From: pharrington@lowerchurchillproject.ca
To: smarshall@nalcorenergy.com
Subject: Fw: SNC-L . LCP Risk Assessment Analysis
Date: Monday, December 18, 2017 11:34:37 AM
Attachments: _.png
_.png
Nalcor - Analysis of SNC-Lavalin"s Risk Assessment VC_F 120717.pdf
snc_lavalin_risk_assessment.pdf

Stan

We chatted about the SNC Risk assessment document released by GNL in 2017 on the recent trip. We had Westney carry out an analysis of the SNC Risk assessment document the results are an attachment.

You also asked about the estimators for the powerhouse, spillway and transmission - they were SNC estimators using SNC's tools and norms from their Hydro experience in Northern Quebec. Our Project team had to drive the SNC team to deliver the estimate for the powerhouse spillway , transmission.

Regards Paul

Paul Harrington
Project Director (Consultant to LCMC)
PROJECT DELIVERY TEAM
Lower Churchill Project
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----- Forwarded by Paul Harrington/NLHydro on 12/18/2017 11:24 AM -----

From: Paul Harrington/NLHydro

To: Scott O'Brien/NLHydro@NLHYDRO, Lance Clarke/NLHydro@NLHydro, Ron Power/NLHydro@NLHydro, Tanya Power/NLHydro@NLHYDRO

Cc: Gilbert Bennett/NLHydro@NLHydro

Date: 12/07/2017 12:53 PM

Subject: Fw: SNC-L . LCP Risk Assessment Analysis

I asked Westney our Risk Advisors to carry out a thorough analysis of the 2013 Risk Assessment that SNC carried out for Internal use that surfaced via GNL in 2017. The scope of

the analysis is captured in the email below.

The results confirm that there is nothing new in the SNC assessment that all risks were already identified, quantified and were being actively mitigated. The allegation that LCP ignored these risks or otherwise dismissed them at the time is not supported by the analysis.

Regards Paul

Nalcor - Analysis of SNC-Lavalin's Risk Assessment VC_F 120717.pdf

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----- Forwarded by Paul Harrington/NLHydro on 12/07/2017 12:45 PM -----

From: Paul Harrington/NLHydro

To: "Justin Dahl" <j_dahl@westney.com>

Date: 11/15/2017 01:28 PM

Subject: SNC-L Risk Report

Justin

I attach a Risk Assessment carried out by SNC-L in 2013 that was not provided to Nalcor Project team at the time but was made public in 2017.

This was an internal SNC-L assessment that apparently was intended for SNC-L internal purposes only. The release of the report in 2017 resulted in a great amount of public /media debate and discussion. I request Westney to review the SNC-L Risk assessment report and address specific issues that were raised when the report was released publically, these include:

I would like to understand if the risks identified in the SNC-L report were identified by the Project team Risk identification in 2012(or earlier) and included in the DG3 QRA by Westney as either tactical or strategic risks and if certain risks were not included was there a valid

reason ?
I would also like to check if there were active mitigation efforts by LCP to reduce the impact of the risks that were identified by SNC-L - were any of the risks simply ignored by LCP?
The SNC-L Assessment also makes certain assertions regarding LCP's risk management approach, I would like each of these to be considered and determine if the assertions are correct or not, supported by the facts.
The SNC-L risks are divided into sections from Very High to Low please cross refer to the LCP risk register available at the time and provide the LCP risk reference.
Check and report if the range of outcomes from the Westney QRA at DG3 inclusive of the results in the SNC-L Risk Assessment report?
Considering the Top Risks , when were these risks first identified and mitigation efforts started?

Ultimately I want to understand if the SNC-L risks included in the assessment report would have been a revelation to LCP Project team at the time or were these risks already identified, understood, quantified and being actively managed. It is important to have these facts available.

snc_lavalin_risk_assessment.pdf

Regards

Paul

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nalcor energy

An Analysis of SNC-Lavalin's Risk Assessment Report

Discussion document

December 2017

Context

- In June of 2017, a Risk Assessment report for the Lower Churchill Project (LCP) was released to the public that was developed by SNC-Lavalin in 2013
- The Risk Assessment made several assertions about Nalcor Energy – LCMC's risk management practices
- LCMC requested that Westney complete a review of the Risk Assessment to analyze the validity of those assertions

Important items to note

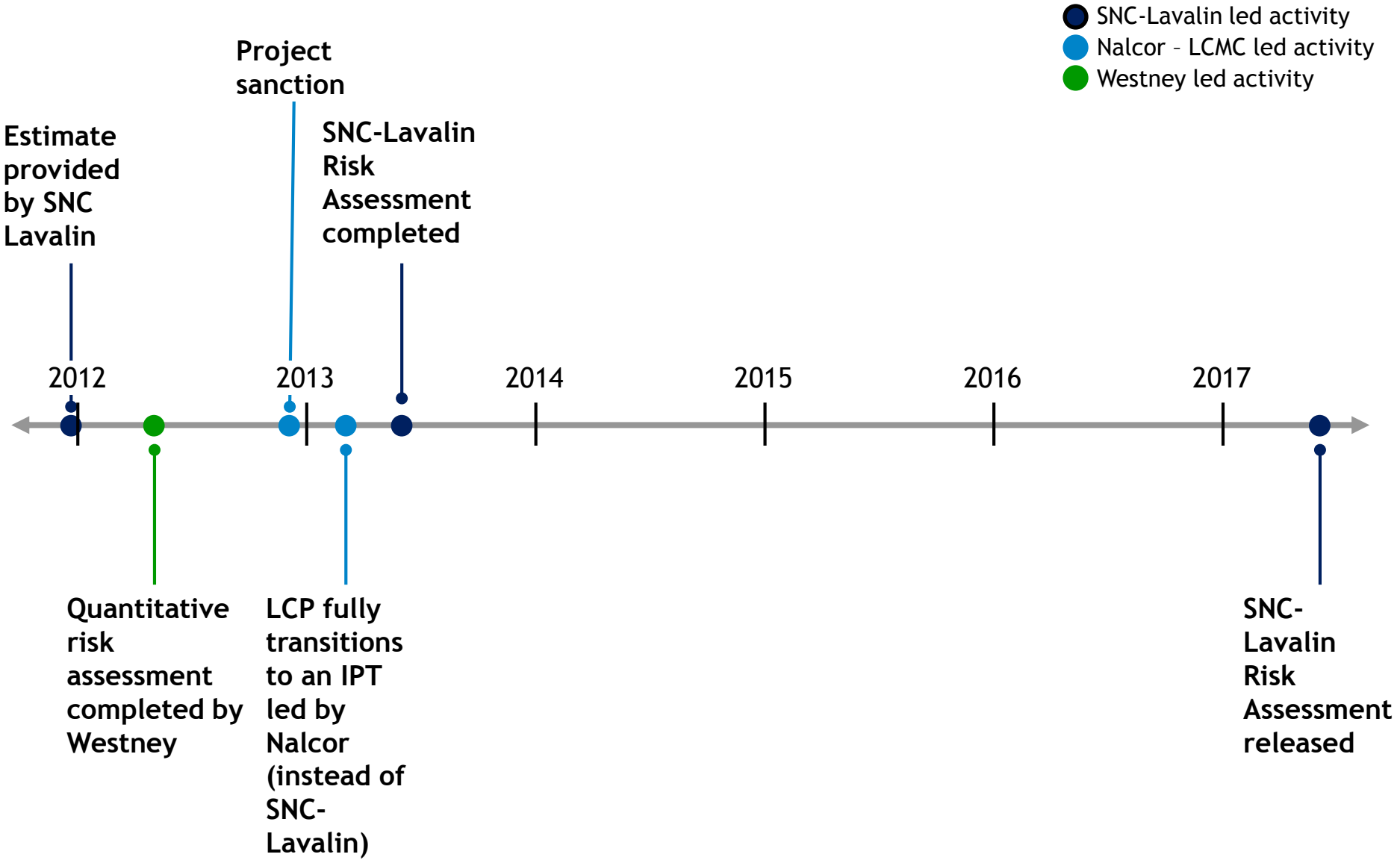
- **The SNC-Lavalin Risk Assessment for the LCP developed in 2013 was never submitted to Nalcor**
- **No copy exists in LCMC's comprehensive document control system**
- **The review was not requested by LCMC management**
- **The document is identified as "Confidential for SNC-Lavalin Internal Use Only" and was not approved (signed) by Executive VP Scott Thon,** who was a sitting member of the Steering Committee for SNC-Lavalin's EPCM services agreement

Assertions made in the 2013 SNC-Lavalin Risk Assessment are not supported by the facts available

Assertions about LCMC's risk management approach	Facts available	Supporting slides
1 **A quantitative evaluation of risk exposure was not completed**	▪ **Westney with LCMC and SNC-Lavalin completed a quantitative risk analysis in 2012** prior to sanction	4
2 **The existing LCP risk register did not provide a realistic portrait of actual project risk**	▪ **All risks identified by SNC-Lavalin were included in the LCP risk register** and considered in Westney's analysis ▪ **SNC-Lavalin had several participants in Westney's risk identification and ranging sessions** (which leveraged the existing LCP risk register)	5 - 6
3 **A clear picture of the total cost-risk exposure was not provided**	▪ **The range of outcomes from Westney's analysis were inclusive of the results in SNC-Lavalin's Risk Assessment** ▪ **SNC-Lavalin provided critical cost estimate data to LCP** (e.g., concrete installation production rates, costs per cubic meter) **and was a key contributor in risk sizing/ranging**	7
4 **The risk management function was not empowered**	▪ **SNC-Lavalin was compensated for a full-time risk manager and a LCMC senior manager was engaged** in the day-to-day risk activities	
5 **Mitigation plans were needed for the top 9 risks identified**	▪ **Top risks had been identified prior to sanction, with mitigations planned or already underway in 2013**	8

Westney

Timeline of key events



All risks included in the SNC-Lavalin Risk Assessment had already been identified by Nalcor-LCMC (1/2)

Top 9 risks by size

	Risk title	Included[1]	Nalcor-LCMC reference[2]
Very high[3]	● High market cost from contractors to be expected	✓	▪ KR 5 / KR 20
	● Concrete works slippage from baseline schedule	✓	▪ KR 20
	● River closure slippage from baseline schedule	✓	▪ KR 20
	● Limited availability of skilled and experienced manpower	✓	▪ KR 24
	● Major components outsourcing in China	✓	▪ KR 26
	▪ Limited availability of skilled site management personnel	✓	▪ KR 22
	▪ Difficulty transitioning to an integrated team project delivery model	✓	▪ KR 43
	▪ Mobilization of community against the project	✓	▪ KR 18 / KR 19
	▪ Additional delays resulting from difficult early works	✓	▪ **Time-risk analysis variable
	● Large EPC packages	✓	▪ KR 29
	▪ Insufficient geotechnical information for north spur area	✓	▪ KR 23
	● Large packages issued for transmission lines	✓	▪ KR 28
	● No geotechnical data available	✓	▪ KR 23
	▪ Lack of control on delivering of Strait of Belle Isle (SOBI) crossing cable	✓	▪ KR 11
	▪ Commissioning failures of T&G units	✓	▪ KR 13
	▪ Insufficient geotechnical information	✓	▪ KR 23
	● Limited camp accommodation capacity at Muskrat Falls site	✓	▪ R 185/ KR 24
	▪ No geotechnical information for dam	✓	▪ KR 23
	▪ C3 coordination of packages will be a challenge	✓	▪ R 162
	▪ Insufficient suppliers' QA/QC	✓	▪ R 61 / R 159

[1] Included in Nalcor's Decision Gate 3 Project Cost and Schedule Risk Analysis Report and incorporated into Westney's analysis [2] KR = Key risk, R = Risk [3] SNC-Lavalin risk level based on "probable consequence" (further details on slide 7)

Westney

All risks included in the SNC-Lavalin Risk Assessment had already been identified by Nalcor-LCMC (2/2)

	Risk title	Included[1]	Nalcor-LCMC reference[2]
Very high[3]	Contractors' (or sub-contractors') errors / omissions	✓	R 59
	Native issues for powerlines in Labrador	✓	KR 18
	Possibility of strike	✓	KR 24
	Underestimating workforce required to accomplish project	✓	KR 24
	Claims arising from contractors or suppliers	✓	R 24
High[3]	Requirements surrounding environmental assessment release	✓	KR 15
	Complexity of commissioning and system integration	✓	KR 13
	Riverside cofferdam catastrophic flooding	✓	R 12
Medium[3]	Scope of packages not aligned with suppliers' core businesses	✓	R 147
	Readiness for start-up might be a challenge	✓	KR 13
	Problematic long lead items	✓	R 51 / R 130
	Possible dispute for acquiring ROW for approx. 100km of powerlines	✓	R 84
	Powerlines corridor located in remote areas	✓	R 122 / R 94
	Delay in availability of admin. building creating inefficient site mgmt.	✓	Not considered a risk (minor issue)
	Suitability of site south access road	✓	R 37 / R 130
	Cost overrun on electrode pond in Labrador	✓	R 70
	Bankruptcy of major LCP contractors or suppliers	✓	KR 26 / KR 5
Low[3]	Limited camp accommodations capacity at Upper Churchill Falls site	✓	KR 5
	Adverse weather conditions	✓	**Time-risk analysis variable
	Insufficient air travel to LCP sites	✓	KR 24

[1] Included in Nalcor's Decision Gate 3 Project Cost and Schedule Risk Analysis Report and incorporated into Westney's analysis [2] KR = Key risk, R = Risk [3] SNC-Lavalin risk level based on "probable consequence" (further details on slide 7)

Westney

The range of outcomes from Westney's analysis were inclusive of the results in SNC-Lavalin's Risk Report

	Westney	SNC-Lavalin
Cost timing assumptions	▪ 2012 C$ (at time of estimate)	▪ End-of-project costs
Estimate basis	▪ C$5.465 Billion	▪ C$6.1 Billion stated, which is likely inclusive of contingency (the amount was C$5.8, excluding contingency)
Risk identification	▪ LCP's risk register and collaborative risk identification sessions with SNC-Lavalin and Nalcor	▪ LCP's risk register and discussion with SNC-Lavalin internal personnel
Risk quantification and modeling	▪ Ranging of best and worst cases for both "tactical" (i.e., risks around the estimate) and "strategic" risks, with probabilistic modeling of all risks via Monte Carlo simulation techniques	▪ Sizing of each risk based on a formula for probable consequence ("consequence" x "probability" x (1 - "manageability")) ▪ Probable consequences added to determine total risk
Analysis completion	▪ 2012	▪ 2013 (after several key bid packages had been received)
Cost-risk results	▪ C$5.8 Billion - C$8.2 Billion[1] (P5 to P95, escalated to end-of-project C$)	▪ C$8.2 Billion (C$5.8 Billion + C$2.4 Billion in risk)

[1] P5 to P95 range in 2012 C$ is C$5.5 Billion – C$7.4 Billion

Westney

Top risks had been identified by Nalcor prior to Decision Gate 2 (2010), with mitigations planned or already underway in 2013

Risk title	SNC-L risked amount ($ millions)	Nalcor-LCMC response / actions already underway in 2013
▪ High market cost from contractors to be expected	225	▪ Bidders were aggressively profiled ▪ Almost all packages bid had 4 or more bidders
▪ Limited camp accommodation capacity at Muskrat Falls site	203	▪ Design of the "in ground" services was changed to allow for additional camp accommodation blocks to be built as the need arose
▪ Limited availability of skilled and experienced manpower	203	▪ A competitive wage / labour agreement with the Hebron Project was established ▪ A high quality camp and accommodations was built (e.g., fiber internet, TVs in all rooms, central gym, cinema, etc.) ▪ An aggressive campaign was executed to attract workers from Western Canada ▪ Transportation was streamlined (e.g., charter aircraft, bussing from the airport)
▪ Large packages issued for transmission lines	180	▪ First package bid (HVac TL) was broken into small packages. Bid revealed significant savings for larger package which was leveraged for the HVdc TL
▪ Major components outsourcing in China	168	▪ An extensive bidding process was conducted and supplier inspections/quality reviews were completed for the proposed facilities in China ▪ LCP had a full-time QA team on-the-ground in China, and quality was good
▪ Concrete works slippage from baseline schedule	126	▪ The project schedule at sanction was recognized as a target schedule with aggressive milestones
▪ River closure slippage from baseline schedule	96	▪ To further de-risk schedule, a decision was made in March of 2013 to move diversion from 2015 to 2016 ▪ Mitigations resulted in river closure, diversion, and spillway operation being achieved on schedule
▪ Large EPC packages	90	▪ LCP's financial advisors and rating agencies required large packages that limited interfaces from contractors with global EPC capabilities and high credit-worthiness, with a preference for unit-rate and lump-sum contractors
▪ No geotechnical information for dam	90	▪ A decision was made that the in-river geotechnical investigations actually offered a much lower cost and schedule risk than portrayed by SNC-Lavalin's geotechnical engineers

SNC-LAVALIN RISK ASSESSMENT

LOWER CHURCHILL PROJECT

505573

CLIENT: NALCOR

APPROVALS

PREPARED BY	TITLE	Signature	DATE
Michel Mackay	Project Risk Manager		April 23, 2013
APPROVED BY	TITLE		DATE
Normand Bechard	Project Manager		May 17, 2013
Philippe Jean	VP Project Services		May 17, 2013
Marc O'Connor	VP PMO		May 17, 2013
Claude Létourneau	Senior Vice President		MAY 17, 2013
Scott Thon	Executive Vice-President		

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1. INTRODUCTION

The LCP project presently under development encompasses the Muskrat Falls Hydroelectric Plant, associated transmission lines, DC specialties and a subsea cable crossing. These four distinct physical specialties are broken down into the following respective components:

- Component 1: Muskrat Falls Hydroelectric Development
- Component 3: High voltage direct current transmission system specialties
- Component 4: High voltage overhead transmission lines including:
  - Sub-component 4A: HVdc overhead transmission lines Muskrat Falls to Soldiers Pond
  - Sub-component 4B: HVac overhead transmission lines Muskrat Falls to Churchill Falls

Component 2 is the Gull Island Hydro power plant (2000 megawatts) to be developed subsequently to Muskrat Falls, and the execution of the subsea cable across the Strait of Belle Isle which is not part of the SLI scope.

This Risk assessment has been made solely by a selected team of SNC-Lavalin Experts at the request of the SNC-Lavalin Project Director for the Lower Churchill Project. Expecting a high market heat up on major strategic packages, the LCP Project Director asked that an internal LCP project risk assessment be conducted following the SNC-Lavalin risk assessment method typically applied on all other SNC-Lavalin projects. The Risk assessment workshop was conducted by the Risk Director, of North America Region of Global M&M Division, who has had previous experience in hydroelectric power projects at Hydro- Québec/Bale James Society (SEBJ).

This review was conducted at SNC-Lavalin's expense with the objective of preventing and or mitigating any unforeseeable risk events that could have a negative impact on the project's cost and schedule and could increase the project exposure by more than 30% from its original budget.

2. KEY ELEMENTS OF THE LCP RISK MANAGEMENT PROCESS:

- Lower Churchill is a high profile project; for the local community, the provincial and federal governments.
- SNC-Lavalin is contractually the EPCM and has an obligation to inform the Owner (Nalcor) with regards to any events that may jeopardize the execution of the project.

- This new Risk Assessment report is more in line with the objectives of the Project Execution Plan and with SNC-Lavalin's risk assessment guidelines.
- The SNC-Lavalin Risk Team has reviewed the original Risk Register in force on the project. The Risk management system implemented on the LCP did not provide for the quantitative evaluation of Risk exposure, focusing rather on qualitative risk assessment aspects aimed mostly at providing visibility and monitoring of actions supporting Risk mitigation strategies. As such, it did not provide a proper overall-encompassing evaluation and clear picture of the dollar value of each risk and the resulting total risk exposure for the LCP project;
- Risk Management is not duly empowered under the present LCP organizational structure, which should report directly to the Project Director. Present organizational reporting structure should be discussed and re-evaluated at the steering committee;
- Under this new methodology of assessing various levels of risks, the very high consequence risks will be highlighted and will be presented to SNC-Lavalin senior management and Nalcor for their review, discussion and agreement on remedial action plan to be implemented, and where possible, a preventive action plan put forward;
- In the present risk assessment report, risks (both threats and opportunities) that could arise during and/or after project execution were considered;
- Risks are managed through the SNC-Lavalin standard management tool, MOINS – RISC – LESS (based on Dyadem International's Stature platform).

3. MANDATE

Appoint a Task Force dedicated to the preparation and issuance of an executive management report drawing optimized conclusions resulting from the high level risk assessment on the Lower Churchill project and identify high level mitigation strategies and supporting action plans, using the standard SNC-Lavalin methodology and tools.

4. EXECUTIVE SUMMARY REPORT

The first LCP project risk register was drafted April 17th, 2013, by a group of selected members from the Montreal, Panama and Newfoundland-Labrador offices, appointed by Senior Management. A second project risk assessment review was conducted from the 18th of April until the 21st of April 2013, by the same team members. Both these reviews were performed in light of the actual LCP project situation, and the increases in pricing received on some major construction packages, well above their original estimated budget and schedule. The project must come to the realization that the market response to these large bid packages is limited to a few major players. The pricing tendency is showing signs of being well above their original set budget. The pricing of all the bids contractual risk factors by the bidders will be much more significant than expected and the procurement

strategy originally foreseen for some major packages may no longer be applicable and may result in a project schedule and budget overrun of more than 30% of the actual project estimated value if the present project conditions are not altered.

The Task Force has reviewed and discussed the original project risk register and decided to proceed with the elaboration of a new risk register based on SNC-Lavalin risk assessment methodology, so as to provide a more realistic and manageable portrait of the actual project risk circumstances.

This new risk assessment approach was approved by SLI's Senior Management at the request of the SNC-Lavalin Project Director for the Lower Churchill Project.

The objective of identifying all the potential risks of the Lower Churchill Project was attained.

A quantitative risk assessment was performed based on the relevant hydroelectric experience of the appointed Task Force Members. The calculated risk exposure for the Lower Churchill project is estimated at **2.4 billion** CDN (please refer to Risk Register Table 1). This figure, based on the Team's experience, represents an order of magnitude of + or – 50% of our potential cost overrun.

This report is at its preliminary stage, since it has not been distributed to all the project participants for their perusal and comments, given the urgency to present this risk assessment report to SNC-Lavalin Executive Management.

Out of the 52 risks originally identified, 12 were retired due to double dipping or not foreseen as a risk. Out of the remaining 40 Project risks evaluated, 25 are considered to be Very High Risks, 3 High, 9 Medium and 3 Low.

The Very High represents 90% of the total number of identified risks from the Lower Churchill project. This is unusual for a project in execution. This indicates that many risks are foreseen to occur during the execution phase and could materialize and cause the project to deviate from its set schedule and baseline.

A strong risk control system should be put in place to prevent the budget cost overruns that are presently foreseen, to be in the **39% range**. The attached risk register herein it details the mitigation measures and actions plans that normally form part of the report and should be review in depth with the project execution plan. A further detailed Risk Review should be performed at a later stage in participation with Nalcor Energy representatives.

Value-wise (quantitative assessment), 9 out of the 25 Very High risks identified, represent 56% of the estimated risk exposure value, estimated at 1.4 Billion CAD.

Risk elements:

The 40 risks ranking from Very High to Low Risks have been identified by the Team members and represent an estimated cost of 2.4billion CAD. It has been evaluated in view of the actual potential cost trend of the project's contractual situation, surrounding economic and socioeconomic environment.

The following 9 Very High Prime Contract risks captured and evaluated give a fair description of the present project risk situation.

1) Restricted pool of major contractors capable of bidding on the very large packages developed for the LCP (already out for bids allowing for limited possibility to re-scope or develop new packages). Fewer bids could be submitted and at higher than original budgeted cost. This Risk is valued at 225 Million (C1) - Risk number 1
2) The unavailability to provide sufficient camp accommodation facilities may force Contractors to find alternate accommodations which could lead to mobilization and start-up delays, resulting in claims and ultimately project schedule delays. This risk valued at 203 Million (C1) - Risk number 32
3) A significant portion of the local labour market works in Western Canada. Local workers are inexperienced in the LCP nature of work. Currently, the NL Hebron project is competing with our project and is attracting labourers by offering good conditions. The unavailability of qualified construction manpower may lead to schedule delays and extra labour costs, as well as impacting on the quality of the works, increased safety risks, etc. For C1, the main trades issues being carpenters, electricians, iron workers (rebar), concrete pouring specialists. For C3, main trades issues being electricians. For C4, main trades issues being lineman. This risk valued at 180 Million (For all) - Risk number 4
4) Due to the heated market conditions ***in transmission lines*** market (currently the case in Alberta; LCP is dealing with the same bidders) and the size of the construction packages, fewer bids could be submitted and at higher than budgeted cost. Also, very few of these major contractors will be able to perform these large packages in the proposed timeframe. This risk value at 180 Million (C4) - Risk number 18
5) Major components, such as turbines and gates, will be procured and manufactured in China. Based on SLI past experiences; quality, performance, warranty service and schedule problems can be anticipated with these Lump Sum turnkey packages (i.e. major claims and delays). This risk valued at 168 Million (C1) - Risk number 5

6) Powerhouse and spillway concrete works are planned on a three year duration (2 winter seasons) with a very tight and aggressive schedule providing little float, which might result in additional delays (possible 6 months) and costs. This risk is valued at 126 Million (C1) - Risk number 2

7) As start-up of the spillway, river closure and river diversion are to be fulfilled-in during an "ice-free" window. There is no float in the schedule with the preceding activities (EA release, camp, road, etc.). Any delay in these previous activities may trigger missing the diversion window which will result in a one year delay in the project schedule. Furthermore, there is also the technical risk of being unable to finish the work within the "ice free" window timeframe. This risk is valued at 96 Million (C1) - Risk number 3

8) Large EPC (Turn-Key) packages sent to a restricted pool of specialized DC manufacturing firms not used to perform all inclusive TK work including civil work. These added risks will most likely result in higher than estimated Bid Budget costs. This risk is valued at 90 Million (C3) – Risk number 11

9) As no geotechnical investigations have been performed in the river under footprint of dam and cofferdam, adverse conditions could be discovered during construction leading to major rework, cost overruns and delays. This risk is valued at 90 Million (C1) – Risk number 33

4.1 MANAGEMENT ASSESSMENT OF RISK EXPOSURE

The risk Team reviewers have serious concerns in regards to the strategy in progress to realize the Lower Churchill project. The packaging strategy used as reflected in the risk numbers 1, 11 and 18 above; is cause for concern. The project will face multiple problems with the large EPC contractors who will be holding the project's budget and schedule hostage and decrease our bargaining power; and should they fail to execute the work, the LCP project will also fail, and at a huge cost. The Public's interest, as well as the Provincial and Federal governments' interests need to be safeguarded.

The EPC's will price the same risks that we have foreseen with a premium and the project management team when negotiating with the lowest bidders, it will most likely occur outside the project's budgetary range. EPC contractors will use all the loops in the contract documents to issue claims.

Procurement and manufacture of major critical project components in China will be a major cause of concern to the project and at multiple levels, i.e., quality, warranty, after-service, schedule, design changes, etc. In Mines and Metallurgy the major suppliers give the

casting of large structures to Chinese companies, but the heart of their sophisticated equipment is made in Europe or other industrialized nations, where quality control standards are more rigorously adhered to.

Manpower availability is a big concern in the Alberta oil and gas industry. They have developed to attract labour from Newfoundland, a frequent fly-in fly-out rotation and a generous salary and conditions package; this in a province with normally low income taxes. We have also a competing project in Newfoundland; the Hebron project is in the oil and gas industry and is also draining whatsoever manpower is left available. The Lower Churchill project must attract a different manpower (earthworks and civil works). The environment where the project is being developed is difficult and the camp conditions are a major concern if we are to attract and retain skilled manpower.

We have used the experience of a dedicated group of Experts in the Energy sector to help the LCP project team in identifying the main key elements that should be used to develop a credible risk assessment, based on SNC-Lavalin's risk management approach so as to be able to capture these various levels of risk that best portray the project's actual situation. Our approach is based on the ISO 31000 International recognition and is in line with our Corporate Guidance procedures.

This is a high profile project for the Newfoundland government, whose Guarantor is the Federal government. It is strongly suggested that these identified risks be discussed openly and with full transparency amongst the Parties, so as to be able to align the project team when executing the proposed mitigation plans.

SNC-Lavalin, as the Project's E.P.C.M. has the legal obligation to advise its client of any major risks that will cause prejudice to the project and which deviates significantly from its budget and schedule. Our present concern is that we foresee that the project will incur more than a 30% cost overrun if the project does not take action on the risk elements raised in the Risk Assessment Report. The actual project structure is contributing to this increasing risk factor. Client has limited experience in huge civil work and earth-filled dam work, power line and power station works. .

5. CONCLUSIONS

The present project execution schedule offers no float and critical activities could be delayed, such as the Dam, Spillway ("ice free" window time frame), long lead items, only to mention few of them. The actual problem to deliver the camps early, will affect the project downstream. Additionally, the specific manpower needed to realize these hydropower facilities will be difficult to find. Most important the expert committee believe that the manpower needed to fulfill the work should be in the neighbourhood of 2500 people and

the project is presently working with 1500. This concern has to be reviewed and given proper consideration at once. The camps facilities into this difficult environment should be looked at carefully and compared with the camps facilities been provided presently in Alberta and Quebec.

This exercise has to be further pursued and developed with the Team experts involving the Client, so that both Parties are aligned on how to best resolve these issues.

Nalcor and the EPCM team have to carefully review their roles, responsibilities and contribution in this major project, since the challenges to be faced during the upcoming execution phase will be major.

6. RECOMMENDATIONS

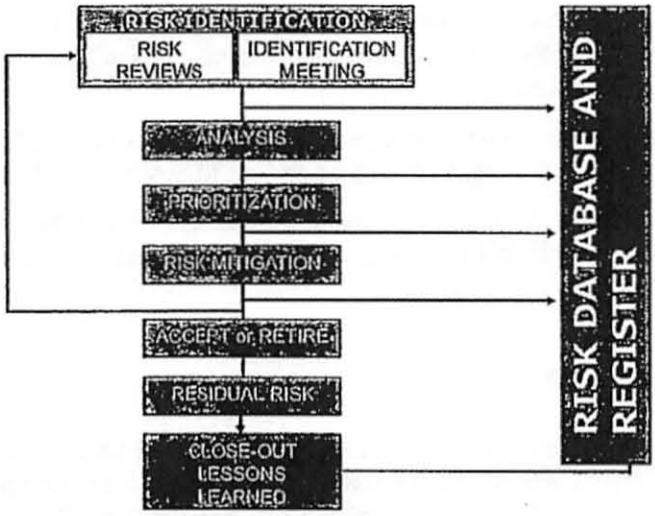
It is recommended that the Executive Management of SNC-Lavalin be involved in order to discuss directly with the High Level management of Nalcor Energy in light of this new risk assessment report, which has evaluated an **EXPOSURE OF 2.4 billion CAD. We have a potential cost overrun of 39% at 20% of project completion.**

When published, this report will be public domain. Nalcor Energy and SNC-Lavalin have to discuss the next step forward.

7. RISK WORKSHOP METHODOLOGY

The risk management approach used in this workshop is based on ISO 31000 guidelines that promote a culture where risk can be openly discussed and effectively managed. **The participants in the risk session each had an opportunity to express their concerns or perceived risks within the sections outlined in the scope above.** The following outlines the methodology undertaken in the risk workshop.

Risk Management Process



The first step in this process was to identify risks based on the components of the project i.e., the Muskrat Falls Hydroelectric Development, the High voltage direct current transmission system specialties and the High voltage overhead transmission lines (ac and dc). **Risk titles and concise descriptions were developed and agreed upon by the panel.** The risk was determined to be either Component 1, 3 or 4 or concerning all the project. The team has not identified any risk owners, but this should come at a later date.

The next phase was to provide a qualitative analysis that served to provide an order of magnitude basis of comparison for each risk. The objective of providing an order of magnitude was to be able to identify the most critical risks (+ or – 50%).

The panel was asked to select a consequence level (from VERY LOW to VERY HIGH), which is determined by a percentage scale based on the project's CAPEX or OPEX. In this case, the CAPEX was concluded to be $6100M CAD, representing the dollar value of the Lower Churchill project. The table below demonstrates the Consequence Level breakdown:

CAPEX Consequence Level

Consequence Level	Minimum (% CAPEX)	Minimum ($ M CAD)	Maximum (% CAPEX)	Maximum ($ M CAD)
Very High	1.00%	$ 61	5.00%	$305
High	0.75%	$ 45.75	1.00%	$ 61
Medium	0.50%	$ 30.50	0.75%	$ 45.75
Low	0.25%	$ 15.25	0.50%	$30.50
Very Low	-	$ 0.0	0.25%	$15.25

The following step included selecting the probability of the risk occurring and the manageability level. Similar tables are illustrated below:

Probability of Occurrence

Probability Level	Probability	Description
Very High	70% to 80%	Will probably occur in most circumstances
High	50% to 70%	Might occur under most circumstances
Medium	30% to 50%	Might occur at some time
Low	10% to 30%	Could occur at some time
Very Low	< 10%	May occur in exceptional circumstances

Manageability

Manageability Level	Probability	Description
Very High	80%	Can easily be managed
High	60%	In most circumstances can be managed
Medium	40%	Can be managed
Low	20%	In most circumstances difficult to be managed
Very Low	0%	Virtually impossible to manage

The risk software then computed the *Probable Consequence* and classified the average risk exposure based on the following calculation and table below:

Probable Consequence = Consequence x Probability x (1- Manageability)

CAPEX Probable Consequence

Probable Consequence Level	% CAPEX Value	Minimum ($ M CAD)	Maximum ($ M CAD)
Very High	0.65% and up	$39.65	-
High	0.35% to 0.65%	$21.35	$39.65
Medium	0.17% to 0.35%	$10.37	$21.35
Low	0.03% to 0.17%	$1.83	$10.37
Very Low	0% to 0.03%	$ 0.0	$1.83

Once the overall risk levels (probable consequences) had been identified, the panel was able to compare and prioritize the risks. The following step in the process was to create very detailed mitigations plans for each risk, including actions to be taken to mitigate these risks. These items were developed in the action log tab of the software. Due dates and

action owners will be developed at later date. This portion of the risk workshop was the most labour intensive in terms of time and overall discussion amongst the panel members.

The team was also able to provide several comments and revisions to all aspects of the elements in the software (risk title, description, mitigation plans, actions, consequence, probability & manageability). In addition, several risks were retired due to the fact that they were included in other risks or they were perceived as double dipping risks by the panel.

8. RISK REGISTER SUMMARY TABLE 1

Lower Churchill Project:

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Risk Register Exposure; 2.4 billion CDN

Component: Project: Category:

ID	Comp	Risk Title	Risk Description	Capex /Opex	Risk	Risk Type	Category	Owner	Risk Status	Maximum Consequence	Consequence	Probability	Manageability	Capex Probable Consequence	Risk Level	Mitigation	Action	Comment
1	4-C1	High market cost from contractors to be expected.	Restricted pool of contractors capable of bidding on the very large packages developed for the LCP (already out for bids allowing for limited possibility to re-scope or develop new packages), fewer bids could be submitted and at higher than budgeted cost.		T	FIN	Procurement	Client	Active	500.00	Very High	Very High	Medium	$ 225 m	VERY HIGH	1.1. Contractor prequalification.	1.1.1. Evaluate contractors abilities through qualifying process (technical, financial, team, etc.)	
																1.2. Contracting strategy.	1.2.1. Analyze other packages to compare prices or to evaluate how it could be possible to re-scope.	
																1.3. Review detailed schedule to re-evaluate sequence and critical path (try to break the monopole effect of larger packages).	1.3.1. Review in detail critical activities to be able to react quickly to any slippage of the schedule.	
																	1.3.2. Evaluate if possible to de-scope some packages to reduce scale.	
																1.4. Bid evaluation	1.4.1. Verify contractor's understanding of scope, schedule and associated known risks during bid evaluation	
2	7-C1	Concrete works slippage from baseline schedule.	Powerhouse and spillway concrete works are planned on a three year duration (2 winter seasons) with a very aggressive schedule providing little float, which might result in additional delays (possible 6 months) and costs.		T	FIN	Construction		Active	350.00	Very High	High	Medium	$ 126 m	VERY HIGH	2.1. Critical path analysis	2.1.1. Identify activities on critical path of the schedule and develop mitigation plans (what-if) for specific schedule risk.	
																	2.1.2. Organize meetings with specific teams to develop alternatives for each activity.	
																2.2. De-scoping packages	2.2.1. Evaluate the de-scoping strategy, where contractor has less expertise and where breaking monopole is practical for schedule.	
																	2.2.2. In case of slippage, evaluate which activities could be transferred to another contractor.	
																2.3. Concrete strategy	2.3.1. Evaluate concrete strategy to prevent slipage (pouring capacity, winter production plan, etc.).	
																	2.3.2. Calculate if contractor has sufficient concrete plant capacity to meet the schedule.	
																2.4. Cement powder supply	2.4.1. Make sure that contractor will have a strategy to ensure continuous supply of cement powder and sufficient inventory (nb. weeks of production).	
3	8-C1	River closure slippage from baseline schedule.	As construction of the spillway is to be fulfilled in an "ice-free" window, there is no float in the schedule with the preceding activities (EA release, camp, road, etc.). Any delay in these previous activities may trigger missing the diversion window which will result in a one year delay in the project schedule. Furthermore, there is also the technical risk of being unable to finish the work within the "ice free" window timeframe		T	FIN			Active	400.00	Very High	Medium	Medium	$ 86 m	VERY HIGH	3.1. Perform constructability review to optimize process leading to completion.	3.1.1. Perform constructability review to optimize process leading to completion.	
																3.2. Contractor pre-qualification.	3.2.1. Ensure that selection process allows choosing experienced contractors in this type of work.	
																3.3. Develop plan B.	3.3.1. Establish activities on critical path of the schedule of this package to allow to identify mitigation plans (what-if) for specific schedule risk.	
																	3.3.2. Identify which other potential contractor could take over the scope.	
4	1-ALL	Limited availability of skilled and experienced manpower.	A significant portion of the local labour market works in Western Canada. Local workers are inexperienced in LCP nature of work. Currently, the NL Hebron project is competing with our project and is attracting labourers by offering good conditions. The lack of		T	FIN	HR		Active	400.00	Very High	Very High	Medium	$ 180 m	VERY HIGH	4.1. Union engagement	4.1.1. Establish measures to assure required labour productivity and availability	Already in package for HVac, the project is facing a cost overrun of 100M$ based on budgeted price of 200M$. The low expected manpower productivity represents
																4.2. Develop labour hiring strategy.	4.2.1. Identify and cover all required and forecasted skills.	
																	4.2.2. Prepare the strategy with unions.	
																	4.2.3. Consider outsourcing out of province and overseas.	

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Component: Project: Category:

ID	Comp	Risk Title	Risk Description	Capex /Opex	Risk	Risk Type	Category	Owner	Risk Status	Maximum Consequence	Consequence	Probability	Manageability	Capex Probable Consequence	Risk Level	Mitigation	Action	Comment
			availability of qualified construction manpower may lead to schedule delays and extra labour costs, as well as impacting on the quality of the works, increased safety risks, etc. For C1, main trades issues being carpenters, electricians, iron workers (rebar), concrete poring specialists. For C3, main trades issues being electricians. For C4, main trades issues being linemen.													4.2.4. Open hiring opportunity to new inexperienced workers (especially for lineman).	probably a large portion of this overrun. Compared to risk no. 6, the medium manageability is explained by a lesser possibility of offering up to or above market conditions (5) to attract labour which is unionized through collective negotiations.
																	4.2.5. Open hiring opportunity to First Nations workers.	
																	4.2.6. Find a way to sell to ex NF workers the project in order to come back to work in the province.	
																	4.2.7. Develop early training programs.	
																	4.2.8. Consider revising rotating cycle (ex. 2 weeks in / 1 week out).	
																	4.2.9. Develop compensation packages to attract workers.	
																4.3. Improve site conditions.	4.3.1. Consider similar site conditions as what is available to the workers in other similar projects.	
																	4.3.2. Offer social and recreative activities.	
																	4.3.3. Consider incentives for room sharing in temporary camp.	
																4.4. Aggressive marketing of LCP among target groups of workers.	4.4.1. Increase visibility of labour strategy at trade shows, by unions, associations, potential contractors, etc. (including promoting in Western Canada)	
																	4.4.2. Promote LCP project of choice by developing an advertising campaign in local and national newspapers and media.	
																4.5. Develop training plan for workers.	4.5.1. Plan a welcoming presentation.	
																	4.5.2. Develop and deploy an induction program.	
																4.6. Follow productivity.	4.6.1. Develop productivity indicators.	
																	4.6.2. Track productivity and adapt strategy accordingly.	
5	1+01	Major components outsourcing in China.	Major components, such as turbines and gates, will be procured in China. Based on SLI past experiences, quality, performance, warranty service and schedule problems can be anticipated with these Lump Sum turnkey packages (i.e. major claims and delays).	[illegible]	T	FIN	Procurement		Active	280.00	Very High	Very High	Low	$ 168 m	VERY HIGH	5.1. Ensure continuous follow-up on production.	5.1.1. Put in place a tight follow-up on contracts to ensure quality and timely delivery.	
																	5.1.2. Ensure sustained surveillance in suppliers manufacturing facilities.	
																5.2. Pallliate for unreliable deliveries.	5.2.1. Secure all possible schedule float on manufacturing.	
																	5.2.2. Award contracts well in advance.	
																	5.2.3. Ensure understanding of packaging requirements to ensure product preservation (transportation, stocking).	
																	5.2.4. Follow-up on transportation and customs requirements.	
																5.3. Develop contractual relationship.	5.3.1. Limit language barriers with suppliers by hiring translators to go though documents or follow experts when travelling.	
																5.4. Financial warranties	5.4.1. Request bank credit letter	
6	1+ ALL	Limited availability of		[illegible]	T	FIN	HR		Active	150.00	Very High	Very High	High	$ 45 m	VERY HIGH	6.1. Recruitment and retention strategy.	6.1.1. Develop value proposition up to or above market standard (compensation packages and	To date, there has been a precedent at C1: a

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Component: Project: Category:

ID	Comp	Risk Title	Risk Description	Capex /Opex	Risk	Risk Type	Category	Owner	Risk Status	Maximum Consequence	Consequence	Probability	Manageability	Capex Probable Consequence	Risk Level	Mitigation	Action	Comment
		skilled site management personnel.															accommodation conditions) for site management staff.	contractor already complained about accommodation conditions for his site management and decided to build his own. All other contractors will be in the obligation to construct similar accommodations for their site management and visitors, which will be added to their price. Compared to risk no. 4, the high manageability is explained by the possibility of offering up to or above market conditions (5) to attract site management personnel through individual negotiations.
																	8.1.2. Develop an aggressive staffing plan with incentives up to or above market standard on key positions.	
																8.2. Offer support from main office.	8.2.1. Identify and assign discipline experts to mentor and support site execution.	
																	8.2.2. Audit sites to identify prioritized action plan to align site execution where required with best practices.	
																8.3. Improve site conditions.	8.3.1. Consider lodging accommodations for site managers up to or above market standard.	
																8.4.		
																8.5. Training.	8.5.1. Hire a full time dedicated person to ensure implementation of a formal and full training program to support site people.	
7	C1	Difficulty transitioning to an integrated team project delivery model.	Lack of proper delegation of authority, leading to an unsustainable authority structure as the site construction ramps up. Decisional team more familiar with the oil and gas industry than with heavy civil and hydro works, leading to mismatched processes and procecures, as well as to less than optimal value-plus decisions.		T	FIN	HR		Active		Very High	High	High	$ 43.92 m	VERY HIGH	7.1. Issue an authority matrix giving site managers latitude.	7.1.1. Re-evaluate who does what to appoint best resources to best suiting position.	
																	7.1.2. Establish trust.	
																	7.1.3. Precise levels of authority of approvals.	
																7.2. Insure key positions filled by skilled and experience people specifically in projects of this nature.	7.2.1. Balance resources and or responsibilities between both entities.	
																	7.2.2. Plan for and deploy alignment and teambuilding sessions	
																	7.2.3. Develop project procedures, work instructions, forms.	
																	7.2.4. Develop and deploy training on use of project procedures, work instructions, forms.	
8	C1	Mobilization of community against the project.	Some groups in the NL population could react against the project, increasing its political sensitivity, protests or demonstration. IBA agreement covers mostly economic aspects of Innu people benefits, some Innu people oppose to LCP due to environmental and cultural concerns, some other First Nation's people (e.g. Metis) seem to wish benefiting from LCP same way as Innu people. Representatives of First Nations could block the construction sites to apply pressure on LCP and to promote their agendas leading to schedule delay, extra costs and reputational damage.		T	FIN	Community		Active		Very High	High	High	$ 43.92 m	VERY HIGH	8.1. Promote engagement of First Nations.	8.1.1. Develop a LCP wide approach to engage First Nations that are not part of or don't support IBA.	
																	8.1.2. As soon as possible, meet all communities to present project in all its aspects (including schedule, scope, resources required, etc.).	
																8.2. Put in place a liaison committee that could address various communities (Innu, Inuit, Metis, etc.) issues on a regular basis.	8.2.1. Organize regular information sessions to keep communities informed.	
																8.3. Hire an aboriginal (Innu an others) affairs coordinator for the project.	8.3.1. Assure permanent communication channel between coordinator and the different communities.	
																8.4. Assure that all IBA conditions (environmental, economics and etc.) are		

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Component: Project: Category:

ID	Comp	Risk Title	Risk Description	Capex /Opex	Risk	Risk Type	Category	Owner	Risk Status	Assessment Consequence	Consequence	Probability	Manageability	Capex Probable Consequence	Risk Level	Mitigation	Action	Comment
																fulfilled in conformity with agreement.		
9	C1	Additional delays resulting from difficult early works.	Early works are already delayed. Schedule delays and cost overruns are already materializing on the early works construction and may deteriorate further as work progresses (ripple effect).		T	FIN	Construction		Active		Very High	High	Medium	$ 65.88 m	VERY HIGH	9.1. Skilled and experienced staff.	9.1.1. Put in place adequate skilled and experienced staff.	
																9.2. Analyze work progress to evaluate slippage and define corrective measures.	9.2.1. Split or modify scope of work.	
																	9.2.2. Add additional contractors.	
																	9.2.3. Delay non critical activities.	
																	9.2.4. Postpone or delay non critical activities.	
10	C2	Requirements surrounding environmental assessment (EA) release	In the event strategic permits are not obtained in a timely fashion the schedule could be delayed. As of 19-Apr-2013, no contract for C3 has been issued. Due to possible misunderstanding by general public and regulators of environmental impact using electrodes instead of metallic return and opposition to the electrode use, a special condition may be attached to EA release to use the metallic return leading to cost implications		T	FIN	Legal & Regulatory	Client	Active		Very High	Low	Low	$ 20.28 m	HIGH	10.1. Acceleration	10.1.1. Add in contracts clause for possible acceleration work	
																10.2. Stakeholder's communications	10.2.1. Ensure education and understanding of regulators and public	
																	10.2.2. Immediately reassess likelihood of metallic return being a condition of the EA release	
																10.3. Secure all possible schedule float.	10.3.1. Evaluate other tasks to find or create float.	
11	3-C3	Large EPC packages	Large EPC (Turn-Key) packages sent to a restricted pool of specialized DC manufacturing firms not used to perform all inclusive TK work including civil work. These added risks will most likely result in higher than estimated		T	FIN	Procurement		Active	250.00	Very High	High	Medium	$ 90 m	VERY HIGH	11.1. Find other	11.1.1. Find other supplier who can qualify for this scope	
																11.2. Bonus and liquidated damages	11.2.1. Include in specific contract clause high value liquidated damage and incentive	
12	3-C3	Scope of packages not aligned with suppliers core businesses	Requiring manufacturers to perform as general contractors and manage scope elements outside their normal area of expertise (such as civil works) will require successful and operational partnering agreements with other parties. Failure in implementing early operational and efficient scope delivery teams could limit ability to meet the tight schedule		T	FIN	Procurement		Active		Medium	Very High	Medium	$ 17.16 m	MEDIUM	12.1. Consider re-scoping.	12.1.1. Give civil work to civil contractor.	
																	12.1.2. Evaluate if site contractor could take on this scope.	
																12.2. Subcontractor approval.	12.2.1. Prior to awarding contract to a contractor, have the option to approve their sub-contractors.	
																12.3. Detailed schedule and construction methods.	12.3.1. Prior to beginning of work, obtain detailed schedule and construction method.	
																	12.3.2. Perform what-if method on critical path (to identify mitigation plans when slippage).	
																12.4. Supervision of work	12.4.1. Ensure constant supervision of subcontracted work.	
																	12.4.2. Ensure that we react quickly to any slippage of work.	
13	D3	Readiness for start-up might be a challenge	Synchronous condensers and AC/DC converter stations are complex technology to integrate to an existing power network, failure to successfully commission these systems could delay start-up up to 6 months		T	FIN			Active	150.00	Very High	Low	High	$ 12 m	MEDIUM	13.1. POV	13.1.1. Have a POV team involved at site as soon as possible after beginning of work	
																13.2. Commissioning	13.2.1. Develop tight commissioning plan	
																13.3. Secure all possible schedule float.	13.3.1. Evaluate other tasks to find or create float.	
14	3-C1	Insufficient geotechnical information for	As limited geotechnical investigations have been performed on the north spur, adverse conditions could be discovered		T	FIN	Construction		Active	200.00	Very High	Medium	Medium	$ 48 m	VERY HIGH	14.1. Perform geotechnical investigation to validate design as soon as	14.1.1. Perform field and desktop (based on historic data) geotechnical studies.	Because of geotech uncertainties, we could find bolder or unstable
																	14.1.2. Validate design with geotechnical investigation	

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Component: Project: Category:

ID	Comp	Risk Title	Risk Description	Capex /Opex	Risk	Risk Type	Category	Owner	Risk Status	Maximum Consequence	Consequence	Probability	Manageability	Capex Probable Consequence	Risk Level	Mitigation	Action	Comment
		north spur area.	during construction leading to major rework, cost overruns and delays													possible.	results.	soil, which could result in a major scope change.
																	14.1.3. Add results to RFPs for contractors.	
																14.2. Adapt contract strategy to data available.	14.2.1. Unit price approach to assure flexibility	
																14.3. Secure all possible schedule float.	14.3.1. Evaluate other tasks to find or create float.	
15	C3	Problematic long lead items	Tight schedule with no float. Typical 30 months delivery for converters, which have not yet been ordered to date. Engineering for civil work to be completed within 6 months of Contract award (?validate) to prevent delaying civil works		T	FIN	Procurement		Active		Very High	Low	High	$ 14.64 m	MEDIUM	15.1. Expedite contract awarding.		
																15.2. Secure all possible schedule float.	15.2.1. Evaluate other tasks to find or create float.	
16	C4	Possible dispute for acquiring right of way on the island for approximatly 100 km of powerlines.	Right of way is not entirely aquired. Negotiation with land owners will be required. In the event of disputes, agreements could be delayed significantly, which would result in delaying contractor's work.		T	FIN	Legal		Active		High	High	Medium	$ 19.22 m	MEDIUM	16.1. Assess land owner situation.	16.1.1. Find out who are land owners, go meet them as soon as possible to find out what is in stake.	
																	16.1.2. As soon as issues with owners are known, then establish mitigation plan to undertake necessary actions.	
																	16.1.3. Prepare a contingency plan for tasks involved in possible delays due to right of way.	
17	C4	Powerlines corridor located in remote areas	In some remote regions of N&L (ex. Long Range Mountains), access and construction could be more difficult than planned leading to cost overruns and delays. As construction of transmission lines is planned in several remote locations (especially in Labrador) and delivery to these sites are possible only in certain season windows, logistics difficulties to deliver construction equipment, materials and crews may occur leading to extra logistics costs, schedule delay.		T	FIN			Active		High	Medium	Medium	$ 12.81 m	MEDIUM	17.1. Obtain from contractors their detailed logistics plan.	17.1.1. Assure that they are covering: access roads, river crossings, delivery schedule for materials, winter construction methods, and camp sizes and locations, helicopter use requirements, etc.	
																17.2. Get involved long ahead in procurement.		
																17.3. Clearing of ROW performed long ahead of construction.		
																17.4. Clear the corridor long ahead of construction.		
18	3-C4	Large packages issued for transmission lines.	Due to heated market in transmission lines (currently the case in Alberta and dealing with the same bidders) and the size of the construction packages, fewer bids could be submitted and at higher than budgeted cost. Also, few contractors able to carry on the work worldwide and in the proposed timeframe.		T	FIN	Procurement		Active	300.00	Very High	Very High	Low	$ 180 m	VERY HIGH	18.1. Re-packing strategy.	18.1.1. Evaluate the possibility to revisit LCP scope packaging strategy.	
																	18.1.2. Focus on limiting risks transferred to bidders?Normand	
																	18.1.3. Provide sufficient geotechnical data to contractors.	
20	3-C4	No geotechnical data available	As no geotechnical investigations have been performed in the TL ROW, adverse conditions could be discovered during construction leading to logistical challenges, cost overruns and delays.		T	FIN	Construction		Active		Very High	High	Medium	$ 65.88 m	VERY HIGH	20.1. Perform early surveys.	20.1.1. Validate corridor and pylone positions with surveys results (HVac & HVdc).	
																	20.1.2. Add results to RFPs for contractors.	
																20.2. Perform geotechnical investigation as soon as possible.	20.2.1. Perform field and desktop (based on historic data) geotechnical studies.	
																	20.2.2. Develop drilling program for HVdc even before EA release	

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Component: Project: Category:

ID	Comp	Risk Title	Risk Description	Capex /Opex	Risk	Risk Type	Category	Owner	Risk Status	Maximum Consequence	Consequence	Probability	Manageability	Capex Probable Consequence	Risk Level	Mitigation	Action	Comment
																	20.2.3. Validate design with geotechnical investigation results.	
																	20.2.4. Add results to RFPs for contractors.	
																20.3. Proceed to clearing of corridor as soon as possible.	20.3.1. Start HVac & HVdc clearing in advance.	
																20.4. Secure all possible schedule float.	20.4.1. Evaluate other tasks to find or create float.	
21	ALL	Lack of control on the delivering of Strait of Belle Isle Crossing (SOBI) cable.	The whole project is dependent on the integration of the marine crossing and delivering capabilities while this scope is manage by another Project Team distinct from the LCP Team.	[illegible]	T	FIN	Construction		Active		Very High	High	High	$ 43.92 m	VERY HIGH	21.1. Have a sound interface plan		
																21.2. Ensure good follow up with an integrated schedule.		
22	ALL	Complexity of commissioning and system integration.	Due to complexity, overall integration of all LCP components and activities plus external Island link prior to project commissioning, may represent significant challenge leading to overall delay of commissioning.	[illegible]	T	FIN	Commissioning		Active		Very High	Medium	High	$ 29.28 m	HIGH	22.1. Have sound turnover and commissioning plan.	22.1.1. Manage final integration as a standing alone project: develop completion strategy and plan including scope, schedule, budget of integration, etc.	
																	22.1.2. Perform proactive management of integration milestones and interfaces (timely applications for outages, requirement of inputs/outputs, regular progress reviews).	
																	22.1.3. Assure a proper follow up of activities.	
																22.2. Get the commissioning team involved as early as possible.	22.2.1. Develop resource requirement list.	
																	22.2.2. Appoint project leader fully responsible for integration.	
23	01	Commissioning failures of T&G units.	As "stress" testing of C1 equipment is part of commissioning, failure of some major equipment may occur during commissioning resulting in schedule delays and increased cost.	[illegible]	T	FIN	Commissioning		Active		Very High	High	Medium	$ 65.88 m	VERY HIGH	26.1. Well detailing of commissioning plan.	26.1.1. Commissioning and test plan which takes into account all realistic potential failures.	
																	26.1.2. Dedicated commissioning team to prepare procedures and implement.	
																	26.1.3. Consider use of a simulator to support testing, commissioning and operating of all components.	
																26.2. Follow-up on major equipement.	26.2.1. Hire an experienced and skilled T&G resource on site.	
																	26.2.2. Tight follow-up on all T&G suppliers quality and execution plan.	
																	26.2.3. Major surveillance and inspection of works performed directly in shops.	
																26.3. Pre-qualifying suppliers.		
																26.4. Assure respect of delivery dates.		
																26.5. Adapt logistics to these types of large components.		
																26.6. POV team present on site from beginning of work.		

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ID	Comp	Risk Title	Risk Description	Capex /Opex	Risk	Risk Type	Category	Owner	Risk Status	Maximum Consequence	Consequence	Probability	Manageability	Capex Probable Consequence	Risk Level	Mitigation	Action	Comment
31	3-C3	Insufficient geotechnical information.	As limited geotechnical investigations has been performed at for the switchyard and converter, adverse conditions could be discovered during construction leading to major rework, cost overruns and delays		T	FIN	Construction		Active		Very High	High	High	$ 43.92 m	VERY HIGH	31.1. Perform geotechnical investigation to validate design as soon as possible.	31.1.1. Perform field and desktop (based on historic data) geotechnical studies. 31.1.2. Validate design with geotechnical investigation results. 31.1.3. Add results to RFPs for contractors.	
																31.2. Develop plan B.	31.2.1. Depending on soil conditions and proposed corrective measures, consider shelters at specific locations where relevant to facilitate winter works and minimize schedule slippage. 31.2.2. Have multiple work fronts to face the problems and to meet baseline schedule. 31.2.3. Adapt contracting strategy to have an opportunity to move from lump sum contract to unit price contract if necessary information is not available upon start of work.	
																31.3. Secure all possible schedule float.	31.3.1. Evaluate other tasks to find or create float.	
32	4-C1	Limited camp accommodation capacity at Muskrat Falls site (1500 beds).	The unavailability to provide sufficient camp accommodation facilities may force Contractors to find alternate accommodations which could lead to mobilization and start-up delays, resulting in claims and ultimately project schedule delays.		T	FIN	Construction	Client	Active	450.00	Very High	Very High	Medium	$ 202.5 m	VERY HIGH	32.1. Develop alternative plan for temporary accommodation in case of camp construction delays.	32.1.1. Rent accommodation space at the local military AF base. 32.1.2. Negotiate agreement with HVGB hotels. 32.1.3. Develop a plan to develop key modules earlier to give minimum services. 32.1.4. Emphasis on infrastructure work and kitchen facilities to make them available from the very beginning. 32.1.5. Keep the 300 beds temporary accommodation camp in place.	
																32.2. Investigation of labour requirements in construction versus camp capacity.	32.2.1. Obtain from package bid winner forecast on camp requirements upon contract award 32.2.2. Re-evaluate (by C1 team) camp requirements taking into account safety requirement, productivity, rotation, etc. factors 32.2.3. Design camp site in scalable way to allow deployment of additional dorms, kitchen space, etc. 32.2.4. Give incentive to workers for sharing rooms.	
33	3-C1	No geotechnical information for dam.	As no geotechnical investigations have been performed in the river under footprint of dam and cofferdam, adverse conditions could be discovered during construction leading to major rework, cost overruns and delays		T	FIN	Construction		Active	250.00	Very High	High	Medium	5.50 m	VERY HIGH	33.1. Perform geotechnical investigation to validate design as soon as possible.	33.1.1. Perform field and desktop (based on historic data) geotechnical studies. 33.1.2. Validate design with geotechnical investigation results. 33.1.3. Add results to RFPs for contractors.	North dam is on the critical path and with a tight schedule.
																33.2. Develop plan B.	33.2.1. Adapt contracting strategy to have an opportunity to move from lump sum contract to unit price contract if necessary information is not available upon start of work. 33.2.2. Evaluate possibility to build a shelter above the dam foundation for winter work.	

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																	33.2.3. Have multiple work fronts to face the problems and to lessen schedule slippage.	
																33.3. Secure all possible schedule float.	33.3.1. Evaluate other tasks to find or create float.	
34	03	C3 coordination of packages will be a challenge	In C3, there are 3 different engineering and 3 different construction packages that will need to interface (especially on Soldier's Pond). Because of different technologies, interface will be a challenge to coordinate. Modification because some equipment will come from ABB or Alstom, undetermined which contractor will be responsible to modify. Technology interface and integration challenge because design will need to be modified		T	FIN			Active		Very High	High	High	$ 43.92 m	VERY HIGH	34.1. Identification	34.1.1. Identify interfaces early	
																	34.1.2. Technical interface management plan and interface matrix	
																	34.1.3. Define boundary conditions for interfaces	
																34.2. Coordination	34.2.1. Establish all required communication venues to manage interfaces	
																	34.2.2. Help coordinate contractors to avoid overlapping work in coordination procedures	
																	34.2.3. Establish interface plan, good communication with contractors, Nalcor, C1, C4, operations/facilities	
35	5-03	Limited camp accommodation capacity at Upper Churchill Falls site (150-200 beds)	In the event, this accomodation package is delayed, in the event of unsufficient accomodation, these contractors will need to find alternate accomodations in a area where existing accommodation is very limited. In addition, delays could result from contractors not being able to find temporary accomodation to mobilize their personnel.		T	FIN	Construction		Active		Low	Medium	High	$ 3.66 m	LOW	36.1. Develop alternative plan for temporary accommodation in case of camp construction delay	36.1.1. Evaluate possibility for contractor to setup trailer park	
																	36.1.2. Enter discussion with town of Churchill Falls	
37	01	Delay in availability of administration building will create inefficiency in site management	As the CH0007 Package is planned to be be awarded in Q3 2013 with mobilization starting in September and as the administration building is planned to be operational by mid-October, the LCP site management team will initially need to be in alternate offices. In the event the administration buildings availability is delayed, contract start-up could be disrupted or be sub-optimal which could lead to project delays and increased costs resulting from inefficiencies and claims		T	FIN			Active		Medium	Very High	Medium	$ 17.16 m	MEDIUM	37.1. Repertories alternative installations.	37.1.1. Renting and installing mobile office trailers.	
																	37.1.2. Temporarily convert some bedrooms in offices.	
																	37.1.3. Evaluate possibility to use schools or others public space.	
																37.2. Attribute priority of office space to management staff (managers, work supervisors, contract administrators, planners and cost control specialists, HSE officer and QC inspector).		
38	01	Suitability of site south access road (SSAR)	As many heavy transport trips will be required for the transport of CH0002 and CH0003 modules (approx. 800 trips) as well as for the mobilization of subsequent major Contracts, in the event the 22km SSAR road conditions, width or capacity is not optimal, transport trips could be delayed resulting consequent overall delays to subsequent packages and Project as well as claims and additional costs		T	FIN			Active		High	High	Medium	$ 19.22 m	MEDIUM	38.1.	38.1.1. Night convoy	
																	38.1.2. Flagmen	
39	ALL	Insufficient	Final products could not pass the quality		T	FIN	Procurement		Active		Very	High	Medium	$ 65.88 m	VERY	39.1. Implement a pre-	39.1.1. Consider adding clauses in contract	

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		supplier's QA/QC.	tests due to failure by supplier to implement effective QA/QC system and lack of control over sub-vendor quality system. Could lead to re-work, extra costs and schedule delay.								High		m		HIGH	qualifying process for suppliers.	requirements to include sub-suppliers.	
																39.2. Implement strong packages QA/QC.	39.2.1. Develop a supplier quality plan and procedures. 39.2.2. Develop effective inspection and test processes (in shops).	
																39.3. Implement package risk management.	39.3.1. Perform proactive package risk management.	
40	ALL	Contractors (or sub-contractors) errors / omissions.	Major supervision capacity will have to be ensured on various sites. Otherwise it would be easy to miss errors or omissions (including false works) leading to re-work, extra costs and schedule delay (41 construction packages). For lump sum contracts, possible impact on schedule, even if cost impact low.		T	FIN	Procurement		Active		Very High	High	Mediu m	$ 65.88 m	VERY HIGH	40.1. Implement strong package QA.	40.1.1. Assure that corresponding insurance is included to RFP/ contract as a mandatory requirement. 40.1.2. Include in contract's requirement to review contractor's drawings that should be signed by qualified engineers (P.Eng.). 40.1.3. Develop QA plan to review drawings and construction on site.	
																40.2. Define interfaces.	40.2.1. List permits provided to contractors. 40.2.2. Address in contracts contractors' internal interfaces.	
																40.3. Implement project and quality control.	40.3.1. Expediting contractors and QC. 40.3.2. Verification of completed works. 40.3.3. Contract strategy for non-compliance language: all English. 40.3.4. QA provisions in contracts for inspections. 40.3.5. Define all required forms for construction (starting with M&M forms and adding missing ones from T&D).	
																40.4. Hire skilled and experienced inspectors to detect defects even before they happen.		
42	C1	Riverside cofferdam catastrophic flooding	As certain flooding reliability design factors are used for cofferdam design (one in 20 years events), a flooding might happen that exceed the reliability design factors used leading to catastrophic failure of the cofferdam, injuries/ fatalities, loss of equipment and reputational damage.		T	FIN			Active		Very High	Low	Low	$ 29.28 m	HIGH	42.1. Use of upper Churchill to reduce flow. Early communication with CFLco	42.1.1. Nalcor to notify CFLco of possible mitigation plan by the start of construction	
																42.2. Handling higher water levels	42.2.1. Develop plan to acquire, utilize and monitor data to predict catastrophic flooding 42.2.2. Measure, model and predict short term weather and hydrological conditions as part of emergency response planning or gate operation strategy	
																42.3. Constructability review of cofferdam	42.3.1. Investigate option of stockpile of fill 42.3.2. Establish construction sequence	
43	18-CA	Native issue for powerlines in Labrador	Possible land claim from Innu against transmission lines		T	FIN			Active		Very High	High	Mediu m	$ 65.88 m	VERY HIGH	43.1. Communication plan for native groups	43.1.1. Find all the native groups susceptible to delay the project 43.1.2. Perform a general information session for all native groups 43.1.3. Establish a permanent liaison committee to deal	

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																	with this type of issue	
																	43.1.4. Ensure they meet on a monthly basis with native groups	
																43.2. Relation with First Nations	43.2.1. Find a native community advisor	
44	D3	Cost overrun on electrod pond in Labrador	Insufficient geotechnical information to design the dyke.		T	FIN			Active		Medium	High	Medium	$ 13.73 m	MEDIUM			
45	ALL	Possibility of strike.	No strike has been accounted for in the schedule for the whole duration of the project.		T	FIN	Procurement		Active		Very High	Medium	Low	$ 58.56 m	VERY HIGH	45.1. Build strong relationships with union leaders.	45.1.1. Maintain strong communication channels with union leaders.	
																	45.1.2. Keep your word on promises.	
																45.2. Be attentive to what comes out of labor committees meetings.	45.2.1. Maintain strong communication channels between union workers and managers.	
																	45.2.2. Follow up on expectations.	
																	45.2.3. Try to solve issues as soon as they materialize.	
																45.3. Put priority on site conditions.	45.3.1. Prioritize lodging, food services and recreative activities for workers.	
48	ALL	Adverse weather conditions.	As several C3 and C4 construction activities are planned for winter, abnormal winter weather (low temperatures, snow storms, snow falls, etc.) may occur during the construction leading to lower productivity, construction delay and safety risks. This could also impact use of helicopters.		T	FIN	Construction		Active		High	Low	High	$ 4.27 m	LOW	48.1. Assure capability to winterize.	48.1.1. Develop a construction plan to winterize specific section for winter works.	
																	48.1.2. Assure that contractors have proper experience of working in winter conditions.	
																	48.1.3. Perform constructability review and winterize where required (concrete plant and mobile equipment isolation, heating of aggregates).	
																	48.1.4. Consider winter works in safety plan.	
																48.2. Evaluate schedule to allow float for adverse weather.	48.2.1. Sufficient estimate for downtime caused by adverse weather (long range mountains), including helicopter use.	
																48.3. Acquire past years statistics to properly plan work.		
49	ALL	Underestimating workforce required to accomplish project.	Considering problems with early works and schedule crunching to make up for lost time, we could expect to have to increase manpower from 1500 to 2500 at a certain point to ensure work progress.		T	FIN	HR		Active		Very High	Very High	High	$ 54.9 m	VERY HIGH	49.1. Prepare camp site to be able to react quickly.	49.1.1. Ensure overcapacity of installed infrastructure to allow for additional modules hookups.	
50	ALL	Insufficient air travel to LCP sites	There is currently no agreement with airlines to provide dedicated chartered flights to LCP sites. All stakeholders will need to make their own travel arrangements with commercial airlines. There could be capacity shortage affecting worker rotations, mobility and satisfaction. Work progress acceleration capabilities as well as worker attraction and retention could be compromised.		T	FIN	HR		Active		High	Medium	Very High	$ 4.27 m	LOW	50.1. Develop and optimize manpower curves.	50.1.1. Ensure that use of resources on site is optimized.	
																	50.1.2. Limit peaks in resources.	
																	50.1.3. Adapt task sequences on schedule if necessary.	
																	50.1.4. Keep in mind where workers originate from.	
																	50.1.5. Modulate worker rotations around capacity of flights.	
																50.2. Consider negotiating an agreement with an airline.		

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51	ALL	Claims arising from contractors or suppliers.	Due to the actual project context, claims could arise for delays, lack of information and etc. and impaired project management, take focus away from priorities, deviate project execution and work progress.		T	FIN	Financial		Active		Very High	Very High	High	$ 54.9 m	VERY HIGH	51.1. Reduce numbers or value of possible claims.	51.1.1. Identify risks and issues in contracts and project context.	
																	51.1.2. Evaluate possibility of creating float in claim proned areas to limit delay claims.	
																	51.1.3. From the beginning, include possible acceleration measures in RFPs if we know that the probability of having to use them is high.	
																	51.1.4. Supply contractors with as much information on sites actual conditions as possible (surveys, investigations, studies, etc.)	
																	51.1.5. Fully elaborate design and specifications (100% complete).	
																	51.1.6. Assure materials and equipments arrive as planned.	
																	51.1.7. Transfer risks to contractors and suppliers through contract clauses (waivers, liability).	
																51.2. Develop effective claim response strategy.	51.2.1. Develop a mediation process.	
																51.3. Implement tight contract management.		
																51.4. Implement effective document management system.	51.4.1. Properly document everything: delays, damages, negligence, etc.	
																	51.4.2. File so that everything can be easily retractable.	
																51.5. Implement changes management.	51.5.1. Follow and document changes to scope or contracts.	
52	ALL	Bankruptcy of major LCP contractors or suppliers.	Bankruptcy of any significant supplier or contractor could compromise the success any of the affected scopes and ultimately the LCP.		T	FIN	Procurement		Active		Very High	Low	High	$ 14.64 m	MEDIUM	52.1. Proceed to a due diligence before awarding contract.	52.1.1. Evaluate contractors and suppliers financial strength before awarding contract.	
																52.2.. Request a letter of credit.	52.2.1. Draw-up RFPs requesting a letter of credit.	
																	52.2.2. Rapidly pull the letter of credit in case of bankruptcy.	
																52.3. Act quickly.	52.3.1. Rapidly evaluate the situation (work progress, possible damages, etc.)	
																	52.3.2. Re-scope what has to be done and grant a new contract.	