



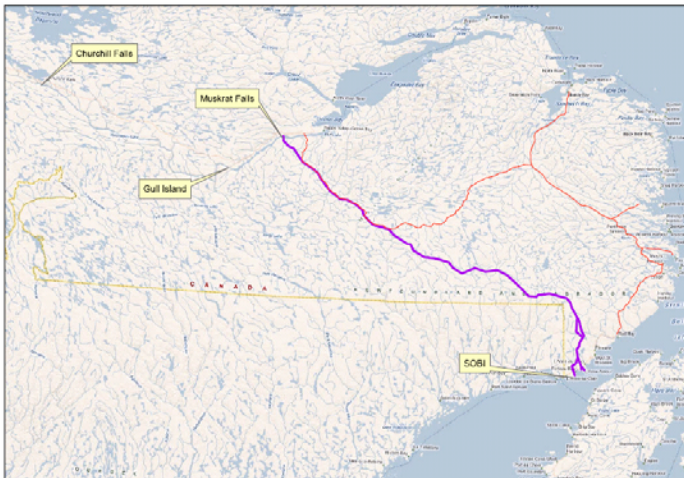
SNC • LAVALIN

# Lower Churchill Project Phase I

## Agreement LC-G-002 for EPCM Services

### Kickoff Meeting

30 – 31 March 2011



**Lower Churchill Project – Phase 1****Agreement LC-G-002  
Engineering, Procurement and Construction Management Services  
(EPCM)****Kickoff Meeting – Attendees****30 & 31 March 2011****Nalcor**

- Paul Harrington Project Director
- Ron Power Project Manager – Generation & Island Link
- Colleen Sutton Office Services Supervisor
- Jason Kean Deputy Project Manager
- Lance Clarke Business Services Manager
- Bob Barnes Engineering Manager
- Pat Hussey Supply Chain Manager
- Mark Bradbury General Manager, Finance
- David Green Quality Manager
- Greg Fleming Marine Crossings Project Manager
- John Hollohan Manager, Safety and Health (Corporate)
- Frank Ricketts Manager – Environmental Services (Corporate)
- Scott O’Brien Area Manager – Intake and Powerhouse
- Clarence Hewitt Contract Coordinator (EPCM)
- Dave Pardy Project Controls Lead
- Tony Scott Sr. Project Planner
- Tom Chudy Area Planner
- Dave Brown Generation Lead Engineer
- John Mallam Operations Lead Engineer
- Raj Kaushik Electrical Lead Engineer
- Bob Besaw Mechanical Lead Engineer
- Kyle Tucker Transmission Lead Engineer
- Catherine Rowsell Lead, Labour Relations & Team Effectiveness
- Maria Moran Benefits & Training Lead
- Mark Peddle Quality Assurance Lead
- Geoff Marshall IS/IT Supervisor
- Gerald Cahill Project Controller
- Peter Thomas System Planning Engineering Specialist
- John Mulcahy Hydroelectric Construction Specialist
- John Cooper Real Property Coordinator

**SLI ATTENDEES**

- Klaus Triendl Project Director
- Marie-Claude Dumas VP Operations – Hydro & Power Systems Division
- Richard Kockel VP Engineering
- Francois Courturier Project Manager – Hydro Plants
- Afzal Hussain Project Manager – Transmission
- Luc Turcotte Engineering Manager – Hydro Plants
- Gokhan Saltan Engineering Manager – Transmission
- Satish Sud Engineering Manager – HVdc Specialties
- Nick Mills Construction Director
- Fred Bergman Construction Manager – Transmission
- Brian Stacey Construction Superintendent – TL Labrador HVdc
- Andre St. Jean Project Services Manager
- Don Mode Health and Safety Manager
- Samir Asfour Area Manager – Dams & Spillways
- Ken Dominie Environmental Manager
- Ian Hendry Procurement Manager
- Jose Gillis HR Manager
- Al Edmunds Area Manager – Infrastructure
- Robert Sanlian Lead Electrical Engineer
- Jean Marc d’Arcy Lead Engineer – Mechanical
- Michel Tremblay Lead Engineer – Hydraulics
- Michel Maeyens Lead Engineer – Geotechnical / Geology
- Pierre de Courval PST - Sr. Geologist
- Rouben Shemie Lead Engineer – HVdc Integration
- Ricardo Quijada Lead Engineer – Protection & Controls
- Michel Belanger Lead Engineer – Towers & Foundations - TL
- Terry McCarthy Lead Engineer – Services
- Nick Gillis Technical & Change Manager
- Line Tremblay Contracts Administrator
- Michel Landreville Contracts Manager
- Chris Woodmass Purchasing Specialist
- Tarek Haggag PM+ Administrator
- Ricardo Cumming IS Manager
- Shenoy Shiva GIS Specialist TL
- Randy Walker TL & DC Safety Specialist
- Alvero Ceballos Geotechnical Engineer
- Gerry Cook Lead Architect
- Lee Stanton PST - Construction Planning Specialist
- Tony Rattue PST – Geotechnical Engineer
- Roger Martel Project Planner/Schedulern



**Lower Churchill Project - Phase I  
Agreement LC-G-002 for EPCM Services**

**Kickoff Meeting  
Agenda  
30 & 31 March 2011 (Sheraton Hotel)**

**DAY 1 (30-Mar-2011)**

**8:00 AM – 8:30 AM – Team Arrival and Continental Breakfast**

**8:30 AM – 9:00 AM**

- |  |           |
|--|-----------|
| 1 – Introductions                          | All       |
| 2 – Safety Moment                          | K. Tucker |
| 3 – Purpose of Meeting / Expected Outcomes | R. Power  |

**9:00 AM – 10:00 AM**

- |  |               |
|--|---------------|
| 4 – Lower Churchill Project: General   |               |
| – Nalcor Safety Culture                | J. Hollihan   |
| – General Overview & Project Rationale | P. Harrington |
| – Mission Statement & Key Objectives   | P. Harrington |

**COMFORT BREAK (10:00 – 10:15)**

**10:15 AM – 11:15 AM**

- |  |          |
|--|----------|
| 5 – Execution Approach / EPCM Services         | R. Power |
| 6 – Nalcor / SLI: Division of Responsibilities |          |
| – Responsibility Assignment Matrix             | J. Kean  |

**11:15 AM – 12:15 PM**

- |                                  |         |
|----------------------------------|---------|
| 7 – Decision Gate 3 Deliverables | J. Kean |
|----------------------------------|---------|

**LUNCH (12:15 PM – 1:00 PM)**

**1:00 PM – 3:00 PM**

- |  |           |
|--|-----------|
| 8 – Organization                             |           |
| – Overall Nalcor LCP Organization            | L. Clarke |
| – Nalcor ECPM Team – Functional Organization | R. Power  |
| 9 – Decision Gate 2 Basis                    |           |
| – Overview                                   | J. Kean   |
| – Basis of Design                            | B. Barnes |
| – Contract Package Listing                   | P. Hussey |



- Project Schedule
- Capital Cost Estimate



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- D. Pardy
- J. Kean

**COMFORT BREAK (3:00 – 3:15)**

**3:15 PM – 5:00 PM**

10 – Project Control

- Responsibilities and Stewardship
- Management of Change

- D. Pardy / T. Chudy
- J. Kean

11 – Review of Company Supplied Data Listing + Other Data to be Provided

- B. Barnes



**DAY 2 (31-Mar-2011)**

**8:00 AM – 8:30 AM – Team Arrival and Continental Breakfast**

**8:30 AM – 10:00 AM**

- |                              |              |
|------------------------------|--------------|
| 12 – Safety Moment           | SLI          |
| 13 – EPCM Execution          | SLI Team     |
| – Organization and Structure | F. Couturier |
| – Component 1                | F. Couturier |

**COMFORT BREAK (10:00 – 10:15)**

**10:15 AM – 12:15 PM**

- |               |            |
|---------------|------------|
| – Component 3 | S. Sud     |
| – Component 4 | A. Hussain |

**LUNCH (12:15 PM – 1:00 PM)**

**1:00 PM – 3:00 PM**

- |   |          |
|---|----------|
| 14 – Construction Management Presentation |          |
| – Approach and Structure                  | N. Mills |
| – Component 1                             | N. Mills |

**COMFORT BREAK (3:00 – 3:15)**

**3:15 PM – 5:00 PM**

- |               |                        |
|---------------|------------------------|
| – Component 3 | S. Sud                 |
| – Component 4 | F. Bergman / B. Stacey |

- |                               |          |
|-------------------------------|----------|
| 15 – Other Key Focus Areas    |          |
| a) Regulatory and Environment | M. Organ |
| b) Quality Management         | D. Green |

- |   |         |
|---|---------|
| 16 – Project Office – Description and Status Update | E. Reid |
|---|---------|

- |                                 |          |
|---------------------------------|----------|
| 17 – Plan for Focused Workshops | R. Power |
|---------------------------------|----------|

- 18 – Wrap-up

# Lower Churchill Project - Phase I: Kickoff Meeting

## Driving in Unfamiliar Locations (Tab 2)

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# Driving in unfamiliar locations

- Know where you're going!
- Use web sites (like Mapquest, or GoogleEarth) to plan your route and print your maps
- If available, have someone navigate for the driver (remember – drivers should have patience for the navigator, and the navigator should have patience for the driver)
- Leave early to give yourself lots of time to get there (and to get lost and find your way back)
- If you do get lost, pull over and figure out where you are – don't read the map unless you're stopped, ask for directions (even the guys)
- If practical, get a cab



# Lower Churchill Project - Phase I: Kickoff Meeting

## Purpose of Meeting / Expected Outcomes (Tab 3)

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# Purpose / Expected Outcomes

- Meet and Greet - “Get to know each other”
  - Reach alignment regarding:
    - Safety and Environmental Benchmarks
    - Project certainty
    - the scope of the undertaking
    - 2011 priorities and Gate 3 requirements
    - our collective commitment to deliver
- “Alignment on Expectations”
- Understanding of respective Nalcor and SLI roles as we proceed to deliver the Project “How we will work together”
  - Identification / list of business areas for follow-on focused workshops (Agenda Item 17) “ Plan for Action”
  - Appreciation of the work that has already been done
- “ Build on Earlier Work – not Duplicate – Move Forward”

# Lower Churchill Project – Phase 1: Kickoff Meeting

## Nalcor Safety Culture (Tab 4)

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# Outline

- Corporate Goals
- Safety Expectations
- Safety Concepts and Models
- Safety Leadership
- Structural Processes and Tools
- Guiding Principles

# Our Goals

- **Safety**

- To be a world class safety leader

- **Environment**

- To be an environmental leader

- **Business Excellence**

- Through operational excellence to provide exceptional value to all consumers of our energy

- **People**

- To ensure a highly-skilled and motivated team of employees who are strongly committed to our success and future direction

- **Community**

- To be a valued corporate citizen in Newfoundland and Labrador

Safety



Relentless commitment to protecting ourselves, our colleagues and our community

# Our Promise

- **Safety** - *to be a world-class safety leader*
  - zero harm workplace – *Nobody Gets Hurt*
  - provide the safest workplace environment
  - *exceptional* safety culture
  - *relentless pursuit* of safety excellence and sustained safety performance
  - *demonstrated personal safety leadership* that must be *Felt* at all levels of the organization

# Core Safety Models and Concepts

- Formalized Systems
- Behaviorally Based Priorities



# Core Safety Models and Concepts

## Formalized Systems:

- Core Values
- Functional Safety Management System
- Framework for Safety Excellence
- Internal Responsibility System (IRS)
- Safety Culture Maturity Model

A proud, diverse energy company, whose people are committed to building a bright future for Newfoundland and Labrador, unified by our core values.

Sharing our ideas in an open and supportive manner to achieve excellence.

## Teamwork

### Honesty and Trust

Being sincere in everything we say and do.

### Open Communication

Fostering an environment where information moves freely in a timely manner.

### Safety

Relentless commitment to protecting ourselves, our colleagues and our community.

### Respect and Dignity

Appreciating the individuality of others by our words and actions.

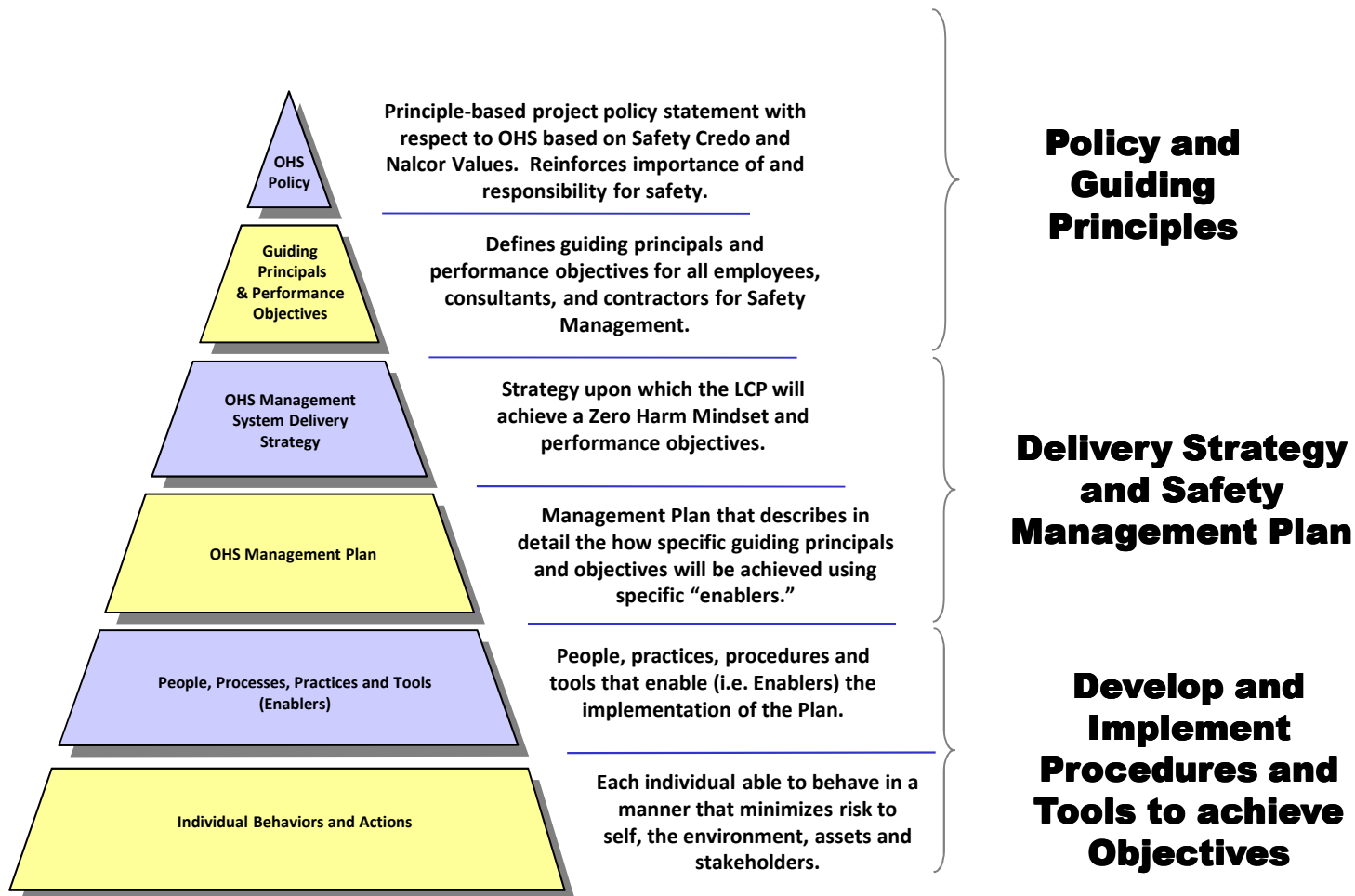
### Leadership

Empowering individuals to help, guide and inspire others.

### Accountability

Holding ourselves responsible for our actions and performance.

# Safety Functional Management System



# Framework for Safety Excellence



## *Reporting, Analysis and Continuous Improvement*

**LEADING INDICATORS**  
 Hazards, Near Misses, Safe and Unsafe Observations, First Aids, Inspections, Audits

**LAGGING INDICATORS**  
 Medical Treatments, Lost Time Injuries, Severity, analyzed by injury type, part of body, location, etc.

# Internal Responsibility System



# Safety Culture Model

<p style="text-align: center;"><b>Independent</b></p> <p style="text-align: center;"><i>“Zero is attainable”</i></p> <ul style="list-style-type: none"> <li>• Well understood process and operation</li> <li>• Personal commitment</li> <li>• Supervision/resource comfortable leading or allowing others to lead</li> <li>• Ownership for procedures at team level</li> <li>• Trust allowing for shared logic and ideas</li> </ul>	<p style="text-align: center;"><b>Interdependent</b></p> <p style="text-align: center;"><i>“Zero is sustainable”</i></p> <ul style="list-style-type: none"> <li>• Co-operation within and across teams</li> <li>• Brother’s keeper</li> <li>• Organizational pride</li> <li>• Self-managed teams</li> <li>• Team fully engaged in the goal</li> </ul>
<p style="text-align: center;"><b>Dependent</b></p> <p style="text-align: center;"><i>“Zero is difficult”</i></p> <ul style="list-style-type: none"> <li>• Management commitment</li> <li>• Governed by rules and regulations</li> <li>• Management centered activities</li> <li>• Selective communication of objectives</li> <li>• Discipline as a development tool</li> <li>• Turf-type atmosphere</li> </ul>	<p style="text-align: center;"><b>Reactive</b></p> <p style="text-align: center;"><i>“Zero is unrealistic”</i></p> <ul style="list-style-type: none"> <li>• Goal of compliance</li> <li>• Discipline is reactive to incidents</li> <li>• Performance driven by management</li> <li>• Management provided resource but lack of management involvement</li> </ul>

# Core Safety Models and Concepts

## Behaviorally Based Priorities:

- Leadership Commitment
- Safety Credo
  - Personal Ownership
- The Human (Family) Aspect of Safety
- Engaging in the Safety Intervention
  - Coaching and Assertive Communication

# Safety Credo

*“The safety of our employees, contractors, visitors and the public is our first and most important priority. Our goal is a workplace where nobody gets hurt -- zero harm -- and a working environment where each and every employee is always concerned for their own safety and the safety of others. Everyone at Nalcor Energy is personally committed to these basic safety values as the foundation for our success as a safety leader.”*

I always follow safety requirements and best practices

I always take the time to complete my work safely

I always take action when I see unsafe acts or conditions



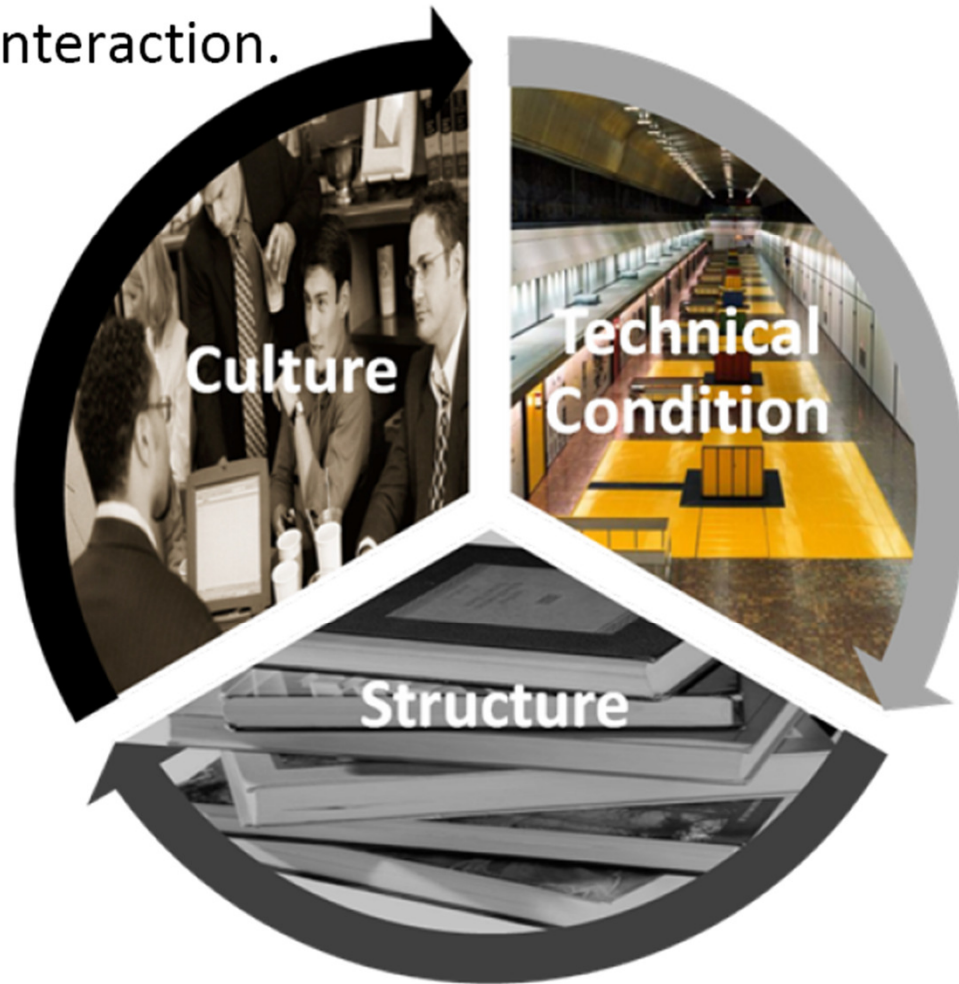


# Felt Leadership

*We expect our formal leaders to demonstrate safety leadership behaviors that are consistent with our goals and values related to safety.*

- **Leadership**
  - making time and caring for employees
  - visible engagement and commitment
- **Teamwork**
  - involves commitment, knowledge, recognition, and valuing others
- **Personal approach**
  - safety must be personalized

Your safety level is a result of this interaction.



It can only be generated by the human being.

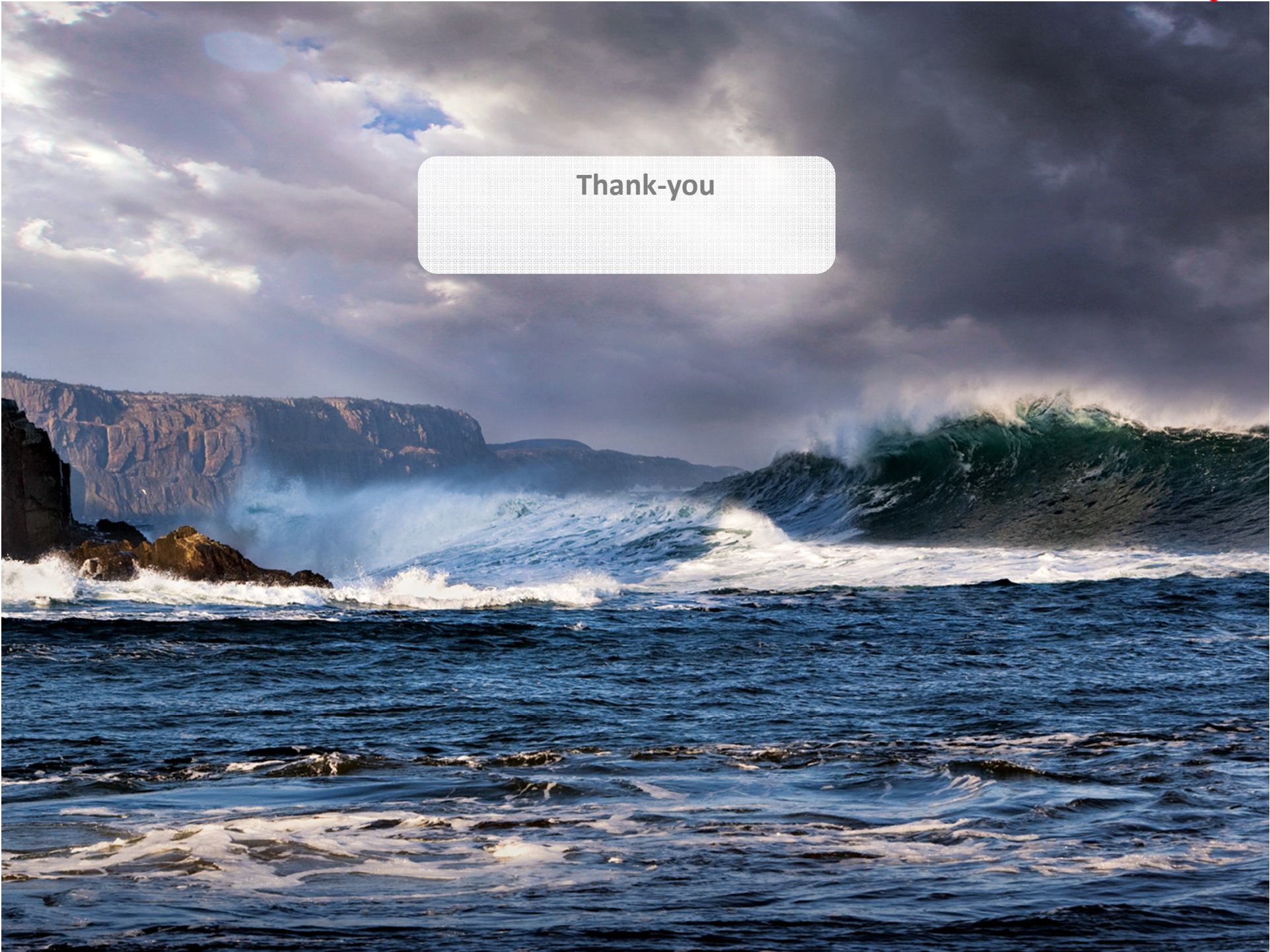
# Zero Harm Enablers

- Espousing a Safety Culture
  - Safety Moments
  - Personal Safety Plans
  - Safety Surveys
  - Contractor Safety Management
  - Safety Reporting
    - Safe Workplace Observation Program (SWOP)
  - Risk Management
    - Task based risk assessments, tailboard safety talks, step back 5x5.
  - Corporate Safety Standards
  - Safety Performance Reporting
  - Work Protection Code
  - Work Method development
  - Incident Investigation
    - Hi-Po near miss
-

# And finally, our Guiding Principles:

- We believe:
  - all incidents are preventable,
  - an incident free workplace is achievable and sustainable,
  - sound safety and health performance is fundamental to our successful business performance,
  - employee and contractor engagement and commitment is critical for success,
  - each and every one of us must get involved, *reach out, speak up* and *take ownership* in safety

Thank-you



# Lower Churchill Project - Phase I: Kickoff Meeting General Overview & Project Rationale – (Tab 4)

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# BENEFITS STRATEGY

## Newfoundland & Labrador Benefits Strategy

- The Benefits Strategy is a commitment to the principles outlined in Newfoundland and Labrador's Energy Plan – *Focusing our Energy*
- Agreed upon by Nalcor and the Government of NL
- All commitments contained will be adhered to by the EPCM Consultant, contractors and subcontractors
- Overriding objective is to optimize opportunities for people and businesses of NL, while adhering to competitive business practices



# Newfoundland & Labrador Benefits Strategy – High-Lights

- Engineering, Procurement and Construction Management and Project Management located and executed in NL
- Established minimum engineering, construction and project management hours to take place in NL
- Specialized engineering to take place outside the province must meet specific criteria
- Adjacency hiring protocols are in place for construction
- Gender Equity and Diversity Programs will be developed and implemented
- Benefits monitoring and reporting guidelines have been established; system to be implemented

# Newfoundland & Labrador Benefits Strategy - Procurement

- Provide NL businesses full and fair opportunity to compete, on a competitive basis, in the supply of goods and services
- Provide open, timely and transparent access to procurement opportunities
- Become familiar with NL contractor/supplier capabilities
- Conduct supplier development sessions
- Include NL benefits in bid evaluation criteria
- Procurement process shall be consistent with any commitments contained in executed IBA's

# Questions?

# Lower Churchill Project – Phase I: Kickoff Meeting

## Mission Statement and Key Objectives (Tab 4)

Boundless Energy



# Project Mission Statement

To develop the Lower Churchill Project, respecting shareholder and stakeholder requirements and commitments, **using best-in-class planning and execution practices** in order to ensure the safe and environmentally sound delivery of an economically viable source of clean, renewable energy to the marketplace in accordance with the approved Project Master Schedule.

# Key Project Objectives

## Under Direct Influence by SNC-Lavalin Inc.

- **Health & Safety**
  - Achieve and sustain world-class safety performance during the construction phase
  - Develop a world-class contractor/supplier H&S Management Program
- **Environment**
  - Design, construct and commission the Project in accordance with Nalcor's Environmental Policy and Guiding Principles
- **Business Excellence**
  - Mobilize a EPCM consultant with world class team.
  - Achieve Decision Gate 3 Key Deliverables by 15-Dec-2010
  - Rigorous Management of Change to achieve Decision Gate 2 cost and schedule targets
  - Achieve First Power in Oct-2016

# Key Project Objectives

## Under Direct Influence by SNC-Lavalin Inc.

- **People**

- Build an empowered, world-class Owner's and EPCM project management teams
- Facilitate communication within the Project through clear reporting relationships and roles & responsibilities
- Negotiate collective bargaining agreement that meets the requirements of the Project

- **Community**

- Demonstrate benefits the Project will provide to the people of Newfoundland and Labrador
- Effectively manage the Project's reputation and brand

# Lower Churchill Project - Phase I

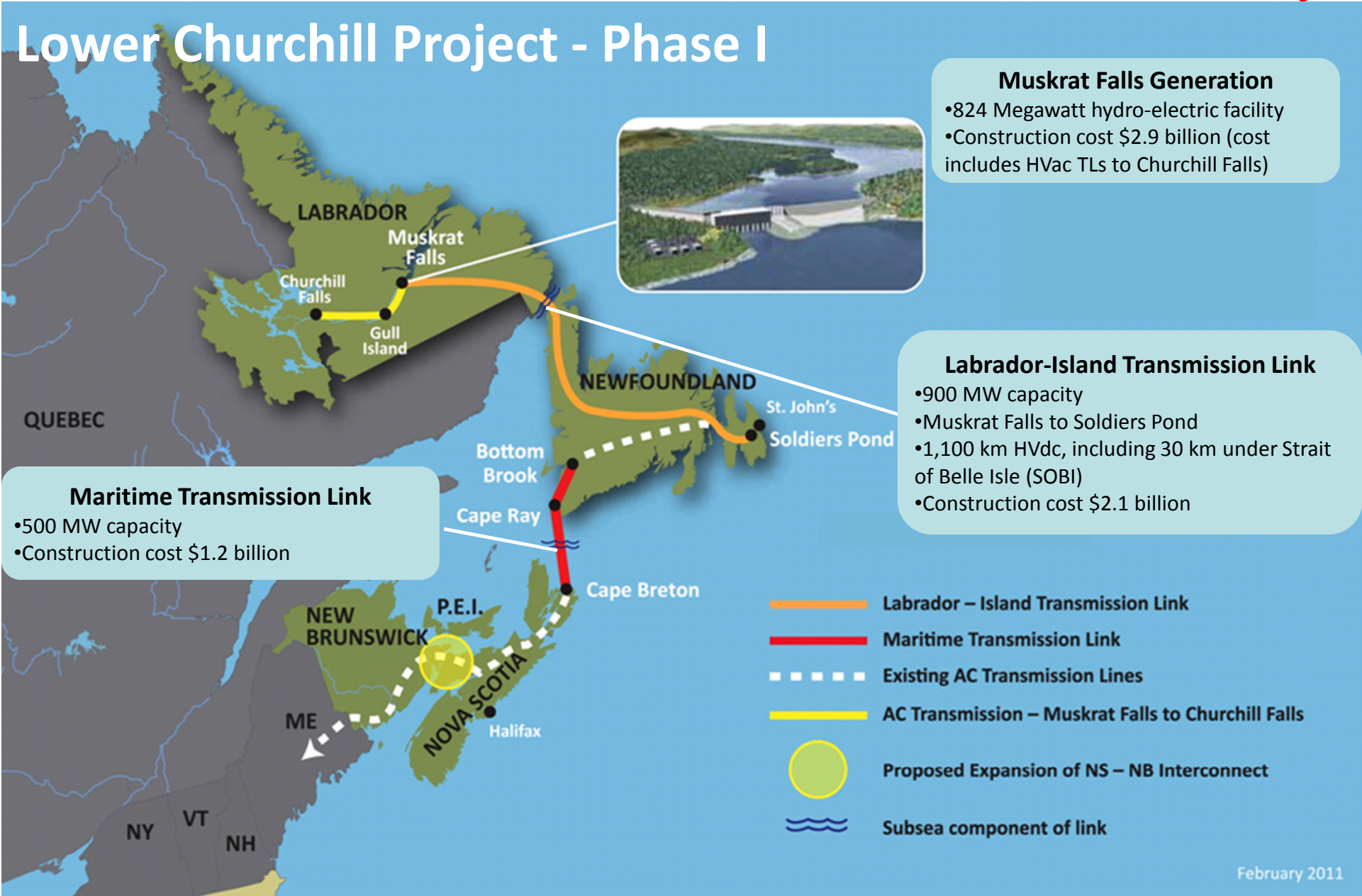
## Execution Approach / EPCM Services (Tab 5)

Boundless Energy





# Lower Churchill Project - Phase I



February 2011

# MANDATE: LCP Management Team

## DELIVER LCP - PHASE I:

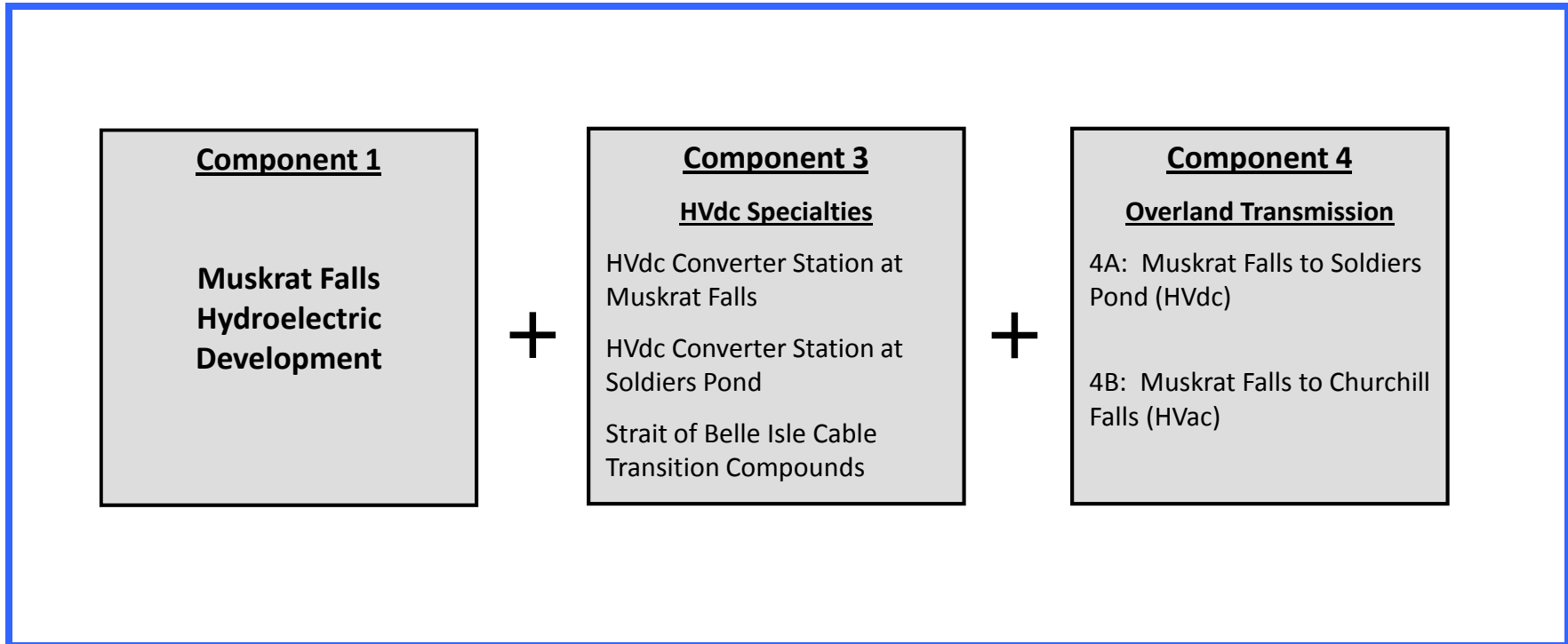
- Safely
- Environmentally Acceptably
- On Budget
- On Schedule
- Meeting Design Criteria

# Execution Approach

- Muskrat Falls – EPCM (SLI)
- Labrador-Island Transmission – EPCM (SLI)
- SOBI Crossing – Nalcor Team + EPC Contracts
- Maritime Link – Emera Lead (Nalcor involvement)

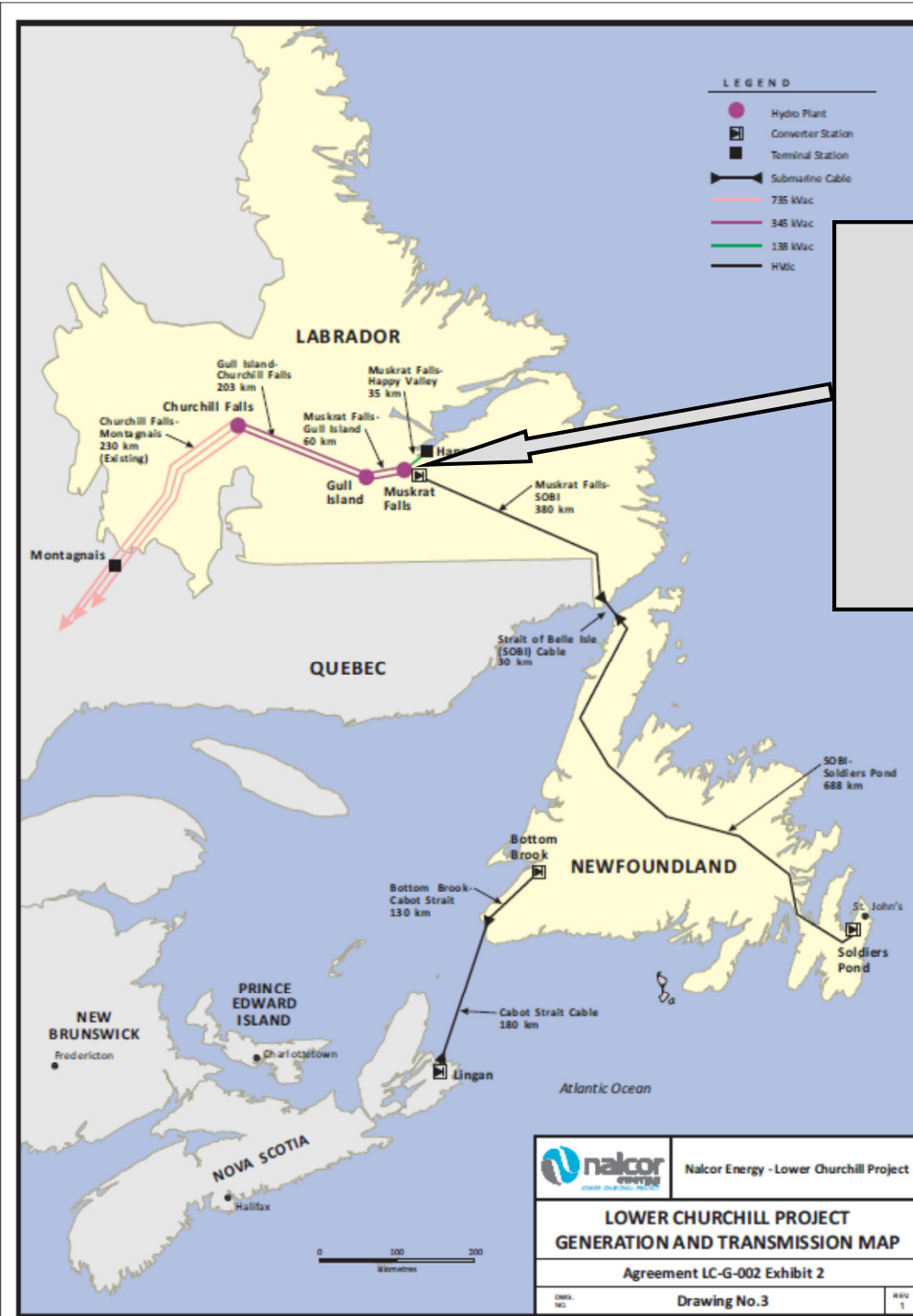
# Agreement LC-G-002: EPCM Services

## Physical Components Covered



**Note:** Strait of Belle Isle Cable Crossing: NOT IN SLI SCOPE

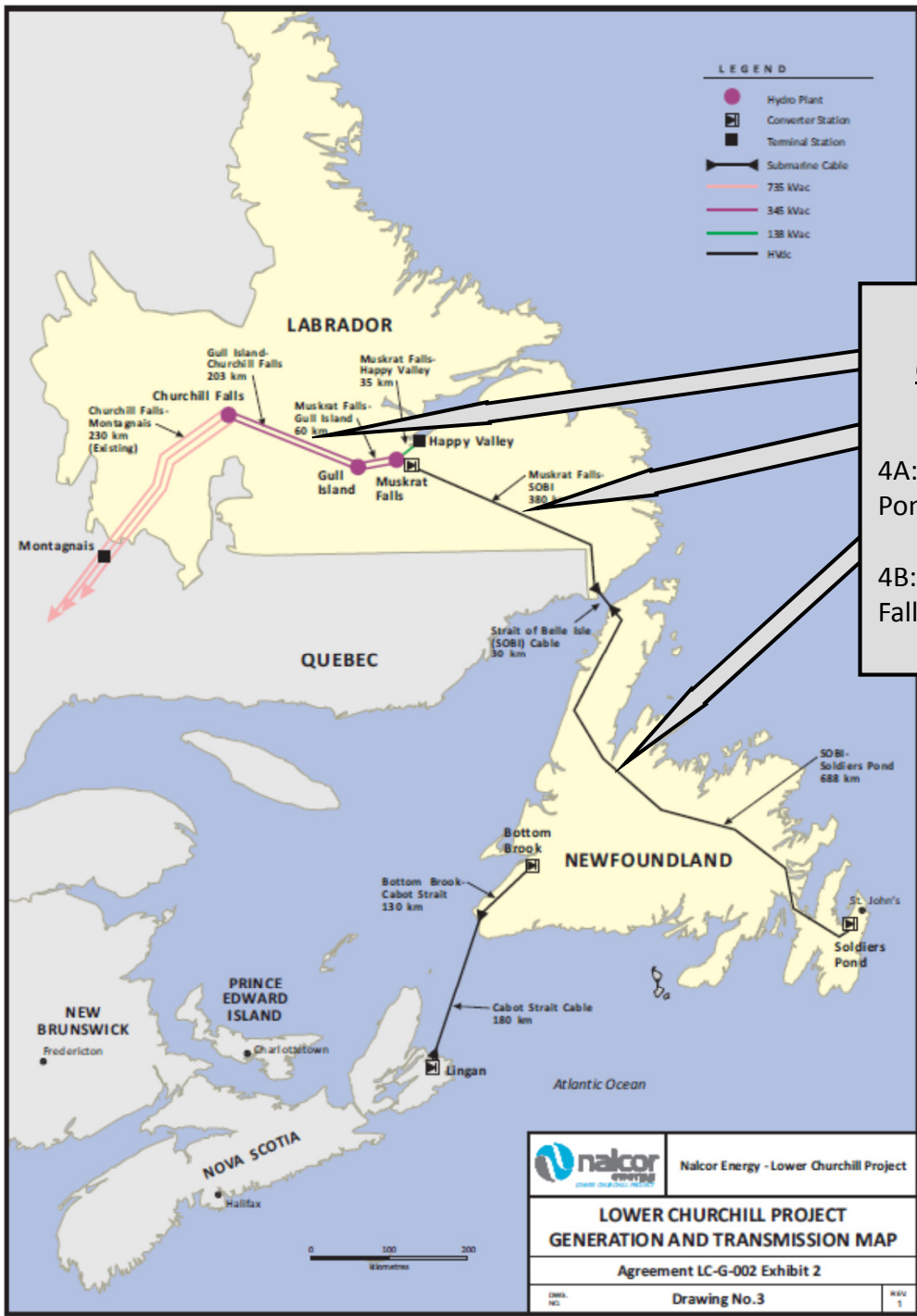
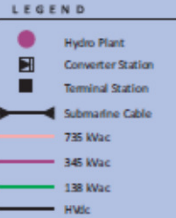
# SLI - EPCM Services



# SLI - EPCM Services



# SLI - EPCM Services

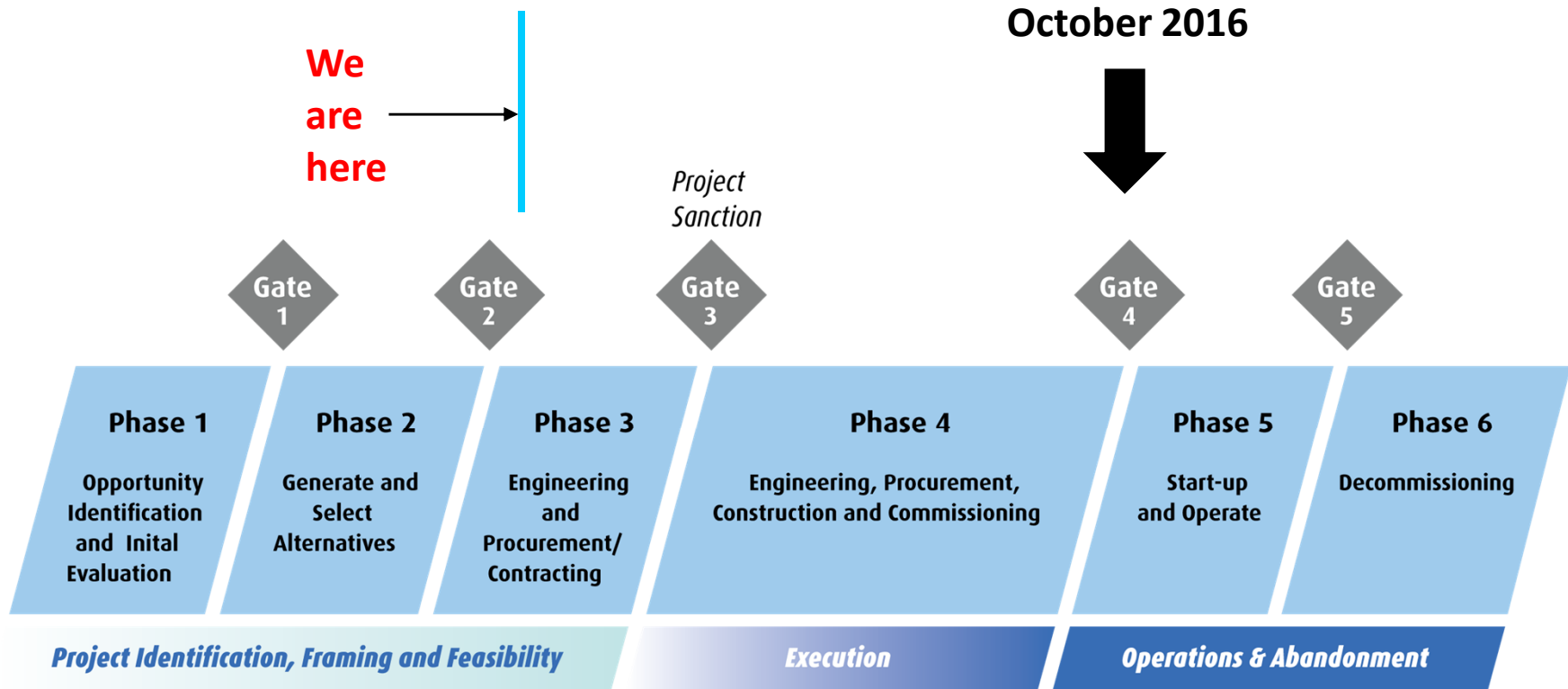


**Component 4**  
**Overland Transmission**

4A: Muskrat Falls to Soldiers Pond (HVdc)  
 4B: Muskrat Falls to Churchill Falls (HVAc)

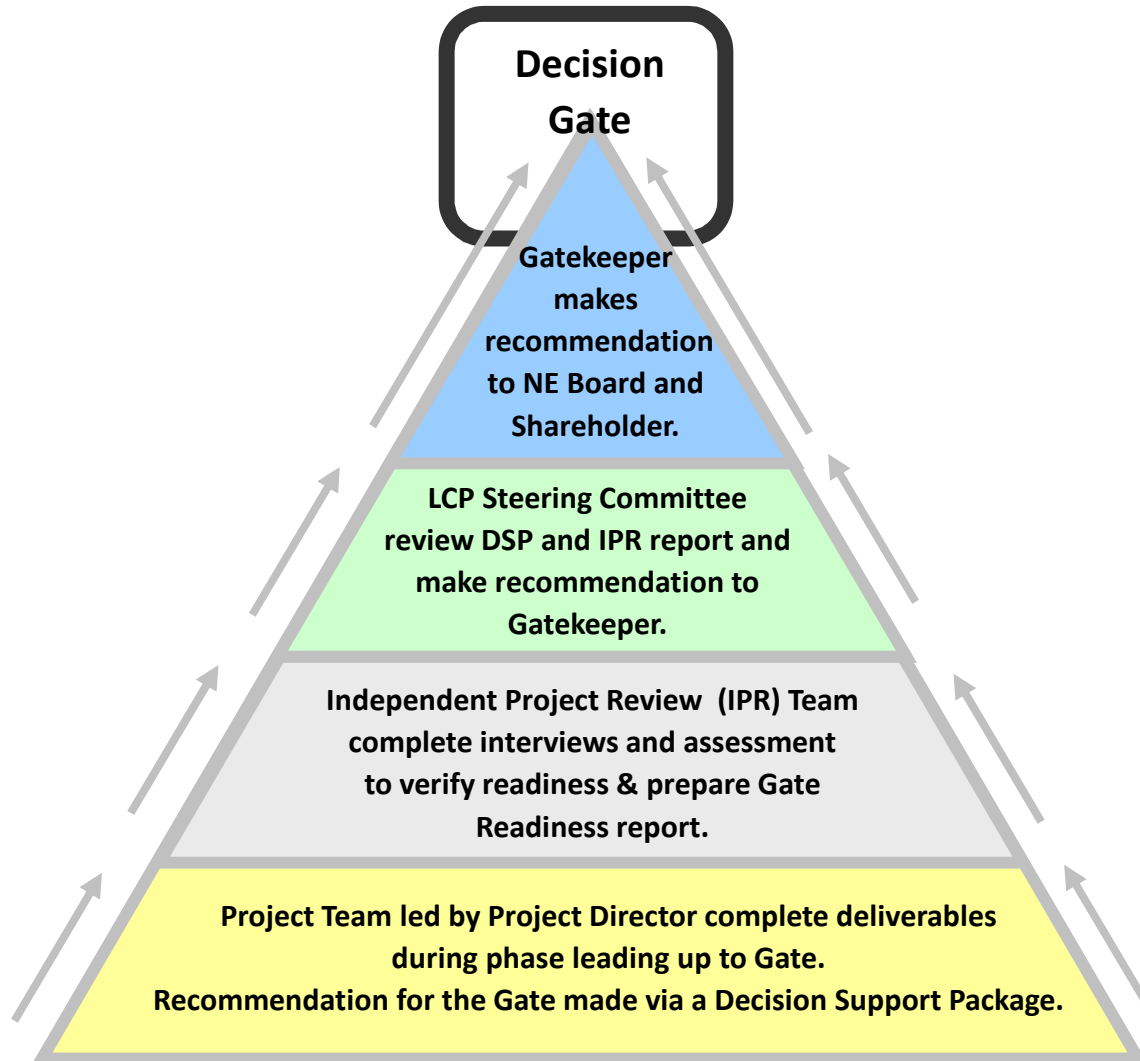
	Nalcor Energy - Lower Churchill Project	
	<b>LOWER CHURCHILL PROJECT</b>	
	<b>GENERATION AND TRANSMISSION MAP</b>	
	Agreement LC-G-002 Exhibit 2	
DRAWING NO.	Drawing No.3	PAGE 1

# NE-LCP Project Gateway Process





# Decision Gate Assessment Process



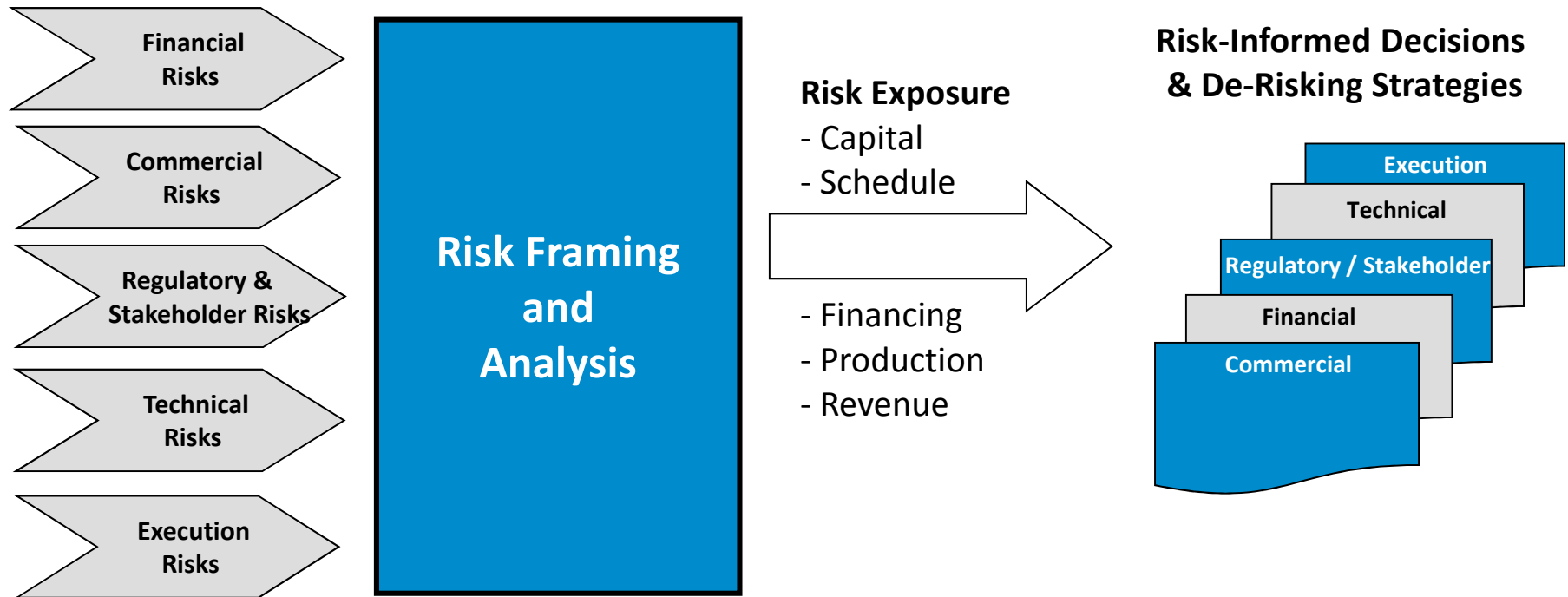
# Decision Gate Project Delivery Model

- Forces early planning and thought into what we really want to achieve – Front End Loading (FEL)
- Defines what is needed to make a decision
- Project path forward (Roadmap) is *decision* and *goal* oriented
- Improves performance on projects dramatically
- Proven method for Mega Projects world wide
  - Oil and gas, Hydro, Mining, Chemical, etc.

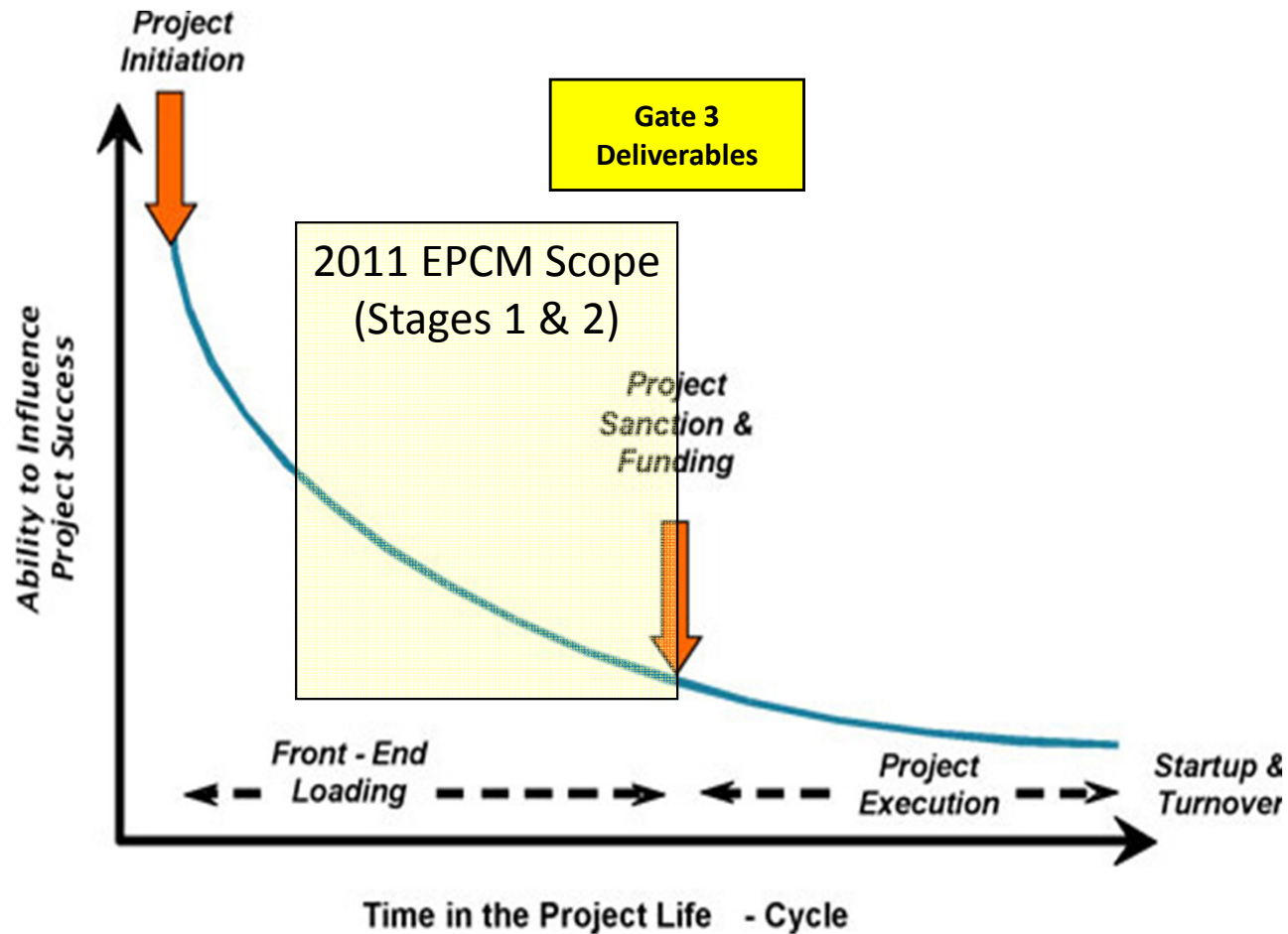
# Risk-Driven Front End Loading (FEL)

- FEL is a key indicator of predictability
- Work leading up to a Decision Gate (DG) is focused towards ensuring a full understanding of all Project risks.
  - Driver behind Decision Gate Key Deliverables
- Based on philosophy that if we understand the risks and opportunities, we make the right choice at the Decision Gate.

# Risk-Informed Decision Making at DG3



# Project Influence Curve



# Agreement LG-G-002

## Scope of Services

# Decision Gate 3 Readiness

## Scope of Services

- *EPCM Scope of Services* thoroughly describes the requirements needed for the Gate 3 Decision Support Package (DSP) and for overall Project Execution
- It has been produced specifically for the Lower Churchill Project

# Scope of Services – Focus Areas

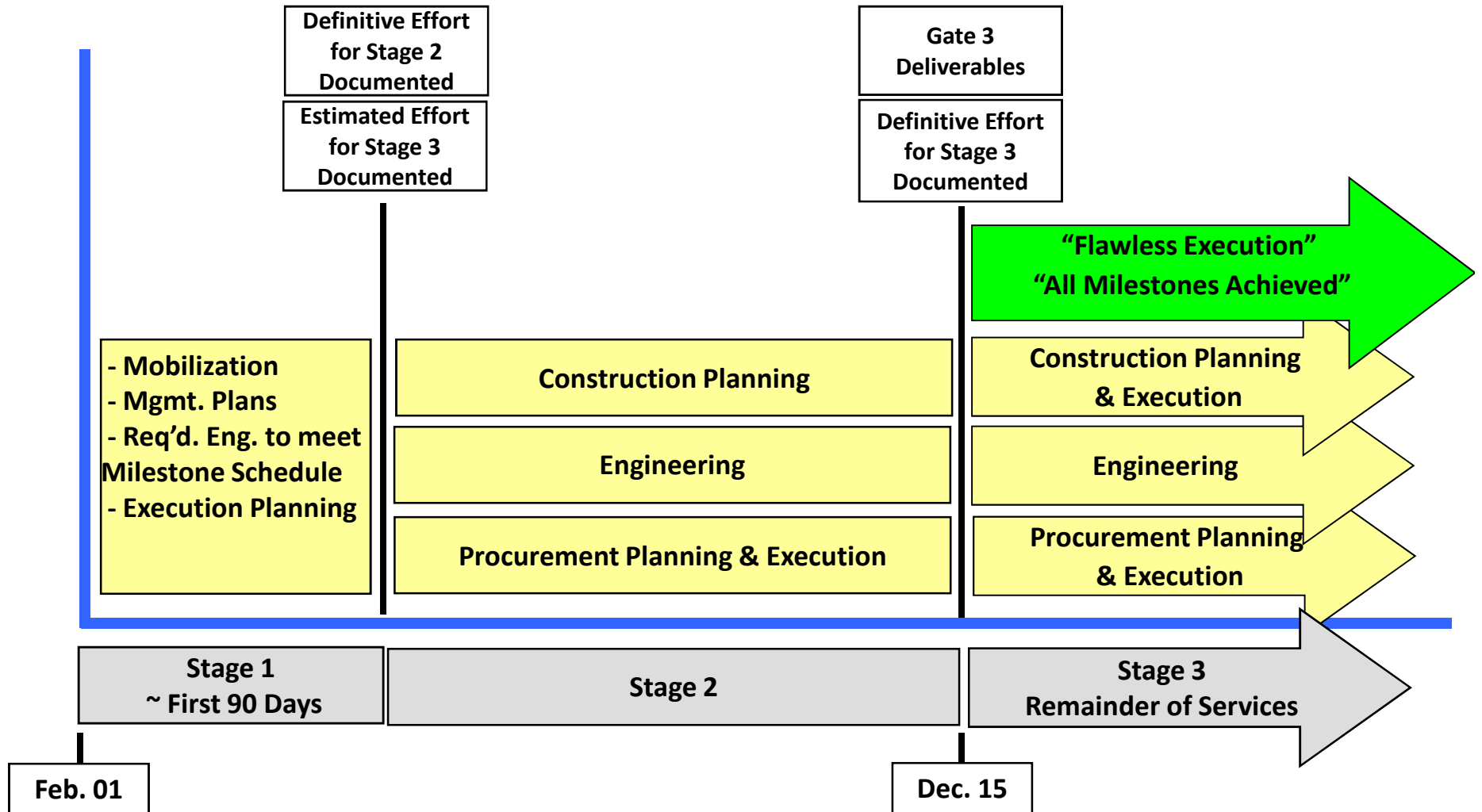
- Safety by Design
  - Environmental Management by Design
  - Risk Identification and Mitigation
  - Constructability in Design
  - Construction Planning
  - Construction Productivity
  - Understanding Labour scenario and associated mitigation planning
  - Value Improvement Practices
  - Asset Management considerations
  - System Engineering
  - Incorporation of Lessons Learned in design and execution
- Intense Construction Expertise Involvement**



# Expectations - SNC Lavalin

- Identify and implement all available value improving opportunities.
- Apply SLI's full capability
- Bring in the "A" team
- Rigorously apply SNC-Lavalin's corporate know-how and Corporate application of Processes, Procedures and Tools

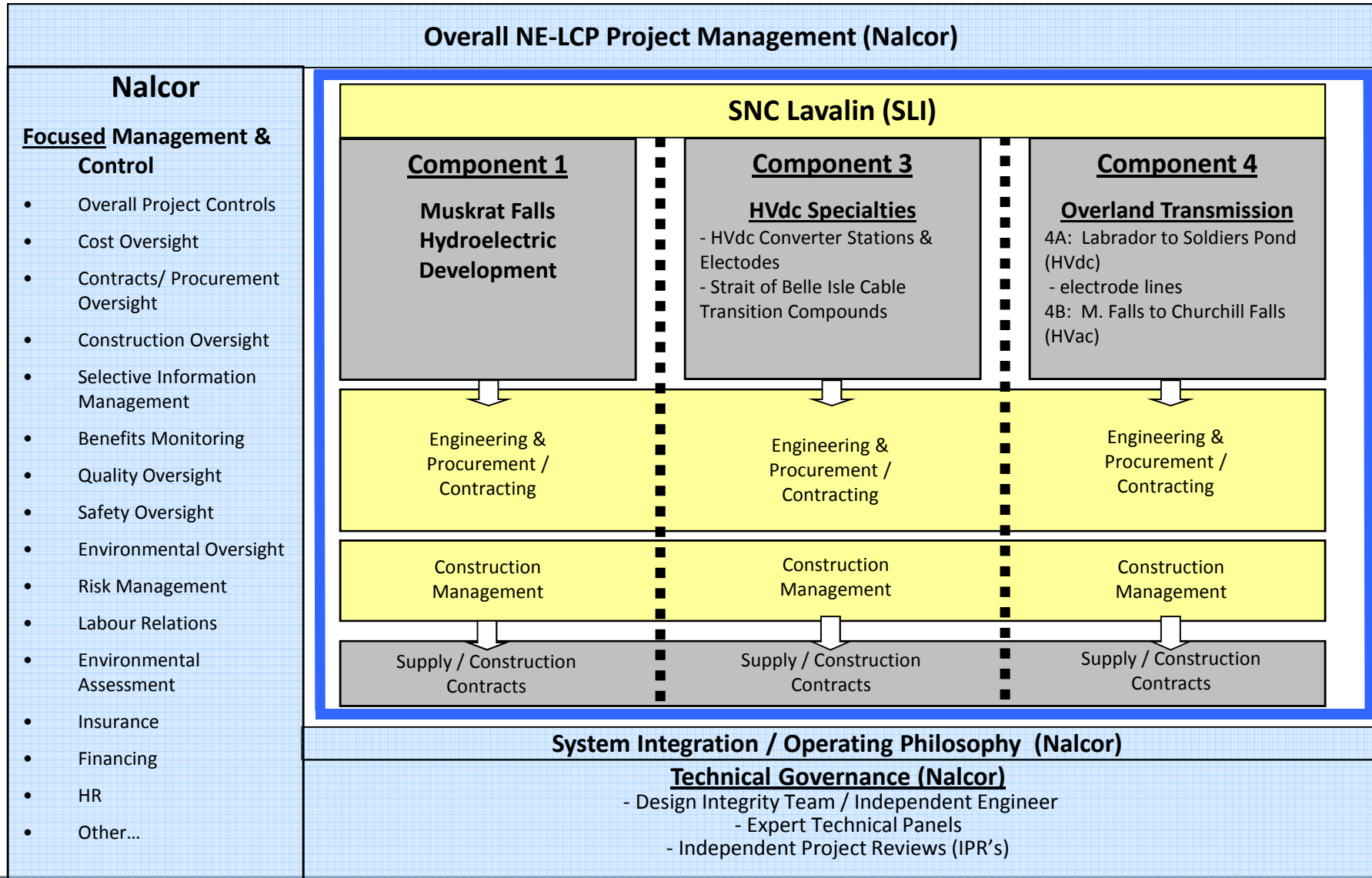
# EPCM Services – Staging



# Agreement LG-G-002

## Interfacing & Coordination Procedures

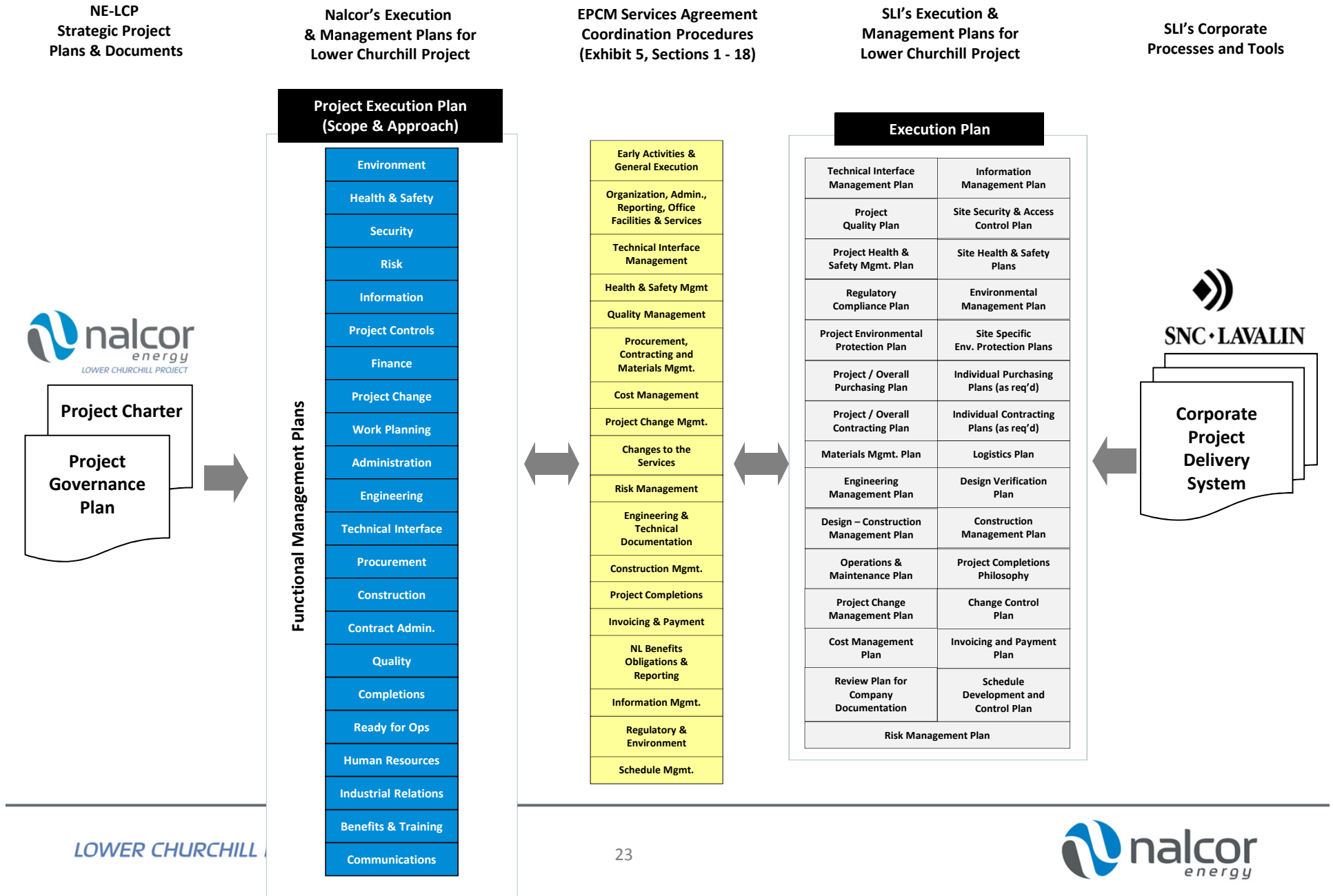
# Nalcor / SLI Responsibilities: Interface / Engagement



# Co-ordination Procedures

- Road Map for mutual success at executing elements of the Services
- Facilitate alignment between Nalcor and SLI
- Define interface points for transfer of information

# Project Management and Coordination using documented Management Plans



# Provision of Services

## Guiding Principles & Core Values

# Guiding Principles

- Successful delivery of the Project is paramount
- Unwavering corporate and staff commitment is fundamental to Project success
- Parties will be solution oriented, not problem focused
- Parties will be mutually collaborative and supportive
- Philosophically, contract changes between the Parties will not be a focus item
- Engineering will be executed in Newfoundland and Labrador
- Management of the Agreement between the Parties to be kept separate from Project execution



# Core Values

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

# Questions?

**EXHIBIT 2**

**PROJECT DESCRIPTION**

*PH*  
*ASD*

EXHIBIT 2.0

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ASP

## 1.0 Introduction

The Churchill River, located in the Province of Newfoundland and Labrador, Canada is a significant source of renewable, clean electrical energy; however, the potential of this river has yet to be fully developed. The existing 5,428 megawatt (MW) Churchill Falls Generating Station, which began producing power in 1971, harnesses about 65 per cent of the potential generating capacity of the River. The remaining 35 percent is planned to be developed via two sites on the lower Churchill River, known as the Lower Churchill Project (LCP).

## 2.0 Description of the LCP

The LCP consists of two undeveloped hydroelectric sites and associated transmission systems: Gull Island Hydroelectric Development, located 225 kilometres downstream from the existing Churchill Falls Generating Station; and Muskrat Falls Hydroelectric Development, located 60 kilometres downstream from the proposed Gull Island Hydroelectric Development. Combined, the developments can produce energy to supply up to 1.5 million households annually and contribute significantly to the reduction of air emissions from thermal, coal and fossil fuel power generation. In particular the developments would displace an estimated 16 megatonnes of carbon dioxide emissions annually from comparable production using coal thermal generation.

The Gull Island Hydroelectric Development will consist of a generating station with a capacity of 2,250 MW, while the Muskrat Falls Hydroelectric Development will consist of a generating station of 824 MW in capacity.

The transmission system(s) can include the following:

- A high voltage direct current (HVdc) system comprised of high voltage overhead lines crossing from Labrador to the island of Newfoundland via sub-sea cables, and associated converter stations.
- High voltage alternating current (HVac) overhead transmission lines interconnecting Gull Island to the existing Churchill Falls Generating Station, and
- High voltage alternating current (HVac) overhead transmission lines connecting the Muskrat Falls Hydroelectric Development to the Churchill Falls Generating Station.

There is potential for the Newfoundland transmission system to connect the island of Newfoundland to Nova Scotia via a 500 MW, bipolar, point to point, HVdc system comprised of  $\pm 200$  kV high voltage transmission lines, sub-sea cables, associated converter stations and related electrode sites.

### 3.0 LCP: Components, Development Options, and Project Framing

#### 3.1 General

The development option for the LCP that will be implemented by Company is Muskrat Falls Development – Scenario A, and the discrete Components (i.e. the Project) for which Consultant shall provide Services under this Agreement are Component 1, Component 3 and Component 4, all as described herein.

#### 3.2 Description of Components

For the purpose of this Agreement, the LCP is considered to be comprised of discrete physical Components, as follows:

- Component 1: Muskrat Falls Hydroelectric Development
- Component 2: Gull Island Hydroelectric Development
- Component 3: high voltage direct current transmission system specialties
- Component 4: high voltage overhead transmission lines (ac and/or dc) comprised of:
  - Sub-component 4A: HVdc overhead transmission lines Muskrat Falls to Soldiers Pond
  - Sub-component 4B: HVac overhead transmission lines Muskrat Falls to Churchill Falls

Physical descriptions of each of the noted Components 1, 2, 3 and 4 are described in the following sections 3.2.1, 3.2.2, 3.2.3, and 3.2.4. The physical descriptions are included herein to provide perspective as to the scope and magnitude of the elements of the respective Component, and are provided for information only. Values are preliminary and subject to revision.

Company stresses that the status of engineering is preliminary. Subsequent to the award of the Agreement, Consultant will be required to formally review all documentation and data provided by Company as listed in Part 2, Exhibit 6. Consultant's formal review process is described in Part 2, Exhibit 5, Section 11.

##### 3.2.1 Component 1 – Muskrat Falls Hydroelectric Development

Muskrat Falls is one of two hydroelectric developments being planned for the lower Churchill River. The remotely controlled nominal 824 MW Muskrat Falls Hydroelectric Development will be comprised of the following sub-components and associated ac connector lines to an ac switchyard:

- a) 34 km of access roads, including upgrading and new construction, and temporary bridges spanning the approach and discharge channels of powerhouse and spillway;
- b) A 1,500 person accommodations complex (for construction period);
- c) Reservoir preparation;
- d) Replacement fish habitat;
- e) A north roller compacted concrete (RCC) overflow dam;
- f) A south RCC dam;
  
- g) River diversion during construction via natural river channel for first two years and via the spillway for subsequent years;
- h) Gated spillway including:
  - Approach and discharge channels,
  - vertical lift gates,
- i) A close coupled intake and powerhouse, including:
  - 4 intakes with gates and trash racks,
  - 4 concrete lined water passages,
  - 4 turbine/generator units at approximately 206 MW each with associated ancillary electrical/mechanical and protection/control equipment,
  - 5 power transformers (includes 1 spare), located on the draft tube deck of the powerhouse,
  - 2 overhead cranes,
- j) ac switchyard at Muskrat Falls;
- k) Churchill Falls switchyard extension;
- l) Port Facilities at Happy Valley Goose Bay and Cartwright:
  - Investigations are required,
  - Potential upgrades may be necessary as a result of those investigations,
  - Extent of those upgrades will be determined in the future; and
- m) North spur stabilization.

### 3.2.2 Component 2 – Gull Island Hydroelectric Development

Gull Island is one of two hydroelectric developments being planned for the lower Churchill River. The remotely controlled nominal 2,250 MW Gull Island Hydroelectric Development will be comprised of the following sub-components and associated ac connector lines to an ac switchyard:

- a) 35 km of access roads, including upgrading and new construction, and a temporary bridge spanning the Churchill River for access to the south side of the river during construction;
- b) A 2,500 person accommodations complex (for construction period);
- c) Permanent accommodations – 40 person capacity;
- d) Reservoir preparation;

- e) Replacement fish habitat;
- f) Erosion control facilities for construction period;
- g) A concrete faced rockfill dam (CFRD), with upstream and downstream cofferdams
- h) River diversion
- i) Spillway including:
  - Approach and discharge channels, a flip bucket and plunge pool,
  - vertical lift gates,
- j) An intake structure and penstocks, including:
  - 5 intakes with gates and trash racks,
- k) Powerhouse and tailrace, including:
  - 5 turbine / generator units at approximately 450 MW each with associated ancillary electrical/mechanical and protection/control equipment,
  - 5 power transformers, located on a rock bench above the powerhouse,
  - 2 overhead cranes,
- l) ac switchyard;
- m) Churchill Falls Switchyard extension; and
- n) Port facilities at Happy Valley Goose Bay and Cartwright:
  - Investigations are required,
  - Potential upgrades may be necessary as a result of those investigations,
  - Extent of those upgrades will be determined in the future.

### 3.2.3 Component 3 – High Voltage Direct Current Transmission System Specialties

Component 3 consists of the HVdc converter station systems associated with the high voltage direct current (HVdc) transmission system for the LCP. The Component 3 HVdc projects will be comprised of the following:

- a) Muskrat Falls HVdc converter station:
  - HVdc bipolar converter station ,
  - 345 kV ac, converted to/from  $\pm 320$  kV dc,
  - Pole capacity of 450 MW, and
  - Shoreline pond electrode located on the Labrador side of the Strait of Belle Isle.

**NOTE:** The shoreline pond electrode will be connected to the converter station at Muskrat Falls with dual overhead conductors supported on a wood pole line. The wood pole line and conductors will form part of Component 4 described herein.

- b) Soldiers Pond HVdc converter station:
  - HVdc bipolar converter station,
  - 230 kV ac, converted to/from  $\pm 320$  kV dc,
  - Pole capacity of 450 MW, and
  - Shoreline pond electrode located on the east shore of Conception Bay.

ADD



**NOTE:** The shoreline pond electrode will be connected to the converter station at Soldiers Pond with dual overhead conductors supported on a wood pole line. The wood pole line and conductors will form part of Component 4 described herein.

c) HVdc Transition Compounds:

Strait of Belle Isle submarine cable terminations transition compounds

- One transition compound for each side of the Strait of Belle Isle submarine cable crossing,
- Associated switch works to manage the junction of multiple submarine cables and the overhead transmission line.

**NOTE:** For the purposes of this Agreement, the LCP does not include any infrastructure or any services associated with the actual crossing of the Strait of Belle Isle. Component 3 does include the Strait of Belle Isle transition compounds, as described in 3.2.3. c) above.

### 3.2.4 Component 4 – High Voltage Overhead Transmission Lines

The high voltage overhead transmission lines projects required for the LCP comprise high voltage alternating current (HVac) lines, high voltage direct current (HVdc) lines, and electrode lines described as follows:

#### 3.2.4.1 Sub-component 4A: HVdc Overhead Transmission Lines Muskrat Falls to Soldiers Pond

a) **Overhead Transmission Line:**

Transmission line from Muskrat Falls converter station to Soldiers Pond converter station (near St. John's, NL):

- 900 MW,  $\pm 320$  kV dc, bipole line, single conductor per pole,
- galvanized lattice steel guyed suspension and rigid angle towers, and
- 1100 km long.

Connections to HVdc transmission system specialties installations, as described in Component 3 herein, will be required.

b) **Electrode Lines:**

- (i) Dual overhead conductors supported on a wood pole line from Muskrat Falls converter station to the shoreline pond electrode located on the Labrador side of the Strait of Belle Isle.
- (ii) Dual overhead conductors supported on a wood pole line from Soldiers Pond converter station to the shoreline pond electrode located on the east shore of Conception Bay.

### 3.2.4.2 Sub-component 4B: HVac Overhead Transmission Lines Muskrat Falls to Churchill Falls

Transmission lines from Muskrat Falls to Churchill Falls:

- 2 – 345 kV ac, 3 phase lines, double bundle conductor,
- Single circuit galvanized lattice steel guyed suspension and rigid angle towers,
- 265 km long

### 3.3 Development Options

The initial development option for the LCP is Muskrat Falls Development – Scenario A.

#### 3.3.1 Muskrat Falls Development - Scenario A

Development comprised of:

- Component 1: Muskrat Falls Hydroelectric Development
- Component 3: high voltage direct current transmission system specialties
- Component 4: high voltage overhead transmission lines (ac and dc) comprised of:
  - Sub-component 4A: HVdc overhead transmission lines Muskrat Falls to Soldiers Pond
  - Sub-component 4B: HVac overhead transmission lines Muskrat Falls to Churchill Falls

Figure 1 in this Exhibit 2 pictorially presents the Muskrat Falls Development - Scenario A with associated Components indicated.

### 3.4 The Project

For the purposes of the Services to be provided by Consultant under this Agreement, the Project refers to the discrete Components of the overall LCP for which Consultant shall provide Services and includes Component 1, Component 3 and Component 4. (The Project does not include Component 2).

The term Project does not refer to the overall LCP.

#### Attachments

Dwg. No. 1 in this Exhibit 2 presents the preliminary physical general arrangement of Component 1 - Muskrat Falls Hydroelectric Development.

Dwg. No. 2 in this Exhibit 2 presents the preliminary physical general arrangement of Component 2 – Gull Island Hydroelectric Development.

Dwg. No. 3 in this Exhibit 2 presents the physical arrangement of the transmission facilities associated with the overall LCP.

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Lower Churchill Project: Development Option

# Muskrat Falls Development – Scenario A

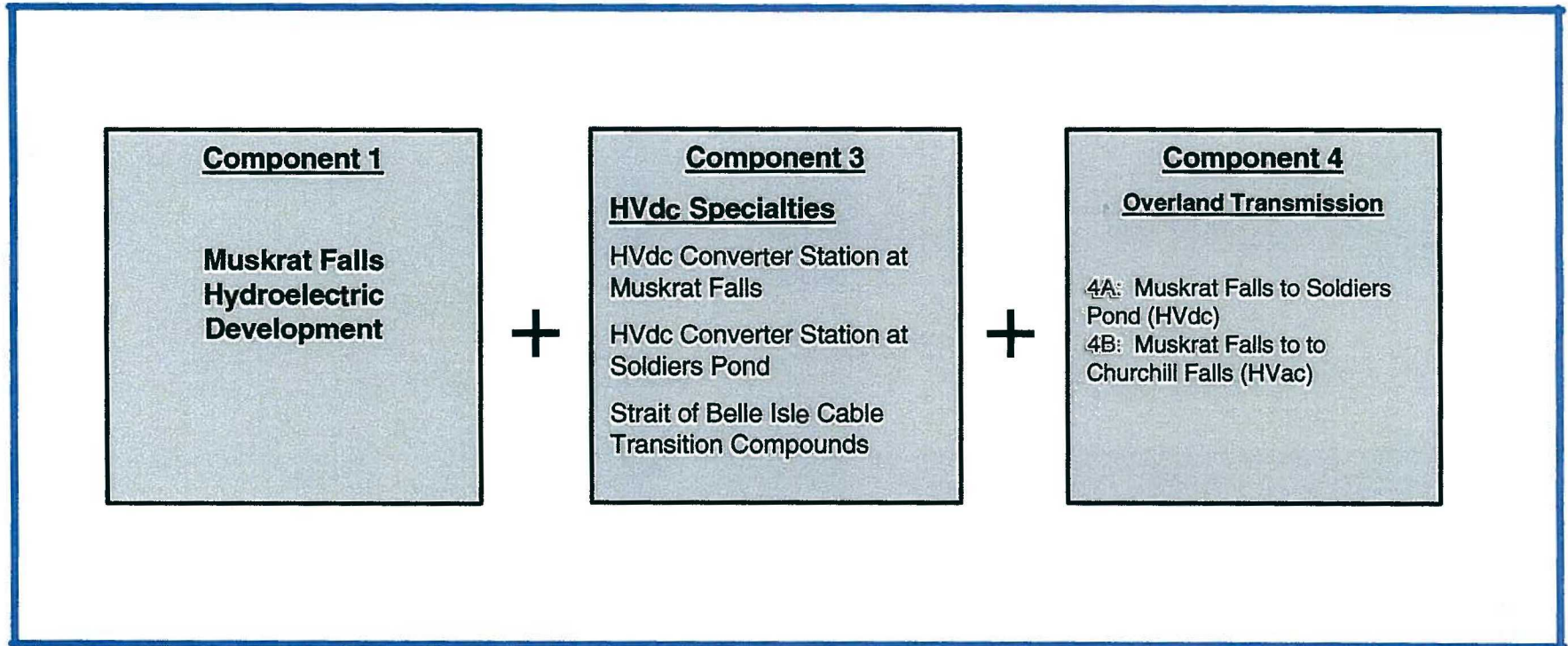
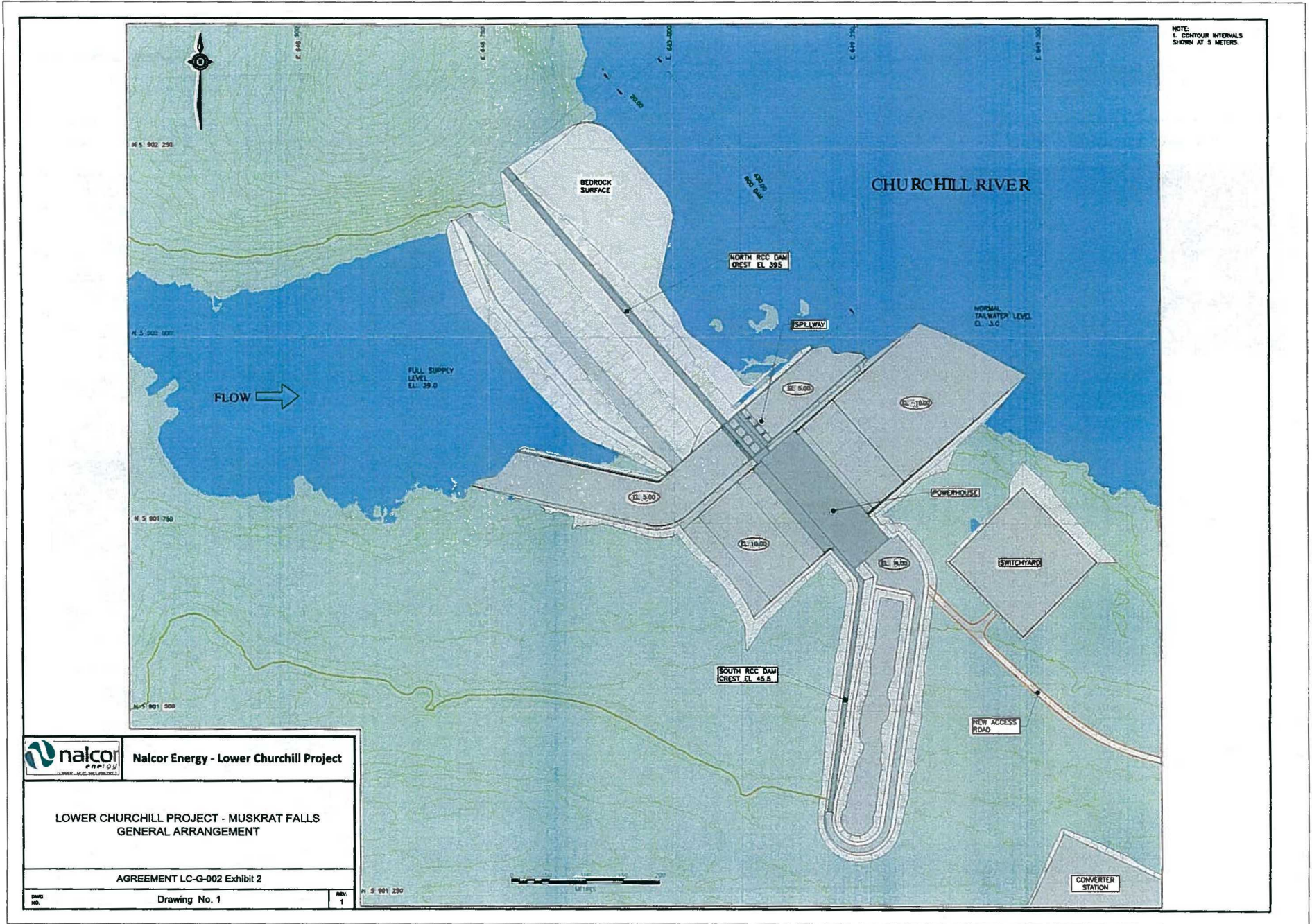


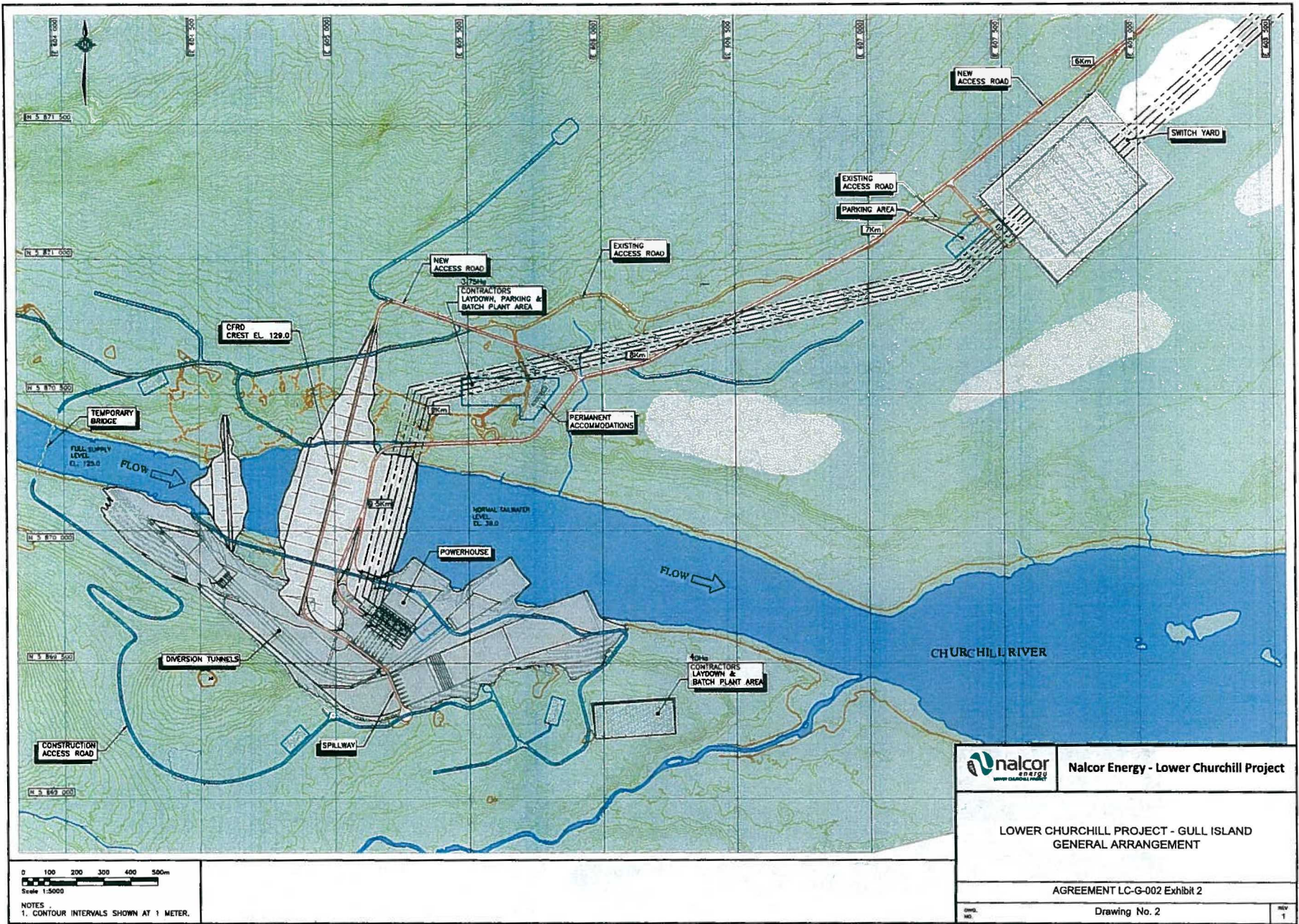
Figure 1: Muskrat Falls Development - Scenario A

ASD LC-G-002

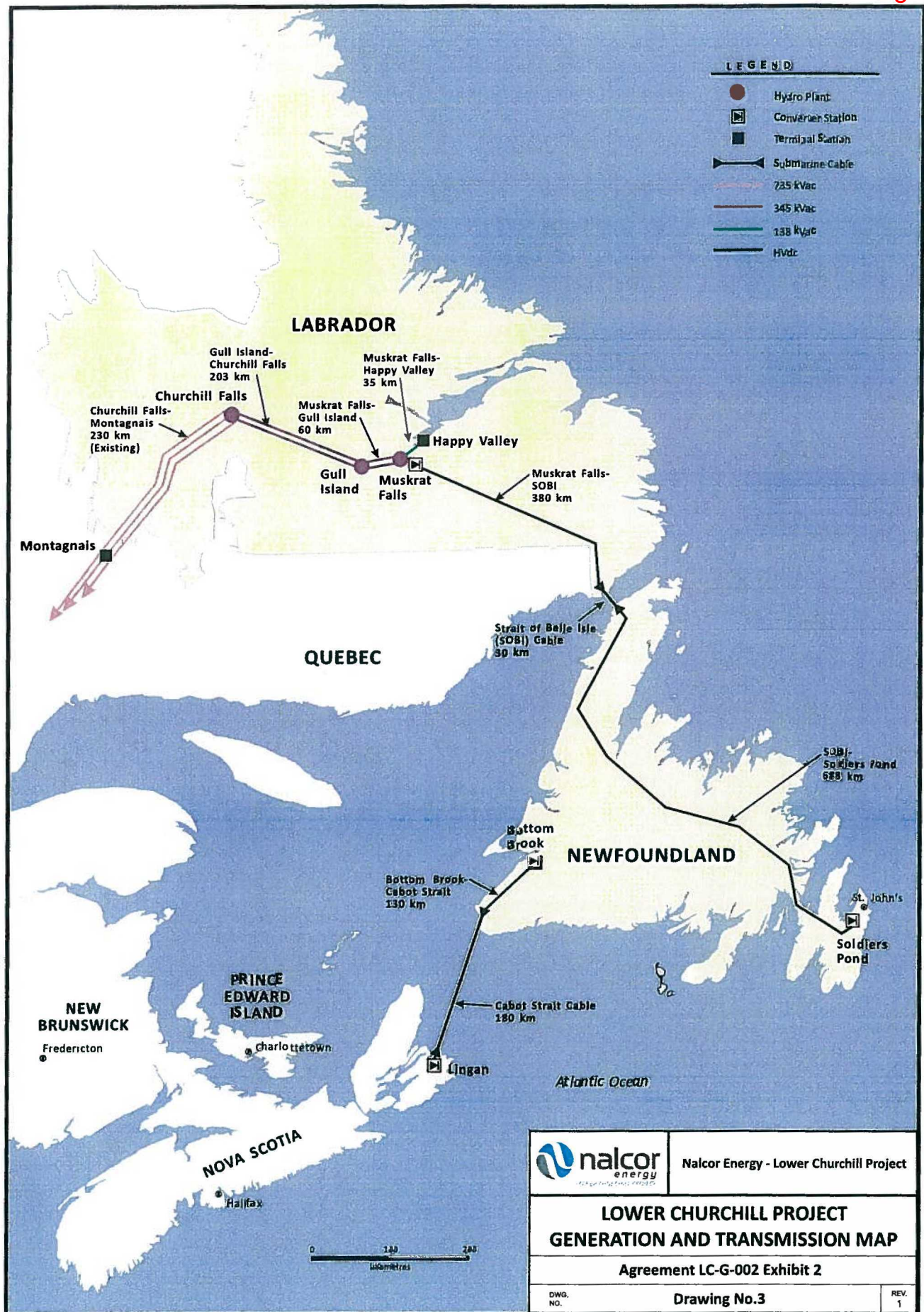




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**EXHIBIT 3**  
**SCOPE OF SERVICES**

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### 3.1 GENERAL

#### 3.1.1 Objectives and Guiding Principles

The objective of the Agreement is for Consultant to provide, in accordance with the Project Milestone Schedule, all Services including Engineering Services, Procurement Services, Construction Management Services, and other project management services to satisfactorily meet Company's requirements as outlined in the Agreement and as required for the implementation of the Project as defined in Exhibit 2.

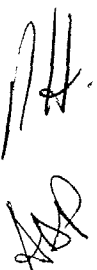
Consultant undertakes, in performing the Services, to fully cooperate and actively participate with Company in seeking beneficial ways to achieve Best Value for the Project and for the development option.

Consultant and Company negotiated the Agreement with the following principles as consideration for guidance during execution:

- Successful delivery of the Project is paramount;
- Unwavering corporate and staff commitment is fundamental to Project success;
- Parties will be solution oriented, not problem focused;
- Parties will be mutually collaborative and supportive;
- Philosophically, contract changes between the Parties will not be a focus item;
- Engineering will be executed in Newfoundland and Labrador. Specialized Engineering may occur outside the Province subject to Company approval and in compliance with the terms of Exhibit 9.
- Management of the Agreement between the Parties to be kept separate from Project execution.

Throughout the provision of Services, it is expected that Consultant and Company will espouse Nalcor Energy's core values:

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

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### 3.1.2 Complete Scope of Services and Responsibility

Consultant is responsible for carrying out and providing, in accordance with the Agreement, design development, engineering including all follow-on engineering, procurement including all necessary contracting, construction management including management of specific Project Completions activities including Mechanical Completion, project management services including management of its Engineering Services, Procurement Services, and Construction Management Services as well as other project management services described herein, co-ordination with Company, Other Consultants, Contractors and Suppliers, and any other activities necessary to realize the Agreement objectives set out in Section 3.1.1.

Consultant shall provide all required resources and do everything necessary to perform and complete the Services satisfactorily in accordance with the Agreement.

Consultant shall, for the duration of the Agreement, assign the necessary qualified and experienced Personnel, facilities, equipment, supervision, tools and all materials, supplies, and other resources, and also use acceptable and efficient work processes required to realize the objectives of the Agreement.

The requirements described in Sections 3.2 to 3.10 herein and the Services to be provided under the Agreement are applicable, where relevant, to each discrete Component which comprises the Project as defined in Exhibit 2.

Company reserves the right to extend the Agreement to include any Components, including Gull Island, of other LCP development options as well as any scope associated with the connection of the Newfoundland transmission system to Nova Scotia.

### 3.1.3 Conformance of the Services

Consultant shall provide the Services to conform to the Company Supplied Data and all other requirements of the Agreement.

No deviations to the Company Supplied Data are to be made by Consultant without prior written approval from Company.

### 3.1.4 Staging of the Services

The Services shall be provided in Stages as described in Exhibit 4.

The staging of the Services is relevant solely to the determination of the Fixed Fee, as is more fully set out in Exhibit 4, and shall not reduce, vary or modify the nature or extent of the Services described in this Exhibit 3.

## 3.2 ENGINEERING SERVICES

### 3.2.1 General

Engineering Services includes the provision of complete engineering services including engineering management and supervision of engineering-specific Personnel for the Project.



Engineering Services shall be provided throughout all phases of Project implementation extending to start of Operations phase.

Engineering Services includes all Detailed Design and engineering necessary to meet the requirements of the contracts plan for the Project, and includes all Detailed Design Documentation including preparation of Design Briefs, design reports, engineering drawings, documents, technical specifications, functional specifications, and other technical content for inclusion in contract and procurement packages (both pre and post contracts award), system engineering, as well as the provision of analytical and technical support through to Project closeout. Engineering Services also includes all engineering required for the Mechanical Completion, Preservation, handover for commissioning, commissioning and turnover to Operations of all Project equipment and infrastructure, and includes all procedures and manuals required for those activities.

All Engineering Services shall be performed by experienced Personnel, and Consultant shall use the necessary tools, supplied by Consultant and endorsed by Company, to perform the Engineering Services in a professional manner and in accordance with accepted engineering practices. Consultant Personnel shall, as part of the provision of Engineering Services, provide all necessary support to the Project's contracting, procurement and construction activities.

### 3.2.2 Company Supplied Data

Significant engineering work was carried out by Company from 2007 through to 2010. A complete listing of the relevant documentation (as well as a selected listing of earlier study reports from 1997-2000 timeframe), is contained in Exhibit 6. Consultant shall develop the design and engineering for the Project using the information contained or referenced in the documents included in Exhibit 6. It is noted that a broader base of study reports dating back to the 1960's is also available in-house. As a result of the earlier work, the overarching Project definition is now in place as described in the "Lower Churchill Project – Basis of Design", document number LCP-PT-ED-0000-EN-RP-0001-01 listed in Exhibit 6. Services provided under the Agreement will build on, and not duplicate, the earlier work. Any deviations from the "Lower Churchill Project – Basis of Design" shall be strictly managed in accordance with the Project Change management requirements as described in Exhibit 5, Section 8 and detailed within the processes of Consultant's Project Change Management Plan.

### 3.2.3 Asset Management Considerations

Company believes it is vital to consider the long-term asset management during the engineering and design phase of the Project. Company defines Asset Management as *"the comprehensive management of asset requirements, planning, procurement, operations, maintenance, and evaluation in terms of life extension or rehabilitation, replacement or retirement to achieve maximum value for the stakeholders based on the required standard of service to current and future generations."*

Consultant shall ensure that Company's Asset Management principles are clearly embedded within all engineering and design activities for the Project, and ensure that the final design achieves the desired balance between cost and reliability.

### 3.2.4 Specific Services

Consultant shall, for each Component comprising the Project:

- (i) Identify all engineering deliverables, in total and for each discipline, and compile a complete deliverables listing necessary for the Services, and submit these for Company's review and acceptance;
- (ii) Identify activities associated with each deliverable and develop an estimate of person-hours to complete each activity;
- (iii) Schedule all activities and deliverables to completion to achieve the milestones contained within the Project Milestone Schedule;
- (iv) Develop and maintain a detailed critical path logic network for all engineering activities;
- (v) Complete all activities and deliverables in accordance with the Project Control Schedule;
- (vi) In accordance with Exhibit 5, Section 11, develop and implement a Review Plan for Company Documentation;
- (vii) During production of deliverables and on receipt of any further Company Supplied Data (hard and electronic copy), Consultant shall check, re-number (re-reference) and correct all cross-references;
- (viii) Prepare a detailed design procedure for each engineering discipline, and submit for Company's review and comment. The procedure shall include, as a minimum, design planning, preliminary design, detailed design, design reviews, design changes, design verification, and, if required, design validation;
- (ix) Produce a design suitable for efficient, economic, and safe construction and operation of the Project;
- (x) Prepare all procedures and manuals required for the Mechanical Completion, Preservation, handover for commissioning, commissioning and turnover to Operations, operation and maintenance of all Project equipment and infrastructure;
- (xi) Produce as-built drawings and update all design documentation to reflect all changes incorporated during construction and commissioning;
- (xii) Coordinate all Factory Acceptance Testing (FAT) and Site Integration Testing (SIT) and develop FAT/SIT procedures including provision for any Company witnessing and acceptance;
- (xiii) Strictly adhere to Consultant's Project Change Management Plan that has been accepted by Company; and
- (xiv) Develop Preservation specifications and a Preservation program for all equipment, materials, and other Project purchased items that will be supplied from Contractors and Suppliers for implementation through all phases of Mechanical Completion, handover for commissioning, commissioning and turnover to Operations.



**3.2.5 Engineering Activities Related to Procurement and Contracts**

Consultant shall:

- (i) Perform all engineering and produce all documents (drawings, material requisitions, specifications, reports, procedures, detailed bills of material, etc.) necessary for the efficient procurement of Procured Goods and Contracts;
- (ii) Identify any deviations of Contractors' and Suppliers' design Standards/design from the Agreement requirements and take appropriate action to ensure Contractors' and Suppliers' deliverables comply with the Agreement requirements;
- (iii) Update all related Consultant's deliverables/documents including specifications where applicable, and carry out any updates to deliverables/documents and/or additional specifications as required, to meet Project requirements;
- (iv) Review, accept, and incorporate into Company's Asset Management system, as applicable, Contractor and Supplier engineering data contained in relevant deliverables;
- (v) Control and coordinate all interfaces that impact procurement;
- (vi) Respond to Contractors' and Suppliers' queries in a timely manner;
- (vii) Participate actively in Quality surveillance activities (such as technical audits, inspections and tests) to verify and assure satisfactory Quality performance by Contractors and Suppliers prior to release for shipment;
- (viii) Develop cost estimates for procurement of goods and materials required for the Project; and
- (ix) Ensure Contractors and Suppliers provide drawings, documents, specifications, manuals and procedures, as specified in contracts / purchase orders, which meet Company's requirements.

**3.2.6 Engineering Activities Related to Construction**

Consultant shall:

- (i) Perform all engineering and produce all documentation necessary for the efficient construction and Completions of the Project;
- (ii) Control and coordinate all interfaces that impact design, fabrication, construction, Mechanical Completion, Preservation, and handover for commissioning;
- (iii) Establish adequately staffed Site teams to perform technical assessment of the Work, and to co-ordinate engineering information between the Site(s) and Consultant's central location;
- (iv) Respond to all Site queries in a timely manner. All Site queries shall be managed including logging and tracking by Consultant;
- (v) Participate actively in Quality surveillance activities (such as technical audits, inspection and tests) to verify and assure satisfactory Quality performance by Contractors;
- (vi) Develop and implement protocols for consideration and inclusion of constructability

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- requirements throughout engineering;
- (vii) Maintain a warranty register for all supplied equipment and ensure warranty is triggered when equipment is first commissioned at the Site(s);
  - (viii) Develop and establish a strategy for dealing with warranty and performance claims for acceptance by Company. Consultant shall establish and maintain a warranty and performance claims register and provide copy to Company on a monthly basis. The claims register shall be kept up to date to reflect the status of activity on each claim. Consultant shall provide due diligence in obtaining timely information to enable timely claims analyses to be performed; and
  - (ix) Provide initial survey control for the general layout of the Work.

### 3.2.7 Engineering Disciplines' Administration and Supervision

Consultant shall:

- (i) Plan, allocate, supervise, control and provide technical support for all engineering disciplines in relation to the Services to the highest Quality level;
- (ii) Prepare and update document/drawing registers;
- (iii) Perform discipline technical reviews of documents/ drawings to ensure adequacy and Quality of discipline design as well as conformance with safety and environmental design and Quality requirements;
- (iv) Ensure adherence to Consultant's Project Change Management Plan, as are described in Exhibit 5, Section 8;
- (v) Arrange, coordinate and attend Hazard and Operability (HAZOP) and Hazard Identification (HAZID) review sessions;
- (vi) Perform Safety Integrity Level (SIL) studies, value improving practices (constructability), and design reviews;
- (vii) Arrange engineering discipline meetings, meetings with Company, interface meetings, and any other meetings required for the effective performance of the Engineering Services; and
- (viii) Ensure that each discipline conforms to Agreement requirements, particularly as related to work practices and documentation.

### 3.2.8 Interdiscipline Checking / Technical Co-ordination

Consultant shall:

- (i) Perform thorough interdiscipline checks of documents/ drawings to ensure design interfaces have been adequately addressed;
- (ii) Ensure thorough interdiscipline technical review meetings are conducted as required;
- (iii) Check and comment on documents/ drawings received from external sources in a timely manner; and
- (iv) Provide technical input to and co-ordination with various disciplines/departments to

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ensure interdisciplinary consistency and compatibility.

### 3.2.9 Engineering Activities Related to Contractor / Supplier Selection and Performance

Consultant shall:

- (i) Participate in technical review and evaluation of submitted bids;
- (ii) Participate in pre-award meetings;
- (iii) Provide technical input to bid summary and recommendation report as required;
- (iv) Provide updated technical data as required for inclusion in purchase order and contract documents;
- (v) Promptly review and process engineering and other data as provided by Contractors and Suppliers;
- (vi) Promptly respond to clarifications, concession requests, etc. as issued by Contractors and Suppliers;
- (vii) Participate in kickoff meetings, FAT and SIT and associated meetings;
- (viii) Attend witness or hold points to ensure that materials and equipment are supplied to the appropriate Quality; and
- (ix) Participate in prequalification / assessment of Contractors and Suppliers

### 3.2.10 Engineering Activities Related to Health, Safety, and Environment (HSE)

Safety, health, and safeguarding of the environment are Company core responsibilities. Company promotes a philosophy that places emphasis on the strong consideration of safety and environment within the engineering and design activities. The goals are to:

- Promote inherent safety and environmental considerations in the Project;
- Achieve safer and environmentally acceptable constructability, operability, and maintainability of the Project;
- Assist with achieving a workplace where “Zero Harm - Nobody Gets Hurt”;
- Ensure safety-by-design is considered;
- Minimize environmental effects by:
  - Design
  - Mitigation
  - Avoiding interactions, and
  - Design of changes which reduce the effects of interactions.

Consultant shall embed the concept of safety-by-design philosophy into the completion of the engineering activities. Consultant shall take all necessary measures to ensure health, safety and environment safeguarding are rigorously considered throughout the provision of Services and throughout the implementation of all Work.

In line with Company's Asset Management expectations and safety-by-design philosophy, Consultant shall be required to assemble and summarize all relevant safety and environmental engineering studies in a safety and environmental evaluation document. This document shall demonstrate that the Project elements have been designed and constructed to enable safe and environmentally responsible operation of the equipment and infrastructure. This may require, where appropriate, the use of risk assessment techniques such as Quantitative Risk Assessment (QRA). Consultant shall be required to present a summary description of the Project and the attendant safety critical elements and features and how these control the risks. Consultant shall be required to present a summary of any particular operational management or maintenance requirement(s) arising out of the design, which will need to be followed during the operation of the Project.

Consultant shall carry out all engineering activities and studies related to HSE in accordance with the safety-by-design philosophy, environmental mitigation philosophy and environmental rehabilitation philosophy and associated philosophies.

### 3.2.11 Engineering Activities Related to Materials

#### Material Selection Related to Consultant's Design

Consultant's material selection will be subject to Company's acceptance.

#### Material Selection Related to Consultant's Procurement

Consultant shall review Contractors' and Suppliers' materials selection and ensure it is consistent with the Consultant's design. Appropriate Quality assurance and control (material identification, traceability, Quality records, etc.) shall be employed during all phases of equipment manufacturing to ensure all material requirements are met.

#### Corrosion Protection

Consultant shall comply with the coating specifications and coating systems accepted by Company for all internal and external surfaces. Consultant shall develop, for Company's acceptance, detailed specifications for coating systems and for Preservation of coating systems prior to final turnover to Operations.

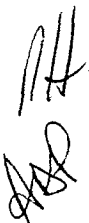
### 3.2.12 System Engineering

Consultant shall execute system engineering as part of the Services. This will include:

- Verification of Project technical interfaces among Consultant, its Subcontractors, Company, Other Consultants, Contractors and Suppliers; and
- Verification of Consultant's designs to function with other designs to form a complete system, free from unacceptable weaknesses.

Consultant shall clearly identify all internal interdependencies and all interdependencies among Consultant, its Subcontractors, Company, Other Consultants, Contractors, and Suppliers for the various parts of the Project;

Consultant shall perform system engineering to verify system integrity when changes to the design occur;



Consultant shall take all necessary measures to fully support Project's system engineering requirements and activities;

With respect to consideration of system interfaces with other Components that may fall outside of Consultant's scope of Services, Company (or Other Consultants acting on behalf of Company's behalf) will provide direction to Consultant;

Consultant's Technical Interface Management System shall be used as a tool to help manage system engineering.

### 3.2.13 Final Documentation

Consultant shall prepare final documentation for the Project in accordance with Company's final documentation requirements and shall include all engineering documentation and data produced by Consultant as well as documentation produced by Contractors and Suppliers. Documentation and data shall be made available prior to the start of operator training.

All documentation and data submissions shall be in accordance with the requirements of Exhibit 5, Section 16. The requirements outlining the management of documentation / data including Company's interfacing, review and receipt requirements shall be facilitated by means of the Central Document Register which shall be produced by Consultant and accepted by Company. Company's review requirements shall be outlined in the register.

Consultant shall control all documentation / data in accordance with Company's requirements contained in Exhibit 5, Section 16. Consultant shall copy, file, and retain copies of the final manufacturer documentation / data for inclusion into the final documents to be handed over to Company prior to the Termination Date.

Throughout the provision of Services, Consultant shall provide Company with on-line access to, or electronic copies of, all relevant documentation / data, in addition to providing relevant hard copy documentation / data, all as outlined in Exhibit 5, Section 16.

#### Operating Procedures/ Manuals

Consultant shall prepare detailed operating manuals for all systems. The associated operating manuals shall be stand-alone documents, separate from all other requirements identified in the final documentation specification including Supplier data dossiers.

The operating manuals shall be specific to the Project and to the equipment actually installed. Generic pamphlets, leaflets and other suppliers' documentation of a similar nature shall not be accepted. The operating manuals shall include start-up, normal operation, normal shutdown, and emergency shutdown instructions. The operating instructions shall describe all operating parameters and product specification requirements. Operations covered shall include the following:

- Description of facilities;
- Normal operation, key operating parameters, operating constraints;
- Control system operation;
- Recommended pre-checks prior to commissioning;
- Units commissioning, start-up, operation, and shut-down;

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- Emergency shut-down, includes partial and total shutdown; and
- Safety & fire protection system;
- Environmental protection plan for operation, including monitoring and surveillance activities.

Consultant shall include any information and instructions noted in Company's final documentation requirements.

#### Maintenance Manuals

Consultant shall prepare detailed maintenance manuals for each system.

The maintenance manuals shall consist of all system manufacturing data books/ catalogues, operating and maintenance manuals and any other information and instructions noted in Company's final documentation requirements and master Supplier data requirements list.

Consultant shall expedite, receive, log, and review all information including data books/catalogues, operating and maintenance instructions to verify that all information is complete.

Generic pamphlets, leaflets and other suppliers' documentation of a similar nature shall not be accepted.

#### Maintenance Support

Consultant shall develop, for Company's acceptance, a procedure for providing Company with information that Company requires to integrate all maintenance and spare parts information into Company maintenance management system. Consultant's information shall be in general accordance with Company requirements.

Consultant shall submit the procedure referred to above within 6 months of the Effective Date.

#### Final Documentation

Consultant shall provide final documentation including:

- User guides;
- Design books;
- Design criteria;
- Statistical reports;
- Health and Safety plan;
- HSE and design philosophies;
- Environmental Protection Plan for construction and operations;
- Consultant, Contractor and Supplier Quality Plans;
- Safety-related deliverables for the Project;
- Operating specifications and manuals;
- Maintenance manuals;
- Manufacturing data books;

- Procurement-related data;
- Spare parts list;
- Fabrication dossiers;
- System test dossiers;
- Installation dossiers;
- Hydrotest dossiers;
- Mechanical Completion and testing records and dossiers including punch lists;
- Certification dossiers;
- Commissioning dossiers;
- Change control records;
- Contract specifications and procedures;
- As built documents and drawings, including those produced by Consultant, Subcontractors, Suppliers and Contractors;
- Handover of electronic files, including the document/drawing database and engineering database;
- Equipment registration (for material and maintenance system);
- Equipment and instrument dossiers;
- Hydraulic and line list dossiers;
- Instrument data sheet dossier (shall include all Consultant produced data sheets and Supplier supplied data sheets in one volume);
- Electronic models and files; and
- All software, data files and programs associated with control systems and equipment, as available.

#### 3.2.14 Operator Training

Consultant shall assist Company in developing training requirements for operator training. Training requirements shall include recommendations from equipment Suppliers.

Consultant shall facilitate visits to Contractors / Suppliers facilities, especially during FAT and Completions, to gain early knowledge of the equipment and systems. Company Operations Personnel will attend such visits, as arranged by Consultant. Consultant shall provide test procedures to Company Operations Personnel prior to commencing FAT.

#### 3.2.15 Design Liability / Responsibility

Design liability / responsibility for Detailed Design performed by Consultant shall be as per the Agreement.

Design liability / responsibility for the functional specifications produced by Consultant required for inclusion in selected Engineering, Procurement, and Construction type contracts wherein the successful Engineering, Procurement, and Construction Contractor(s) will

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perform detailed design as well as procurement and construction activities, shall reside with Consultant.

Design liability / responsibility for detailed design performed by others as part of their contractual obligations under Engineering, Procurement, and Construction type contracts will reside with the successful Engineering, Procurement, and Construction Contractor(s) and not with Consultant.

### **3.2.16 Value Improving Practices**

Company is a strong proponent of the use of value improving practices as a means to improve cost, schedule and operability / reliability of the LCP.

Consultant shall provide the Services to ensure that best overall value is achieved for Company. Consultant shall be proactive in identifying and implementing value improving practices with regard to the optimizing the provision of the Services and to generate a Project design that is efficient and cost effective. Alternatively, Company reserves the right to introduce value improving practices to improve business practices specific to the Services. Where process or technology changes impact Consultant, Consultant shall be required to adopt the process changes or technology into its work practices as directed by Company.

Consultant shall employ life cycle cost / value analysis techniques during the specification and selection of equipment and designs for the Project. This process shall consider environmental concerns, compliance with legislation, and industry best practices. Company document "Lower Churchill Project – Life Cycle Cost Design Philosophy for Equipment, Assets and Structures" document number LCP-PT-ED-0000-EN-PH-0042-01 listed in Exhibit 6 provides guidelines and Company's expectations with respect to use of this technique.

### **3.2.17 Newfoundland and Labrador Requirements Related to the Practice of Engineering and Geoscience**

The practice of engineering and geoscience in Newfoundland and Labrador is subject to the requirements of the Engineers and Geoscientists Act, SNL2008, Chapter E-12.1, An Act Respecting the Practice of Engineering and Geoscience.

Professional Engineers and Geoscientists of Newfoundland and Labrador (PEG-NL), is responsible for regulating the practice of Engineering and Geoscience.

Consultant shall provide its Services in compliance with the requirements of the Act and Regulations, and also with the requirements of PEG-NL.

### **3.2.18 Company's Technical and Design Integrity Oversight**

Company will maintain oversight for technical and design integrity for the Project. Further details regarding Consultant's and Company's responsibilities and requirements, including engagement protocols, regarding Company's oversight for technical and design integrity, are described in Exhibit 5, Section 11.

**3.3 PROCUREMENT SERVICES**

Consultant is responsible, on behalf of Company, for procurement of Procured Goods (as set out in item (vii) below) and for issuing and managing, on behalf of Company, all construction-related and other Contracts required for the implementation of the Project.

Company or Consultant, on behalf of Company, may procure equipment and materials and free-issue to Contractors. However, Contractors may also purchase equipment and materials as agreed with Consultant and Company. Consultant shall recommend appropriate procurement and contracting strategies.

Consultant shall provide all resources to manage all aspects of procurement and contracting for the Work. Consultant shall implement a procurement organization including Key Personnel, all consistent with the requirements of the Agreement.

Consultant shall provide and maintain a materials management system. Consultant shall utilize proven systems and procedures, facilities and sufficient resources to identify, manage, and report on material requirements.

Consultant's scope shall include the tasks to produce deliverables that include those listed below. Exhibit 5, Section 6 outlines, in more detail, the responsibilities of Consultant.

- (i) Development of detailed construction and Completions schedule, consistent with the Project Control Schedule, for Company review and acceptance;
- (ii) All necessary purchasing, contracting, inspection, expediting and transportation services to obtain and deliver equipment and material and services required consistent with the Project Control Schedule;
- (iii) Overall management, control, monitoring and reporting of procurement and contracting activities;
- (iv) Assessment of Contractors and Suppliers during the pre-qualification process to determine their capability to perform the Work;
- (v) Preparation and issuing of tender packages;
- (vi) Commercial and technical evaluation of tenders;
- (vii) Preparation and issue of purchase orders and contracts in Company's name (Company will pay resulting invoices);
- (viii) Review and approval of Contractors' and Suppliers' progress payment requests and invoices, and submittal to Company for further processing and payment.
- (ix) Input orders and other procurement data in Consultant's materials management system;
- (x) Expediting and developing mitigating actions for delivery delays;
- (xi) Supplier source inspection and FAT;
- (xii) Report and manage non-conforming materials;
- (xiii) Arrangement of material deliveries and receiving inspection;
- (xiv) Stock control, storage and Preservation and security of materials and equipment;
- (xv) Develop and implement a material management strategy for bulk materials (e.g. fuel, cement, etc.) that will assure timely completion of the Work while minimizing surplus;
- (xvi) Provision of documentation for customs clearance for materials and equipment import into Canada;



- (xvii) Develop a sparing philosophy and a list of recommended operating spares and special tools required to effectively start up and maintain the facility; and
- (xviii) Development and implementation of a Preservation program to include Preservation procedures, inspections, and reports to ensure that the equipment and materials are kept in a preserved state ready for use.

### **3.4 CONSTRUCTION MANAGEMENT SERVICES**

#### **3.4.1 General**

Consultant shall provide overall management and oversight, including construction planning, management of Site(s), cost and schedule management, Contractor and Supplier management, risk management, management of change, etc., of all activities required for the successful construction and Completions of the Project while meeting Company's objectives of the LCP. Construction Management Services shall include:

- (i) Development and implementation of the detailed construction execution and management plans and support schedules for the Project;
- (ii) Development and implementation of all construction management processes and procedures;
- (iii) Overall management of Project Site(s), including provision of all support services and infrastructure (e.g. accommodations complex, medical facilities, security services, etc.) required by Contractors performing the Work;
- (iv) Overall management and oversight of all Work performed by Contractors at Site(s);
- (v) Administration of all Contracts for the Work;
- (vi) Overall management of Company's labour agreement used by Contractors;
- (vii) Overall management and oversight of all Project-related fabrication activities at all locations;
- (viii) Overall management and oversight of all Project-related transportation and logistics activities at all locations;
- (ix) Overall management and oversight of all Project-related installation activities at Site(s);
- (x) Overall management and oversight of Mechanical Completion, Preservation, and handover for commissioning, and provision of support services for commissioning and turnover to Operations activities at Site(s) required to implement the Project; and
- (xi) Implementation of all best practices, productivity improvement initiatives, risk mitigation, and lessons learned.

#### **3.4.2 Pre-Construction Phase**

Construction Management Services to be employed during the pre-construction phase of the Project shall include the following:

- (i) Development and implementation of construction execution and management plans including all strategies, organization, cost estimates, logistics, labor and work scheduling considerations;

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- (ii) Development and implementation of Project constructability-related processes, with consideration to the incorporation of industry best practices, productivity issues, risk issues, and lessons learned;
- (iii) Constructability reviews of the design, including reviews for the incorporation of construction safety elements logistics, location, & seasonality constraints, industry best practices, productivity issues, risk issues, and lessons learned;
- (iv) Development of construction contracting strategy and Project contract packages;
- (v) Completion of Contractors' and Suppliers' competency evaluations, including assessment of their Quality systems for capacity and capability to perform to the requirements stated;
- (vi) Development of cost estimates for the construction Work in order to establish the Project Budget;
- (vii) Development of detailed construction and Completions schedule;
- (viii) Development of overall productivity action plan for the Work in order to ensure that the Project is planned and executed with productivity as a key driver of success;
- (ix) Development of a logistics and materials movement plan;
- (x) Development and implementation of program to assess and address potential productivity issues and gaps in critical construction labor and supervision;
- (xi) Completion of modularization / prefabrication analysis for relevant Project components;
- (xii) Completion of a Project-level construction hazards analysis and mitigation plan that considers all physical safety and environmental hazards that may be encountered during construction, and Completions;
- (xiii) Industrial Relations (IR) planning and negotiations planning / labour estimates in conjunction with Company;
- (xiv) Establishment of construction safety targets and safety management programs for incorporation into Contracts;
- (xv) Establishment of construction environmental targets and environmental management programs for incorporation into Contracts;
- (xvi) Development of construction period staffing plan, roles and responsibilities, reporting structure;
- (xvii) Production and management of required construction management related procedures;
- (xviii) Development of strategies for overall construction progress, performance management and cost management;
- (xix) Provision of support to Company in the negotiation of labor collective agreements for the LCP;
- (xx) Provision of support to Company in the placement of Company's insurance program for the Project; and
- (xxi) Provision of input to, support for, and participation in the Newfoundland and Labrador Benefits program.

### 3.4.3 Construction Phase

#### 3.4.3.1 General

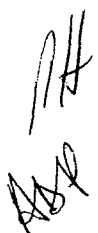
Consultant's Construction Management Services to be employed during the construction phase of the Project shall include the following:

- (i) Guidance and leadership of multifunctional teams to advance the preparation and planning required to commence the main construction Work at the earliest possible opportunity in order to meet or exceed the Project Control Schedule and Project Budget;
- (ii) Management of the effort required to provide the engineering, procurement, commercial and environmental deliverables required to be able to place purchase orders, award contracts and commence and execute the main construction Work in accordance with the Project Control Schedule;
- (iii) Selection, hiring, training and deployment of Consultant's Site teams that will monitor and direct the Work performed by Contractors;
- (iv) Overall management and coordination of the Site teams, development of Site procedures to administer the Work by the Site Contractors;
- (v) Overall management of the Site(s) including the coordination and management of all common services (e.g. accommodations, medical facilities, etc.) provided by the Consultant, on behalf of the Company, to Contractors;
- (vi) Completion of the construction Work safely, on time and within budget respecting all environmental and other requirements and provisions;
- (vii) Ensure that the construction Work is delivered in accordance to Company's Quality objectives;
- (viii) Ensuring compliance with commitments made in Impact and Benefits Agreement during the planning/preparation phase and during the construction Work;
- (ix) Ensuring compliance with all Newfoundland and Labrador Benefits obligations; and
- (x) Day to day management, with construction Contractors, of labour agreements for Company.

#### 3.4.3.2 Specific Construction Phase Responsibilities

Specific construction phase responsibilities Consultant shall be responsible for shall include the following:

- (i) **General**
  - Pre-mobilization planning;
  - Development and deployment of Site teams – all disciplines and functions;
  - Overall Site coordination / Site offices management;
  - Permits management, including acquisition and oversight;
  - Approval of Contractors' methods / plans / plant / Personnel;



- Overall management of the Site;
- Management of Site access;
- Management of communication systems;
- Assignment of measuring methods;
- Reporting & establishment of reporting requirements;
- Stewardship of management meetings;
- Rejection of Work / replacement of defective Work;
- Extra Work authorization / management of design changes & impacts on cost & schedule;
- Support of the management of Company's insurance program for the Project; and
- Establishment and provision of off-site warehousing, staging areas, and logistics offices necessary for the Project and for use by Company Personnel.

(ii) **Health and Safety Management**

- Overall Project-level safety management including Site(s) safety oversight & coordination;
- Development and implementation of safety management programs;
- Review and approval of Contractors' safety management plans;
- Review and consolidation of safety statistics reported by Contractors, Subcontractors and Suppliers;
- Establish and maintain medical, emergency response, fire protection facilities and services at each Site(s);
- Emergency response management and coordination at Site(s);
- Coaching of Contractors to achieve the desired safety performance;
- Chair the site-level safety steering committee; and
- Establish and administer Site orientations for all Personnel, including diversity awareness and training.

(iii) **Security Management**

- Development and implementation of Project and Site(s) security plan; and
- Overall management of Site(s) security.

(iv) **Environmental Management**

- Development and implementation of Environmental Management Plan for construction Works for acceptance by Company;
- Environmental oversight / monitoring, coordination and management of Site(s);
- Management of restrictions on construction operations; and
- Development and implementation of environmental mitigations and rehabilitation plan for use during and post the construction Work.

(v) **Site Technical & Engineering Interface**

- Assessment of excavated foundations / determination of foundation treatment and support requirements;
- Interface with home office engineering / queries / expedite design decisions;
- Timely issuance of approved for construction documents;

- Review / approval of Contractors' drawings;
- Management of changed Site conditions;
- Management of rock support requirements;
- Management of alterations / additions;
- Review / approvals of alternates; and
- Timely / prompt response to Contractor queries, information requests, Change Requests, and decision making.

(vi) **Quality Assurance**

- Overall responsibility for Construction Quality;
- Ensuring that construction and installation activities are conducted in accordance with drawings, specifications and any special Supplier installation procedures;
- Ensuring that all applicable Standards, codes and jurisdictional regulations are observed and adhered to by Contractors;
- Providing oversight of Contractors' Quality assurance plans, including verification (through checking, surveillance and audits) that the procedures used and the results obtained are in compliance with Project's Quality requirements;
- Quality control, including quality control at Site(s) and fabrication plants;
- Providing attendance at factory acceptance testing (FAT) and system integration testing (SIT);
- Establishment of survey control system and necessary survey control points;
- Participation at inspection and tests;
- Approval of planned concrete Work prior to placement of concrete;
- Approval of completed Work, including all foundations, prior to covering up; and
- Operation of Site laboratories (soils / concrete / photography etc..).

(vii) **Verification Activities**

- Verification of Contractors' systems for:
  - management of Requests for Information (RFI) / queries from Contractors and Suppliers;
  - maintenance of change logs;
  - most current design information being constructed; and
  - design Standards and codes being used and any requests for deviations from applicable codes, Standards or specifications.

(viii) **Logistics and Materials Management**

- Overall logistics management for the Site(s);
- Oversee the provision of common logistics and materials management services at Site(s);
- Management of Company supplied items, if applicable;
- Management of storage / laydown areas and staging areas, at the Site and off-site;
- Site material management as required (commodities / receiving / OS&D / surplus / scrap / spares / etc.);
- Management of temporary facilities; and



- Preservation of materials and equipment and storage, shipping and handling in accordance with associated Company reviewed methods and procedures.

(ix) **Contracts Management**

- Contract coordination and management in accordance to Contract conditions and Consultant's processes;
- Oversight of Contractors' procurement activities;
- Warranty and claims management;
- Conducting periodic audits of Contractors' files;
- Settlement / resolution of disputes / claims in conjunction with Company; and
- Management of Contractor change requests.

(x) **Schedule Management**

- Management of overall Project Control Schedule and of discrete construction schedules;
- Approval of Contractors' schedules ensuring alignment among Contractors and with overall Project Control Schedule;
- Development and implementation of processes and procedures to monitor schedule(s) and to address issues;
- Development and implementation of reporting protocols for Company's approval;
- Development and implementation of progress verification methods and procedures to include all payment methods, progress measurements, quantity survey and verification, progress payments, payment measurement methods, and verification methods;
- Regular reporting of progress and performance against the Project Control Schedule and Services Budget and Project Budget; and
- Development of recovery schedules in case of actual or forecast schedule slippage of critical path activities.

(xi) **Cost Management**

- Measurement and reporting of project costs including committed, incurred and earned cost against the Services Budget and Project Budget;
- Identifying and management of all cost and schedule trends;
- Monthly forecasting of estimate-at-completion for the Project and the Services; and
- Management of Project contingency in conjunction with Company;

(xii) **Productivity Management**

- Leading effort to maximize productivity on the Site(s) and to engrain a productivity mentality into the Site(s) culture; and
- Measurement of actual productivity, and development of productivity improvement initiatives.

**(xiii) Risk Management**

- Development and implementation of risk identification and management program including roll-out and full engagement / usage of all Contractors in accordance with Consultant's Risk Management Plan;
- Development and implementation of risk challenge process to preclude usage of contingency funds as a first line of defense to address risk issues;
- Development and implementation of process for identification of emerging risk issues; and
- Stewardship of Contractors' risk monitoring and management processes and plans.

**(xiv) Document Management**

- Overall document management function at the Site(s) including document control, document transmittal capability and document status reporting;
- Implementation of a disaster recovery plan for all documentation and data;
- Regular audit of Contractors' systems / documents; and
- Management / stewardship of as-built documentation.

**(xv) Labour Management**

- Development and implementation of processes and procedures to manage, report on, and analyze labour usage and productivity;
- Implementation of remedial actions to address issues regarding critical skills gaps;
- Oversight of Project labour agreements, in particular being used by construction contractors;
- Administration of dispute resolution mechanisms as outlined in Project labour agreements; and
- Implementation of policies and procedures related to Personnel on site.

**(xvi) Newfoundland and Labrador Benefits**

- Specification of requirements for Newfoundland and Labrador Benefits reporting in Contracts;
- Oversight of Newfoundland and Labrador Benefits reporting for Contractors within Company processes and systems; and
- Monitoring of Newfoundland and Labrador Benefits, in conjunction with Company, and manage all corrective actions.

**3.4.3.3 Site Teams**

At each Site, Consultant shall have a management team fully capable of providing Construction Management Services in support of the Work in order to achieve satisfactory completion in accordance with the Project Control Schedule.

### 3.4.4 Activities Related to Mechanical Completion, Preservation, Handover for Commissioning, Commissioning and Turnover to Operations

Consultant shall be responsible for developing a Project Completions philosophy for Company acceptance. The purpose of this philosophy is to provide a concise set of guidelines for the execution of Mechanical Completion, Preservation, handover for commissioning, commissioning and turnover to Operations activities, and to establish and maintain a Completions system for all phases of the Project.

The overall goal of Project Completions is to verify and document that all equipment/systems/infrastructure are fabricated and installed as specified, and tested to ensure they function as designed. Safety will govern all decisions.

Contractors and Suppliers, under the management of Consultant, are responsible for performing installation and Mechanical Completion, Preservation, and handover for commissioning activities. Contractors and Suppliers are responsible for development of documentation related to Mechanical Completion including procedures, manuals and other documents required for the Mechanical Completion activities. Consultant shall provide the overall direction to Contractors and Suppliers for these deliverables and shall coordinate the production of the required manuals and procedures in a standard and uniform format to be developed by Consultant and applied to all Contractors and Suppliers.

Consultant, in conjunction with Company, shall define a Completions organization. The organization will include discipline technicians to monitor Completions and to support all Project Completions activities and tests as required. The Completions organization shall include key Company and Consultant Personnel. Consultant shall be responsible for developing an Execution Plan that shall detail how all required activities shall be accomplished to achieve Mechanical Completion, Preservation, handover for commissioning, commissioning and turnover to Operations.

Completions documents are to detail and define as a minimum:

- Completions organization, detailing key positions and roles and responsibilities within the organization during all phases of Project Completions;
- Commissioning packages and boundary drawings for systems / equipment;
- Outline of Mechanical Completion packages;
- Content of Mechanical Completion packages by tag / item number and allocated Inspection Test Record;
- Mechanical Completion (MC) forms including Inspection Test Records forms, Punch List forms, and MC handover forms.
- Mechanical Completion Inspection Test Records;
- The Project Completions System (PCS) computerized system or other;
- Quality assurance and Quality control activities;
- Development of Project specific Completions procedures for items such as:
  - Punch List of work;
  - Preservation;



- Permit to work;
- Material handling;
- Lock out tag out for equipment;
- Handover documentation (i.e. from Mechanical Completion to commissioning, commissioning to Operations);
- Level of Mechanical Completion for Contractors and Suppliers;
- Commissioning static and dynamic documentation such as commissioning check lists, run logs, and other documentation; and
- Commissioning procedures.

Consultant shall select, for Company acceptance, and utilize a computer-based Completions system that tracks and documents system / equipment Mechanical Completion, Preservation, handover for commissioning, commissioning and turnover to Operations. This system will also form the basis for the stages of Company's acceptance of the equipment and infrastructure. Consultant shall populate this system with all the required data. Consultant shall also provide trained Personnel to operate the PCS system.

Consultant shall furnish Company with Completions test dossiers that include all mandatory test and inspection certificates, and the reports that Consultant and Contractors have completed to demonstrate Completions. Consultant shall also furnish a complete set of "As-Built" documentation together with commissioning and operating / maintenance manuals.

Additional information regarding Consultant's and Company's responsibilities and requirements, as well as definitions regarding Mechanical Completion, Preservation, handover for commissioning, commissioning and turnover to Operations, are contained in Exhibit 5, Section 13.

### **3.5 SPECIFIC SERVICES REQUIRED IN SUPPORT OF COMPANY'S GATEWAY PROCESS**

#### **3.5.1 General**

Company is developing the LCP using its staged-gate delivery method referred to as the Gateway Process. The Gateway Process, (refer to Figure 1 - Lower Churchill Project Gateway Process), acts as a decision assurance process that has been and continues to be used to guide Company's strategic planning and execution activities for the LCP. The Gateway Process serves to ensure Quality decision-assurance at crucial points in a project's lifecycle.

As part of the Services, Consultant shall produce pre-defined "readiness" deliverables, referred to as Key Deliverables, as listed below, which are required by Company under the Gateway Process. Consultant shall, building upon Company's existing work, produce these Key Deliverables for Company's review and acceptance prior to the decision gate for which they are required.

**Gateway Process**

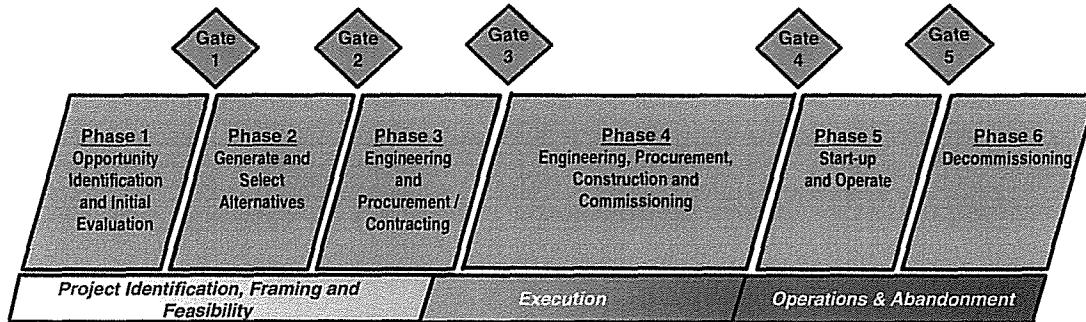


Figure 1 – Lower Churchill Project Gateway Process

Consistent with the Key Deliverables of Gate 3, Consultant shall complete the level of Project definition (i.e. engineering design, procurement and construction planning) in order for Consultant, in conjunction with Company, to produce a Class 3 Estimate (as defined under the Association for Advancement of Cost Engineering (AACEI) International cost estimate classification system) and equivalent detailed schedule for the Project required for the Gate 3 decision gate process.

**3.5.2 Key Deliverables Produced by Consultant**

**3.5.2.1 Gate 3 Deliverables**

Company specified Key Deliverables for Gate 3 shall include the following:

- Detailed cost and schedule estimates for complete Project execution, with an accuracy of AACEI Class 3 Estimate equivalent;
- Organization design and practices for Gateway Process Phase 4 in-place with all key staff mobilized and plan for mobilization of remaining team in-place;
- Updated Basis of Design for Project completed (in conjunction with Company);
- All design technology and processes selected and accepted by Company;
- Project-specific design criteria documented for all disciplines and Issued for Use;
- Project-specific equipment specifications issued for design, as required to meet Consultant’s contracting plan;
- Project-specific bulk materials specifications, as required to meet Consultant’s contracting plan, approved by Consultant and accepted by Company;
- Project Site / plot plans - layout plan frozen;
- All geotechnical surveys and data acquisition and analyses complete;
- Gateway Process Phase 3 engineering and Detailed Design deliverables complete as

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- required to meet Consultant's contracting plan;
- Approved for Design (AFD) and Approved for Construction (AFC) Process Hazard Analysis (PHA) and Hazard Operability Reviews (HAZOPS) completed, commensurate with the maturity of engineering;
  - Constructability Review, commensurate with maturity of engineering, completed for Project supported by level 4 construction schedule and documented construction philosophy;
  - Project Control Schedule, supported by detailed construction and Completions schedule, in place with primary critical path(s) identified;
  - Overall productivity action plan for the Work in place and accepted by Company;
  - Project Execution Plan for Gateway Process Phase 4;
  - Contract plan in-place for implementation of the Project;
  - All equipment packages defined;
  - Procurement underway for all long-lead items in accordance with procurement plan;
  - Construction Management Plan - temporary facilities and services identified;
  - Project management processes and supporting tools in place;
  - Logistics and freight forwarding plan in place, ready for use / being used;
  - Project Information Management and technology plan implementation complete;
  - Project Quality Plan in-place;
  - Environmental compliance monitoring plan in place / being used;
  - H&S management plan in place / being used;
  - Project Change Management Plan - implementation complete;
  - All key Interfaces identified and Technical Interface Management Plan in-place / being used;
  - Labour recruitment plan in-place (in conjunction with Company);
  - All consents, permits and licenses required identified with early consents, permits and licenses received with no schedule showstoppers identified;
  - Environmental effects management program in-place and ready to be deployed;
  - Lessons learned / value improvement practices review and implementation complete for Gateway Process Phase 3;
  - Operability review complete on the overall Project design and configuration, commensurate with the maturity of engineering;
  - Sparing strategy in-place;
  - Life cycle value analysis design reviews complete, commensurate with the maturity of engineering;
  - Completions philosophy in-place;
  - Operability Standards for equipment selection defined, commensurate with the maturity of engineering;



- Documentation for Operations strategy in-place with turnover protocols defined; and
- Office, equipment, IS/IT and infrastructure plan for Gateway Process Phase 4 in place.

### 3.6 CONSULTANT'S PROJECT MANAGEMENT SERVICES

#### 3.6.1 General

Consultant's project management services include management of its Engineering Services, Procurement Services, Construction Management Services, management of the construction Work, as well as other project management services described herein.

Consultant shall have an efficient management organization, fully supported by effective systems and procedures, to ensure that all project management services are performed to meet fully the safety, environmental, Quality, price, schedule, and other requirements of the Agreement.

Consultant shall provide:

- Sufficient numbers of suitably qualified and skilled Personnel with relevant experience;
- Suitable facilities;
- All necessary systems, procedures, tools and methods; and
- All other resources required for the proper performance and completion of the Services.

Consultant's project management services include:

- Overall management of the Services and the Work;
- Development and implementation of an Execution Plan for provision of the Services and implementation of the Project;
- Technical interface management;
- Quality management;
- Safety and security management;
- Environmental management;
- Cost management;
- Schedule management;
- Risk management;
- Project Change Management;
- Engineering management;
- Procurement, contracting and materials management;
- Construction and Mechanical Completion management;
- Engineering and drafting control;
- Information Management;
- Invoice and payment management for the Services; and

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- Newfoundland and Labrador Benefits Monitoring.

Consultant is responsible for the proper management and delivery of the Services, wherever performed, and it shall have appropriate representation at Site(s) to ensure the safe and timely performance of all elements of the Services in accordance with the Quality Standards and other requirements set out in the Agreement. Consultant shall keep Company fully informed at all times of progress and areas of concern.

Further details regarding Consultant's responsibilities and requirements related to the Consultant's project management services are described in Exhibit 5.

Company shall assist and advise Consultant, as Company, in its sole judgement, considers appropriate in relation to Consultant's performance of the Services without this relieving Consultant in any way of its responsibilities, duties and obligations under the Agreement.

### **3.6.2 Execution Plan for Provision of the Services and Implementation of the Project**

In accordance with the requirements described in Exhibit 5, Section 1, subsequent to the execution of the Agreement, Consultant shall prepare a final Execution Plan for the provision of the Services and implementation of the Project for review and acceptance by Company. Consultant's Execution Plan shall be predicated upon the composition of the Project, scope of the Services and the Project Milestone Schedule.

Consultant's Project Execution Plan shall describe in detail Consultant's strategies and plans for provision of the Services and delivery of the Project. All subsequent changes to the Project Execution Plan shall be submitted for review and acceptance by Company.

Further details regarding general execution planning are described in Exhibit 5, Section 1.

### **3.6.3 Technical Interface Management for the Project**

Consultant shall develop, implement, operate and manage a dedicated Technical Interface Management System and associated processes for the Project. The system will serve as a management tool to facilitate the management of all Project related technical interfaces throughout Project execution. The system will encompass all Hard and Soft Interfaces identified through Project development. The system will also address technical interfaces with other components that may fall outside of Consultant's scope of Services.

As part of the Services related to technical interface management, Consultant shall manage and coordinate all interfaces internally, and with Company, Contractors, Sub-contractors, Other Consultants, and Suppliers. Consultant shall develop a Technical Interface Management Plan to actively manage the interface system, and shall carry out all required interface activities to ensure successful implementation of the system and timely closeout of all interfaces.

Consultant shall appoint a Technical Interface Manager who shall be responsible for the Technical Interface Management System and its overall management, and who shall be the focal point for interface co-ordination, response, and closeout, and reporting for the Project.

Further details regarding Consultant's responsibilities and requirements related to technical interface management are described in Exhibit 5, Section 3.



### 3.6.4 Quality Management

Company LCP documents “LCP Quality Policy”, document no. MSD-QM-001 and “LCP – Overarching Quality Management Plan”, document no. LCP-PT-MD-0000-QA-PL-0001-01 listed in Exhibit 6 lay out Company’s overarching philosophies, goals, objectives and expectations in the area of Quality assurance and Quality control, and act as a framework for all LCP Quality activities. These documents act as a guide with respect to Project Quality for Company, as well for Consultant, Other Consultants, Subcontractors, Contractors and Suppliers providing services or work for LCP.

Consultant shall carry out its Quality management to ensure that the Services, and ultimately the Work, are executed to meet all the requirements of the LCP Quality Policy and LCP – Overarching Quality Plan and the Agreement, with the objective of eliminating defects, non-conformances and the need for remedial work.

Consultant shall ensure, through the proper operation of a Quality system conforming to the principles of an internationally recognized Standard such as the ISO 9000 series of Standards, systematic and satisfactory:

- Project management of the Services;
- Planning of every aspect of the Services;
- Execution of every element of the Services;
- Verification of all Services as they are performed to confirm that they meet all the requirements of the Agreement; and
- Auditing, surveillance and inspection to ensure the Quality objectives are fulfilled.

Consultant’s Quality management of the Services includes all Quality-related functions at Site(s), including Quality assurance and Quality control.

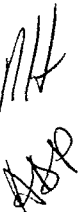
Further details regarding Consultant’s responsibilities and requirements related to Quality management for the Services are described in Exhibit 5, Section 5.

### 3.6.5 Health and Safety Management

Company is committed to providing a safe and healthy workplace for its employees, Consultant, Subcontractor, Other Consultants, Contractors, Suppliers and the general public. Company’s goal is a workplace where “Zero Harm - Nobody Gets Hurt” – and an environment where each and every employee is always concerned for their own safety and the safety of others. Consultant shall pay the highest regard to health and safety, and shall meet or exceed Company’s requirements.

Consultant shall be responsible for completion of the Services and the Project without accident or incident, and is solely responsible for:

- Providing a healthy and safe working environment at Site(s);
- Safe performance of the Work by all Personnel; and
- Actively promoting the importance of health and safety at Site(s).



Consultant shall ensure safety through the proper operation of a safety management system including safety risk assessment procedures conforming to the principles of internationally recognized safety Standards applicable to all phases of the Work.

Consultant's safety management shall include all safety-related functions at Site(s) to protect the well being of all Personnel, and to prevent loss of or damage to property.

Consultant shall place a strong emphasis on coaching Subcontractors, Contractors, and Suppliers to achieve a workplace where nobody gets hurt.

Consultant's safety management services for the Project shall include the evaluation, selection, and management of Subcontractors, Contractors and Suppliers who are able to execute the work safely.

Consultant shall provide all required administration support, Personnel resources, systems, processes, and anything else required to enable Consultant to provide safety management services to meet the requirements of the Agreement.

Consultant shall prepare Site(s) specific safety plans to address safety management at each Site(s), and shall ensure that Subcontractors, Contractors, and Suppliers' safety management systems and plans reflect the requirements within Consultant's safety management system.

Further details regarding Consultant's responsibilities and requirements related to health and safety management are described in Exhibit 5, Section 4.

### 3.6.6 Environmental Management

Consultant shall pay the highest regard to protection of the environment in carrying out the Services. Consultant shall conform to all Agreement requirements, including Company's environmental guidelines and policies in this regard.

Consultant's objective is to ensure through the proper application of its environment protection procedures such that the Work is:

- Managed, planned and engineered to minimize any impact upon the environment;
- Performed and completed without incidents detrimental to the environment; and
- Performed in full compliance with the environmental policy objectives.

Consultant shall ensure environmental compliance through the proper operation of an environmental management system.

Consultant's environmental management shall include all environment-related functions at Site(s) to protect the environment, and to prevent environmental impacts.

Further details regarding Consultant's responsibilities and requirements related to environmental management are described in Exhibit 5, Section 17.

### 3.6.7 Cost Management

Consultant shall be responsible for overall cost management of the Services and the Work against the Company approved control budget and Code of Accounts. Cost management shall include the establishment of an approved control budget; as well as the tracking,

monitoring and reporting of all commitments and incurred cost against the approved control budget in order to detect potential variances or trends.

Consultant shall provide all required administration support, Personnel resources, systems, processes, and anything else required to enable Consultant to provide its cost management services to meet the requirements of the Agreement.

Consultant's cost management services shall include the use of a trend management system to act as an early warning system of potential change and facilitate Consultant's management of potential changes and accurate forecasting of cost against the approved control budget.

Consultant's cost management services must be fully integrated with its Schedule Management services in order for Consultant to produce timely progress and performance reports using Earned Value Management practices.

Consultant shall specify to Sub-Contractors, Contractors, and Suppliers the requirements for cost management and reporting, and shall receive, analyze, approve and integrate Subcontractors, Contractors, and Suppliers' data and information as input into Consultant's cost reports.

Consultant shall produce regular cost reports for the Services and the Project as specified within the Agreement.

Further details regarding Consultant's responsibilities and requirements related to the provision of cost management services are described in Exhibit 5, Section 7.

### **3.6.8 Schedule Management**

Consultant shall be responsible for overall schedule management of the Services and the Work against the Project Milestone Schedule, contained in Exhibit 7. Consultant shall develop a Project Control Schedule for the Services and the Project, for approval by Company, that reflects both the milestones contained within the Project Milestone Schedule, and the Consultant's Project Execution Plan.

Consultant's schedule management responsibilities shall include the development of schedules; analyzing schedule using Earned Value Management practices to detect variances / trends; forecasting completion dates; report the progress against accepted schedules; and taking corrective remedial action against negative schedule variance.

Consultant shall specify to Contractors, Sub-Contractors, and Suppliers the requirements for development and approval of schedules, management and reporting against these schedules, and shall receive, analyze, approve and integrate Subcontractor, Contractor, and Supplier data and information as input into Consultant's schedule management and reporting activities .

Consultant shall provide all required administration support, Personnel resources, systems, processes, and anything else required to enable Consultant to provide its schedule management services to meet the requirements of the Agreement.

Further details regarding Consultant's responsibilities and requirements related schedule management are described in Exhibit 5, Section 18.



### 3.6.9 Risk Management

Company has implemented a formal risk management system for the LCP under the umbrella of its corporate enterprise risk management program. Company's risk management program for the LCP has the objectives of:

- Identifying and analyzing risks and opportunities which have potential safety; environmental, operational, cost, schedule or reputation implications;
- Utilizing knowledge of these risks and opportunities to facilitate more effective decision making by removing uncertainty and / or capitalizing on the opportunity;
- Responding to identified risks in a timely and cost effective manner in order to control their potential adverse and / or beneficial impact; and
- Allocating or transferring risk ownership to the party who can most efficiently and effectively manage the risk.

Consultant is responsible to ensure an understanding of the documentation requirements of Company, to participate in the Company's overall risk management program for the LCP.

Consultant shall develop and implement a risk management plan for the Project under the framework of Company's risk management program, and shall lead project-level risk management activities for the Project.

Further details regarding Consultant's responsibilities and requirements related to risk management are described in Exhibit 5, Section 10.

### 3.6.10 Project Change Management

Consultant shall be responsible for the management of change to the Project, including changes to the Services, the Work, Lower Churchill Project Basis of Design, organization, and all other changes to the Project. Consultant shall ensure that all changes to the Project are managed in order to achieve Company's objective for the LCP.

Further details regarding Consultant's responsibilities and requirements related to Project Change Management are described in Exhibit 5, Section 8.

### 3.6.11 Engineering Management

Consultant shall manage all engineering in relation to the Services, giving particular consideration to all requirements and interfaces of design, procurement, construction, Completions and Operations. Consultant shall ensure that all engineering in relation to the Services conforms to all requirements of the Agreement, including particularly those of the Government Authorities.

Consultant shall request and obtain Company approval prior to sub-contracting any Engineering Services.

Further details regarding Consultant's responsibilities and requirements related to the management of Engineering Services, including responsibilities and requirements regarding Company's oversight for technical and design integrity, are described in Exhibit 5, Section 11.

### 3.6.12 Procurement and Contract Management

Consultant shall provide all required administration support, Personnel resources, systems, processes, and anything else required to enable Consultant to provide its procurement and contract management services to meet the requirements of the Agreement.

Further details regarding Consultant's responsibilities and requirements related to procurement and contract management are described in Section 3.4 in this Exhibit 3 and in Exhibit 5, Section 6.

### 3.6.13 Construction and Completions Management

Consultant shall provide all required administration support, Personnel resources, systems, processes, and anything else required to enable Consultant to provide its Construction Management services including management of specific Project Completions activities including Mechanical Completion, to meet the requirements of the Agreement.

Further details regarding Consultant's and Company's responsibilities and requirements related to the provision of construction management services are described in Exhibit 5, Section 12.

Further details regarding Consultant's and Company's responsibilities and requirements regarding Project Completions activities are described in Exhibit 5, Section 13.

### 3.6.14 Information Management

Information Management (IM) for the LCP includes the management of all information created, generated or received as a result, or in support of, the activities required for planning, execution and Project implementation. Included are the associated processes, resources and tools required to manage this information throughout its life cycle.

The specific functional areas of IM required for the Project are:

- Records management;
- Document Management/Control;
- Data Management;
- Information Systems/Information Technology (IS/IT), and
- Information Security.

Project document "Lower Churchill Project – Information Management Policy" document number LCP-PT-MD-0000-IM-PY-0001-01 and Project document "Lower Churchill Project - Information Management Plan" document number LCP-PT-MD-0000-PL-0003-01, listed in Exhibit 6 provides the overall policy, strategy and direction with respect to Information Management for the LCP.

Consultant shall establish secure, Agreement-specific, Information Management system(s), acceptable to Company, and meeting Company's expectations and requirements as outlined in the document "Lower Churchill Project - Information Management Strategy". The Information Management system(s) shall be capable of efficient capture, distribution/dissemination, management, filing and retrieval of all data and documentation in relation to the Services.



Consultant shall:

- Maximize the use of electronically-accessible documents and data on a common or integrated system where possible;
- Ensure the latest version of all information shall be readily available to all relevant parties (including Company, Subcontractors, Suppliers, Other Consultants, and Contractors) at all times;
- Establish control procedures to prevent the use of outdated documentation or data by any party;
- Have satisfactory infrastructures, systems, procedures and resources to ensure the security of all documentation and data;
- Provide disaster recovery plans for both hard copy and electronic information, and
- Format and deliver all electronic documentation and data in compliance with Company's requirements.

Coding of all information pertaining to the LCP shall be in accordance with document "Lower Churchill Project – Coding Standard", document number MSD-IM-008 listed in Exhibit 6. Further details regarding Consultant's and Company's responsibilities and requirements related to Information Management are described in Exhibit 5, Section 16.

### 3.6.15 Invoice and Payment Management

Consultant shall provide all required administration support, Personnel resources, systems, processes, and anything else required to enable Consultant to manage invoicing and payment for its Services.

Further details regarding Consultant's and Company's responsibilities and requirements regarding invoicing and payment are described in Exhibit 5, Section 14.

### 3.6.16 Engineering and Drafting Control for the Project

Consultant shall implement comprehensive engineering and drafting controls for the Engineering Services. All procedures shall be structured to ensure that there is a common approach to the design and that the design errors are minimized. Central to these controls shall be an Engineering Management Plan that shall be issued for acceptance by Company in accordance with Exhibit 5, Section 11. The mechanisms for checking and approval of all calculations, specifications, data sheets, and drawings will be adopted and strictly adhered to. Checking and approval of these documents shall be within scope of the Services. Consultant shall ensure that this procedure is strictly implemented.

As part of its Engineering Management Plan, Consultant shall develop a drawing control procedure for acceptance by Company in accordance with Exhibit 5, Section 11. This procedure should address 3D, CADD, GIS, manual drafting, and any other method. The procedure shall have particular emphasis on the unique drawing control problems associated with CADD drafting. The CADD procedure should ensure adequate backup is maintained and that the control of plotted drawings is sufficient to prevent duplication of out of date drawings.

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All technical documentation completed by Consultant, Subcontractor(s), Contractors and Suppliers shall meet Company's requirements.

Further details regarding Consultant's responsibilities and requirements related to engineering and drafting control are described in Exhibit 5, Section 11.

### **3.7 COMPLIANCE WITH PROJECT MILESTONE SCHEDULE**

Consultant shall perform all Services and prepare all plans and schedules required for the detailed planning and management of the Services and the Project to meet the Project Milestone Schedule. Such plans and schedules shall address all Services' activities without limitation, including Engineering Services, Procurement Services, Construction Management Services including commissioning services to ensure that the Project is completed on schedule in accordance with the requirements of the Agreement.

Consultant shall identify potential risks to the schedule-critical elements of the Services and shall develop contingency plans to ensure prompt implementation of pre-emptive and corrective actions whenever they are needed.

### **3.8 OFFICE FACILITIES AND SERVICES FOR COMPANY**

Consultant shall provide office facilities and associated services to the Company as required by Company during the execution of the Agreement.

Exhibit 5, Section 2 sets out the details of office facilities and associated services that shall be provided by Consultant for Company.

### **3.9 REGULATIONS AND PERMITTING**

#### **3.9.1 General Requirements**

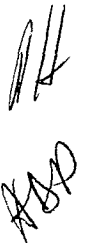
Consultant shall comply with all relevant Laws, including conditions of Environmental Assessment release, and / or regulations of any governmental authorities having jurisdiction with respect to the Services.

Consultant shall prepare all documents, drawings, Design Briefs, analyses, manuals, etc. as required by any governmental authorities with respect to the Services.

Company Document PM0010 "Regulatory / Permitting List" located in Exhibit 6 highlights the consents, licenses, permits, notifications and approvals that may be required by the LCP, covering the Project phases from pre-construction through to Operations.

Consultant shall determine and put into effect all regulatory, and permitting requirements, including conditions of Environmental Assessment release, affecting the performance of the Services, including design, engineering, procurement/manufacture, transportation, construction, and Completions activities.

Consultant shall prepare and issue a regulations register in accordance with the requirements outlined in Exhibit 6 identifying the current (or otherwise specifically applicable) version of all documents that contain regulatory, certification, and permitting requirements applicable to the design, engineering, procurement/manufacture, fabrication,



transportation, construction, and Completions for the Project. Consultant shall keep the regulations register fully updated at all times throughout the performance of the Services. The register shall identify the latest editions of such documents and where Consultant and/or Company Personnel can access each document freely. Note that the editions of these documents that are current at the time of Agreement signing will be the basis of design and construction. Updates and later editions that are issued during the course of the Agreement are to be reviewed by Consultant and the effects on the Services and on the Project provided to Company for evaluation.

### 3.9.2 Regulations

Consultant shall be familiar and comply with the technical and safety requirements of Canadian Standards and Laws related to environmental, safety and health issues where applicable in Consultant's and Subcontractors' work location(s).

In performing the Services, Consultant, its Subcontractors shall be familiar with and comply with all Laws for equipment and facilities certification. This applies to actual equipment used during fabrication at Contractor or Supplier locations.

Consultant is responsible for cooperation and coordination with the Government authorities including arranging the supply of necessary documents, drawings, calculations, etc. wherever required as determined during any process for equipment and facilities certification associated with the Project. The form of cooperation includes arranging provision of access for Company and any third party inspectors to Site(s) and documents, drawings, and calculations.

### 3.9.3 Permitting

Consultant is responsible, except as otherwise noted, for obtaining all regulatory permits, approvals, consents, documents and licenses required for performing the Work. Consultant shall develop and maintain a permit plan identifying permits required, dates required, and submittal and expected processing durations. Both permits and certifications will be covered in this plan. The Consultant shall identify permits which can only be obtained by Company. Company will be responsible for obtaining these permits with the assistance and input from the Consultant.

Consultant is responsible for producing and providing any information and documentation required for Company to obtain all applicable Governmental Authorities' approvals. As requested by Company, Consultant shall submit copies of Project documentation and technical information to Governmental Authorities to enable Company to secure such permits.

Any consequences for non-compliance of Consultant to the required permits, documents and licenses to perform the Work shall be to Consultant's account including payment of fines. Consultant shall use reasonable efforts to require compliance by Contractors and Suppliers. Consultant is responsible for obtaining documents such as visas and work permits for its Personnel.

Further details regarding Consultant's responsibilities and requirements related to regulations and permitting and engineering are described in Exhibit 5, Section 17.

**3.10 NEWFOUNDLAND AND LABRADOR BENEFITS OBLIGATIONS AND REPORTING**

Company is committed to supporting the accrual of benefits for the people of Newfoundland and Labrador, with Labrador residents benefiting from both business and employment opportunities. To ensure maximum return on investment and in turn to maximize benefits for the people of the Province, the LCP will be executed on an economic basis adhering to competitive business practices.

Consultant shall work together with Company and all LCP stakeholders (the public, suppliers of goods and services, the workforce and governments) to promote opportunities in Newfoundland and Labrador while maintaining the economic viability of the LCP through access of Best Value in the acquisition of goods and services. Consultant shall commit to the following:

- A. Consultant and Company shall work together to form a high performing team to optimize Newfoundland and Labrador Benefits on the Project;
- B. Consultant and Company shall work together to develop and execute an implementation plan consistent with the objectives and principles committed to by Company as relating to optimizing Newfoundland and Labrador Benefits on the Project;
- C. Consultant and Company shall work together to develop and implement a contracting and purchasing policy consistent with the objectives outlined in Exhibit 9 Newfoundland and Labrador Benefits;
- D. Consultant and Company shall work together to ensure information relating to Newfoundland and Labrador Benefits is collected and available for reporting purposes by Company.

Further details regarding Consultants responsibilities and obligations are described in Exhibit 5, Section 15.

# Lower Churchill Project – Phase I: Kickoff Meeting

## Responsibility Assignment Matrix (Tab 6)

Boundless Energy



# Overview

- Provides a summary level assignment of Responsibility for key activities
- Intended to provide internal clarity during the development of Scope of Services and Coordination Procedures
- Captures key areas of Scope of Services, but not fully inclusive
- Currently an Appendix to NE-LCP Execution Plan
- Refer to Agreement LC-G-002 for final assignments.



# Areas Covered

- Project Management / General
- Health, Safety and Security Management
- Environmental Management and Regulatory Compliance
- Labor and HR Management
- External and Public Relations / Communications
- Reviews and Audits
- Engineering and Design
- Supply Chain Management
- Construction Management
- Project Completions
- Quality Management
- Project Control
- Accounting and Invoicing
- Risk Management
- Information Management
- Benefits and Training

### Responsibility Assignment Matrix - Nalcor Energy / SNC-Lavalin Inc.

(Refer to Agreement LC-G-002 for Inclusive Listing of Responsibilities)

CORE ACTIVITY	RESPONSIBILITY ASSIGNMENT		
	Nalcor Energy	SNC-Lavalin	NOTES
<b>Project Management / General</b>			
Prepare Overarching Project Execution Plan	R		
Establish / Implement Project-wide Policies	R		EPCM Consultant to input as appropriate.
Project Management Plans and Associated Procedures	R	R	2 sets - Nalcor and EPCM Contractor
Project Execution Plan for EPCM Services Scope		R	
Prepare / Implement Project Procedures for within EPCM Services Scope)		R	
Prepare Technical Interface Management Plan		R	
Overall Technical Interface Management for EPCM Project		R	
Prepare Deliverable List & EPCM Work Packages		R	
Approval of EPCM Personnel	R		Reimbursable personnel only.
Recruitment & Training of Operations Staff	R		EPCM to support training
<b>Health, Safety and Security Management</b>			
Develop and implement a Project-specific H&S Management Plan for all phases of the work		R	Within EPCM's scope.
Chairs Project-level OHS Steering Committee	R		
Monitors contractor / sub-contractor performance and coaches to achieve desired outcomes		R	
Develop and implement site-specific H&S Management Plans		R	
Establish supporting H&S procedure, processes & tools for the H&S Plan.		R	
Prepare and implement Emergency Preparedness/Response Plans		R	
Develop & Implement Security Plan and Procedures		R	
Compliance with Occupational Health and Safety Act and Safety Regs		R	
Monitor Safety Performance and Prepare Safety Statistics Reports		R	
Establish construction safety targets		R	
Investigate and report Accidents and Near Misses		R	
Site Safety Inductions		R	
Verifying Contractor Safety Management Systems and site safety plans		R	
Implement a Safety-By-Design program to support the Engineering phase		R	

**Responsibility Assignment Matrix - Nalcor Energy / SNC-Lavalin Inc.**

(Refer to Agreement LC-G-002 for Inclusive Listing of Responsibilities)

CORE ACTIVITY	RESPONSIBILITY ASSIGNMENT		
	Nalcor Energy	SNC-Lavalin	NOTES
<b>Project Management / General</b>			
Prepare Overarching Project Execution Plan	R		
Establish / Implement Project-wide Policies	R		EPCM Consultant to input as appropriate.
Project Management Plans and Associated Procedures	R	R	2 sets - Nalcor and EPCM Contractor
Project Execution Plan for EPCM Services Scope		R	
Prepare / Implement Project Procedures for within EPCM Services Scope)		R	
Prepare Technical Interface Management Plan		R	
Overall Technical Interface Management for EPCM Project		R	
Prepare Deliverable List & EPCM Work Packages		R	
Approval of EPCM Personnel	R		Reimbursable personnel only.
Recruitment & Training of Operations Staff	R		EPCM to support training
<b>Health, Safety and Security Management</b>			
Develop and implement a Project-specific H&S Management Plan for all phases of the work		R	Within EPCM's scope.
Chairs Project-level OHS Steering Committee	R		
Monitors contractor / sub-contractor performance and coaches to achieve desired outcomes		R	
Develop and implement site-specific H&S Management Plans		R	
Establish supporting H&S procedure, processes & tools for the H&S Plan.		R	
Prepare and implement Emergency Preparedness/Response Plans		R	
Develop & Implement Security Plan and Procedures		R	
Compliance with Occupational Health and Safety Act and Safety Regs		R	
Monitor Safety Performance and Prepare Safety Statistics Reports		R	
Establish construction safety targets		R	
Investigate and report Accidents and Near Misses		R	
Site Safety Inductions		R	
Verifying Contractor Safety Management Systems and site safety plans		R	
Implement a Safety-By-Design program to support the Engineering phase		R	
<b>Environmental Management and Regulatory Compliance</b>			
Obtain Environmental Release	R		
Develop a Project-specific Environmental Protection Plan for all phases of the work		R	
Develop and implement environmental mitigations and rehabilitation plan for use during and post the construction phase		R	
Monitors contractor compliance with EPP		R	
Obtain and manage all construction permits, licences, notifications and maintain conditions.		R	Constructor will be responsible for individual permits
Establish construction environmental management targets		R	
Develop Site Specific EPPs		R	
Prepare and implement Project Regulatory Compliance Plan		R	
Identify requirements and complete applications for permits and licenses		R	Permits in Nalcor's name.
Compliance with applicable Environment Regulations and Conditions of Permits		R	
Environmental Awareness Training		R	
Verify Contractor Environmental Management Systems and EPPs		R	
Environment Management Committee	R		
<b>Labor and HR Management</b>			
Establish Project Labor Agreement (incl. Special Project Order)	R		EPCM supports negotiations and implements.
Overall management of Project labor agreements used by Contractors.		R	
Administer dispute resolution mechanisms outlined in Project labor agmt		R	
Overall labor management include productivity and performance.		R	

**Notes:** If there any discrepancy between this matrix and Agreement LC-G-002, the later shall be assumed to be accurate.

**Responsibility Assignment Matrix - Nalcor Energy / SNC-Lavalin Inc.**

(Refer to Agreement LC-G-002 for Inclusive Listing of Responsibilities)

CORE ACTIVITY	RESPONSIBILITY ASSIGNMENT		
	Nalcor Energy	SNC-Lavalin	NOTES
Administer of policies and procedures related to Personnel on site.		R	
Project Human Resources Policies	R		
<b>External and Public Relations / Communications</b>			
Project Press Releases	R		
Project Presentations	R		EPCM Consultant deliver presentations as approved by Nalcor.
Agreements with Outside Authorities			
• Government	R		
• Public Affairs	R		
• Community	R		
Manage Environmental Assessment Commitments	R		EPCM to execute commitments.
Property Assessment and Acquisition	R		
Innu Nation IBA Commitments	R		EPCM to execute commitments.
<b>Reviews and Audits</b>			
Project Audits			
• General Technical		R	
• Project-Level/Financial	R		
• Management		R	
• Environmental		R	
Prepare Design Verification Plan		R	
Independent Project Reviews	R		
Constructability Reviews		R	
Operability Reviews	R		
Technical Peer Reviews		R	
<b>Engineering and Design</b>			
Establish and maintain Project Basis of Design	R		
Establish Design Philosophies	R		
Prepare Review Plan for Company Supplied Documentation		R	
Engineering Management Plan for EPCM Scope		R	
Develop Engineering Procedures for each discipline		R	
Develop Design Integrity Stewardship Procedures	R		
Identify Design Codes and Standards		R	
Identify all engineering deliverables for each discipline		R	
Estimate a Person-hour effort for production of engineering deliverables		R	
Prepare Design Briefs & Criteria		R	
Prepare Technical and Functional Specifications		R	
Implement a Value Improving Practices (VIP) program as a means to improve cost, schedule and operability/reliability		R	
Equipment Spec/Data Sheets/Evaluation/MOC, Drawings - All Disciplines		R	
Preparation of all tender drawings		R	
Prepare any Technical Specifications for Tenders		R	
Manage all hard and soft technical interfaces within and touching the EPCM scope		R	
Perform Interdiscipline checks on all engineering deliverables		R	
Prepare Construction Drawings		R	Except contractor or supplier furnished
Prepare Operations and Maintenance Plan		R	
Prepare Design - Construction Management Plan		R	
Conduct design in accordance to Company-supplied Life Cycle Cost Analysis Philosophy		R	
Arrange and coordinate HAZID and HAZOP reviews		R	
Perform Safety Integrity Level (SIL) studies as required		R	
Detailed Technical Studies		R	
Overall System Engineering and Integration Studies		R	
Complete Equipment Criticality Ranking for use in determining surveillance		R	
Technical Bid Analysis		R	
Technical Review of Contractor Shop Drawings		R	

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**Responsibility Assignment Matrix - Nalcor Energy / SNC-Lavalin Inc.**

(Refer to Agreement LC-G-002 for Inclusive Listing of Responsibilities)

CORE ACTIVITY	RESPONSIBILITY ASSIGNMENT		
	Nalcor Energy	SNC-Lavalin	NOTES
Equipment Model Testing		R	
Ensure equipment Installation Procedures are available		R	
Automation, Control, Monitoring, Remote Operation		R	
Review of Construction Contractor's Drawings		R	
<b>Supply Chain Management</b>			
<b>Contracting and Procurement</b>			
Establish Master Contract Package List and Contracting Strategy		R	
Prepare Contracts/Purchasing Policies	R		EPCM implements
Prepare Overall Purchasing Plan		R	
Prepare Overall Contracting Plan		R	
Prepare and implement Contracts/Purchasing Procedures		R	
Define Construction/Procurement Packages		R	
Establish standard Commerical Terms and Conditions for agreements	R		
Special and Supplementary Conditions - Inquiry Document	R		
Develop procurement and contracting schedule including Delivery Schedule (ROS Dates)		R	
Data Submittal Schedule		R	
Prepare list of qualified Bidders		R	
Prepare and Issue EOI & Pre-Qual. Documents		R	
Prepare and issue tender / RFP packages		R	
Respond to Clarification from Bidders		R	
Receive Bids/Opening		R	
Commercial and Technical Evaluations of Tenders		R	
Conduct pre-award meetings		R	
Contract/Purchase Requisition		R	
Issue Purchase Order (PO)/Contract		R	
Contract/Purchase Order Register		R	
Status of Purchase Orders/Contract		R	
Contract/Purchase Order Amendments		R	
Contractor Competency Evaluations		R	
Claims Management		R	
Dispute Resolution		R	
Close Out PO/Contracts		R	
<b>Materials Management and Control</b>			
Material Management Plan		R	
Produce Detail Material Management Control Procedures/Plans		R	
Provide and maintain Material Management Control System		R	
Report Progress and Update Regularly		R	
Establish a Site Materials Storage Area		R	
Schedule Deliveries to Site		R	
Perform receiving inspection		R	
Establish and Maintain Material Receipts Register		R	
Distribute Equipment and Material to Contractors		R	
Report and manage non-comforming material		R	
Carry Out Regular Inventory Checks		R	
Procure and maintain Commissioning Spares		R	
Procure and maintain Operating Spares	R		
Warehousing of Spares		R	
Secure Vendor Commissioning Assistance		R	
Transfer Insurance and Operating Spares to Owner's Warehouse		R	
Stored Equipment Maintenance & Preservation		R	
<b>Expediting</b>			
Expediting and Inspection Procedures		R	
Expediting Visit Register		R	
Vendor Information		R	
Equipment and bulk materials		R	
Status Reporting		R	

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**Responsibility Assignment Matrix - Nalcor Energy / SNC-Lavalin Inc.**

(Refer to Agreement LC-G-002 for Inclusive Listing of Responsibilities)

CORE ACTIVITY	RESPONSIBILITY ASSIGNMENT		
	Nalcor Energy	SNC-Lavalin	NOTES
<b>Logistics</b>			
Develop Logistics and Materials Movement Plan		R	
Develop Logistics and Materials Movement Procedures		R	
Coordinate Inland Freight		R	
Obtain shipping documents		R	
Coordinate Ocean Freight		R	
Prepare Customs Documents for importing into Canada		R	
Prepare shipping data for export		R	
Operating Plant Logistics Planning	R		
<b>Construction Management</b>			
Prepare and implement Construction Management Plan		R	
Overall construction management for the Project		R	
Construction Planning		R	
Develop and Implement Construction Management Procedures		R	
Complete modularization / prefabrication analysis		R	
Prepare Detailed Construction Execution Plan & Schedule		R	
Manage Site Queries		R	
Engineering Query Process		R	
Manage Owner supplied materials		R	
Develop and implement Constructability Program and supporting procedures in order to incorporate industry best practice		R	
Carry Out Constructability Design Reviews		R	
Develop and implement a Productivity Improvement Plan		R	
Overall management of Project sites and provision of common services (e.g. accommodations, fire, security, transportation, etc.)		R	
Provision of Temporary Facilities at Site including Construction Office		R	For EPCM and NE-LCP team.
Provide Services to Offices		R	
Provision of Site Administration Services and Accommodations / Messing		R	
Establish and maintain Fire Protection and Medical Facilities and Services		R	
Provide Suitable access and lay down / storage areas to allow contractors to mobilize		R	
Reports/Communication External to Project Team	R		
Relocations of Services and Site Clearing		R	
Overall work site coordinator		R	
Control of the Work and Contractors.		R	
Contractor Performance Monitoring		R	
Productivity Monitoring and Improvement		R	
Managing and Checking the setting out of the works on site including control survey		R	
Liaison with Contractors to determine material/equipment requirements and expediting from field where necessary		R	
Procure, administer, maintain all construction equipment, consumables, small tools, safety supply		R	Monitors contractors
Provide site communications - backbone system	R		
Provide construction power feed to site	R		
Provide Site Transport (to and from the site and within the site)		R	
Construction Power - Site Distribution		R	
Provide site communications - Local system		R	
Establish and maintain Warranty Register		R	
<b>Project Completions</b>			
Prepare Project Completions Philosophy		R	
Prepare Mechanical Completion (MC), Commissioning, and Preservation Specifications		R	
Prepare project-specific procedures for punch-list, preservation, permit-to-work, lock-out/tag-out, material handling		R	

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**Responsibility Assignment Matrix - Nalcor Energy / SNC-Lavalin Inc.**

(Refer to Agreement LC-G-002 for Inclusive Listing of Responsibilities)

CORE ACTIVITY	RESPONSIBILITY ASSIGNMENT		
	Nalcor Energy	SNC-Lavalin	NOTES
Establish and implement a computerized Project Completion System		R	
Mechanical Completion (MC) - Manual, Execution / Management		R	Monitors contractors
Prepare Commissioning Manual		R	
Develop preservation program		R	
System / Equipment Preservation - Manual, Execution / Management		R	
Mechanical Completion Hand-Over Plan & Execution		R	
Prepare Handover Packages after Mechanical Completion		R	
Prepare M/C Inspection Test Records		R	
Prepare Mechanical Completion Certificate		R	
Prepare Commissioning Plan		R	
Readiness Process - define and implement	R		
Prepare and Update Pre-Op Schedule	R		
Commissioning Procedures		R	
Prepare commissioning static and dynamic documentation (e.g. checklist, run logs, etc.)		R	
Commissioning Spares Recommendation		R	
Prepare Testing Requirements, Procedures and Check Lists	R		
RFO Turnover Packages	R		
Arrange for Equipment Data Books, Operating and Maintenance Manuals to be supplied		R	
Hand-Over As-Built Drawings after Acceptance Tests		R	
Arrange for Contractors or Consultants to provide Commissioning Services		R	
Spare Parts Recommendation		R	
Prepare Spare Parts Lists		R	
Arrange for the provision of the necessary spare and replacement parts for initial Operation	R		
Prepare / maintain Master Equipment List		R	
Prepare Training Manuals		R	
Prepare Operations Procedures	R		
Prepare Operating Manuals		R	
Prepare Maintenance Manuals		R	
Prepare As-Built Documentation		R	
<b>Quality Management</b>			
Prepare Overarching Project Quality Assurance Plan	R		
Prepare and implement Project Quality Plan		R	Nalcor to audit implement.
Develop risk-based contractor / supplier screening tools for use in determining surveillance requirements		R	
General Quality Audits	R		
EPCM / Contractors Audit Function		R	NE will approve / accept the Contractors Audit Process
Develop and implement NCR Process		R	NE will approve / accept the Contractors NCR Process
Closure of Audit Findings		R	
Continuous Improvement Process		R	
Assess Contractors Quality Plans		R	
Overall Quality Statistics / Metrics		R	
Quality Training		R	
Lessons Learned		R	EPCM responsible for its scope.
<b>In Engineering</b>			
Development and implement engineering QA plan		R	
Engineering QC process		R	
Engineering Quality Reviews		R	
<b>In SCM</b>			
Risk-Based evaluation of suppliers / contractors for surveillance program development		R	
Prequalification - Establish Quality requirements		R	
Prequalification - Establish Quality requirements		R	
RFP - Quality Requirements		R	

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**Responsibility Assignment Matrix - Nalcor Energy / SNC-Lavalin Inc.**

(Refer to Agreement LC-G-002 for Inclusive Listing of Responsibilities)

CORE ACTIVITY	RESPONSIBILITY ASSIGNMENT		
	Nalcor Energy	SNC-Lavalin	NOTES
Third Party Inspection		R	
Materials Traceability		R	
<b><u>In Construction</u></b>			
Overall responsibility for construction quality		R	
Contractor adherence to codes and regulations		R	
Establish site survey control system and control points		R	
Processing of Site NCR's		R	
Producing Construction Surveillance Reports		R	
Receiving Inspection at Site		R	
Prepare and implement Inspection Policies		R	
Prepare and implement Inspection Work Plan		R	
Review Quality Assurance (QA) programs/inspections		R	
Review of Vendors ITP's for equipment		R	
Conduct Shop Inspections		R	
Coordinate Factory Acceptance Testing and Site Integration Testing		R	
Develop FAT and SIT procedures		R	
Witness Shop Performance Testing		R	
Establish and operate site laboratories		R	
Review Vendor's Inspection and Testing Reports		R	
Status Reporting		R	
Endorse equipment Release for Shipment		R	
<b>Project Control</b>			
Establish and manage Management Summary Schedule (MSS)	R		Overall Project
Establish and manage Integrated Project Schedule (IPS)	R		Overall Project
Develop Project Controls Work Plan		R	For EPCM scope
Business Systems Integration	R		EPCM runs its PM tools (i.e. PM+)
Develop Work Breakdown Structure(WBS) & Cost Code of Accounts	R		
Progress and Performance Management		R	
Planning & Scheduling		R	
Progress Reports			
• Overall Project	R		
• EPCM Scope		R	
<b><u>Estimating</u></b>			
Estimating Work Plan & Procedures		R	
Prepare Services Budget Estimate		R	
Prepare Cost Estimates for the Work		R	
Assign Coding System		R	
Equipment and Material List		R	
Prepare Basis of Estimate		R	
Develop Material Quantities (bulks and consumables)		R	
Develop Equipment and Material Supply Cost (rates)		R	
Develop Labor Rates for use in estimating	R		
Develop production norms / rates to be used in the estimate		R	
Prepare Capital Estimate of Direct Costs and Matrix Summaries	R		
Develop Construction Hours including Productivity Factor	R		
Establish Estimate Contingency	R		
Contingency Management	R		
Capital Cost Estimate Details and Matrix Summaries	R		
Prepare estimates for Project Changes		R	
Check Bid Estimates for Construction Contracts		R	
Operating Cost Estimate	R		
<b><u>Planning and Scheduling</u></b>			
Manage EPCM Services to achieve Project Milestone Schedule		R	For EPCM Scope
Prepare Scheduling Development and Control Plan		R	For EPCM Scope
Implement Scheduling Development and Control Plan		R	For EPCM Scope
Develop Scheduling Procedures		R	For EPCM Scope
Prepare detailed Project Control Schedule and updates		R	For EPCM Scope

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**Responsibility Assignment Matrix - Nalcor Energy / SNC-Lavalin Inc.**

(Refer to Agreement LC-G-002 for Inclusive Listing of Responsibilities)

CORE ACTIVITY	RESPONSIBILITY ASSIGNMENT		
	Nalcor Energy	SNC-Lavalin	NOTES
Prepare detailed schedule of Engineering Activities by work Package		R	For EPCM Scope
Prepare detailed schedule of Equipment Procurement by Package		R	For EPCM Scope
Prepare detailed Construction Schedules and updates		R	For EPCM Scope
Prepare schedules showing sequence and timing for individual Contracts		R	For EPCM Scope
Prepare work hour histograms and "S" curves		R	For EPCM Scope
<b>Cost and Schedule Stewardship</b>			
Convert EPCM Consultant's Services Budget and Sanction Cost Estimate into a Project Budget		R	For EPCM Scope
Prepare Cost Management Plan		R	For EPCM Scope
Implement Cost Management Plan		R	For EPCM Scope
Develop forms and Procedures for Capital Cost Control		R	For EPCM Scope
Develop Progress and performance management procedures		R	For EPCM Scope
Code of Accounts for Asset Classification and Capitalization	R		
Cost Control for the Work		R	For EPCM Scope
Maintain and update EPCM Budget		R	For EPCM Scope
Allocate funds for Contract Change Orders	R		
Receipt and review of contractor cost reports		R	For EPCM Scope
Prepare monthly Project Cost Report		R	For EPCM Scope
<b>Management of Change</b>			
Prepare Change Management Plan for EPCM Project		R	
Management of Change within EPCM Services		R	
Engineering / Design Change Management		R	Using EPCM's process, linked to Project MOC process.
Maintain the individual Contract Scope Change Register		R	
<b>Accounting &amp; Invoicing</b>			
Prepare Invoicing and Payment Plan for construction contracts and supply agreements		R	
Establish a Project Bank Account to Disburse all Payments	R		
Attest invoices from Vendors/Contractors		R	
Issuing Payments	R		
Submit detailed invoice progress payment listing complete with reconciled order status as stipulated in the purchase order		R	
Final Plan Cost Reconciliation and Closeout Report		R	
Maintain a comprehensive Accounting service to maintain a full set of books of Accounts in accordance with General Accepted Accounting Practice for the entire Project Cost through to Balance Sheet	R		
Annual Audit of Project Accounts	R		
Prepare and maintain a comprehensive Assets Register which reconciles with the total Project expenditure	R		
Cash Management	R		
Maintain Payment Ledger	R		
Develop Currency Management Strategy	R		
Prepare monthly Cash Flow Report		R	
Prepare Certificates of Payments		R	
Forecasts for Cash Flow demand and foreign currency requirements		R	
Project Tax Management	R		
<b>Risk Management</b>			
Prepare Risk Management Plan for scope within EPCM Services		R	
Approval of Contractor Risk Management Plans		R	Dependent upon contract form.
Project Risk Assessments		R	Within EPCM scope
Management of Tactical Risks		R	Within EPCM scope. Nalcor approves plans.
Management of Strategic Risks	R		Project wide.
Establish Project Insurance Program	R		Project wide.
<b>Information Management</b>			
Prepare Information Management Plan		R	

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**Responsibility Assignment Matrix - Nalcor Energy / SNC-Lavalin Inc.**

(Refer to Agreement LC-G-002 for Inclusive Listing of Responsibilities)

CORE ACTIVITY	RESPONSIBILITY ASSIGNMENT		
	Nalcor Energy	SNC-Lavalin	NOTES
<b>IS/IT</b>			
Infrastructure integration of Business Systems, if required	R	R	Requirements to be determined.
IT Infrastructure Contractor Offices/sites.		R	
Hardware/Software for NE-LCP team members located at Contractor offices/sites.		R	
Help Desk Support for NE-LCP team members located in Contractor offices/sites.		R	
<b>Document Management</b>			
Management of Engineering data and documents.		R	
Management of Vendor data and documentation.		R	
Management of Contractor data and documentation		R	
Provide Company with on-line / electronic access to key documentation		R	
Project Information Coding	R		EPCM Implements
Document /Data Standards (formatting)	R		EPCM Implements
Signing, stamping and sealing of Engineering documents		R	
Document Review Coordination		R	
Provision and use of existing project data/documentation	R		EPCM Utilizes
Deliverables List Submission Timing Matrix		R	
Prepare Final Documentation		R	
Deliverables Handover/Retention Matrix		R	
<b>Benefits and Training</b>			
Adhering to Nalcor/LCP hiring adjacency protocol and commitments from other agreements		R	
Meeting Participation Nalcor/LCP objectives with respect to under represented groups		R	
Developing and Delivering Training, orientations and apprenticeship programs			Apprenticeship Programs require Input by EPCM
Encouraging relevant stakeholder groups to access and develop training opportunities	R		
Providing manufacturers, consultants, contractors, and service companies in Newfoundland and Labrador with full and fair opportunity to participate on a competitive basis in the supply of goods and services		R	
Developing and Implementing supplier development Initiatives		R	
Implementing Diversity plan and Diversity Commitments as per other Agreements		R	
Carrying out consultant and contractor proposed programs in Newfoundland and Labrador to promote education, technology transfer and research and development		R	
Collecting and reporting Relevant Benefits Data as per Nalcor/LCP Benefits Criteria		R	
Defining and Executing commitments based on Nalcor/LCP Benefits Strategy and other agreements		R	

# Lower Churchill Project – Phase I: Kickoff Meeting

## Decision Gate 3 Key Deliverables (Tab 7)

Boundless Energy



# Contents

- Key Deliverables
  - What they are
  - Objectives
  - Myths
  - Requirements
  - Detailed Listing
- Decision Gate 3 Cost Estimate
  - Overview
  - Attributes and Characteristics

# Key Deliverables – What they are

- 37 tangible, strategic documents that thoroughly define **what** the Project is and **how** it will be delivered in order to achieve the Project's objectives.
- Document critical execution strategies and plans which are required to ensure predictability.
- Help to demonstrate a readiness to pass through a Decision Gate.
- Several establish the **Controlled Project Documents** to facilitate effective Management of Change.

# Key Deliverables – Objectives

- Ensure we are on a solid foundation for procurement and construction execution.
- Demonstrate the completeness and thoroughness of work completed.
- Provide the key information required to produce the DG 3 cost estimate and project schedule.
- Facilitate risk-informed decision making at the Decision Gate.

# Key Deliverables – Myths

- Required to get a “tick in the box”
- Assessed against some standardized criteria to ensure suitability
- Never used – gather dust on a shelf

# Key Deliverables – Requirements

- Integrated and linked
- Represent the latest project thinking
- Reflect lessons learned
- Inherent Quality
- Interdisciplinary verified
- Status visible and supported by underlying activity progress
- Each Key Deliverable to be **accepted** by Nalcor



# 37 Gate 3 Key Deliverables

1. Cost and schedule estimates with an accuracy of AACEI Class 3 Estimate equivalent
2. Organization design and practices for Phase 4 in-place with all key staff mobilized and plan for mobilization of remaining team in-place
3. Updated Basis of Design for Project completed (in conjunction with Company)
4. All design technology and processes selected and accepted by Company
5. Project-specific design criteria documented for all disciplines and Issued for Use
6. Project-specific equipment specifications issued for design, as required to meet Consultant's contracting plan
7. Project-specific bulk materials specifications, as required to meet Consultant's contracting plan approved by Consultant and accepted by Company

## 37 Gate 3 Key Deliverables (cont'd)

8. Project Site / plot plans – layout plan frozen
9. All geotechnical surveys and data acquisition and analyses complete
10. Gateway Phase 3 engineering and Detailed Design deliverables complete as required to meet Consultant's contracting plan
11. Approved for Design (AFD) and Approved for Construction (AFC) Process Hazard Analysis (PHA) and Hazard Operability Reviews (HAZOPS) Completed, commensurate with the maturity of engineering
12. Constructability Review, commensurate with maturity of engineering, Completed for Project supported by level 4 construction schedule and documented construction philosophy
13. Project Control Schedule, supported by detailed construction and Completions schedule, in place with primary critical path(s) identified
14. Overall productivity action plan for the Work in place and accepted by Company

## 37 Gate 3 Key Deliverables (cont'd)

15. Project Execution Plan for Gateway Phase 4
16. Contract plan in-place for implementation of the Project
17. All equipment packages defined
18. Procurement underway for all long-lead items in accordance to procurement plan
19. Construction Management Plan – temporary facilities and services identified
20. Project management processes and supporting tools in place
21. Logistics and freight forwarding plan in place, ready for use / being used
22. Project Information Management and technology plan implementation complete
23. Project Quality Plan in-place
24. Environmental compliance monitoring plan in place / being used

## 37 Gate 3 Key Deliverables (cont'd)

25. H&S management plan in place / being used
26. Project Change Management Plan – implementation complete
27. All key Interfaces identified and Technical Interface Management Plan in-place / being used
28. Labour recruitment plan in-place (in conjunction with Company)
29. All consents, permits and licenses required established with early consents, permits and licenses received with no schedule showstoppers identified
30. Environmental effects management program in-place and ready to be deployed
31. Lessons learned / value improvement practices review and implementation complete for Gateway Phase 3

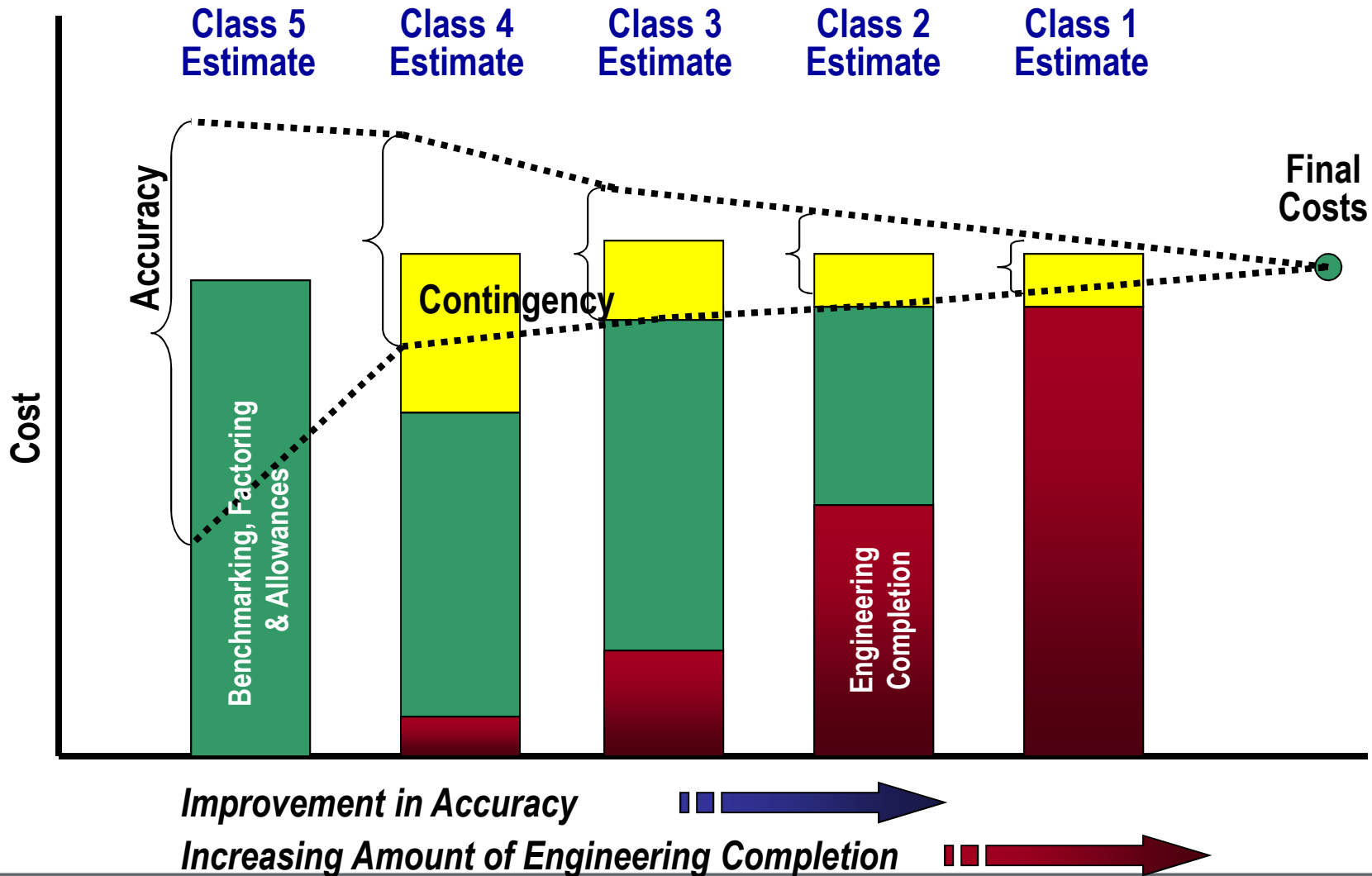
## 37 Gate 3 Key Deliverables (cont'd)

31. Operability review complete on the overall Project design and configuration, commensurate with the maturity of engineering
32. Sparing strategy in-place
33. Life cycle value analysis design reviews complete, commensurate with the maturity of engineering
34. Completions philosophy in-place
35. Operability Standards for equipment selection defined, commensurate with the maturity of engineering
36. Documentation for Operations strategy in-place with turnover protocols defined
37. Office, equipment, IS/IT and infrastructure plan for Gateway Phase 4 in place

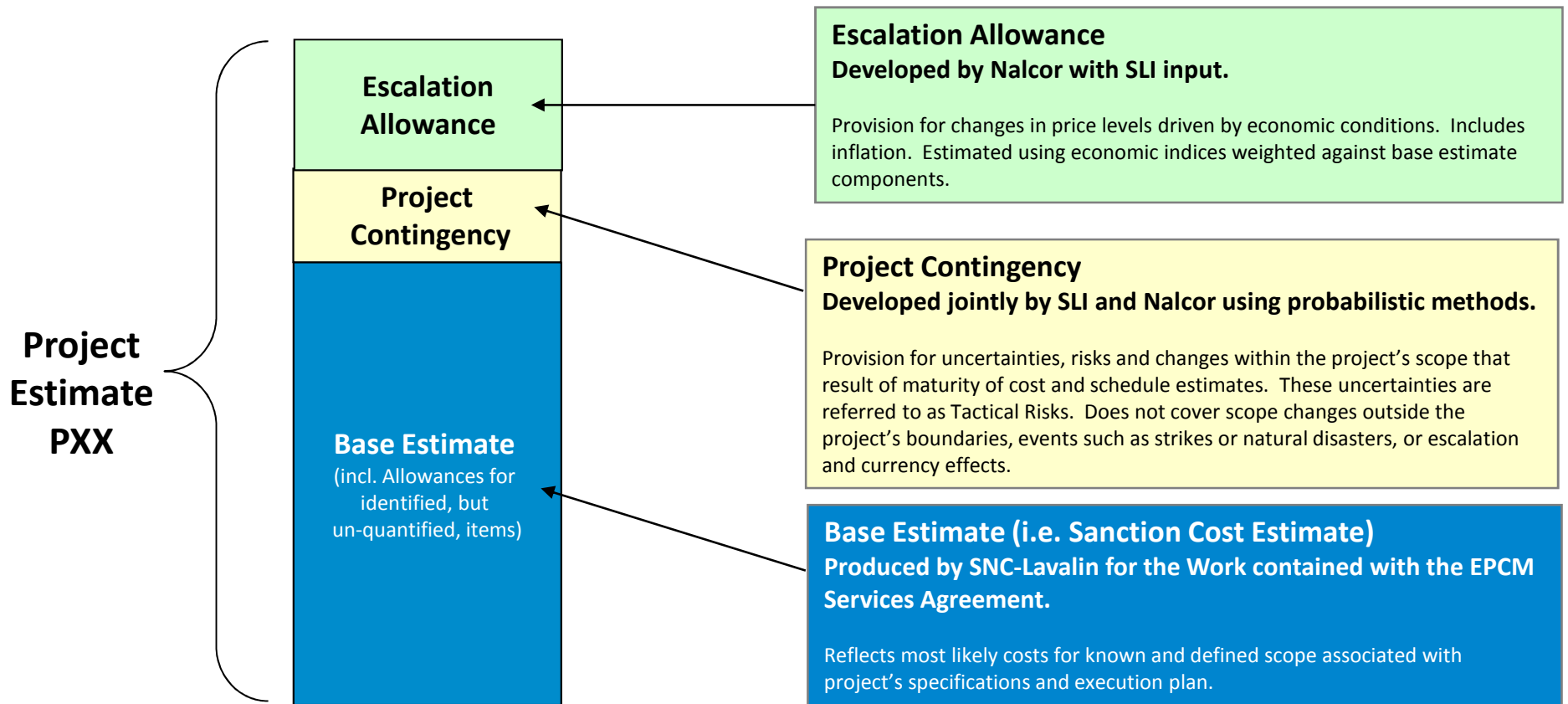
# Decision Gate 3 Estimate

- Consistent with the DG 3 Key Deliverables
- Intended to **verify the DG2 estimate**.
- Once approved, is the Control Cost Estimate for Gateway Phase 4 – procurement and construction.
- Commensurate with a AACE International Class 3 estimate.
- Aligned with the detailed construction schedules and Project Control Schedule.
- Led by SLI, with Nalcor strategic input.

# Estimate Class and Maturity



# DG 3 Estimate Components





## DG3 Estimate Attributes and Characteristics

### Intended Purpose

- Verify the Decision Gate 2 estimate
- Provides increased level of confidence in outcome
- Seek Effective Project Approval or Sanction
- Establishes the Project Budget

## DG3 Estimate Attributes and Characteristics

### Project Definition

- Completed design documents including drawings and outline specifications at the end of Gateway Phase 3.
- All project execution strategies in-place for execution.
- Early procurement / contracting underway.
- Complete working drawings for early construction packages being issued for tender.
- Significant amount of engineering completed.

## DG3 Estimate Attributes and Characteristics Preparation Methodology

- Deterministic based for both direct and indirect cost.
- Majority of estimate prepared from measured and priced quantities obtained from the completed design drawings and outline specifications.
- Price and performance factors developed specifically for the Project (i.e. project labor agreement, commodity prices, productivity rates) and benchmarked against historical projects.
- Production rates and timeline durations aligned with detailed construction schedule.
- A very minor proportion of the estimate may be in the form of allowances.

# DG3 Estimate Attributes and Characteristics

## Base Estimate Elements

### DEFINITION

### PERFORMANCE



- Location Factors
- Plant Definition
- Major Equipment
- Bulk Quantities
- Design Constraints
- Design Criteria
- Design Standards
- Technology Limits

- Build Sequence and Constraints
- Construction Equip.
- Labor Demands
- Trade Mix
- In-directs
- Support Facilities
- Seasonality

- Labor Rates
- Equipment Rates
- Marine Construction Vessels
- Commodities Rates
- Permanent Equip.
- Materials Cost
- Contracting & Procurement Strategy

- Labor Productivity
- Mobilization Constraints
- Seasonality Impacts
- Equipment Productivity
- In-Directs
- Project Management Resources

# DG3 Estimate Attributes and Characteristics

## Level of Precision and Cost Flow

- **Level of Precision**
  - Medium to High
- **Cost Flow**
  - Aligned with Project Control Schedule
  - Monthly cost flow available for each major commodity and for each currency and for each WBS Physical Component.

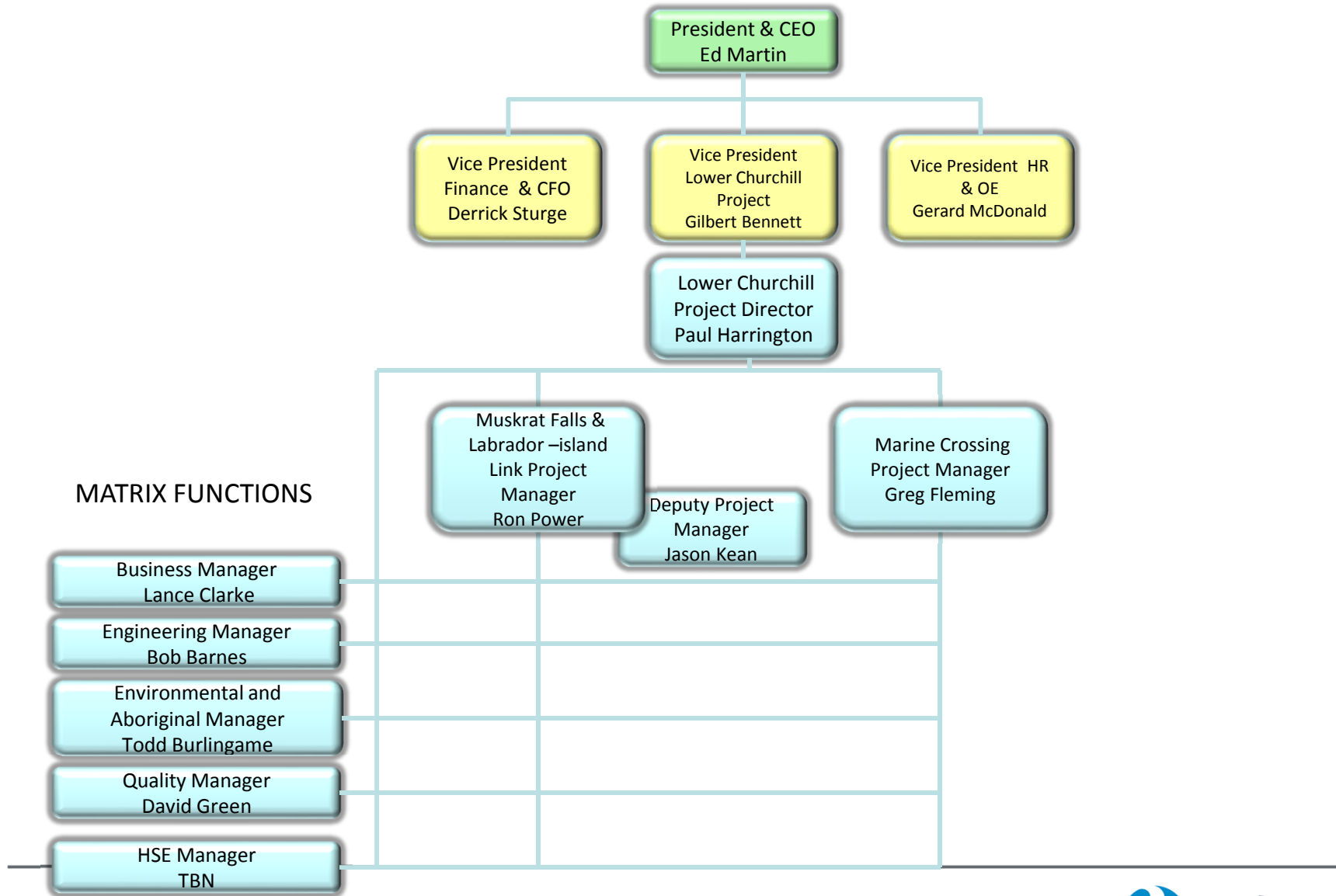
# Lower Churchill Project – Phase I: Kickoff Meeting

## Overall Nalcor LCP Organization (Tab 8)

Boundless Energy



# Overall Nalcor Organization and Lower Churchill Project



# Lower Churchill Project – Phase I: Kickoff Meeting

## Decision Gate 2 Basis (Tab 9)

Boundless Energy





# Contents

- Overview
- Basis of Design
- Master Contract Package Listing
- Project Schedule
- Capital Cost Estimate

## Decision Gate 2 Basis

- Project Baseline (scope, time, cost, execution approach) defined at Decision Gate 2 (DG 2)
- Project Baseline captured in several key Controlled Project Documents, including:
  - Basis of Design
  - Capital Cost Estimate
  - Project Control Schedule
  - Contracting Strategy & Master Contract Package List
- These documents form the basis against which Project change will be managed.

# Establishing Controlled Project Documents

## Scope Tracking & Management

## Management of Change

### Control Documents

- Basis of Design (Rev B1)
- Gate 2 PEP
- PM & Contracting Strategy
- Gate 2 Estimate
- Gate 2 PCS
- Master Contract Package List
- Gate 2 Org. Design

### Control Documents

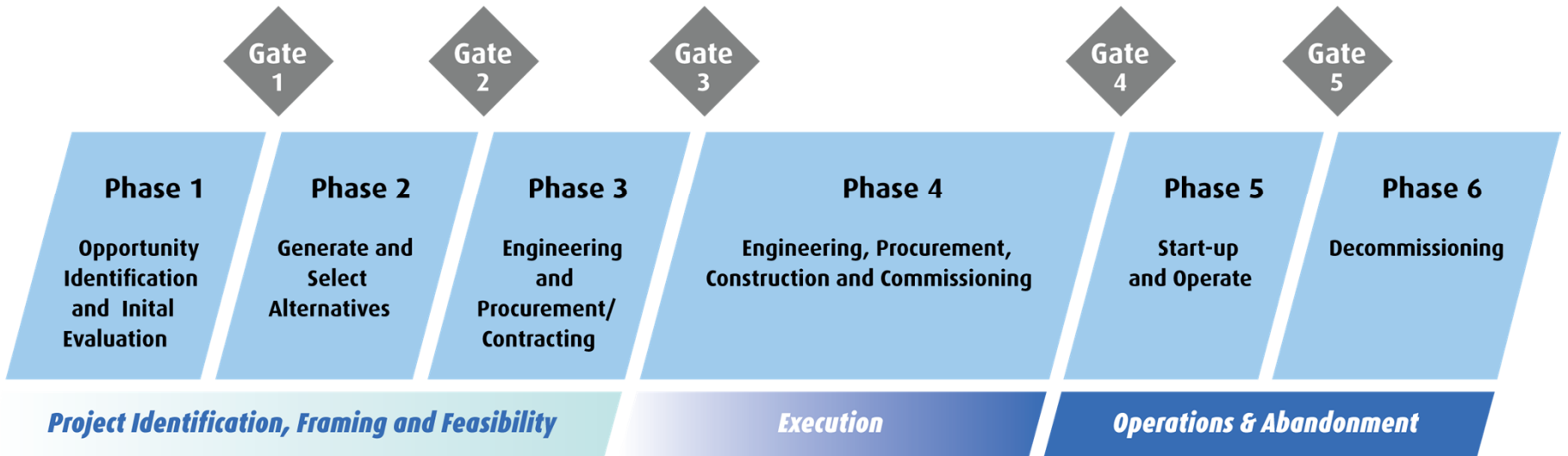
- Basis of Design (Rev B1)
- Gate 3 Project Execution Plan
- Gate 3 Estimate and Basis of Estimate
- Gate 3 Integrated Project Schedule (IPS)
- Design Philosophies
- Technical Specifications and Standards
- Design Criteria
- Contract Package Listing
- EPCM Execution and Select Mgmt Plans
- Construction Execution Plan
- Regulatory Compliance Plan
- Environmental Protection Plan
- Single Line Diagram
- Plot Plants (TL routing & Facility Layout)

### Document Origin

NE-LCP PT

SNC-Lavalin Inc.

*Project Sanction*



# Basis of Design (BOD)

Nalcor Energy – Lower Churchill Project



Lower Churchill Project – Basis of Design

LCP-PT-ED-0000-EN-RP-0001-01

Comments:		Total # of Pages (including Cover): 38 34 P/B	
Supersedes Document #: MSD-PM-006 Issued for Decision Gate 2			
B1	(1) Feb-11 Issued For Use BOD BOD 2.0	R. Barnes	J. Kean
Status/ Revision	Date	Reason For Issue	Prepared By
			Checked By
			Project Director Approval

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# BOD Overview

- Tab 9 of your binders
- Provides an overarching Project definition at Decision Gate 2
- Revision B1 issued 14-Feb-2011
- Issued to SLI

# BOD Table of Contents

- Purpose
- Scope
- Definitions
- Abbreviations and Acronyms
- Reference Documents
- Descriptions
- Drawings

# BOD Scope

- LCP Phase I
  - Muskrat Falls Hydroelectric Facility
  - Labrador – Island Transmission Link
  - Maritime Link
  
- LCP Phase II
  - Gull Island Hydroelectric Facility – covered in BOD however not part of EPCM Services Agreement

# BOD Reference Documents

- Reference list includes:
  - Gull Island – 29
  - Muskrat Falls – 26
  - HVac Transmission – 8
  - HVdc Systems – 26
  - Other – 18
- Details covered under Agenda Section 9.
- Not all are applicable to EPCM Services Agreement



# Overarching Principles of BOD

- Proven technology
- Remotely operated plants
- Proactive environmental mitigation & rehabilitation
- Good Utility Practice
- Fail Safe Design
- Respects Nalcor H&S policies and programs
- Respects Nalcor environmental policies and guiding principles
- Respects Nalcor Asset Management policies and guiding principles

# Muskrat Falls

- LSL = 38.5 m; FSL = 39.0 m; MFL = 44.0 m
- 4 – 206 MW units, Kaplan turbines
- 4 units, 4 intakes, 4 water passages (close coupled intake/powerhouse), 4 power transformers
- Surface powerhouse, all facilities under one roof
- Main Dam to be RCC
- Spillway – combination of gates and overflow, designed for PMF
- River diversion – through partially completed spillway, CDF = 1:20/year

## Muskrat Falls (cont'd)

- Reservoir Clearing – 3 m below LSL to 3 m above FSL
- Accommodation Complex – 1500 persons capacity
- No Permanent Accommodations
- Main access along new road along south side of river

## HVAc Transmission Line

- Interconnection of Muskrat Falls to Churchill Falls
  - 2 – 345 kV, single circuit transmission lines
  - 900 MW capacity for each line
  - Galvanized lattice steel towers
  - 1:50 year reliability level return period of loads
- Gull Island to Churchill Falls – on hold
- Granite Canal to Bottom Brook – Maritime Link

# Labrador – Island Transmission Link

- 900 MW HVdc bi-pole operating at  $\pm 320$  kV
- LCC converter stations at Muskrat Falls and Soldiers Pond
- Mono-polar operation via shoreline pond electrodes
- HVdc overhead Transmission Line MF to SP
  - 450 MW per pole, single conductor
  - Galvanized lattice steel towers
  - 1:50 year reliability level return period of loads

## Labrador – Island Transmission Link (cont'd)

- HVdc SOBI sub-sea cables (by Nalcor)
  - 3 cables – including 1 spare
  - 450 MW per cable
  - Cables protected along entire route
- Transition compounds each side of SOBI (by SLI)
- System upgrades (by Nalcor)
  - Conversion of 2 thermal units to synch.condensers
  - Addition of high inertia sync condensers at SP
  - Additional upgrades to NE-NLH system

# Maritime Link

- 500 MW HVdc bi-pole operating at  $\pm 200$  kV
- VSC converter stations at Bottom Brook and Cape Breton
- Mono-polar operation via shoreline pond electrodes
- HVdc overhead Transmission Line BB to Cape Ray
  - 250 MW per pole, single conductor
  - Galvanized lattice steel towers
  - 1:50 year reliability level return period of loads

## Maritime Link (cont'd)

- HVdc Cabot Strait sub-sea cables
  - 2 cables – no spare
  - 250 MW per cable
  - Cables protected along entire route
- Transition compounds on each side of CS
- HVac Transmission Line
  - Bottom Brook to Granite Canal
  - 1 – 230 kV single circuit transmission line
  - Capacity TBD
  - TL corridor TBD



# Contracting Strategy / Package Listing

**Nalcor Energy – Lower Churchill Project**



**nalcor**  
energy  
LOWER CHURCHILL PROJECT

**Muskrat Falls & Island Link Master Contract Package List**

**LCP-PT-ED-0000-SC-LS-0001-01**

Comments: Updated for Gate 2 purposes. Includes both Muskrat Falls and Island Link Projects. For information related to Gull Island see MSD-MM-018	Total Page Count (including cover): <p style="text-align: center;"><b>14</b></p>
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Approvals and Revision History						
Status / Revision	Date	Reason For Issue	Prepared By	Checked By	Checked By	Project Manager Approval
B1	03-Mar-11	Issued for Use	 P. Huxley	 J. Kean	 T. Scott	 P. Power
			 P. Harrington			

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# Contract Package List

- Prepared by Nalcor with input from SNC-Lavalin
- Represents a logical breakdown of Project into discrete work packages based upon known interfaces
- Ongoing market intelligence received over the past 3+ years
  - Considers market capacity limitations and EPCM execution strategy
- Consistent with DG2 project schedule and capital cost estimate
- Basis for informing business community
- **This is a planning document only – SLI are to develop a best-for-project contracting and packaging strategy that promotes the achievement of Project objectives.**

# Contract Package List

- For each package provides:
  - Name and boundaries
  - Whether it must be bid to an Innu Nation businesses first
  - Notional compensation scheme
  - Estimated manufacturing durations
  - Key engineering deliverables required to support tender
  - Estimated procurement process durations
  - Potential cash forecasting requirements

# Contract Package List - Headings

- Package number
- Contract name
- Sub Project
- IBA listed contract
- Description & Scope
- Summary of key quantities
- Contract form / type
- Estimated manufacturing duration
- Mobilization time / transportation time
- Contract process duration
- Engineering deliverables
- Payment terms

Package Reference No.	Contract Name	Sub-Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / (working days)	Contract process duration (Issue EOI to award)	Engineering Deliverable Types	Project Payment Terms
C-001	Main Site Access Road - South Side	Muskkrat Falls	Yes	- Access Road on South side of Churchill River from Muskkrat Falls to near Blackrock Bridge on Trans Labrador Highway - 19 km long	Including: Clearing 40 ha Stripping 155,000 m <sup>3</sup> Rock Excavation 30,000 m <sup>3</sup> Rock Fill 96,500 m <sup>3</sup> Granular Sub-base 44,000 m <sup>3</sup> Granular Base 27,000 m <sup>3</sup>	Combination - Lump Sum & Unit Rates	N/A	3 - 4 months	96	Technical Specifications Site Location Plans and General Specifications Detailed Site Mapping Access Road Plan, Profile and Sections Culvert Locations and Details Design Brief Environmental Permitting, Mitigation and Remediation Plans and Details	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob.

# Contract Package List – Examples

- Accommodations Complex
- Site Access Road
- Bulk Excavation Works
- Intake and Powerhouse Construction
- RCC Dams – North & South
- Converter Stations
- Transmission Line Construction
- Turbines & Generators
- Powerhouse Building
- Reservoir Clearing

# Contract Package List – Next Steps

- Additional market intelligence required to validate DG 2 planning basis
- Risk brokering strategy to be developed
- Detailed Overall Contracting and Procurement Plan to be produced
- Detailed contracting and procurement schedule to be prepared and feed into Project Control Schedule
- Identify IBA contracts that must be bid first to Innu Nation Businesses
- Publish on SLI and Nalcor website

# Project Schedule

**Nalcor Energy – Lower Churchill Project**



**Project Control Schedule**  
LCP-PT-ED-0000-EP-SH-0002-01

Comments: Prepared for Gate 2. Note: Supersedes GEN-PJ-001 & GEN-PJ-004	Total Page Count (including cover): <b>158</b>
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Approvals and Revision History						
Item / Revision	Date	Reason for Issue	Prepared By	Checked By	Checked By	Dept. Manager Approval
B1	29-Oct-10	Issued for Use	T. Scott	C. Freake	D. Pardy	J. Kean
A1	03-Sept-10	Issued for Review / Comment	T. Scott			

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# Basis of Schedule

- Founded upon extensive studies and planning work done for both Gull Island, Muskrat Falls, and Labrador – Island Tx Link since 2007.
- Structured around Gateway Phases, with DG 3 requirements achieved for DG 3 approval by end 2011.
- Construction-driven schedule with Engineering and Procurement scheduled to support.
  - Desire is for T/G sets to be critical path and have civil construction support installation program.



## Basis of Schedule (cont'd)

- Schedule is closely aligned with DG 2 estimate (i.e. major quantities and production rates) and Contracting Strategy.
- Target Milestone Dates established using knowledge of construction durations and key activity sequence for Muskrat Falls.
- Excludes the MF1340 recommendations.

# Basis of Schedule

## Key Planning Assumptions

- For DG2, EPCM Consultant can rapidly mobilize for contract award and prepare critical design scope required for early tendering activities.
- DG 3 Key Deliverables available by 15-Dec-2011.
- Release for Environmental Assessment and subsequent approval of construction permits is a pre-requisite for start of construction.
  - MF site infrastructure (access, accommodations, construction power, communications, etc.) to start immediately

# Basis of Schedule (cont'd)

## Key Planning Assumptions

- Generation Project EA release to allow establishment of permanent site access prior to July 2012 start of mass excavation.
- No major schedule implications due to 2010 field investigations or MF Layout Study (MF1340).
  - SLI must be validate given **large change** in key quantities.
- Labrador – Island Link EA release achieved within 12 months of Environmental Impact Statement submittal.

# Basis of Schedule (cont'd)

## Key Planning Assumptions

- DG 3 approval is a pre-requisite for commitment of major procurement expenditures.
- Winter work assumed.
- Reservoir clearing underway 10 months each year.
- EA Release conditions do not constraint construction schedule (e.g. migratory birds).

# Basis of Schedule (cont'd)

## Key Planning Assumptions

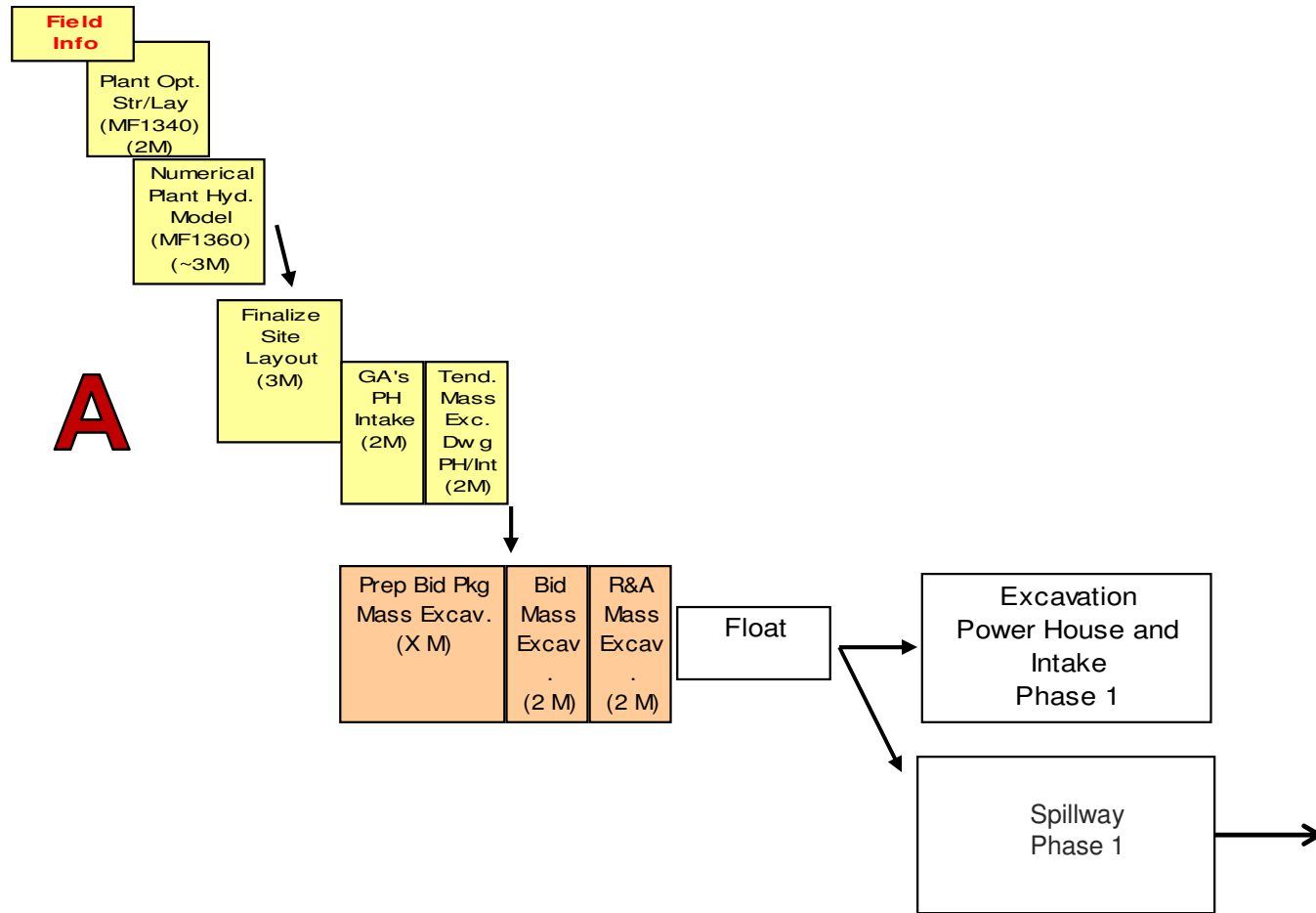
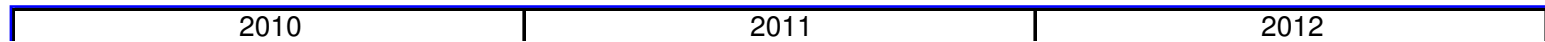
- Commissioning and First Power can be via 345 kV line to Churchill Falls.
- Labrador – Island Transmission Link must be in place for Units 3 & 4 to be commissioned.
- Muskrat Falls construction will be the dominant critical path. Labrador – Island Tx Link can be completed within the MF construction timelines.
- No labor capacity or supply chain constraints.

# Basis of Schedule (cont'd)

## Schedule Driving Logic

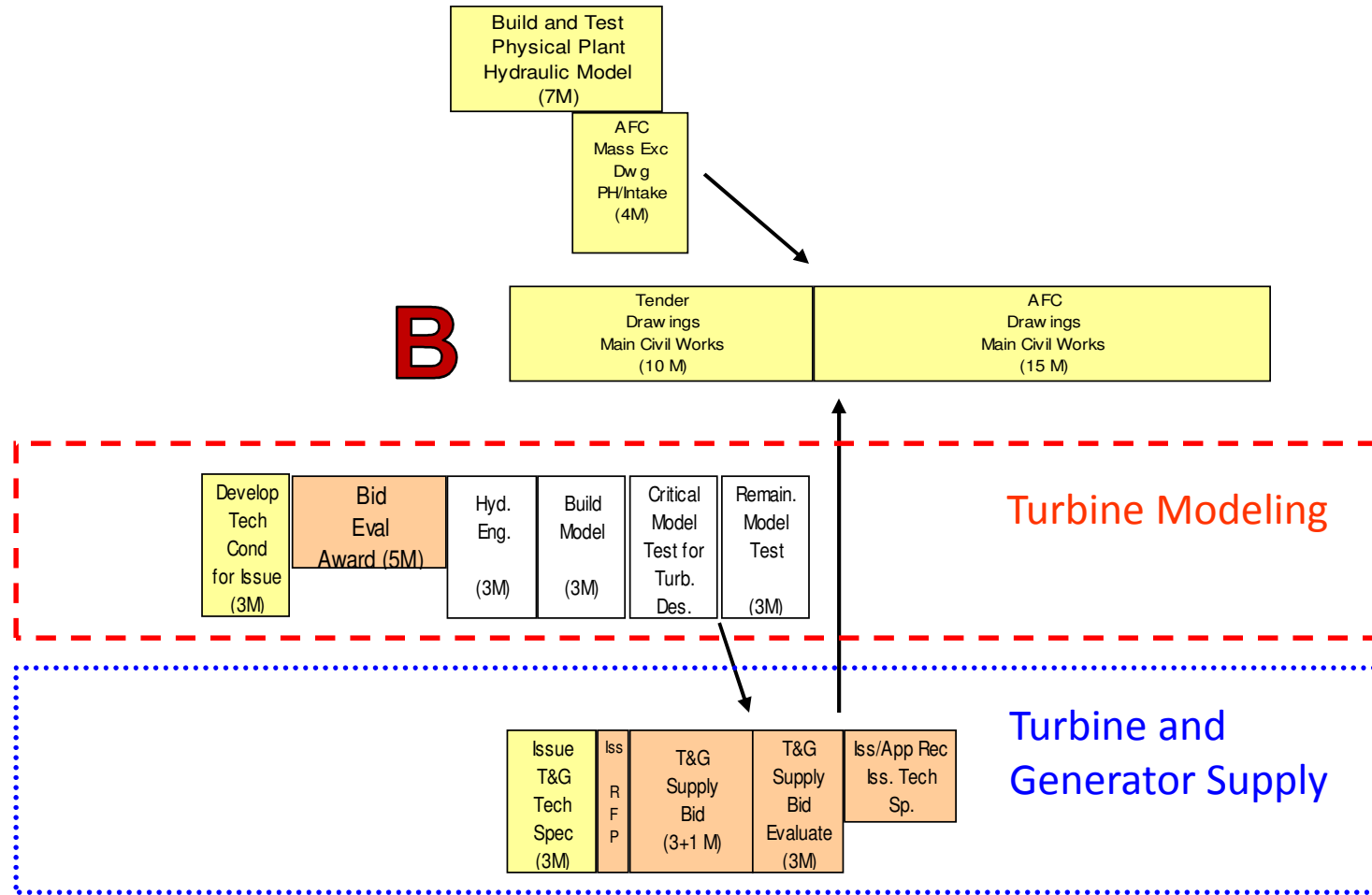
Indicative driving logic for the Project Schedule is presented on the following slides.

# Mass Excavation Works



# T/G Modeling & Supply & Civil Interface

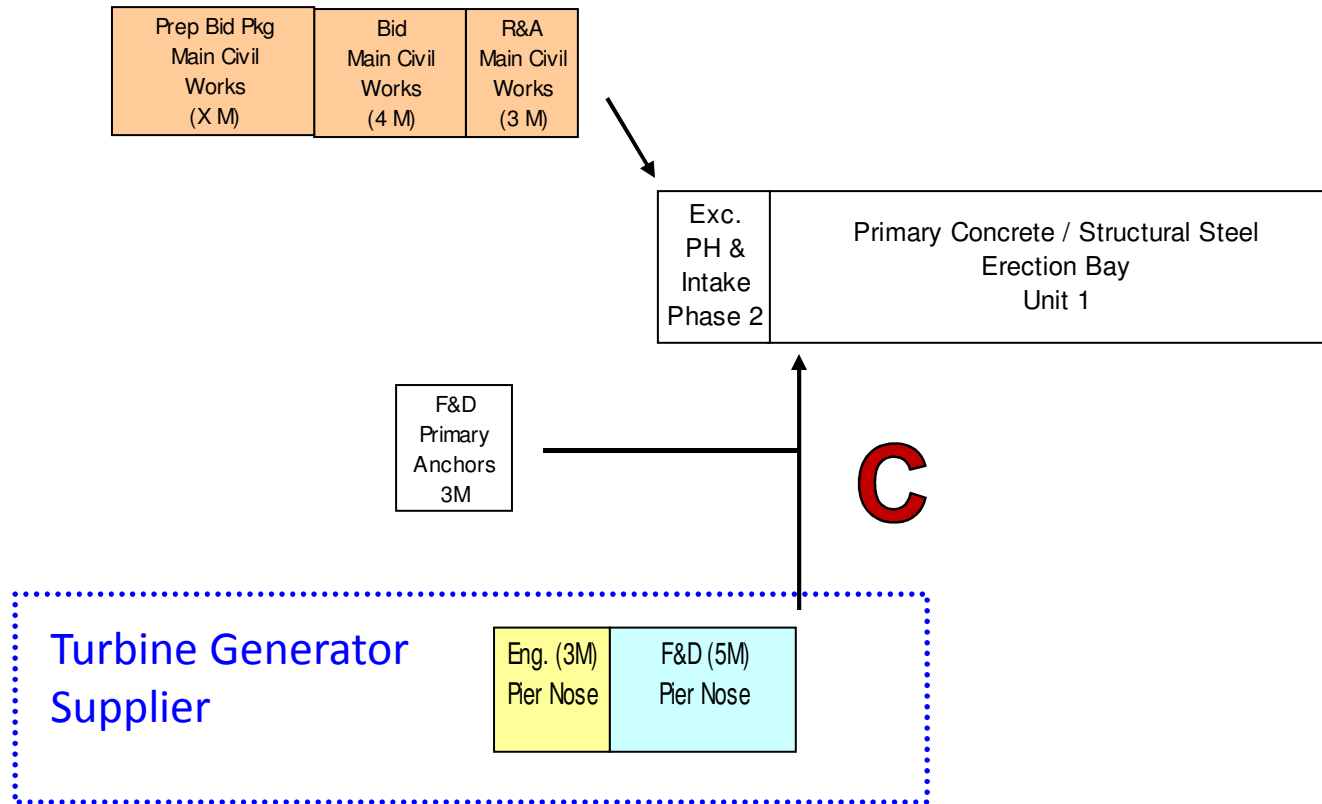
2010	2011	2012	2013
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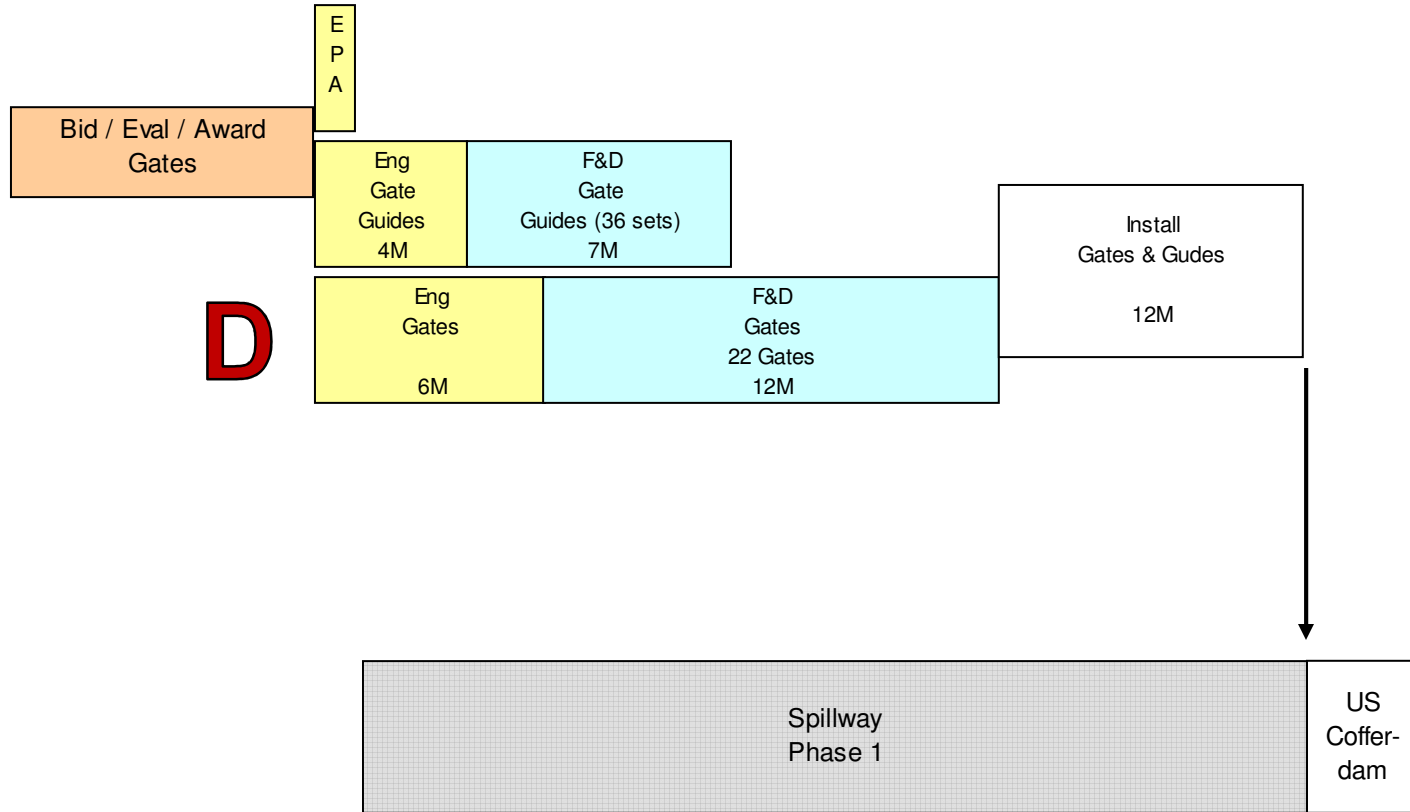
# 1<sup>st</sup> Delivery for T/G – Pier Nose

2011	2012	2013	2014
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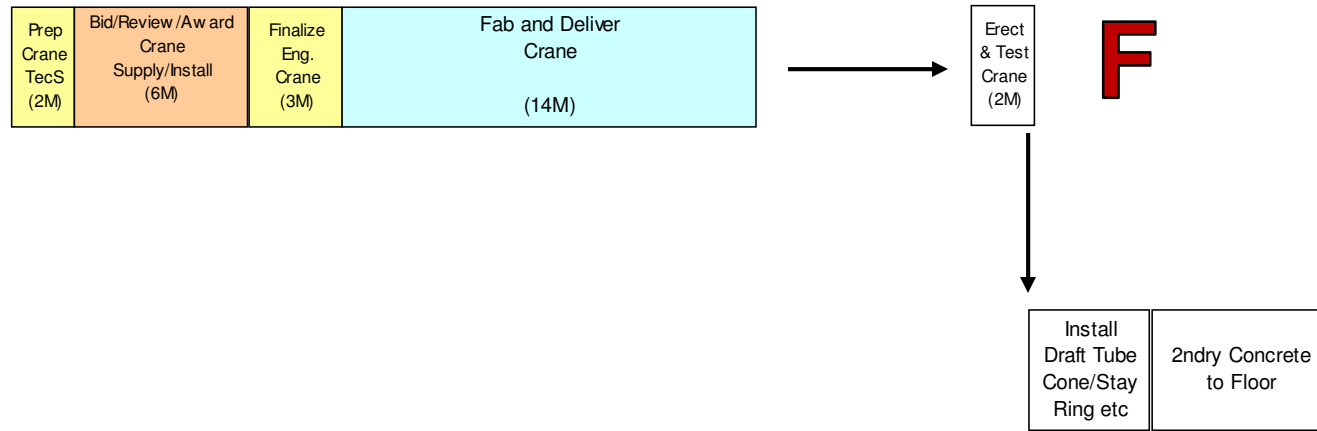
# Spillway Gates for Diversion

2011	2012	2013	2014
------	------	------	------

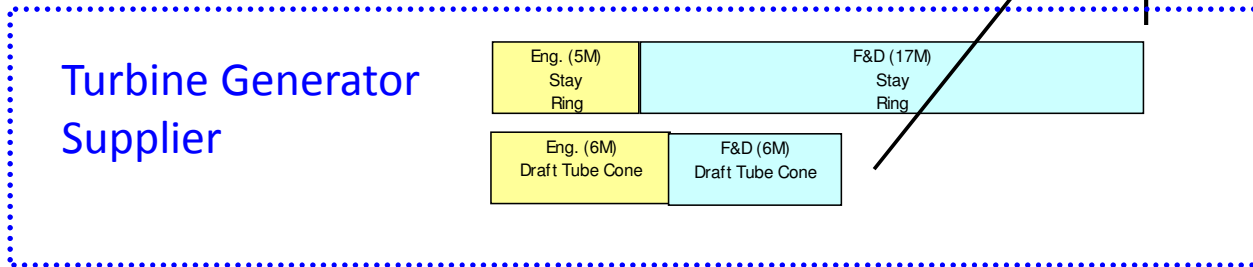


# 2<sup>nd</sup> T/G Components for Primary Concrete

2011	2012	2013	2014	2015
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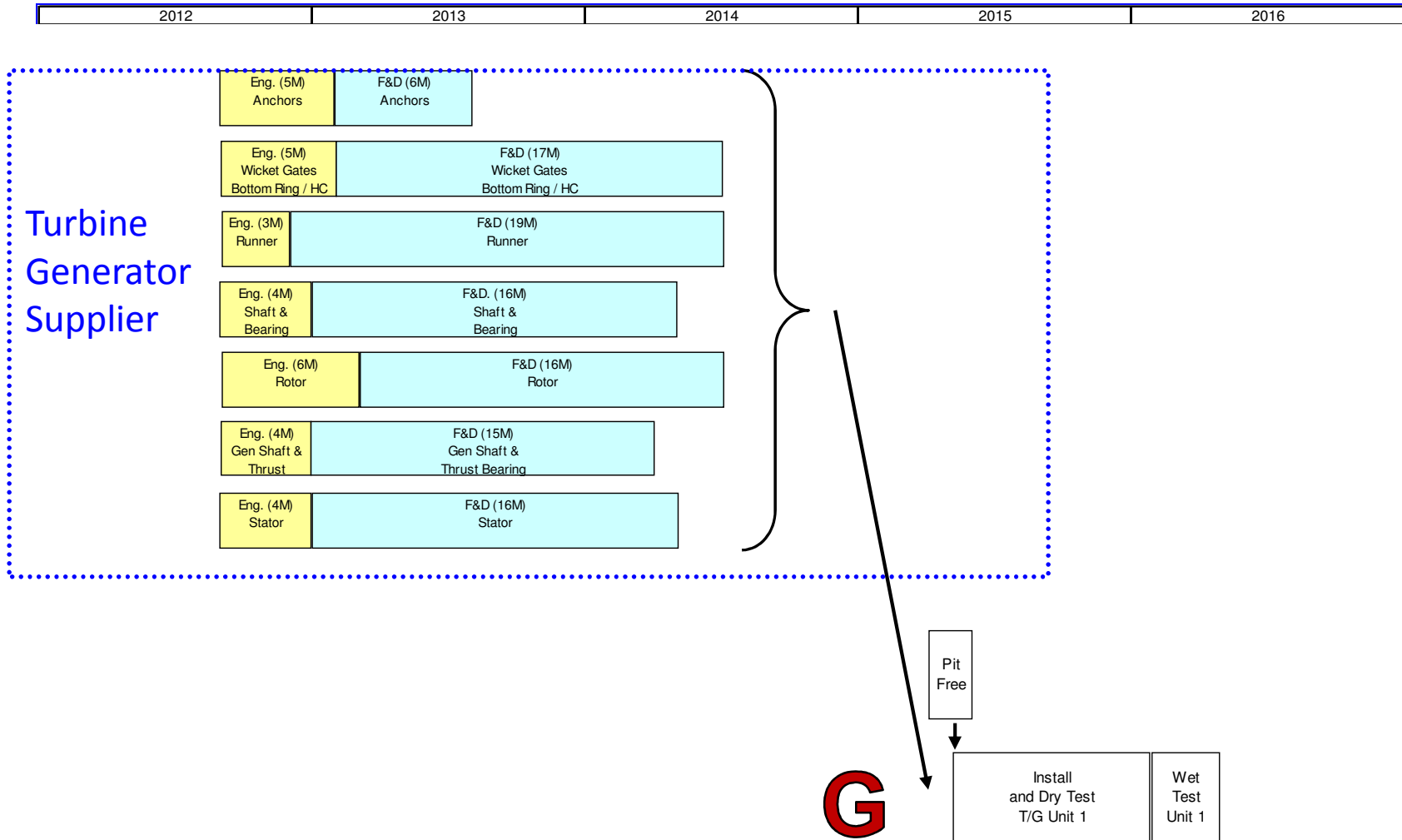


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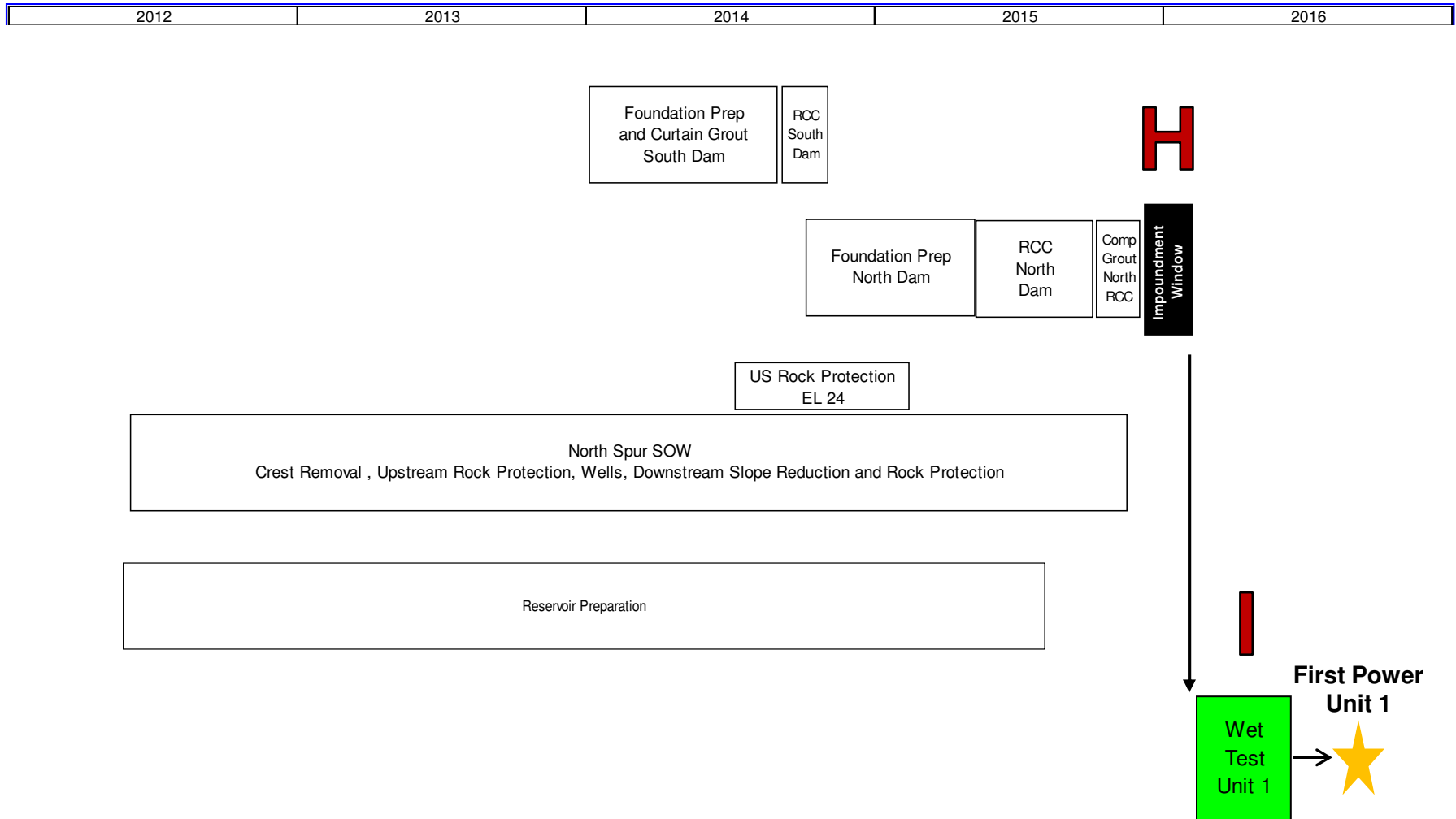


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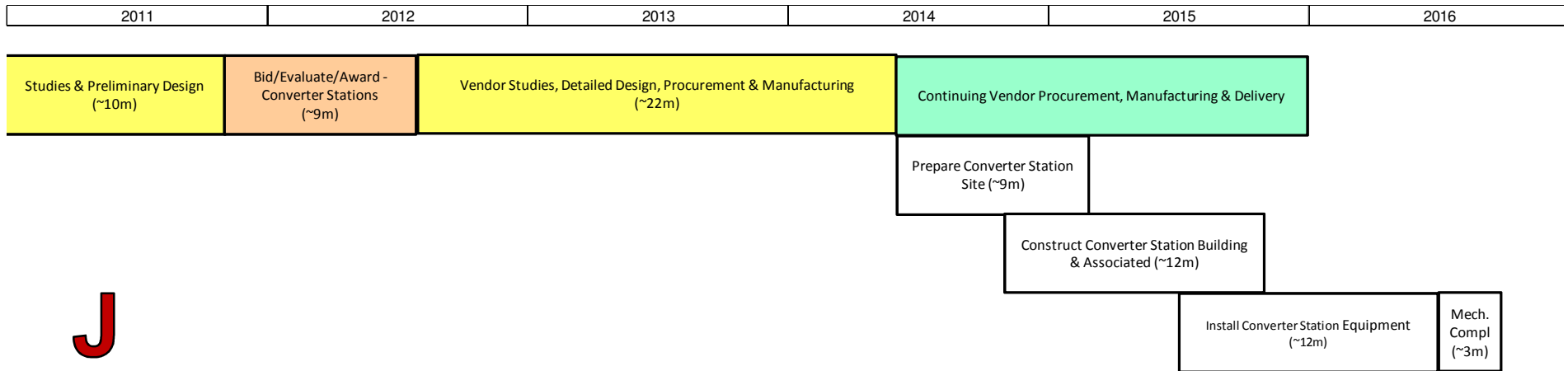
# Deliver & Assemble T/G Unit 1



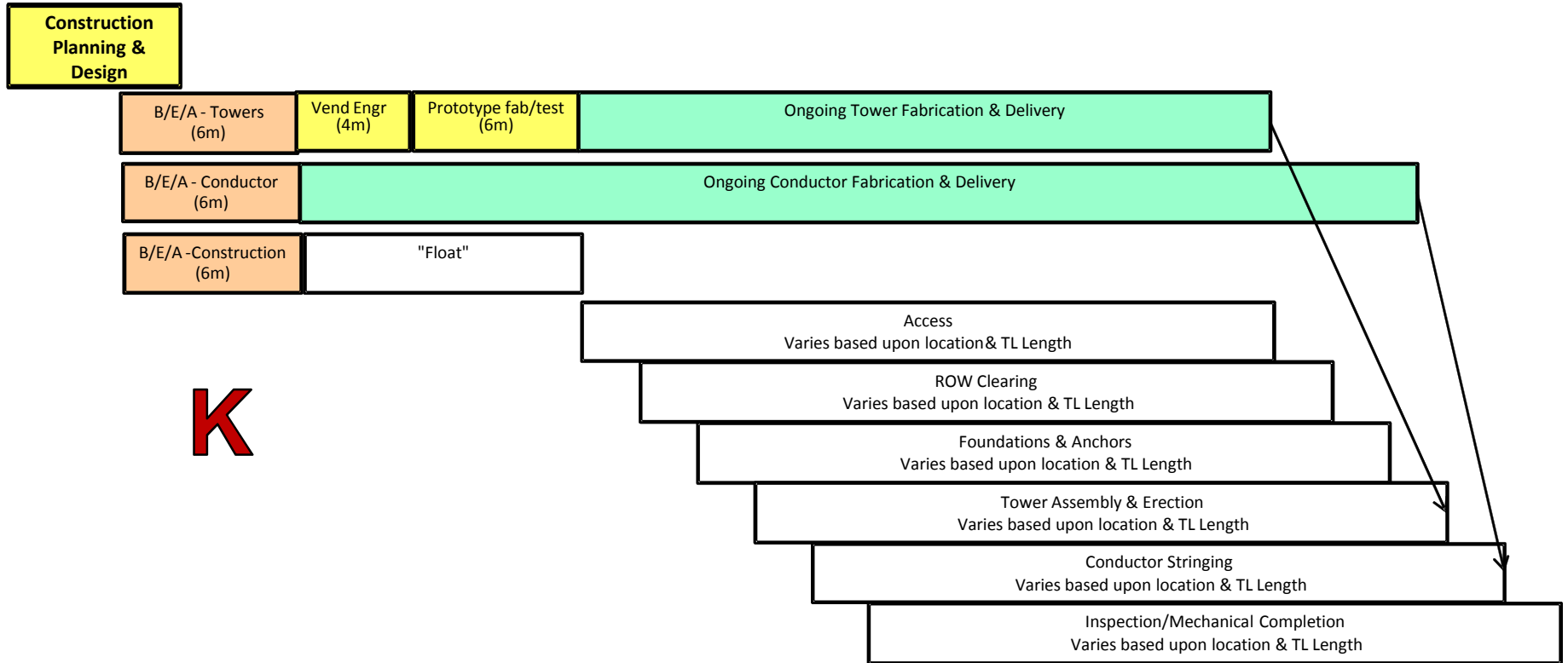
# Dams & Reservoir



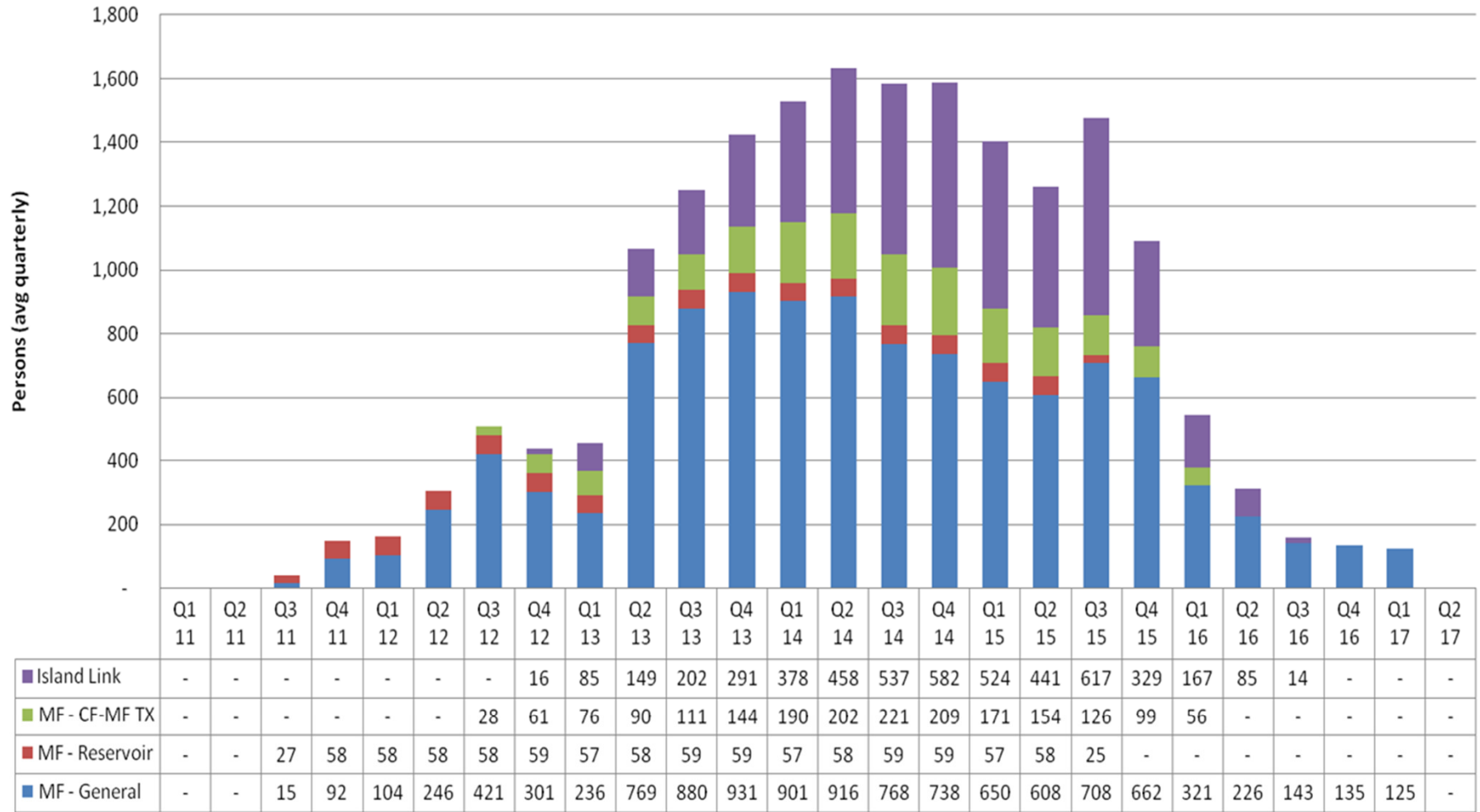
# Converter Stations



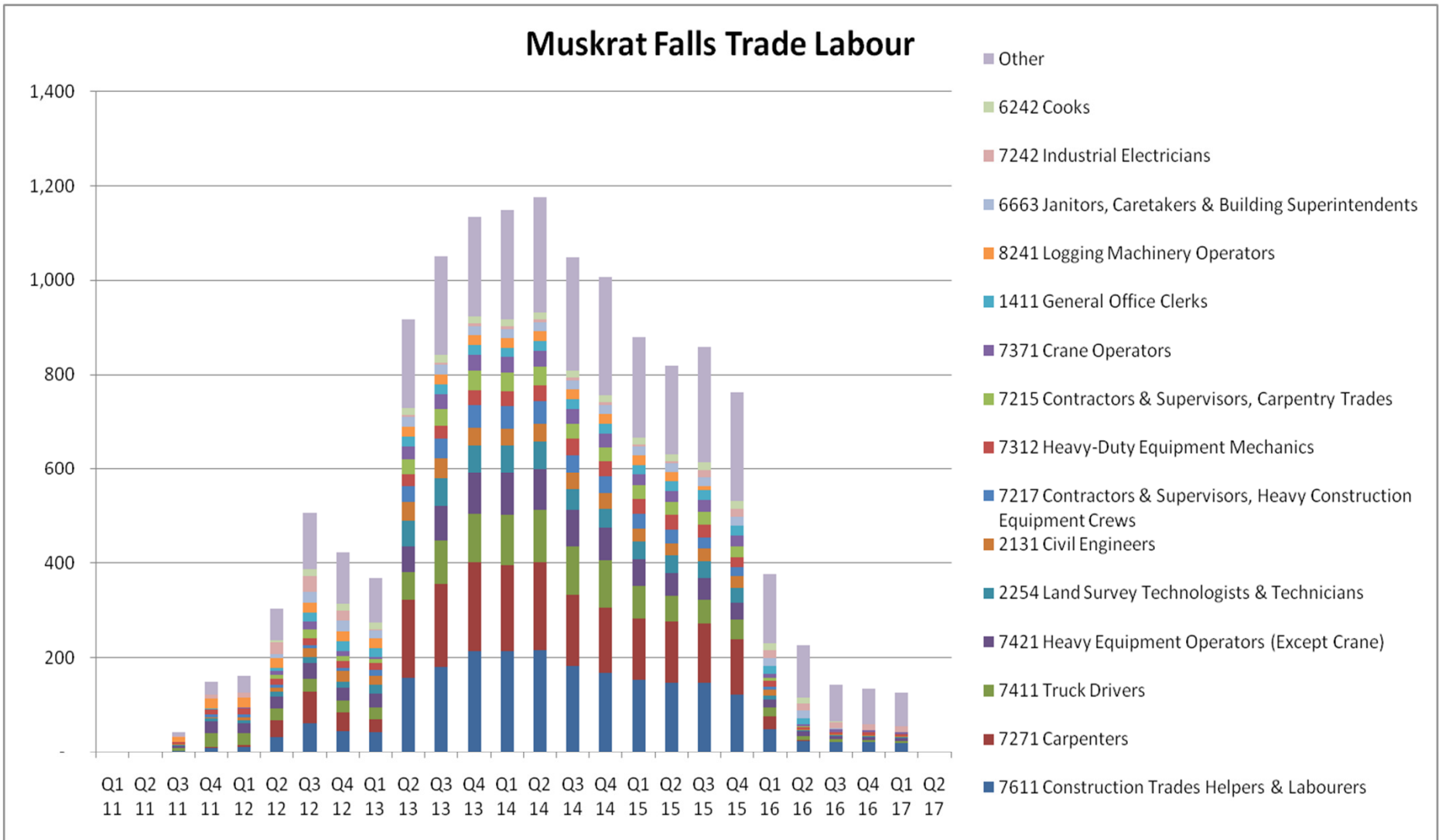
# Overland Transmission

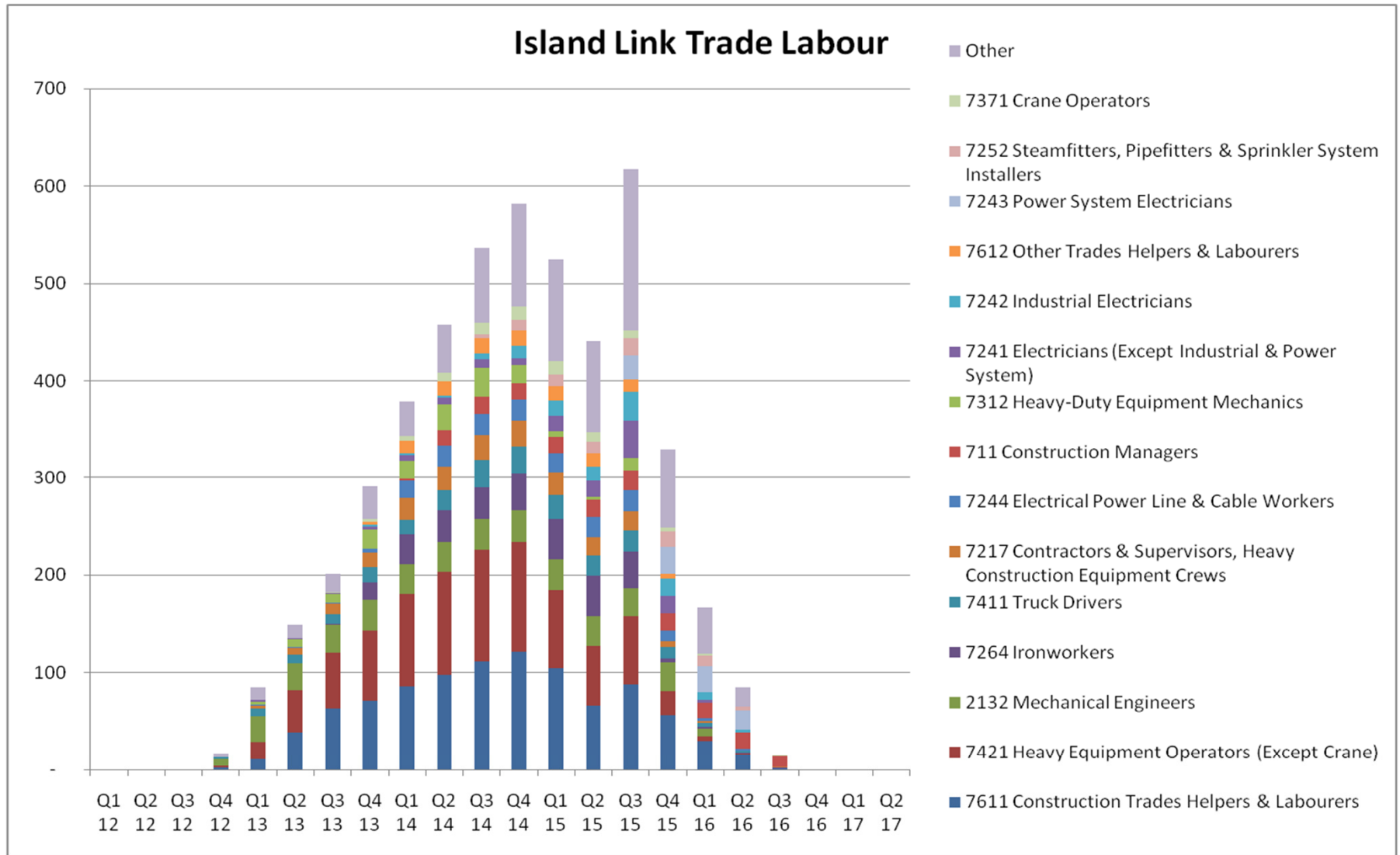


### Total Labour Demand - Muskrat Falls and Island Link









# Implemented Schedule De-risking Initiatives

- Turbine Modeling Testing – Underway
- Accommodation Complex Specifications – Prepared
- LiDAR survey for Overland TL – Complete
- LiDAR survey for MF Site – Complete
- Critical MF and IL Geotechnical surveys – Complete
- Reservoir Preparation Study – Complete
- MF Site Access Road Routing, LiDAR & Geotechnical surveys – Complete

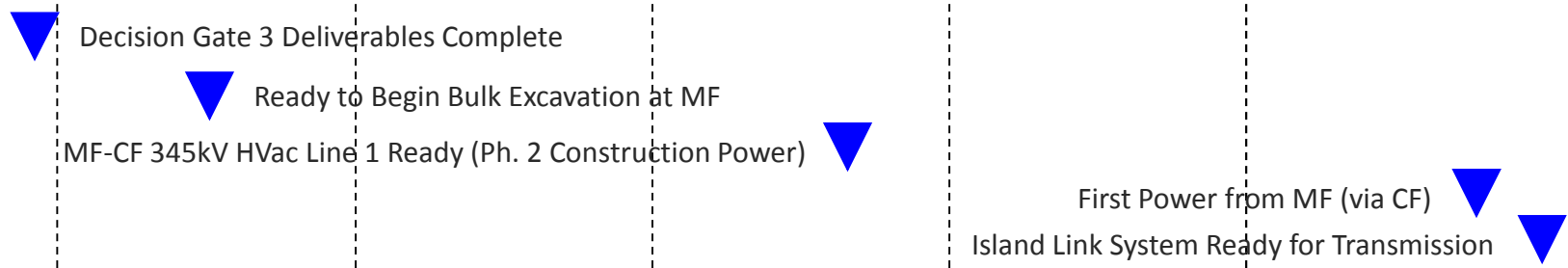
## 2011 Priorities identified at DG2

- DG 3 Key Deliverables – by 15-Dec-2011
- Finalization of MF Layout & Physical Modeling
- Spillway finalization & design – particularly as impacts Gates
- Confirmation of contracting strategy and packaging
- Collective agreement negotiations
- Overland Tx construction approach, design and contracting
- Reservoir preparation execution strategy
- MF site access to facilitate commencement of Mass Excavation
- Tender Accommodations Complex and Site Services
- Tender bulk excavation works at the Muskrat Falls site
- Tender of supply & install of turbines / generators
- HVdc system studies and converter station specs
- Location & footprint of SOBI transition buildings (key interface)

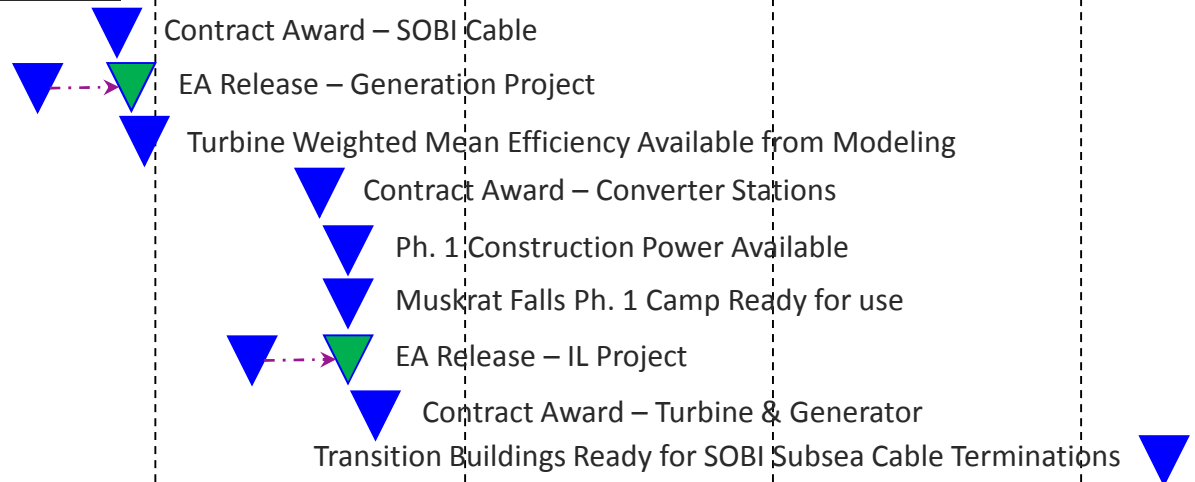
# Key Front-End Dates

2011				2012				2013				2014				2015				2016			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

## Contract Milestones



## Key Dates



2011				2012				2013				2014				2015				2016			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

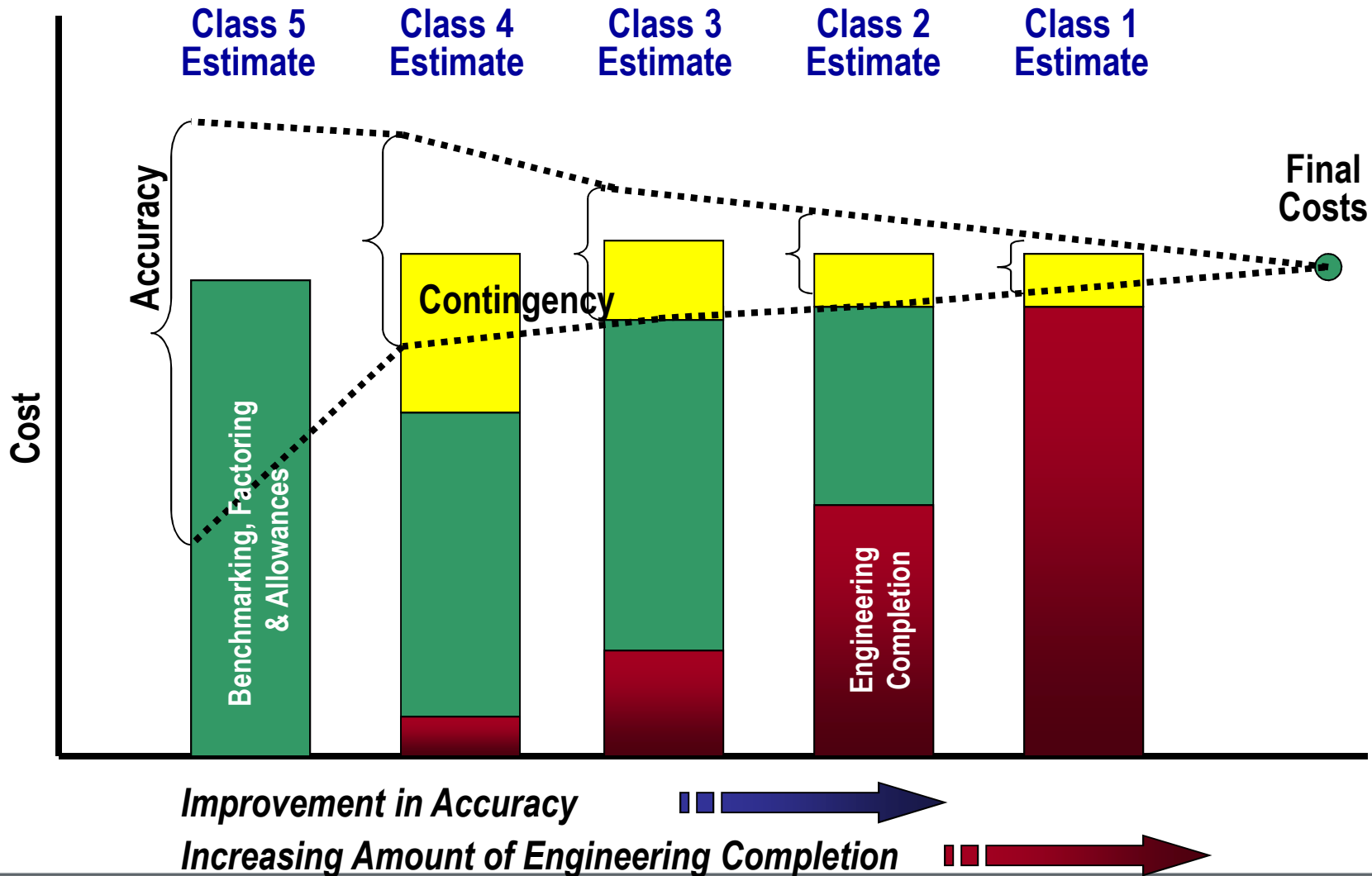
# Capital Cost Estimate



# Decision Gate 2 Estimate

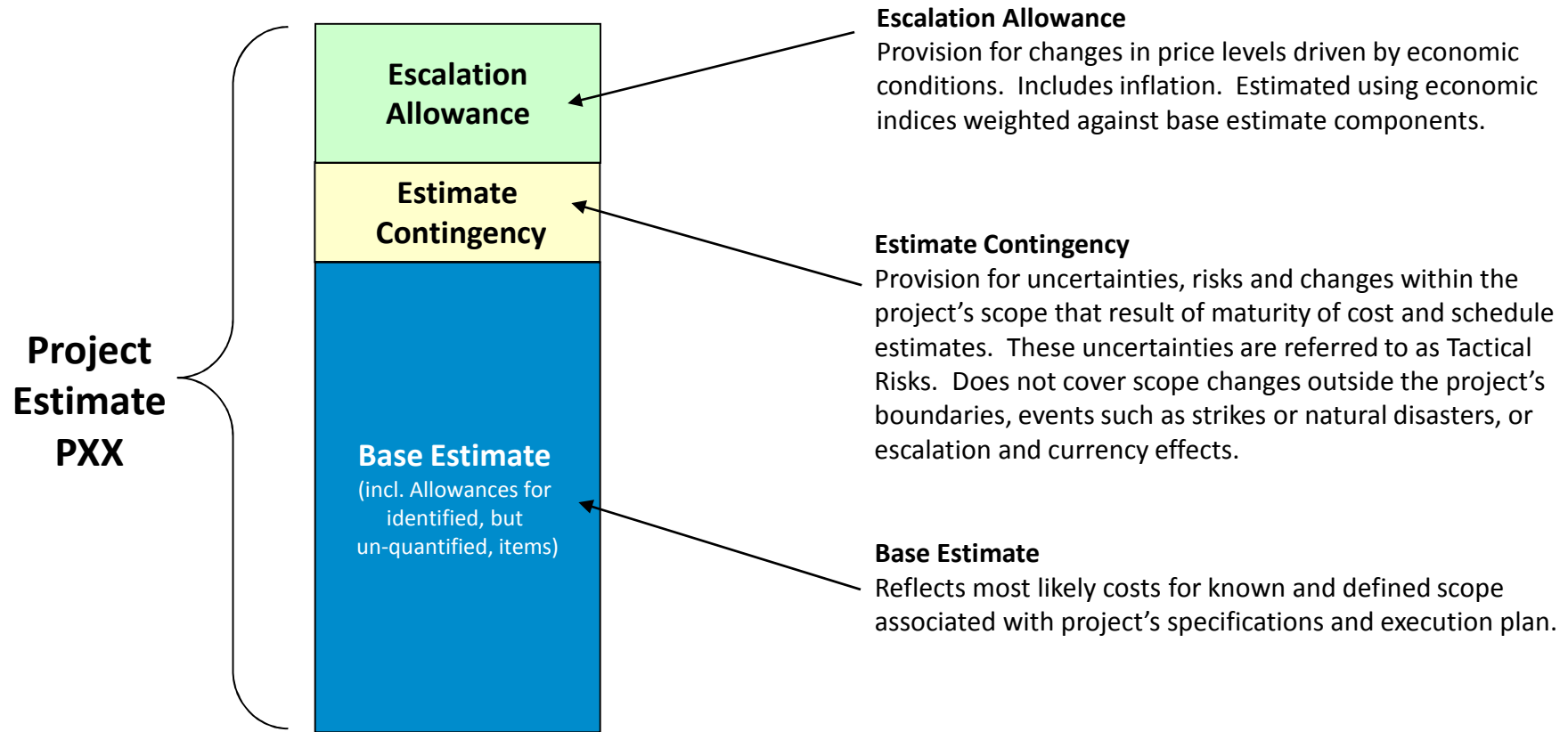
- Deterministic estimate – uses a combination of quantity based, unit rate and factored estimate with allowances.
- Commensurate with a AACE International Class 4 estimate classification.
- Leverages extensive estimating work for LCP completed over proceeding 3 years, including input from various third party specialists.
- Estimate uncertainties addressed via a comprehensive risk analysis process.

# Estimate Class and Maturity





# Project Cost Estimate Components



# Base Estimate Elements

## DEFINITION

## PERFORMANCE



- Location Factors
- Plant Definition
- Major Equipment
- Bulk Quantities
- Design Constraints
- Design Criteria
- Design Standards
- Technology Limits

- Build Sequence and Constraints
- Construction Equip.
- Labor Demands
- Trade Mix
- In-directs
- Support Facilities
- Seasonality

- Labor Rates
- Equipment Rates
- Marine Construction Vessels
- Commodities Rates
- Permanent Equip.
- Materials Cost
- Contracting & Procurement Strategy

- Labor Productivity
- Mobilization Constraints
- Seasonality Impacts
- Equipment Productivity
- In-Directs
- Project Management Resources

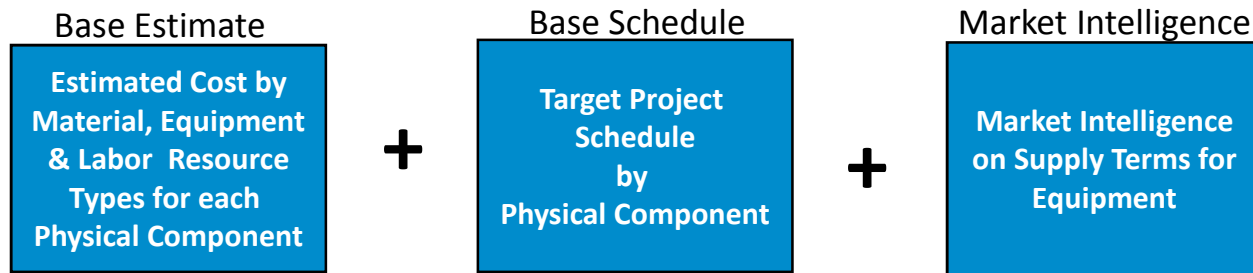
# Noteworthy

- Estimate based upon contract package listing.
- Includes detailed build-up of in-directs, in lieu of % of direct.
- Historical as-built productivities for concrete, formwork, tower erection and conductor stringing considered.
- Key construction consumables (e.g. rebar, explosives, etc.) based upon supplier quotes.
- Consistent with Building Trades / IBEW labor demarcation.

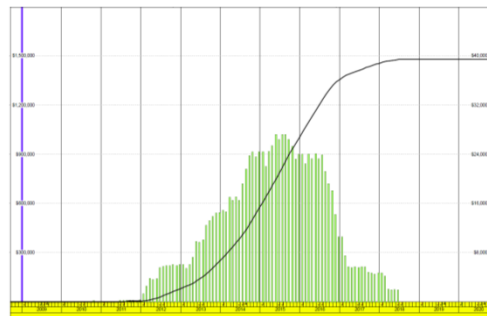
## Noteworthy (cont'd)

- Labor rates competitive with other East Coast megaprojects.
- Permanent equipment items re-quoted late 2009 / early 2010
  - Turbines, submarine cable, transmission towers, insulators, converter stations, transformers
- Fleet and productivity assumptions made for major earth works. Validated by CAT Fleet Productivity software using known site layout.
- Fleet hourly cost calculated from first principles.
- Cost flow of all major commodities and equipment in-place.

# Estimate Cost Flow using Primavera



Schedule Loaded with Resources and Demand Profiles  
Producing Cost Flow by Physical Component and Project



**Note:**  
Subsequent adjustments are then made to Base Schedule in order to generate P50 & P75 schedules and associated cost curves.

- Typical Physical Components**
- Dam
  - Diversion
  - Accommodations
  - Converter Station

**NOT CONTROLLED**

Nalcor Energy – Lower Churchill Project



**Lower Churchill Project – Basis of Design**

LCP-PT-ED-0000-EN-RP-0001-01

<p>Comments:</p> <p style="text-align: center;">Supersedes Document #: MSD-PM-006 Issued for Decision Gate 2</p>	<p>Total # of Pages</p> <p>(Including Cover): <del>33</del> 34 <i>RLB</i></p>
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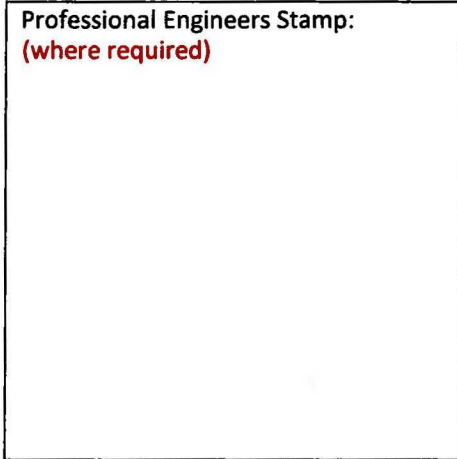
			<i>RLB</i>	<i>J.R. Kean</i>	<i>MP</i>	<i>P. Harrington</i>
<b>B1</b>	14-Feb-11	Issued For Use to reflect Gate 2 Estimate	R. Barnes	J. Kean	R. Power	P. Harrington
Status/ Revision	Date	Reason For Issue	Prepared By	Checked By	Checked By	Project Director Approval

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NOT CONTROLLED

Additional Signatures (where required)

Professional Engineers Stamp:  
(where required)



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## 1.0 Purpose

The purpose of this document is to establish a Basis of Design (BOD) for the Lower Churchill Project (LCP). This BOD will form the overarching project definition that will be used to prepare engineering design philosophies, project contract packaging, project estimates, project schedules, design briefs, detailed design specifications and drawings, construction planning, and all other project functions that depend on a clear definition of what is to be specifically financed and constructed.

Typically, this BOD is not changed or altered without major cost and schedule implications to the project as a whole and would only be considered and approved by LCP Executive Management, and then only after a clear recommendation from the Project Director.

## 2.0 Scope

The objectives of this document are to establish the Basis of Design for the following:

- Gull Island Hydroelectric Facility.
- Muskrat Falls Hydroelectric Facility.
- Island Link System.
- Maritime Link System.

## 3.0 Definitions

### Basis of Design

A compilation of the fundamental criteria, principles and/or assumptions upon which Design Philosophies and Engineering Design Briefs will be developed.

### Bulkhead Gates

Steel gates used to isolate water passages for inspection or maintenance and are installed and removed under balanced pressures.

### Cavitation Resistant Design

A design to prevent the formation of the vapour phase in a liquid flow when the hydrodynamic pressure falls below the vapour pressure of the liquid.

### Change Control Board

A panel within the Project Management Team that is responsible for making the ultimate decision to approve, reject or elevate a Project Change Notice is to become a Project Change, as explained in LCP-PT-MD-0000-PM-PL-0002-01, Project Change Management Plan.

<b>Cofferdam</b>	A temporary barrier for excluding water from an area that could otherwise be submerged.
<b>Construction Flood</b>	The seasonal peak river flow that the diversion facilities are designed to pass during construction of the dam. Accepted practice is based on a 5% risk of exceedence for the duration of the operation of the diversion facilities.
<b>Converter Station</b>	A Converter Station consists of equipment that converts power from ac to dc (rectifier) and dc to ac (inverter).
<b>Counterpoise</b>	Steel wire installed along the length of the overhead line and bonded (connected) to each tower. Used to reduce resistivity between the overhead line structures and the ground for lightning protection.
<b>Electrode</b>	A grounded means to provide a return path for unbalanced dc current for HVdc transmission system, enabling it to operate in mono-polar mode.
<b>Electrode Line</b>	A transmission line connecting the Electrode site to the converter station.
<b>Fail Safe Design</b>	A design that in the event of the failure of equipment, processes or systems, the event will produce minimum propagation beyond the immediate environment of the failing entity. In addition, the failure will be economically acceptable, and those devices in the system will perform their intended function and eliminate danger upon the loss of actuating power.
<b>Fish Compensation Flow</b>	Minimum flow required downstream of the dam sites during reservoir impoundment which will be required to maintain fish habitat and reduce the effects of salt water intrusion into the Churchill River.
<b>Flip Bucket</b>	A formed geometrical shape at the downstream end of a spillway discharge for the purpose of throwing the water clear of the hydraulic structure and into a Plunge Pool for energy dissipation.

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<b>Francis Turbine</b>	A mixed flow reaction turbine with fixed runner vanes that converts hydraulic energy to mechanical energy where the water flow is controlled by the setting of the adjustable wicket gates.
<b>Generator</b>	An assembly of stationary and rotating components coupled to the turbine, converting mechanical energy to electrical energy.
<b>Good Utility Practice</b>	The practices, methods and acts engaged in, or approved by, a significant portion of the electrical utility industry in North America, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, are expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to optimum practice, method or act to the exclusion of all others, but rather to include all practices, methods or acts generally accepted in North America.
<b>Kaplan Turbine</b>	A reaction type, axial flow, adjustable blade turbine that converts hydraulic energy to mechanical energy.
<b>Life Cycle Cost Analysis</b>	The process of selecting the most cost effective approach from a series of alternatives so that the least long-term cost of ownership is achieved where life cycle costs are total costs estimated to be incurred in the design, development, production, operation, maintenance, support, and final disposition of an asset over its anticipated useful life from inception to disposal.
<b>Mass Impregnated (MI)</b>	An electrical insulation method used for power cables. The conductor is tightly wrapped with porous paper and saturated with oil, installed under pressure, to provide electrical insulation.
<b>Mitigation</b>	Measures implemented during the design, construction and operations phases of the project which are intended to avoid or reduce known or predicted impacts to the existing environment.

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<b>Overhead Ground Wire (OHGW)</b>	Provides lightning protection for the power conductors. When used, direct lightning strikes are minimized, and potential disturbances due to lightning are reduced.
<b>Optical Ground Wire (OPGW)</b>	Performs the same function as Overhead Ground Wire; however, it also carries a fibre optic communication system within the wire strands.
<b>Penstock</b>	A conduit that conveys water from the intake to the turbine.
<b>Plunge Pool</b>	A deep depression downstream of a spillway into which spilled water “plunges” to dissipate energy.
<b>Probable Maximum Flood (PMF)</b>	Canadian Dam Association terminology for “an estimate of hypothetical flood (peak flow, volume and hydrograph shape) that is considered to be the most severe ‘reasonably possible’ at a particular location and time of year, based on relatively comprehensive hydro meteorological analysis of critical runoff-producing precipitation (snowmelt if pertinent) and hydrologic factors favourable for maximum flood runoff”.
<b>Proven Technology</b>	This is the state of technology used in the design, construction and operation of any system including each piece of equipment, component or structure that has a proven record of performance. (First technology applications will only be considered after review by the LCP Design Integrity group and then only after approval by Executive Management).
<b>Rehabilitation</b>	Measures taken to remedy environmental damage to the environment.
<b>Reliability Level Return Period</b>	A statistical measurement denoting the average recurrence interval over an extended period of time. Used to estimate loads to design transmission lines.
<b>Rotor</b>	The multi-poled rotating component of the generator.

<b>Split Yard</b>	Switchyard divided physically into two independent sections with an electrical connection so as to limit the loss of generation in order to meet reliability criteria.
<b>Stoplog</b>	Steel sections used to isolate water passages for inspection or maintenance and are installed and removed under balanced pressures.
<b>Tailrace</b>	A watercourse that carries water away from a turbine or powerhouse.
<b>Trash Boom</b>	An anchored, floating barrier spanning the approach channel of the intake. It is used to limit floating objects from reaching the intake and blocking the Trash Racks.
<b>Trash Racks</b>	Equally spaced rectangular bars installed at the entrance to the intake to protect the turbine from impinging objects.
<b>Waste Management</b>	The management of waste generation in order to reduce the volume of solid waste deposited in landfills through recycling and the reuse of materials where practical.
<b>Wicket Gates</b>	Adjustable guide vanes used to regulate the flow of water into a turbine.

#### 4.0 Abbreviations and Acronyms

<b>ac</b>	alternating current
<b>BOD</b>	Basis of Design
<b>CF</b>	Churchill Falls Hydroelectric Facility
<b>CFRD</b>	Concrete Faced Rockfill Dam
<b>CPU</b>	Central Processing Unit
<b>dc</b>	direct current
<b>DFO</b>	Department of Fisheries and Oceans
<b>EPP</b>	Environmental Protection Plan
<b>FSL</b>	Full Supply Level (Reservoir)
<b>GI</b>	Gull Island Hydroelectric Development
<b>HADD</b>	Harmful Alteration Damage or Disruption (Fish Habitat)

<b>HVac</b>	High Voltage alternating current
<b>HVAC</b>	Heating, Ventilation and Air Conditioning
<b>HVdc</b>	High Voltage direct current
<b>HVGB</b>	Happy Valley – Goose Bay
<b>kV</b>	kilovolts (Thousand Volts)
<b>LCC</b>	Line Commutated Converter
<b>LEED</b>	Leadership in Energy and Environmental Design
<b>LCP</b>	Lower Churchill Project
<b>LSL</b>	Low Supply Level (Reservoir)
<b>MF</b>	Muskrat Falls Hydroelectric Development
<b>MFL</b>	Maximum Flood Level (Reservoir)
<b>MI</b>	Mass Impregnated
<b>MVAR</b>	Mega Volt Ampere Reactive (Million VARs)
<b>MW</b>	MegaWatt (Million Watts)
<b>NE</b>	Nalcor Energy
<b>OHGW</b>	Over-Head Ground Wire
<b>OPGW</b>	Optical Ground Wire
<b>pf</b>	power factor
<b>PMF</b>	Probable Maximum Flood
<b>RCC</b>	Roller Compacted Concrete
<b>ROW</b>	Right of Way
<b>SCADA</b>	Supervisory Control and Data Acquisition
<b>SLD</b>	Single Line Diagram
<b>SOBI</b>	Strait of Belle Isle
<b>TBD</b>	To Be Determined
<b>TL</b>	Transmission Line
<b>TLH</b>	Trans Labrador Highway
<b>VSC</b>	Voltage Source Converter

## **5.0 Reference Documents and/or Associated Forms**

Engineering Studies comprising the 2007/2008/2009/2010 Engineering Program

### Gull Island Hydroelectric Development

GI1010 Gull Island 2007 Site Investigation

GI1013 Gull Island 2008 Site Investigation

GI1015	Inspection and Structural Analysis Goose Bay Dock
GI1017	Update Report - Reassessment of Gull Island Diversion
GI1020	Study of Concrete Face Rockfill Dam (CFRD) Alternative
GI1030	Powerhouse Configuration
GI1050	Tailrace Channel Improvements Phase 1 – Preliminary Assessment
GI1060	Review of Structure Layouts and Interfaces
GI1061	Review of Structure Layouts and Interfaces, 5x450 MW
GI1070	Ice Study (Gull Island and Muskrat Falls) (by Hatch)
GI1071	Ice Studies (Gull Island) (by SNCL)
GI1076	Ice Observation Program (2010-2011)
GI1090	Review of Construction Camp and Other Infrastructure
GI1100	Review of Access Roads and Bridges
GI1110	Hydraulic Modeling of River
GI1130	River Operation During Construction & Impounding
GI1140	PMF and Construction Design Flood Study
GI1141	Upper Churchill PMF and Flood Handling Procedures Update
GI1170	Seismicity Analysis
GI1180	Review of Site Access, Goose Bay and Off-Site Infrastructure
GI1190	Dam Break Study
GI1200	Gull Island Constructability Review
GI1230	Gull Island Site Information for Tenderers
GI1280	Gull Island – Diversion Facilities Numerical Modeling
GI1281	Gull Island – Power Intake and Spillway Facilities – Numerical Modeling
GI1282	Gull Island – Diversion Facilities Physical Modeling Technical Specifications
GI1290	Hydraulic Production Model
GI1300	Gull Island 2008 Report Plates (drawings)
GI1310	Workshop Report on Design and Operational Problems Resulting from Reservoir Preparation
GI1602	Bank Stability and Fish Habitat Deltas

#### Muskrat Falls Hydroelectric Development

MF1010	Review of Variants
MF1020	Muskrat Falls Site Investigations
MF1050	Spillway Design Review
MF1080	Review of Construction Camp and Other Infrastructure
MF1090	Review of Access Roads and T&W Bridge
MF1091	Desktop Study – Implications/Consequences of Constructing Muskrat Falls Prior to Gull Island
MF1120	Potential Impact of Reservoir Flooding on the TLH
MF1130	River Operation during Construction and Impounding
MF1250	Numerical Modeling of Muskrat Falls Structures
MF1260	Condition Assessment of Existing Pumpwell System (2007)
MF1271	Condition Evaluation of Wells and Pumps in the Muskrat Falls Pumpwell System (2009)

- MF1272 Installation of New Piezometers in the Muskrat Falls Pumpwell System
- MF1281 Pumpwell System Telecommunication Upgrades
- MF1300 2010 Field Investigation Program
- MF1310 Site Access Review
- MF1320 Power and Energy Study
- MF1330 Report #1: Hydraulic Model of the River - 2010 Update
- MF1330 Report #2: PMF and Construction Design Study
- MF1330 Report #3: Dam Break Study
- MF1330 Report #4: Ice Study
- MF1330 Report #5: Review of Gull Island 1:60 year Construction Design Flood
- MF1330 Report #6: Regulation Study
- MF1340 Review and Confirmation of Structure Layout Interfaces
- MF1360 Review of Numerical Modeling
- MF1380 Site Information for Tenderers
- MF1390 Review Impacts of Earlier Construction of MF on GI and Later Construction of GI on MF

#### HVac Transmission Systems

- AC1020 Tower type selection, 735 kV
- AC1030 Field Investigations and Construction Requirements - 735 kV TL - GI to CF
- AC1050 Tower type selection, 230 kV
- AC1060 Field Investigations and Construction Requirements - 230 kV TL - GI to MF
- AC1080 Load Control and Failure Containment
- AC1090 Assess Cable De-icing
- AC1100 Conductor Selection
- AC1130 Corridor Selection & Construction Infrastructure - 735 kV Transmission Line - Gull Island to Quebec Border

#### HVdc Transmission Systems

- DC1010 Voltage and Conductor Optimization
- DC1020 HVdc System Integration Study
- DC1050 Corridor Selection & Construction Infrastructure-Gull Island to Soldiers Pond
- DC1051 Field Investigations – HVdc TL – Gull Island to Soldiers Pond
- DC1060 Corridor Selection & Construction Infrastructure-Taylor's Brook to Cape Ray
- DC1070 Preliminary Meteorological Load Review
- DC1080 Tower Type Selection and Preliminary Optimization
- DC1090 Site Investigation - Converter Stations Gull Island and Soldiers Pond
- DC1110 Electrode Review - Gull Island and Soldiers Pond
- DC1130 Submarine Cable - Strait of Belle Isle
- DC1131 Submarine Cable Corridor Survey - Strait of Belle Isle
- DC1132 Strait of Belle Isle - Existing Data Compilation
- DC1133 Regional Multi-Beam Survey - Strait of Belle Isle
- DC1140 Submarine Cable - Cabot Strait



- DC1141 Submarine Cable Corridor Survey - Cabot Strait
- DC1142 Cabot Strait - Existing Data Compilation
- DC1180 Fixed Link Tunnel Cost, Strait of Belle Isle
- DC1200 HVdc Overland Transmission Re-estimate
- DC1210 HVdc System Sensitivity Analysis
- DC1240 HVdc and HVac Proximity Analysis
- DC1250 Electrode Review – Type and Location
- DC1300 Ice Loadings on HVdc Line Crossing Long Range Mountains
- DC1301 Section by Section Analysis of Extreme Rime Ice on the Long Range Mountains using WRF Modeling
- DC1500 Electrode Review – Confirmation of Type and site Selection
- DC1600 VSC Technology Review for LCP
- DC1700 Review of Holyrood Units 1 & 2 Conversion to Synchronous Condensers

Other Documents

- LCP-PT-ED-0000-EN-PH-0032-01 Synopsis of Engineering Studies
- LCP-PT-ED-0000-EN-PL-0002-01 Reservoir Preparation Plan
- LCP-PT-ED-0000-EN-PL-0002-02 Reservoir Preparation Plan – Summaries and Map Sheets – Muskrat Falls
- LCP-PT-ED-0000-EN-PL-0002-03 Reservoir Preparation Plan – Summaries and Map Sheets – Gull Island
- LCP-HE-CD-0000-EA-RP-0001-01 Muskrat Falls – Review of Saltwater Intrusion
- LCP-HE-CD-0000-EA-RP-0007-01 Muskrat Falls – Review of Sediment Plume
- LC-EN-011 2010 Transmission Corridor LiDAR and Orthographic Data Collection Program
- LC-EN-006 Coordinate System Evaluation, Survey Engineering Services - Transmission
- LCP-PT-MD-0000-PM-PL-0002-01 Project Change Management Plan
- Development of Extra High Voltage Transmission Lines in Labrador – EDM/RSW - 1999
- Gull Island Power Development SNC-Lavalin Power Division - October 1997
- Gull Island Hydro Electric Development – SNC-AGRA Joint Venture - December 2000
- Gull Island to Soldiers Pond Interconnection – Teshmont Consultant Inc. - June 1998
- Muskrat Falls Hydroelectric Development – SNC-AGRA - January 1999
- Lower Churchill Hydroelectric Generation Project Baseline Report, Application of HADD Determination Methodology – AMEC – December 2007
- Evaluate Extreme Ice Loads From Freezing Rain For Nalcor Energy – Kathy Jones – May 2009
- Assessment of Rime Ice Loading on the Long Range Mountains, Landsvirkjun Power, December 2010.
- Newfoundland and Labrador Hydro Environmental and Guiding Principles

## 6.0 Responsibilities

**Project Director** – The Project Director is responsible for approval of the BOD. The Project Director ultimately is responsible for the allocation and expenditure of the project budget to support the BOD.

**Engineering Manager and Leads** – The Engineering Manager is responsible to prepare the BOD. The Engineering Leads are to support this process and prepare individual sections of the BOD for coordination and final preparation by the Engineering Manager.

**Project Services Manager** - The Project Services Manager is to ensure that all sections of the BOD are prepared as per the applicable LCP Procedures to establish and maintain PCM process. In addition, the Project Services Manager is to ensure that all project estimates and schedules respect the BOD.

**Commercial Services Manager** – The Commercial Services Manager is to ensure that all contracts and commercial issues respect the BOD.

**Environmental Assessment Manager** - The Environmental Assessment Manager is to ensure that the Environmental Impact Statements and subsequent documentation related to the Environmental Assessment reflect the BOD and that the BOD reflects good environmental practices.

## 7.0 Descriptions

### 7.1 General

This BOD includes the Gull Island hydroelectric facility, the Muskrat Falls hydroelectric facility, all related high voltage alternating current transmission lines, all high voltage direct current transmission lines associated with the Labrador to Island transmission link, including Converter Stations, submarine cables and landing sites, and all related facilities including switchyards, terminal stations, infrastructure upgrades, communications and project specific transportation networks.

The BOD also includes the Maritime Link which currently reflects the level of technical and economic work carried out to date. It must be emphasized that the Maritime Link is at a lesser degree of technical maturity.

All design assumptions used to establish the BOD respect the following overarching principles:

- Only proven technologies will be considered, unless it can be clearly demonstrated to the satisfaction of the Engineering Manager, Project Director and VP of the LCP that emerging technologies can be as reliable and provide significant cost and/or schedule savings.
- Local climatic/service conditions such as ambient temperature, elevation, humidity, sea temperature, sea currents and wind will be respected throughout the Project.
- All hydroelectric plants and transmission systems will be remotely operated and monitored from NE-NLH's Energy Control Centre.

- Environmental mitigation and rehabilitation will be designed by LCP prior to issuing construction contracts for tender.
- The designs will assume the use of existing transportation infrastructure to the maximum extent possible. In particular, existing roads, bridges, railways and wharfs.
- Good Utility Practice will be observed.
- Fail Safe Design principles will be employed.
- Principles of Life Cycle Cost Analysis will be employed.
- The designs will be consistent with the NE Safety and Health Program.
- The designs will be consistent with NE Environmental Policy and Guiding Principles.
- The designs will be consistent with NE Asset Management Policy and Guiding Principles.
- The designs will be consistent with all applicable governing Standards, Codes, Acts and Regulations.
- All assets and systems will be designed to ensure safety, reliability, efficiency and minimal impact to the environment.

## **7.2 Gull Island Hydroelectric Development**

### **1100 Access - General**

- Site roads to be gravel surfaced, unless conditions dictate otherwise e.g. to limit dust and flying stones in areas such as accommodations complex and other site facilities.
- Site access to north side from TLH.
- Site access to south side initially by ferry and barge, thence by a temporary one-lane construction bridge to be located upstream of the site. This temporary construction bridge will be removed prior to reservoir impounding; however concrete piers/abutments may be left in place if determined prudent to do so.

### **1200 Permanent Accommodations**

- Constructed in place on a concrete foundation.
- To be located on north side of the river approximately 0.5 km downstream of dam.
- 40 person capacity.
- Self contained facility.
- Energy Star qualified building systems (Nalcor Energy's LEED program).

### **1300 Construction Power**

- Construction power will be from NE-NLH whenever practicable.

### **1400 Construction Telecommunications – General**

- Construction communication system required.

### **1500 Temporary Site Facilities and Accommodations Complexes**

- Staged, modular construction to accommodate up to 2,500 persons with appropriate offices, cooking, dining, sleeping, washing, medical, fire fighting, entertainment, recreational, power, water, sewage, and other life support facilities both at site, within the project area and at other locations, yet to be determined.

- Includes substation and distribution system with construction power supplied from NE-NLH and backup diesel generation at the site.
- Main site location and facilities to be on North side of river approximately 6 km downstream from dam on existing cleared site.
- Voice and data communication systems.
- Designed for removal following construction.

#### 2100 Reservoir

- FSL = 125 m; LSL = 122 m; MFL = 127 m.
- Remove all trees that grow in, or extend into, the area between 3 m above FSL and 3 m below LSL, except where the reservoir preparation strategy dictates otherwise.
- Trash management system required for the reservoir.
- Fish habitat will be based on compensation strategy agreed with DFO.

#### 2200 Diversion

- 2 tunnels in rock located on south side of river.
- Capacity = 4,800 m<sup>3</sup>/s.
- Concrete portals at inlet of both tunnels.
- Operable gates at inlet portals.
- Fish Compensation Flow will be approximately 30% of mean annual flow.

#### 2300 Dams & Cofferdams

- Main dam is to be CFRD.
- Main dam crest is to be El. 129 m.
- Deep concrete cut-off wall connecting base of dam to bedrock.
- Cofferdams are to be earth/rockfill dams.
- Downstream cofferdam designed to carry collector lines from powerhouse to switchyard.

#### 2400 Spillway

- Concrete structure in rock excavation.
- Capacity = PMF @ 20,800 m<sup>3</sup>/s.
- Vertical lift gates with individual wire rope hoists in heated enclosures designed for severe cold climate operation.
- 2 gates to be heated.
- All gate gains to be heated.
- 1 set of interchangeable steel Stoplogs with a permanent hoist system.
- Downstream chute with Flip Bucket and Plunge Pool for energy dissipation.

#### 3100 Tailrace

- Channel to river in open cut earth/rock excavation.

### 3220 Intakes

- Approach channel in open cut earth/rock excavation; designed to eliminate frazil ice.
- Concrete structure in rock excavation.
- 5 intakes (one per Penstock).
- 5 sets of vertical lift operating gates with individual wire rope hoists in heated enclosures.
- 1 set of steel Bulkhead Gates with a permanent hoist system.
- 5 sets of removable steel Trash Racks.
- 1 permanent trash management system.

### 3250 Penstocks

- 5 individual Penstock tunnels in rock.
- All tunnels are concrete/steel lined.
- Separate venting (exterior to intake) of each Penstock.

### 3300 Powerhouse Civil Works

- Concrete structure in rock excavation.
- Structural steel super-structure with metal cladding.
- Energy Star qualified building systems (Nalcor Energy's LEED program).
- 5 unit powerhouse with maintenance bay large enough to assemble 1 complete turbine/Generator unit, plus assembly and transfer of 1 extra rotor. Provision for an unloading area.
- Area for offices, maintenance shops and warehouse. After completion of turbine/generator installation, the maintenance bay may be reduced in size to accommodate the dismantling of 1 entire turbine/generator unit only. Offices, maintenance shops, and warehouse may occupy the remaining area of the maintenance bay.
- 2 sets of draft tube Stoplogs with a permanent hoist system in a heated enclosure.

### 3400 Turbines and Generators

- 5 – 450 MW, approximately, @ 0.9 pf vertical axis Generators.
- 5 Francis Turbines with Cavitation Resistant Design.
- Unitized approach from intake to Generator step-up transformer.
- Failure of any equipment/system of one unit not to affect the operation of the remaining units.

### 3440 Electrical Ancillary Equipment

- Dual dc battery system.
- A minimum of 2 sources of station service.
- Dual digital protection systems.
- A distributed digital control and monitoring system.
- Dual CPU for control system functions.
- 2 standby emergency diesel Generators, in separate locations, complete with fuel storage systems.

#### 3450 Mechanical Ancillary Equipment

- Separate high & low pressure compressed air systems.
- Separate service, domestic, and fire water systems.
- HVAC systems. Generators are to be a source of powerhouse heating.
- 2 overhead powerhouse cranes, with the capability to operate in tandem having a combined design capacity, when operated in tandem, to lift a fully assembled Rotor.
- Elevator access to all levels of powerhouse, including transformer gallery.
- Dewatering and drainage systems c/w oil interception system.
- Permanent waste hydraulic & lubricating oil storage and handling system complete with a permanent centrifuge filtration system.
- Permanent hoist system required for each turbine pit.

#### 3460 Generator Transformers & Switching

- 5 step up transformers located upstream of the powerhouse.
- Each unit will have a Generator breaker.

#### 4200 Gull Island Switchyard - General

- Situated on the north side of the Churchill River on a level fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Details ON HOLD – final design is dependent on the market access route and the export transmission connection point which is currently subject of ongoing transmission access applications and an appeal of the Regie de l'énergie ruling of May 2010.

#### 9210 Operations Telecommunication Systems

- All permanent control, teleprotection, SCADA and voice circuits to have communication redundancy.

### **7.3 Muskrat Falls Hydroelectric Development**

#### 1100 Access - General

- Site roads to be gravel surfaced unless conditions dictate otherwise e.g. to limit dust and flying stones in areas such as accommodations complex and other site facilities.
- Permanent site access from south, along south side of river via TLH.
- Temporary site access to north side from TLH.

#### 1200 Permanent Accommodations

- No permanent accommodations required.

#### 1300 Construction Power

- Construction power will be from NE-NLH whenever practicable.

#### 1400 Construction Telecommunications – General

- Construction communication system required.

### 1500 Temporary Site Facilities and Accommodations Complexes

- Staged, modular construction to accommodate up to 1,500 persons with appropriate offices, cooking, dining, sleeping, washing, medical, fire fighting, entertainment, recreational, power, water, sewage, and other life support facilities both at site, within the project area and at other locations, yet to be determined
- Main site facilities to be located on south side of river.
- Includes substation and distribution system for construction power supplied from NE-NLH and backup diesel generation at the site.
- Voice and data communication systems.
- Designed for removal following construction.

### 2100 Reservoir

- FSL = 39 m; LSL = 38.5 m; MFL = 44 m.
- Remove all trees that grow in, or extend into the area between 3 m above FSL and 3 m below LSL, except where determined otherwise by the reservoir preparation strategy.
- Trash management system required for the reservoir.
- Fish habitat will be based on compensation strategy agreed with DFO.

### 2200 Diversion

- Through spillway structure.
- Capacity = 5,930 m<sup>3</sup>/s.
- Fish Compensation Flow will be approximately 30% of mean annual flow.
- Fish Compensation Flow will be through spillway structure.

### 2300 Dams & Cofferdams

- Main dams are to be RCC.
- Development flood capacity is based on PMF.
- South RCC Dam crest elevation to be El. 45.5 m.
- North RCC Dam to be an overflow dam with a crest elevation of El. 39.5 m.
- All dams are to be founded directly on bedrock.
- Cofferdams are to be earth/rockfill dams.

### 2400 Spillway (Gated Section)

- Concrete structure in rock excavation.
- Capacity = PMF in conjunction with North RCC Dam at MFL elevation of 44 m.
- Spillway sill at El. 5.0 m.
- Gates with heating and hoisting mechanisms designed for severe cold climate operation.
- 1 set (upstream and downstream) interchangeable steel Stoplogs with a permanent hoist system.

### 2800 North Spur - General

- Significant infrastructure will be required for long term stabilization of the North Spur.

### 3100 Tailrace

- Draft tubes discharge directly into river in rock excavation.

### 3220 Intakes

- Approach channel in open cut earth/rock excavation and designed to eliminate frazil ice.
- Concrete structure in rock excavation.
- 4 intakes (one per unit).
- 4 sets of vertical lift operating gates with individual wire rope hoists in heated enclosures.
- 1 set of Bulkhead Gates with a permanent hoist system.
- 4 sets of removable steel Trash Racks.
- 1 permanent trash management system.

### 3250 Penstocks

- No penstocks; 4 individual water passages in concrete (close-coupled intake/powerhouse).

### 3300 Powerhouse Civil Works

- Concrete structure in rock excavation.
- Structural steel super-structure with metal cladding.
- Energy Star qualified building systems (Nalcor Energy's LEED program).
- 4 unit powerhouse with maintenance bay large enough to assemble 1 complete turbine/Generator unit, plus assembly and transfer of 1 extra rotor. Provision for an unloading area.
- Area for offices, maintenance shops and warehouse. After completion of turbine/generator installation, the maintenance bay may be reduced in size to accommodate the dismantling of 1 entire turbine/generator unit only. Offices, maintenance shops, and warehouse may occupy the remaining area of the maintenance bay.
- 2 sets of draft tube Stoplogs with a permanent hoist system in a heated enclosure.

### 3400 Turbines and Generators

- 4 – 206 MW, approximately, @ 0.90 pf vertical axis Generators.
- 4 Kaplan turbines with Cavitation Resistant Design.
- Unitized approach from intake to Generator step-up transformer.
- Failure of any equipment/system of one unit not to affect the operation of the remaining units.



#### 3440 Electrical Ancillary Equipment

- Dual dc battery system.
- A minimum of 2 sources of station service.
- Dual digital protection systems.
- A distributed digital control and monitoring system.
- Dual CPU for control system functions.
- 2 standby emergency diesel Generators, in separate locations, complete with fuel storage systems.

#### 3450 Mechanical Ancillary Equipment

- Separate high & low pressure compressed air systems.
- Separate service, domestic, and fire water systems.
- HVAC systems. Generators are to be a source of powerhouse heating.
- 2 overhead powerhouse cranes, with the capability to operate in tandem having a combined design capacity, when operated in tandem, to lift a fully assembled Rotor.
- Elevator access to all levels of powerhouse.
- Dewatering and drainage systems c/w oil interception system.
- Permanent waste hydraulic & lubricating oil storage and handling system complete with a permanent centrifuge filtration system.
- Permanent hoist system required for each turbine pit.

#### 3460 Generator Transformers & Switching

- 4 - step up transformers (unit voltage to 345 kV) located on powerhouse draft tube deck.
- Each unit will have a Generator breaker.

#### 4100 Churchill Falls Extension - General

- To accommodate 2 X 345 kV HVac transmission lines from Muskrat Falls.
- To be an extension within the existing CF Switchyard.
- Construction and operation not to adversely impact the existing CF operation.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.

#### 4300 Muskrat Falls Switchyard - General

- Situated on the south side of the river on a level, fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Electrical layout of the switchyard is to be in accordance with the proposed SLD. (See Drawings).

#### 9220 Operations Telecommunication Systems

- All permanent control, teleprotection, SCADA and voice circuits to have communication redundancy.

## **7.4 HVac Transmission Systems**

### **4500 Soldiers Pond Switchyard**

- Situated on the north-east side of Soldiers Pond on a level, fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Electrical layout of the switchyard is to be in accordance with the proposed SLD. (See Drawings).

### **6110 HVac Overland Transmission - Gull Island to Churchill Falls**

- ON HOLD - final design, including suitability of 345 kV transmission lines between Gull Island and Churchill Falls, is dependent on the market access route and the export transmission connection point which is currently subject of ongoing transmission access applications and an appeal of the Regie de l'energie ruling of May 2010.

### **6130 Muskrat Falls Switchyard to HVdc Converter Station**

- 2 - 345 kV HVac transmission lines to connect the Muskrat Falls switchyard to the  $\pm 320$  kV HVdc Converter Station.
- Each of the 345 kV HVac lines to have a designed power capacity of 900 MW.

### **6140 HVac Overland Transmission - Muskrat Falls to Churchill Falls**

- 2 - 345 kV HVac overhead transmission lines to connect the Muskrat Falls switchyard to Gull Island and the Churchill Falls switchyard extension.
- Lines are to be carried on galvanized lattice steel towers, with self supported angles and deadends, and guyed suspension towers.
- Line power capacity is to be 900 MW for each line, allowing for all load to be carried on a single circuit.
- Line corridor as per Key Plan. (See Drawings).
- 50 year Reliability Level Return Period of loads.
- All lines to have overhead lightning protection (OHGW) with one being OPGW for the Operations Telecommunications System.
- Counterpoise installed from station to station.

### **6160 HVac Overland Transmission - Collector Lines**

- Gull Island
  - ON HOLD
- Muskrat Falls
  - 4 – 345 kV HVac cable sets to connect the high side of the step up transformers to the switchyard.

4600 Lingan Switchyard Extension - General

- To be an extension within the existing Lingan Switchyard.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Electrical layout of the switchyard TBD.

4700 Bottom Brook Switchyard Extension - General

- To be an extension within the existing Bottom Brook Switchyard.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Electrical layout of the switchyard extension is TDB.

4800 Granite Canal Switchyard Extension - General

- To be an extension within the existing Granite Canal Switchyard.
- To accommodate 1 X 230 kV HVac transmission lines to Bottom Brook.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.

6170 HVac Overland Transmission – Granite Canal to Bottom Brook

- 1 X 230 kV HVac overhead transmission line to connect the Granite Canal switchyard to the Bottom Brook switchyard.
- Line is to be carried on galvanized lattice steel towers, with self supported angles and deadends, and guyed suspension towers.
- Line power capacity is to be sized to ensure the NE 230 kV transmission system feeding the Bottom Brook Terminal Station has sufficient capacity to supply the Maritime Link with 500 MW while one of the incoming 230 kV lines is out of service.
- Line corridor is TBD.
- 50 year Reliability Level Return Period of loads.
- Line to have overhead lightning protection (OHGW) with one being OPGW for the Operations Telecommunications System.
- Counterpoise installed from station to station.

## 7.5 HVdc Transmission Systems

Overall HVdc system consists of a 900 MW HVdc Island Link between Labrador and Newfoundland and assumes a 500 MW HVdc Maritime Link between NS and NL as described further in this BOD. Without this HVdc Maritime Link, overload capacity may be required at the Labrador and Soldiers Pond converter stations.

### 7.5.1 HVdc Island Link

#### 8210 Muskrat Falls Converter Station

- 900 MW,  $\pm 320$  kV bi-pole, LCC Converter Station capable of operating in mono-polar mode.
- Each pole rated at 450 MW with 100% overload protection for 10 minutes and 50% overload protection for continuous operation.
- Situated on the south side of the Churchill River on a level fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Mono-polar operation shall be supported by an Electrode.

#### 6310 Electrode Line - Muskrat Falls to SOBI

- An Electrode Line carrying 2 conductors – route to be selected within the same ROW of the HVdc transmission line.
- Wood pole construction.
- 50 year Reliability Level Return Period of loads.
- Electrode line will have provision for lightning protection.

#### 8610 Electrode - Labrador

- A shoreline pond electrode to be located on the Labrador side of the SOBI.
- Nominal rating of 450 MW with 100% overload protection for 10 minutes and 50% overload protection for continuous operation.

#### 6270 HVdc Overland Transmission - Muskrat Falls to Strait of Belle Isle

- An HVdc overhead transmission line,  $\pm 320$  kV bi-pole, to connect the Muskrat Falls Converter Station to the Labrador Transition Compound at the Strait of Belle Isle.
- Line to carry both poles (single conductor per pole), and one OPGW.
- Line corridor as per Key Plan. (See Drawings).
- This segment of the HVdc line is to have a designed nominal power capacity of 900 MW; however, given the mono-polar operation criteria, each pole is to have a nominal rating of 450 MW with 100% overload capacity for 10 minutes and 50% overload capacity for continuous operation.
- Counterpoise installed from station to station.
- Towers are to be galvanized lattice steel, with self supported angles and deadends, and guyed suspension towers.
- 50 year Reliability Level Return Period of loads.

8510 Transition Compound - Labrador

- Situated on a level fenced site.
- Provision for cables and associated switching requirements.
- Concrete pads and steel structures to support the electrical equipment and switchgear.
- Overhead line to cable transition equipment.
- Switching, control, protection, monitoring and communication equipment.

8110 Marine Crossing - SOBI

- 3 -  $\pm 320$  kV MI sub-sea cables transmit power across the SOBI. One of these cables will be a spare.
- Cable(s) for each pole to have a nominal rating of 450 MW with 100% overload capacity for 10 minutes and 50% overload capacity for continuous operation.
- The route for the sub-sea cable(s) crossing shall be designed to meet the transmission, protection, reliability, and design life requirements, and give consideration to technical and economic optimization.
- Cable corridor as per Key Plan. (See Drawings).
- Cables shall be adequately protected along the entire length of the crossing as required. However, installation methodologies may be employed to mitigate damage from external environmental and man-made risks.
- Where discrete protection application is required, protection measures shall be designed to meet the transmission and reliability requirements.
- Cable protection methodology will employ proven technologies only, and may include tunnelling, rock placement, trenching, horizontal directional drilling (HDD) and concrete mattresses.

8520 Transition Compound – Northern Peninsula

- Situated on a level fenced site.
- Provision for cables and associated switching requirements.
- Concrete pads and steel structures to support the electrical equipment and switchgear.
- Cable to overhead line transition equipment.
- Switching, control, protection, monitoring and communication equipment.

6220 HVdc Overland Transmission - Strait of Belle Isle to Soldiers Pond

- An HVdc overhead transmission line,  $\pm 320$  kV bi-pole, to connect the Northern Peninsula Transition Compound at the Strait of Belle Isle to the Soldiers Pond Converter Station.
- Line to carry both poles (single conductor per pole) and one OPGW.
- Line corridor as per Key Plan. (See Drawings).
- This segment of the HVdc line is to have a designed nominal power capacity of 900 MW; however, given the mono-polar operation criteria, each pole is to have a nominal rating of 450 MW with 100% overload capacity for 10 minutes and 50% overload capacity for continuous operation.

- Counterpoise installed from station to station.
- Towers are to be galvanized lattice steel, with self supported angles and deadends, and guyed suspension towers.
- 50 year Reliability Level Return Period of loads.

#### 8220 Soldiers Pond Converter Station

- 900 MW,  $\pm 320$  kV bi-pole, LCC Converter Station capable of operating in mono-polar mode.
- Each pole rated at 450 MW with 100% overload protection for 10 minutes and 50% overload protection for continuous operation.
- Situated on the north side of the Soldiers Pond Tap on the Avalon Peninsula on a level fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Mono-polar operation shall be supported by an Electrode.

#### 6320 Electrode Line – Soldiers Pond to Conception Bay

- An Electrode Line carrying 2 conductors generally follows the existing transmission ROW from Soldiers Pond to Conception Bay.
- Wood pole construction.
- 50 year Reliability Level Return Period of loads.
- Electrode line will have provision for lightning protection.

#### 8620 Electrode - Soldiers Pond

- A shoreline pond electrode to be located on the east side of Conception Bay.
- Nominal rating of 450 MW with 100% overload protection for 10 minutes and 50% overload protection for continuous operation.

#### 7100 System Upgrades for Island Link

- Conversion of existing Holyrood Units 1 & 2 to synchronous condensers.
- 230 kV and 138 kV circuit breaker replacements.
- 1 - 230 kV HVac transmission line – TBD.
- 3 - 300 MVAR high inertia synchronous condensers at Soldiers Pond to maintain system performance.
- Additional upgrades to be determined by NE-NLH's System Planning following further studies and analysis.

#### 9230 Operations Telecommunication Systems – Island Link

- All permanent control, teleprotection, SCADA and voice circuits to have communication redundancy.

## **7.5.2 HVdc Maritime Link**

### **8240 Bottom Brook Converter Station**

- 500 MW,  $\pm 200$  kV bi-pole, VSC Converter Station capable of operating in mono-polar mode at 250 MW continuous operation.
- Situated near Bottom Brook Terminal Station on a level fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Mono-polar operation shall be supported by an Electrode.

### **6340 Electrode Line – Bottom Brook**

- An Electrode Line carrying 2 conductors joining the Bottom Brook HVdc converter station to the Bottom Brook shoreline pond electrode.
- Wood pole construction.
- 50 year Reliability Level Return Period of loads.
- Electrode line will have provision for lightning protection.

### **8640 Electrode – Bottom Brook**

- A shoreline pond electrode to be located on the west coast of Newfoundland near Bottom Brook.
- Capable of operating at 250 MW continuous operation.

### **6260 HVdc Overland Transmission – Bottom Brook to Cape Ray**

- An HVdc overhead transmission line,  $\pm 200$  kV bi-pole, to connect the Bottom Brook Converter Station to the Cape Ray Transition Compound.
- Line to carry both poles (single conductor per pole) and one OPGW.
- Line corridor as per Key Plan. (See Drawings).
- This segment of the HVdc line is to have a designed power capacity of 500 MW; however, given the mono-polar operation criteria, each pole can sustain 250 MW continuously.
- Counterpoise installed from station to station.
- Towers are to be galvanized lattice steel, with self supported angles and deadends, and guyed suspension towers.
- 50 year Reliability Level Return Period of loads.

### **8530 Transition Compound – Cape Ray**

- Situated on a level fenced site.
- Provision for cables and associated switching requirements.
- Concrete pads and steel structures to support the electrical equipment and switchgear.
- Cable to overhead line transition equipment.
- Switching, control, protection, monitoring and communication equipment.

#### 8120 Marine Crossing – Cabot Strait

- 2 -  $\pm 200$  kV MI sub sea cables transmit power across the Cabot Strait.
- Cable(s) for each pole to be rated to carry the 250 MW continuously.
- Cables shall be designed for exposure to a marine environment, criteria specific to the Cabot Strait region.
- The route for the sub-sea cable(s) crossing shall be designed to meet the transmission, protection, reliability, and design life requirements, and give consideration to technical and economic optimization.
- Cables shall be adequately protected along the entire length of the marine crossing and may include, as an alternative to discrete protection, installation methodologies employed to mitigate damage from external environmental and man-made risks.
- Where discrete protection application is required, protection measures shall be designed to meet the transmission and reliability requirements.
- Cable protection methodology will employ proven technologies only, and may include rock placement, trenching, horizontal directional drilling (HDD) and concrete mattresses.
- Cable corridor as per NL-NS HVdc Proposed Link. (See Drawings).

#### 8540 Transition Compound – Lingan

- Situated on a level fenced site.
- Provision for cables and associated switching requirements.
- Concrete pads and steel structures to support the electrical equipment and switchgear.
- Cable to overhead line transition equipment.
- Switching, control, protection, monitoring and communication equipment.

#### 8230 Lingan Converter Station

- 500 MW,  $\pm 200$  kV bi-pole, VSC Converter Station capable of operating in mono-polar mode at 250 MW continuous operation.
- Situated in Lingan, Nova Scotia on a level fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Mono-polar operation shall be supported by an Electrode.

#### 6330 Electrode Line – Lingan

- An Electrode Line carrying 2 conductors joining the Lingan HVdc converter station to the Lingan shoreline pond electrode.
- Wood pole construction.
- 50 year Reliability Level Return Period of loads.
- Electrode line will be protected by lightning arrestors located at each end of the line.



8630 Electrode - Maritimes

- A shoreline pond electrode to be located on the north coast of Cape Breton Island near Langan.
- Capable of operating at 250 MW continuous operation.

7200 Island System Upgrades for Maritime Link

- Island system upgrades to be determined by NE-NLH's System Planning following further studies and analysis.

9240 Operations Telecommunication Systems – Maritime Link

- All permanent control, teleprotection, SCADA and voice circuits to have communication redundancy.

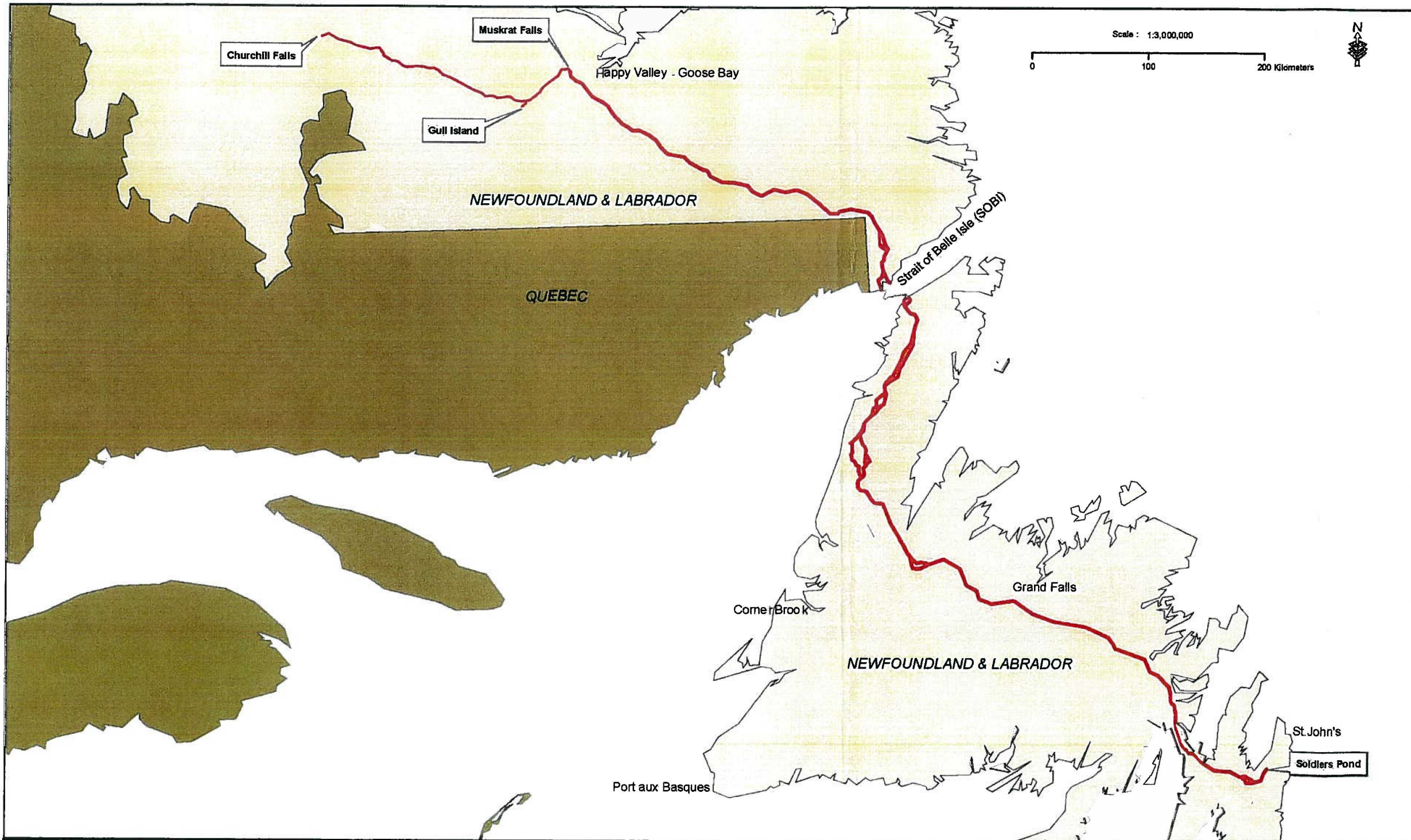
**A.0 Activity Flow Chart**

N/A

**B.0 Attachments/Appendices**

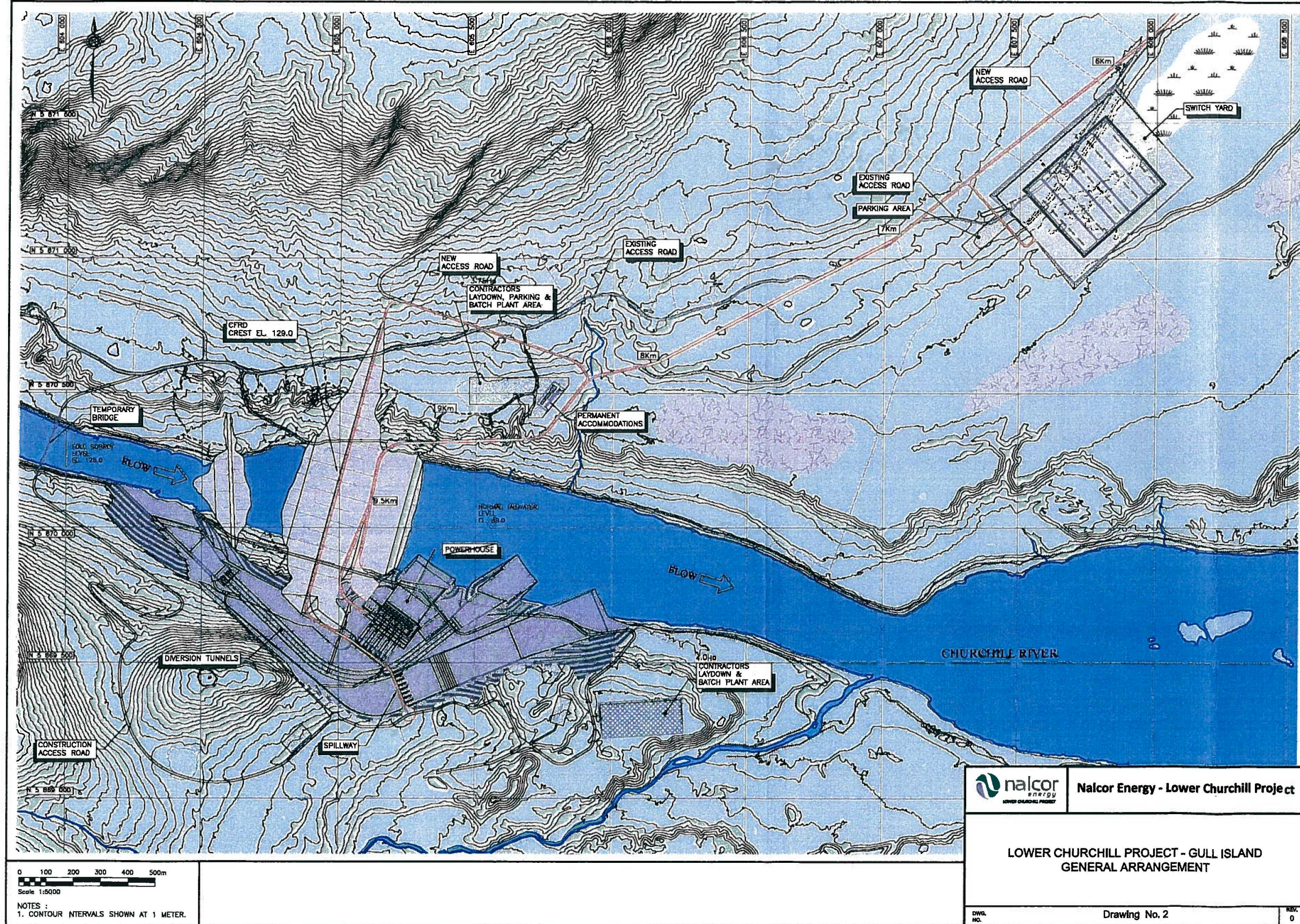
**B.1 DRAWINGS**

1. Key Plan
2. Gull Island General Arrangement
3. Muskrat Falls General Arrangement
4. Proposed Single Line Diagram – Muskrat Falls
5. NL-NS HVdc Proposed Link
6. Proposed Single Line Diagram – Bottom Brook, Granite Canal and Soldiers Pond



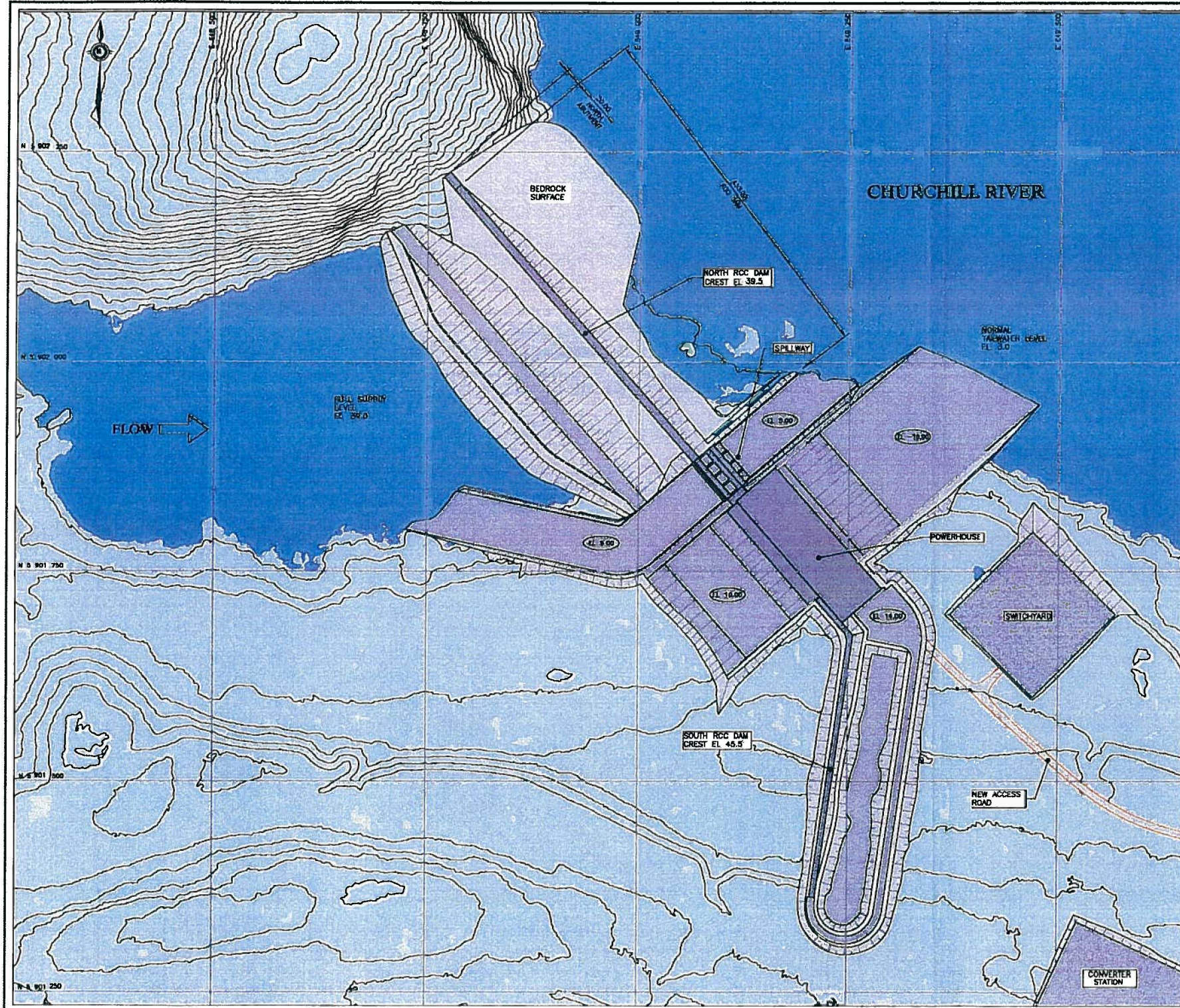
**LOWER CHURCHILL PROJECT  
KEY PLAN**

SHEET : 1 OF 1
DATE : JAN 2011
REVISION : 2



	<b>Nalcor Energy - Lower Churchill Project</b>
<b>LOWER CHURCHILL PROJECT - GULL ISLAND GENERAL ARRANGEMENT</b>	
<small>DWG. NO.</small>	<b>Drawing No. 2</b>

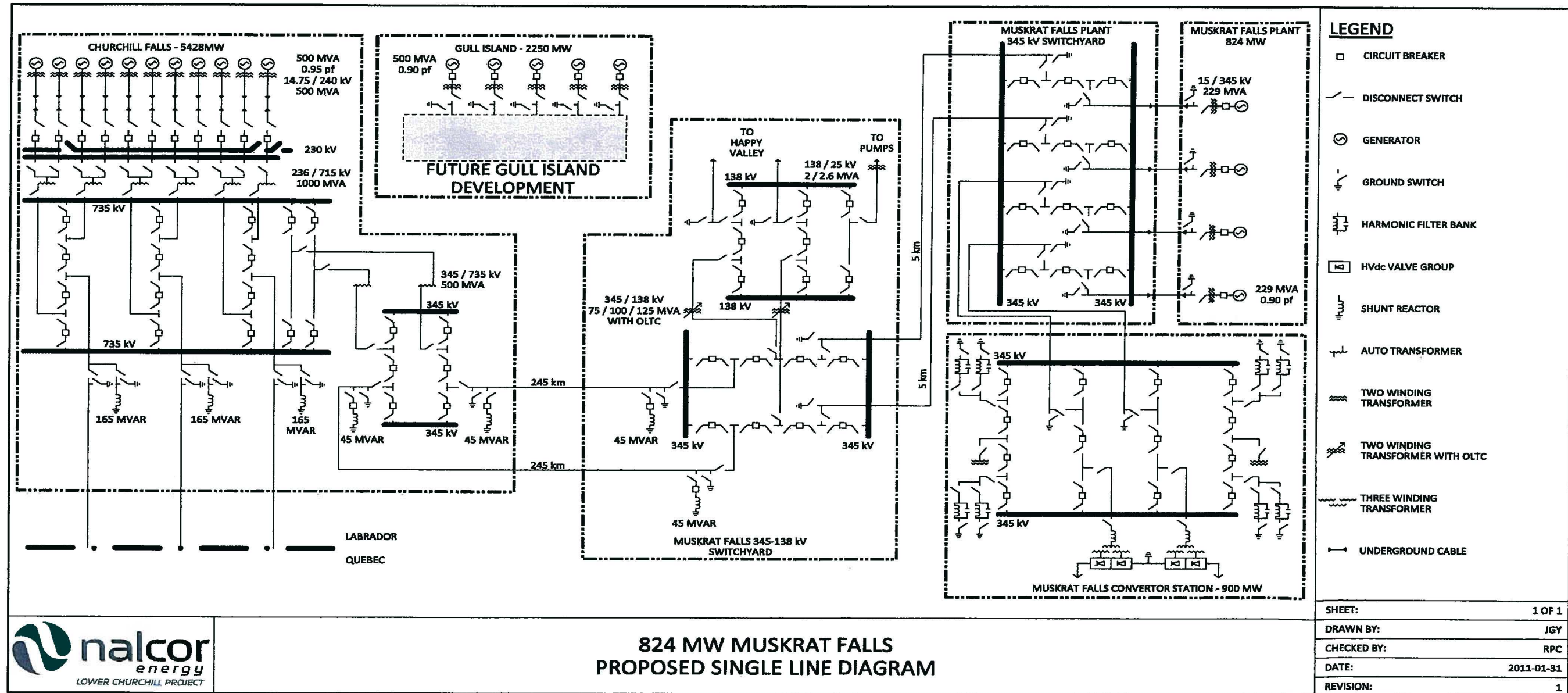
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 NOTES :  
 1. CONTOUR INTERVALS SHOWN AT 1 METER.



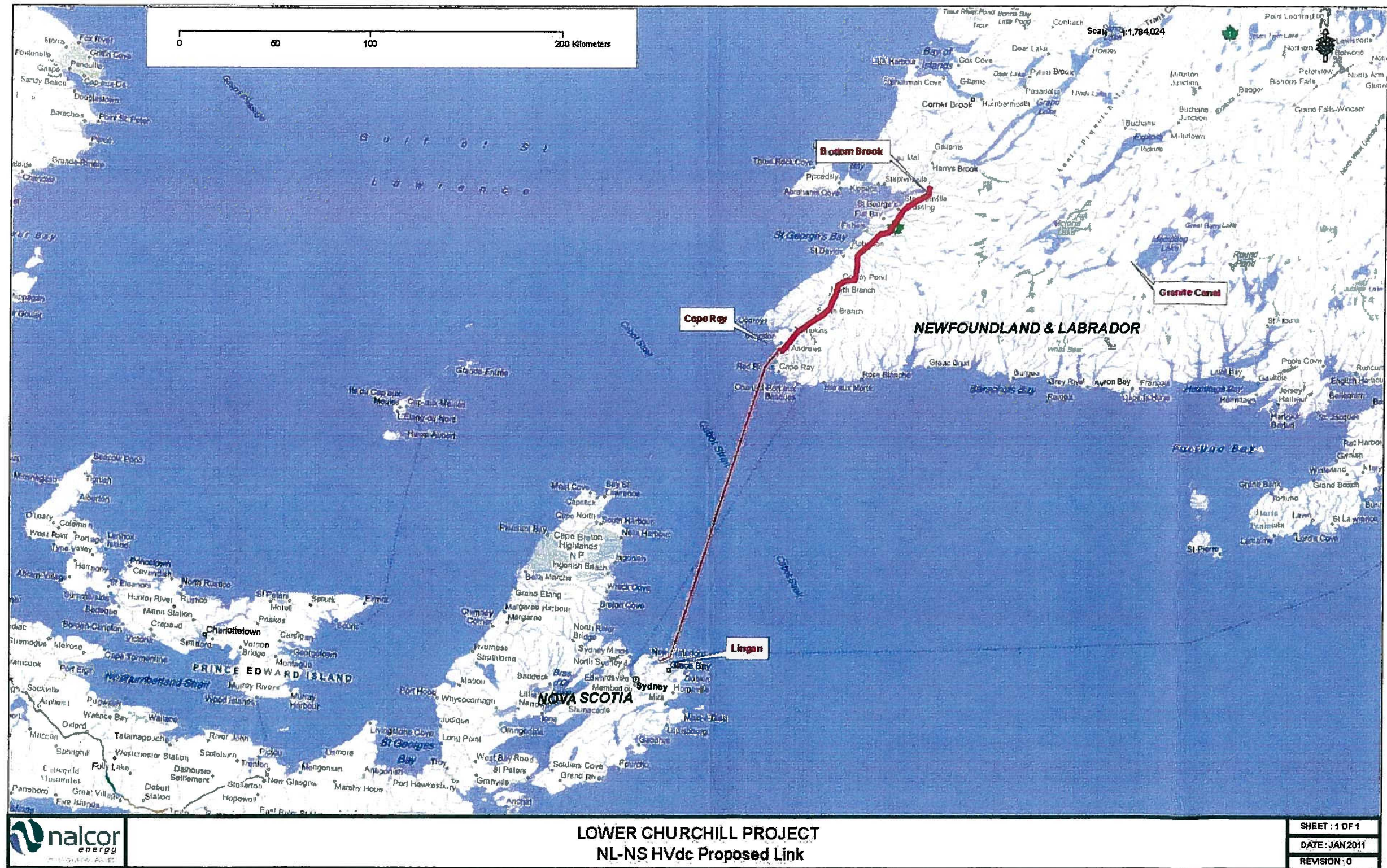
NOTE:  
1. CONTOUR INTERVALS SHOWN AT 5 METERS.



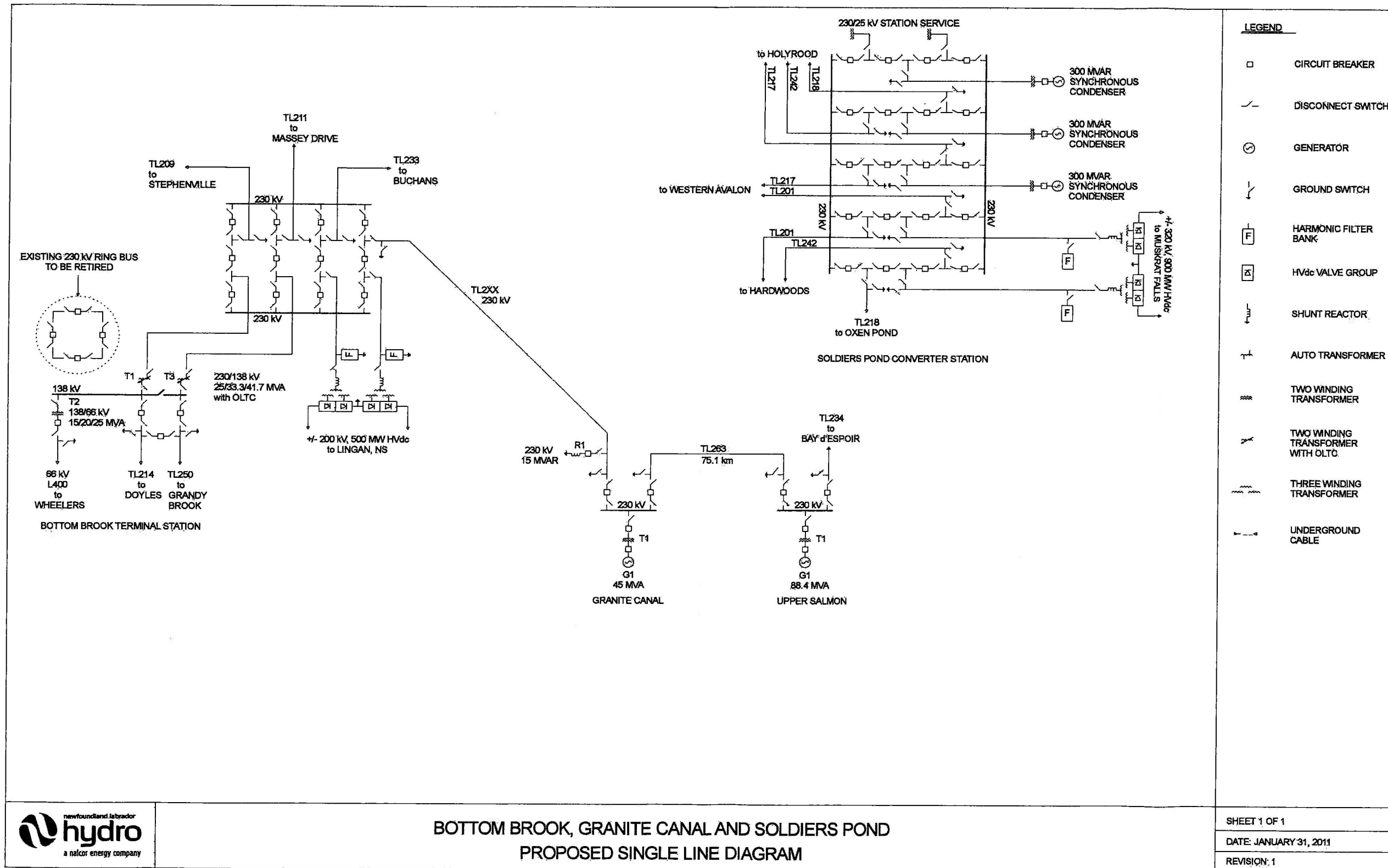
	<p>Nalcor Energy - Lower Churchill Project</p>	
<p>LOWER CHURCHILL PROJECT - MUSKRAT FALLS GENERAL ARRANGEMENT</p>		
<p>DWG. NO.</p>	<p>Drawing No. 3</p>	<p>REV. 0</p>



**824 MW MUSKRAT FALLS  
 PROPOSED SINGLE LINE DIAGRAM**



LOWER CHURCHILL PROJECT  
NL-NS HVdc Proposed Link



BOTTOM BROOK, GRANITE CANAL AND SOLDIERS POND  
PROPOSED SINGLE LINE DIAGRAM

SHEET 1 OF 1

DATE: JANUARY 31, 2011

REVISION: 1

**Nalcor Energy - Lower Churchill Project Master Contract Package List**

Package Reference No.	Contract Name	Sub Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / or equipment)	Contract process duration (Issue EOI to award) (working days)	Engineering Deliverable Types	Project Payment Terms
A-001	Accommodations Complex Buildings	Muskrat Falls	Yes	Supply and installation of construction accommodations complex including: - Dormitories, 1,500 person capacity - Recreation Centre & Commissary (1,325 m2) - Bar / Convince / Restaurant (700 m2) - Gymnasium / Fitness Centre (1,410 m2) - Outdoor Recreation - Camp Admin. Building & Reception Centre (170 m2) - Cafeteria and Kitchens (3,080 m2) - Laundry (170 m2)		Combination - Lump Sum & Unit Rates	12 mos.	2 months	95	<b>Contractor to Supply;</b> Architectural layouts General Arrangement drawings Site Layout dwgs. Interface Drawings Site Location Plans and General Specifications (to be provided with all packages) Commissioning / O & M Documentation <b>Nalcor to provide;</b> Design Brief Functional Specification	10% Down Payment for Engineering, 10% for Long Lead Items when Orders Committed to Subcontractors (defined), 40% progress payments through manufacture, 30% on Shipment including transportation costs if these costs are to contractor, 10% upon erection at site commissioned ready for occupancy.
A-002	Administrative Buildings	Muskrat Falls	No	Supply and Installation of construction Administrative Buildings including: - Medical Clinic / Security (180 m2) - Garage for Management Vehicles (250 m2) - Gate House (85 m2) - Management Site Offices (1,600 m2) - Fire Station & Ambulance Shelter (330 m2) - Administration / Information Building (110 m2) - Owner's Warehouse (1,860 m2)		Combination - Lump Sum & Unit Rates	N/A	2 months	110	<b>Contractor to Supply;</b> Architectural layouts General Arrangement drawings Site Layout dwgs. Interface Drawings Site Location Plans and General Specifications (to be provided with all packages) Commissioning / O & M Documentation <b>Nalcor to provide;</b> Design Brief Functional Specification	10% Down Payment for Engineering, 10% for Long Lead Items when Orders Committed to Subcontractors (defined), 40% progress payments through manufacture, 30% on Shipment including transportation costs if these costs are to contractor, 10% upon erection at site commissioned ready for occupancy.
C-001	Main Site Access Road - South Side	Muskrat Falls	Yes	- Access Road on South side of Churchill River from Muskrat Falls to near Blackrock Bridge on Trans Labrador Highway - 19 km long	Including: Clearing 40 ha Stripping 155,000 m3 Reck Excavation 30,000 m3 Reck Fill 96,500 m3 Granular Sub-base 44,000 m3 Granular Base 27,000 m3	Combination - Lump Sum & Unit Rates	N/A	3 - 4 months	96	Technical Specifications Site Location Plans and General Specifications Detailed Site Mapping Access Road Plan, Profile and Sections Culvert Locations and Details Design Brief Environmental Permitting, Mitigation and Remediation Plans and Details	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob.
C-002	Site Preparation & Site Access Roads	Muskrat Falls	Yes	Includes; - Upgrade Site Access Road - North Side to Trans Labrador Highway (3.25 km) - Temp. Access around Knoll (1.20 km) - Main Access Road to Borrow & Laydown Areas (4.76 km) - Site Prep - Camp Area (12.5 ha) - Water Supply / Distribution & Fire Protection - Sewage Treatment Plant & Sewer Mains - Site Prep - Owner's Warehouse & Laydown (1.5 ha) - Site Prep. - Contractor's Laydown Area (12.5 ha) - Includes clearing, stripping, excavation and Primary Environmental Mitigation	Including: Clearing 45 ha Stripping 73,000 m3 Reck Exc. 14,000 m3 Reck Fill 46,500 m3 Gran Subbase 75,000 m3 Watermain 2,000 m Sewer Main 1,800 m Water Treatment Plant x 1 Sewage Treat.Plant x 1	Combination - Lump Sum & Unit Rates	N/A	1 month	130	Technical Specifications Site Location Plans and General Specifications Detailed Site Mapping Access Road Plan, Profile and Sections Culvert Locations and Details Design Brief Environmental Permitting, Mitigation and Remediation Plans and Details	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob.
C-003	Batch Plant	Muskrat Falls	No	Large Batch Plant for Site	Including: Concrete 450,000 m3	Unit Rate Contract	N/A	4 months	150	Functional Specifications Site Location Plans and General Specifications Environmental Permitting, Mitigation and Remediation Plans and Details Aggregate Sources Access Road Layouts Water Supply Source Concrete Production Schedule	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob.



**Nalcor Energy - Lower Churchill Project Master Contract Package List**

Package Reference No.	Contract Name	Sub Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / or equipment)	Contract process duration (Issue EOI to award) (working days)	Engineering Deliverable Types	Project Payment Terms
C-004	Bulk Excavation Works	Muskrat Falls	No	Including; Access Road Construction (10 km) - Access Road Maintenance (600 km-month) - Powerhouse / Intake Excavation - Tailrace Excavation - Spillway Excavation	Including: Common 155,000 m3 P'Hse - Rock 1,284,000 m3 T'Race - Rock - Dry 25,000 m3 T'Race - Rock - Wet 50,000 m3 Spillway - Common 44,000 m3 Spillway - Rock 273,000 m3	Unit Rate Contract	N/A	2 months	86	Design Briefs Technical Specifications Site Location Plans and General Specifications Access Road Layouts Excavation Plans and Details Foundation Preparation Dwgs. Environmental Permitting, Mitigation and Remediation Plans and Details Site Information for Tenderers General Arrangement Drawing River Hydraulic Data Disposal Drawings Detailed Site Mapping Geotechnical Baseline Report	10% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob. Capital Costs vs Cost per cubic metre to be determined.
C-005	Intake and Powerhouse Construction	Muskrat Falls	No	Concrete Structures including; - Final Detailed Excavation - Formwork & Concrete - Intake Powerhouse including Draft Tube - Service & Erection Bay - including Reinforcing Steel - Embedded parts and grounding,	Including: Reinforcing Steel 11,240 tonnes Embed Steel/Anchors 18 tonnes Intake/P'Hse Conc. 103,000 m3 Service/Erection Bay 20,000 m3 Draft Tube Concrete 124,000 m3 2nd Stage Concrete 37,000 m3	Unit Rate Contract	N/A	2.5 months	168	Technical Specifications Site Location Plans and General Specifications Access Road Layouts Excavation Plans and Details Environmental Permitting, Mitigation and Remediation Plans and Details Site Information for Tenderers General Arrangement Drawing River Hydraulic Data Concrete Drawings / Embedments Foundation Preparation and Grouting Drawings Grounding Details Gate, Trashrack, and Stoplog Details (for info) Penstock Civil Drawings Powerhouse Architectural Drawings Structural Drawing Cladding Drawings Window and Door Schedules Electrical, Mechanical and HVAC Drawings Miscellaneous Steel Drawings Elevator Drawings Site Grading, Landscaping and Paving Details Warehousing / Storage Dwgs. (various types) Crane Details (for info) Equipment Life Cycle Cost Analysis Operability Reviews Commissioning / O&M Documentation	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob. (5% holdback for documentation)
C-006	Spillway Structure Construction	Muskrat Falls	No	Including; Final Detailed Excavation - Formwork and Concrete Secondary Concrete - Gate Guides - Reinforcing Steel	Including: Concrete 74,000 m3 Secondary / Gate Guides 560 m3 Reinforcing Steel 3,500 tonnes	Unit Rate Contract	N/A	2.5 Months	168	Design Brief Specifications General Specifications Drawings Technical Site Location Plan Design	
C-007	North Spur Stabilization & Cofferdams Construction	Muskrat Falls	No	Including; - Upstream Berm - Downstream Stabilization - Pumpwells Crest Unloading - North End of Spur	Including: Common Excavation 862,000 m3 Dumped Till 165,000 m3 Compacted Till 73,000 m3 Dumped Rockfill 329,000 m3 Compacted Rockfill 525,000 m3 Dumped Filter 20,000 m3 Compacted Filter 32,000 m3 Toe Wall Concrete 6,000 m3 Cofferdam Removal 6,000 m3 Compacted Gran Fill 198,000 m3 New Pumpwells 44 ea Refurbish Pumpwells 22 ea	Combination - Lump Sum & Unit Rates	N/A	1.5 months	96	Design Brief Specifications Excavation Plan and Details Environmental Permitting, Mitigation and Remediation Plans and Details Site Information for Tenderers Arrangement Drawing Technical Site Location Plan General Design Drawings	

**Nalcor Energy - Lower Churchill Project Master Contract Package List**

Package Reference No.	Contract Name	Sub-Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / or equipment)	Contract process duration (Issue EOI to award) (working days)	Engineering Deliverable Types	Project Payment Terms
C-008	RCC Dams - North & South Construction	Muskrat Falls	No	RCC Dam Works including; - Foundation Preparation - RCC Dam Construction - Concrete Downstream Face - Concrete Cap and Retaining Walls - Drainage Gallery - Instrumentation Cofferdam Installation and Removal - Downstream Toe Wall	Including: Common Excavation 90,000 m3 Drill/Pressure Grout 6,000 m Found. Prep - Rock 45,000 m2 Roller Compact Conc 265,000 m3 Concrete 35,000 m3	Unit Rate Contract	N/A	1.5 months	132	Design Brief Technical Specifications Site Location Plans and General Specifications Access Road Layouts Excavation Plans and Details Environmental Permitting, Mitigation and Remediation Plans and Details Site Information for Tenderers General Arrangement Drawing River Hydraulic Data Disposal Drawings Detailed Site Mapping Dewatering Plans and Details Dam Safety Instrumentation Concrete Face and Parapet Details Concrete Interface Dams Details Foundation Preparation and Grouting Drawings Commissioning / O&M Documentation	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob. (5% holdback for documentation)
C-009	terrestrial Habitat Construction	Muskrat Falls	No	??		??	N/A	3 months	167		5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob. (5% holdback for documentation)
E-001	Construction Power	Muskrat Falls	No	Including: Bring power from 138 Transmission Line at Trans Labrador Highway to site and across Churchill River. - Substation 138 kV down to 25 kV		Lump Sum Contract	N/A	2 months	160	Technical Specifications Site Location Plans and General Specifications Environmental Permitting, Mitigation and Remediation Plans and Details	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob.
E-002	Site Electrical Services and Distribution	Muskrat Falls	No	Including; 138 Kv Transmission Line @ Reservoir - Electrical Supply for Camp Distribution - Emergency Generator c/w Tank - 25 Kv - Switchyard, Transformer and Distribution for Construction Power On Site Communications - Electrical Infrastructure Need power on both sides of river		Combination - Lump Sum & Unit Rates	N/A	2 months	211	Technical Specifications Site Location Plans and General Specifications Environmental Permitting, Mitigation and Remediation Plans and Details	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob. (5% holdback for documentation)
E-003	Converter Stations @ Muskrat Falls and Soldiers Pond	Island Link	No	Converter Stations @ Muskrat Falls and Soldiers Pond & building including; - electro-mechanical equipment - switchyard civil works - site preparation - fencing - services.		EPC Lump Sum Contract	36-39 Months	2 months	211	Power, Energy and System Studies Design Brief Functional Specifications Site Studies Site Location Plans and General Specifications Detailed Site Mapping Environmental Permitting, Mitigation and Remediation Plans and Details Access Road Layouts Switchyard Layouts (for info) Sites acSLD Electrode System Drawings (for info) Interface Documentation Life Cycle Cost Analysis Operability Reviews Commissioning / O&M Documentation	

**Nalcor Energy - Lower Churchill Project Master Contract Package List**

Package Reference No.	Contract Name	Sub Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / or equipment)	Contract process duration (Issue EOI to award) (working days)	Engineering Deliverable Types	Project Payment Terms
E-004	Switchyard at Muskrat Falls	Muskrat Falls	No	Switchyard at Muskrat Falls including all site preparation, civil works, equipment supply and installation and commissioning		EPC Lump Sum Contract	36-39 Months	2 months	211	Design Brief Functional Specifications Site Location Plans and General Specifications Detailed Site Mapping Environmental Permitting, Mitigation and Remediation Plans and Details Access Road Layouts Switchyard Layouts / Grading / Drainage DC Station Servi	<b>General Note assume 70% Equipment Costs and 30% Installation Costs.</b> 5% Mobilization, 10% Engineering Design complete, 10% on award of all subcontracted Equipment and Materials / Long Lead Items, 25% at 50% manufacture of all equipment, 30% on shipment of
E-005	Electrode design, supply, construction	Island Link	No	Electrode design, supply, construction and Site Preparation including underwater cable and transition compound.		EPC Lump Sum Contract	12 months	2 months	211	Sites Selection Studies Design Briefs Functional Specifications Including data for tenderers Site Location Plans and General Specifications Detailed Site Mapping Environmental Permitting, Mitigation and Remediation Plans and Details Life Cycle Cost Analysis Operability Review Commissioning / O&M Documentation	10% on Engineering Design Drawing approval, 60% progress payments throughout manufacture, 20% on shipment, 5% on Commissioning and 5% on documentation.
E-007	Communications System for HVDC System	Island Link	No	Communications System for HVDC system, and remote control & monitoring of all facilities.		Lump Sum Contract	18 months	2 months	127	Design Brief (Operational Voice Network, Administrative Data Network, Operational Data Network, Optical Transport System, Microwave Transport System, Leased Services System, VHF Radio System, Teleprotection System) Functional Specifications (all systems) Study Work (all systems) Drawings (all systems) Life Cycle Cost Analysis (all systems) Commissioning / O&M Documentation (all systems) Site Location Plans and General Specifications Environmental Permitting, Mitigation and Remediation Plans and Details Communication Network Layout Transmission Network	5% Mob. progress payments against labour (time) and materials and equipment monthly, and 5% Demob. (5% holdback for documentation)
E-008	Transmission Line construction and Installation	Muskrat Falls	No	Transmission Line Construction and Installation Contract including line clearing, access, tower erection, conductor stringing and tension, insulator installation.	-263 km	Unit Rate Contract (Potentially two contracts)	N/A	3 months	211	Design Brief Technical Specifications (Construction & Installation, LIDAR Surveying, Staking, Geological Investigations & Photo Interpretation) Site Location Plans and General Specifications Access Roads, Bridges, Culverts, Clearing Dwgs. Camps / Storage	<b>General Note: We expect that there will be 6 Contracts working simultaneously on this work.</b> 5% Mobilization, 75% progress payments throughout construction schedule monthly, 15% on successful energization, 5% Demobilization.

**Nalcor Energy - Lower Churchill Project Master Contract Package List**

Package Reference No.	Contract Name	Sub-Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / or equipment)	Contract process duration (Issue EOI to award) (working days)	Engineering Deliverable Types	Project Payment Terms
E-009	Conductor for AC / DC overhead lines	Common	No	Conductor for AC / DC overhead lines - Purchase		Lump Sum PO	12 months	2 months	127	Technical Specifications Delivery Schedule Bill of Materials	10% on finalized design, 20% raw material receipt ready for manufacture, 30% progress payments through manufacture, 40% on shipment.
E-010	AC and DC Insulators	Common	No	AC and DC Insulator's - Purchase		Lump Sum PO	12 months	2 months	127	Technical Specifications Delivery Schedule Bill of Materials	10% on finalized design, 20% raw material receipt ready for manufacture, 30% progress payments through manufacture, 40% on shipment.
E-011	Tower Steel	Common	No	Tower Steel including detailing, prototype testing, foundations, anchors and bolting - Purchase		Lump Sum PO	12 months	2 months	127	Technical Specifications Delivery Schedule Bill of Materials Tower Family Drawings Logistics Document	10% on approved Tower Design each type class, 10% on material receipt ready for fabrication, 10% upon type Successful Prototype testing, progress payments through fabrication and manufacture up to 35% of the value, 25% on shipment, 10% holdback.
E-012	Tower Hardware	Common	No	Tower Hardware - Purchase		Lump Sum PO	12 months	2 months	127	Technical Specifications Delivery Schedule Bill of Materials Logistics Document	10% on finalized design, 20% raw material receipt ready for manufacture, 30% progress payment, 40% on shipment.
E-013	Optical Ground Wire (OPGW) Conductors	Island Link	No	Optical Ground Wire (OPGW) Conductors - Purchase		Lump Sum PO	12 months	2 months	127	Technical Specifications Delivery Schedule Bill of Materials Logistics Document	10% on finalized design, 20% raw material receipt ready for manufacture, 30% progress payment, 40% on shipment.
E-014	Overhead Ground Wire (OHGW) Conductor	Island Link	No	Overhead Ground Wire (OHGW) Conductor including guy wires - Purchase		Lump Sum PO	12 months	2 months	127	Technical Specifications Delivery Schedule Bill of Materials Logistics Document	10% on finalized design, 20% raw material receipt ready for manufacture, 30% progress payment, 40% on shipment.
E-015	Modifications to Existing Switchyard at Churchill Falls.	Muskrat Falls	No	Modifications to existing switchyard at Churchill Falls and associated requirements including; - Civil Works Grounding - Hardware - Supply and Install		EPC Lump Sum Contract	12 months	2 months	127	Design Brief Technical Specifications Site Location Plans (CF) and General Specifications Detailed Site Mapping Environmental Permitting, Mitigation and Remediation Plans and Details Existing Switchyard Layouts and Extension Layout SLD for Existing and Extension Provide Fenced Level Yard Interface Drawings Existing Switchyard Info. Existing Relay Building - Layout of new equipment / Potential Extension to Bldg. (Civil, mech., elect.) Control Room Mods (CF) Plan (Civil, electrical and mechanical) Life Cycle Cost Analysis Operability Review Commissioning / O&M Documentation	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob. (5% holdback for documentation)

**Nalcor Energy - Lower Churchill Project Master Contract Package List**

Package Reference No.	Contract Name	Sub-Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / or equipment)	Contract process duration (Issue EOI to award) (working days)	Engineering Deliverable Types	Project Payment Terms
E-016	Transmission Line Mech. Completion	Common	No	Transmission Line Mechanical Completion		Lump Sum Contract	N/A	2 months	127	Site Location Map Book Technical Specifications Tower Drawings Transmission Line Routing Plan and Profile Sag Charts	
E-017	Other Island upgrade requirements	Island Link	No	Other Island upgrade requirements including synchronous condensers, Holyrood Upgrades, Transmission Line upgrades, breaker replacements, Gas Turbines, Switchyard at Soldiers pond.		??					
G-001	Project Office, St. John's, NL	Common	No	Project Office, St. John's, NL		Unit Rate Contract	N/A	3 months	127	General Requirements	Mobilization, Renovations (Leasehold improvements) and Furniture Costs to be negotiated as a (% in lease rate or upfront costs) monthly invoice lease costs.
G-002	EPCM Contract	Common	No	Engineering Design and Project Support Contract		Lump Sum Contract	N/A	2 months	127	BOD and Technical Reports	Monthly invoice approved timecards and expenditures.
G-003	Catering	Common	Yes	Catering including Camp Operations and Housekeeping		Unit Rate Contract	N/A	3 months	127	General Requirements Camp Layout / Buildings Info.	Monthly Account
G-004	Janitorial	Common	Yes	Janitorial		Unit Rate Contract	N/A	3 months	127	General Requirements Camp Layout / Buildings Info.	Monthly Account
G-005	Security	Common	Yes	Security		Lump Sum Contract	N/A	3 months	127	General Requirements Camp Layout / Buildings Info.	Monthly Account
G-006	Medical Services	Common	Yes	Medical Services		Lump Sum Contract	N/A	3 months	127	General Requirements Camp Layout / Buildings Info.	Monthly Account
G-007	Site Ground Transportation	Common	Yes	Transportation, at Site, Site to HVGB and Return and HVGB Airport to other destinations.		Unit Rate Contract	N/A	3 months	127	General Requirements Camp Layout / Buildings Info.	Monthly Account
G-008	Camp and Building Maintenance	Muskrat Falls	Yes	Camp and Building Maintenance		Unit Rate Contract	N/A	3 months	127	General Requirements Camp Layout / Buildings Info.	Monthly Account
G-009	Snow Removal and Road Maintenance	Muskrat Falls	No	Snow Removal and Road Maintenance		Unit Rate Contract	N/A	3 months	127	Technical Specifications / General Requirements Site Location Plans and General Specifications (Meteorological Data) Site Layout / Access Roads Layout	Monthly Account
G-010	Fuel supply and dispensing	Common	No	Fuel supply and dispensing		Unit Rate Contract	N/A	3 months	127	Technical Specifications Site Location Plans and General Specifications Environmental Permitting, Mitigation and Remediation Plans and Details Civil, Mechanical and Electrical Dwgs.	Monthly Account
G-011	Sewage & Garbage Disposal	Common	Yes	Remote Sewage Disposal, washcars / portable toilets, dryhouses, including garbage collection.		Unit Rate Contract	N/A	3 months	127	General Requirements Technical Specifications Site Location Plans and General Specifications	Monthly Account
G-012	Potable Water Delivery	Common	No	Remote Sites, Potable Water Delivery, to washcars and contractors.		Unit Rate Contract	N/A	3 months	127	General Requirements Technical Specifications Site Location Plans and General Specifications	Monthly Account
G-013	Explosives Supply and Warehouse	Common	No	Explosives Supply and Warehouse includes security, issuance and permitting.		Unit Rate Contract	N/A	3 months	127	Technical Specifications / General Requirements Site Location Plans and General Specifications Bill of Materials (including quantities) Environmental Permitting, Mitigation and Remediation Plans and Details	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob.

**Nalcor Energy - Lower Churchill Project Master Contract Package List**

Package Reference No.	Contract Name	Sub-Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / or equipment)	Contract process duration (Issue EOI to award) (working days)	Engineering Deliverable Types	Project Payment Terms
G-014	Reservoir Clearing	Muskrat Falls	No	Reservoir Clearing including surveying & clearing, harvesting, collection of materials and disposal of waste, including debris and slash management.	Clearing - 3,760 ha	Unit Rate Contract	??	2 months	115	Design Brief Functional Specifications Location Plans and General Specifications Access Points to Reservoir River Hydraulic Data Environmental Permitting, Mitigation and Remediation Plans and Details Reservoir Mapping	10% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob.
G-015	Barge Contract	Muskrat Falls	No	Barge Contract to move Equipment to South Side to Commence Grading at Campsite, Site Access Roads, Excavation of Spillway, Intake, Approach Channel, and Powerhouse Structure. Including the Site Clearing of any Borrow and Disposal Areas		Lump Sum or Unit Rate Contract	N/A	3 months	127	Functional Specifications Site Location Plans and General Specifications River Hydraulic Data Detailed Site Mapping River Bathymetry Access Road Layouts Environmental Permitting, Mitigation and Remediation Plans and Details	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob.
G-016	Muskrat Falls Site Communications	Muskrat Falls	No	Muskrat Falls Site Communications, including Cell Towers (2), Satellite Phone, Telephone for Accommodation complex and Contractors, Cable or Satellite TV for Accommodation complex, and Computer Data Lines.		Lump Sum Contract	12 months	3 months	127	Functional Specifications and General Requirements Site Location Plans Topographic Mapping Site and Camp Layout	5% Mob, progress payments against labour (time) and materials and equipment monthly, and 5% Demob.
G-017	Happy Valley / Goose Bay Project Office	Common	No	Happy Valley / Goose Bay Project Office, including Communications, Public Relations and Administration		Unit Rate Contract	N/A	2 months	85	General Requirements	Monthly Account
G-018	Happy Valley Goose Bay Hotels	Common	No	Happy Valley Goose Bay Hotels (Mob / Demob) or Peak periods, including catering and Box Lunches.		Unit Rate Contract	N/A	2 months	25	General Requirements	Monthly Account
G-019	Freight Forwarding and Logistics	Common	No	Freight Forwarding and Logistics Contract, including Custom Duties Consultation.		Unit Rate Contract	N/A	2 months	167	General Requirements	Monthly Account
G-020	3rd Party Expediting Services	Common	No	Field expediting services from a 3rd Party Expediting Service Provider		Unit Rate Contract	N/A		127		
G-021	3rd Party Inspection Services	Common	No	Field inspection surveillance from a 3rd Party Inspection Service provider		Unit Rate Contract	N/A		127		
G-022	Site Restoration incl Landscaping, Paving, Signs etc.	Common	No			Unit Rate Contract					
M-001	Turbine & Generator - Model Testing	Muskrat Falls	No			Lump Sum Contract					
M-002	Turbine & Generators	Muskrat Falls	No	Turbine & Generators, including exciters, control systems and governors - Purchase and Install. (TBD)	Kaplan Turbines 4 ea Transformers 4 ea Spare Transformer 1 ea Electrical Ancillary 1 ls Mech. Ancilla	EPC Lump Sum Contract	53 Months	2 month	235	Functional Specifications Site Location Plans and General Specifications Powerhouse General Layouts / Cranage Interface Drawings Site Layout Access and Transportation Details	General Note: Equipment Supply would equate to 65-70% and Installation Costs 30-35% of overall cost. Engineering and Model Test equates to 5% of equipment costs spread equally over a period of 12 months from award. Material Orders for each unit 1,2,3,4,

**Nalcor Energy - Lower Churchill Project Master Contract Package List**

Package Reference No.	Contract Name	Sub-Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / or equipment)	Contract process duration (Issue EOI to award) (working days)	Engineering Deliverable Types	Project Payment Terms
M-003	Balance of Plant	Muskrat Falls	No	Balance of Plant (TBD) including powerhouse E&M services, transformers(15/230kv), switchyard structure, electro mechanical equipment, including diesel generator back-up unit and control systems. NEED TO REVIEW STRATEGY		EPC Lump Sum Contract	24 months	2 month	211	Functional Specifications Site Location Plans and General Specifications Powerhouse Layouts Structure Layouts Interface Drawings Site Layout Access and Transportation Details Grounding Details Structural Drawings SLD Switchyard Layout Electrical, Mechanic	General Note assume 70% Equipment Costs and 30% Installation Costs. 10% Engineering, 10% on award of all subcontracted equipment, 40% progress payments at 50% manufacture, 10% at Testing, 20% at shipment and 10% upon successful site acceptance test. Ins
M-004	Spillway Gates	Muskrat Falls	No	Spillway Gates (3) including Stop Logs (1 set) complete with storage and retrieval system, hoists and heating system and Guides / Concrete embedments.	Including: Gates/Hoist/Embed Parts 1,019 t Stoplogs 679 t	Lump Sum PO	3 months (Anchors)	2 month	192	Functional Specifications Site Location Plans and General Specifications Concrete Details of the Structure General Arrangement of the Structure Hoist Enclosure Details Interface Drawings Equipment Arrangement Dwgs. Life Cycle Cost Analysis Commissioning Documentation	10% for Engineering, 60% on progress payments through out delivery, 30% on delivery.
M-005	Intake Gates	Muskrat Falls	No	Intake Gates (4 sets) including Bulkhead Gates (1 set), Trashracks (4 sets), hoists and heating system and Guides / Concrete embedments and trash removal system.	Including: Gates/Hoist/Embed Parts - 1,766 t Stoplogs - 511 t Trashracks/Hoists - 1,212 t	Lump Sum PO	4 months	2 month	192	Functional Specifications Site Location Plans and General Specifications Concrete Details of the Structure General Arrangement of the Structure Hoist Enclosure Details Interface Drawings Equipment Arrangement Dwgs. Life Cycle Cost Analysis Commissioning Documentation	10% for Engineering, 60% on progress payments through out delivery, 30% on delivery.
M-006	Draft Tube Gates	Muskrat Falls	No	Draft Tube Gates (2 sets) complete with storage and retrieval system and Guides / Concrete embedments.	Including: Draft Tube Gates/Hoists - 738 t Draft Tube Temp Plugs - 400 t	Lump Sum PO	12 months	2 month	127	Functional Specifications Site Location Plans and General Specifications Concrete Details of the Structure General Arrangement of the Structure Interface Drawings Equipment Arrangement Dwgs. Commissioning Documentation	10% for Engineering, 60% on progress payments through out delivery, 30% on delivery.
M-007	Powerhouse Crane	Muskrat Falls	No	Powerhouse Crane Supply and Install		Lump Sum PO	12 months	1 month	127	Functional Specification Equipment Arrangement Dwgs. Commissioning Documentation	
M-008	Powerhouse Building	Muskrat Falls	No	Powerhouse Building including the supply and installation including Structural Steel, Cladding, HVAC, and Electro-Mechanical Equipment.	Including: Structural Steel - 4,000 tonnes Cladding & Roof - 15,000 m2	Lump Sum Contract	18 months	1 month	127	Technical Specifications Civil and architectural dwgs. Mechanical and electrical dwgs.	
M-009	Elevator	Muskrat Falls	No	Elevator, Supply and Install		Lump Sum PO	12 months	1 month	127	Functional Specification Equipment Arrangement Dwgs. Commissioning Documentation	
M-010	Hoist Enclosures for Gates and Hoists	Muskrat Falls	No	Hoist Enclosures for Gates and Hoists		Lump Sum PO	12 months	1 month	127	Technical Specification Enclosures Dwgs.	

**Nalcor Energy - Lower Churchill Project Master Contract Package List**

Package Reference No.	Contract Name	Sub-Project	IBA Listed Contract (Yes / No)	Description & Scope	Summary of Key Quantities	Notional Contract Form	Estimated Manufacturing Duration (months)	Mobilization / Delivery Duration (mobilize personnel and / or equipment)	Contract process duration (issue EOI to award) (working days)	Engineering Deliverable Types	Project Payment Terms
SB-003	Submarine Cable Design, Supply and Install	Island Link	No	SOBI Submarine Cable and Installation including; - landing sites - cable protection - cable storage building - testing and mechanical completion.  NOTE: Cable Manufacturing Slot and Cable Lay Vessel reservations required.		EPC Lump Sum Contract	6 months manufacturing time however leadtime ARO 30 -36 Months, type testing adds 6 months to one year to lead time factories taking order for 2012 and 2013 today. Vessel for installation needs to be confirmed at same time.		273	Design Brief Functional Specifications Site Location Plans and General Specifications Detailed Site Mapping / Route Engineering Additional Feasibility Study / Field Work Cable Design / Laying / Protection / Landing Point and Shore Approach Eng. Environmental Permitting, Mitigation and Remediation Plans and Details Access Road Layouts Termination Layouts Site SLD Life Cycle Cost Analysis Operability Review Commissioning / O&M Documentation	10% on Engineering Design Drawing approval, 60% progress payments throughout manufacture, 20% on shipment, 5% on Commissioning and 5% on documentation.
SB-008	HDD Detailed Design	Island Link	No	Design of HDD Transition Compounds		Unit Rate	N/A		144	General Requirements	
SB-010	HDD Construction	Island Link	No	HDD Drilling of Transition Compounds		Unit Rate	N/A		278	General Requirements	
SB-011	Rock Berm Design, Supply and Install	Island Link	No	Design & Installation of Cable Protection SOBI		Unit Rate	N/A		278	General Requirements	



# Lower Churchill Project – Phase I: Kickoff Meeting

## Project Control (Tab 10)

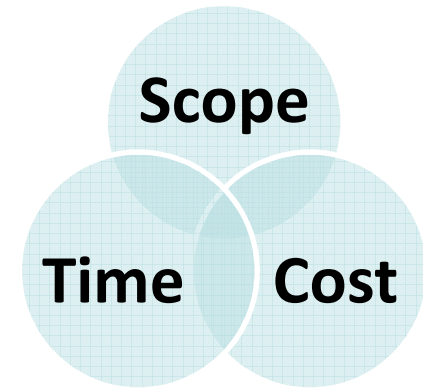
Boundless Energy



# Contents

- Our Approach
- SLI Project Control Responsibilities
- Nalcor's Stewardship Approach
- Management of Change

# Our Approach



- Scope, cost and time (schedule) are intricately linked and must be managed as one.
- Project Management are relying upon timely communication of accurate performance information.
- Nalcor Area Managers are Cost and Schedule Stewards.
- SLI are responsible for project control of the Project scope contained within the Agreement.
- SLI is to provide Nalcor with Project Control information quickly, correctly and consistently to support the Nalcor's Overall Project Stewardship Process.

# Our Approach (cont'd)

## Integrated Project Control Process Cycle

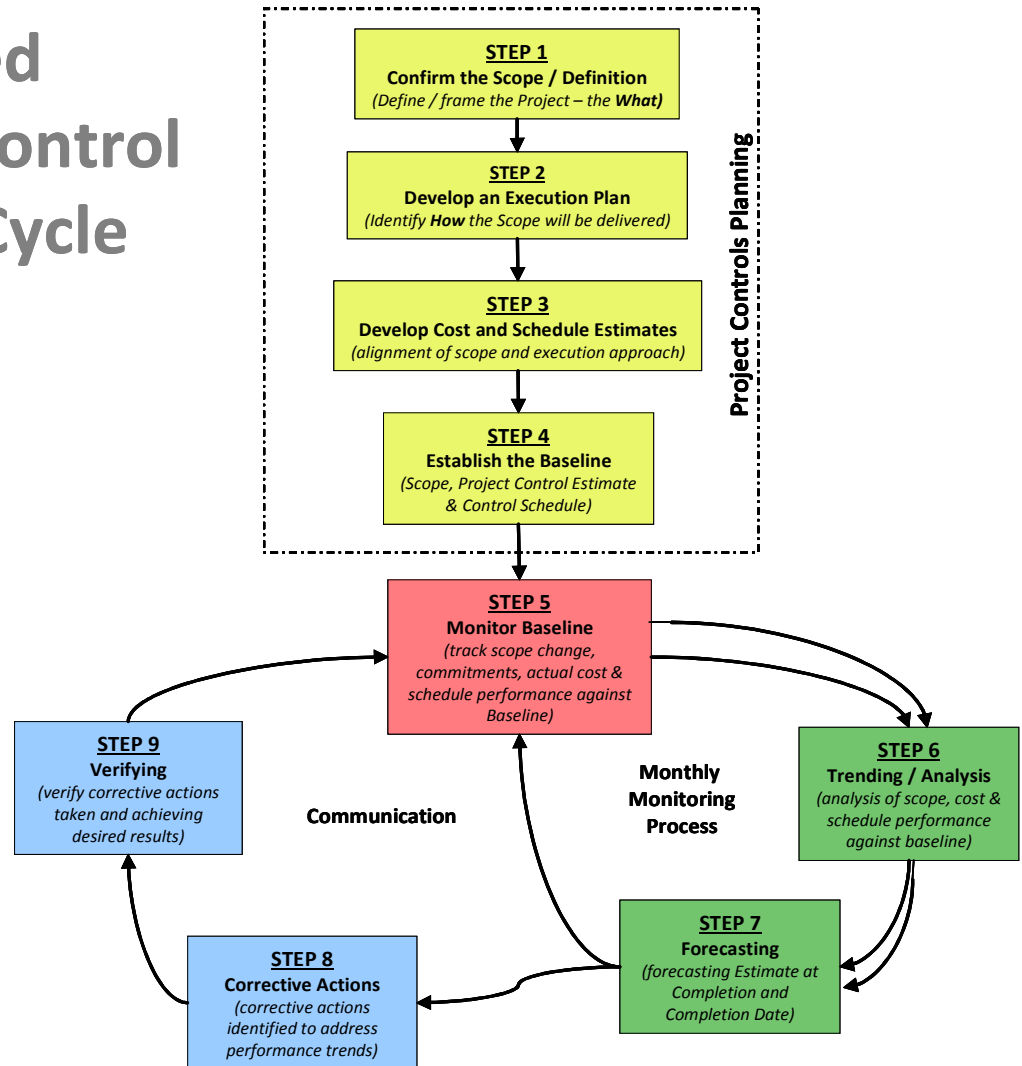


**Plan** – establish a plan and budget for a given work scope

**Do** – carry out the planned work and measure performance

**Check** – compare the measured performance against the plan

**Assess/Act** – take corrective, mitigating or improvement action as required

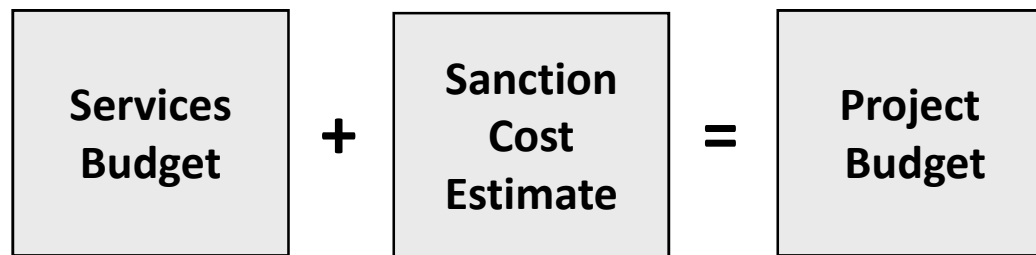


# SLI Project Control Responsibilities



# SLI Responsibilities

- Preparation of Services Estimate and Project Control Schedule (both aligned)
- Preparation of Sanction Cost Estimate for the Work – Key Deliverable of DG 3.
- Together form the project control baseline.



**Notes:**

- 1.) Sanction Cost Estimate is a Class 3 estimate encompasses all of the Work. Excludes Estimate Contingency or Escalation Allowance.
- 2.) Project Budget = Cost Baseline

# SLI Responsibilities

- SLI are responsible for stewarding against the established Original Control Budget and Project Control Schedule as detailed in its Management Plans once approved by Nalcor.
- Accurate and timely stewardship reporting.
- Project Contingency and Escalation Allowance will be managed using the Project's Management of Change Process.
  - Both are owned by Nalcor's Project Director.

# Specific SLI Project Control Deliverables

## Agreement Award

**1-Feb-2011**

Agreement Award + 60 days

### Project Control Schedule

(Entire scope but with emphasis on Services up to DG 3 )

Agreement Award + 90 days

### Services Budget (up to DG 3)

## Decision Gate 3

**15-Dec-2011**

### Project Control Schedule

Entire scope of Services and the Work

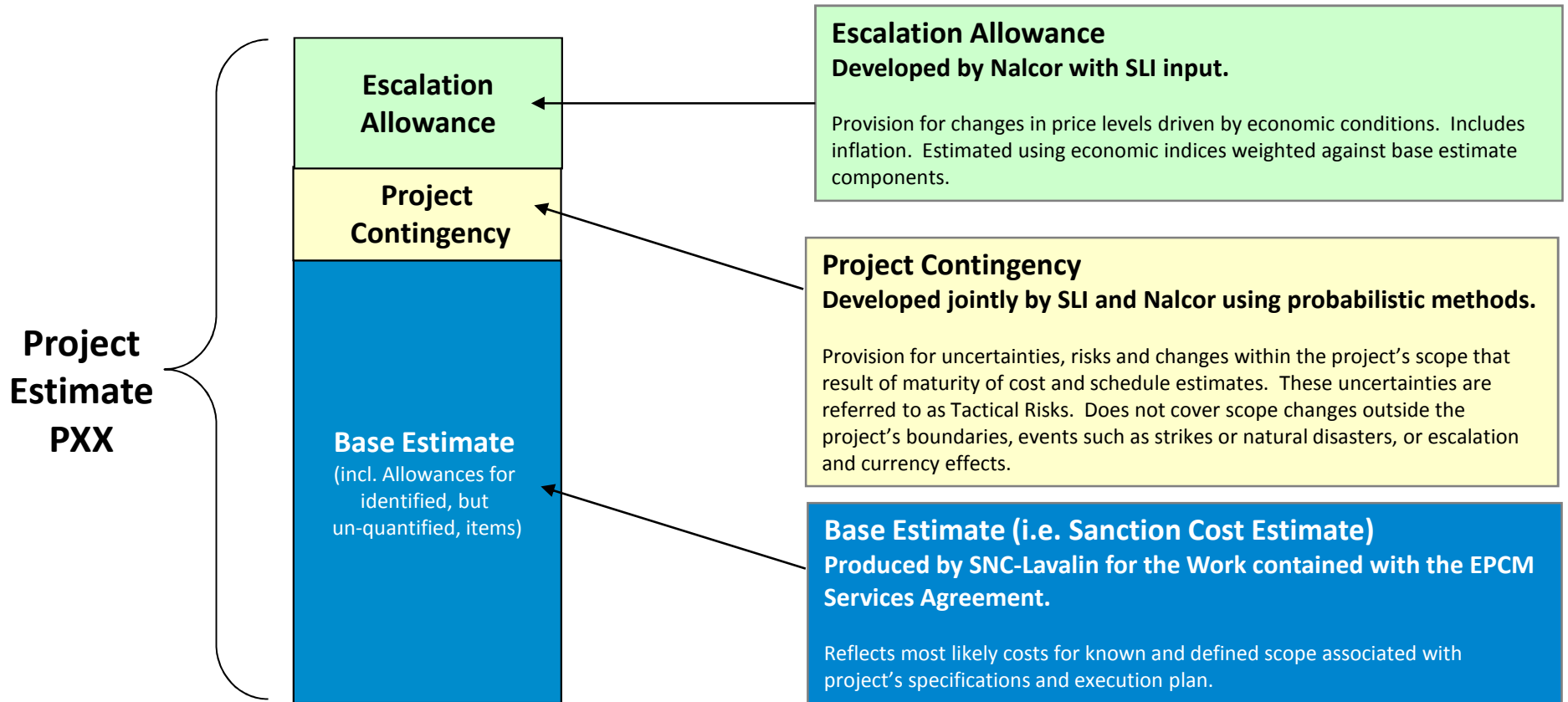
### Project Budget

- Services Budget - Overall
- Sanction Cost Estimate

**Plus** SLI Management Plans detailing how Cost, Schedule and Project Change will be managed for LCP.



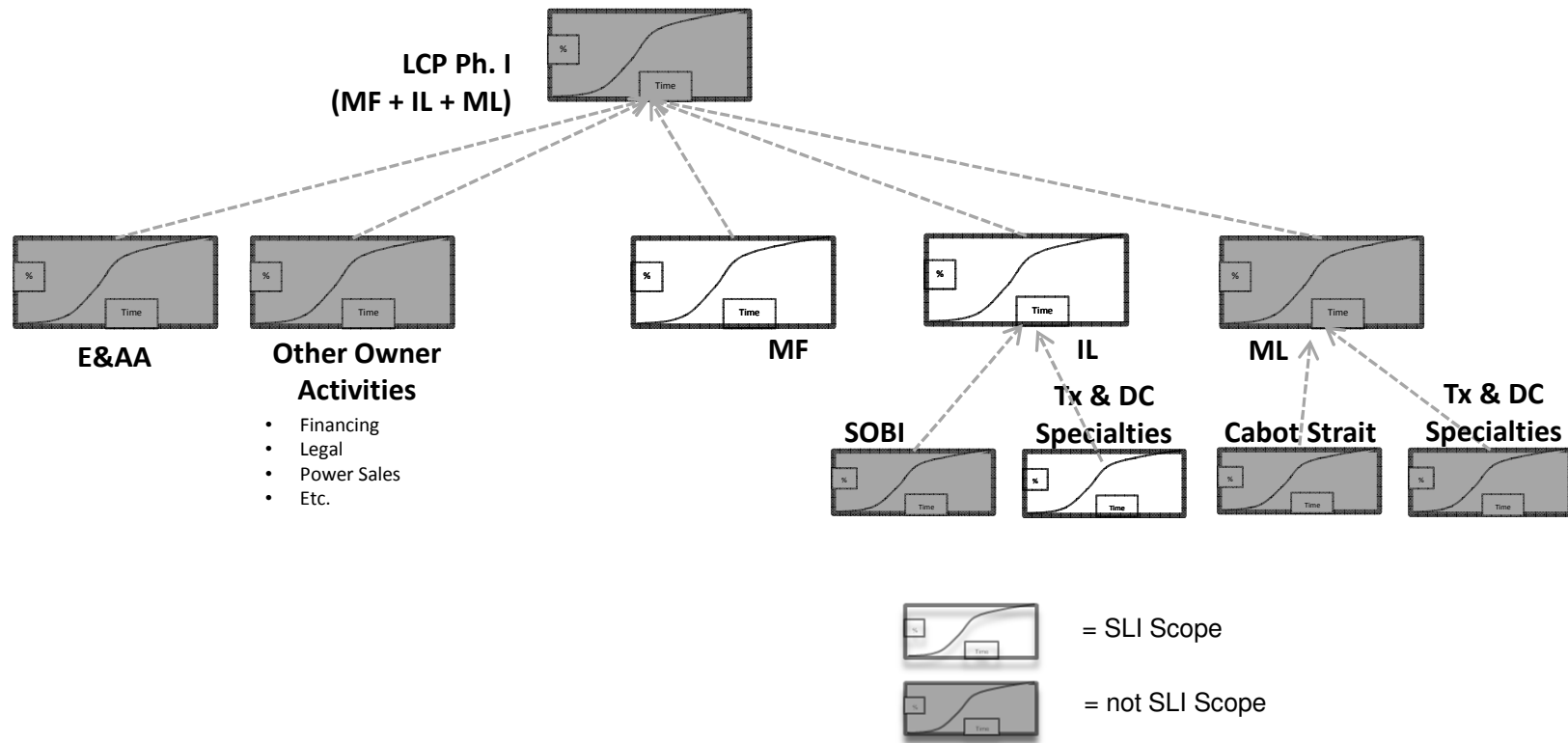
# Project Cost Estimate Components Becomes the Original Control Budget



# Nalcor's Stewardship Approach

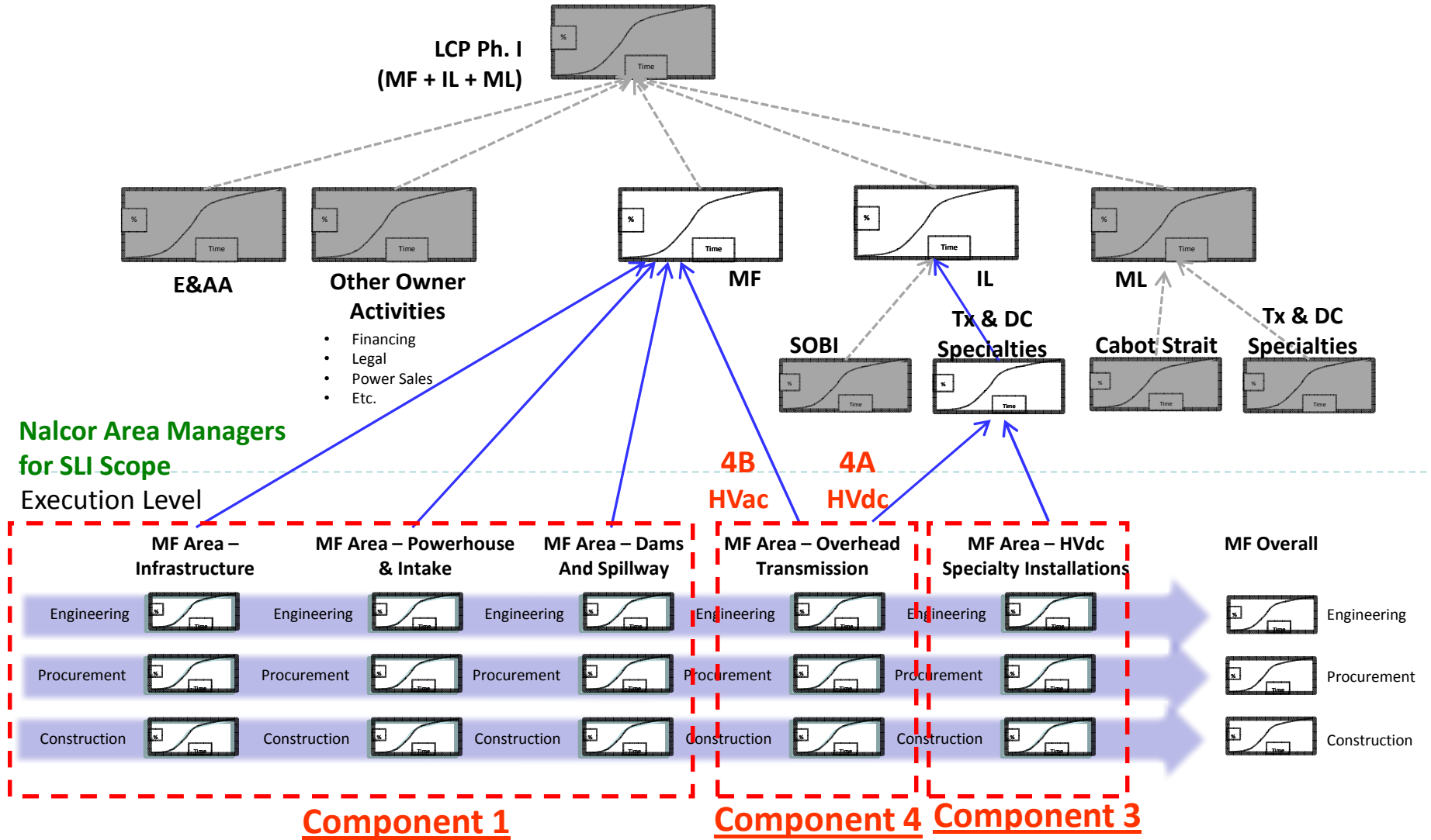


# Cost & Schedule Stewardship: Sub-Project Groupings



LCP = Lower Churchill Project	E&AA = Environmental & Aboriginal Affairs
MF= Muskrat Falls (incl. MF to CF Link)	CF= Churchill Falls
IL = Labrador – Island Link	ML= Maritime Link
SOBI= Strait of Belle Isle	Tx = Overland Transmission

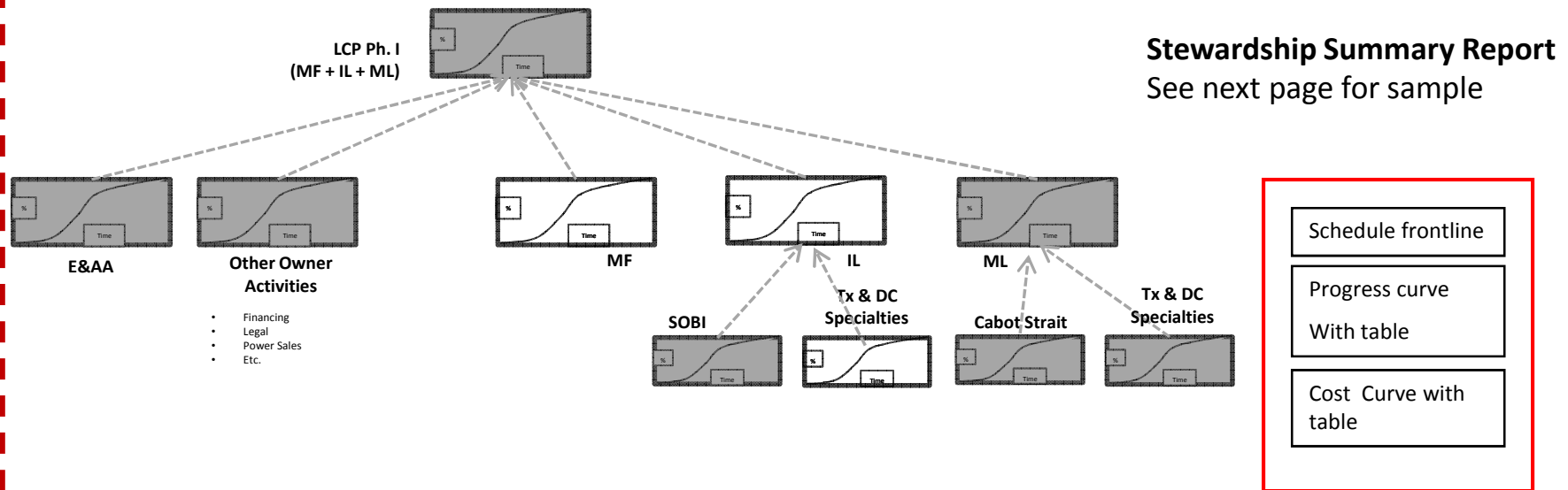
# Bridging to SLI Components via Area Managers



# Cost & Schedule Stewardship: Reporting

The LCP-PMT reports in the Stewardship Meeting and monthly report will be standardized from an overall and subproject designation viewpoint.

The “Stewardship Summary Report “ report will be produced monthly for Overall and the following subprojects:



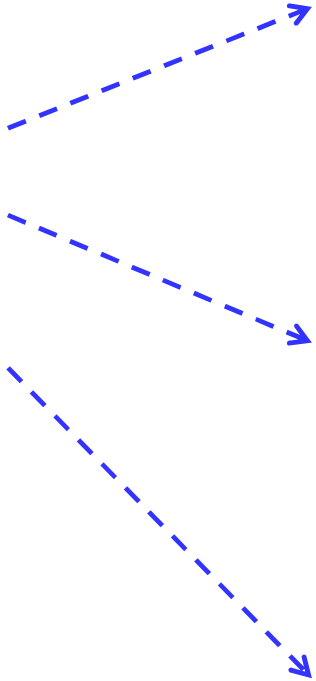
# Cost & Schedule Stewardship Summary Report

**For Illustration Purposes Only**

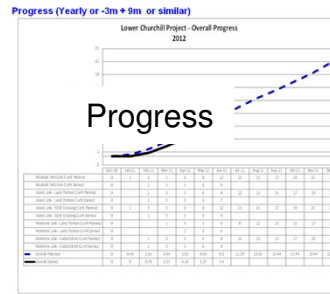
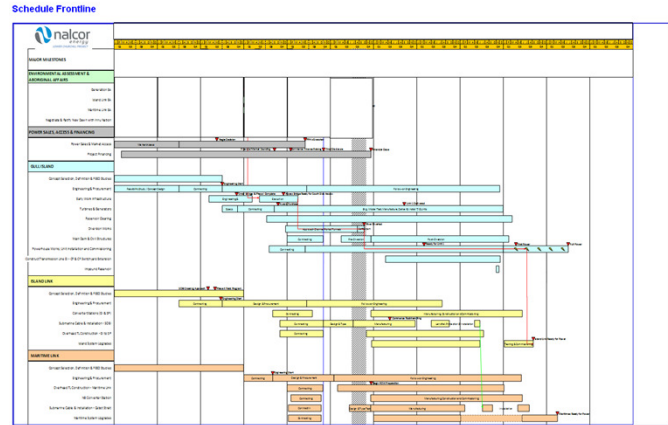
Schedule frontline

Progress curve  
With table

Cost Curve with table

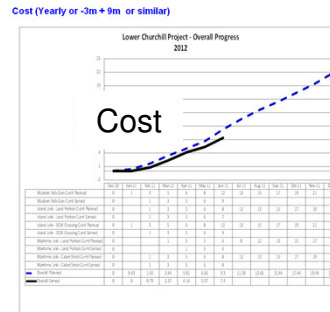


## Lower Churchill Project Phase 1 - Cost & Schedule Stewardship Summary Report OVERALL



Format will include planned/earned/actual and reflect one-page breakdown

LCP-SubProject Sections	Planned Progress (%)		Earned Progress (%)	
	A	B	C	D
Phase 1 - Environmental Assessment & Design	100%	100%	100%	100%
Phase 2 - Construction	100%	100%	100%	100%
Phase 3 - Operation	100%	100%	100%	100%



Format will reflect one-page breakdown

Nalcor Energy - Lower Churchill Project Cost Report Template - Project Based Report - Level 1	Funding	Original Cost		Current Cost		Change %	Estimate %
		Estimate	Actual	Estimate	Actual		
Major/Key Generation Facility							
Component/Equipment							
Material/Equipment							
Construction Work							
Other/Overhead							
Contingency							
Escalation							
Unallocated/CRS adjustment							
DC Change							

Sample

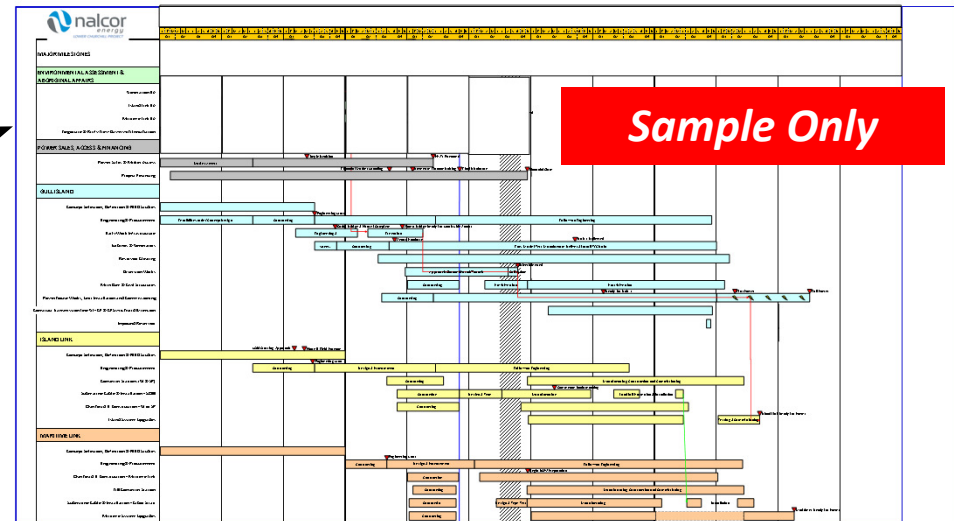
# Schedule Management

## LCP-PMT Management Summary Schedule (LCP-MSS)

This schedule is the highest level of summation and contains:

**Milestones** – Overall Project Milestones and Approvals

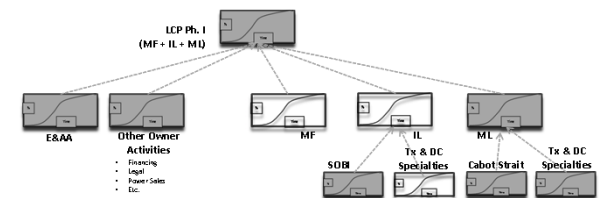
**Project Activities** – Major project activities per SUBPROJECT which include: milestones, key dates and summary activities with the overall critical path highlighted in red.



**Subproject:** Cost & Schedule Stewardship - Groupings

**Milestone:** Defined in the Contract and Nalcor Document

**Key Date:** Significant event not Defined in the Contract or Nalcor Document.



# Schedule Management

## LCP-PMT Integrated Project Schedule (LCP-IPS)

### Milestones

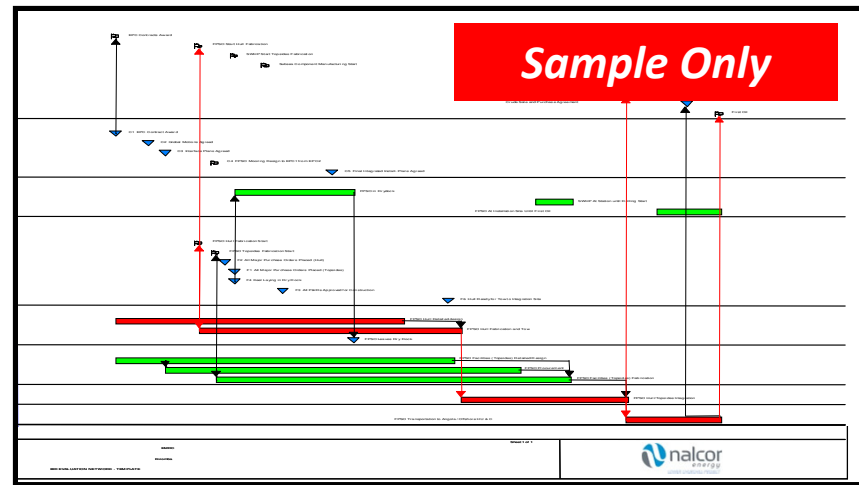
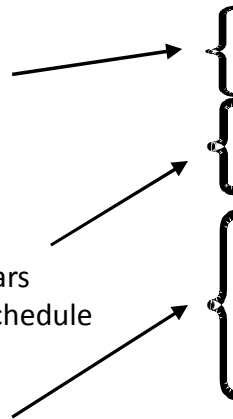
Project Milestones as shown on the Summary Level

### Key Dates per SUBPROJECT

Events as shown on individual bars at the management Summary Schedule

### Activities:

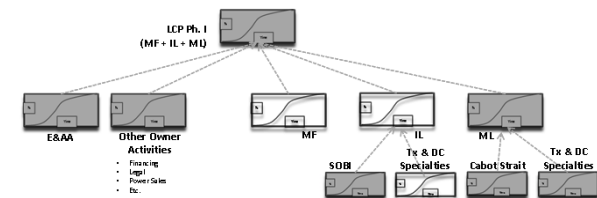
Logically Linked activities stated on periodic basis.



**Subproject:** Cost & Schedule Stewardship - Groupings

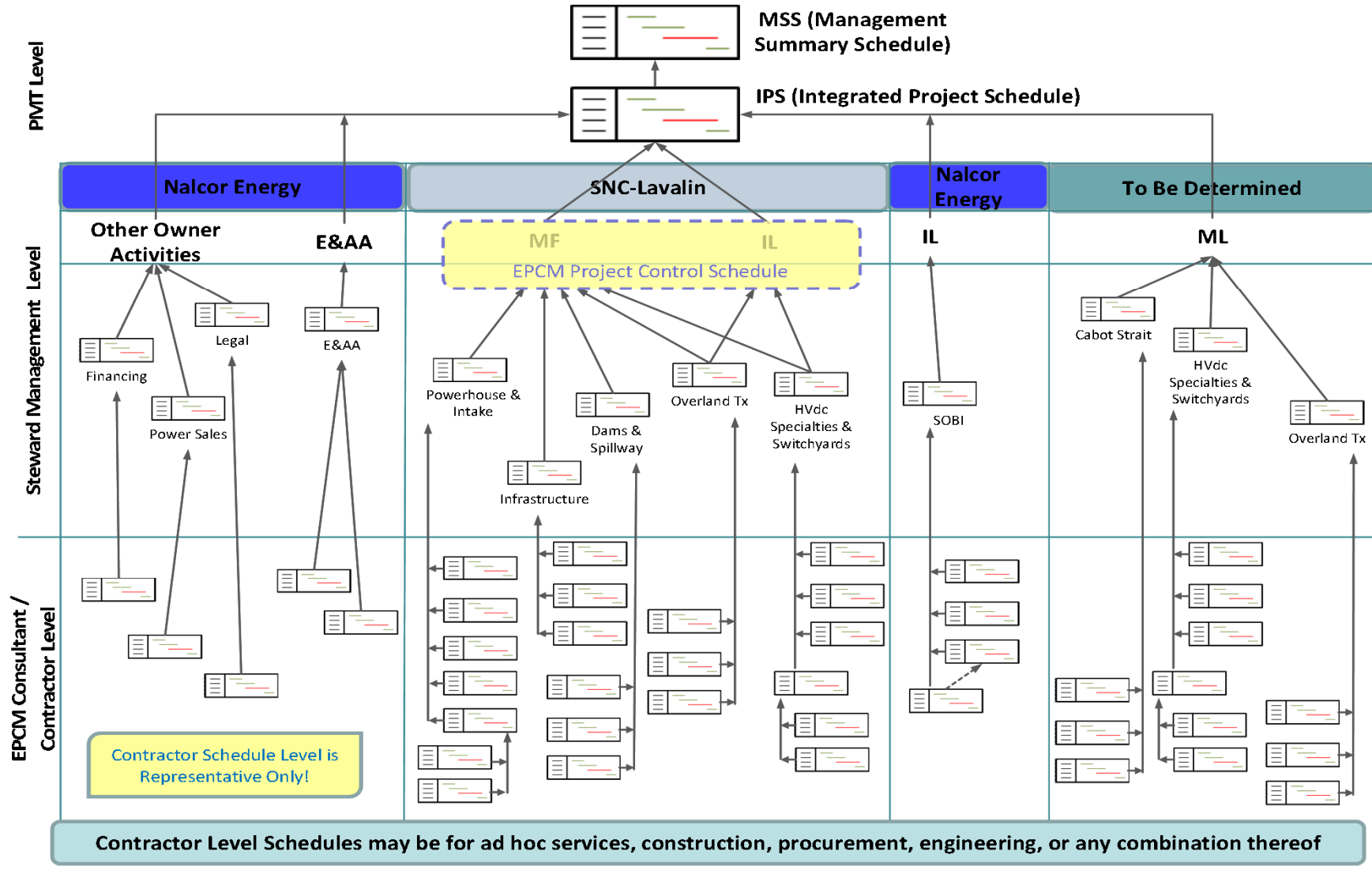
**Milestone:** Defined in the Contract and Nalcor Document

**Key Date:** Significant event not Defined in the Contract or Nalcor Document.





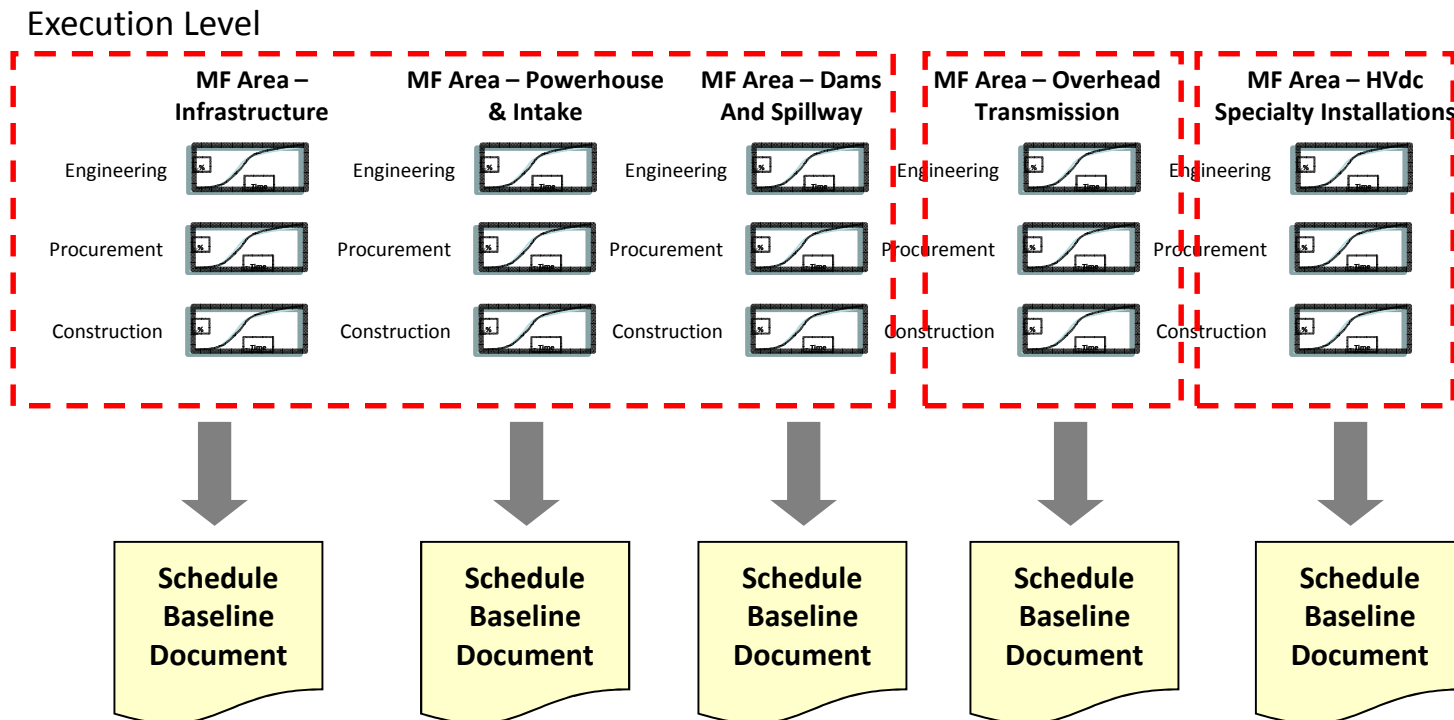
# Nalcor – SLI Schedule Interface



# Schedule Management

## Documenting a Baseline

- Schedule Stewardship by each Nalcor Area Manager will be facilitated through a Baseline Document produced in conjunction with SLI (SLI provide details).



# Schedule Management

## Baseline Document Contents

- Current & Planned Revisions – with Explanation
- Overall for Area Responsibility
  - Overall Issues and Assumptions at Baseline
  - Overall Summary Schedule
  - Overall Progress Curve
  - Overall Eng/Procure/Construction Combined Progress Curve
  - Overall Progress Table
  - Overall Critical & Sub-critical Paths
- Following information for each sub section (*Example - Dams, Spillway, Tailrace*)
  - Issues and Assumptions at Baseline
  - Summary Schedule
  - Progress Curve
  - Eng/Procure/Construction Combined Progress Curve
  - Progress Table
  - Critical & Sub-critical Paths
  - Manpower Histograms
  - Etc (to be agreed)
- Cut-Off and reporting Calendar
- Entire Schedule (PDF)

# Progress Measurement/Reporting

## Progress is...

- \* Progress is represented by the physical completion of work.
- \* Actual progress is calculated based on achievements related to physical completion of work.

## Progress is not... Indirect work hours associated with:

- Home Office
- Project Management
- Procurement
- Project Controls
- Engineering Management
- HSE Management
- Document Control
- Indirect craft support

## Weighted progress ...

Physical progress is planned and weighted according to budget work-hours, or other measurable quantity, and aggregated to a defined total.

## SLI

SLI will utilize its own system for progress measurement. This system must be reviewed in detail by LCP-PMT Project Controls and its implementation agreed.

# Progress – How it is Summarized

Sample Only

Summary Level by SubProject

Determined by LCP-PMT

LCP-SubProjects	Weight Factor in %		Weighted Progress in %	
	Overall Project A	Reported Progress B	Overall Project A*B	
<b>LCP-Phase 1</b>				
Environmental Assessment & Aboriginal Affairs	4%	70.4%	2.8%	
Nalcor Functions	3%	51.0%	1.5%	
Muskirat Falls	33%	49.8%	17.4%	
Island Link	37%	69.6%	25.7%	
Maritime Link	21%	27.0%	5.7%	
<b>Phase 1 total</b>	<b>100%</b>		<b>53.2%</b>	

Summary Level by SubProject Sections

SNC Component	LCP-SubProject Sections	Weight Factor in %		Weighted Progress in %	
		LCP-SubProject Sections A	Reported Progress B	LCP-SubProject Sections A*B	
<b>LCP-Phase 1</b>					
Not-SNC Scope	<b>Environmental Assessment &amp; Aboriginal Affairs</b>				
	EA - LC Generation - MF/GI & Interconnect	63%	89.1%	56.1%	
	EA - Island Link	16%	45.3%	7.2%	
	EA - Maritime Link	10%	56.0%	5.6%	
Not-SNC Scope	<b>Aboriginal Affairs</b>	11%	12.7%	1.4%	
	<b>subtotal</b>	<b>100%</b>		<b>70.4%</b>	
Not-SNC Scope	<b>Nalcor Functions</b>				
	Power Sales and Marketing	20%	32.9%	6.6%	
	Finance	5%	45.3%	2.3%	
	Existing Contracts	35%	56.0%	19.6%	
	Industrial Relations	20%	12.7%	2.5%	
	<b>Execution Readiness</b>	20%	100.0%	20.0%	
<b>subtotal</b>	<b>100%</b>		<b>51.0%</b>		
<b>Component 1</b>	<b>Muskirat Falls Generation Facility</b>				
	(MF) 82MW powerhouse & structures	72%	0.0%	0.0%	
	345KV AC interconnect MF to CF	28%	0.0%	0.0%	
<b>Component 4B</b>	<b>subtotal</b>	<b>100%</b>		<b>0.0%</b>	
<b>Component 4A</b>	<b>Island Link</b>				
	DC overhead lines MF to SP (Soldiers Pond)	32%	0.0%	0.0%	
<b>Component 3</b>	<b>Converter stations MF &amp; SP</b>	21%	0.0%	0.0%	
	Shore Electrodes at SOBI & Dowden's Pond	18%	0.0%	0.0%	
Not-SNC Scope	Island Link - System Upgrades	8%	100.0%	8.0%	
	SOBI Crossing	23%	100.0%	23.0%	
	<b>subtotal</b>	<b>100%</b>		<b>31.0%</b>	
Not-SNC Scope	<b>Maritime Link</b>				
	Maritime Link - Overhead Lines (127km)	21%	32.9%	6.9%	
	Maritime Link - converter stations BB & Lingan	28%	45.3%	12.7%	
	Maritime Link - Shore Electrodes NL & NS	4%	56.0%	2.2%	
	Maritime Link - Cabot Strait crossing	41%	12.7%	5.2%	
	<b>subtotal</b>	<b>100%</b>		<b>27.0%</b>	

Summary Level by SubProject Section Parts

**SLI Scope Only**

SNC Component	Area Manager	SNC Area Manager Divisions	Weight Factor in %		Reported Progress C	Weighted Progress in %			
			EPCM Project Sections A	EPCM Project Sections B		EPCM Project Sections C*A	EPCM Project Sections C*B		
<b>Component 1</b>	Infrastructure	Muskirat Falls 824MW powerhouse & structures	Site infrastructure	5%	42%	100.0%	5.0%	2.1%	
			Reservoir Clearing	5%	42%	56.0%	2.8%	1.2%	
	Infrastructure	Powerhouse & Intake	Turbines & Generators	12%	42%	45.3%	5.4%	2.3%	
			Powerhouse	20%	42%	32.9%	6.6%	2.8%	
	Infrastructure	Dams & Spillway	Dams	35%	42%	12.7%	4.4%	1.9%	
			Trailrace	12%	42%	28.1%	3.4%	1.4%	
	Infrastructure	Dams & Spillway	Spillway	11%	42%	23.5%	2.6%	1.1%	
			<b>subtotal</b>	<b>100%</b>		<b>30.2%</b>	<b>12.7%</b>		
	<b>Component 1</b>	Overhead Transmission	345KV AC interconnect MF to CF	Muskirat Falls Switchyard	19%	18%	100.0%	19.0%	3.4%
				Churchill Falls Switchyard extension	9%	18%	100.0%	9.0%	1.6%
Overland Transmission Lines MF to CF				72%	18%	100.0%	72.0%	13.0%	
<b>Component 4B</b>	<b>subtotal</b>	<b>100%</b>			<b>100.0%</b>	<b>18.0%</b>			
<b>Component 4A</b>	Overhead Transmission	DC overhead lines MF to SP (Soldiers Pond)	Soldiers Pond Switchyard	12%	27%	100.0%	12.0%	3.2%	
			Overhead Line Muskirat falls to SOBI	32%	27%	100.0%	32.0%	8.6%	
			Electrode Line Muskirat falls to SOBI	9%	27%	87.8%	6.1%	1.6%	
			Overhead Line SOBI to Soldiers Pond	39%	27%	78.9%	30.8%	8.3%	
			Electrode Line Muskirat falls to Soldiers Pond	8%	27%	12.2%	1.0%	0.3%	
			<b>subtotal</b>	<b>100%</b>				<b>81.8%</b>	<b>22.1%</b>
<b>Component 3</b>	HVdc Specialty Installations	Converter stations	Labrador Converter station	59%	12%	100.0%	59.0%	7.1%	
			Avalon Converter station	41%	12%	0.0%	0.0%	0.0%	
			<b>subtotal</b>	<b>100%</b>				<b>59.0%</b>	<b>7.1%</b>
<b>Component 3</b>	HVdc Specialty Installations	Shore Electrodes	Shore Electrodes at SOBI	45%	1%	0.0%	0.0%	0.0%	
			Shore Electrodes at Dowden's Pond	55%	1%	0.0%	0.0%	0.0%	
			<b>subtotal</b>	<b>100%</b>				<b>0.0%</b>	<b>0.0%</b>
<b>total</b>				<b>100%</b>			<b>59.9%</b>		

Weight factor by LCP-PMT



Weight factor by SLI

# Progress – How it is Used

**Sample Only**

## Cost & Schedule Stewardship Summary Report

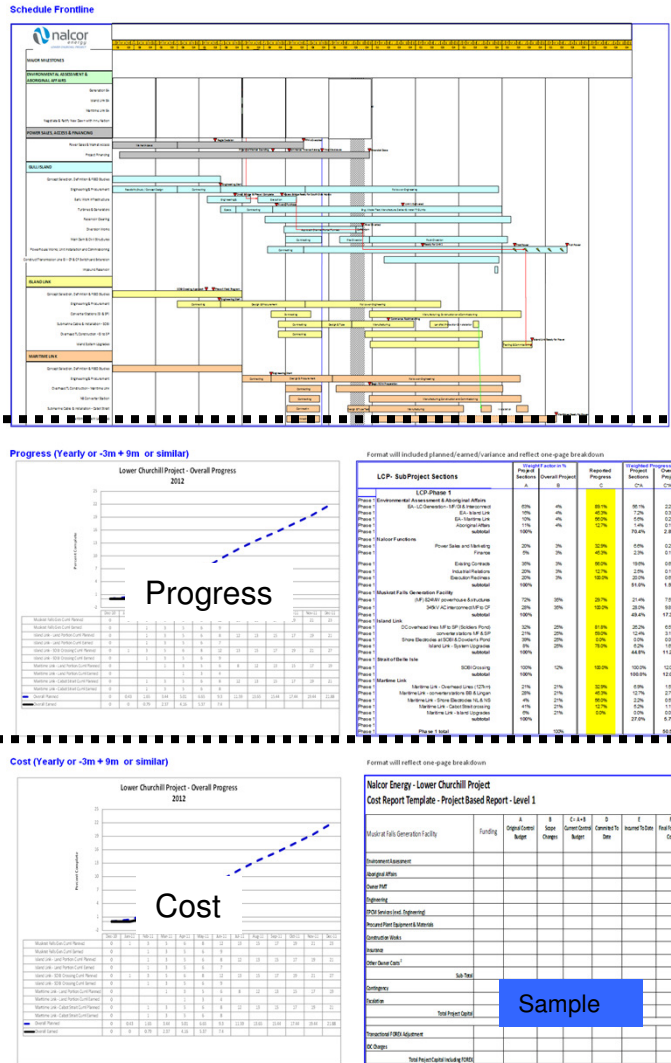
Schedule frontline

Progress curve

With table

Cost Curve with table

OVERALL



Previous pages show how progress for the Cost and Stewardship Summary Reports are determined

Sample

# Management of Change



# Fundamentals

- Discipline, proactive approach to anticipating and managing change is a necessity.
  - It is a core component of effective Project Control
- Both NE and SLI have discrete roles in MOC
  - SLI MOC process will feed LCP MOC process
  - Coordination position within each organization
- MOC process must include consultation with internal functional groups (e.g. HSE).



# Gateway Phase 3 MOC Expectations

- Identifying and obtaining alignment for Project Changes as they occur.
- Documenting and controlling pre-investment in excess of the design basis.
- Securing approval for Project Changes consistent with the required levels of authority.
- **Avoiding the sudden surprise of significant Project cost growth from the DG 2 estimate versus DG 3 estimate.** This goal requires regular reporting of cost and schedule developments, as changes occur.
- Facilitating the cost and schedule reconciliation at the completion of the DG 3 estimate.

# Managing Change between Decision Gates

- Between DG 2 and DG 3
  - Optimization of plant and execution approach to reduce risk – hence some change anticipated
  - Focus is Scope Tracking and Management
- Change is assessed against Project Baseline (i.e. a change baseline) as captured in **Controlled Project Documents**.
  - # of documents will increase from DG 2 to DG 3

# Evolution of Controlled Project Documents

## Scope Tracking & Management

## Management of Change

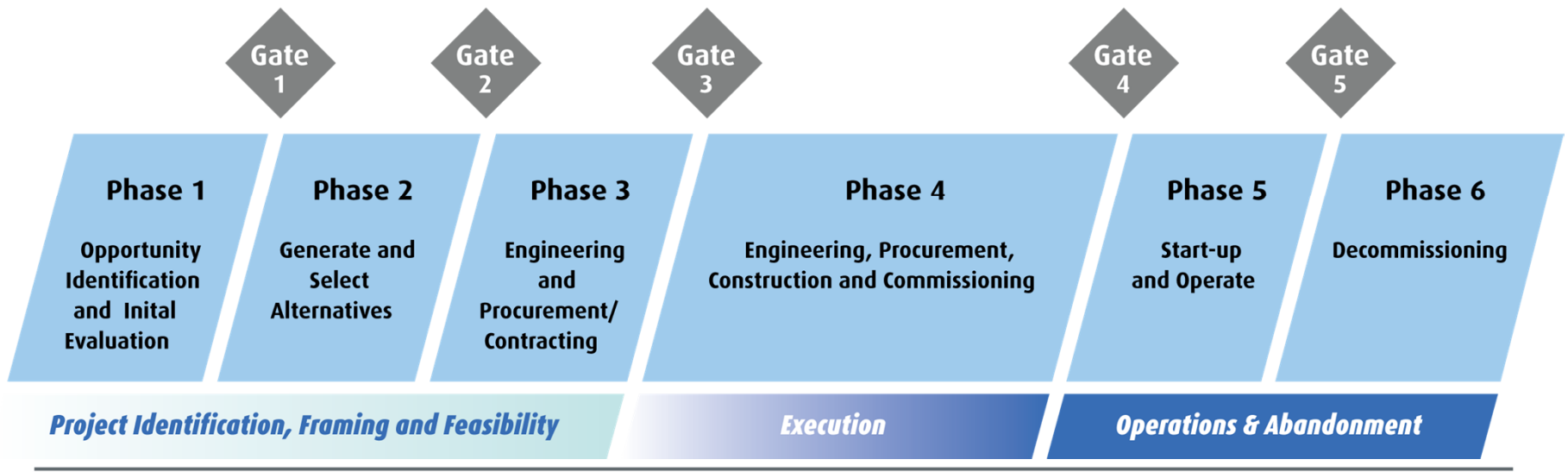
- Control Documents**
- Basis of Design (Rev B1)
  - Gate 2 PEP
  - PM & Contracting Strategy
  - Gate 2 Estimate
  - Gate 2 PCS
  - Master Contract Package List
  - Gate 2 Org. Design

- Control Documents**
- Basis of Design (Rev B1)
  - Gate 3 Project Execution Plan
  - Gate 3 Estimate and Basis of Estimate
  - Gate 3 Integrated Project Schedule (IPS)
  - Design Philosophies
  - Technical Specifications and Standards
  - Design Criteria
  - Contract Package Listing
  - EPCM Execution and Select Mgmt Plans
  - Construction Execution Plan
  - Regulatory Compliance Plan
  - Environmental Protection Plan
  - Single Line Diagram
  - Plot Plants (TL routing & Facility Layout)

**Document Origin**

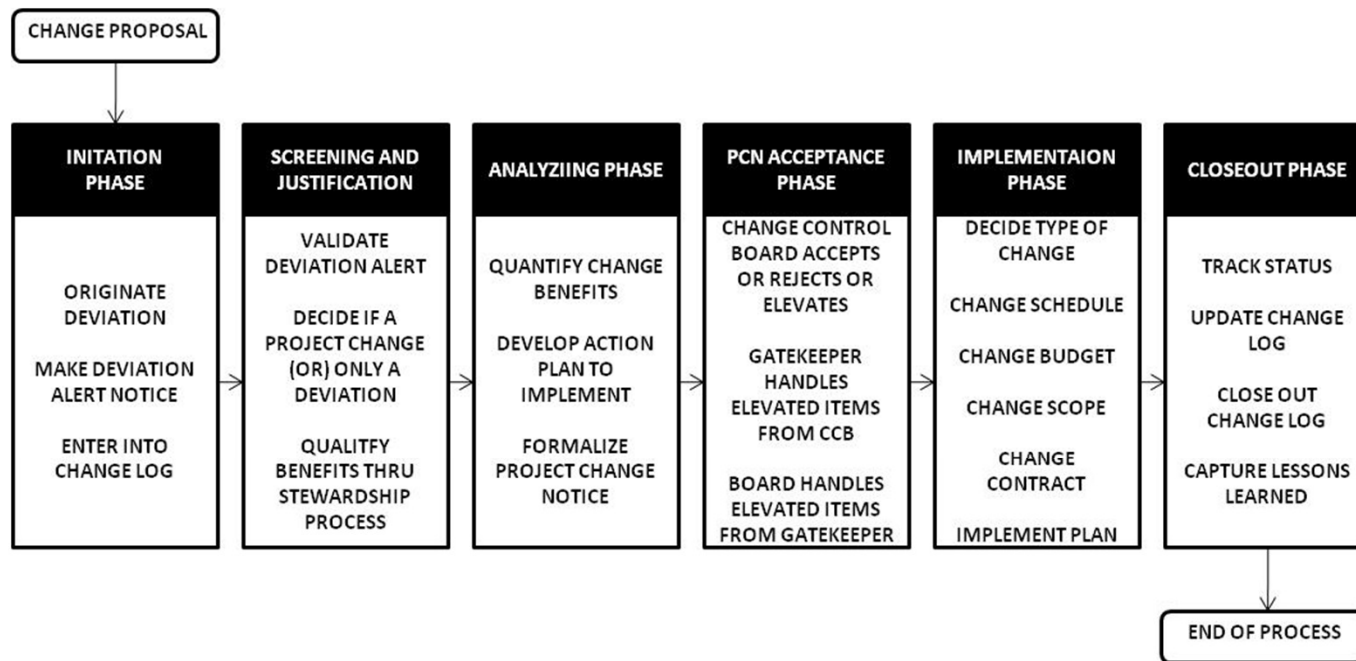
NE-LCP PT
SNC-Lavalin Inc.

*Project Sanction*



# Process Mechanics

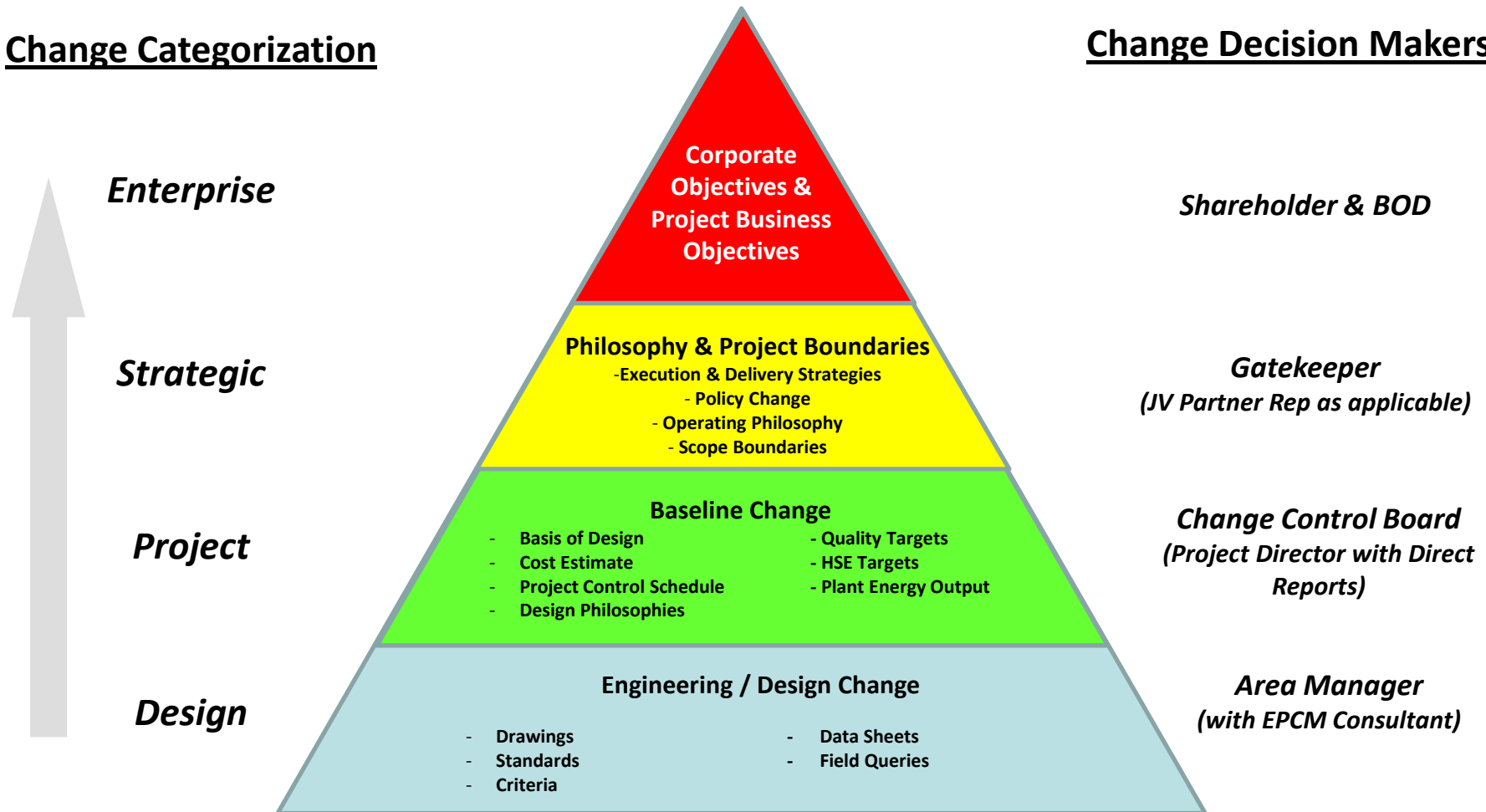
- MOC Process begins with the identification of a potential change via a Deviation Alert Notice.
- Proposed changes must be justified by benefit and will be risk screened.



# Project Change Approval Hierarchy

Change Categorization

Change Decision Makers



# Lower Churchill Project – Phase I: Kickoff Meeting

Company Supplied Data (Tab 11)

Boundless Energy



# Overview

- We have documents dating back over 45 years
- Recent efforts in 1997 to 2000
- Significant effort starting in 2006
- A number of consultants involved including SLI
- Some reports from 2010 still not complete.

## Overview (cont'd)

- Extensive list under Tab 11 in the binders
- Some documents were provided to SLI and other consultants at the RFP stage
- More have been provided to SLI since contract award
- Still more to come when various pieces of work are completed



# Summary of Data

- General and Procedural – 15
  - Basis of Design
  - Technical Reports
    - General – 4
    - Muskrat Falls – 25
    - Gull Island – 30
    - Reservoir Preparation – 4
    - HVac Transmission Systems – 8
    - HVdc Transmission Systems – 17
    - Other technical reports – 9
  - Technical Philosophy Documents – 27
- 
- Other including Early Works - 12

# Company Supplied Data

## Exhibit 3 – Scope of Services

### 3.2.2 Company Supplied Data

**“Services provided under the Agreement will build on, and not duplicate, the earlier work.”**

# Design Philosophies

	REV.	ISSUED TO SLI	YET TO BE ISSUED
Operations and Maintenance Philosophy for Design			X
Design Philosophy for LCP Reservoir Preparation			X
Design Philosophy for LCP Environmental Mitigation	B1	YES	
Design Philosophy for LCP Equipment Criticality, Reliability, Redundancy & Spare Parts			X
Design Philosophy for LCP Temporary Accommodations Complexes	B1		X
Design Philosophy for Impoundment at Gull Island			HOLD
Design Philosophy for Gull Island River Diversion			HOLD
Design Philosophy for Gull Island South Side Access			HOLD
Design Philosophy for Gull Island Permanent Accommodations			HOLD
Design Philosophy for Gull Island Plant Layout			HOLD
Design Philosophy for LCP Fish Habitat Compensation			X
Design Philosophy for LCP Automation, Control, Monitoring & Remote Operation	B1	YES	
Design Philosophy for LCP Communications Systems	B1	YES	
Design Philosophy for LCP Converter Stations	B1	YES	
Design Philosophy for Muskrat Falls River Diversion	B1	YES	
Design Philosophy for HVAC Transmission Line	B1	YES	
Design Philosophy for HVDC Transmission Line	B1	YES	
Design Philosophy for LCP Terrestrial Habitat			X
Design Philosophy for Emergency Repair of Overhead Transmission			X
Design Philosophy for Muskrat Falls Plant Layout	B1	YES	
Design Philosophy for Facility Operational Security			X
Design Philosophy for LCP Construction Power		YES	
Design Philosophy for Reservoir Debris & Trash Management	B1	YES	
Design Philosophy for LCP Environmental Rehabilitation	B1	YES	
Operations and Maintenance Philosophy			X
Completions Philosophy	B1	YES	
Lower Churchill Project - Life Cycle Cost Design Philosophy for Equipment, Assets and	B1	YES	

# Design Process

**Basis of Design** (Nalcor)

**Design Philosophies** (Nalcor)

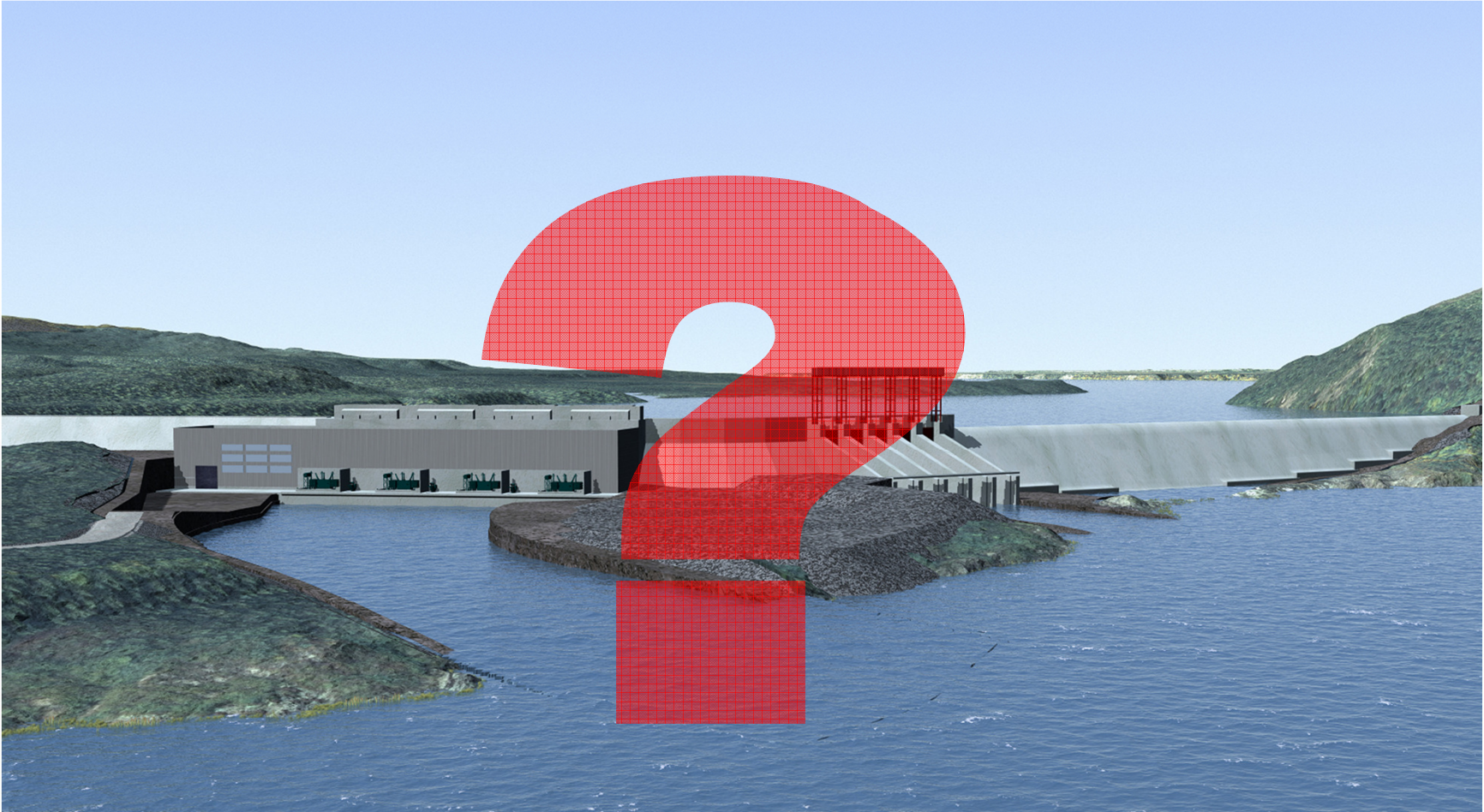
**Design Briefs/Criteria** (SLI)

**Technical Specifications & Drawings** (SLI)

**Tender Documents & Contracts** (SLI)

**Contractor Supplied Documents**

**Completions / As-Builts / Manuals** (SLI)



COMPANY SUPPLIED DATA				
DOCUMENT NO.	TITLE	REV.	ISSUED TO SLI	YET TO BE ISSUED
GENERAL & PROCEDURAL				
Corporate Document	Nalcor Energy - Occupational Health and Safety Policy		YES	
LCP-PT-MD-0000-IM-PY-0001-01	Lower Churchill Project - Information Management Policy	B1		X
LCP-PT-MD-0000-IM-PL-0003-01	Information Management Plan			X
LCP-PT-MD-0000-IM-PL-0001-01	Information Technology Plan			X
LCP-PT-MD-0000-IM-PL-0002-01	LCP IS/IT Technology Environment - Baseline Architecture			X
LCP-PT-MD-0000-IM-SD-0001-01	Lower Churchill Project - Coding Standard			X
LCP-PT-MD-0000-EN-SD-0001-01	Lower Churchill Project - Standard for the Production and Format of Engineering Drawings			X
LCP-PT-MD-0000-OP-PH-001-01	Lower Churchill Project - Documentation For Operations			X
LCP-PT-MD-0000-PC-LS-0001-01	Lower Churchill Project - Project Work Breakdown Structure and Code of Accounts	B1	YES	
MSD-QM-001	Lower Churchill Project - Quality Policy	B1	YES	
LCP-PT-MD-0000-QA-PL-0001-01	Lower Churchill Project - Overarching Quality Management Plan	B2	YES	
MSD-RI-001	Lower Churchill Project - Project Risk Management Policy	B1	YES	
MSD-RI-002	Lower Churchill Project - Project Execution Risk and Uncertainty Ranking Matrix	B1	YES	
MSD-RI-004	Lower Churchill Project - Risk Management Philosophy	B1	YES	
Rpt. PM0010	Regulatory / Permitting List	Rev. 0	YES	
DESIGN BASIS DOCUMENTS				
LCP-PT-ED-0000-EN-RP-0001-01	Lower Churchill Project - Basis of Design	B1	YES	
TECHNICAL REPORTS				
General				
LCP-PT-ED-0000-EN-PH-0032-01	Synopsis of Engineering Studies			X
MF1330, Report #1	Hydraulic Modeling of the River - 2010 update	Final	YES	
MF1091	Desktop Study – Implications/Consequences of Constructing Muskrat Falls Prior to Gull Island	Final	YES	
MF1390	Review Impacts of Earlier Construction of Muskrat Falls on Gull Island and Later Construction of Gull Island on Muskrat Falls	Final	YES	
Muskrat Falls				
MF1010	Review of Variants	Final	YES	
MF1020	Muskrat Falls Site Investigations	Final	YES	
MF1050	Spillway Design Review	Final	YES	
MF1080	Review of Construction Camp and Other Infrastructure	Final	YES	
MF1090	Review of Access Roads and T&W Bridge	Final	YES	
MF1120	Potential Impact of Reservoir Flooding on the TLH	Final	YES	
MF1130	River Operation During Construction and Impounding	Final	YES	
MF1250	Numerical Modeling of Muskrat Falls Structures	Final	YES	
MF1260	Condition Assessment of Existing Pumpwell System (2007)	Final	YES	
MF1271	Condition Evaluation of Wells and Pumps in the Muskrat Falls Pumpwell System (2009)	Final	YES	

COMPANY SUPPLIED DATA				
DOCUMENT NO.	TITLE	REV.	ISSUED TO SLI	YET TO BE ISSUED
MF1272	Installation of New Piezometers in the Muskrat Falls Pumpwell System (2009)	Final	YES	
MF1300	Muskrat Falls 2010 Field Investigation Program			X
MF1310	Muskrat Falls Site Access Review	Final	YES	
MF1320	Muskrat Falls Power and Energy Study			X
MF1281	Muskrat Falls Pumpwell System Telecommunication Upgrades			X
MF1330, Report #2	Muskrat Falls PMF and Construction Design Flood Study	Final	YES	
MF1330, Report #3	Muskrat Falls Dam Break Study	Final	YES	
MF1330, Report #4	Muskrat Falls Ice Study			X
MF1330, Report #6	Muskrat Falls Regulation Study			X
MF1340	Muskrat Falls Review and Confirmation of Structure Layout and Interfaces			X
MF1360	Muskrat Falls Review of Numerical Modeling			X
MF1380	Muskrat Falls Site Information for Tenderers			X
LCP-HE-CD-0000-EA-RP-0001-01	Muskrat Falls - Review of Saltwater Intrusion (Addendum)	Final	YES	
LCP-HE-CD-0000-EA-RP-0002-01	Muskrat Falls - Review of Saltwater Intrusion - 3D Model Study - Final Report	Final	YES	
LCP-HE-CD-0000-EA-RP-0007-01	Muskrat Falls - Review of Sediment Plume	Final	YES	
	Gull Island			
GI1010	Gull Island 2007 Site Investigation	Final		HOLD
GI1013	Gull Island 2008 Site Investigation	Final		HOLD
GI1015	Inspection and Structural Analysis Goose Bay Dock	Final	YES	
GI1017	Update Report - Reassessment of Gull Island Diversion	Final	YES	
GI1020	Study of Concrete Face Rockfill Dam (CFRD) Alternative	Final	YES	
GI1030	Powerhouse Configuration	Final	YES	
GI1060	Review of Structure Layouts and Interfaces	Final	YES	
GI1061	Review of Structure Layouts and Interfaces, 5x450 MW	Final	YES	
GI1070	Ice Study (Gull Island and Muskrat Falls)	Final	YES	
GI1071	Ice Studies (Gull Island)	Final	YES	
GI1090	Review of Construction Camp and Other Infrastructure	Final	YES	
GI1100	Review of Access Roads and Bridges	Final	YES	
GI1110	Hydraulic Modeling of River	Final	YES	
GI1130	River Operation During Construction & Impounding	Final	YES	
GI1140	PMF and Construction Design Flood Study	Final	YES	
GI1141	Upper Churchill PMF and Flood Handling Procedures Update	Final	YES	
GI1170	Seismicity Analysis	Final	YES	
GI1180	Review of Site Access, Goose Bay and Off-Site Infrastructure	Final	YES	
GI1190	Dam Break Study	Final	YES	
GI1200	Gull Island Constructability Review	Final	YES	
GI1230	Gull Island Site Information for Tenderers	Final		HOLD
GI1280	Gull Island – Diversion Facilities Numerical Modeling	Final	YES	
GI1281	Gull Island – Power Intake and Spillway Facilities – Numerical Modeling	Final	YES	
GI1282	Gull Island – Diversion Facilities Physical Modeling Technical Specifications	Final		HOLD
GI1290	Hydraulic Production Model	Final		HOLD
GI1300	Gull Island 2008 Report Plates (drawings)	Final	YES	

COMPANY SUPPLIED DATA				
DOCUMENT NO.	TITLE	REV.	ISSUED TO SLI	YET TO BE ISSUED
GI1310	Workshop Report on Design and Operational Problems Resulting from Reservoir Preparation.	Final	YES	
MF1330, Report #5	Review of Gull Island 1:60-year Construction Design Flood (letter report)	Final	YES	
GI1602	Gull Island Bank Stability and Fish Habitat Deltas			X
GI1076	Ice Observation Program (this would be received in 2011)			X
Reservoir Preparation				
LCP-PT-ED-0000-EN-PL-0002-01	Reservoir Preparation Plan	B2	YES	
LCP-PT-ED-0000-EN-PL-0002-02	Reservoir Preparation Plan - Summaries and Map Sheets – Muskrat Falls	B1	YES	
LCP-PT-ED-0000-EN-PL-0002-03	Reservoir Preparation Plan - Summaries and Map Sheets – Gull Island	B1	YES	
LCP-PT-ED-0000-EN-PL-0002-04	Reservoir Preparation Plan - Cost and Schedule Estimate			X
HVac Transmission Systems				
AC1020	Tower type selection, 735 kV	Final	YES	
AC1030	Field Investigations and Construction Requirements - 735 kV TL - GI to CF	Final	YES	
AC1050	Tower type selection, 230 kV	Final	YES	
AC1060	Field Investigations and Construction Requirements - 230 kV TL - GI to MF	Final	YES	
AC1080	Load Control and Failure Containment	Final	YES	
AC1090	Assess Cable De-icing	Final	YES	
AC1100	Conductor Selection	Final	YES	
LC-EN-011	2010 Transmission Corridor LiDAR and Orthophoto Data Collection Program			X
HVdc Transmission Systems				
DC1010	Voltage and Conductor Optimization (c/w Addendum)	Final	YES	
DC1020	HVdc System Integration Study (Vol. 1 to 6)	Final	YES	
DC1050	Corridor Selection & Construction Infrastructure-Gull Island to Soldiers Pond	Final	YES	
DC1051	Field Investigations – HVdc TL – Gull Island to Soldiers Pond (Vol. 1 and 2)	Final	YES	
DC1070	Preliminary Meteorological Load Review	Final	YES	
DC1080	Tower Type Selection and Preliminary Optimization	Final	YES	
DC1090	Site Investigation - Converter Stations Gull Island and Soldiers Pond	Final	YES	
DC1110	Electrode Review - Gull Island and Soldiers Pond	Final	YES	
DC1200	HVdc Overland Transmission Re-estimate	Final		X
DC1210	VSC Risk Assessment	Final	YES	
DC1500	Electrode Review - Confirmation of Type and Site Selection	Final	YES	
DC1600	VSC Technology Review for LCP – (Supplier)			X
HOLD	VSC Technology Review for LCP			X
DC1700	Review of Holyrood Units 1&2 Conversion to Synchronous Condenser			X
DC1300	Ice Loadings on HVdc Line Crossing Long Range Mountains	Final	YES	
LC-EN-006	Coordinate System Evaluation, Survey Engineering Services - Transmission	Final	YES	
DC1301	Section by Section Analysis of Extreme Rime Ice on the Long Range Mountains using WRF Modeling			X



COMPANY SUPPLIED DATA				
DOCUMENT NO.	TITLE	REV.	ISSUED TO SLI	YET TO BE ISSUED
Other Technical Reports				
MFA-RS-CD-6140-TL-RP-0001-01 MFA-RS-CD-6140-TL-RP-0002-01 MFA-RS-CD-6140-TL-RP-0002-02	Development of Extra High Voltage Transmission Lines in Labrador – EDM/RSW - 1999		YES	
N/A	Gull Island Power Development SNC-Lavalin Power Division - October 1997			HOLD
N/A	Gull Island Hydro Electric Development – SNC-AGRA Joint Venture - December 2000			HOLD
ILK-TM-CD-6200-TL-RP-0001-01 ILK-TM-CD-6200-TL-RP-0002-01 ILK-TM-CD-6200-TL-RP-0002-02	Gull Island to Soldiers Pond HVDC Interconnection – Engineering Review and Update of Capital Cost Estimate (June 1998)		YES	
MFA-SN-CD-3000-CV-RP-0002-01	Muskrat Falls Hydroelectric Development Final Feasibility Study - Volume 1 - Engineering Report – SNC-AGRA - January 1999		YES	
MFA-SN-CD-3000-CV-RP-0002-02	Muskrat Falls Hydroelectric Development Final Feasibility Study - Volume 2 -1998 Geotechnical Investigations– SNC-AGRA - January 1999		YES	
MFA-SN-CD-3000-CV-RP-0002-03	Muskrat Falls Hydroelectric Development Final Feasibility Study - Volume 3 - Detailed Backup of Capital Cost Estimate – SNC-AGRA - January 1999		YES	
N/A	Lower Churchill Hydroelectric Generation Project Baseline Report, Application of HADD Determination Methodology – AMEC – December 2007			HOLD
N/A	Evaluate Extreme Ice Loads From Freezing Rain For Nalcor Energy – Kathy Jones – May 2009		YES	
TECHNICAL PHILOSOPHY DOCUMENTS				
LCP-PT-ED-0000-EN-PH-0005-01	Operations and Maintenance Philosophy for Design			X
LCP-PT-ED-0000-EN-PH-0006-01	Design Philosophy for LCP Reservoir Preparation			X
LCP-PT-ED-0000-EN-PH-0007-01	Design Philosophy for LCP Environmental Mitigation	B1	YES	
LCP-PT-ED-0000-EN-PH-0015-01	Design Philosophy for LCP Equipment Criticality, Reliability, Redundancy & Spare Parts			X
LCP-PT-ED-0000-EN-PH-0008-01	Design Philosophy for LCP Temporary Accommodations Complexes	B1		X
LCP-PT-ED-0000-EN-PH-0009-01	Design Philosophy for Impoundment at Gull Island			HOLD
LCP-PT-ED-0000-EN-PH-0011-01	Design Philosophy for Gull Island River Diversion			HOLD
LCP-PT-ED-0000-EN-PH-0012-01	Design Philosophy for Gull Island South Side Access			HOLD
LCP-PT-ED-0000-EN-PH-0013-01	Design Philosophy for Gull Island Permanent Accommodations			HOLD
LCP-PT-ED-0000-EN-PH-0014-01	Design Philosophy for Gull Island Plant Layout			HOLD
LCP-PT-ED-0000-EN-PH-0016-01	Design Philosophy for LCP Fish Habitat Compensation			X
LCP-PT-ED-0000-EN-PH-0017-01	Design Philosophy for LCP Automation, Control, Monitoring & Remote Operation	B1	YES	

COMPANY SUPPLIED DATA				
DOCUMENT NO.	TITLE	REV.	ISSUED TO SLI	YET TO BE ISSUED
LCP-PT-ED-0000-EN-PH-0018-01	Design Philosophy for LCP Communications Systems	B1	YES	
LCP-PT-ED-0000-EN-PH-0019-01	Design Philosophy for LCP Converter Stations	B1	YES	
LCP-PT-ED-0000-EN-PH-0020-01	Design Philosophy for Muskrat Falls River Diversion	B1	YES	
LCP-PT-ED-0000-EN-PH-0021-01	Design Philosophy for HVAC Transmission Line	B1	YES	
LCP-PT-ED-0000-EN-PH-0022-01	Design Philosophy for HVDC Transmission Line	B1	YES	
LCP-PT-ED-0000-EN-PH-0025-01	Design Philosophy for LCP Terrestrial Habitat			X
LCP-PT-ED-0000-EN-PH-0026-01	Design Philosophy for Emergency Repair of Overhead Transmission			X
LCP-PT-ED-0000-EN-PH-0028-01	Design Philosophy for Muskrat Falls Plant Layout	B1	YES	
LCP-PT-ED-0000-EN-PH-0041-01	Design Philosophy for Facility Operational Security			X
LCP-PT-ED-0000-EN-PH-0029-01	Design Philosophy for LCP Construction Power		YES	
LCP-PT-ED-0000-EN-PH-0030-01	Design Philosophy for Reservoir Debris & Trash Management	B1	YES	
LCP-PT-ED-0000-EN-PH-0031-01	Design Philosophy for LCP Environmental Rehabilitation	B1	YES	
LCP-PT-MD-0000-PM-PH-0001-01	Operations and Maintenance Philosophy			X
LCP-PT-ED-0000-EN-PH-0043-01	Completions Philosophy	B1	YES	
LCP-PT-ED-0000-EN-PH-0042-01	Lower Churchill Project - Life Cycle Cost Design Philosophy for Equipment, Assets and Structures	B1	YES	
	<b>OTHER DOCUMENTS</b>			
DC1300	HVDC Labrador – Island Transmission Link Review of in-cloud icing on the Long Range Mountain Ridge	Final	YES	
723469-GI1501-40EB-0001-1	Gull Island Accommodations Complex Functional Design Brief	Final	YES	
723469-GI1501-40EB-0002-1	Gull Island Accommodations Complex Functional Specification Design, Supply and Construction of Services	Final	YES	
723469-GI1501-40EB-0003-1	Gull Island Accommodations Complex Functional Specification - Design, Supply and Construction of Buildings	Final	YES	
723469-MF1501-40EB-0001-1	Muskrat Falls Accommodations Complex Functional Design Brief	Final	YES	
723469-MF1501-40EB-0002-0	Muskrat Falls Accommodations Complex Functional Specification - Design, Supply and Construction of Services	Final	YES	
723469-MF1501-40EB-0003-1	Muskrat Falls Accommodations Complex Functional Specification Design, Supply and Construction of Buildings	Final	YES	
H335459-GI1500-SPEC-123-5001	Cable Barge Performance Specification (Gull Island)	Final		X
H335459-GI1500-SPEC-123-5002	Suspension Bridge Performance Specification (Gull Island)	Final		X
H335459-GI1500-SPEC-123-5003	Passenger Ferry Performance Specification (Gull Island)	Final		X
H335459-GI1500-SPEC-123-5004	Technical Specification for Gull Island South Side Access Facilities			X
H335459-GI1500-SPEC-123-5005	Fast Rescue Craft Performance Specification (Gull Island)	Final		X

# Lower Churchill Project - Phase I

## Regulatory and Environment Compliance Environmental Management Strategy (Tab 15)

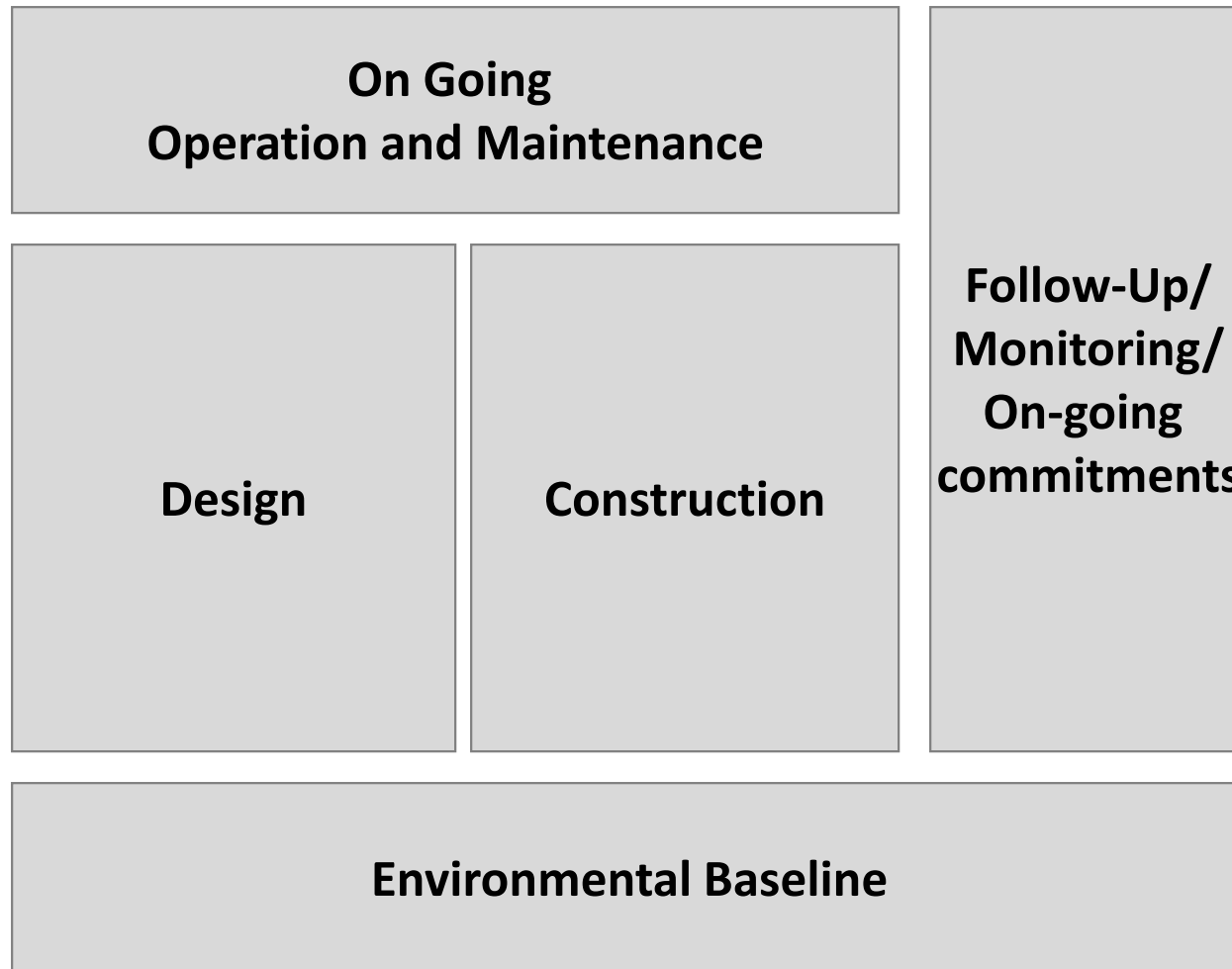
Boundless Energy



# Sustainable Development

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

# Building Blocks



# The Knowledge Base

- Volume 1A, Chapter 9.1
  - “In preparing the EIS, two important sources of information have been relied upon: local community and Aboriginal Traditional Knowledge (the latter as communicated through Innu Nation) and an extensive body of field data collected from the biophysical environment”
- Over 65 Baseline Studies 1998 - 2008

# Environmental Management Strategy

- Describes and communicate the strategy by which the Nalcor Energy will manage the aspects of environmental performance during the design and construction of all Project components.
- Define the roles and responsibilities of various functional groups within the Lower Churchill Project (LCP), Nalcor Energy (NE), SNC-Lavalin (SLI) and on-site contractors and interfaces between these groups.

# Nalcor Responsibilities

## Environment and Aboriginal Affairs (EAA)

- Environmental Assessment (EA) Processes for all Project components, aboriginal agreements and regulatory consultations to obtain necessary authorizations required as conditions of the environmental assessment.
- Public and aboriginal consultations.
- Communication of requirements and commitments made as part of on-going assessment, aboriginal agreements or requirements of EA release to the Nalcor HSE Group and to the Nalcor Engineering Group.
- On-going public consultation.
- Participation in environmental management committees resulting from EA requirements or aboriginal agreements.
- Environmental effects monitoring to confirm the predictions made in the EA.



# Nalcor Responsibilities

## HSE – Environmental & Regulatory Compliance

- Directly responsible for the oversight of SLI for environmental compliance.
- Review and acceptance of SLI's Environmental Management Plan / regulatory management plan
- Review and acceptance of SLI's Overall Environmental Protection Plan
- Review and acceptance of SLI's and contractor's site specific regulatory compliance and environmental protection plans
- Obtain owner required permits
- Assist the Project team in understanding applicable environmental laws, regulations, codes, guidelines, and permit/license/authorization/approval conditions throughout the engineering, design and construction phases of the Project;
- Auditing SLI
- Maintain key interfaces with regulatory agencies, SLI, contractors and Project personnel.

# Nalcor Responsibilities

## Technical Design & Integrity - Environmental

- Oversight of SLI to ensure that designs reflect environmental sustainability
- Ensure that SLI take a pro-active approach to environmental mitigation and site remediation at the design stage
- Consider environmental requirements during the review and acceptance of all Project specifications
- Provide information and guidance on the requirements of EA release, authorizations, aboriginal agreements, Project commitments and permitting conditions to SLI.

# SLI Responsibilities

- Design of environmental mitigations and rehabilitations
  - Include environmental mitigation and rehabilitation in tender packages issued to contractors
  - Ensure environmental compliance on all Project sites
  - Develop, implement and maintain the Environmental Management Plan for the respective Project component
  - Develop, implement and maintain a regulatory management plan for the respective Project component
  - Ensure that the procedures, plans and work methods proposed by contractors are consistent with requirements provided by Nalcor
  - Develop, implement and maintain an overall EPP
-

# SLI Responsibilities

- Review and accept site specific environmental protection plans developed by contractors
- Coach, guide and mentor contractors with respect to environmentally sustainable construction practices
- Identify, obtain and track all required permits
- Monitor the site for environmental compliance

# Contractor's Responsibilities

- Develop, implement and maintain the site specific environmental protection plans for all construction sites based on accepted work plans
- Construction and maintenance of environmental mitigations and complete rehabilitation of the work sites as specified in their contracts

# Lower Churchill Project – Phase 1: Kick-off Meeting

## Quality Management (Tab 15)

Boundless Energy



# SLI Quality Management Expectations

- Quality Assurance - planned and systematic activities that are necessary to establish quality requirements
- Quality Control – planned and systematic controls, techniques, activities that provide a means of measuring and controlling the characteristics of an item, element, component, product, service or installation to meet the established requirements

## SLI Quality Management Expectations (cont'd)

- **All** Quality Plans, and ultimately the Quality Management Systems are effective and capable of producing required deliverables for the project.
- All components of the asset must comply with contract, environment and permit requirements, applicable government regulations, statutes, sound and accepted E, P, & CM practices, including commissioning management and other project management services.



## SLI Quality Expectations - Organization

- QA/QC organization empowered by SLI management with freedom and authority to oversee management of Quality project wide, manage Quality issues and their resolution, and to correct nonconformances and/or adverse Quality trends;

# SLI Quality Expectations - Engineering

- Engineering design is clearly documented, consistent with approved design standards and performed in accordance with the approved “Basis of Design”.
- Develop & implement design review and verification plans.
- Control design through proper MOC process.

# SLI Quality Expectations - Procurement

- Equipment and/or materials procured meet or exceed engineering design.
- Quality involvement related to procured materials and equipment are based on a criticality analysis and/or risk-based priority.

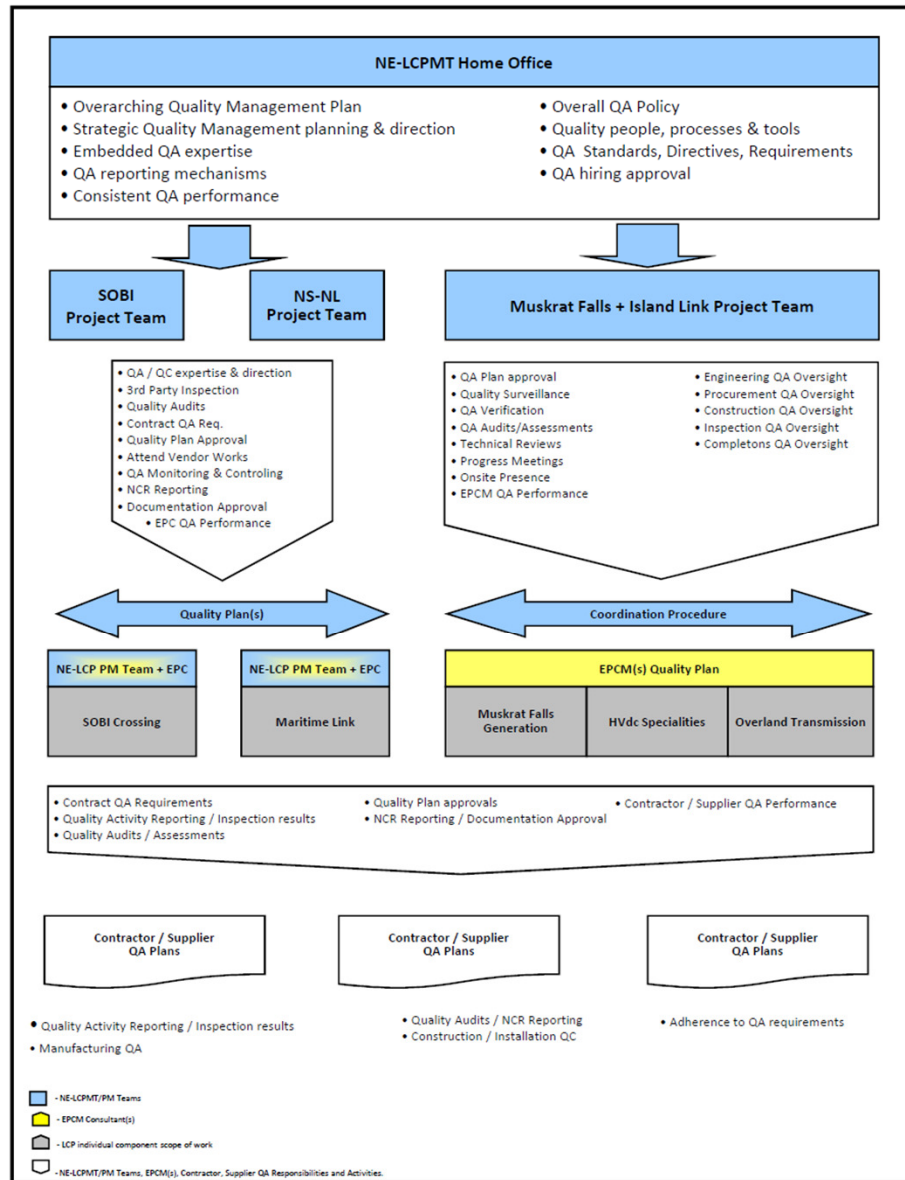
# SLI Quality Expectations - Construction

- Executed in accordance with construction best practices, standards and methods, project specifications and environmental requirements.
- Ensure construction and installation activities are conducted in accordance with engineering drawings and specifications, and if required, special vendor installation procedures.

# Nalcor - Oversight & Surveillance Role

- Verify that SLI/Contractors/Suppliers perform work in accordance with documented plans and procedures and produce deliverables that meet defined project requirements.
- Provide focused QA oversight, surveillance and issue identification through document reviews, audits, and inspections; based on risk and cost exposure.

LCP Quality Management - Execution Model



Focused Workshops - Functional Areas					
	FUNCTIONAL AREA	NALCOR LEAD	SLI LEAD	WORKSHOP DATE	COMMENTS
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