



**Westney**  
Consulting Group



# An Analysis of SNC-Lavalin's Risk Assessment Report

Discussion document  
December 2017

## Context

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- 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

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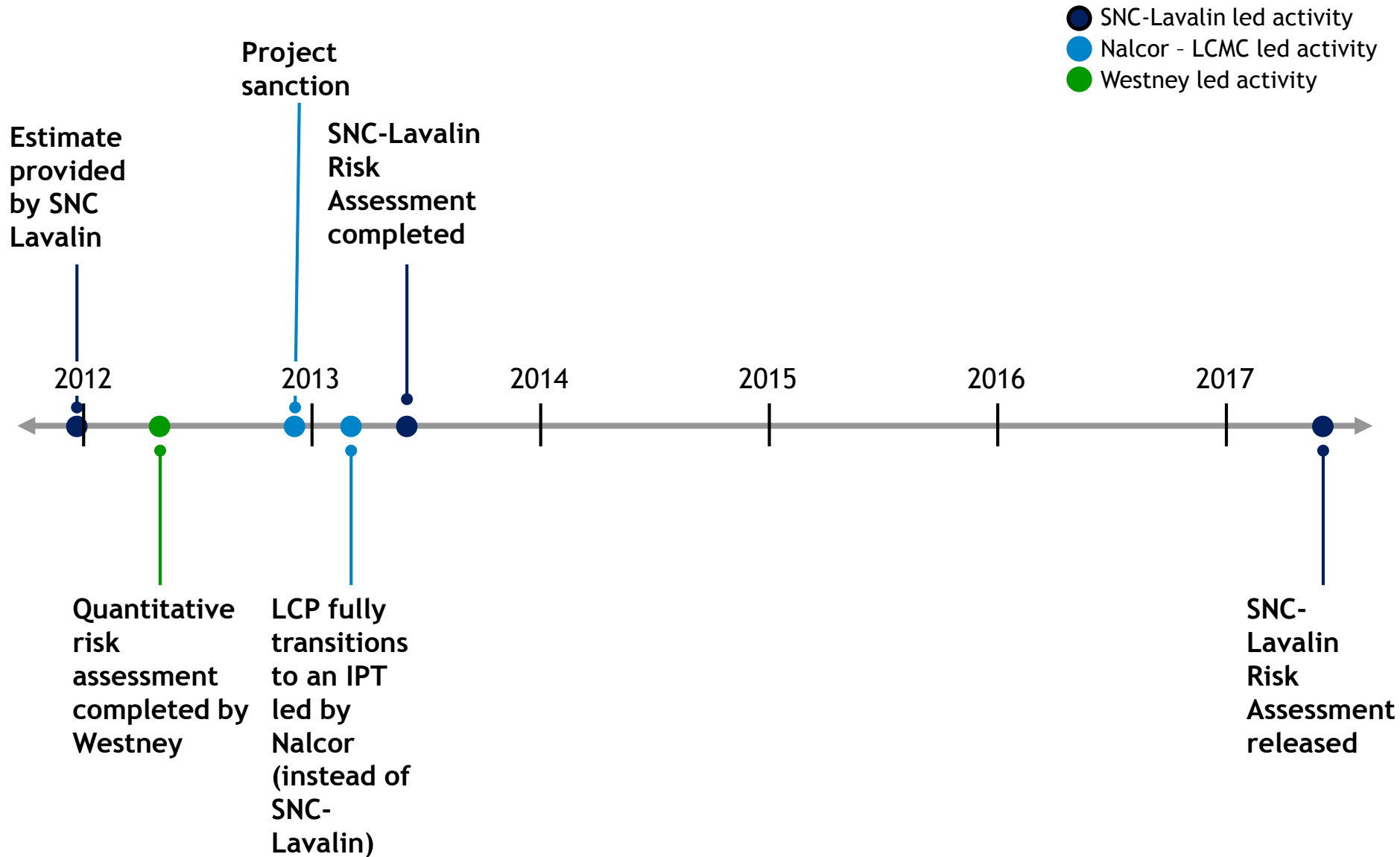


- The SNC-Lavalin Risk Assessment for the LCP developed in 2013 was never submitted to Nalcor
- No copy exists in LCMC's comprehensive document control system
- The review was not requested by LCMC management
- The document is identified as "Confidential for SNC-Lavalin Internal Use Only" and was not 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	<ul style="list-style-type: none"> <li>Westney with LCMC and SNC-Lavalin completed a quantitative risk analysis in 2012 prior to sanction</li> </ul>	4
2 The existing LCP risk register did not provide a realistic portrait of actual project risk	<ul style="list-style-type: none"> <li>All risks identified by SNC-Lavalin were included in the LCP risk register and considered in Westney's analysis</li> <li>SNC-Lavalin had several participants in Westney's risk identification and ranging sessions (which leveraged the existing LCP risk register)</li> </ul>	5 - 6
3 A clear picture of the total cost-risk exposure was not provided	<ul style="list-style-type: none"> <li>The range of outcomes from Westney's analysis were inclusive of the results in SNC-Lavalin's Risk Assessment</li> <li>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</li> </ul>	7
4 The risk management function was not empowered	<ul style="list-style-type: none"> <li>SNC-Lavalin was compensated for a full-time risk manager and a LCMC senior manager was engaged in the day-to-day risk activities</li> </ul>	
5 Mitigation plans were needed for the top 9 risks identified	<ul style="list-style-type: none"> <li>Top risks had been identified prior to sanction, with mitigations planned or already underway in 2013</li> </ul>	8

# 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 <sup>1</sup>	Nalcor-LCMC reference <sup>2</sup>
● 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

Very high<sup>3</sup>

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

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

	Risk title	Included <sup>1</sup>	Nalcor-LCMC reference <sup>2</sup>
Very high <sup>3</sup>	▪ 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 <sup>3</sup>	▪ Requirements surrounding environmental assessment release	✓	▪ KR 15
	▪ Complexity of commissioning and system integration	✓	▪ KR 13
	▪ Riverside cofferdam catastrophic flooding	✓	▪ R 12
Medium <sup>3</sup>	▪ 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 <sup>3</sup>	▪ 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

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

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

	Westney	SNC-Lavalin
<b>Cost timing assumptions</b>	<ul style="list-style-type: none"> <li>2012 C\$ (at time of estimate)</li> </ul>	<ul style="list-style-type: none"> <li>End-of-project costs</li> </ul>
<b>Estimate basis</b>	<ul style="list-style-type: none"> <li>C\$5.465 Billion</li> </ul>	<ul style="list-style-type: none"> <li>C\$6.1 Billion stated, which is likely inclusive of contingency (the amount was C\$5.8, excluding contingency)</li> </ul>
<b>Risk identification</b>	<ul style="list-style-type: none"> <li>LCP's risk register and collaborative risk identification sessions with SNC-Lavalin and Nalcor</li> </ul>	<ul style="list-style-type: none"> <li>LCP's risk register and discussion with SNC-Lavalin internal personnel</li> </ul>
<b>Risk quantification and modeling</b>	<ul style="list-style-type: none"> <li>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</li> </ul>	<ul style="list-style-type: none"> <li>Sizing of each risk based on a formula for probable consequence ("consequence" x "probability" x (1 - "manageability"))</li> <li>Probable consequences added to determine total risk</li> </ul>
<b>Analysis completion</b>	<ul style="list-style-type: none"> <li>2012</li> </ul>	<ul style="list-style-type: none"> <li>2013 (after several key bid packages had been received)</li> </ul>
<b>Cost-risk results</b>	<ul style="list-style-type: none"> <li>C\$5.8 Billion - C\$8.2 Billion<sup>1</sup> (P5 to P95, escalated to end-of-project C\$)</li> </ul>	<ul style="list-style-type: none"> <li>C\$8.2 Billion (C\$5.8 Billion + C\$2.4 Billion in risk)</li> </ul>

<sup>1</sup> P5 to P95 range in 2012 C\$ is C\$5.5 Billion - C\$7.4 Billion



# 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
<ul style="list-style-type: none"> <li>High market cost from contractors to be expected</li> </ul>	225	<ul style="list-style-type: none"> <li>Bidders were aggressively profiled</li> <li>Almost all packages bid had 4 or more bidders</li> </ul>
<ul style="list-style-type: none"> <li>Limited camp accommodation capacity at Muskrat Falls site</li> </ul>	203	<ul style="list-style-type: none"> <li>Design of the “in ground” services was changed to allow for additional camp accommodation blocks to be built as the need arose</li> </ul>
<ul style="list-style-type: none"> <li>Limited availability of skilled and experienced manpower</li> </ul>	203	<ul style="list-style-type: none"> <li>A competitive wage / labour agreement with the Hebron Project was established</li> <li>A high quality camp and accommodations was built (e.g., fiber internet, TVs in all rooms, central gym, cinema, etc.)</li> <li>An aggressive campaign was executed to attract workers from Western Canada</li> <li>Transportation was streamlined (e.g., charter aircraft, bussing from the airport)</li> </ul>
<ul style="list-style-type: none"> <li>Large packages issued for transmission lines</li> </ul>	180	<ul style="list-style-type: none"> <li>First package bid (HVac TL) was broken into small packages. Bid revealed significant savings for larger package which was leveraged for the HVdc TL</li> </ul>
<ul style="list-style-type: none"> <li>Major components outsourcing in China</li> </ul>	168	<ul style="list-style-type: none"> <li>An extensive bidding process was conducted and supplier inspections/quality reviews were completed for the proposed facilities in China</li> <li>LCP had a full-time QA team on-the-ground in China, and quality was good</li> </ul>
<ul style="list-style-type: none"> <li>Concrete works slippage from baseline schedule</li> </ul>	126	<ul style="list-style-type: none"> <li>The project schedule at sanction was recognized as a target schedule with aggressive milestones</li> </ul>
<ul style="list-style-type: none"> <li>River closure slippage from baseline schedule</li> </ul>	96	<ul style="list-style-type: none"> <li>To further de-risk schedule, a decision was made in March of 2013 to move diversion from 2015 to 2016</li> <li>Mitigations resulted in river closure, diversion, and spillway operation being achieved on schedule</li> </ul>
<ul style="list-style-type: none"> <li>Large EPC packages</li> </ul>	90	<ul style="list-style-type: none"> <li>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</li> </ul>
<ul style="list-style-type: none"> <li>No geotechnical information for dam</li> </ul>	90	<ul style="list-style-type: none"> <li>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</li> </ul>