISFACTORY
		15	NOT APPLICABLE		NOT APPLICABLE
2	CH0007 (MF) RFP	6	LC AND PAYMENT BOND JUDGED TO BE TOO SMALL; WARRANTY OF WORK FOR THREE YEARS PARENTAL GUARANTEE IS REQUIRED	NALCOR IS REVIEWING ALL PROVISIONS FOR LCS, GUARANTEES, WARRANTIES, PAYMENT AND PERFORMANCE BONDS.	SATISFACTORY

Table 4-4 (cont'd)

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
		12	LDS RANGING FROM [redacted] FOR MISSED MILESTONES ARE GIVEN IN PART 2, EXHIBIT 2, SECTION 13 LDS PERSONNEL PERFORMANCE INCENTIVES ARE ALSO GIVEN IN SECTION 12.2 [redacted]	EXAMPLES OF HOW LDS ARE COMPUTED ARE REQUIRED BY THE IE; THESE WERE FURNISHED BY NALCOR. IE REQUIRES FINAL LDS AS GIVEN IN CONTRACT. NALCOR PROVIDED INFORMATION.	SATISFACTORY
		13	SEE 12 DIRECTLY ABOVE FOR [redacted] DECISIONS ON PERFORMANCE BONDS AND LDS DISCUSSED IN 6 ABOVE	NALCOR REQUIRED TO MAKE DECISIONS REGARDING THESE ISSUES. NALCOR PROVIDED INFORMATION.	SATISFACTORY
		15	NOT APPLICABLE		NO OPINION REQUIRED
3	CH0030 (MF) CONTRACT	6	GUARANTEES ARE DISCUSSED IN EXHIBIT 1, APPENDIX B AND IN THE TECHNICAL SPECIFICATIONS IN SECTION 2.3 WARRANTIES ARE DISCUSSED IN THE TECHNICAL SPECIFICATIONS UNDER 2.4	TYPICAL GUARANTEES AND WARRANTEES ARE PROVIDED. DIMENSIONABLE STABILITY AND CRACKING ARE ALSO COVERED.	SATISFACTORY

Table 4-4 (cont'd)

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
		12	LDS DISCUSSED IN EXHIBIT 2, SECTION 7. EXHIBIT 1, APPENDIX B DISCUSSES PERFORMANCE GUARANTEES. SECTION 2.3 OF THE TECHNICAL SPECIFICATIONS DISCUSSES GUARANTEES	SAMPLE COMPUTATIONS TO SHOW HOW LDS ARE DERIVED HAVE BEEN REQUESTED; NALCOR FURNISHED TO MWH. ALSO, HOW THE LIMIT ON PENALTIES WILL BE USED. FURNISHED.	REQUIRES FURTHER REVIEW. SAMPLE COMPUTATIONS NOW INCLUDED IN APPENDIX I.
		13	ARTICLE 35 DISCUSSES PERFORMANCE GUARANTEES; ARTICLE 36 DISCUSSES LDS; ARTICLE 37 DISCUSSES PERFORMANCE TESTING. BUYOUT PROVISIONS ARE ALSO GIVEN. NO BONUS PROVISIONS HAVE BEEN PROVIDED	THE IE NOTES REVISIONS TO FORMULAS SHOULD BE CONSIDERED.	SATISFACTORY
		15	APPENDIX B, EXHIBIT 1 DISCUSSES PERFORMANCE GUARANTEES	WE WOULD LIKE TO VIEW SAMPLE COMPUTATIONS TO ILLUSTRATE HOW THESE PROVISIONS WOULD BE APPLIED. PROVIDED IN APPENDIX I.	SATISFACTORY

Table 4-4 (cont'd)

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
1	LC-SB-003 (LIL)	6	NO GUARANTEES 36 MONTH WARRANTY		SATISFACTORY
		12	[redacted]		SATISFACTORY
		13	[redacted] CONTRACT PRICE PERFORMANCE BOND; LC OF [redacted] CONTRACT PRICE	NO COMPANY GUARANTEE WAS REQUIRED	SATISFACTORY
		15	NO GUARANTEES 36 MONTH WARANTY		SATISFACTORY

4.11 CONSTRUCTION SCHEDULE

The IE has reviewed the Integrated Project Schedule (IPS) (Rev B3, dated 27 July 2013) that provides the timeline for completion of the MFG, LTA and LITL projects' components. A copy of the Rev B3 version of the IPS is attached in Appendix J.

4.12 SCHEDULE ACHIEVABILITY

To account for uncertainty in the project's schedule opinion, stakeholders should be aware that a range of probable outcomes is possible. The IE has extensive global experience with hydro-power projects of this scale. Similar projects have taken approximately five to seven (5-7) years to complete. Nalcor's estimated 5.25-year build-out and commissioning period is observed to be within that range. While there is probability that the projects' schedule objectives, as defined by Nalcor can be achieved, there is also reportable probability that the target in-service dates will remain under pressure for protraction as field execution challenges are encountered.

4.13 SCHEDULE RISK DISCUSSION

Nalcor carried out a Schedule Risk Analysis at DG3 and identified weather risk and volume of work to be carried out in the powerhouse as being the main risks. Subsequent to that, Nalcor has reviewed the Risk analysis carried out at DG3 which identified the risks that Nalcor needed to mitigate in order to reduce the schedule risk identified at that time. The weather risk has been mitigated by a "mega dome" that the contractor for contract CH0007 will erect to enclose the powerhouse structure which will provide a controlled climate for the concrete to be poured year round. This directly addresses a significant component of the weather risk identified at DG3 and the volume of concrete that can be placed year round. This avoids a slowdown in winter and levelizes the workforce year round.

4.14 CRITICAL PATH DISCUSSION

At a high level, the project is defined by three concurrent critical paths running through the Muskrat Falls project element. The IPS indicates simultaneous completion of the following: turbine/generator supply and install work, spillway construction, and the powerhouse/intake work in late 2017. Correspondingly, the project maintains two sub-critical paths associated with the LTA and LITL transmission components. While the schedule indicates some float for the transmission assets relative to MFGS, at a high level with respect to reporting accuracy, the transmission work comes on line just ahead of the MFGS first power milestone and the indicated float component is not considered significant to offset critical path implications. However, in subsequent discussions with Nalcor additional details regarding the transmission line schedule were provided, and assurance was given that neither the LTA nor the LIL critical paths affect the overall project critical path that goes through the MF Project.

Schedules that are characterized by multiple major concurrent critical paths are generally considered risky by industry standards. That is, statistically there is a greater potential for overall schedule protraction by slippage in any one of three concurrent critical paths and two sub-critical concurrent paths versus a schedule that entailed a singular linear critical path. The mega-project status and remote nature of the project emphasizes the need to maintain vigorous scheduling controls to mitigate schedule protraction.

4.15 GENERAL SCHEDULE COMMENTS/OBSERVATIONS

A review of the high level IPS Gantt chart documenting planned versus actual for the LTA, LITL and the MFGS sub-projects provides the following observations:

- Generally, the LCP milestones indicate an as-planned execution to date.
- Contract CH0006 (Bulk Excavation) is substantially complete and access has been provided to the CH0007 contractor.
- Nalcor has provided assurances that Contract CH0007 (Construction of Intake & Powerhouse) has been awarded with a limited NTP (September 2013) versus the originally-planned June award timeframe. MWH understands that the contractor had started his mobilization and pre-construction planning activities during final contract negotiations under the LNTP.
- The explicit schedule impacts associated with the six-month award delay to CH0007, installation of all-weather structures to facilitate powerhouse construction, and the one-year delay in the river diversion are not expressed in the B3 version of the IPS.

Despite general slippage in the early tasks for all three sub-projects, generally the as-planned completion milestones remain relatively unaffected by the early delays. This outcome suggests

that Nalcor is implementing mitigation measures or mid-course schedule corrections to maintain schedule. This action is reasonable and is expected for a well-managed project.

4.16 PERFORMANCE TEST CRITERIA

4.16.1 Turbines and Generators

The performance test criteria for the turbines and generators (Contract: CH0030) are the only ones that are currently available for review (November 2013). As noted in the Summary Table 4-2, Items 13 and 15, we find that they are Satisfactory and would meet Good Utility Practice. We have noted that two of the test criteria and the penalties for not meeting the criteria are usually not found in specifications and contracts for other projects that we have reviewed; we find these extra provisions that are given in the Contract Documents very appropriate for the large size equipment. For our readers' benefit, we repeat what the LCP has accepted as its definition of Good Utility Practice as given in Schedule A of the WMA and quote this definition as follows since it is succinctly stated:

> Good Utility Practice means those practices, methods or acts, including but not limited to the practices, methods or acts engaged in or approved by a significant portion of the electric utility industry in Canada, that at a particular time, in the exercise of reasonable judgment, and in light of the facts known at the time a decision is made, would be expected to accomplish the desired result in a manner which is consistent with laws and regulations and with due consideration for safety, reliability, environmental protection, and economic and efficient operations.

4.16.1.1 Other Equipment

Currently there is no other equipment where performance test criteria are available for comment by the IE.

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SECTION 5

CAPITAL BUDGET

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SECTION 5

CAPITAL BUDGET

5.1 TOTAL PROJECT COST ESTIMATE

The IE has reviewed the DG3 Basis-of-Estimate document (LCP-PT-ED-0000-EP-ES-0001-01, rev B1 dated 03 Dec 2012) and the DG3 Capital Cost and Schedule Estimate Summary Report (LCP-PT-MD-0000-IM-PR-0003-01, rev B1 dated 09 Nov 2012) as input materials describing the capital budget for LCP's MFGS, LTA, and LITL project elements. Table 5-1 provides Nalcor's most recent (DG3) Capital Cost Estimate Summary.

5.1.1 Cost Estimating Methodology

The cost estimating methodology employed by Nalcor utilizes a deterministic approach to calculate the project's direct and indirect costs and a risk-adjusted analytical technique to develop a contingency allocation for defined tactile risks. Finally, a separate escalation analysis has been developed to calculate and fund anticipated changes in forward price levels via an allowance into the capital budget. The IE notes that Nalcor follows standard estimating practices as put forward by the Association for the Advancement of Cost Engineering International (AACEI), including 69R-12, 58R-10, 18R-97, and 17R-97.

IE's review of the above-noted cost estimating documentation indicates that Good Utility Practice (GUP) was followed by Nalcor to develop the DG3 capital cost budget. Generally, the cost estimate methodology can be described as a "bottom-up" approach relative to the level of detail, supporting documentation, and implied level of effort. A "top-down" approach was utilized for certain allowances and undefined scope elements to ensure budget inclusion. As well, the methodology applied to the risk analysis is considered to meet GUP expectations for quantifying pricing uncertainties utilizing range modeling against group subtotals with standard statistical techniques.

5.1.2 Reconciliation of the DG3 Capital Cost Estimate to Actual

To account for uncertainty in the project’s cost opinion, stakeholders should be aware that a range of probable outcomes is possible. Reconciliation of the project's DG3 capital cost estimate to actual tendered amounts up to the current date provides a means for interested parties to trend the current budget and understand variance relative to DG3 metrics.

Table 5-2 provides a summary of the DG3 capital budget as compared to actual expenditures to the date of the DG3 estimate.

Table 5-1

DG3 CAPITAL COST ESTIMATE SUMMARY

MF		
Description	**Code**	**Budget (DG3)**
Owner, admin and EPCM	100	[redacted]
Feasibility engineering	200	[redacted]
Environmental and regulatory compliance	300	[redacted]
Aboriginal Affairs	400	[redacted]
Procurement and Construction	500	[redacted]
Commercial and Legal	900	[redacted]
Contingency	990	[redacted]
	Grand Total	**2,901,158,288**

LITL		
Description	**Code**	**Budget (DG3)**
Owner, admin and EPCM	100	[redacted]
Feasibility engineering	200	[redacted]
Environmental and regulatory compliance	300	[redacted]
Aboriginal Affairs	400	[redacted]
Procurement and Construction	500	[redacted]
Commercial and Legal	900	[redacted]
Contingency	990	[redacted]
	Grand Total	**2,609,748,892**

TABLE 5-1 (cont'd)

DG3 CAPITAL COST ESTIMATE SUMMARY

LTA		
Description	**Code**	**Budget (DG3)**
Owner, admin and EPCM	100	[redacted]
Feasibility engineering	200	[redacted]
Environmental and regulatory compliance	300	[redacted]
Aboriginal Affairs	400	[redacted]
Procurement and Construction	500	[redacted]
Commercial and Legal	900	[redacted]
Contingency	990	[redacted]
	Grand Total	**691,582,486**

LCP		
Description	**Code**	**Budget (DG3)**
Owner, admin and EPCM	100	[redacted]
Feasibility engineering	200	[redacted]
Environmental and regulatory compliance	300	[redacted]
Aboriginal Affairs	400	[redacted]
Procurement and Construction	500	[redacted]
Commercial and Legal	900	[redacted]
Contingency	990	[redacted]
	Grand Total	**6,202,489,666**

Table 5-2

EXPENDITURES TO DATE VERSUS THE DG3 CAPITAL COST ESTIMATE

Description	Amount ($CDN)	Metric
Awarded Work to Date	$2,401,387,000	44% of total original budget less Program costs ($5.52B)
Net Variance on Awarded Work to Date Relative to DG3	[redacted]	[redacted]
Soon to be Awarded Work (within +2 Quarters)	$1,797,221,000	33% of total original budget less Program costs ($5.52B)
Estimated Net Variance on Soon to be Awarded Work	[redacted]	[redacted]
Overall Net Variance on Awarded and Soon to be Awarded Work Relative to DG3	[redacted]	[redacted]
Overall Positive to Negative Variance on Awarded and Soon to be Awarded Work Relative to DG3	[redacted]	[redacted]
Unreconciled Work	[redacted]	[redacted]
Contingency Reduction Post DG3	[redacted]	[redacted]
Remainder Contingency	[redacted]	[redacted]
Contingent Equity Provision for Overruns	Undefined	n/a

These data indicate the awarded work has experienced a [redacted] percent positive variance from the DG3 cost estimate. Overall, the analysis indicates a combined [redacted] percent positive estimating variance for the awarded and soon-to-be awarded work based on information recently provided by Nalcor. The IE is of the opinion that the estimating variance will continue to trend downwards for the remainder of the un-awarded work and project support costs. Since the revised budget projection put forward by Nalcor does not factor in an allowance for estimating variance, the IE suggests that Nalcor consider applying an appropriate management reserve to accommodate future changes in project scope and cost.

5.1.3 Contingency Analysis

While Nalcor adopted a theoretical P50 contingency based on analytical modeling (i.e., range uncertainty) of the project's sub-element summary budgets, the IE is of the opinion that the calculated overall 6.7 percent scope contingency is aggressive relative to our legacy experience with similar remote heavy-civil construction endeavors. The IE understands that the Province will provide contingent equity for any budget shortfalls past the $6.3B FLG. The contingent equity is currently undefined.

As the project moves into full-scale field execution with the award of CH0007 (Muskrat Falls Powerhouse), the IE would advocate for adjustment of the project contingency fund. [redacted] The IE believes the drivers on contingency will be varied and not entirely predictable as the project unfolds over the next several years. Issues associated with budget estimate accuracy, baseline schedule accuracy, uncompetitive market conditions, directed scope changes, changed field conditions, claims, weather impacts, resource shortages, directed schedule acceleration, potential contractor defaults, incremental owner project support costs, and other unknown risks are some of the typical factors that our experience indicates will consume contingency on a remote large-scale, heavy-civil endeavor.

5.1.4 Cost Escalation

Estimated capital costs included in the DG3 estimate are costs based on 2012 values. These values were escalated in the Nalcor financial models to reflect expected cost bases in the years of construction.

The long duration of the development, construction, and operation phases of the LCP subject project costs to escalation caused by inflation and various other factors, including changes in market conditions, labor rates, productivity, etc.

As shown in Table 5-1, above, the DG3 capital cost estimates have been adjusted to reflect cost escalation and contingency allowances. The Nalcor financial models also incorporate cost escalation and contingencies as separate line items. The capital costs projected and input into the financial models also incorporate escalation in addition to contingency, which addresses separately risks of a different nature. With the assistance of external experts, Nalcor has projected cost escalation that takes into account how each sector of the economy, e.g. commodity, labor market or global economic factors, is impacted differently. In our opinion, the strategy adopted by Nalcor permits a realistic estimate of escalation. Escalation assumptions input into the MF, LTA, and LIL spreadsheets in the financial models reflect the detailed estimates prepared, and appear consistent with the trends projected for the region. Table 5-3 summarizes the annual escalation through 2018.

Table 5-3

ANNUAL COST ESCALATION

ESCALATION	2012	2013	2014	2015	2016	2017	2018
MUSKRAT FALLS							
CUMULATIVE	1.1%	2.8%	5.8%	8.3%	10.1%	10.6%	10.2%
ANNUAL	1.1%	1.7%	2.9%	2.3%	1.7%	0.5%	-0.3%
LABRADOR TRANSMISSION ASSETS							
CUMULATIVE	0.6%	2.5%	5.4%	10.3%	13.0%	14.8%	
ANNUAL	0.6%	1.9%	2.8%	4.7%	2.5%	1.5%	
LABRADOR ISLAND TRANSMISSION LINK							
CUMULATIVE	0.2%	2.5%	5.0%	7.8%	9.5%	14.2%	21%
ANNUAL	0.2%	2.3%	2.4%	2.7%	1.6%	4.4%	5.9%
TOTAL PROJECT ESCALATION							
CUMULATIVE	0.9%	2.7%	5.3%	8.2%	9.8%	12.0%	11.9%
ANNUAL	0.9%	1.8%	2.6%	2.7%	1.5%	1.9%	

5.1.5 Contingency Used in Financial Model

Capital costs used in the Nalcor financial models include contingency as well as escalation, as shown in Table 5-1.

The level of accuracy supported by the amount of engineering performed at this stage of project development should provide an adequate margin to mitigate the risk of uncertainty still present in the absence of the larger contracts being awarded. At this point in our review, the IE is of the opinion that allowances for contingencies should be greater than the figures provided by the Nalcor cost estimating consultants and summarized in Table 5-1.

By arriving at the contingency levels used as input to the pro forma following a multi-faceted Project Risk Management Plan, and using AACEI's recommended practice, Nalcor has adopted a reasonable approach in the interim period. They have arrived at some figures that, in comparison to those used in other similar projects we have reviewed, are aggressive. The IE typically sees contingency allowances in the range of 6 percent to 10 percent at this state of project development.

The contingency allowance figures for the three projects are identified in Table 5-1. Table 5-4 shows the same capex and P50 contingency as Table 5-1 and includes the ratio of those two

parameters. Total aggregate contingency percentage is about 6 percent. These contingency values appear to be at the low end of the observed range which in our opinion is aggressive..

Table 5-4

CONTINGENCY ALLOWANCE

	MF	LTA	LIL	Total
Total DG3 Capital Cost Estimate	$2,901,158,288	$691,582,486	$2,609,748,892	$6,202,489,666
Growth allowance components				
P50 contingency	$ 226,800,000	$ 54,400,000	$ 86,600,000	$ 368,000,000
P50 contingency $ of Nalcor total capex	7.81%	7.92%	3.31%	5.93%

5.1.6 Indirect Costs

An important component capitalized into the LCP funding mechanisms is the cost of financing. This cost category includes bond counsel, financial advisory, underwriter discount, official statement printing and distribution, and other costs. Because of the very high credit worthiness of the financing securities, we are advised that there will be no cost of bond insurance premiums or surety costs.

Financing costs for the three projects included in the models total more than [redacted] as follows:

MF ..... [redacted]

LTA ..... [redacted]

LIL ..... [redacted]

Sum ..... [redacted]

Other indirect costs included in the DG3 estimate include:

- project management;
- integrated commissioning;
- project vehicles / helicopter support;
- insurance / commercial;
- land acquisition and permits;
- quality surveillance and inspection;

- freight forwarding services; and
- environmental and aboriginal affairs.

In our opinion, the approach and the comprehensiveness of the technical estimates is consistent, and even better than those normally seen in projects of this type.

Financing fees, namely those for arrangement and commitment (LIL at [redacted] percent of amount financed, for example), are in the range typically seen in other similar projects.

5.1.7 Historical Capital Outlay

Capital costs that have occurred or shall have occurred prior to project financing are included in the DG3 estimate. Some utilities capitalize such costs in their main financing packages where some form of short-term "bridge financing" may have been used to pay for the initial construction activities. Such bridge financing securities are refinanced into the main financing structures. Other utilities fund the initial construction outlay using equity funds on-hand and do not re-capitalize those expenditures into the main financing vehicles.

Nalcor's DG3 cost estimate and financial planning models include more than $186M in pre-operating construction costs.

Table 5-5 summarizes these costs by project.

Table 5-5

HISTORICAL COSTS

PROJECT	HISTORICAL COST (note 1; note 2)
Muskrat Falls	$97,303,164
Labrador Transmission Assets	4,196,093
Labrador Island Transmission Link	85,307,165
Total	**$186,806,422**

Notes:
Note 1: Cost data in Table 5-5 are reported at original cost.
Note 2: Historical costs are those costs associated with the projects that have occurred before Project Sanction, December 17, 2012.

5.1.8 Interest During Construction

The DG3 construction cost estimate does not include costs of IDC, also called AFUDC. However, IDC is an important feature to capitalize in the financings and it is included in the Nalcor financial models. Table 5-6 summarizes the IDC values included for the three projects.

Table 5-6

INTEREST DURING CONSTRUCTION COST

PROJECT	IDC
MF	$364,522,428
LTA	$79,164,135
LIL	$558,444,313
TOTALS	**$1,002,130,876**

5.1.9 Renewals and Replacements

Nalcor advised the IE that the financial planning for the projects does did not specifically include costs for renewals and replacements in the capital or annual cost estimates. Their opinion is that with proper design and installation and with regular and prudent maintenance following manufacturers' recommended scheduled maintenance there should be no need to replace the equipment since its useful life will exceed the bond repayment period.

The IE is of the opinion, based on experience that funds should be provided for major replacements in the 25-30 year period with minor replacement after 10-15 years of service.

If major repairs/replacements become necessary, Nalcor will have access to Provincial equity funding to be repaid subsequently. This program is consistent with the manner of utilities that use the "Cash Needs" method of revenue requirements. The three step solution: (1) problem happens or will happen; (2) problem solution is funded; and (3) the funding is repaid, is optimized if the utility has a capital reserve or other liquidity feature to minimize the time taken in the funding step.

Although Renewals and Replacements are not included in either DG3 or the Nalcor financial models, Nalcor has included in its Asset Management Philosophy report the Renewals and Replacements data included here in Table 5-7.

Table 5-7

MAJOR MAINTENANCE ACTIVITIES PLANNING

Hydro Power Plant Major Maintenance Activity	Interval (years)	Activity Duration	Activity Cost
Replace bearings	Turbine 25-35 Generator 40-50 Thrust 40-50	4 days	[redacted]
Replace wicket gate bushing	25-50	1 month	[redacted]
Replace shaft seal	15-30	2 days	[redacted]
Clean rotor and stator	50-75	1 month	[redacted]
Repair cavitation	25-50	2 weeks	[redacted]
Replace generator cooler	35-50	1 week	[redacted]
Rewind generator	60-80	1.5 months	[redacted]
Replace exciter	15-20	5 weeks	[redacted]
Replace governor	15-20	5 weeks	[redacted]
Replace voltage regulator	15-20	5 weeks	[redacted]

5.1.10 PM, Construction Contractors Experience

At the present time, we only have knowledge of the EPCM contractor and three other contracting groups of the contracts the IE is required to review and report on. These entities are included in the following Table 5-8 with our remarks.

Table 5-8

CONTRACTOR'S EXPERIENCE

CONTRACT NO.	CONTRACT DESCRIPTION AND CONTRACTOR	REMARKS	OPINION OF INDEPENDENT ENGINEER
CH0006	BULK EXCAVATION HT O'CONNELL, EBJ, NIELSON, AND KIEWIT	EACH OF THE CONTRACTORS IS WELL-KNOWN IN CANADA AND HAS THE FULL CAPABILITIES TO PERFORM THE ENTIRE CONTRACT BY THEMSELVES. THE CONTRACTORS HAVE WORKED TOGETHER ON	SATISFACTORY

Table 5-8 (cont'd)

CONTRACTOR'S EXPERIENCE

CONTRACT NO.	CONTRACT DESCRIPTION AND CONTRACTOR	REMARKS	OPINION OF INDEPENDENT ENGINEER
		OTHER HEAVY CIVIL PROJECTS AND ALL HAVE WORKED ON HYDROELECTRIC PROJECTS	
CH0030	TURBINES & GENERATORS DESIGN, SUPPLY. AND INSTALL AGREEMENT ANDRITZ HYDRO CANADA INC.	ANDRITZ IS A TIER ONE SUPPLIER OF HYDRAULIC TURBINES AND ASSOCIATED EQUIPMENT. ANDRITZ HAS EXPERIENCE IN LARGE-DIAMETER KAPLAN TURBINES OF SIMILAR SIZE (9 METER SIZE)	SATISFACTORY
LC-SB-003	STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL NEXANS CABLE	NEXANS CABLE IS A TIER ONE DESIGNER, SUPPLIER, AND INSTALLER OF SUBMARINE CABLES WORLDWIDE.	SATISFACTORY
EPCM	ENGINERING, PROCUREMENT, AND CONSTRUCION MANAGEMENT SNC-L.	SNC-L IS A TIER ONE ENGINEERING AND CONSULTING COMPANY WHICH HAS DESIGNED AND MANAGED MANY LARGE HYDROELECTRIC PROJECTS, THERMAL GENERATING STATIONS, AND NUCLEAR POWER PLANTS	SATISFACTORY

Table 5-8 (cont'd)

CONTRACTOR'S EXPERIENCE

CONTRACT NO.	CONTRACT DESCRIPTION AND CONTRACTOR	REMARKS	OPINION OF INDEPENDENT ENGINEER
CH0007	CONSTRUCTION COST OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS	ASTALDI HAS BEEN SELECTED AND GIVEN LIMITED NOTICE TO PROCEED.	SATISFACTORY. CLOSE MONITORING DURING CONSTRUCTION BY THE INTEGRATED PROJECT TEAM IS ADVISED TO ACHIEVE PROJECT GOALS AND CONTRACT REQUIREMENTS.

Note: No additional contracts were available for review prior to Financial Close.

5.2 MAJOR EQUIPMENT DELIVERY DATES

MWH has included in Table 5-9 below, the major equipment delivery dates used by Nalcor in developing the DG3 schedule and cost estimate. Nalcor has advised MWH that these dates will be given in the contracts as milestone requirements that will ensure project schedule adherence. They will also be used by suppliers and contractors to develop their costs.

Table 5-9

DELIVERY DATES

MAJOR EQUIPMENT AND SYSTEMS

Muskrat Falls Generation		
	Spillway	
CH0032	Gate Anchors	2014 Jan
CH0032	Gate Guides 1	2015 Mar
CH0032	Gate 1	2015 Jun
CH0032	Stoplog Anchors	2014 Jan
CH0032	Stoplog Guides	2015 Mar
CH0032	Stoplog 1	2015 Oct
CH0033	**Powerhouse Crane**	
	Powerhouse Unit 1	

Table 5-9 (cont'd)

DELIVERY DATES

MAJOR EQUIPMENT AND SYSTEMS

CH0032	Draft Tube Gate anchors	2014 Mar
CH0032	Draft Tube Gate guide	2015 Sep
CH0032	Draft Tube Gate	2016 May
CH0032	Intake Gate anchors	2014 Apr
CH0032	Intake Gate guide	2016 Mar
CH0032	Intake Gate	2016 Jun
CH0030	T/G anchors (embedded)	2014 Mar
CH0030	Stay Ring (embedded) non-embedded parts not included in this list	2016 May
PH0014	Power Transformer	2015 Jul
PH0015	Isophase System	2017 Jul
Labrador Transmission Asset		
PD0537	**Transformers 735kV – Churchill Falls Switch Yard**	2015 Jun
PD0537	**Transformers 315kV – Muskrat Falls Switch Yard**	2015 Jun
	Labrador Marshalling Yard for Transmission Line	
PD0335	Anchors – 50% to Marshalling yard	2013 Aug
PD0307	Steel Tower Foundations – 40% to Marshalling yard	2013 Sep
PD0302	Steel Towers – 1000 Tons to Marshalling yard	2013 Oct
PD0300	Conductor – 50% to Marshalling yard	2013 Nov
Labrador Island Transmission Link		
	Synchronous Condensers – Soldiers Pond	
CD0534	1st unit at site	2014 Dec
	Converter Station Equipment – Muskrat Falls	
CD501	DC Equipment	2015 Jan
CD501	AC Equipment	2015 Mar
	Converter Station Equipment – Soldiers Pond	
CD501	DC Equipment	2015 Apr
CD501	AC Equipment	2016 Feb
	Labrador Marshalling Yard for Transmission Line	

Table 5-9 (cont'd)

DELIVERY DATES

MAJOR EQUIPMENT AND SYSTEMS

PT0352	Anchors – 50% to Marshalling yard in Lab	2014 Apr
PT0308	Steel Tower Foundations – 50% to Marshalling yard in Lab	2014 Jun
PT0330	Steel Towers – 50% Tons to Marshalling yard in Lab	2014 Aug
PT0328	Conductor – 50% to Marshalling yard in Lab	2014 May
	Newfoundland Marshalling Yard for Transmission Line	
PT0352	Anchors – 50% to Marshalling yard in Nfld	2014 Apr
PT0308	Steel Tower Foundations – 50% to Marshalling yard in Nfld	2014 Jun
PT0330	Steel Towers – 50% Tons to Marshalling yard in Nfld	2014 Aug
PT0328	Conductor – 50% to Marshalling yard in Nfld	2014 May
SOBI Crossing		
	Subsea Cable fabricated and available for pick-up	2015 Nov

5.2.1 Schedule of Values

The schedule showing the estimated base cost (DG3 Cost) by component for MF, LTA and LIL projects cash expenditure schedule and accumulated cash flow is given in Figure 5-1 at the bottom of the table, which has been enlarged following the figure. This exhibit was copied directly from Decision Gate 3 Capital Cost Estimate, LCP-PT-ED-00000-EP-ES-0002-01, and clearly illustrates what Nalcor predicts is the cash flow for the three different projects comprising their portion of the LCP. In the opinion of the IE, we find this schedule to be reasonable and supported by Nalcor's evaluation and analysis.

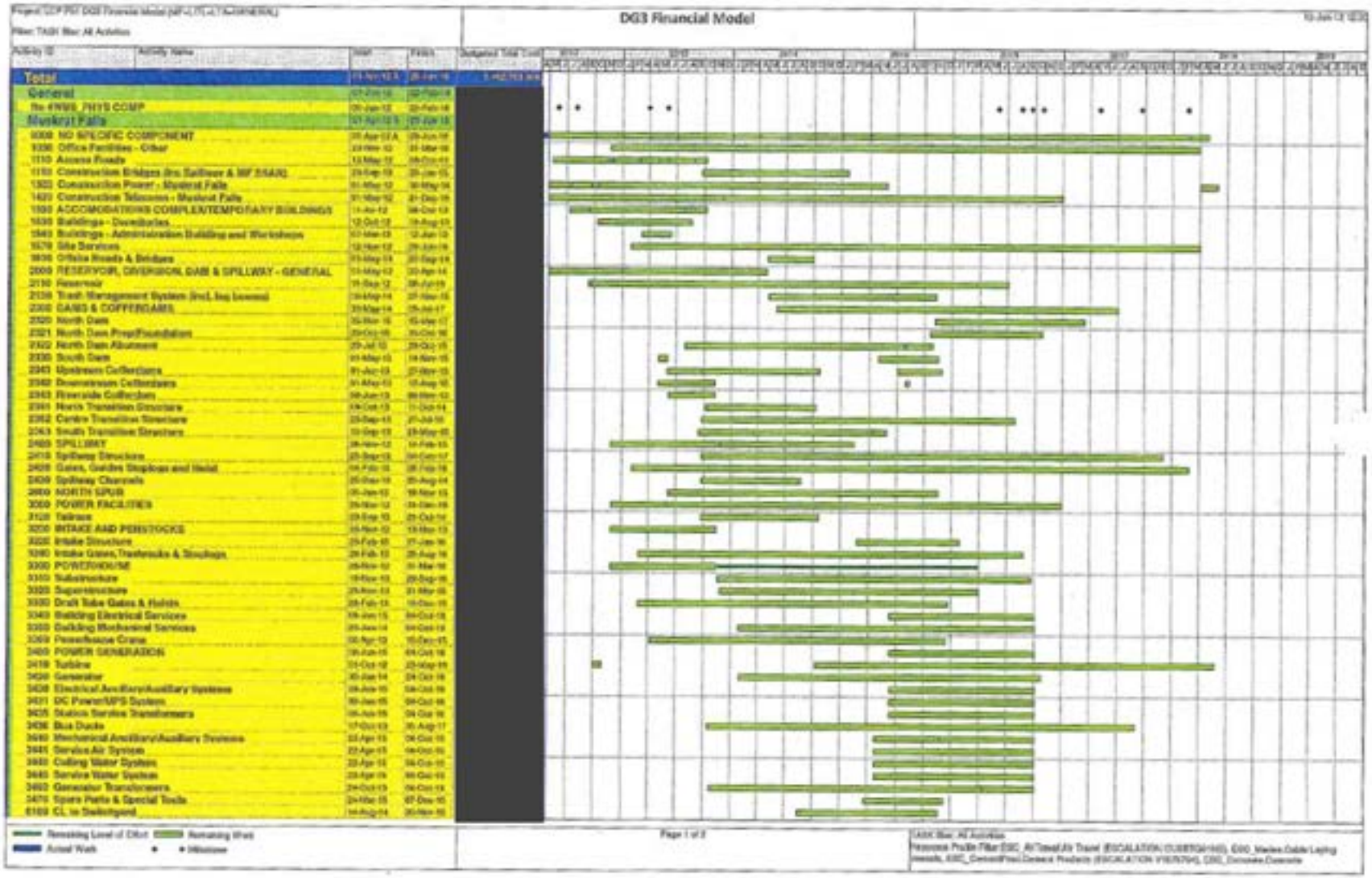


Figure 5-1 Schedule of Expenditures for Major Components of the Projects and Accumulated Cash Flow Projection

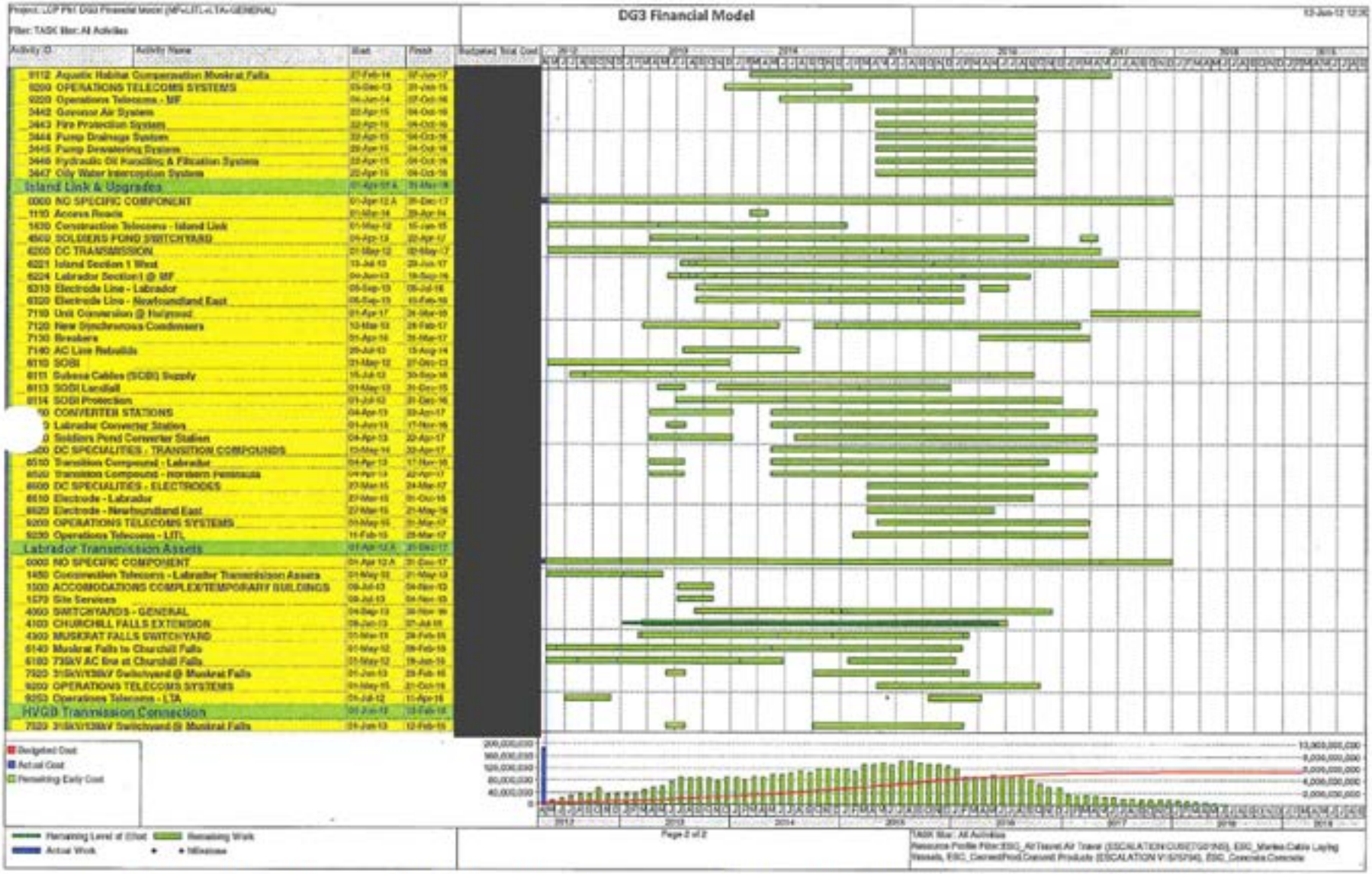
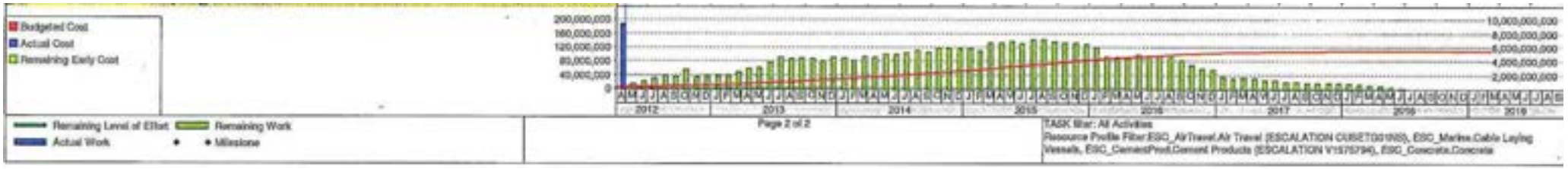


Figure 5-1 Schedule of Expenditures for Major Components of the Projects and Accumulated Cash Flow Projection (continued)

Enlargement of bottom section of Figure 5-1.



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5.2.2 Allowance for Contractor Bonus

[redacted]

5.2.3 Highlight Sensitive and Critical Areas

Nalcor has identified several areas that they initially believe are the critical risk areas for the projects, namely the following: Performance Risk and Schedule Risk. A brief discussion of each, from Nalcor's perspective, follows.

[redacted]

Nalcor considered that there was a potential for a time or schedule risk exposure for the MF powerhouse beyond the plan they developed due to weather and the sheer magnitude of the volume of work for the powerhouse. The main concern was that the placement and curing of the 460,000 CM of powerhouse reinforced concrete over several winters will be a significant challenge for the contractor for CH0007. Additionally, the Bulk Excavation contractor (CH0006) needed to keep to schedule to complete its work this fall (2013) to enable the contractor for CH0007 to start its work on time, which was achieved.

MWH agrees with Nalcor's assessment that these are certainly risks that must be considered and accounted for in the schedule and cost estimate. MWH notes that the perceived schedule risk exposure pertaining to the Bulk Excavation contractor completing on time appears to be a non-issue, as viewed during the field trip in late September 2013, assuming that the contractor's performance continues to be satisfactory. Additionally, MWH believes that with Nalcor's acceptance of the contractor's proposal to use an all-weather enclosure for powerhouse construction as proposed by the contractor for CH0007 can work to mitigate the risk of extensive delays in the powerhouse concrete construction during the winter seasons.

With the concern that Nalcor has expressed in the past regarding uncertainties surrounding the potential cost increase due to the competition for labor and key personnel, MWH believes that this concern could have been addressed in the cost estimate and reflected in the Project

Schedule by including higher more customary contingencies and a lengthened project schedule. A larger Owner's contingency could have been assumed as compared to what Nalcor used to offset the risk of overrunning the project budget and communicated timeline. In the DG2 and DG3 estimates, MWH generally follows AACEI's guidelines for projects with respect to contingencies since AACEI has a broad data base to support the contingency values and accuracy statement used for each level of the cost estimate. In addition, the schedule opinion will gain accuracy if the project's risk register is mapped to the individual line item activities and supported with an analytical uncertainty analysis using Monte Carlo simulation to discern finish date accuracy relative to desired confidence intervals. [redacted] they believe they have mitigated the risk successfully and will complete their projects within their estimate.

5.2.4 Price Risks

Nalcor has discussed in the contracting philosophy their methods to quantity and manage price risks due to changing market conditions, inflation, labor issues, weather and hydrology issues, manufacturing space and equipment availability, delays in meeting milestones, and competition with other projects in Canadian Provinces. The risk assessments they conducted following a multi-faceted Project Risk Management Plan using AACEI's recommended practice for price changes for major equipment they will purchase, as well as the construction and installation contracts they and SNC-L will administer, appear to be carefully performed and were taken into consideration in their economic analysis. The CPM schedule was also integrated into the analysis to arrive at appropriate unit cost pricing.

Where appropriate, LDs, LCs and performance protection have also been used to protect Nalcor as [redacted] to help Nalcor achieve their development schedule.

5.3 DRAWDOWN SCHEDULES

In order to opine on the reasonableness of the drawdown schedules for each of the contracts that MWH is required to review and comment on, we have prepared Table 5-10 wherein we have summarized our findings for each of the contracts. We note that even where we believe we have observed some payments in favor of the contractor or vendor, since the payment schedule was considered among many items in the consideration and award of the contract, other issues may override any unbalance we may observe.

Table 5-10

PAYMENT SCHEDULES FOR CONTRACTS REVIEWED

BY THE INDEPENDENT ENGINEER

PROJECT	CONTRACT NUMBER	PAYMENT SCHEDULE		REMARKS/COMMENTS
		NORMAL EXPECTED	UNUSUAL	
MF	CH0030	Normal		Satisfactory
	CH0006	Normal		Satisfactory
	CH0007			Awaiting contract award and payment schedule
SOBI	LC-SB-003	Unknown		Under review

To allow a more easy comparison to determine if the drawdown payment schedule is normal or unusual, we have plotted each of the schedules we have been asked to review where information is available. A composite plot is given in Figure 5-2 below for contract CH0006, contract LC-SB-003, and contract CH0030, which has three currencies to consider. The plots indicate no unusual issues with drawdown payments.

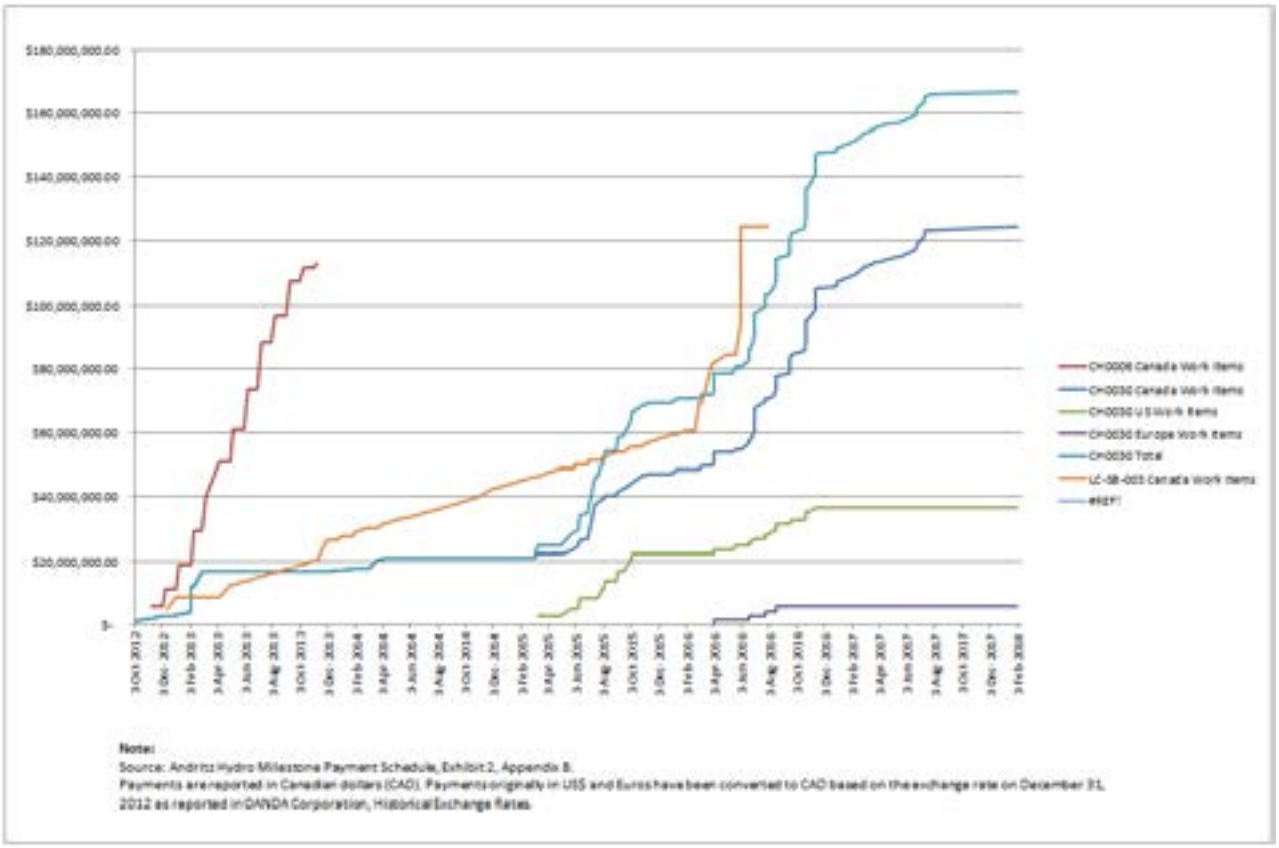

Figure 5-2 Composite Plot of Drawdown Payment Schedule –

Contract CH0006, Contract LC-SB-003, and Contract CH0030

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SECTION 6

COMMERCIAL OPERATION AND MAINTENANCE SERVICES

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SECTION 6

COMMERCIAL OPERATION AND MAINTENANCE SERVICES

6.1 OPERATIONS AND MAINTENANCE PLAN

6.1.1 Commercial Operation Services

Nalcor plans to use outside services to assist it in operating and maintaining the terminal station extension at CF according to Nalcor's Operations and Maintenance (O&M) Philosophy document. The Churchill Falls Labrador Corporation will be responsible for the operation and maintenance of this facility.

Nalcor plans to operate the other components of the LCP they are constructing and financing by themselves, or through subsidiary companies established for taxing and legal reasons.

6.1.2 Adequacy of Start-Up and Long-Term Procedures

No comments will be furnished by MWH prior to Financial Close. The program for the operation services is currently under development and will not be available for review until later next year.

6.1.3 Reasonableness of Annual Operations and Maintenance Budget

MWH requested computation spreadsheet to support Nalcor's values of O&M Annual Charges contained in Table 6-1.

6.1.4 Proposed Training Budget

No information is yet available for MWH's review. Nalcor advises that this information will not be available until late 2014.

6.2 OPERATIONS AND MAINTENANCE COST ESTIMATE

6.2.1 Completeness

The following table presents the estimated annual O&M costs provided for our review by Nalcor. They are figures that have been developed by the Integrated Project Team, which have been used in Nalcor's financial pro forma.

Table 6-1

ANNUAL OPERATIONS AND MAINTENANCE COSTS

Year:	1	2	3	4	5	10	20	30	40	50
Muskrat Falls Generation	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025
Labrador Transmisson Assets	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360
Labrador - Island Transmisson Link	$15,970,624	$15,970,624	$14,623,124	$15,870,624	$14,623,124	$16,070,624	$14,823,124	$14,823,124	$14,823,124	$14,823,124
Total:	**$24,464,009**	**$24,464,009**	**$23,116,509**	**$24,364,009**	**$23,116,509**	**$24,564,009**	**$23,316,509**	**$23,316,509**	**$23,316,509**	**$23,316,509**

The data shown in Table 6-1 are based on January 2012 costs and include 15 percent contingency allowances. Each of the first five years, starting from the first date of commercial operation of the project, the tenth year, and then each subsequent tenth year are indicated.

MWH has independently tried to verify that the annual operating and maintenance costs for Muskrat Falls are reasonable for the project using information from the following sources: data published in U.S. Energy Information Administration publication for power plants owned by major U.S. investor-owned utilities; historical information gathered by Canadian investigators from plants in the Canada and the United States and published in 1987 by "Water Power and Dam Construction" (WPDC) and updated by MWH via appropriate indices experienced by the USBR tracking system, one of the largest owners of hydroelectric power plants in the USA (the largest being the U.S. Army Corps of Engineers); and a recent study completed by MWH for the Susiana-Watana hydroelectric project in Alaska (600 MW). We find that the closest comparison to the value derived by Nalcor was the WPDC cost information that clearly separates out annual Operation and Maintenance costs and Renewals and Replacements costs. The information does not include the General and Administrative costs which typically run in the range of 35 percent to 40 percent of the O&M costs. G&A needs to be added to the O&M, R&R, as well as insurance costs to arrive at the Annual Cost for a project. Annual costs from this compilation do not include insurance. We find that annual O&M costs are nearly $8,445,000, approximately 33 percent more than those derived by Nalcor. Since the Muskrat Falls plant will be operated remotely, this would account for some of the disparity we have found in trying to compare the values. However, we believe that the O&M cost are below the normal annual costs experienced for other large hydroelectric plants that MWH is aware of.

Corporate costs (general and overhead) are allocated among the three projects based on the direct O&M cost estimates. They are:

- MF 23.95 percent;
- LTA 19.28 percent; and
- LIL 56.77 percent.

Energy Control Centre (ECC) costs are allocated among two projects based on expected use. They are:

- LTA 25 percent; and
- LIL 75 percent.

6.2.2 Assumptions

6.2.2.1 Nalcor's O&M strategy is to operate MF, terminal and converter stations at Soldiers Pond and MF, terminal station extension at CF, AC transmission lines in Labrador, DC transmission lines in Labrador and Newfoundland, and the SOBI crossing and transition stations remotely from Nalcor's ECC in St. John's and by local staff as required.

6.2.2.2 Routine maintenance, condition and performance monitoring, inspection, adjustment and minor repairs will be performed by Nalcor staff working at the facilities, or located nearby in other Nalcor facilities.

6.2.2.3 Major maintenance and repair, specialized inspections, tests, and adjustments will be performed by contractors through various arrangements depending on the service to be provided.

6.2.2.4 Support services including technical, environmental, accounting, budgeting, financial reporting, procurement, human resources, legal, etc. will be provided from Nalcor headquarters in St. John's.

6.2.2.5 Staffing requirements are discussed in the tables below, and were provided by Nalcor.

6.2.2.6 Nalcor has advised MWH that, as the design is refined and more specific details are finalized, the staffing requirements will be reviewed and adjusted, if needed.

6.2.3 Reasonableness of Assumptions

The assumptions listed in Table 6.2 are reasonable and many are generally assumed by utilities for large projects like Churchill Falls.

6.2.4 Staffing

Contained within Nalcor's O&M Philosophy document, LCP-PT-0000-PM-00010-01, are summary tables that designate the positions, number of personnel, and classification/expertise that are required for each of its major facilities found in the document for the LCP. For the principal facilities, we have included several of these tables below as reported by Nalcor.

Table 6-2

STAFFING REQUIREMENTS PROPOSED FOR MUSKRAT FALLS FACILITY

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE
PLANT MANAGER	1	ELECTRICAL/MECHANICAL ENGINEER
PLANT ENGINEER, ASSET SEPCIALIST	1	ELECTRICAL/MECHANICAL ENGINEER
TECHNCIAL SUPERVISOR	1	P&C/OPERATIONS/MECHANICAL/ ELECTRICAL TRADES & TECHNOLOGY
TECHNCIAL OPERATOR	4	P&C/COMMUNICATIONS/OPERATIONS/MECHANICAL/ELECTRICAL TRADES & TECHNOLOGY
UTILITY WORKER	2	GENERAL MAINTENANCE
PLANNER	1	MECHANICAL/ELECTRICAL—TRADES & TECHNOLOGY
ENVIRON-MENTAL COORDI-NATOR	1	BIOLOGY, SCIENCE
AREA OFFICE CLERK	1	ADMINISTRATION, ACCOUNTING
CLERK	1	CLERICAL/DOCUMENT CONTROL/STORES/TOOL CRIB
TOTAL STAFF MF	**13**	

Table 6-3

STAFFING REQUIREMENTS PROPOSED FOR

MUSKRAT FALLS, ISLAND LINK AND MARITIME LINK TRANSMISSION (SIC) FACILITIES

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE
SYSTEM OPERATOR	5	ELECTRICAL TECHNOLOGY
SYSTEM PERFORMANCE	1	ELECTRICAL ENGINEERING
OPERATIONS PLANNING	1	ELECTRICAL ENGINEERING
GENERATION COORDINATOR	1	ELECTRICAL OR HYDROTECHNICAL ENGINEER
TOTAL MF; LIL; ML	**8**	

The IE notes that the staffing includes provisions for the Maritime Link facilities that are believed to be just those that deal with Nalcor assets.

According to Nalcor's O&M Philosophy document, the Churchill Falls Labrador Corporation will be responsible for the operation and maintenance of the terminal station extension at CF.

Table 6-4

STAFFING REQUIREMENTS PROPOSED FOR MAINTENANCE OF TRANSMISSION LINES, ELECTRODE LINE, SHORE LINE POND ELECTRODE, DISTRIBUTION LINES AT MUSKRAT FALLS AND ASSOCIATED FACILITIES IN LABRADOR WILL BE THE RESPONSIBILITY OF TRANSMISSION AND RURAL OPERATIONS (TRO) LABRADOR. THIS INCLUDED THE SWITCHYARD AND CONVERTER STATION AT MUSKRAT FALLS, THE TRANSITION STATION AT FORTEAU BAY

POSITION	NO. REQUIRED	CLASSIFICATIONS/EXPERTISE	REMARKS
LINE WORKER	6	TRADES	
PROTECTION & CONTROL (P&C) TECHNOLOGIST	2	ELECTRICAL TECHNOLOGY	
ELECTRICIAN	4	TRADES	
TERMINAL MAINTENANCE A	2	TRADES	
SUPERVISOR	2	TRADES	
CLERICAL	1	TRADES	
PLANNER	1	TRADES	THE IE QUESTIONS THE EXPERTISE REQUIRED FOR THE PLANNER BELIEVING IT SHOULD BE AN ENGINEER OR TECHNOLOGIST
EQUIPMENT ENGINEER	1	PROFESSIONAL ENGINEER	
MECHANIC	1	TRADES	
TOTAL TRO LABRADOR	**20**		SATISFACTORY

Table 6-5

PROPOSED STAFFING LEVELS FOR TRO NORTHERN/CENTRAL INCLUDING MAINTENANCE OF TRANSMISSION LINES AND ASSOCIATED FACILITIES ON NEWFOUNDLAND INCLUDING SWITCHYARD AT SOLDIER'S POND, THE ELECTRODE LINE, SHORELINE POND ELECTRODE AT CONCEPTION BAY, THE SOBI CABLE CROSSING AND TRANSITION STATION NEAR SHOAL COVE

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE	REMARKS
LINE WORKER	8	TRADES	
P&C TECHNOLOGIST[1]	4	ELECTRICAL TECHNOLOGY	
NETWORK SERVICES TECHNICIAN	3	COMMUNICATION TECHNOLOGY	
EQUIPMENT ENGINER	1	ELCTRICAL ENGINEERING	
ELECTRICIAN	6	TRADES	
TERMINAL MAINTENANCE A	2	TRADES	
GENERAL MAINTENANCE B	1	TRADES	
SUPERVISOR	2	TRADES	
VEGETATION INSPECTOR	1	TRADES	
PLANNER[2]	1	TRADES	THE IE QUESTIONS THE EXPERTISE REQUIRED FOR THE PLANNER. IT IS OUR OPINION THAT THIS IS AN ENGINEERING TASK.
MECHANIC	2	TRADES	
TOTAL TRO[3] NORTHERN & CENTRAL	**31**		SATISFACTORY

Notes:

1. A P&C Technologist is a person who will installs, tests, and performs maintenance and modifications to protective relaying, metering, instrumentation, and control equipment.
2. A Planner is defined as a person who co-ordinates the development and implementation of a computerized maintenance program, develops schedules, and assists in the implementation of maintenance.
3. Transmission and Rural Operations (TRO)

Table 6-6

PROPOSED STAFFING LEVELS FOR SOLDIERS POND CONVERTER STATION

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE	REMARKS
TECHNICAL SUPERVISOR	1	TECHNICAL SUPERVISOR P&C/ELECTRICAL TECHNOLOGY/ENGINEERING	
TECHNICAL OPERATOR	4	P&C/ELECTRICAL/MECHANICAL/OPERATIONS-TRADES AND TECHNOLOGY	
UTILITY WORKER	2	GENERAL MAINTENANCE	
ASSET SPECIALIST	1	ELECTRICAL/MECHANICAL ENGINEER TECHNOLOGIST	
TOTAL SOLDIERS POND	**8**		SATISFACTORY

Table 6-7

PROPOSED STAFFING LEVELS FOR ST. JOHN'S CORPORATE HEAD OFFICE

(ADDITIONAL STAFF REQUIRED FOR THE PROJECT)

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE	REMARKS
ENGINEERING	3	**MECHANICAL, P&C, ELECTRICAL**	
FINANCE-BUDGETS	1	ACCOUNTING GRADUATE	
FINANCE—GENERAL ACCOUNTING, FINANCIAL STATEMENT PREPARATION AND REPORTING	2	ACCOUNTING GRADUATE	
FINANCE—TRANSACTIONAL PROCESSING	3	ACCOUNTING GRADUATE	
FINANCE—CASH MANAGEMENT	1.5	ACCOUNTING GRADUATE	

Table 6-7 (cont'd)

PROPOSED STAFFING LEVELS FOR ST. JOHN'S CORPORATE HEAD OFFICE

(ADDITIONAL STAFF REQUIRED FOR THE PROJECT)

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE	REMARKS
ENVIRONMENTAL SPECIALIST, ECOLOGIST	3	BIOLOGY, SCIENCE	IN THE IE'S OPINION, THERE DO NOT SEEM TO BE SUFFICIENT BIOLOGISTS AND ENVIRONMENTAL ENGINEERS TO MONITOR THE PROJECT AND ITS GREAT GEOGRAPHIC SPREAD, ESPECIALLY IN THE EARLY YEARS WHEN THERE WILL BE NUMEROUS REPORTS TO DEVELOP AND FACILITIES TO MONITOR AND REPORT ON. THERE IS NO MENTION OF ANY CONTRACTORS AND CONSULTANTS PLANNED TO AID THE PROPOSED STAFF AS PRESENTLY PLANNED.[1]
INFRASTRUCTURE SUPPORT & CLIENT SUPPORT SPECIALIST (IS)	3	DEGREE OR DIPLOMA WITH APPROPRIATE TRAINING	
TOTAL CORPORATE HEAD OFFICE	**16.5**		SATISFACTORY

[1]Nalcor advised there are other staff to assist, thus a reasonable number of biologists will be available to accommodate project needs.

The total number of personnel that Nalcor proposes to use to operate and maintain the LCP facilities under their domain is 105.5 people.

In addition to those technical personnel and specialists who will be assigned to the LCP, Nalcor plans to engage the following services from others as given in Table 6-8, immediately below.

Table 6-8

CONTRACTORS AND CONSULTANTS

SERVICE
SNOW CLEARING
ROAD MAINTENANCE
SUPPLY OF CONSUMABLES
PEST CONTROL
VEGETATION MANAGEMENT
VEHICLE MAINTENANCE
HELICOPTER SERVICES
TRUCKING AND OTHER TRANSPORTATION
DIVING
ELEVATOR MAINTENANCE
FIRE ALARM AND SUPPRESSION SYSTEMS MAINTENANCE
CRANE AND HOIST MAINTENANCE
PRESSURE VESSEL INSPECTIONS
HVAC MAINTENANCE
DAM SAFETY INSPECTIONS[(1)]

NOTES:
(1) IE suggests this consultant be included.

In addition to the outside services to be provided by others to Nalcor for the LCP, Nalcor has identified specialized technical support for the following equipment and systems as given in Table 6-9.

Table 6-9

TECHNICAL SUPPORT

SERVICE, EQUIPMENT OR SYSTEM
TURBINES
GOVERNORS
GENERATORS
EXCITERS
CONVERTER STATION EQUIPMENT
CONTROL SYSTEMS
SWITCHGEAR
TRANSFORMERS
SUBMARINE CABLE
DYKE BOARD OF CONSULTANTS(1)
ENVIRONMENTAL CONSULTANTS(2)

NOTES:
(1) IE recommends that the Dyke Board of Consultants be moved to table 6 8.
(2) IE recommends that it be considered that environmental consultants be added to this list.

6.2.5 Maintenance Provisions

No information is currently available to review; descriptive material will not be available until 2014.

6.2.6 Administrative Costs

Corporate costs (general and overhead) are allocated among the three projects based on the direct O&M cost estimates. They are:

- MF 23.95 percent;
- LTA 19.28 percent; and
- LIL 56.77 percent.

ECC costs are allocated among two projects based on expected use. They are:

- LTA 25 percent; and
- LIL 75 percent.

MWH has found that General and Administrative costs are about 40 percent of O&M. Those being used by Nalcor are within this general parameter and appear to have been developed to support the listed values. MWH has not seen the actual derivation of these numbers.

6.2.7 Management Fees

No information is currently available for MWH's review. Nalcor advised information will be available next year.

6.2.8 Consumables

No information is currently available for MWH's review. Nalcor advised information will be available next year.

6.3 NALCOR ENERGY'S RELIABILITY STATISTICS

In the review of information furnished to MWH by Nalcor, we found information that is germane to consider for this review in document: LCP-PT-MD-0000-AM-PH-0001-01, REV.B1, Appendix XIV: Reliability Statistics. Nalcor's regulated utility, NLH, has been a member of the Canadian Electricity Association (CEA) for many years, and the 2006 to 2010 reporting period, which is tabulated below for reference, is a good source of data pertaining to the reliability of their projects compared to other utilities in their classification.

Table 6-10

NLH HISTORICAL RELIABILITY STATISTICS

YEARS 2006-2010

PARAMETER	CEA AVERAGE	NLH AVERAGE	NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION *Generating Availability Data System* (2007-2011) AVERAGE VALUE IS:[8]
FOR (FORCED OUTAGE RATE)[1]	2.60%	0.79%	5.79
DAFOR (DERATE ADJUSTED FORCED OUTAGE RATE)[2]	2.74	0.96	5.30

Table 6-10 (cont'd)

NLH HISTORICAL RELIABILITY STATISTICS

YEARS 2006-2010

PARAMETER	CEA AVERAGE	NLH AVERAGE	NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION *Generating Availability Data System* (2007-2011) AVERAGE VALUE IS:[8]
DAUFOP (DERATE ADJUSTED UTILIZATION FORCED OUTAGE PROBABILITY)[3]	2.40	0.84	NO DATA AVAILABLE
ICBF (INCAPABILITY FACTOR)[4]	8.4	8.04	11.92
FAIL RATE[5]	2.15	2.79	3.10
MOF (MAINTENANCE OUTAGE FACTOR)[6]	0.85	0.70	1.92
POF(PLANNED OUTAGE FACTOR)[7]	5.41	6.59	8.46

NOTES:

1. A measure of the time a unit is unable to operate because of a problem.
2. A measure of the time a unit is unable to operate, or is able to operate but not at rated capacity, because of a problem.
3. The probability that a unit will not be available, or is available but not at rated capacity, when required.
4. A measure of the total outage time for a unit.
5. The rate at which a unit encounters a forced outage.
6. A measure of the total maintenance outage hours for a unit.
7. A measure of the planned maintenance outage hours for a unit.
8 Values in table were computed by MWH using North American Electric Reliability Corporation's (NAERC) Generating Availability Data System (GADS) data.

Nalcor draws the following conclusion: "The table indicates that the generating equipment operated by Newfoundland and Labrador Hydro performs very well compared to the other Canadian utilities." Based on the numbers presented in Table 6-10, the IE concurs with this observation.

The IE has also added values taken from NAERC's GADS for about the same period of time for comparison purposes. Based on these values, which have a much broader base but include plants in the southern and western portion of the United States, we find Nalcor's overall performance exceeds the NAERC averages for the period compared.

Based on the above data, the IE is of the opinion that the expected performance of Nalcor, and the companies it has established to operate and maintain the LCP assets, is expected to be at least as reliable as the CEA average and is satisfactory.

SECTION 7

PROJECT AGREEMENTS

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SECTION 7

PROJECT AGREEMENTS

As required by the Professional Services Agreement among Nalcor, MWH, and Government, requirements were set forth for MWH to review the following Project Agreements: Power Purchase Agreement; Interconnection Facilities Agreement; Water Management Agreement; Water Lease Agreement; and O&M Agreements. Subsequent to completion of MWH's review following the terms of this agreement, Government directed MWH to only review the technical portions of the Water Management Agreement; the Water Lease Agreement; and the O&M Agreements. The other agreements to be reviewed by MWH that were initially included in MWH's Scope of Work, at Government's request, are currently being reviewed by other independent consultants under their agreement with Government.

7.1 WATER MANAGEMENT AGREEMENT (WMA)

The WMA, between Nalcor and the Churchill Falls Labrador Corporation Limited was ordered by the Board of Commissioners of Public Utilities, Newfoundland and Labrador, No. P.U. 8(2010) on March 9, 2010. The intent of the WMA is to manage and operate facilities within the Province in the most efficient way for the production, transmission, and distribution of power and energy, and be assessed and allocated and re-allocated in the manner necessary to effect such a policy. As such, the objective of the WMA

> shall be the coordination of the Power generation and Energy production in the aggregate for all Production Facilities on the Churchill River to satisfy the Delivery Requirements for all Suppliers, in a manner that provides for the maximization of the long term Energy-generating potential of the Churchill River, while ensuring that the provisions of any Prior Power Contracts are not adversely affected.

The WMA requires the establishment of a Water Management Committee consisting of four members selected by the parties, and the Committee is required to appoint an Independent Coordinator which may be one or more persons.

The duties of the Independent Coordinator shall

> establish short and long term Production Schedules for all Production Facilities on the Churchill River, through the coordination of production scheduling of the Suppliers based upon the use of the aggregate generating Capability, storage and transmission facilities of any supplier on the Churchill River.

The Independent Coordinator is required to determine the total power to be produced and is required to determine and prepare the production schedules, which shall specify the amount of

power to be produced by each supplier's production facilities in accordance with the provisions of the WMA. The Independent Coordinator is required to determine the energy storage and energy losses assignments for each of the suppliers in accordance with the terms of the WMA. The procedure under which this is accomplished and the calculations necessary to do so are described in Annex "A" to the WMA to appropriately assign energy storage amounts and energy losses to each supplier. Energy benefits for each of the suppliers are also described therein.

The term of the WMA is discussed in Article 12 of the agreement and will continue in full force until the earliest of the

> (i) the permanent cessation of all operations at either of the CF(L)Co Production Facilities or the Nalcor Production Facilities, and (ii) any earlier date agreed to by the Suppliers, subject to the execution of a new water management agreement agreed to by the Suppliers and approved by the Board pursuant to Subsection 5.4(3)(a) of the Act.

In the opinion of the IE, the WMA is similar to other agreements where compensation must be allocated to generation facilities that share the resources of a river basin and is found to be satisfactory.

7.2 WATER LEASE AGREEMENT (LEASE)

The Water Lease Agreement (Lease) between Nalcor and Newfoundland and Labrador was made March 17, 2009. It gives Nalcor the exclusive use of all of that part of the Churchill River below the 425-foot-contour line and that part of the Churchill River below El. 425, downstream to the intersection of the Churchill River with the meridian of 60 degrees-45 minutes west of Greenwich, and includes all waters that originate within the Churchill River catchment area and all rivers that naturally flow within the catchment area. It also gives Nalcor the right to flood those areas held by the Lease. The period of the Lease is 50 years.

Government has reserved rights of the public to use the Lower Churchill River for the purpose of fishing, shooting, hunting, trapping, logging, and travelling. It places restrictions on the public that would constitute a hazard to Nalcor where it would create an operation concern.

The Lease gives Nalcor the exclusive right to store and regulate so much of the Lower Churchill River as is economic or beneficial for the purpose of developing the Lower Churchill River.

Nalcor may be required to install, operate, and maintain stream flow, water level monitoring stations, and other instrumentation and means to measure and record level of quality at designated locations. Copies of records can be provided, as requested, at least once per year.

Nalcor is required to pay to Government $2.50 per MWhour of power generated each year from their facilities. This rate can be adjusted every year based on the Consumer Price Index (CPI, Canada, All-items) as established under the Statistics Act of Canada.

Records must show the rates and amounts of water used on a daily basis for the generation of hydroelectric power, rates and amounts of water spilled or released downstream, operating water levels, extent of the flooded area, and additional related information requested by Government. Submittals are to be made at the end of March each year to the Water Rights Section of the Department of Environment and Conservation.

7.3 O&M AGREEMENTS

O&M Agreements are currently being discussed and planned by Nalcor and will not be available for review until later next year. The IE, therefore, cannot comment on the following: Term and Termination Provisions; Budget Review and Control; Owner and Operator Responsibilities; Operations and Maintenance Plans; Environmental Compliance Plans; Reporting Procedures; Compensation and Incentive Bonus; and Consistency.

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SECTION 8

REVIEW PERMITS AND LICENSES

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SECTION 8

REVIEW PERMITS AND LICENSES

We have included in Section 8.2 our review of only those typical permits prepared for the Muskrat Falls project since there are currently over 300 permits that are current which do not include those being prepared for the LIL project. We have also reviewed the EIS, Executive Summary, for the LIL project during the early phase of our studies.

8.1 PROJECT-WIDE ENVIRONMENTAL PROTECTION PLAN (P-WEPP)

As part of MWH's review of permits and licenses, we reviewed the Project-Wide Environmental Protection Plan (P-WEPP)-Component 1 and 4b (Plan) provided by Nalcor. Our copy notes a date of January 24, 2013, which is believed to be the most current edition of the Plan. The Plan succinctly provides the basis for all work practices required to mitigate negative environmental effects associated with construction and commissioning of the LCP. These requirements can be found in the following sections of the Plan:

- INTRODUCTION
- PROJECT DESCRIPTION
- ROLES AND RESPONSIBILITIES
- RELEVANT LEGISLATION
- GENERAL ENVIRONMENTAL PROTECTION PROCEDURES
- ENVIRONMENTAL MONITORING AND FOLLOW UP
- CONTINGENCY PLANS
- FORMS
- REFERENCE DOCUMENTS
- REGULATORY CONTACT LIST.

The Plan includes an extensive number of figures and several tables that illustrate typically acceptable or unacceptable practice, and presents examples of recommended mitigation methods. The Plan lists in considerable detail the General Environmental Protection Procedures recommendations that are to be followed for the LCP. The Plan provides to those monitoring the progress of the work the guidelines and information necessary to successfully inform others as to the acceptability of the work being performed in a satisfactory manner in compliance with the Plan. Sample forms are provided in Section 8 of the Plan, as noted above, to track the activities for which environmental monitoring is prescribed. The forms provide a historic record for regulatory review, as may be required in the permits issued to Nalcor, as well as its contractors. In the opinion of the IE, the Plan, itself, is comprehensive and suitable, and is judged to be satisfactory for the LCP.

8.2 REVIEW OF PERMITS AND LICENSES AND APPROVALS

Based on our initial review of the documents furnished and those that are available on the Nalcor website for the LCP, we have summarized our findings of representative permits that currently are available for review. This summary is contained in Table 8-1, below. We realize that additional documents will be made available as they are prepared and issued for the LIL that will require further sampling to ascertain the information to form the IE's opinions.

Table 8-1

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
SLI-00006	DFO Project Review C7 (5+800) Caroline's Brook	Approved	Complete	Permit should reference Project- Wide Environmental Protection Plan relative to potential equipment oil leaks, operation of equipment in and near water, fueling and overnight storage of equipment, and working within 15 m of a water body. Nalcor comments: 1. The P-WEPP has been referenced in all applications; 2. The requirements P-WEPP requirements are applicable for all construction activities regardless of the approval documentation. 3. Requirements are made aware to all contractors during the procurement process and during construction by the LCP Environment Team

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
SLI-00008	Alter a Body of Water - Temporary Bridge C7 (5+800) Caroline's Brook	Approved	Complete	Permit should reference P-WEPP Plan relative to potential equipment oil leaks, operation of equipment in and near water, fueling and overnight storage of equipment, and working within 15 m of a water body. Nalcor comments: See SLI-00006
SLI-00082	DOEC Blanket Permit - Construction Power- Work within 15m	Approved	Complete	
SLI-00115	Department of Fisheries and Oceans (DFO) Project Review - Water Use - C7 - C22	Approved	Complete	
SLI-00094	DFO Project Review Culvert 1 - Access Road to GD11	To Be Reviewed	Complete	Permit should reference P-WEEP Plan relative to potential equipment oil leaks, operation of equipment in and near water, fueling and overnight storage of equipment, and working within 15 m of a water body. Nalcor Comment: See SLI-0006 Is there a need for water control/pumping contingency

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				if higher stream discharges are encountered? Nalcor Comment: The contingency not required for this temporary structure; design is 1:5 year peak flow; if the flow exceeded, the road will be temporarily closed.
SLI-00079	Navigable Waters Protection Act (Muskrat Falls) p-WC-1e	To Be Reviewed	Complete	
SLI-00158	DOEC Alter a body of water - Dams	To Be Reviewed	Complete	
LCP-AM-CD-0000-EA-RP-0014-01	Fish Habitat Compensation Strategy	DRAFT		pg. 58-60: Would be helpful to have a map showing the various reaches referred to in the Total Phosphorous graphs. Reaches appear to be different from those shown in Figure 3.2. Nalcor Comment: Nalcor advised by DFO to keep additional figures to minimum; the reaches, as MWH notes are slightly different, however, they are known to the regulators.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				pg. 95: Figure 3.24 shows general cut and fill associated with Delta Compensation Works. Biological function of the delta habitat would likely improve if the placed excavated material elevations paralleled the original ground profile rather than being uniformly horizontal. Nalcor comment: Agree with the comment, however, based on constructability and past experience, they selected least-cost solution recognizing that ice and high flows will modify the sections during post-construction. Fine sediments (i.e., silts and fine sands) would need to comprise <15-18% of the substrate composition if the proposed deltas are to be effective as spawning habitat for most fish (i.e., redd builders and broadcast spawners). It's mentioned that wave action will act to 'clean' the sediments in the new near shore terraces (pg. 96) that will be constructed for habitat compensation. Are all proposed terrace sites subject to sufficient wave action to ensure substrates remain functional for successful fish spawning /

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				incubation? Will the benefits of wave action be outweighed by the effect of waves on shoreline stability/erosion and consequent sediment inputs to those habitats? The Edward's Brook (pg. 100) delta is located in a relatively protected bay. Will tributary discharges be sufficient to scour fine sediments and maintain the spawning function proposed for all the proposed new delta Compensation areas? For example, it appears unlikely that the Metchin River area (pg. 105), Minipi River (pg. 106), Elizabeth River (pg. 107), and West Mechin River (pg. 108) discharges will maintain spawning function within the entire area of the constructed deltas. pg.102: Does the Gull Island Plateau have groundwater upwelling? If it doesn't, then brook trout spawning would be unlikely due to the importance of groundwater upwelling for selection of their spawning locations.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				Nalcor Comment: This is potential physical habitat construction option and is not included in the Fish Habitat Compensation Plan. It is being considered relevant for ongoing compensation considerations. Nalcor also includes a lengthy additional paragraph regarding this matter that is not included herein, for brevity.
TF8110486-LCD-DRAFT Compensation Plan, Dec 2020, 12 Rev 4[1]	Draft Fish Habitat Compensation Plan, Muskrat Falls Rev 4 Dec 2012	DRAFT		pg. 43: Predicted use of shoals for brook trout spawning will be unlikely due to the importance of groundwater upwelling for selection of their spawning locations. Also, what is the predicted functional life (i.e., number of years) of these shoals as viable spawning / incubation areas given the relatively low velocities and high water depths (see Table 5.5, pg. 40) and the predicted increase in TSS for the initial 10-15 years? pg. 49-50: Predicted use of deltas for brook trout spawning will be unlikely due to the importance of groundwater upwelling for selection of their spawning locations.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				Nalcor comment: Comment similar to above comment on upwelling RP-0014 pg. 51: Figure 5.14 shows general cut and fill associated with Delta Compensation Works. Biological function of the delta habitat would likely improve if the placed excavated material elevations paralleled the original ground profile rather than being uniformly horizontal. Nalcor Comment: Comment similar to above comment in RP-0014 pg. 53-54: Will high frequency flood discharges in Pinus River be sufficient to scour fine sediments and maintain the spawning function of proposed new delta compensation area? What proportion of the delta is expected to be 'flushed' of fine sediments during a higher frequency event such as 2-yr. event? Nalcor Comment: Yes. Mean annual spring flows are pro-rated at 90 cms. Table 5.8 shows that at a discharge of 55 cms has the potential to flush up to 1 cm diameter

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				material. A 2-yr event would be assumed to be of this magnitude. "...therefore, most of the delta is anticipated to flush, although there will be areas of deposition. Exact extent of substrate redistribution will not be known until monitoring begins after inundation." pg. 58: Have any habitat compensation options for improving / creating spawning and rearing habitat been explored within the cross section of the existing tributaries upstream of the full surface level (FSL)? Nalcor Comment: Yes. As part of the stakeholder consultation process (both Framework and strategy stages) all potential options were presented, and on the table, including compensation outside the entire watershed as well as areas of existing tributaries upstream of the FSL. It was indicated by some stakeholders, similar to other projects in Labrador, that any extension of physical works outside the proposed project area would be an extension of the project footprint.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				Therefore, compensation options were directed at fish species within the reservoir with physical construction constrained within the reservoir boundary. pg. 63: If slope in Tables 5.7 and 5.8 is in percent (as stated), then Incipient Particle Diameters (cm) should be divided by 100. Similarly, potential calculation error in Table 5.09 and 5.10. For the tractive force equation in Newbury and Gaboury (1993), slope is measured as m/m. Nalcor Comment: Correction required. The values of slope are in m/m however the column headings for slope in Tables 5.7 and 5.9l indicate %. The headings have been revised. pg. 83+88: Grain size analysis should also be done at some spawning redd sites to determine percent fines, and therefore, the suitability of the substrate for incubation.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				Nalcor Comment: As stated on page 87, grain size distributions will be determined for material placed in each delta so that they can be used to determine the degree of substrate shifting and movement. The geotechnical programs have provided data related to existing material as well and will be used for comparisons. Baseline samples of existing instream material can be collected in 2013 and added to the material baseline.
TF1010486_LCHGEEM_Rev3_Dec2012[1]	Aquatic Environmental Effects Monitoring Program Dec 2012	DRAFT		Generally, the proposed EEM program appears to be quite comprehensive and appropriate in breadth for monitoring effects downstream of Muskrat Falls dam. pg. 27: The frequency and intensity / duration of field sampling events of, for example, turbine entrainment, fish habitat utilization, and fish population assessments, in the mainstem and tributaries should be clearly stated or shown in a table. pg. 43: Why is the trigger for injury/survival rate not provided? Will it be established prior to conducting the monitoring?

Responses to our questions and comments on Permits, Fish Compensation Strategy, Draft Fish Habitat Compensation Plan, and Aquatic Environmental Effects Monitoring Program were provided by Nalcor. We acknowledge that our questions pertaining to these four subjects were satisfactorily answered by Nalcor and, in our opinion, conclude that the adopted approach is satisfactory.

8.3 FUNDING OF ENVIRONMENTAL STUDIES AND ADEQUACY OF BUDGET AMOUNT

8.3.1 Current Studies Funding

Table 8-2 contains the information available from Nalcor that lists budget funding for current environmental studies.

Table 8-2

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
Environmental Affairs - General Consultation	5.1.300.0000.0303.02.00	NE-LCP General	[redacted]
		Consultation Database	
		Environmental Affairs - General Consultation	
	5.1.300.0000.0303.02.00 Total		
Environmental Effects Monitoring	5.1.360.0000.0310.02.00	Both Gull Island and Muskrat Falls Generation	
		Aerial surveys of the river and surrounding locations for waterfowl and analyze temporal use of traditional ashkui sites.	
		Ambient air quality monitoring (AAQM) program	
		Caribou Program	
		Environmental Effects Monitoring	
		Mercury levels monitoring program	
		Nalcor will monitor and assess greenhouse gas fluxes as a result of LCP activities.	
		Nalcor will monitor ice conditions and issue public advisories on the condition of ice.	

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
		Nalcor will monitor methylmercury levels in river otter feces.	
		Baseline methylmercury exposure program (HHRA)	
		Regionally uncommon terrestrial vegetation survey	
		Muskrat Falls – Generation	
		Comprehensive monitoring and follow-up program upon LCP start-up, employing an adaptive management process	
		Nalcor will access marten data for post-project trapping for analysis and comparison with pre-project trapping data.	
		Nalcor will re-deploy GPS/VHF collars on bears in the river valley.	
		Winter aerial and ground or GPS telemetry surveys of moose	
		Mud Lake Drinking Water Baseline Study	
		Labrador - Island Transmission Link	
		Access Impacts Monitoring Program	
		Environmental Effects Monitoring Program	
		Furbearer Baseline Study	
		Harlequin Duck Baseline	
		Rare Plant Survey & Planning	
	5.1.360.0000.0310.02.00 Total		
Environmental Management Expert Legal Advice	5.1.300.0000.0103.02.10	E&AA Management	
		Environmental Management Expert Legal Advice	
	5.1.300.0000.0103.02.10 Total		
General (Response to Project Modifications)	5.4.330.0000.0000.02.00	Labrador - Island Transmission Link	

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
		General (Response to Project Modifications)	
		Labrador Woodland Caribou Recovery Team	
	5.4.330.0000.0000.02.00 Total		
LCP Aboriginal Agreements Consultation (Interpretation & Translation)	5.1.420.0000.0000.02.01	Aboriginal Affairs	
		LCP Aboriginal Agreements Consultation (Interpretation & Translation)	
		Continually engage Aboriginal groups throughout the construction and operation of the LCP.	
		Aboriginal Affairs consultation - Linked to Item #1	
	5.1.420.0000.0000.02.01 Total		
LCP Aboriginal Agreements General Planning & Strategic Support	5.1.420.0000.0000.02.12	IBA	
		EMC	
		LCP Aboriginal Agreements General Planning & Strategic Support	
		IBA Implementation Committee shared costs with Innu Nation	
	5.1.420.0000.0000.02.12 Total		
LCP Aboriginal Planning Expert Advice	5.1.420.0000.0000.02.11	Aboriginal Affairs	
		LCP Aboriginal Planning Expert Advice	
	5.1.420.0000.0000.02.11 Total		
LCP E&AA - Agreements with Other Aboriginal Groups	5.1.430.0000.0403.52.00	Aboriginal Affairs	
		LCP E&AA - Agreements with Other Aboriginal Groups	
	5.1.430.0000.0403.52.00 Total		

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP E&AA - Island Link Environmental Impact Statement (EIS) Response to Information Requests (IRs)	5.4.330.0000.0306.02.00	Labrador - Island Transmission Link	
		LCP E&AA - Island Link EIS Response to IR's	
	5.4.330.0000.0306.02.00 Total		
LCP E&AA - OAG Document Production	5.1.430.0000.0403.02.00	Aboriginal Affairs	
		LCP E&AA - OAG Document Production	
	5.1.430.0000.0403.02.00 Total		
LCP E&AA - OAG translation	5.1.430.0000.0403.02.01	Aboriginal Affairs	
		LCP E&AA - OAG translation	
	5.1.430.0000.0403.02.01 Total		
LCP E&AA - Project Commitments - Island Link Transmission	5.4.330.0000.0350.02.01	Labrador - Island Transmission Link	
		Caribou Considerations in Design	
		Environmental Effects Monitoring Program	
		LCP E&AA - Project Commitments - Island Link Transmission	
		Marine Fisheries Compensation Planning/Support	
		Rare Plant Mitigation Efforts	
		Socioeconomic Effects Monitoring Program	
	5.4.330.0000.0350.02.01 Total		
LCP E&AA Aboriginal Agreements Legal Support	5.1.400.0000.0103.02.00	IBA	
		EMC	
		LCP E&AA Aboriginal Agreements Legal Support	
	5.1.400.0000.0103.02.00 Total		

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP E&AA Generation Project Commitments (WQM, Research, EMS, etc.)	5.2.320.0000.0350.02.00	Both Gull Island and Muskrat Falls Generation	
		Caribou Program	
		Compensation program for flooded trap lines	
		LCP E&AA Generation Project Commitments (WQM, Research, EMS etc.)	
		RTWQM	
		Muskrat Falls – Generation	
		Nalcor will conduct an amphibian relocation program prior to reservoir filling.	
		Nalcor will re-deploy GPS/VHF collars on bears in the river valley.	
		Winter aerial and ground or GPS telemetry surveys of moose	
	5.2.320.0000.0350.02.00 Total		
LCP E&AA Generation Updates and Supplements to Studies	5.2.320.0000.0304.02.10	Both Gull Island and Muskrat Falls Generation	
		LCP E&AA Generation Updates and Supplements to Studies	
		Muskrat Falls – Generation	
		Update to EcoRisk Assessment - Re-Baseline for Monitoring Program	
	5.2.320.0000.0304.02.10 Total		
LCP E&AA Island Transmission Aboriginal & Stakeholder Consultation	5.4.330.0000.0304.02.04	Labrador - Island Transmission Link	
		LCP E&AA Island Transmission Aboriginal & Stakeholder Consultation	
		Stakeholder Relations	
	5.4.330.0000.0304.02.04 Total		

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP E&AA Management General Consultant Services	5.1.310.0000.0000.02.00	E&AA Management	
		LCP E&AA Management General Consultant Services	
	5.1.310.0000.0000.02.00 Total		
LCP E&AA Transmission Island Link DFO Compensation Strategy	5.4.330.0000.0320.02.00	Labrador - Island Transmission Link	
		LCP E&AA Transmission Island Link DFO Compensation Strategy	
		Labrador - Island Transmission Link DFO Compensation Strategy	
	5.4.330.0000.0320.02.00 Total		
LCP E&AA Transmission Island Link Document Production	5.4.330.0000.0305.02.02	Labrador - Island Transmission Link	
		LCP E&AA Transmission Island Link Document Production	
	5.4.330.0000.0305.02.02 Total		
LCP E&AA Transmission Island Link Legal Support	5.4.330.0000.0103.02.00	Labrador - Island Transmission Link	
		LCP E&AA Transmission Island Link Legal Support	
		LIL Environmental Management Plans	
		Marine Fisheries Compensation Planning/Support	
		Socioeconomic Effects Monitoring Program	
	5.4.330.0000.0103.02.00 Total		
LCP EA GENERATION - PERMIT fees & Studies	5.2.350.0000.0320.02.00	Both Gull and Muskrat Falls Generation	
		LCP EA GENERATION - PERMIT fees & studies	
		Gull Island and MF Stream Surveys	
	5.2.350.0000.0320.02.00 Total		

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP EA Generation (Aboriginal and Stakeholder Consultation)	5.2.320.0000.0303.02.00	Both Gull Island and Muskrat Falls Generation	
		LCP EA Generation (Aboriginal and Stakeholder Consultation)	
	5.2.320.0000.0303.02.00 Total		
LCP EA Generation DFO Compensation Strategy	5.2.320.0000.0320.02.00	Both Gull Island and Muskrat Falls Generation	
		LCP EA Generation DFO Compensation Strategy	
		Muskrat Falls – Generation	
		FHCP	
	5.2.320.0000.0320.02.00 Total		
LCP EA Generation Legal Support	5.2.300.0000.0103.02.00	Both Gull Island and Muskrat Falls Generation	
		Compensation program for flooded trap lines	
		LCP EA Generation Legal Support	
		Baseline methylmercury exposure program (HHRA)	
		Generation EA Court Injunction Legal Support	
		Muskrat Falls – Generation	
		FHCP	
		Aboriginal Affairs	
		Continually engage Aboriginal groups throughout the construction and operation of the Project.	
		Aboriginal Affairs consultation - Linked to Item #1	
	5.2.300.0000.0103.02.00 Total		

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP EA Island Link Process Costs (Panel, Harmful Alteration, Disruption or Destruction [HADD], etc.)	5.4.330.0000.0310.02.00	Labrador - Island Transmission Link	
		LCP EA Island Link Process Costs (Panel, HADD, etc.)	
		LCP EA Island Link Process Costs	
	5.4.330.0000.0310.02.00 Total		
LCP IBA Third Party Service (Document Preparation IBA, IMA)	5.1.420.0000.0000.02.00	IBA	
		LCP IBA Third Party Service (Document Preparation IBA, IMA)	
	5.1.420.0000.0000.02.00 Total		
Regulatory Compliance	5.1.360.0000.0000.00.00	Both Gull Island and Muskrat Falls Generation	
		Canada Yew relocation program	
		Historic and Archaeological Resources Contingency and Response Plan	
		Historic and Archaeological Resources Recovery	
		Historic Resources Overview Assessment pre-construction Stage 1	
		Regionally uncommon aquatic vegetation survey	
		Muskrat Falls – Generation	
		Active osprey nest survey and relocation program	
		Nalcor will conduct an amphibian relocation program prior to reservoir filling.	
		Nalcor will conduct surveys of forest avifauna (ruffed grouse and wetland songbird habitat) at key intervals during construction, and operation and maintenance.	

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
		Reservoir Beaver survey program	
		Fish Recovery/Relocation	
		Labrador - Island Transmission Link	
		Historic Resources Overview Assessment	
		Rare Plant Mitigation Efforts	
	5.1.360.0000.0000.00.00 Total		
LCP EA LIL - PERMIT fees & studies	5.4.350.0000.0320.02.00	Labrador - Island Transmission Link	
		Stream Surveys	
	5.4.350.0000.0320.02.00 Total		
Generation Environmental Policy and Plan Development	5.2.360.0000.0000.00.00	Both Gull Island and Muskrat Falls Generation	
		Compensation program for flooded trap lines	
		Nalcor will develop mitigation measures for any species of plant to be in danger of extirpation in Labrador to the LCP.	
	5.2.360.0000.0000.00.00 Total		
LIL Environmental Policy and Plan Development	5.4.360.0000.0000.00.00	Labrador - Island Transmission Link	
		Adaptive Management	
		Avifauna Considerations in Design	
		Caribou Considerations during Operations	
		Caribou Considerations in Design	
		LIL Environmental Management Plans	
		Marine Fisheries Compensation Planning/Support	
		Marten Baseline Study & Considerations in Design	

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
		Socioeconomic Effects Monitoring Program	
	5.4.360.0000.0000.00.00 Total		
	GRAND TOTAL		**$12,972,224**

Because the project was the subject of a full environmental assessment process, the IE's review was not requested by Nalcor.

8.3.2 Studies to be Performed During Construction

Nalcor has prepared a budget for the period 2012 through 2018 to cover the required environmental activities that will be occurring during the construction period and leading up to it. As a basis for the studies, Nalcor considered the following items and commitments:

- Requirements of the Environmental Assessment (EA) for MF and the LTA;
- Commitments and anticipated requirements of the LIL EA;
- Environmental requirements of the Impacts and Benefits Agreement (IBA) with the Innu Nation;
- Mitigation measures designed to maintain compliance with applicable legislation, EA commitments and requirements, and minimize effects; and
- Baseline data needed to inform the environmental effects monitoring programs required post-construction.

Nalcor has advised MWH that they have completed extensive field programs in support of the EA process. The estimates provided herein have been derived with consideration of these costs. Nalcor advised MWH that many of the projected costs should be considered conservative with sampling frequencies at the upper limit of those expected for all programs.

Table 8-3

STUDIES AND SURVEYS TO BE PERFORMED DURING CONSTRUCTION

PROJECT/TOPIC	2012	2013	2014	2015	2016	2017	2018	Total
Muskrat Falls								
Historic Resources--Stage 1								
Historic Resources--Stage 3								
Stream Surveys								
Avifauna Management (Including Osprey nest relocation)								
Terrestrial Relocation (Beaver/Amphibian)								
Fish Recovery and Fish Relocation								
Subtotal								
Labrador TL Asset								
Historic Resources—Stage 1								
Historic Resources—Stage 3								
Stream Surveys								
Avifauna Management (Including Osprey nest relocation)								
Rare Plant Survey (Aquatic)								
Subtotal								
Island Link								
Historic Resources								
Stream Surveys								
Rare Plant Surveys								
Avifauna Management (Including Osprey nest relocation)								
Subtotal								
Total	**$90,500**	**$852,500**	**$1,027,500**	**$510,000**	**$517,500**			**$3,812,500**

8.3.3 Studies to be Performed During Project Operation and Environmental Monitoring

Nalcor has furnished budget estimates for funding programs/studies associated with environmental issues that will be conducted during the operating period of the project (current dollars). A summary of this information is contained in Table 8-4.

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Table 8-4

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Bank Recession Rates downstream						MF	
Bank Erosion with the Reservoir						MF	
Sediment Transport						MF	
Ice Formation - Reservoirs, downstream including Mud Lake						MF	

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Water Quality Monitoring						MF	
Green House Gas Flux						MF	
Fish Habitat utilization upstream and Downstream						MF	

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Nutrient Levels upstream and downstream						MF	Seven years required for Granite Canal authorization. Depends of monitoring results. Based on baseline monitoring
Fish Growth, condition, fecundity, trophic feedings and age structure upstream and downstream						MF	Seven years required for Granite Canal authorization. Depends of monitoring results. Based on baseline monitoring
Entrainment						MF	One time study. Assume results are acceptable.
Compensation Works for substrate placement, habitat stability						MF	Seven years required for Granite Canal authorization. Depends of monitoring results. Based on baseline monitoring

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Benthic macro-invertebrates, primary and secondary productivity, and fish health and habitat utilization in reservoir						MF	Seven years required for Granite Canal authorization. Depends of monitoring results. Based on baseline monitoring. Based on 3 trips per year.
Monitoring Wetland habitat creation and development success						MF	Assume similar requirements as FHCP. 10 year monitoring program.
Methylmercury levels in river otter						MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first 5 years to confirm predictions. May be revised based on monitoring results.

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Monitoring of osprey methylmercury levels through feather collection						MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first 5 years to confirm predictions. May be revised based on monitoring results.
Telemetry monitoring of black bears (included relocated bears)						MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first few years to confirm predictions. May be revised based on monitoring results.

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Aerial surveys to monitor the effectiveness of the beaver relocation program	[redacted]					MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first few years to confirm predictions. May be revised based on monitoring results.
Monitor relocated osprey nests						MF	Based on baseline monitoring cost. Should determine success within first 2-3 years. High degree of confidence that no significant effect. Extensive experience with technique.

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Winter and summer ground surveys of wildlife habitat association transects established as part of baseline to examine changes to distribution and abundance, will be conducted for furbearers and other wildlife						MF	Based on baseline monitoring costs. Not predicted to be an effect but may be longer term in terms of seeing effects. Monitoring may be required for first 10 years to confirm predictions. May be revised based on monitoring results.
Forest avifauna will be monitored for changes in distribution and abundance by resurveying along transects established in 2006 and 2007						MF	Based on baseline monitoring costs. Not predicted to be an effect but may be longer term in terms of seeing effects. Monitoring may be required for first 10 years to confirm predictions. May be revised based on monitoring results.

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Moose will be monitored using winter aerial surveys and/or GPS telemetry of moose in key wintering areas and areas where habitat is altered						MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first 5 years to confirm predictions. May be revised based on monitoring results.
Assessment of trapping data post project will be conducted						MF	Desk top review to confirm effects prediction. [redacted] first 5 years.
Methylmercury levels in the reservoirs will be monitored. Monitoring will include fish in the lower Churchill River, Goose Bay, and Lake Melville. Monitoring will also include seals downstream of Muskrat Falls.					$400,000	MF	[redacted] based on baseline program costs (upstream and downstream). Maybe scaled backed based on results but predicted to take 25 years to return to baseline levels.
Total MF	$7,930,000	$4,450,000	$600,000	$600,000	$600,000		

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Monitor the effects on listed plants or induced effects resulting from improved access.						LIL	Limited area to be monitored
Monitoring of any compensation works as a result of HADD of marine fish habitat will be conducted according to a protocol acceptable to DFO. Initial monitoring (as-built monitoring) will be conducted to provide information on the structure of the compensation works, and subsequent effectiveness monitoring will also include a biological component to provide some measure of productivity occurring at the compensation works.						SOBI	Monitoring of the rock berms will be done using a remotely operated method such as ROV. [redacted] for data collection, data analysis and report preparation x 4 years (Year 2, 3, 5, &7) = [redacted]

Assumptions

- Based on review of Generation EIS limited monitoring for Labrador Transmission Assets

- Based on review of LIL EIS there are limited commitments for the overland transmission. Subject to conditions of EA release (i.e. assume no freshwater habitat monitoring for DFO)

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8.3.4 Mitigation During Construction

Nalcor furnished to MWH a list of studies and mitigation measures that they intend to conduct during construction of the LCP. As noted previously, the mitigation measures were designed to maintain compliance with the applicable legislation, EA commitments and requirements, and to minimize effects on the habitat. We have repeated the items that contain mitigation measures in Table 8-5 that were taken from Table 8-3 without knowledge of any study work that was included with the mitigation since there was no breakout of the mitigation costs from study costs. The IE has confirmed with Nalcor that the bulk of the cost is for mitigation of the items listed in Table 8-5. Nalcor has informed MWH that if additional funds are necessary for mitigation, Nalcor will provide the funds to ensure that habitat is fully protected.

Table 8-5

MITIGATION COSTS DURING CONSTRUCTION

PROJECT/TOPIC	2012	2013	2014	2015	2016	2017	2018	TOTAL
Muskrat Falls								
Historic Resources—Stage 3								
Avifauna Management (Including Osprey nest relocation)								
Terrestrial Relocation (Beaver/Amphibian)								
Fish Recovery and Fish Relocation								
SUBTOTAL								
Labrador TL Asset								
Historic Resources—Stage 3								
Avifauna Management (including Osprey nest relocation)								
SUBTOTAL								
Island Link								
Historic Resources								
Avifauna Management (including Osprey nest relocation)								
SUBTOTAL								
TOTAL	**$870,000**	**$650,000**	**$825,000**	**$375,000**	**$392,500**			**$3,112,500**

8.4 ENVIRONMENTAL FLOW

To maintain and provide environmental habitat downstream of the LCP, studies were performed to establish the minimum flow release required from the Muskrat Falls facilities when the power station was shut down. Usually these studies employ instream flow incremental methodology (IFIM) techniques requiring habitat assessment at numerous cross sections along the river and for different depths of water that relate to flow releases. These assessments in turn are related to the requirements of different fish species to arrive at the most desired range of depth, associated with the amount of habitat in which the fish can be sustained. Information provided to MWH indicates that the minimum release flow established for the LCP (the environmental flow) is 552 cms for impoundment of the MF reservoir. No environmental flow condition during operations exists in the DFO Section 35 Fisheries Authorization or the Authorization to Alter a Body of Water provided by the Government of Newfoundland and Labrador. Churchill Falls' minimum flow is 475 cms and Nalcor advises that for practically all times, to maintain the reservoir at 39.0 FSL, flow and of the plant will be at least 475 cms. We have not independently reviewed the data to support this determination of no minimum flow being prescribed.

During the period while the reservoir is filling, estimated to be about 10 to 12 days, releases will be made that amount to 30 percent of the normal flow for the period. Once the reservoir is filled to FSL, El 39.0 flows will be released equal to the inflow. The reservoir will be maintained between El 38.5 and 39.0 msl.

8.5 TECHNICAL REQUIREMENTS AND CONSTRAINTS

From an environmental perspective, Nalcor identified a number of constraints during the planning process that were considered in the design and execution of the LCP. Constraints and methods and means of mitigation to address the issues are summarized in Table 8-6.

Table 8-6

CONSTRAINTS AND PROVIDED MITIGATION

Constraint	Mitigation
Harmful Alteration, Disruption or Destruction of Fish and Fish Habitat, including fish mortality	- Obtain authorization from Dept. of Fisheries and Oceans based on a comprehensive habitat compensation program, environmental effects monitoring program and an approved environmental protection plan. - Used a unique approach to leverage the incidental habitat gained with the reservoir to obtain habitat units. - Committed to compensation flow during impoundment to reduce fish mortality caused by dewatering.

Table 8-6 (cont'd)

CONSTRAINTS AND PROVIDED MITIGATION

Constraint	Mitigation
Stream Crossings	Addressed through a blanket approval process with the Dept. of Environment and Conservation and standard mitigation approach accepted by DFO. Navigable water crossings identified and approval provided for navigable waters.
Historic Resources	Historic Resources potential mapping created and an investigation approach agreed with the provincial archeology office. Recovery plan approved for known sites and a contingency plan in place for inadvertent discoveries.
Wetlands	- Environmental protection plan approved which includes mitigation measures for wetlands. - A wetland compensation strategy has been proposed and a plan will be developed to address wetland losses within the reservoir. - Potential partnerships with wetland conservation agencies are to be explored.
Downstream Effects (including mercury)	Extensive analysis and modeling as part of the environmental assessment process indicates no significant downstream effects beyond Goose Bay. An environmental effects monitoring program has been developed to confirm effects predictions and an adaptive management approach will be employed.
Avifauna and Migratory Birds Convention Act	An avifauna management plan based on comprehensive surveys has been developed to allow project activities to continue during the migratory bird nesting season and to avoid raptor nesting.
Red Wine Mountain Caribou and Endangered Species (including rare plants)	The approved environmental protection plan includes measures to protect caribou and other endangered species. An environmental effects management plan has also been developed for caribou and species at risk.
Transmission Line Routing	Constraint mapping developed for all transmission lines and environmental constraints considered in conjunction with technical and economic constraints to optimize routing.

Table 8-6 (cont'd)

CONSTRAINTS AND PROVIDED MITIGATION

Constraint	Mitigation
Reservoir Clearing	Reservoir clearing methodology selected to optimize technical and economic constraints as well as ensure wildlife access, navigation and aesthetics during operations.

The IE has reviewed the EA requirements and Fisheries Act Authorization and is of the opinion that the prescribed conditions will not restrict the LCP given the design will accommodate the prescribed conditions to mitigate the issues. Nalcor has advised MWH that during the LCP's execution, if issues that are being mitigated are not as effective as proposed, they will modify the mitigation methods and means to achieve the intended results.

8.6 TECHNICAL AND COMMERCIAL ISSUES

Nalcor advised MWH that only a very limited number of issues were identified during the study and design phase of the project that were of technical and commercial importance. Table 8-7 lists the two potential commercial issues related to constraints to the LCP and includes the adopted mitigation for resolution of the issue.

Table 8-7

TECHNICAL AND COMMERCIAL ISSUES AND PROVIDED MITIGATION

Issue	Mitigation
Requirement for a letter of credit for the fisheries authorization.	This requirement was waived by the Department of Fisheries and Oceans based on the public ownership of the LCP.
Requirement for the provision of minimum downstream flow during impoundment and operations.	Flow values required align with available inflows and the WMA with the Upper Churchill plant.

Based on information made available to MWH and correspondence with Nalcor, there are no known issues with respect to technical or commercial aspects of the project or with permits or licenses. Because the majority of the LCP is on Crown Land, with the exception of small lengths of HVdc transmission line, land acquisition or expropriation will mitigate any perceived issues.

8.7 REVIEW SOCIO-ECONOMIC ENVIRONMENT ASSESSMENT REPORT

The Executive Summary presents a comprehensive review of the topics that were studied and included in Table 16-3 of the EIS, starting on page 85 of this document, the *Cumulative Environmental Effects Summary: Socio-economic Environment* for the findings to date.

Table 8-8 is a simplified version of the EIS Summary and is presented below to be a readily available resource for further assessment by the IE.

Table 8-8

ABBREVIATED SUMMARY OF ENVIRONMENTAL EFFECTS FINDINGS OF EIS

SOCIOECONOMIC ENVIRONMENT

LABRADOR-ISLAND TRANSMISSION LINK

TOPIC	FINDING	FINDING
VALUED ENVIRONMENTAL COMPONENT (VEC)	LIKELY CUMULATIVE ENVIRONMENTAL EFFECTS OF OTHER FUTURE PROJECTS AND ACTIVITIES	CUMULATIVE ENVIRONMENTAL EFFECTS SUMMARY
HISTORIC AND HERITAGE RESOURCES	GROUND DISTURBANCE LCH; GENERAL INFRASTRUCTURE; INCREASED OHV ACCESS WITH FORESTRY ROADS; COULD CONTRIBUTE TO CUMULATIVE EFFECTS NEAR COMMUNITIES	NOT SIGNIFICANT
COMMUNITIES	MAY BE DEMAND ON HEALTH-RELATED INFRASTRUCTURE DURING CONSTRUCTION; HEALTH CONCERNS WITH PROJECT OPERATION; UNIQUE TO THIS TYPE OF PROJECT	NOT SIGNIFICANT
ECONOMY, EMPLOYMENT AND BUSINESS	MAY HAVE EFFECTS THAT OVERLAP WITH PROJECT EFFECTS; MAY RESULT IN LABOR SHORTAGES AND HIGH LABOR COSTS; CAPACITY OF PROVINCIAL COMPANIES TO SUPPLY MATERIALS AND SERVICES TO THE LCP AND OTHER PROJECTS MAY BE COMPROMISED; PROVINCIAL REVENUE BENEFIT FROM the LCP AND OTHER PROJECTS	NOT SIGNIFICANT

Table 8-8 (cont'd)

ABBREVIATED SUMMARY OF ENVIRONMENTAL EFFECTS FINDINGS OF EIS

SOCIO-ECONOMIC ENVIRONMENT

LABRADOR-ISLAND TRANSMISSION LINK

LAND AND RESOURCE USE	LIMITED PROPOSED DEVELOPMENT ACTIVITY OR LIKELY CHANGES IN NATURE AND INTENSITY OF EXISTING ACTIVITIES	NOT SIGNIFICANT
MARINE FISHERIES	NO KNOWN OR LIKELY CHANGES TO THE NATURE AND INTENSITY OF VESSEL TRAFFIC, OR ANY OTHER PROPOSED DEVELOPMENT PROJECTS IN THE AREA	NOT SIGNIFICANT
TOURISM	INSUFFICIENT SUPPLY OF SHORT-TERM ACCOMMODATIONS AND INCREASED DEMAND FOR RESTAURANTS AND RETAIL SERVICES; INCREASED TRAFFIC ON ROUTE 510 AND ROUTE 430; INCREASED NUMBER OF WORKERS AS RESULT OF GENERAL ECONOMIC DEVELOPMENT COULD AFFECT THE ABILITY OF TOURISTS TO FIND AVAILABLE ACCOMMODATION DURING THE PEAK TOURISM SEASON	NOT SIGNIFICANT
VISUAL AESTHETICS	ALTERATIONS TO THE EXISTING VIEWSCAPES DUE TO VEGETATION CLEARING TO ACCOMMODATE ACTIVITIES, OR INFRASTRUCTURE CONSTRUCTION RELATED TO OTHER PROJECTS	NOT SIGNIFICANT

8.8 SALT WATER INTRUSION

In an early study performed by Hatch for Nalcor, a salt water intrusion 3D Model Study was performed to determine the effects of the reservoirs and new schedule of releases that would be necessary for the Muskrat Falls generating complex and the effects in the Churchill River and the estuary from Goose Bay. Salinity and temperature modeling was conducted using a software program DHI MIKE 3 using data from bathymetric surveys of the Churchill River and Canadian Hydrographic Service nautical chart data, and temperature and salinity measurements taken during the 1998-1999 oceanography field program.

The salinity program concluded that there is a stable and slightly brackish surface layer of 2-4 practical salinity units (PSU) in Goose Bay and Lake Melville. There is also a stable saline bottom layer (15-25 PSU) that extends throughout Goose Bay and Lake Melville. Lower Churchill River salinity was between 2-3 PSU with no variation in depth or location between Muskrat Falls and the river mouth.

With the Muskrat Falls plant in operation and the compensation flow being followed, the salt water penetrations would be pushed back to almost their original location at the river mouth as was modeled when Gull Island was modeled (Muskrat Falls was not solely modeled at this time and we believe that it was not modeled alone). The report concludes that saline intrusion is limited to the ”last few kilometers of the river nearest the mouth” and “that the progress of the intrusion would be halted at this maximum extent even without the release of any compensation flow.” Based on this early study, in the IE’s opinion, there should be no issues with saline penetrations with the LCH in operation.

8.9 RESERVOIR FILLING AND MANAGEMENT STRATEGIES

The IE reviewed the Information Request, IR#JPR.28 (Information Request-Joint Review Panel) associated with the proposed reservoir filling and management strategies under which both Gull Island and the Muskrat Falls projects were reviewed. The criteria that was adopted for flow release was 30 percent of the Mean Annual Flow (MAF) which equates to about 500 cms for the minimum fixed flow during reservoir impounding. The actual minimum flow release is 534 cms. The current normal minimum flow release is 350 cms. The 500 cms has been found to be a flow that ”both the fish populations within the river and the habitat would have experienced previously.” Nalcor has advised the IE that once the spillway is constructed, the compensation flow (minimum flow of 350 cms) will be modified, if necessary based on monitoring results. This will allow flexibility to allow proper adjustments in the flow based on what the monitoring results reveal. It is uncertain whether the permits provide for this adjustment and it must be verified that they do allow for revisions to the prescribed and agreed to value by the regulatory agencies and concerned parties. The report determines the filling time for Muskrat Falls and the environmental effects for fish and fish habitat. The report does not lead directly to a recommendation, but lists the findings of the study, both pro and con. Based on the data presented, Alternative 4: Fall appears to be the desirable choice with a filling time of 15-19 days. Elsewhere in the documents that MWH reviewed, we found a citing of filling time of 9-11 days

which equates to the spring alternative, Alternative 2, which lists 9-11 days; this alternative was apparently selected. This alternative notes that it has the least amount of adult mortality, but the young-of-year would be lost in de-watered habitat perimeters. Table 8, page 11, where this information is found does not mention the adults issues under the fish issues. We note there was apparently a trade-off made in which more data was presented to support this decision. We requested support backup data but it was never furnished.

8.10 DOCUMENTATION AND SUPPORT CONCLUSIONS

As noted in Section 8.2, the IE has reviewed a sample of the permits that have been prepared to date and requested additional information as well as providing comments on what has been performed. This information was received from Nalcor and noted in Table 8-2.

Based on the exchange of comments to date, in the opinion of the IE, the documentation presented supports the conclusions. No further information has yet been presented on permits and studies performed for the LIL project; no opinion by the IE is necessary since Government has advised MWH that it is no longer a part of their scope of work.

For other studies (e.g., the saline study as discussed in Section 8.10), the documentation presented by Nalcor supports the conclusion that there will be no adverse effect from LCP operations.

8.11 UNUSUAL CIRCUMSTANCES

Unusual circumstances identified by Nalcor that are related to the Muskrat Falls/LTA and LIL include the following items summarized in Table 8-9:

Table 8-9

UNUSUAL CIRCUMSTANCES AND PROVIDED MITIGATION

Circumstance	Mitigation
Cultural significance of the rock knoll at Muskrat Falls.	This effect was mitigated through consultation with the Innu Nation and project design which avoided diversion tunnels through the rock knoll and minimized the disturbance in this area.
Presence of culturally significant sites such as the last shaking tent ceremony.	This effect was mitigated through consultation with the Innu Nation and funding of an Innu Elder Site visit and documentation of this event.
Presence of cultural significant plant in the river valley (Canada Yew).	This was mitigated by commitment to relocate the plants prior to impoundment.

The IE is not aware of any other significant unusual circumstances that should be identified and discussed herein.

8.12 STATUS OF REMEDIAL ACTIVITIES

Information provided by Nalcor pertaining to remedial activities associated with the environmental surveys, studies, monitoring, and mitigation that are currently ongoing and will be performed during and after construction is summarized in Table 8-10.

Table 8-10

SUMMARY AND STATUS OF REMEDIAL ACTIVITIES ASSOCIATED WITH ENVIRONMENTAL WORK

IER Table No.	Title	Cost to Date	Status	Remarks
8--3	Current Studies Funding MF and LIL	Unknown	Unknown	No information pertaining to the ML is included in this Table or IER
8--4	Studies and Surveys to be Performed During Construction	Unknown	Unknown	
8--5	Environmental Programs/Studied and Monitoring Costs, Operating Period	Period has not started	Not Applicable	

Table 8-10 (cont'd)

SUMMARY AND STATUS OF REMEDIAL ACTIVITIES ASSOCIATED WITH ENVIRONMENTAL WORK

IER Table No.	Title	Cost to Date	Status	Remarks
8—6	Mitigation Costs During Construction	Unknown	Unknown	These costs are only for mitigation and do not include studies which are included in Table No. 8--4

8.13 CURRENT STATUS OF PERMITS

Table 8-11 presents a general summary of the permit process to date and the status of the permits, including the authorizing entities responsible for issuing the permits. Table 8-12 lists a breakout of permits for each of the principal contracts furnished to MWH, the agency responsible for review, and the current status. As can be noted in this table, there are still 63 pending permits yet to be approved by Government (as of October 2, 2013). We note that Nalcor advises that the approved permits by Government are all current. MWH has not

independently checked to verify that this represents the current conditions and has not directly talked to Government Agencies about any of the permits, relying solely on the input we receive from Nalcor.

Table 8-11

PERMIT STATUS

Description	Permit For	Date Issued	Status
EA Release Federal and Provincial	MF and LTA	March 2012	Issued
EA Release Provincial	LIL	June 2013	Issued; Federal Release imminent
Authorizations	DFO (Generation) DFO (Transmission)		Issued Habitat Quantification Accepted. Determining Compensation requirements.
Authorizations	Transport Canada Dam and Reservoir		Minor Works approved Authorization in progress
Provincial Permits	Crown Lands Dam and Powerhouse Reservoir and Transmission Line Clearing Quarries (blanket), stream crossings (blanket), and buildings		Approved for Generation Site and Labrador Transmission Assets Permit issued Permit issued Numerous permits (See representative permits in Table 8-2.)

Table 8-12

PERMIT STATUS BY CONSTRUCTION PACKAGE

Construction Package	Permits Required	Permits Developed	Submitted to Nalcor	Reviewed by EMC	Submitted to Government	Approved	Pending
South Side Access Road – CH0004	51	51	51	51	51	51	0
Bypass Road – SSAR	8	8	8	8	8	3	5
Clearing – CH0048	54	54	54	54	54	54	0
Site Utilities – CH0005 (temp camp)	22	22	22	22	22	22	0
Construction Power – CD0512	34	34	34	34	34	34	0
Reservoir Clearing	11	11	11	11	11	8	3
Bulk Excavation – CH0006	42	40	40	40	40	35	7
Construction of Intake and Powerhouse, Spillway and Transition Dams – CH0007	2	2	2	2	2	1	1
North Spur Stabilization Works – CH0008	20	12	12	12	12	11	9
HVac Line Clearing – CT0341	15	15	15	15	15	10	5
HVac Line Construction – CT0319	23	23	23	23	23	15	8
Geotechnical SM0713	4	4	4	4	4	3	1
Churchill Falls Camp – CD0538	8	8	8	8	8	7	1
Electrode Geotechnical – SD0565	3	3	3	0	0	0	3
Component 3 Earth Works – CD0503	17	5	5	5	5	0	17
SOBI Civil Works – LC-SB-021	3	1	1	1	1	0	3
TOTAL	**317**	**293**	**293**	**290**	**290**	**254**	**63**

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SECTION 9

NALCOR ENERGY'S PROJECT FINANCIAL PRO FORMA

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SECTION 9

NALCOR ENERGY'S PROJECT FINANCIAL PRO FORMA

The purpose of this section is to review Nalcor's[7] financial planning for the LCP as represented in Nalcor financial models/pro forma and other resources, and to review projected results of operations as represented in Nalcor financial models.

9.1 INTRODUCTION

This section includes the following topics:

- Capital costs
- Financial planning
- Annual costs
- Revenue requirements and projections
- Implementation issues

Reviews of Nalcor's financial planning and projected results of operations are preliminary, conditioned by development of the LCP. The LCP is progressing rapidly, but at this juncture the financial information includes a number of unknown features, including the accuracy and degree of precision of estimated costs and cost contingencies.

The review of overall LCP economics has been narrowed by this constraint, and focus is placed on technical content and analysis of the Nalcor financial models.

The scope of the review covers three projects being developed by Nalcor, namely the Muskrat Falls Generation Facility (MF), Labrador Transmission Assets (LTA), and Labrador Island Link (LIL), collectively comprising the LCP. The review does not include the Maritime Link (ML) project being developed by Emera.

9.2 CAPITAL COSTS

A principal feature of the development of the LCP is preparation of estimates of construction and ancillary costs, collectively known as Capital Costs. Section 5 of this IER addresses in detail the LCP construction cost estimate; Section 4 addresses the construction schedule. This section addresses ancillary costs, including indirect costs, historical capital outlay, interest during construction, and renewals/replacements.

[7] Nalcor is a body corporate existing pursuant to the Energy Corporation Act being Chapter E-11.01 of the *Statutes of Newfoundland and Labrador*, 2007.

9.3 FINANCIAL PLANNING

The Nalcor financial planning/pro forma models are comprehensive and evaluate nearly every variable of project cost, financing and debt repayment. The models address the three basic project elements, MF, LTA and LIL, each in two separate Excel workbooks. Nalcor is currently intending to finance each of MF/LTA and LIL with a series of three large bullet underwritten bonds with amortization payments going into a sinking fund.

9.3.1 Sources and Uses of Capital Funds

Tables 9-1 and 9-2 show the sources and uses of funds for the MF and LTA projects, as configured in the Nalcor financial models. The MF and LTA projects have combined debt amounts about $2.6B ($2.136B + $0.464B). The total amounts to be debt and equity funded are shown at the bottom of the Uses columns of the two tables: [redacted].

[redacted]

[redacted]

Table 9-1

MF SOURCES AND USES OF CAPITAL FUNDS

MF Sources & Uses of Funds During Funding Period					
Sources	**$ Million**	**%**	**Uses**	**$ Million**	**%**
Pre-FC Equity Funding	[redacted]		Pre-FC Capex & Innu	[redacted]	
Post-FC Equity Funding			Post-FC Capex		
Debt Funding			Post-FC Innu Payments		
Interest on BSF			Financing Upfront Fees		
Interest on SDN & BHA			Capitalized Interest		
			DSRA Pre-Funding		
			LRA Funding		
Total	[redacted]	**1.00**	**Total**	[redacted]	**1.00**

Table 9-2

LTA SOURCES AND USES OF CAPITAL FUNDS

LTA Sources & Uses of Funds During Funding Period					
Sources	**$ Million**	**%**	**Uses**	**$ Million**	**%**
Pre-FC Equity Funding			Pre-FC Capex & Innu		
Post-FC Equity Funding			Post-FC Capex		
Debt Funding			Financing Upfront Fees		
Interest on BSF			Capitalised Interest		
Interest on SDN & BHA			DSRA Pre-Funding		
			LRA Funding		
Total		**1.00**	**Total**		**1.00**

Analysis of the LTA information, paralleling the above discussion for the MF project confirms the "Debt Funding" labeled debt financing amount of $0.464B for the LTA project.

Table 9-3 shows the sources and uses of funds for LIL as per the Nalcor financial models. LIL has a maximum allowable debt amount of $2.4B.

Table 9-3

LIL SOURCES AND USES OF CAPITAL FUNDS

LILSources & Uses of Funds During Funding Period					
Sources	**$ Million**	**%**	**Uses**	**$ Million**	**%**
Debt Funding			Pre-FC Capex		
Equity Funding			Post-FC Capex		
AFUDC on Equity			Financing Costs		
			IDC / AFUDC		
			DSRA		
Total		**1.00**	**Total**		**1.00**

Financial planning must be revisited by Nalcor once the capital cost estimates, O&M cost estimates, and forms of long-term financing are better defined.

The LIL models do not include Sources and Uses of Capital Funds tables, per se, but are found in the Sum CCE table; LIL Model.

9.4 ANNUAL COSTS

Annual costs may seem immaterially small in comparison with the capital costs of the LCP, but it will be important to forecast annual costs for the purposes of bond documents. Operations and

maintenance, debt service, depreciation expense, and pay-as-you-go annual capital requirements will be the largest annual costs.

9.4.1 Annual O&M Expenses

Annual O&M cost data have been estimated by Nalcor. The costs for each of the three projects include the following cost categories:

- Staff
- Vehicles
- Service contracts
- Miscellaneous costs.

The LIL cost estimate also includes O&M costs associated with Submarine Cable and Sea Electrodes.

Nalcor has provided projected annual O&M expenses from the time of commissioning, Year 2018, out fifty years.

9.4.2 Debt service

The financial models compute annual debt service, debt service coverage requirements, and debt service reserve account. Annual debt service becomes an expense that must be paid to bond holders by Nalcor or the Province of Newfoundland and Labrador under the terms of the FLG. Nalcor will plan that rate revenue will be sufficient to meet (with the Liquidity Reserves) the DSCR stipulated in the FLG.

MWH are not lawyers and do not practice law. From a business perspective, we infer from the FLG that the project has full equity backing from the Province of Newfoundland and Labrador, including all costs to completion, including cost overruns, and that revenue agreements then cover all ongoing costs including any resulting debt.

9.5 REVENUE PROJECTIONS

Nalcor provided projections of revenue based on the assumed terms of the power PPA and the average annual power forecast of 4.93 TWH in their model. Plant usage and internal usage of the other project facilities may or may not be included in the computations. Confirmation of these power deductions has not been independently made by the IE.

9.6 IMPLEMENTATION ISSUES

9.6.1 Dispatch Constraints

The dispatch of the project's power is controlled by the WMA under which the Water Management Committee selects the Independent Coordinator whose responsibility is to: "…determine the total power to be produced and is required to determine and prepare the production schedules which shall specify the amount of power to be produced by each supplier's production facilities in accordance with the provisions of the Agreement. Nalcor and Churchill Falls (Labrador) Corporation Limited are the "Suppliers of power."

MWH currently does not see where a dispatch constraint could occur, in our opinion, with the WMA in place and dutifully promulgated, and with the information the IE has been provided.

We requested further information from Nalcor pertaining to any dispatch constraints and where and why they may occur, since this issue was studied and risk assessments conducted. Nalcor reports that no constraints were identified.

9.6.2 Project Performance and Reliability

Based on the number of contracts and the RFP for CH0007 that we have been able to review to date, it is still too early to forecast directly from actual results of LCP testing and commissioning of systems, and how each of the turbine-generating units and the systems actually will perform over time. However, based on other projects of similar complexity and size and their performance and reliability history which we are aware of, we have no reason to question at this time that the LCP, as presently configured and provided with the proposed adequate O&M and renewals and replacement budgets, will produce satisfactory performance and will be a reliable and dependable resource.

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SECTION 10

CONCLUSION AND INDEPENDENT ENGINEER'S OPINIONS

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SECTION 10

CONCLUSIONS AND INDEPENDENT ENGINEER'S OPINIONS AND RECOMMENDATIONS

The following section lists our principal conclusions and recommendations as of November 13, 2013, which are based on a site visit conducted during the week of September 23, 2013 and data, RFPs, and contracts furnished by Nalcor, the Borrower for the following three of the four projects of the LCP: MFGS; LTAP; and LIL.

10.1 CONCLUSIONS AND INDEPENDENT ENGINEER OPINIONS

10.1.1 Qualifications of Participants

In our opinion, and based on past experience, the Integrated Project Team consisting of SNC-L (the borrower's Engineer) and Nalcor (the borrower) are qualified to design, contract, manage, commission, operate and maintain the three projects currently under design and construction for the LCP.

10.1.2 Project Design and Performance

The Muskrat Falls Generating site is a relatively easy site to develop from a technical and logistical point of view. The terrain is relatively flat with nearby access to a principal road in Labrador. For both the temporary structures and the permanent facilities, sufficient space is available for the project development.

The North Spur area has been geologically explored and studied in the past by several engineering organizations as well as during the most recent studies conducted by the Integrated Project Team to develop a satisfactory solution to reduce seepage and provide stabilization remediation procedures that should provide a useful life beyond the design life of 50-years, in our opinion. The planned North Spur remediation measures are appropriate to stabilize the slopes, arrest natural mass wasting and to control seepage and piezometric pressures after impoundment of the reservoir. Recommended additional studies on the sensitive clays will be useful to confirm current design assumptions, but should not significantly affect the current design scheme.

Hydrological risk in terms of generation capability is well understood as documented in the studies conducted for the project. With average annual energy of 4.93 TWH/year established by using long-term flow records, the power purchase agreement with Emera allowed Emera to claim 20 percent of the power for 35-years with the commitment to build the transmission system to Nova Scotia, and Nalcor and their special purpose companies using the rest of the power in the Labrador and Newfoundland system. Long-term generation is assured by the

WMA that provides storage at Churchill Falls and a means of operating the Churchill River to near-optimize the power production.

Hydrological risk in terms of construction diversion flows at Muskrat Falls have been satisfactorily studied and cofferdam heights and means of diversion have been designed to account for ice jams as well as flood flows with a return period of 20-years; 40-years for the ice jam events. Mitigation of flooding event risks beyond these normally assumed return-period events will be the responsibility of Nalcor Energy.

10.1.3 Construction Plan and Schedule

Construction safety requires contractors to supply their Health, Safety and Security Plans as part of their required submittals. They must follow the generally-high standards established by Nalcor Energy which follows a 'safety first' philosophy. We understand that Nalcor intends to strictly monitor these plans to ensure these requirements are met.

The risk of problems associated with transportation are mitigated to some extent by Nalcor providing storage facilities at two locations as well as providing transportation to the sites of the projects. Risk associated with transportation of materials, equipment, and supplies to these facilities is the responsibility of the contractors. Risk still exists using overseas suppliers, however, these shipments will be closely monitored as required by Nalcor's overarching transportation plan by the Integrated Project Team.

RFPs and Contracts reviewed to date are generally satisfactorily written and similar with respect to terms and conditions imposed on the suppliers and contractors. The contracts convey to the parties the clear responsibilities of the contractor as well as Nalcor, with no ambiguities detectable by the IE in the documents we have reviewed to date. Nalcor has established a system wherein they weigh the bid amount with the security provided (performance bond amount, letters of credit, and parent-company guarantees) to arrive at a satisfactory level of risk and to keep the price as low as practical. We normally do not see this level of balancing all factors considering risk to reduce cost on other projects we are aware of, but find the methodology employed by Nalcor to be satisfactory for the projects.

We have reviewed the Integrated Project Schedule prepared by Nalcor and find that it is generally complete as far as listing contracts, but it is a Gantt chart without activity linking, critical path(s), float time, etc., and is not suitable to the level of detail we require and had expected to view to allow us to form opinions. Until we view more large contracts under construction and obtain the P6 classic CPM view of the project schedule, we cannot express an opinion as to the likelihood of the contracts being completed as scheduled.

10.1.4 Capital Budget

After reviewing Nalcor's detailed cost estimate and supporting documentation it's our opinion that the DG3 cost estimate was robustly prepared and follows the general procedures as

outlined by the AACEI for a Class 3 cost estimate. Based on the limited number of awarded contracts to date and other contributing factors, we believe that DG3 cost estimate complies with AACEI's recommended range of accuracy for a Class 3 cost estimate: -20% to +30%..

Construction to date pertaining to the contracts that MWH is required to review is limited to the Bulk Excavation contract, CH0006, that currently is on, or ahead of, schedule and at budget levels. [redacted]

10.2 RECOMMENDATIONS

1. Nalcor is requested to furnish to the IE the Contractor schedules to enable the IE to fulfill its obligations under the Project Financing Agreements.

2. When available, Nalcor is requested to furnish to the IE for review the complete analysis of the North Spur including the laboratory test reports that determine the strength of the soils under the loadings that it will sustain during the life of the project.

3. In accordance with the Project Financing Agreements, updated cost estimates will be provided as stipulated in said Agreements.