Technical Note – Strategic Risk Analysis and Mitigation

Purpose

This document provides a summary of the continued advancement of the strategic risk analysis and mitigation work undertaken by Nalcor Energy (Nalcor) from the summer of 2010 to Decision Gate 2 – Concept Selection (DG2) in late 2010.

Background

Risk analysis is a tool which provides a framework to assist project managers in identifying and prioritizing key project schedule and cost risks/opportunities early enough to effectively mitigate risks and to take advantage of opportunities.

As part of its project work leading to DG2, Nalcor undertook an independent project review by external parties with expertise in mega project management and risk assessment.

This work was completed during the summer of 2010, allowing time in the project development for any recommendations to be considered and acted upon prior to a decision at DG2. One of the reviews was a Risk Assessment undertaken by the Lower Churchill Project team in conjunction with Westney Consultants.

For the purposes of this analysis, Nalcor categorized risks into two categories: tactical and strategic risk.

<u>Tactical Risks:</u>

Definition Risks — These risks are associated with the degree of design development and planning definition for the given project scope reflected in key project controlled documents (e.g. basis of design, basis of estimate, project execution plan), including such items as quantities, location-driven factors, etc.

Performance Risks — These risks are associated with normal/reasonably expected variations in owner and contractor performance, including such items as construction productivity risk, weather delays, material pricing, etc.

<u>Strategic Risks:</u>

Background Risks — These are typically associated with changes in: scope, market conditions, location factors, commercial or partner requirements and behaviours.

Organization Risks — These risks are typically associated with an asymmetry between size, complexity, and difficulty of projects and the organization's ability to deliver.

Assessment

When considering the level of the strategic risk reserve for the Project, progress made on mitigating and/or eliminating the strategic exposures was substantial. (A status report on actions taken to resolve and mitigate these risks between the evaluation in the summer of 2010 and DG2 is included in Appendix A.) For the reasons set out below, the following two were of particular importance:

1. Federal government support for generation and transmission investment (item 7)
2. Application of VSC technology on Island Link (item 34)

Federal government support

Negotiations with the federal government regarding support for the Project, either in the form of a loan guarantee or support through the P3 Canada Fund, were ongoing through 2010. A loan guarantee had the potential to reduce the present value of project financing costs by over $600 million, so considering this from a probabilistic view, the P50 value of the federal support could reasonably be in the order of -$300 million dollars. This risk was not quantified in the initial analysis by the Project team.

Application of VSC technology

While Voltage Source Converter (VSC) technology was identified as a potential technical solution for the Labrador Island Transmission Link, modelling completed at DG2 indicated that conventional Line Commutated Converter (LCC) technology offered equivalent performance. As a result, the technology risk (and up to $200 million exposure) was retired. Eliminating this risk could reasonably be valued at -$100 million on a P50 basis.

With the extent of the mitigation activities undertaken and in progress, and probabilistic cost reductions in the order of -$400 million being available and a P50 strategic exposure of $290 million (in the range of $187 million (P25) to $413 million (P75)), Nalcor executive determined that it was not appropriate to create a positive or negative strategic reserve amount at DG2. These factors were also considered in establishing Project tactical contingency at 15%.

Nalcor recognizes that risks identified for the development of Muskrat Falls also transcend both alternatives so work continues to ensure a thorough and diligent approach to risk management and mitigation in the alternative business case. For example, Nalcor is closely following the oil price forecast which represents a considerable risk in the Isolated Island scenario and is closely monitoring the potential for near term green house gas costs as a result of emissions regulation.

Substantial work continues on both risk assessment and risk mitigation at both the tactical and strategic levels as the project advances. A prudent and thorough approach to risk management is a cornerstone of Nalcor's approach to the development.

Appendix A – Strategic Risk Management and Mitigation Progress at Decision Gate 2

Strategic Risk	Summer 2010 View of Mitigated Risk Exposure	Year End 2010 View of Mitigated Risk Exposure
1. Organizational experience and resources for a project of this size	-$50 to $10 million	Led to Engineering Contractor EOI and RFP, with selection of SNC-Lavalin as EPCM Contractor High quality Owner Team personnel selected to fill key positions This risk has been largely mitigated with an experienced EPCM contractor
2. Time required under Crown Corporation rules to gain approval	$4 to $10 million	Gatekeeper has maintained regular engagement with shareholder to maintain alignment Clear decision making process in place with shareholder and clear distinction between policy and execution roles. VP-LCP has regular engagement at DM level with key government departments to communicate issues and to streamline decision making
3. Changes in financial markets	Not applicable	Interest rates used in financial modelling based on advice from LCP financial advisors and close engagement with financial markets Risk is significantly mitigated with federal loan guarantee
4. Foreign currency exchange risk	$10 million	Project team has used appropriate $US/$CAN exchange rate ($1CAN=$0.95US) Currency purchases will be hedged to the degree possible
5. Risk Premium for obtaining lump sum contracts	Not applicable	Province has fiscal capacity to invest significant equity into the project

6. Extra time required to secure long-term PPA's	$0 to $24 million	This risk has been eliminated based on decision to advance domestic solution that does not require external long-term PPA's
7. Federal government support for generation and transmission projects	Not quantified by summer of 2010 analysis	Federal loan guarantee has potential to reduce borrowing costs significantly, up to $600M -$600 million to $0
8. Changing power market portfolio requires changes in scope	Not applicable	This risk has not materialized, and the basis of design has been confirmed
9. Good HSE record is critical for project success	$10 to $20 million	Following mitigation approaches outlined in risk review. HSE continues to be the highest priority Nalcor has a high and sustained focus corporately and organization wide on HSE
10. Availability of resources to achieve a quality design	-$10 to $10 million	Mitigated with engagement of SNC Lavalin who have considerable project engineering resources
11. Submarine cable crossing	$0 to $50 million	Feasibility of shore approach, crossing methods, protection scheme, as well as iceberg risk assessment has confirmed the feasibility of the sea bed crossing option Residual risk exposure is associated with project execution
12. Faults in submarine cable during commissioning and post installation	$0 to $15 million	Mitigation measures include the selection of mass impregnated cable type which has longer operational track record at the selected operating voltage Basis of design calls for an installed spare cable and installation methods are tried and tested offshore NL

		Although it is not possible to completely mitigate this risk, the measures that are being implemented will significantly reduce risk exposure
13. System reliability during commissioning and startup	$5 to $15 million	factory acceptance testing and owner involvement in these tests along with the project philosophy of using proven technology and high quality suppliers has mitigated this risk exposure Further measures will be taken to ensure system reliability in subsequent project phases
14. Securing generation project release from EA	$0 to $5 million	Necessary resources were deployed during the EA, and the hearing process is completed EA clarity will be obtained prior to sanction- project will not proceed without EA approval by the Ministers
15. Environmental process impact on design	$0 million	No material changes to generation design were made during EA process. Transmission changes to date are not material.
16. Unanticipated design changes from EA process	$0 million	Although there were no changes recommended by regulators during EA hearing, this remains a potential risk.
17. Schedule impact due to delay in ratification of IBA by Innu Nation	$0 to $10 million	IBA is ratified. This risk has been retired.
18. Lack of support from other aboriginal groups	$0 to $10 million	Extensive consultation program in compliance with EA guidelines undertaken, however the possibility of action by other aboriginal groups remains
19. Non-governmental organization /	$0 to $10 million	Extensive communications efforts undertaken by Nalcor and the EA

stakeholder protest		process is comprehensive and process driven Potential of protest or other actions remains
20. Availability of experienced hydro contractors	$0 to $10 million	Following mitigation approaches outlined in risk review.
21. Ability to use Newfoundland and Labrador contractors due to creditworthiness	Not Applicable	Following mitigation approaches outlined in risk review.
22. Availability of qualified construction management and supervision	-$100 to $10 million	Following mitigation approaches outlined in risk review.
23. Site conditions worse than geotechnical baseline	$0 to $75 million	Extensive geotechnical programs undertaken
24. Availability and retention of skilled construction labour	$0 to $20 million	Following mitigation approaches outlined in risk review.
25. Availability of unskilled construction labour	Not Applicable	Following mitigation approaches outlined in risk review.
26. Limited number of creditworthy hydro turbine suppliers	$0 to $50 million	Turbine modelling with 3 suppliers undertaken as phase II activity to reduce this exposure
27. De-escalation and hyperinflation risks	$0	This risk still exists, but Nalcor is following summer 2010 mitigation recommendations
28. Availability of experienced high voltage contractors and skilled labour	$0 to $20 million	This risk still exists, but mitigation activities outlined in risk review will continue.
29. Limited number of HVdc specialties suppliers and installers	$0 to $35 million	Three LCC HVdc converter suppliers are available HVdc cable RFP will be released in 2011 as a phase II activity, at least three bidders are likely
30. Island Link and Maritime Link EA's	$0 million to $25 million	Labrador Island Transmission Link community consultation activities

result in late design changes		undertaken. Community issues (alignment with TLH and relocation of electrode to Strait of Belle Isle) have been addressed in early design.
31. Willingness of shareholder to fund early construction	$0 to $25 million	Value of early start with shareholder funding will be discussed as part of Phase III planning Shareholder and Federal support have mitigated this risk significantly
32. Delay in release of Labrador Island Transmission Link	$0	Comprehensive study / EIS announced. Final EA guidelines released. EIS preparation on schedule.
33. Uncertainty on commercial structure for transmission	$0	Commercial structure is established for Labrador Island Transmission Link and Maritime Link.
34. Failure of application of VSC HVdc technology for Island Link	$0 to $200	This risk is retired Phase II modelling has shown that conventional LCC technology has equivalent performance to VSC

Appendix B – Risk Analysis Results for the Option of Muskrat Falls First plus the Island Link
June – July 2010

Risk Analysis Results for the Option of Muskrat Falls First plus the Island Link
June-July 2010

Risk Resolution®

Westney™

Consulting Group, Inc.
www.westney.com

General Information

It is important to note that the scope of work for Westney Consulting Group was for Westney to guide and facilitate the Risk Ranging Process, using the consultants' experience to ask the right questions and, where appropriate, challenge the Nalcor participant's thinking. This resulted in an outcome of the analysis that represented the best thinking and efforts of both the Nalcor participants and the consultants from Westney.

Contents

Consultants' Comments

- The work included in this report builds upon previous risk analyses for the Lower Churchill Project. However, the project in this option is defined somewhat differently than it was in the fall of 2009:

  1) the smaller and technically less complex Muskrat Falls plant has replaced the Gull Island plant as the first phase of the total project;

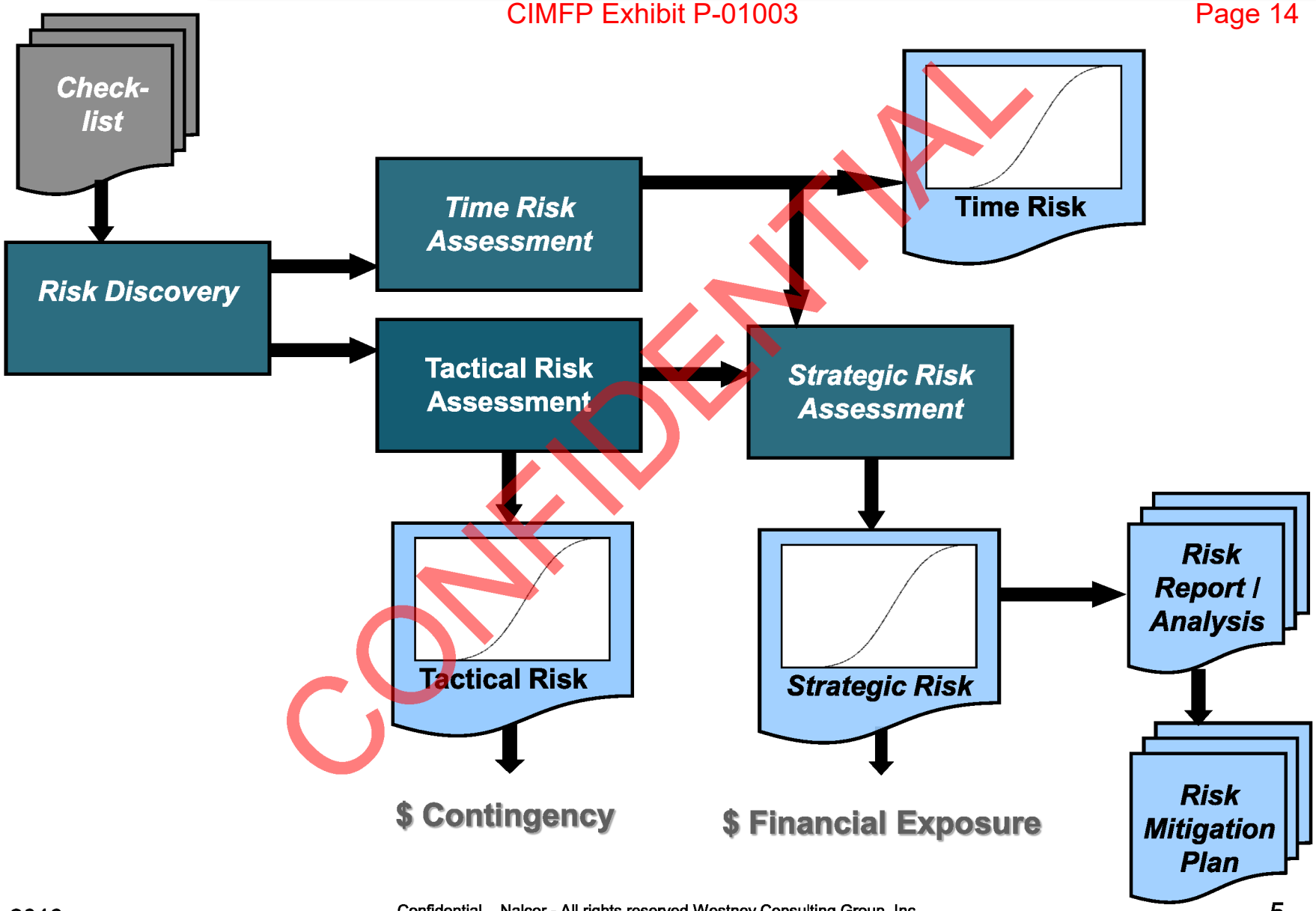
  2) the first phase project is no longer envisioned to require project financing; and

  3) the assumptions for handling power sales are now different, with the Maritime Link now viewed as a separate project phase.

- The project's first phase option of a smaller size and less complex structure have a significant impact on the results of the risk analyses, with many of the Gull Island strategic risks no longer being applicable for Muskrat Falls. However, it should be noted that much of the analysis for the Muskrat Falls plant is still in a more preliminary stage than the analysis for the Gull Island plant. Therefore, the probability distributions chosen for the Muskrat Falls risk analyses reflect the higher levels of uncertainty that would be associated with a less mature project.

- As the Muskrat Falls analysis matures, it would be appropriate to consider updating these preliminary risk assessments, especially the Strategic Risk Assessment, where a preliminary risk assessment is less likely to fully capture the impact of unique risks.

The Westney Risk Resolution® Process



Basis of Assessment

Project Components*

1) Muskrat Falls 824 MW Plant
2) 600 MW 250kV HVdc Island Link (50-year return period)

*Consistent with client Capital Cost Case 8

Cost Estimates+

1) Muskrat Falls Plant: $2,215 million
2) Island Link: $1,144 million

+Estimates are in C$ and do not include any contingency

Current Project Schedule

Ready to Start Site Work at Muskrat Falls	19-Jun-11
First Power	22-Sep-16
Island Link Ready for Power Delivery	7-Feb-17
Full Commercial Power	16-May-17

Assessment Summary

Time Risk	The modeled results show a predictive range (P25 to P75) for Full Commercial Power of February 2018 to September 2018, which equates to 9 to 16 months later than the current schedule of May 2017.	Almost half of this delay is due to schedule slippage that occurs from Powerhouse Excavation (Task 29) through Commissioning of the final turbine/generator unit (Task 51) – (slippage is driven by powerhouse excavation and concreting). About two months of the delay is associated with the Generation Project EA (Task 16) and the EP+CM Bid and Award (Task 8).
Tactical Risk	The predictive range for the Tactical-Risk analysis for Muskrat Falls and the Island Link is $3,469 million to $4,367 million, with the P50 value being $3,885 million.	The P50 value of $3,885 million compares to an estimate of $3,359 million, suggesting that an estimate contingency of $526 million (16%) would be appropriate for Muskrat Falls combined with the Island Link.
Strategic Risk	The predictive range for the Unmitigated Risk Exposure is $490 million to $852 million; the predictive range for the Mitigated Risk Exposure drops to $187 million to $413 million.	It is recommended that a reserve be established to cover the Mitigated Risk Exposure level of $413 million. This reserve is in addition to the contingency and equates to approximately 12% of the estimate.

Time-Risk Assessment

Basis of Assessment

Time-Risk Model

A Time-Risk model was built for the Muskrat Falls Plant and the Island Link using Microsoft Project. The model logic incorporates the dates, durations, and key dependencies (including weather modeling) that are contained in the current project master schedule. The key activities were identified and framed by Nalcor.

Westney consultants met with Nalcor representatives at Nalcor's St. John's office to discuss possible outcomes for each modeled activity. The final ranging was performed by the Nalcor team, but it was vetted and questioned by the Westney participants. The modeling simulation was performed by Westney using the @Risk Monte Carlo technique with 10,000 iterations.

Assessment Results

Time-Risk Results

The modeled results had a predictive range for Full Commercial Power approximately 9 to 16 months after the currently scheduled date of May 16, 2017.

Predictive Range	
P25	P75
19-Feb-2018	30-Sep-2018

These results are driven by modeled delays in several key activities, particularly Powerhouse Excavation and Powerhouse Concreting (Primary and Secondary). The critical path In the simulation included Muskrat Falls construction activities almost 80% of the time.

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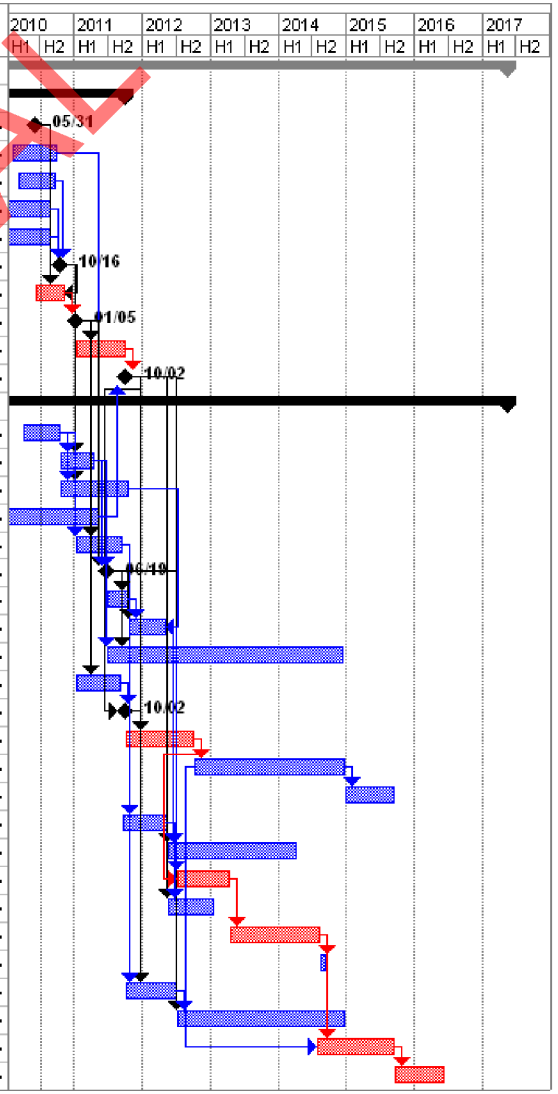
ID	Name	Duration	Start	Finish	Predecessors	@RISK: Critical Index
0	**Nalcor Energy - Lower Churchill Project - June 2010**	**3820 d**	**12/01/06**	**05/16/17**		
1	**Gateway Phase 2 Activities / Readiness to Mobilize EP+CM**	**824 d**	**07/01/09**	**10/02/11**		**17.00%**
2	Ready to Issue EP+CM RFP	0 d	05/31/10	05/31/10		47.90%
3	Ratification of IBA by Innu Nation	240 d	02/01/10	09/28/10		0.36%
4	Business Case Comfort Achieved by Gatekeeper	200 d	03/01/10	09/16/10		11.09%
5	Project Team Phase 3 Readiness Preparation (incl. IPR)	240 d	01/01/10	08/28/10		4.57%
6	Complete Phase 2 Concept Opt. Studies (SOBI, MF, VSC)	420 d	07/01/09	08/24/10		0.20%
7	Gate 2 Approval	0 d	10/16/10	10/16/10	4FS+30 d,6,5	15.86%
8	EP+CM Bid and Award	160 d	05/31/10	11/06/10	7FF,2	63.44%
9	EP+CM Contractor Mobilized	0 d	01/05/11	01/05/11	8FS+60 d	63.44%
10	Gate 3 Key Deliverables	270 d	01/06/11	10/02/11	9	22.21%
11	Project Sanction	0 d	10/02/11	10/02/11	10,16	22.70%
12	**Muskrat Falls (824 MW) Plant**	**3820 d**	**12/01/06**	**05/16/17**		**78.81%**
13	Early Works Infrastructure Engineering & Procurement	200 d	04/01/10	10/17/10		1.07%
14	Early Civil Works & Reservoir Clearing Contracting	180 d	10/18/10	04/15/11	13,7FS-60 d	1.06%
15	Phase 1 Camp - Vendor Engineering, Fab & Deliver	365 d	10/18/10	10/17/11	7FS-60 d,13	0.26%
16	Generation Project EA	1620 d	12/01/06	05/08/11		29.83%
17	Initial Critical Contracting for Engineering Detailed Design	250 d	01/06/11	09/12/11	9,13	17.92%
18	Readiness to Commence Site Work	0 d	06/19/11	06/19/11	16FS+42 d,3,14,9FS+90 d	31.24%
19	Access Road & Early Site Roads Infrastructure	120 d	06/20/11	10/17/11	18	30.67%
20	Phase 1 Camp Construction	200 d	10/18/11	05/04/12	15FF+90 d,18,19	30.93%
21	Reservoir Clearing (incl. decomm.) & Habitat Compensation	1275 d	06/20/11	12/15/14	14,18	0.57%
22	T/G - Prepare Specification and Tender Process	240 d	01/06/11	09/02/11	9	5.88%
23	Award Turbine / Generator Contract	0 d	10/02/11	10/02/11	22,11	28.56%
24	T/Gs - Vendor Design, Model Test, Completion of Basic Des.	365 d	10/03/11	10/01/12	23	28.56%
25	T/Gs - Shop Detailing, Fabrication, & Delivery - Unit 1	810 d	10/02/12	12/20/14	24	0.63%
26	T/Gs - Additional Time for Delivery of Final Unit	270 d	12/21/14	09/16/15	25	0.62%
27	Contracting for Civil Works (Pwrhse, Spill., North Spur, RCC)	240 d	09/13/11	05/09/12	17	17.91%
28	Spillway (Phase 1) - Excavation, Concrete & Gates	700 d	05/10/12	04/09/14	27,20,11FS+60 d	0.16%
29	Powerhouse Excavation (Incl Intake & Tailrace)	280 d	07/04/12	04/09/13	27,20,24FS-90 d,11FS+60 d	76.61%
30	North Spur Work (Pre Phase 1 Impoundment)	250 d	05/10/12	01/14/13	27,18,11FS+60 d	0.00%
31	Intake & Powerhouse Primary Concrete	488 d	04/10/13	08/10/14	29	76.61%
32	Complete Powerhouse Crane Installation	30 d	08/11/14	09/09/14	31	0.00%
33	Contracting for 345 kV Hvac and CF Yard Ext. Mat. & Constr.	270 d	10/03/11	06/28/12	17,11	0.02%
34	345 kV HVac TL to CF	908 d	06/29/12	12/23/14	33,18	0.01%
35	Powerhouse Secondary Concreting for Unit 1	420 d	07/22/14	09/14/15	31FS-20 d,25SS+25%	76.61%
36	Completion of Secondary Concrete for Units 2 - 4	270 d	09/15/15	06/10/16	35	75.73%



Time-Risk Model (continued)

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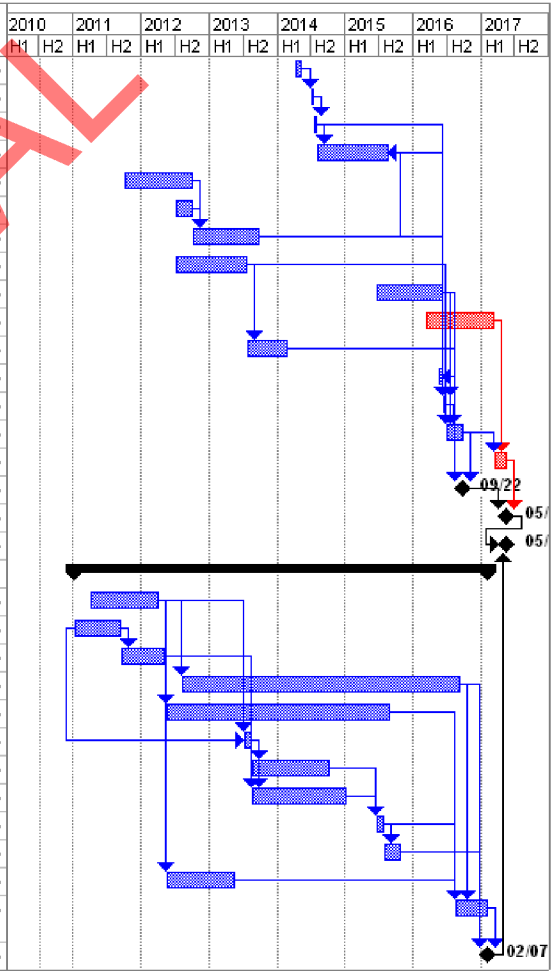
ID	Name	Duration	Start	Finish	Predecessors	@RISK: Critical Index
37	Spillway - Upstream & Downstream Plug Removals	28 d	04/10/14	05/07/14	28	0.16%
38	Close Cofferdam	14 d	07/01/14	07/14/14	37	0.96%
39	Stage 1 Impoundment	14 d	07/15/14	07/28/14	30,38	0.96%
40	North Dam (Foundation & Dam)	220 d	07/29/14	08/18/15	39,43FF	0.96%
41	"Year after Project Sanction (Task 11)"	365 d	10/03/11	10/01/12	11	0.00%
42	"90 Days after Start of Powerhouse Excavation (Task 27)"	90 d	07/04/12	10/01/12	29SS	0.00%
43	South Dam (RCC)	194 d	10/02/12	09/26/13	27,18,41,42	0.00%
44	CF Switchyard Mods	222 d	06/29/12	07/21/13	33,18	0.02%
45	T/G - Assembly/Installation Unit 1	365 d	06/12/15	06/10/16	35FF+270 d,32FF-180 d,25	0.89%
46	T/G - Assembly/Installation Final Unit	365 d	03/08/16	03/07/17	26,36FF+270 d	76.35%
47	Construct MF Switchyard	220 d	07/22/13	02/26/14	44,18	0.02%
48	Tailrace Plug Removal	28 d	05/14/16	06/10/16	29,31,45FF	0.89%
49	Stage 2 Impoundment	14 d	06/11/16	06/24/16	39,48,43,40,21FF	2.42%
50	T/G - Commissioning Unit 1	90 d	06/25/16	09/22/16	45,49,44,34,47	2.45%
51	T/G - Commissioning Final Unit	70 d	03/08/17	05/16/17	50,46	78.80%
52	First Power (Unit 1)	0 d	09/22/16	09/22/16	47,50,34	0.00%
53	Full Power (Unit 4)	0 d	05/16/17	05/16/17	52,51	78.80%
54	**Full Commercial Power**	0 d	05/16/17	05/16/17	53,68	100.00%
55	**Island Link 600 MW (250 kV) HVdc VSC Link**	**2225 d**	**01/06/11**	**02/07/17**		**21.20%**
56	Island Link EA	365 d	04/01/11	03/30/12	7	1.11%
57	Initial Critical Contracting for Engineering Detailed Design	250 d	01/06/11	09/12/11	9	17.01%
58	Complete Contracting and Procurement	235 d	09/13/11	05/04/12	57	15.60%
59	HVdc TL Overland Construction - MF to Soldier's Pond	1500 d	08/03/12	09/10/16	56FS+44 d,7,58FS+90 d,11	16.69%
60	Soldier's Pond and Muskrat Falls Converter Stations	1200 d	05/12/12	08/24/15	56FS+42 d,7,11	0.03%
61	SOBI Cable Survey	42 d	07/05/13	08/15/13	56,7,57SS+520 d,58,11	1.43%
62	SOBI Design, Type Test & Manufacturing	420 d	08/16/13	10/09/14	61	1.06%
63	SOBI Cable Landfall and Protection Preparation	510 d	08/16/13	01/07/15	58,61	0.37%
64	SOBI Cable Installation (with weather window)	45 d	06/15/15	07/29/15	6,62,63	4.48%
65	Finalize SOBI Cable Protection Scope	90 d	07/30/15	10/27/15	6,64	3.05%
66	Island System Upgrades and Reinforcements	365 d	05/12/12	05/11/13	56FS+42 d	0.00%
67	System Testing and Commissioning	180 d	08/12/16	02/07/17	64FS-30 d,66FS-60 d,60FS-60 d,59FS-30 d	18.15%
68	Island Link Ready for Power Delivery	0 d	02/07/17	02/07/17	59,67,65	21.20%



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Lower Churchill Project Time-Risk Assessment

Ranging Sheet - Base Case

		Time-Risk Model			Changes in Months	
ID	Task Description	Duration	Start	Finish	Best	Worst
01	**Gateway Phase 2 Activities / Readiness to Mobilize EP+CM**	**824 d**	**1-Jul-09**	**2-Oct-11**		
02	Ready to Issue EP+CM RFP	0 d	31-May-10	31-May-10	0.5	1.5
03	Ratification of IBA by Innu Nation	240 d	1-Feb-10	28-Sep-10	3	8
04	Business Case Comfort Achieved by Gatekeeper	200 d	1-Mar-10	16-Sep-10	-0.5	3.5
05	Project Team Phase 3 Readiness Preparation (incl. IPR)	240 d	1-Jan-10	28-Aug-10	0	4
06	Complete Phase 2 Concept Optimization Studies (SOBI, MF, VSC)	420 d	1-Jul-09	24-Aug-10	0	2
07	**Gate 2 Approval**	**0 d**	**16-Oct-10**	**16-Oct-10**		
08	EP+CM Bid and Award	160 d	31-May-10	6-Nov-10	0	3
09	**EP+CM Contractor Mobilized**	**0 d**	**5-Jan-11**	**5-Jan-11**		
10	Gate 3 Key Deliverables	270 d	6-Jan-11	2-Oct-11	-2	4
11	**Project Sanction**	**0 d**	**2-Oct-11**	**2-Oct-11**		
12	**Muskrat Falls (824 MW) Plant**	**3820 d**	**1-Dec-06**	**16-May-17**		
13	Early Works Infrastructure Engineering & Procurement	200 d	1-Apr-10	17-Oct-10	-1	2
14	Early Civil Works & Reservoir Clearing Contracting	180 d	18-Oct-10	15-Apr-11	0	2
15	Phase 1 Camp - Vendor Engineering, Fab & Deliver	365 d	18-Oct-10	17-Oct-11	-1.5	3
16	Generation Project EA	1620 d	1-Dec-06	8-May-11	0	8
17	Initial Critical Contracting for Engineering Detailed Design	250 d	6-Jan-11	12-Sep-11	-1	3
18	**Readiness to Commence Site Work**	**0 d**	**19-Jun-11**	**19-Jun-11**		
19	Access Road & Early Site Roads Infrastructure	120 d	20-Jun-11	17-Oct-11	-1	2
20	Phase 1 Camp Construction	200 d	18-Oct-11	4-May-12	-1	3
21	Reservoir Clearing (incl decommissioning) & Habitat Compensation	1275 d	20-Jun-11	15-Dec-14	0	15
22	T/G - Prepare Specification and Tender Process	240 d	6-Jan-11	2-Sep-11	-1	2
23	**Award Turbine / Generator Contract**	**0 d**	**2-Oct-11**	**2-Oct-11**		

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Lower Churchill Project Time-Risk Assessment

Ranging Sheet - Base Case

		Time-Risk Model			Changes in Months	
ID	Task Description	Duration	Start	Finish	Best	Worst
24	T/Gs - Vendor Design, Model Test, Completion of Basic Design	365 d	3-Oct-11	1-Oct-12	-3	2
25	T/Gs - Shop Detailing, Fabrication, & Delivery - Unit 1	810 d	2-Oct-12	20-Dec-14	-3	2
26	T/Gs - Additional Time for Delivery of Final Unit	270 d	21-Dec-14	16-Sep-15	-3	3
27	Contracting for Civil Works (Powerhouse, Spillway, North Spur, RCC)	240 d	13-Sep-11	9-May-12	0	2
28	Spillway (Phase 1) - Excavation, Concrete & Gates	700 d	10-May-12	9-Apr-14	-2	4
29	Powerhouse Excavation (Incl Intake & Tailrace)	280 d	4-Jul-12	9-Apr-13	0	6
30	North Spur Work (Pre Phase 1 Impoundment)	250 d	10-May-12	14-Jan-13	-2	4
31	Intake & Powerhouse Primary Concrete	488 d	10-Apr-13	10-Aug-14	-2	6
32	Complete Powerhouse Crane Installation	30 d	11-Aug-14	9-Sep-14	-0.5	1
33	Contracting for 345 kV Hvac and CF Yard Ext. Materials and Constr.	270 d	3-Oct-11	28-Jun-12	-1	3
34	345 kV HVac TL to CF	908 d	29-Jun-12	23-Dec-14	-3	6
35	Powerhouse Secondary Concreting for Unit 1	420 d	22-Jul-14	14-Sep-15	-2	4
36	Completion of Secondary Concrete for Units 2 - 4	270 d	15-Sep-15	10-Jun-16	-1	2
37	Spillway - Upstream & Downstream Plug Removals	28 d	10-Apr-14	7-May-14	-0.5	0.5
38	Close Cofferdam	14 d	1-Jul-14	14-Jul-14	0	0.5
39	**Stage 1 Impoundment**	**14 d**	**15-Jul-14**	**28-Jul-14**		
40	North Dam (Foundation & Dam)	220 d	29-Jul-14	18-Aug-15	-1	2
41	**"Year after Project Sanction (Task 11)"**	**365 d**	**3-Oct-11**	**1-Oct-12**		
42	**"90 Days after Start of Powerhouse Excavation (Task 27)"**	**90 d**	**4-Jul-12**	**1-Oct-12**		
43	South Dam (RCC)	194 d	2-Oct-12	26-Sep-13	-1	3
44	CF Switchyard Mods	222 d	29-Jun-12	21-Jul-13	-2	4
45	T/G - Assembly/Installation Unit 1	365 d	12-Jun-15	10-Jun-16	-2	2
46	T/G - Assembly/Installation Final Unit	365 d	8-Mar-16	7-Mar-17	-1.5	1.5

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Lower Churchill Project Time-Risk Assessment

Ranging Sheet - Base Case

		Time-Risk Model			Changes in Months	
ID	Task Description	Duration	Start	Finish	Best	Worst
47	Construct MF Switchyard	220 d	22-Jul-13	26-Feb-14	0	4
48	**Tailrace Plug Removal**	**28 d**	**14-May-16**	**10-Jun-16**		
49	**Stage 2 Impoundment**	**14 d**	**11-Jun-16**	**24-Jun-16**		
50	T/G - Commissioning Unit 1	90 d	25-Jun-16	22-Sep-16	-0.5	3
51	T/G - Commissioning Final Unit	70 d	8-Mar-17	16-May-17	0	2
52	**First Power (Unit 1)**	**0 d**	**22-Sep-16**	**22-Sep-16**		
53	**Full Power (Unit 4)**	**0 d**	**16-May-17**	**16-May-17**		
54	**Full Commercial Power**	**0 d**	**16-May-17**	**16-May-17**		
55	**Island Link 600 MW (250 kV) HVdc VSC Link**	**2225 d**	**6-Jan-11**	**7-Feb-17**		
56	Island Link EA	365 d	1-Apr-11	30-Mar-12	0	6
57	Initial Critical Contracting for Engineering Detailed Design	250 d	6-Jan-11	12-Sep-11	-1	4
58	Complete Contracting and Procurement	235 d	13-Sep-11	4-May-12	0	4
59	HVdc TL Overland Construction - MF to Soldier's Pond	1500 d	3-Aug-12	10-Sep-16	-6	6
60	Soldier's Pond and Muskrat Falls Converter Stations	1200 d	12-May-12	24-Aug-15	-2	4
61	SOBI Cable Survey	42 d	5-Jul-13	15-Aug-13	-0.5	0.5
62	SOBI Design, Type Test & Manufacturing	420 d	16-Aug-13	9-Oct-14	-3	12
63	SOBI Cable Landfall and Protection Preparation	510 d	16-Aug-13	7-Jan-15	-6	6
64	SOBI Cable Installation (with weather window)	45 d	15-Jun-15	29-Jul-15	-0.5	0.5
65	Finalize SOBI Cable Protection Scope	90 d	30-Jul-15	27-Oct-15	-1	3
66	Island System Upgrades and Reinforcements	365 d	12-May-12	11-May-13	-2	6
67	System Testing and Commissioning	180 d	12-Aug-16	7-Feb-17	-1	6
68	**Island Link Ready for Power Delivery**	**0 d**	**7-Feb-17**	**7-Feb-17**		
	Last Line					

Time-Risk Assessment Results

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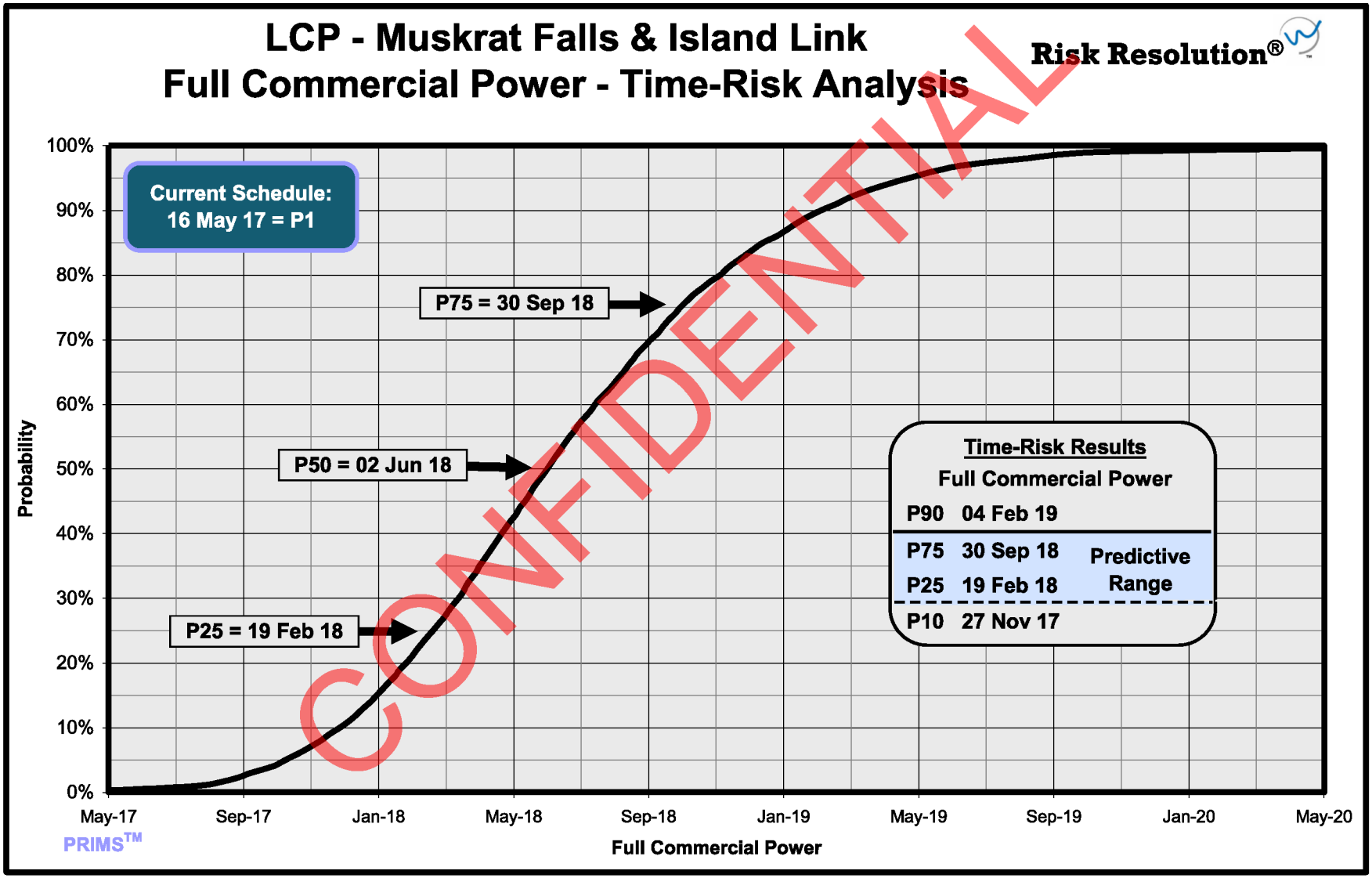

Time-Risk Assessment Results

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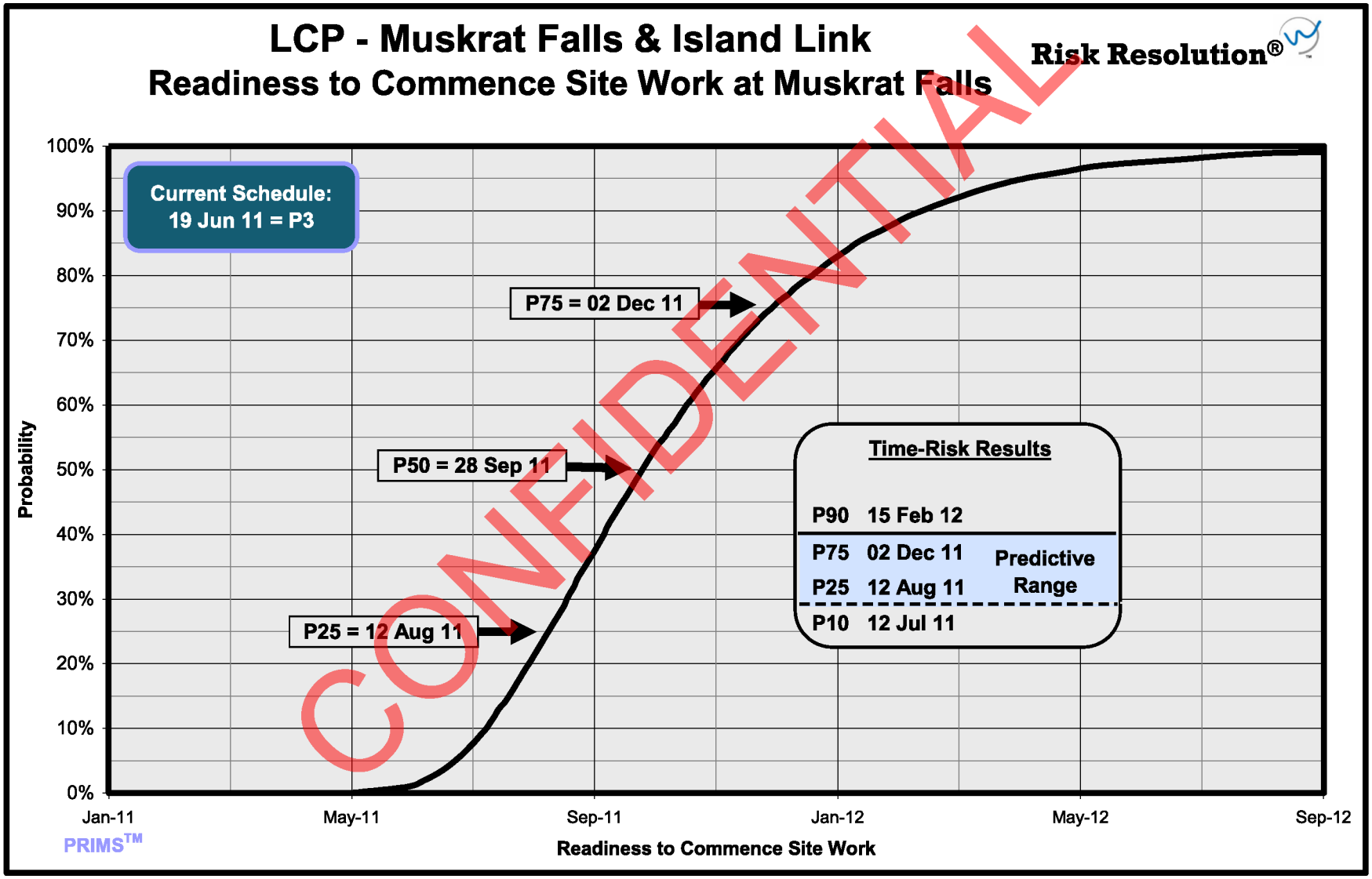


Time-Risk Assessment Results

LCP - Muskrat Falls and Island Link - Timing of Key Tasks/Milestones

Task	Current Schedule	Time-Risk Model Results P25	P50	P75	Difference (P50 - Schedule)
9 - EP+CM Contractor Mobilized	05-Jan-11	26-Feb-11	21-Mar-11	17-Apr-11	2.5 months
16 - Generation Project EA (finish)	08-May-11	17-Jun-11	09-Aug-11	18-Oct-11	3.0 months
18 - Ready to Start Site Work at Muskrat Falls	19-Jun-11	12-Aug-11	28-Sep-11	02-Dec-11	3.5 months
23 - Award Turbine / Generator Contract	02-Oct-11	10-Dec-11	24-Jan-12	18-Mar-12	3.5 months
28 - Spillway (Phase 1) - (start)	10-May-12	15-Sep-12	02-Nov-12	03-Jan-13	5.5 months
52 - First Power (Unit 1)	22-Sep-16	21-May-17	07-Sep-17	04-Jan-18	11.5 months
56 - Island Link EA (finish)	30-Mar-12	29-Apr-12	09-Jun-12	02-Aug-12	2.5 months
64 - SOBI Cable Installation (finish)	29-Jul-15	02-Aug-15	11-Jul-16	01-Aug-16	11.5 months
68 - Island Link Ready for Power Delivery	07-Feb-17	13-Jun-17	02-Oct-17	03-Mar-18	8.0 months
54 - Full Commercial Power	16-May-17	19-Feb-18	02-Jun-18	30-Sep-18	12.5 months

Analysis of Probabilistic Critical Path

In the early portion of the Time-Risk model, there are primarily two parallel paths which share the probabilistic critical path:

- EP+CM Bid and Award (Task 8) – on the probabilistic critical path in approximately 64% of the iterations; the timing for Gate 2 Approval has only a modest impact on this task (critical 17% of the time)

- Generation Project EA (Task 16) - on the probabilistic critical path in approximately 30% of the iterations

Analysis of Probabilistic Critical Path

In the middle portion of the Time-Risk model, there are primarily four parallel paths which share the probabilistic critical path:

- Generation Project EA (Task 16) through Phase 1 Camp Construction (Task 20) to Powerhouse Excavation (Task 29) – on the probabilistic critical path in approximately 31% of the iterations

- EP+CM Contractor Mobilized (Task 9) through Gate 3 Key Deliverables (Task 10) and T/Gs – Vendor Design, Model Test, Completion of Basic Design (Task 24) to Powerhouse Excavation (Task 29) – critical 29% of the time

- EP+CM Contractor Mobilized (Task 9) through Contracting for Civil Works (Task 27) to Powerhouse Excavation (Task 29) – critical 18%

- EP+CM Contractor Mobilized (Task 9) to Island Link Initial Critical Contracting for Engineering Detailed Design – critical 18%

Analysis of Probabilistic Critical Path

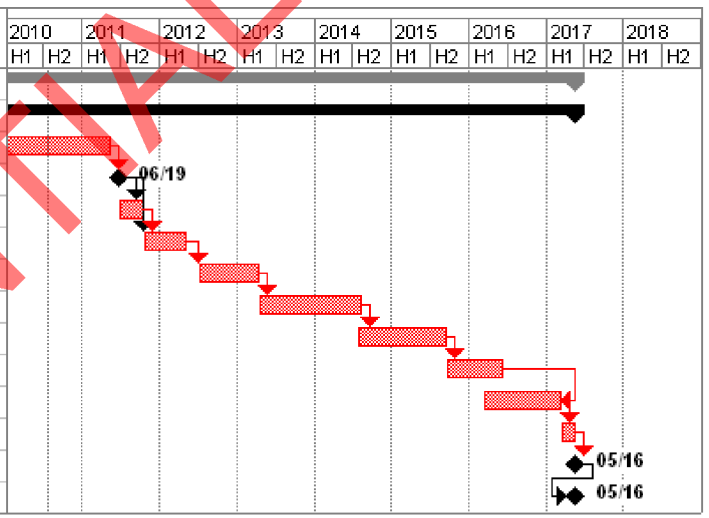
In the later portion of the Time-Risk model, there are primarily two parallel paths which share the probabilistic critical path:

- Powerhouse Excavation (Task 29) through T/G – Commissioning Final Unit (Task 51) to Full Commercial Power (Task 54) – on the probabilistic critical path in approximately 80% of the iterations

- Island Link Initial Critical Contracting for Engineering Detailed Design (Task 57) through Island Link System Testing and Commissioning (Task 67) to Full Commercial Power (Task 54) - on the probabilistic critical path in approximately 20% of the iterations

Most Common Probabilistic Critical Path

ID	Name	Duration	Start	Finish	@RISK: Critical Index
0	**Nalcor Energy - Lower Churchill Project - June 2010**	**3820 d**	**12/01/06**	**05/16/17**	
12	**Muskrat Falls (824 MW) Plant**	**3820 d**	**12/01/06**	**05/16/17**	**78.81%**
16	Generation Project EA	1620 d	12/01/06	05/08/11	29.83%
18	Readiness to Commence Site Work	0 d	06/19/11	06/19/11	31.24%
19	Access Road & Early Site Roads Infrastructure	120 d	06/20/11	10/17/11	30.67%
20	Phase 1 Camp Construction	200 d	10/18/11	05/04/12	30.93%
29	Powerhouse Excavation (Incl Intake & Tailrace)	280 d	07/04/12	04/09/13	76.61%
31	Intake & Powerhouse Primary Concrete	488 d	04/10/13	08/10/14	76.61%
35	Powerhouse Secondary Concreting for Unit 1	420 d	07/22/14	09/14/15	76.61%
36	Completion of Secondary Concrete for Units 2 - 4	270 d	09/15/15	06/10/16	75.73%
46	T/G - Assembly/Installation Final Unit	365 d	03/08/16	03/07/17	76.35%
51	T/G - Commissioning Final Unit	70 d	03/08/17	05/16/17	78.80%
53	Full Power (Unit 4)	0 d	05/16/17	05/16/17	78.80%
54	**Full Commercial Power**	0 d	05/16/17	05/16/17	100.00%



* The task network identified above represents the most commonly occurring unique critical path in the Monte Carlo simulation. There are several individual tasks, not on this unique critical path, which have a significant impact on the Time-Risk results. The individual tasks most critical to the Time-Risk results are identified on slides 21 and 22.

Time-Risk Tornado Chart

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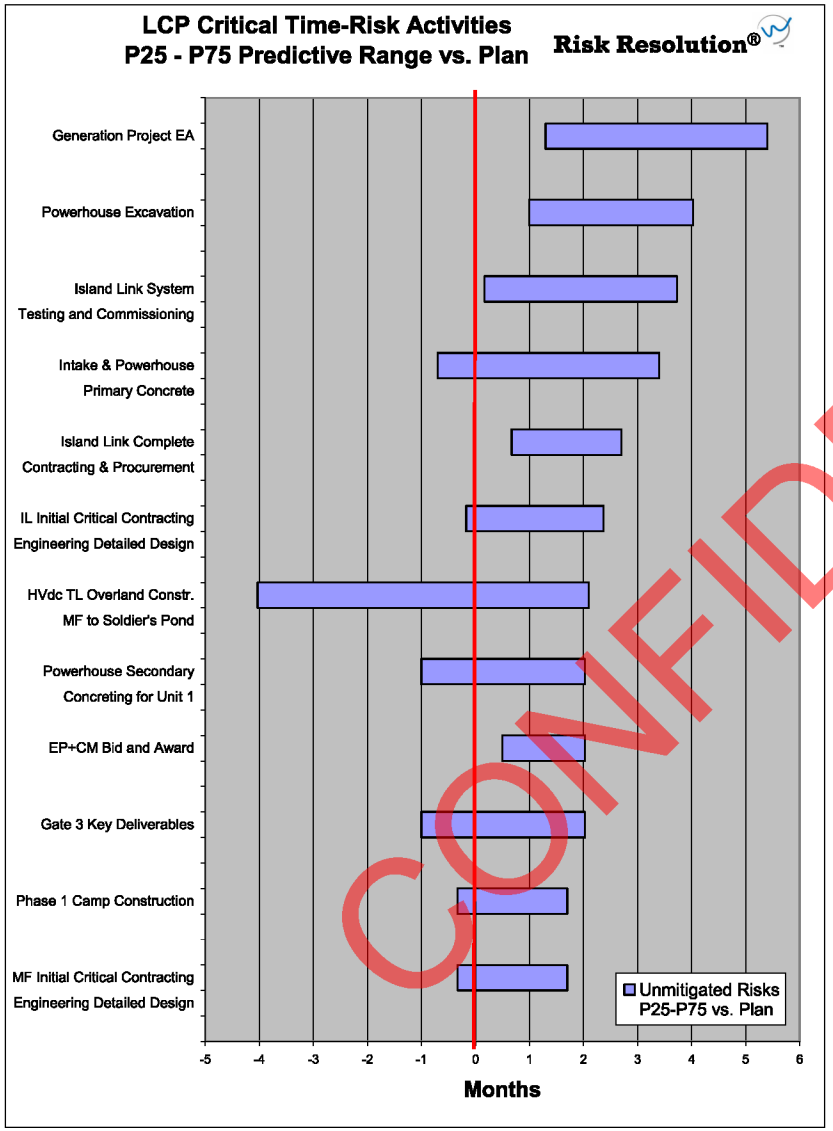

Percent of Time on Probabilistic Critical Path

30%
77%
18%
77%
16%
17%
17%
77%
63%
22%
31%
18%

The P25-P75 vs. Plan ranges (shown in blue) indicate which tasks have a high level of uncertainty; the information on probabilistic critical paths indicates the likelihood of a given risk impacting project results.

To accelerate the expected timing of Full Commercial Power, it is recommended that risk mitigation efforts focus on those tasks which have a high level of uncertainty and are on the probabilistic critical path a high percentage of the time. It may also be helpful to take action that would change the model logic (such as accelerating the mobilization of the EP+CM contractor).

Predictive Range vs. Schedule (Months)

Schedule Activities with Significant Time Risk

The analysis shows that these seven activities have the greatest impact on project timing and, therefore, should receive considerable attention.

	Months P25*	Months P75*
≈ Generation Project EA	1.5	5.5
≈ Powerhouse Excavation	1.0	4.0
≈ Island Link Testing & Comm.	0	3.5
≈ Intake & Pwrhse Pri. Concrete	-0.5	3.5
≈ Pwrhse Sec. Concret. Unit 1	-1.0	2.0
≈ EP+CM Bid and Award	0.5	2.0
≈ Phase 1 Camp Construct.	-0.5	1.5

Base Case Predictive Range vs. Plan:
P25 = 9 months and P75 = 16 months

***Values may not be added to give total exposure.**

Tactical-Risk Assessment

Basis of Assessment

The Tactical-Risk Assessment considers the impact of definition and performance risks on the project cost estimate. Nalcor provided estimates for both the Muskrat Falls Plant and the 600 MW HVdc VSC Island Link (not including any contingency amounts) using its Case 8 capital cost assumptions. Each cost estimate was broken down by major category.

Westney consultants met with Nalcor representatives to discuss the Best and Worst Case ranges around the estimate for each cost category. The final ranging was performed by Nalcor, but it was vetted and questioned by the Westney participants. Westney selected the probability distributions to use with the ranged data and ran the Monte Carlo simulation.

Assessment Results

Tactical-Risk Results

The P50 of the Tactical-Risk Assessment equates to the cost estimate plus the recommended contingency. The Tactical-Risk Assessment yields the following results for the Muskrat Falls Plant combined with the Island Link:

	Millions of C$
Tactical-Risk P50:	$3,885
Muskrat Falls Estimate:	$2,215
Island Link Estimate:	+$1,144
Total Estimate:	$3,359 (100%)
	$3,885
	-$3,359
Recommended Contingency:	$526 (16%)

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Lower Churchill Project - Muskrat Falls & Island Link

Tactical Cost Ranging Sheet

Cost Category	Original Estimate (C$ MM)	Spent to Date (C$ MM)	Special Adjust-ments (C$ MM)	Cost to be Risked (C$ MM)	Risk Range: Best - What % Less Could It Cost? (enter as negative)	Risk Range: Worst - What % More Could It Cost?	Risk Range: Best Cost (C$ MM)	Risk Range: Worst Cost (C$ MM)
Muskrat Falls								
Site Preparation & Access Roads	17.0			17.0	-10	200	15.3	50.9
Camp and Support Facilities	233.0			233.0	-20	15	186.4	268.0
Communications	12.6			12.6	-10	100	11.3	25.2
Reservoir Clearing / Preparation	119.1			119.1	-20	20	95.3	142.9
Main Excavation Works	77.2			77.2	-15	25	65.6	96.5
Intake & Powerhouse	519.1			519.1	-30	40	363.4	726.8
Spillway Structure	121.3			121.3	0	25	121.3	151.6
Cofferdams & North Spur Stabilization	74.1			74.1	-10	20	66.7	88.9
RCC Dams - North and South	78.4			78.4	-10	20	70.6	94.1
Turbines & Generators	326.9			326.9	-10	20	294.2	392.3
Muskrat Falls Switchyard (230 kV)	28.3			28.3	-10	30	25.5	36.8
CF Switchyard Extension	22.8			22.8	-10	40	20.5	31.9
345 kV Dual Transmission Lines - MF to CF	210.4			210.4	-15	20	178.8	252.5
Feasibility & Design Engineering	40.0			40.0	50	175	60.0	110.0
Insurance	30.0			30.0	-10	20	27.0	36.0
Owner / Project Mgmt / Construction Mgmt	255.0			255.0	-15	50	216.8	382.5
Habitat Compensation	30.0			30.0	0	100	30.0	60.0
Historical / Prior Costs (Spent)	20.0	20.0		0.0				
Muskrat Falls Total, C$ MM	**2,215.2**	**20.0**	**0.0**	**2,195.2**				

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Lower Churchill Project - Muskrat Falls & Island Link

Tactical Cost Ranging Sheet

Cost Category	Original Estimate (C$ MM)	Spent to Date (C$ MM)	Special Adjust-ments (C$ MM)	Cost to be Risked (C$ MM)	Risk Range: Best - What % Less Could It Cost? (enter as negative)	Risk Range: Worst - What % More Could It Cost?	Risk Range: Best Cost (C$ MM)	Risk Range: Worst Cost (C$ MM)
600MW HVdc VSC Island Link								
Converter Station 600 MW - Muskrat Falls	126.0			126.0	-10	25	113	158
Converter Station 540 MW - Soldiers Pond	113.4			113.4	-10	25	102	142
Cable Supply & Delivery	61.7			61.7	0	100	62	123
SOBI Cable Install & Protection	145.1			145.1	0	60	145	232
Overland Tx - Muskrat Falls to SOBI	122.5			122.5	-10	35	110	165
Overland Tx - SOBI to Taylor's Brook	83.3			83.3	-10	25	75	104
Overland Tx - Taylor's Brook to Soldier's Pond	157.5			157.5	-10	20	142	189
Switchyards	34.5			34.5	-10	30	31	45
Island Upgrades	6.8			6.8	0	200	7	20
Electrodes	48.4			48.4	-10	30	44	63
Habitat Compensation	12.0			12.0	-50	100	6	24
Owner / Project Mgmt / Construction Mgmt	170.4			170.4	0	35	170	230
Historical / Prior Costs (Spent)	62.0	62.0		0.0				
600MW HVdc VSC Island Link Total, C$ MM	**1,143.6**	**62.0**	**0.0**	**1,081.6**				
Project Total Cost								
Project Total Cost, C$ MM	**3,358.8**	**82.0**	**0.0**	**3,276.8**				

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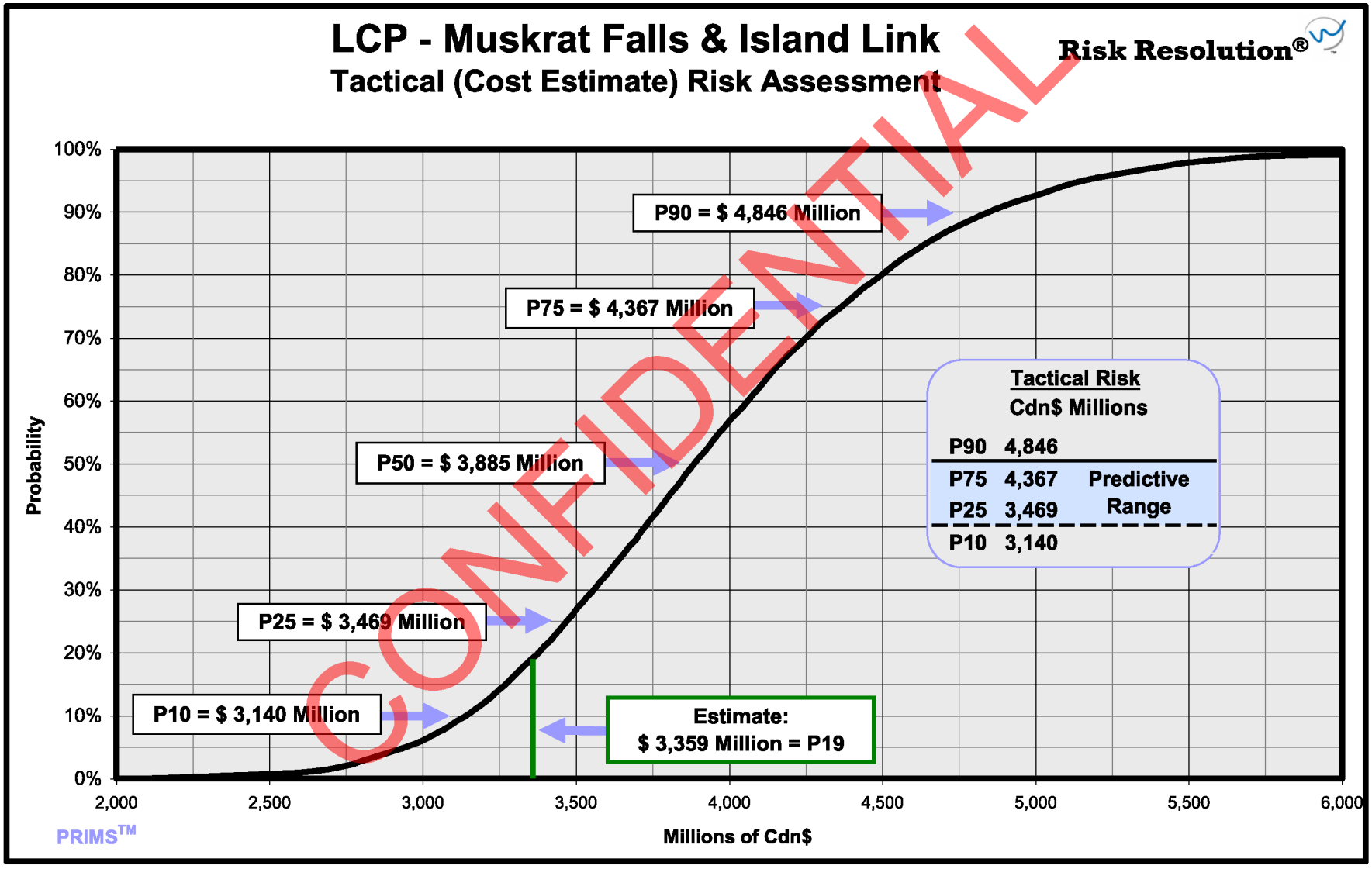

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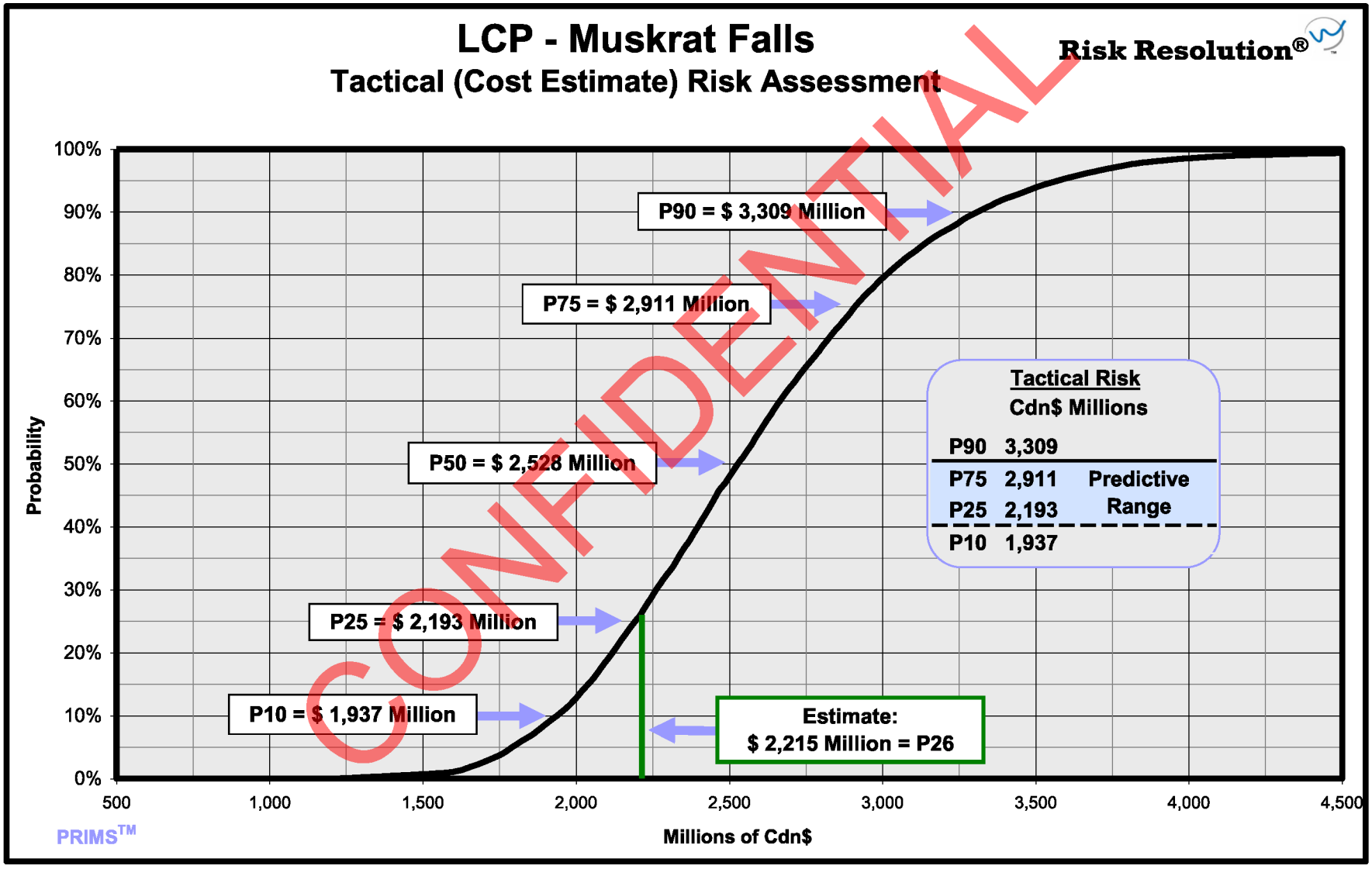

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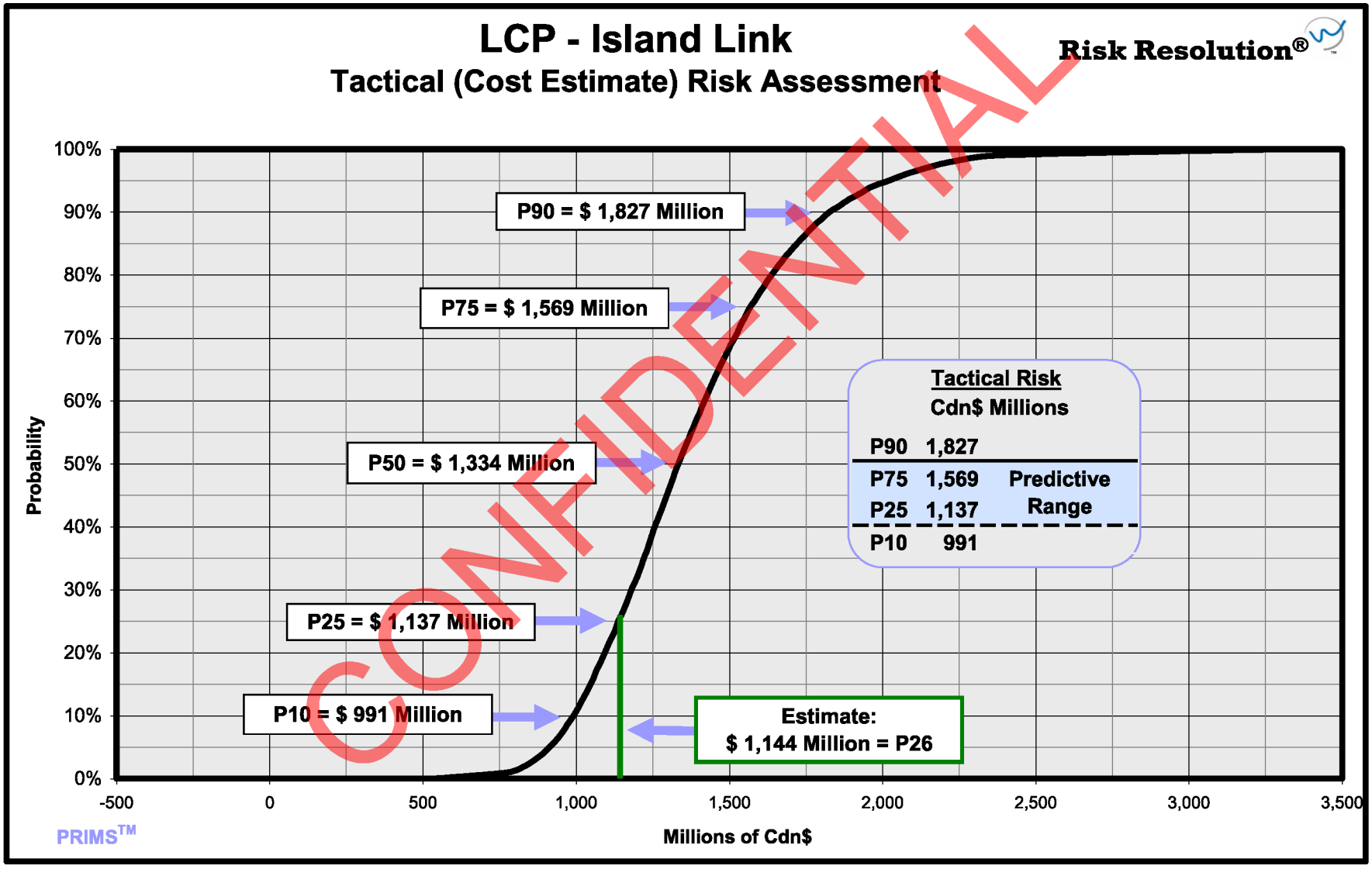


Strategic-Risk Assessment

Basis of Assessment

The Strategic-Risk Assessment does not consider the impact of tactical risks (i.e., estimate contingency) on the costs of the Lower Churchill Project. This assessment dealt solely with Capex issues; revenue and Opex issues were noted for the economic model.

The strategic risks for the Muskrat Falls Plant and the Island Link were identified and framed on a preliminary basis by the Nalcor team. Westney consultants met with Nalcor representatives at Nalcor's St. John's office to discuss possible outcomes for both the Unmitigated and Mitigated cases. The final ranging was performed by the Nalcor team, but it was vetted and questioned by the Westney participants. The Monte Carlo simulation was run by Westney.

Assessment Results

Strategic Risk Exposure

The Strategic Risk Exposure is the range of the costs that might be incurred that currently would not be incorporated into the estimate. A decision will be required as to whether these risks become costs in the estimate or remain as Risk Exposure above the estimate.

	Predictive Range	
	P25 (mil)	P75 (mil)
Unmitigated Risk Exposure	$490	$852
Mitigated Risk Exposure*	$187	$413

*Includes costs of mitigation.
All currency is in C$.

nalcor energy
LOWER CHURCHILL PROJECT

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Organizational Risks

1 **Organizational experience and resources for a project of this size**	– Processes, Resources, and Governance – Specific experience of large hydro project – **Mitigation represents early and aggressive effort to address each issue** • **Recruiting experienced people** • **Installing best of practice processes and governance** • **Plans to secure experienced consultants and contractors**	**$0 to $50** **-$50 to $10**

Interface Risks

2 **Time required under Crown Corporation rules to gain approval**	– Delayed decisions leading to schedule slippage and cost increases – Loss of vendor and contractor interest – Loss of team morale – **Mitigation - Communicate impact of issue to stakeholders and proactively work at executive level**	**$7 to $20** **$4 to $10**

Financial Risks

3 **Changes in the financial market**	– Increased interest rate spreads – Preferred financing instruments may not be available in quantities or on terms and conditions projected – **Little mitigation possible**	**Not Applicable**

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Financial Risks

4 **Foreign currency exchange risk**	– Approximately $1.0 B of estimate is in non-CAD $ expenditures (e.g., U.S.$, Kroner, Euro) – Potential for 10% swing in exchange rates – **Mitigated Case assumes hedging of all currency risks**	**-$100 to $100** **$10**
5 **Risk Premium for obtaining lump sum contracts**	– Market shifting from seller's market to buyer's market for contractors and vendors – Contractor and vendor creditworthiness continues to be a concern for potential financiers – **Reduce exposure by using independent risk brokering to improve risk allocation and/or increase equity contribution**	**Not Applicable**

Commercial Risks

6 **Extra year required to secure long-term PPA's**	– Concern about time to secure agreements to support financial close – **Mitigate potential exposure by awarding engineering contract at Gate 2b only when clarity on market access is available** – **Risk is not entirely within Nalcor's control, thus some acceptance of this risk is required**	**Not Applicable**

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Commercial Risks

7 Federal government support for generation and transmission projects

- Federal government visible support of the project in any form would benefit the confidence in the market that the project will proceed
- **Active pursuit of support by executive management**

Not Quantified in Analysis

---

8 Changing power market portfolio requires changes in project scope

- The power market for this project could influence new routes and capacities for power sales
- **Mitigate by engaging counterparties and validating project scope assumptions ASAP and maximizing Front-End Loading prior to sanction**

Not Applicable

HSE Risks

9 Good HSE record is critical for project success

- Remote and difficult site
- Multiple work faces
- Potential for contamination of river
- **Mitigation includes early and proactive program to promote and secure commitment to best practices**
- **Engage and retain contractors who are leaders in safety performance**

$0 to $100
$10 to $20

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Engineering / Technical Risks

10 Availability of resources to achieve a quality design

- Limited capacity within NL for hydro, resulting in need to mobilize resources outside the Province
- Hydro design market level of demand not seen since 1988
- Many reductions in hydro engineering resources in last decade
- **Mitigations include:**
  - **Taking early and aggressive action to secure required engineering competencies and resources**
  - **Scheduling sufficient time for engineering completion prior to start of construction**
  - **Implementing a project-wide Quality Management System and embed QA requirements in all contracts**

$10 to $35
-$10 to $10

---

11 Submarine cable crossing of Strait of Belle Isle

- Many firsts:
  - Buried shore approaches due to icebergs
  - Weather window very short
  - Sea currents at 5 to 7 knots will be very challenging
  - Viability of trenching technology is questionable
  - Limited capacity of installation vessels
- **Mitigations include:**
  - **Evaluate all available opportunities as soon as possible**
  - **Engage best consultants for subsurface conditions**
  - **Additional studies, particularly on trenching technology**

$0 to $100
$0 to $50

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Engineering / Technical Risks

12 Faults in submarine cable during commissioning and post installation

- Recent installations in Europe experiencing faults
- Faults in buried Belle Isle section expensive to repair
- **Mitigations include using a conservative, robust design**
- **Using lessons learned from recent installations**
- **Evaluating insurance coverage**

$0 to $120
$0 to $50

---

13 System reliability during commissioning and start-up

- Many hydro projects have had reliability issues in recent years
- **Engage experienced engineering contractors**
- **Conduct system studies**
- **Consider commercial insurance products**

$0 to $75
$5 to $15

Environmental Approvals & Permitting Risks

14 Securing generation project release from Environmental Assessment

- Highly problematic
  - Regulators decision-making process
  - Use of process to protest project
  - Alternatives requested
- **Bolster team resources to allow for efficient management and support of the EA process**
- **Step up consultation efforts, esp. w/ aboriginal groups**

$0 to $30
$0 to $5

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Environmental Approvals and Permitting Risks

15	**Environmental process impact on design**	– Design changes may be required as a result of environmental concessions – **Work to understand issues and accommodate realistic solutions early in design process to minimize downstream effects on procurement and construction**	**$0 to $10** **$0**
16	**Unanticipated design changes impact environmental process**	– Due to changes, the design may no longer be consistent with concepts previously submitted for regulatory approval – **Screen for issues early and try to work acceptable solutions that avoid schedule impact** – **Include EA Manager in approval process for design changes**	**$0 to $30** **$0 to $10**

Stakeholder Risks

17	**Schedule impact due to delay in ratification of IBA by Labrador Innu Nation**	– Ratification delay due to non-alignment within the Innu community – **Maintain close ties with aboriginal leaders and be responsive to the needs of various aboriginal groups**	**$0 to $20** **$0 to $10**

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Stakeholder Risks

18 Lack of support from other aboriginal groups

- Other aboriginal groups may claim a lack of consultation during the project EA process which may result in the EA process being stayed
- **Aggressively engage and consult all potentially impacted aboriginal groups**

$0 to $20
$0 to $10

19 Non-governmental organization / stakeholder protest

- Protest could come at critical stage of construction or during the EA process
- **Implement a stakeholder communication plan**
- **Focus on getting Nalcor's message out on the benefits of the project**

$0 to $25
$0 to $10

Muskrat Falls Construction Risks

20 Availability of experienced hydro contractors

- Industry consolidation and lack of hydro activity for 20 years has limited available and viable contractors
- Contractor market improving due to weakening demand
- **Engage worldwide market and "sell the project" to stimulate interest**
- **Use innovative contracting strategy to make project attractive to contractors with risk / benefit balance**

$0 to $50
$0 to $10

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Muskrat Falls Construction Risks

21 **Ability to use Newfoundland & Labrador contractors due to lack of creditworthiness**	– Conditions of project finance will demand contractors be creditworthy for value of scope – **Proactive program to educate contractors on issue** – **Work with contractors to find suitable partners or underwriters** – **Consider this risk in the contract package definition**	**Not Applicable**
22 **Availability of qualified construction management / supervision**	– Worldwide construction at historic high with peak early next decade; however, due to recession, there is a forecasted slowdown for the short to medium term – **Establish benefit/reward relationships with contractors** – **Actively recruit Newfoundlanders home**	**-$100 to $50** **-$100 to $10**
23 **Site conditions worse than geotechnical baseline**	– Contractors will not take unknown geotechnical risks without prohibitive risk premiums – **Maximize geotechnical investigations to determine conditions as well as possible before bidding**	**$0 to $75** **$0 to $75**

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Muskrat Falls Construction Risks

24 **Availability and retention of skilled construction labour**	– Current worldwide peak construction over Q2 2011 – **Actively recruit Newfoundlanders home** – **Recruit supervision that works well with Newfoundlanders** – **Negotiate a labor agreement that supports trade flexibility**	**$0 to $40** **$0 to $20**
25 **Availability of unskilled construction labour**	– Remote jobsite and less desirable work – **Promote opportunity for training and advancement** – **Leverage underutilized labour pools** – **Provide competitive opportunities for locals**	**Not Applicable**

Hydro Turbine Supplier Risks

26 **Limited number of creditworthy hydro turbine suppliers**	– "Seller's market" worldwide - order books full for 2010 – North America declining in importance as market – **Actively engage the two existing "bankable" suppliers** – **Explore contracting model and risk allocation strategy** – **Decide early on strategy and selection of supplier**	**$0 to $50** **$0 to $50**

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

De-escalation / Inflation Risks

27 **De-escalation / hyper-inflation risks**	– Driven by global demand with future difficult to predict – Need to consider hyperinflation due to significant barriers to entry in the specialty supply marketplace – **Monitor market and understand supply / demand balances for goods and materials**	$0 $0

Transmission Risks

28 **Availability of experienced high-voltage contractors and skilled labour**	– Limited number of qualified transmission contractors – Resource requirements very large compared to supply – **Actively pursue potential suppliers worldwide** – **Phase the transmission build in order to flatten resource demands** – **Actively support training of linespersons**	$0 to $100 $0 to $20
29 **Limited number of HVdc specialties suppliers and installers**	– Basically two suppliers and installers of subsea cable – Location (especially Strait of Belle Isle) challenging – Tight weather window for installation – **Optimize packaging strategy of HVdc specialties equipment and services to entice key players** – **Select and engage early to ensure availability**	$0 to $50 $2 to $35

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Transmission Risks

30 Island Link EA results in late design changes

- Sea-return electrodes faced challenges in other jurisdictions
- Significant public concerns raised regarding access routes
- Habitat destruction in the SOBI due to submarine cable
- **Work to understand environmental issues and promote realistic solutions early in the design process**
- **Complete early concept desktop studies on potential design changes that the EA could recommend**

$0 to $50
$0 to $25

Shareholder Risks

31 Unwillingness of Shareholder to fund early construction on equity defers construction

- Current engineering and construction schedule assumes $1-2 B of equity injection by 2013
- Major go/no-go decision regarding equity spend is in late 2011 – concurrent with the next provincial election when there could be an unwillingness to commit to spending
- **Ensure early and ongoing alignment with the Shareholder on all aspects of the project**
- **Seek early commitment and release of capital for 2010 activities**

$0 to $50
$0 to $25

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Environmental Assessment Risks

32 Delay in the release of the Island Link from EA

- Federal government decisions on type and level of federal EA required have not yet been made
- Uncertainty re: type and location of electrodes
- Uncertainty re: conduit or subsea option for SOBI
- **Make a strategic decision to go with a Comprehensive Review rather than a Screening Study to avoid recycle and schedule slippage**
- **Increase stakeholder consultation activities**

$0
$0

Enterprise Risks

33 Uncertainty on commercial structure for transmission

- Ownership philosophy for the Maritime Link and Island Link not yet determined; Emera and NB Power are potential equity partners
- Uncertainty also exists as to whether this will be a merchant or regulated asset
- **Identify and evaluate all plausible options and develop recommendation based on alignment with Nalcor's and the Province's strategic objectives**
- **Aggressively engage Emera and NB Power**

$0
$0

Strategic Risks Considered in Analysis

Key Risks / Potential Benefits

Bold Comments are Mitigations

Impact (Millions)
Unmitigated
Mitigated (including cost of mitigation)

Technology Risks

34 **Failure of application of VSC HVdc technology for Island Link**

- Technology maturing for overhead system application – one existing overhead system built (Africa); however, currently not fully proven to operate within specification
- Fallback to LCC technology results in the need to install three 80 MVAR synchronous condensers and additional system reinforcements on the island
- **Monitor technology development / evolution and adjust project direction accordingly (there is time for the technology bugs to be worked out)**
- **Actively engage three HVdc vendors to study solutions for LCP**

$0 to $200
$0 to $200

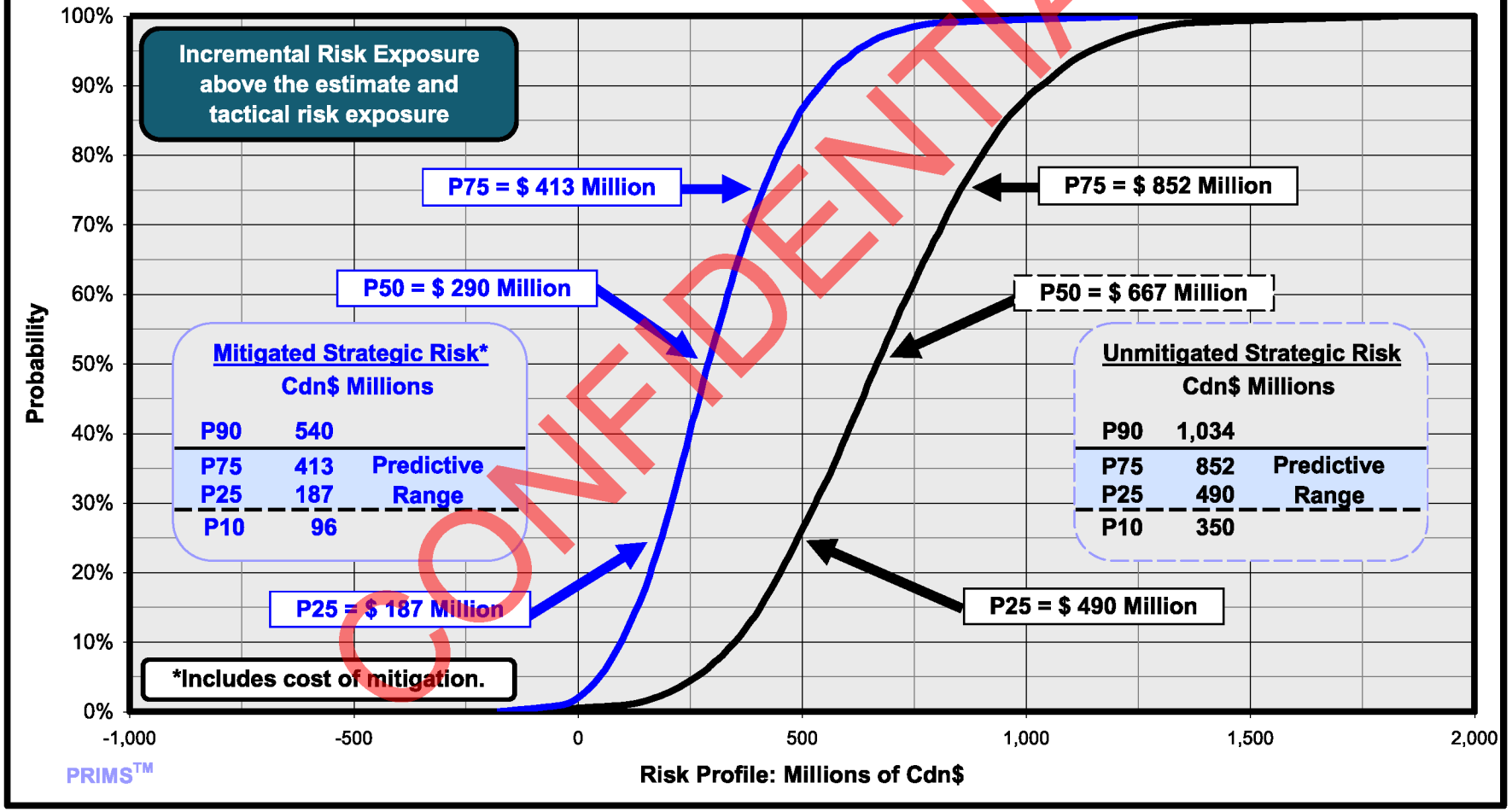
Strategic-Risk Exposure

CIMFP Exhibit P-01003

LCP - Muskrat Falls & Island Link

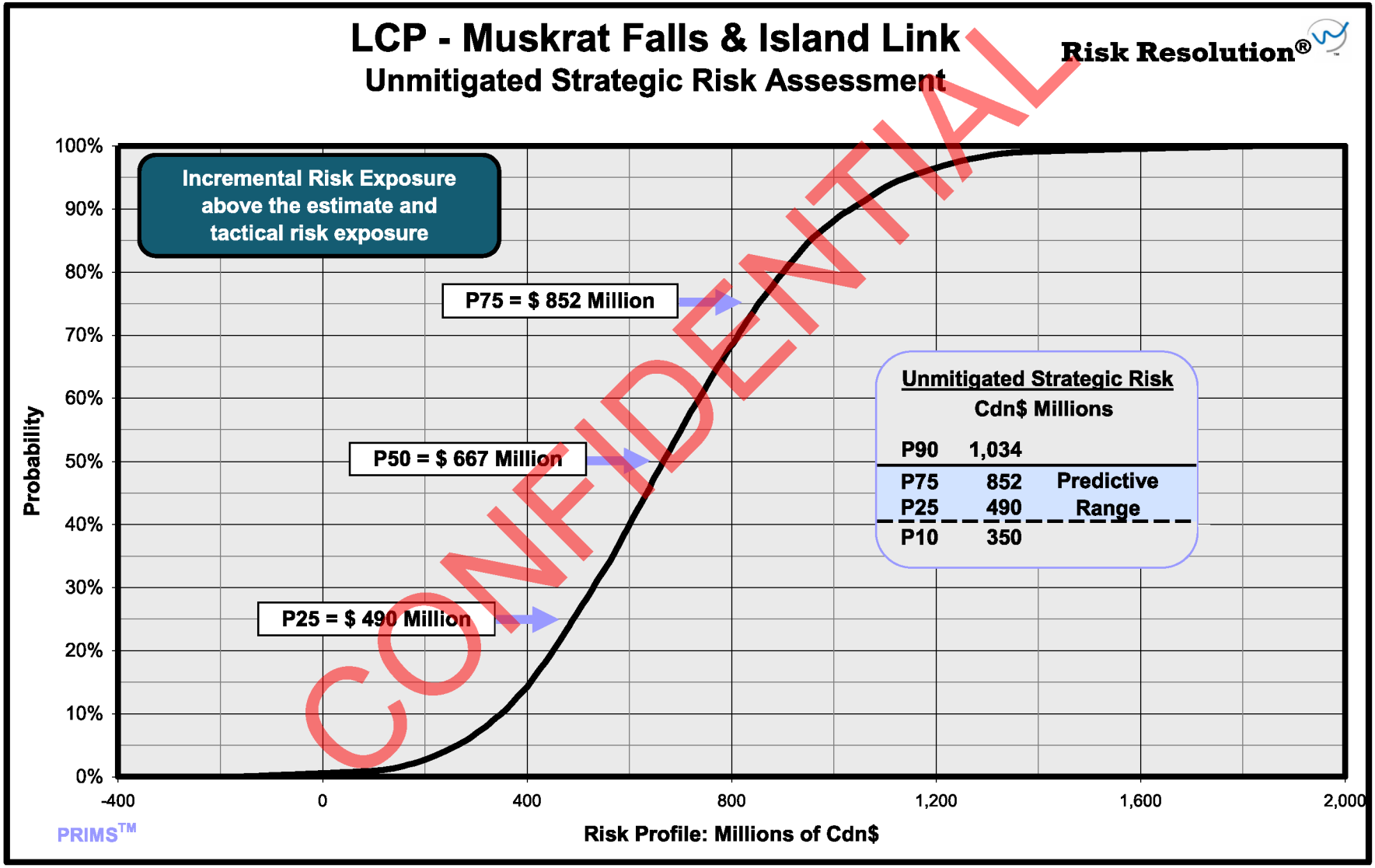
Mitigated and Unmitigated Strategic Risk Assessments

Risk Resolution®

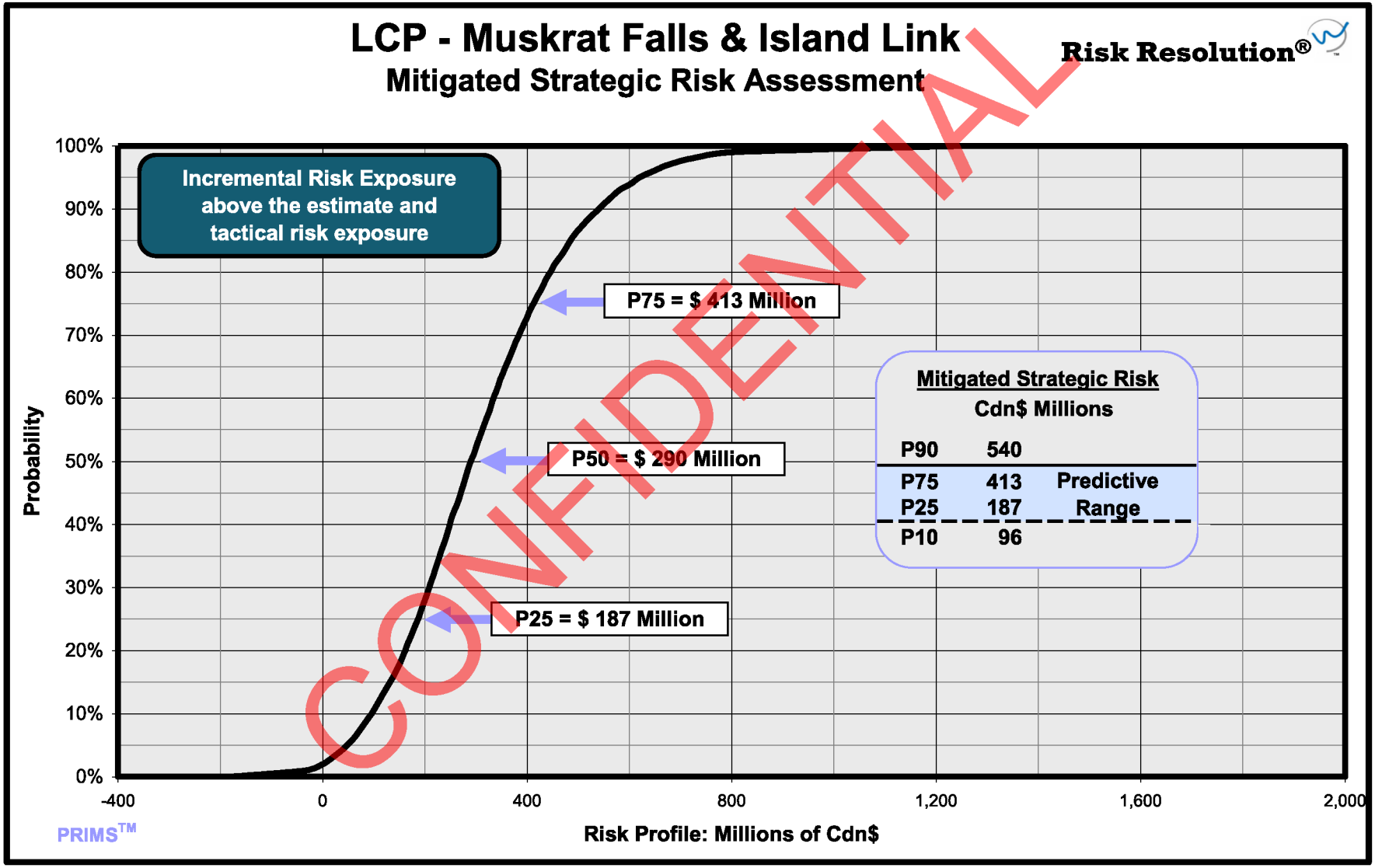


Unmitigated Risk Exposure

CIMFP Exhibit P-01003



Mitigated Risk Exposure



Strategic-Risk Tornado Chart

CIMFP Exhibit P-01003

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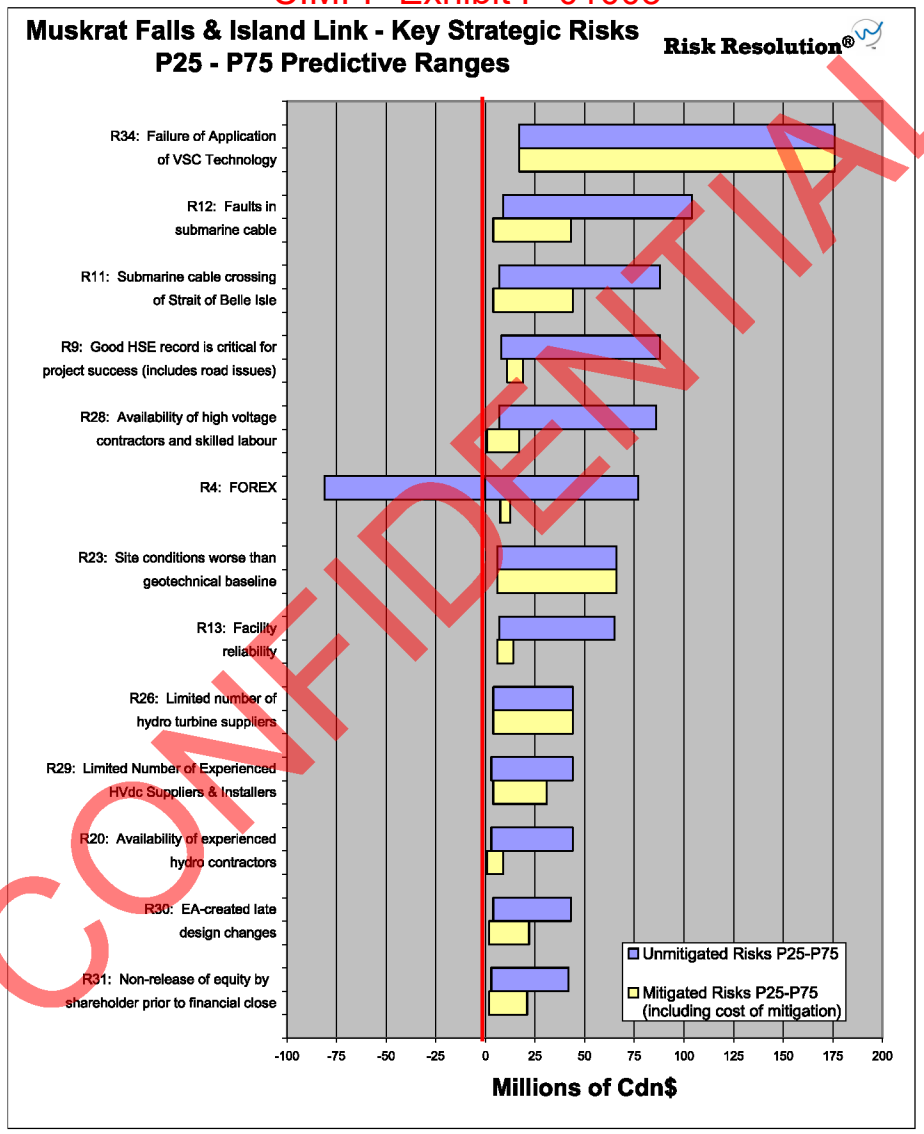

Strategic-Risk Exposure

CIMFP Exhibit P-01003

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All Values in C$ Millions

Mitigated Strategic Risks with Significant Impacts

Mitigated Predictive Range (P25 to P75)

	P25 *	P75 *
≈ Failure of Application of VSC Tech.	17	176
≈ Site Conditions vs. Geo. Baseline	6	66
≈ Limited Hydro Turbine Suppliers	4	44
≈ Strait of Belle Isle Crossing	4	44
≈ Faults in Submarine Cable	4	43
≈ Ltd. HVdc Suppliers/Installers	4	31
≈ EA-created Design Changes	2	22

Project Mitigated Risk Exposure
Predictive Range: P25 = $187 to P75 = $413

***Values may not be added to give total exposure.**

Supplemental Information

Predictive Range

Predictive Range: The term predictive range is used throughout this report when describing the results of Monte Carlo simulations for all types of risk assessments. Specifically, the predictive range refers to the P25 to P75 band of results for a given assessment. Because the predictive range is comprised of the middle 50% of the results, it is usually thought to be the most relevant indicator of future outcomes when assessing a modeled situation.

Weather Windows for Time-Risk Activities

The following weather windows are used in the Time-Risk analysis:

1) Task 38: Close Cofferdam
July 1 – September 30

2) Task 40: North Dam (Foundation and Dam)
Task 43: South Dam (RCC)
Task 44: Churchill Falls Switchyard Modifications
May 1 – November 15

3) Task 61: SOBI Cable Survey
Task 64: SOBI Cable Installation
June 15 – October 15

4) Task 65: Finalize SOBI Cable Protection Scope
May 1 – October 31