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# **Nova Scotia Utility and Review Board**

**IN THE MATTER OF**

*The Maritime Link Act, S.N.S 2012 c.9  
and the  
Maritime Link Cost Recovery Process Regulation, N.S. Reg. 189/2012*

## **NSPML Quarterly Report Q4 2015**

**December 15, 2015**

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1 **1.0 INTRODUCTION**

2

3 This is the Q4 2015 Quarterly Report for the Maritime Link as directed by the Utility  
4 and Review Board (UARB) where the UARB ordered in its Supplemental Decision:

5

6 [115]....detailed reports must be filed by NSPML on a semi-  
7 annual basis, on June 15 and December 15 each year. The reports  
8 shall commence December 15, 2013. Updated status reports must  
9 be filed quarterly.

1 **2.0 UPDATE OF PROJECT SCHEDULE WITH VARIANCE EXPLANATION**

2

3 As per Enerco U-31, sections 1.1, 1.2, and 1.3, this section provides an update on the  
4 project schedule, along with a variance explanation and general status updates.

5

6 Please refer to Attachment 1 for the Detailed Project Schedule and Attachment 2 for  
7 the Level 1 Project Schedule.

8

9 **2.1 Gates and Milestones**

10

11 The Project remains on schedule for commissioning and commencement of  
12 operations scheduled for Q4, 2017.

13

14 **2.2 Safety**

15

16 In the October Quarterly report, NSPML described recent safety incidents and  
17 concerns which led to a shutdown of construction activities in NS and NL. NSPML  
18 conducted a review of all contractor safety procedures and once satisfied, a staged  
19 start-up of work began in late September, based on each contractor's ability to  
20 demonstrate their readiness to fulfill their obligations. This review resulted in a project  
21 safety procedure change where new upcoming field activities by contractors are  
22 subject to a safety review before approval to proceed is granted. This new procedure is  
23 now in place and proving effective to date.

24

25 **2.3 Abengoa Update**

26

27 In February, 2015 NSPML entered into a contract with Abengoa S.A., a global  
28 Spanish energy company, for the transmission line construction on the Maritime Link  
29 Project. Abengoa S.A. has filed a notice under Spanish law, which provides for pre-  
30 insolvency protection in Spain, giving the company up to 4 months to reach an  
31 agreement with creditors to avoid a full insolvency process. NSPML has retained  
32 external experts to provide advice with respect to this development to protect

1 customers' interests in ensuring the Project will continue to be constructed on schedule  
 2 and within budget. NSPML is working closely with Abengoa, its subcontractors, and  
 3 the performance bond sureties to develop options to maintain stability for the Project  
 4 as Abengoa and its advisers work to obtain financing solutions. At the time of filing  
 5 this report, work on the Project continues as anticipated.

6  
 7 **2.4 Commercial Activities**

8  
 9 The key major procurement activities are presented in Table 1 with an update of the  
 10 status for each initiative.

11  
 12 **Table 1**

<b>Commercial Activity</b>	<b>Status in October, 2015</b>	<b>Initiative Number</b>	<b>Status in December, 2015</b>
HVdc Submarine Cable Supply and Installation	The Contract was awarded to Nexans in January, 2014.	E11-18	No Change
Converter stations, switchyards and related structures (“converters and structures”)	The Contract was awarded to ABB Inc. in June, 2014.	E12-74	No Change
Right of Way Clearing along Transmission Lines	Contracts were awarded to Majors Logging Limited in NL, and R. MacLean Forestry in NS in February, 2014.	E13-88	No Change
Transmission Structures and Grillages	The Contract was awarded to Kalpataru Power Transmission Ltd in September, 2014 for design and delivery of Structures and Grillages.	E13-85	No Change

<b>Commercial Activity</b>	<b>Status in October, 2015</b>	<b>Initiative Number</b>	<b>Status in December, 2015</b>
Site Preparation Services (Includes construction of access road upgrades)	<p>The Contract was awarded to Joneljim Concrete Construction (1994) Ltd. for NS Site Preparation Services in September, 2014.</p> <p>The Contracts were awarded to Marine Contractors Inc., MCI Limited Partnership for NL Site Preparation Services in September, 2014.</p>	E13-92	No Change
Transmission Line Construction	The Contract was awarded to Abengoa S.A. in February, 2015.	E13-95	No Change
Transmission Line Conductors	<p>The Contract for the supply of conductors was awarded to Midal Cables in March, 2015.</p> <p>The contract for the supply of OPGW was awarded to Composite Power Group Inc. in June, 2015.</p> <p>This is also within the scope of the E13-87 initiative.</p>	E13-87	No Change  No Change
Horizontal Directional Drill (HDD) Construction Program	<p>Contract negotiations remain in progress and the contract award is scheduled for Q4, 2015.</p> <p>The E13-157 HDD Drilling Services RFP was issued in February, 2015 and closed in March, 2015. Evaluations are</p>	E13-156  E13-157	<p>Contract negotiations remain in progress and the contract award is scheduled in the coming weeks.</p> <p>E13-157 is scheduled to be awarded in January 2016.</p>

<b>Commercial Activity</b>	<b>Status in October, 2015</b>	<b>Initiative Number</b>	<b>Status in December, 2015</b>
	<p>in progress.</p> <p>The E13-158 Marine Intervention Services RFP was issued in February, 2015 and closed in March, 2015. Evaluations are in progress.</p> <p>The supply of the HDD casing was separated from E13-156 as a separate initiative. The RFP was issued and closed in August, 2015 and evaluations and negotiation are in progress.</p>	<p>E13-158</p> <p>E15-238</p>	<p>E13-158 is scheduled to be awarded in Q1 2016.</p> <p>The supply of the HDD casing (E15-238) was awarded to East Coast Tubulars Limited in October 2015.</p>
Accommodations Operations	The contract for the accommodations operations services was awarded to East Coast Catering in April, 2015.	E13-89	No Change

1

#### 2 **2.4.1 Land Access Agreements**

3

4 Since the June 2015 quarterly report, NSPML has continued with the applications  
5 before the UARB pursuant to the Expropriation Act to determine the appropriate  
6 compensation for the remaining parcels. Similarly, applications will be made in  
7 Newfoundland and Labrador with respect to the remaining parcels in that province  
8 once the arbitration panel processes have been established. Rights associated with  
9 access trails, as well as additional easements relating to guying anchors, are  
10 anticipated to continue to be pursued into 2016 as necessary, in both provinces.

1 **2.4.2 Funding**

2  
3 As in prior months, Funding and Drawdown Requests containing comprehensive  
4 details of costs for the upcoming month were submitted to the Collateral Agent and  
5 Government of Canada as necessary, and all requested funds were received on  
6 schedule. Please refer to Attachment 3 for the IE Draw Confirmation Certificates for  
7 the period. These draws permit payments to Material Project Participants to be paid  
8 with the proceeds of the ML Construction Loan under the payment terms of the  
9 Material Project Documents and the ML Credit Agreement.

10  
11 For the first time since the project debt financing was received in April 2014, the  
12 November 20, 2015 Funding Request included both a draw for debt and also a draw  
13 for equity from NSPML's shareholder, Emera. At this juncture, NSPML has reached  
14 its targeted Debt:Equity ratio of 70:30. This is consistent with the terms of the Federal  
15 Loan Guarantee and with the UARB approval of the Project. Future draws during  
16 construction will be from a combination of debt and equity with the goal of  
17 maintaining the 70:30 Debt:Equity ratio as approved by the UARB.

18  
19 **2.4.3 Joint Development Agreements**

20  
21 NSPML continues to work with Nalcor and NS Power to finalize the remaining  
22 operational agreements arising from the Formal Agreements with Nalcor.

23  
24 **2.5 Engineering Activities**

25  
26 Commissioning of the Maritime Link continues to align with the in-service target date  
27 of Q4 2017. Engineering is captured in three main categories across several Work  
28 Breakdown Structures ("WBS's"):

- 29  
30 • HVdc Submarine Cable Supply and Installation – cable design and manufacturing  
31 is being engineered by the supplier of the cable, Nexans, which will include  
32 performance criteria consistent with service life and reliability targets subject to



1 approval by NSPML. In this period, Nexans engineering activities continued in  
2 the five major categories including Cable HV System; Electrical Accessories;  
3 Mechanical Accessories; Land Works; DTS Systems; and Marine Works.  
4 Engineering quality reviews continue for the manufacturing of the marine cable 1  
5 and the land cable which continue to proceed ahead of schedule. The marine route  
6 is currently being finalized, and may require the cable length to increase by  
7 approximately 5 km to attain the burial requirements.

8  
9 • The HDD bore trajectories were designed under a separate engineering initiative  
10 (E12-51). The conceptual plans and profiles were developed by Hatch. The HDD  
11 trajectory design was completed in March which provided the necessary  
12 documentation for the procurement activities for the HDD construction services.  
13 The contracting activities continued throughout this period to allow drilling to start  
14 in 2016.

15  
16 • HVdc Converters and Substations - engineering is included in the contract awarded  
17 to ABB for the supply and installation of these assets. During this period, there  
18 were advances in the HVdc design of the Control and Protection system, civil  
19 designs, and the plant electrical mechanical designs. Structural, electrical and  
20 station designs advanced for the HVac systems for the Woodbine, Granite Canal  
21 and Bottom Brook locations, allowing procurement of the converter buildings to  
22 proceed ahead of schedule. ABB engineering continues on schedule.

23  
24 • Overland Transmission and Switchyard/Grounding Sites – Designs for the  
25 transmission and grounding lines are complete. There are modifications which  
26 required additional engineering activities to ensure all equipment is within the right  
27 of way, and to ensure Bell Aliant equipment is relocated as required. An  
28 alternative design of the breakwater location at Indian Head, in NL was completed  
29 prior to this reporting period, and a similar design of the breakwater for Big  
30 Lorraine is in progress. The civil designs for Granite Canal site were completed in  
31 this period. All other design work for the transmission lines and the grounding  
32 sites is completed.

1 **2.6 Submarine Cables (Marine)**  
2

3 Manufacturing of the marine cable 1 began at the Futtsu manufacturing facility in July,  
4 and continues to progress ahead of schedule. The core of the cable was manufactured  
5 to its full length and the paper lapping for Batch 1 was completed in November  
6 followed by the start of Batch 2. The manufacturing of the land cable also progressed  
7 as planned in advance of the impregnation and drying process scheduled to start in Q4,  
8 2015. Procurement and delivery of other related materials progressed as planned.  
9

10 **2.7 Horizontal Directional Drilling (HDD) Boreholes**  
11

12 The construction and installation of the HDD boreholes in NS and NL will be  
13 comprised of several contracts. The RFP for the Landfall Drilling and Casing Install  
14 (E13-156) was issued and closed. This contract is scheduled to be awarded in the  
15 coming weeks. The supply of the HDD casing (E15-238) was awarded in October,  
16 2015. The contract award for the Drilling Services (E13-157) is scheduled for  
17 January 2016 and the award for the Marine Intervention Services (E13-158) is  
18 scheduled for Q1, 2016. These are in advance of the start of the construction of the  
19 HDD bore holes which is scheduled for Q2, 2016.  
20

21 **2.8 Converters and Substations**  
22

23 ABB were approved to mobilize and commence construction at the Woodbine and  
24 Bottom Brook sites in Q3. Excavation and construction of the foundations of the  
25 converters and substations are in progress and will continue into January when  
26 construction will stop for the remainder of the winter months, and recommence in Q2  
27 2016. Procurement and fabrication of several of the components and subsystems  
28 advanced throughout this period as planned. This advancement of civil work mitigates  
29 risks in the 2016 execution plan.

1 **2.9 Right of Way Clearing Contractor(s) – Transmission Lines**

2

3 The right of way clearing in both NS and NL was completed for the Grounding and  
4 HVdc lines. Prior to the safety stand-down, the right of way clearing for the HVac line  
5 from Granite Canal to Bottom Brook progressed ahead of schedule. Following  
6 approval to proceed after the safety review, clearing resumed on Segment 2 of the AC  
7 line. This segment has the most difficult high angle terrain. Special safety training and  
8 safety work practices were developed and implemented. Substantial completion of the  
9 right of way clearing is scheduled for Q1, 2016 and minor cleanup activities are  
10 planned in the summer of 2016.

11

12 **2.10 Construction Contractor(s) – Transmission Lines**

13

14 Marshalling yards in NS and NL have been established and are operational with  
15 materials being received. The supplies of conductors, contracted with Midal, were  
16 delivered to each marshalling yard. The OPGW hardware was ordered and received in  
17 NL and NS from Compow. Lots 1 and 2 of three lots of the OPGW wiring were  
18 delivered. The final lot will be delivered before year end. Abengoa continued to order  
19 and receive wood poles and relevant hardware from their suppliers. Structures,  
20 foundation grillages and other hardware began to arrive from Kalparatu in Q3 with  
21 completion expected in Q1, 2016. The items that will be delivered in 2016 are not on  
22 the critical path.

23

24 In Q3, the staking of the lines were completed and confirmed. The geotechnical  
25 activities began and are in progress which confirms the type of foundations required  
26 for each structure. Construction of the grounding lines began in October in NL, and in  
27 December in NS.

28

29 **2.11 Construction Contractor(s) – Site Preparation**

30

31 In NL, site preparation is scheduled to be completed in Q4 with the exception of Cape  
32 Ray, which is now scheduled to be completed in Q1, 2016. All work at Bottom Brook

1 was completed in Q3 and the site was passed over to ABB for its civil work program.  
2 The Granite Canal site preparation has been completed. At Cape Ray, work on the  
3 HDD pad, the land cable access route and the transition compounds restarted in  
4 November following the safety review. All access road work at Indian Head was  
5 completed. Work along the Burgeo highway to Victoria River is progressing.

6  
7 In NS, site preparation work was completed in November. The Woodbine site was  
8 completed and transferred to the control of ABB in Q3. Site preparation work at Big  
9 Lorraine and Point Aconi was completed in November.

## 10 11 **2.12 Granite Canal Accommodations Construction**

12  
13 The contract for the construction of the 100 person accommodations facility at Granite  
14 Canal (E13-89B) was awarded in November, 2014. The construction of the 100 beds  
15 and kitchen facilities was completed in July, 2015. Final administrative closeout of  
16 this contract is in progress.

## 17 18 **2.13 Granite Canal Accommodations Operations**

19  
20 The contract for the operations of the Granite Canal accommodations facility (E13-  
21 89A) was awarded to East Coast Catering in April, 2015. The camp has been in full  
22 operation since July, 2015.

## 23 24 **2.14 Grounding Sites**

25  
26 The contract was awarded in October, 2015 for the construction of the breakwater at  
27 Indian Head in NL under initiative E13-102A. Planning and mobilization began in  
28 October and construction began in November. Construction will continue into  
29 December and will restart in Q2, 2016 following the winter shutdown. The  
30 construction of the on-land portion of the work is forecasted to be completed in Q4,  
31 2015 and the marine breakwater construction is forecasted to be completed in the  
32 spring of 2016.

1 The contract for the NS Breakwater at Big Lorraine is scheduled to be awarded in Q1,  
2 2016 and construction is scheduled to take place in Q2 and Q3, 2016

3  
4 Both scopes of work will be followed by the installation of the electrical equipment at  
5 both Grounding Sites. The RFP for this Initiative (E13-103 A/B) is forecasted to be  
6 issued in Q1, 2016 and awarded by Q2, 2016. The work is forecasted to be completed  
7 by Q4 of 2016.

8  
9 **2.15 Independent Engineer**

10  
11 During August, 2015, the Independent Engineer (IE) visited the manufacturing sites of  
12 Nexans in Norway and of ABB in Sweden. Please refer to Attachment 4 for a copy of  
13 the site visit report. In November 2015, the IE conducted a site visit to various  
14 locations in Newfoundland and Labrador. A site visit report will be prepared and filed  
15 in a future Quarterly Report once it is received from the IE. Following the site visit, a  
16 meeting was held with the IE to review findings; no corrective actions were identified.

1 **3.0 UPDATED COST SUMMARY**

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As per Enerco U-31, section 2.1, the detail below outlines the DG3 forecasted costs.

Table 2 below provides an updated cost summary for the Maritime Link, which includes actual costs incurred to the end of Q3 2015 and forecasted costs for the remainder of the Project's construction phase.

NSPML continues to track and report all costs, actual and forecast (2011-2017), consistent with the methodologies used in the costs forecast represented in the ML Project application, for inclusion in the final approved ML Capital Cost application. Project costs include fully allocated costs for the entire Project Management Team, including contractors, employees, executives dedicated to the project, and NS Power seconded employees at affiliate mark-up rates according to the Code of Conduct for Affiliate Transactions. All costs provided are in Canadian dollars.

Actual AFUDC is being tracked and recorded monthly. AFUDC remains within the \$230 million amount estimated at the time of filing of NSPML's Application.

The project remains on target for completion in 2017 and within the approved budget of \$1.577B.

Table 2

Description	Actual Costs						Forecast			Total Project Estimate at Completion
	2011-2013	2014	Q1 2015	Q2 2015	Q3 2015	Total Project to Date	2016	2017		
							Q1 - Q4	Q1 - Q4		
Emera NL Project Management Costs	44,379	42,315	6,338	5,516	6,333	104,881	6,888	27,934	29,617	169,320
Nalcor Project Support Costs	-	15,232	170	270	9	15,681	-	-	-	15,681
Construction and Engineering Initiatives	14,975	167,980	83,168	76,938	46,934	389,995	71,993	521,952	234,058	1,217,998
Environmental Approval	2,651	4,378	58	158	550	7,794	1,001	5,706	9,060	23,561
Submarine and related	3,359	83,797	29,826	24,242	12,616	153,841	10,166	54,115	105,527	323,649
Converters, structures, and other ancillary equipment	1,517	48,747	40,700	26,914	14,218	132,096	30,352	302,314	83,026	547,788
AC and DC Transmission	7,448	31,057	12,584	25,624	19,550	96,263	30,474	159,817	36,446	323,000
<b>Total</b>	<b>59,354</b>	<b>225,527</b>	<b>89,676</b>	<b>82,724</b>	<b>53,276</b>	<b>510,557</b>	<b>78,882</b>	<b>549,886</b>	<b>263,675</b>	<b>1,403,000</b>
Escalation	-	-	-	-	-	-	290	1,722	33,342	35,354
Contingency	-	-	-	-	-	-	-	22,711	116,289	139,000
<b>Grand Total</b>	<b>59,354</b>	<b>225,527</b>	<b>89,676</b>	<b>82,724</b>	<b>53,276</b>	<b>510,557</b>	<b>79,172</b>	<b>574,319</b>	<b>413,306</b>	<b>1,577,354</b>

### Total Actual Project Costs at end of Q3, 2015 Compared to Previous Forecast

The total actual project costs for Q3, 2015 were \$23.2 million less than the Q3 costs forecasted in the NSPML Quarterly Report of Oct 15, 2015. The explanations of the variances are as follows:

- Project management and other: \$0.8 million lower cost incurrence due to lower spending on general and administration expenses including labour, legal, regulatory and consulting.
- Submarine and related: \$0.9 million lower cost incurrence due to rescheduled site preparation activities at the Horizontal Directional Drilling (HDD) site at Cape Ray, NL.
- Converters, structures and other ancillary equipment: \$12.5 million lower cost incurrence due to rescheduling of the engineering and procurement activities for the Converter / Substations supply contract.

- 1           • AC and DC Transmission: \$8.8 million lower cost incurrence attributable to timing  
2           of the start of the construction for the grounding lines and the delivery of  
3           structures, grillages and other materials.

4  
5           These variances do not change the expectation that the Project remains on time and  
6           within budget.



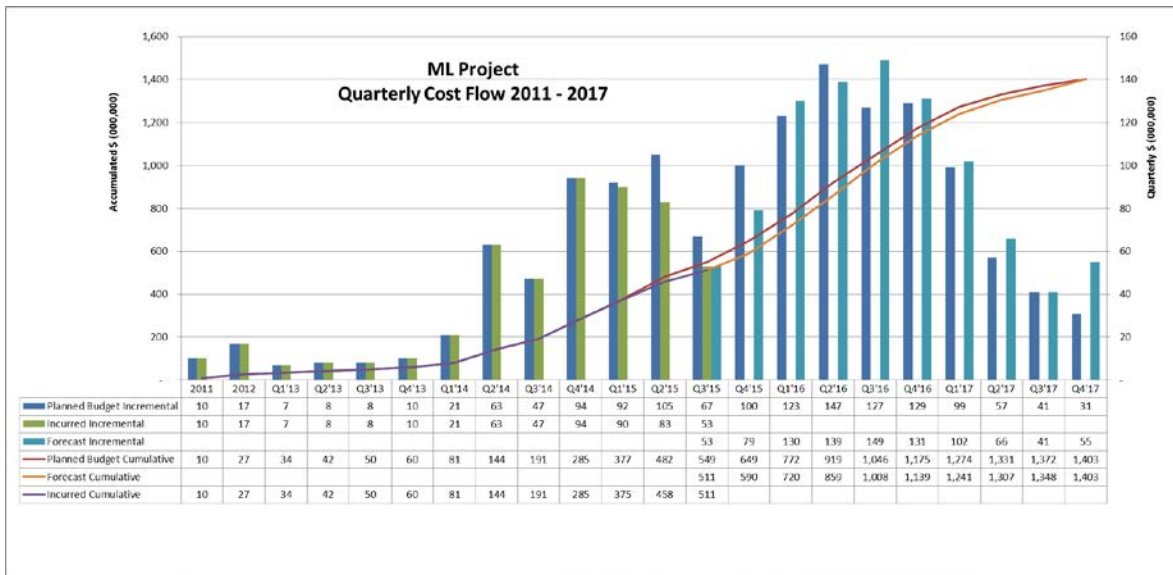
1 **4.0 COST FLOW**

2

3 As per Enerco U-31, section 2.2, please refer to Table 3 below for the cost flow until  
 4 the Maritime Link is commissioned. This cost flow provides a base capital spending  
 5 forecast of \$1.403 billion. Escalation and contingency in the amount of \$174 million  
 6 will be allocated to appropriate accounts if and when necessary to account for  
 7 expenditures associated with project risks. The total of the base capital spending,  
 8 escalation, and contingency amounts remains at \$1.577 billion.

9

10 **Table 3**



Activity Name	Start	Finish	2014				2015				2016				2017			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>Maritime Link Project-- Master Schedule ( DD-NOV-01-15 )</b>																		
<b>GATES AND MILESTONES</b>																		
<b>Gates &amp; Milestones.</b>																		
DG2 Concept Selection	01-Mar-11 A	22-Nov-17																
DG3 Approval to Construct	01-Mar-11 A	01-Oct-17																
Project Completion (Handover)	24-Dec-12 A	29-Sep-17																
DG4 Approval to Operate	29-Sep-17*	15-Sep-17																
<b>Milestones</b>																		
Start MLP	01-Mar-11 A	01-Oct-17																
Submit EA Report	01-Mar-11 A	10-Jan-13 A																
Submit UARB Application		28-Jan-13 A																
Environmental Assessment Approval		21-Jun-13 A																
UARB Approval		29-Nov-13 A																
Marine Cable Contract Award (EPC1)		31-Jan-14 A																
Transmission Line Tree Clearing Start 12000 BB to CR	17-Feb-14 A	30-Jun-14 A																
Converter Station Contract Signoff (EPC2) ( E12-74 )		14-Sep-17																
Commission Complete		22-Sep-17*																
Marine Cable Install Substantial Complete		01-Oct-17																
First Commercial Power		29-Sep-17																
Milestones For E12-74	02-Jul-14 A	29-Sep-17																
02-Oct-12 A	11-Sep-17																	
<b>OVERHEAD TRANSMISSION LINE</b>																		
<b>11000 (T23001) Overhead AC Transmission Line from Granite Canal to Bottom Brook (</b>	<b>05-Nov-12 A</b>	<b>30-Mar-17</b>																
ENGINEERING	05-Nov-12 A	17-Mar-17																
PROCUREMENT ( MATERIALS & FABRICATION ).	02-Feb-15 A	19-Jan-16																
CONSTRUCTION	02-Jul-14 A	30-Mar-17																
COMMISSIONING	11-Apr-16	29-Mar-17																
<b>12000 (X20005/6) Overhead HVDC Transmission Line from Bottom Brook to Cape Ray</b>	<b>05-Nov-12 A</b>	<b>29-Mar-17</b>																
ENGINEERING	05-Nov-12 A	17-Mar-17																
PROCUREMENT ( MATERIALS & FABRICATION )	01-Oct-14 A	11-Jan-16																
CONSTRUCTION	24-Feb-14 A	29-Mar-17																
COMMISSIONING	08-Sep-16	29-Mar-17																
<b>13000 (X20001/2) Overhead HVDC Transmission Line from Point Aconi to Woodbine ( t</b>	<b>02-Oct-12 A</b>	<b>28-Oct-16</b>																
ENGINEERING	02-Oct-12 A	24-Oct-16																
PROCUREMENT ( MATERIALS & FABRICATION )	02-Feb-15 A	18-Jan-16																
CONSTRUCTION	17-Feb-14 A	28-Oct-16																
COMMISSIONING	07-Oct-16	28-Oct-16																
<b>14100 (E00502) Grounding line from Bottom Brook to Indian Head ( NL )</b>	<b>05-Nov-12 A</b>	<b>25-Jul-16</b>																
ENGINEERING	05-Nov-12 A	25-Nov-15																
PROCUREMENT ( MATERIALS & FABRICATION )	02-Mar-15 A	23-Nov-15																
CONSTRUCTION	17-Mar-14 A	25-Jul-16																
COMMISSIONING	10-May-16	30-May-16																
<b>14200 (E00501) Grounding line - Woodbine to Big Lorraine ( NS )</b>	<b>02-Oct-12 A</b>	<b>22-Aug-16</b>																
ENGINEERING	02-Oct-12 A	22-Aug-16																
PROCUREMENT ( MATERIALS & FABRICATION )	18-Mar-15 A	22-May-15 A																
CONSTRUCTION	23-Feb-15 A	29-Jul-16																

█ Primary Baseline   
 █ Remaining Work   
 ◆ Milestone   
 ◆ Actual Work   
 ◆ Baseline Milestone   
 ▶ Summary

TASK filter: All Activities

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Activity Name	Start	Finish	2014				2015				2016				2017				
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
<b>COMMISSIONING</b>	08-Jul-16	29-Jul-16																	
<b>15000 Accommodations</b>	23-Aug-13 A	11-Sep-17																	
<b>ENGINEERING</b>	23-Aug-13 A	31-Oct-14 A																	
<b>PROCUREMENT ( MATERIALS &amp; FABRICATION )</b>	15-Sep-14 A	10-Nov-14 A																	
<b>CONSTRUCTION</b>	01-Sep-14 A	11-Sep-17																	
<b>AC INTERCONNECTION STATIONS.</b>	03-Dec-12 A	30-Aug-17																	
<b>21100 (103NL) Switchyard at Granite Canal ( NL )</b>	03-Dec-12 A	15-May-17																	
<b>ENGINEERING</b>	03-Dec-12 A	30-Nov-16																	
<b>PROCUREMENT ( MATERIALS &amp; FABRICATION )</b>	29-Sep-14 A	26-Oct-16																	
<b>CONSTRUCTION</b>	01-Oct-15 A	20-Feb-17																	
<b>COMMISSIONING</b>	03-Jan-17	15-May-17																	
<b>21200 (102NL) Modifications for P&amp;C Communications, Ductbanks to Existing 230 kV</b>	29-Sep-14 A	02-Jun-17																	
<b>ENGINEERING</b>	29-Sep-14 A	03-Jun-16																	
<b>PROCUREMENT ( MATERIALS &amp; FABRICATION )</b>	01-Dec-15	01-Dec-16																	
<b>EPC2 CONSTRUCTION</b>	30-Jun-16	15-Feb-17																	
<b>COMMISSIONING</b>	09-Feb-17	02-Jun-17																	
<b>22000 (101NL) Switchyard at Bottom Brook</b>	03-Dec-12 A	20-Jul-17																	
<b>ENGINEERING</b>	03-Dec-12 A	29-Feb-16																	
<b>PROCUREMENT ( MATERIALS &amp; FABRICATION )</b>	29-Sep-14 A	25-Apr-17																	
<b>CONSTRUCTION</b>	29-Sep-14 A	28-Mar-17																	
<b>COMMISSIONING</b>	08-Mar-17	20-Jul-17																	
<b>22100 Generator Fuel Supply</b>	19-Jun-17	20-Jul-17																	
<b>23100 (301NS) Connect 345 kV Substation at Woodbine to Converter Station, ( NS )</b>	06-May-13 A	29-Aug-14 A																	
<b>23200 (301NS) Extension of Substation at Woodbine ( NS )</b>	17-Feb-14 A	25-Jul-17																	
<b>ENGINEERING</b>	04-Aug-14 A	18-Jan-16																	
<b>PROCUREMENT ( MATERIALS &amp; FABRICATION )</b>	29-Sep-14 A	15-Nov-16																	
<b>CONSTRUCTION</b>	17-Feb-14 A	12-Apr-17																	
<b>COMMISSIONING</b>	03-Apr-17	25-Jul-17																	
<b>23300 (301NS) NSPI Control Centre Modifications ( NS )</b>	03-Jan-17	29-Jun-17																	
<b>CONSTRUCTION</b>	03-Jan-17	15-Jun-17																	
<b>COMMISSIONING</b>	15-Jun-17	29-Jun-17																	
<b>23400 (301NL) NLH Control Centre Modifications ( NL )</b>	03-Jan-17	30-Aug-17																	
<b>CONSTRUCTION</b>	03-Jan-17	15-Jun-17																	
<b>COMMISSIONING</b>	15-Jun-17	30-Aug-17																	
<b>GROUNDING SITES ASSOCIATED WITH CONVERTER STATIONS.</b>	06-May-13 A	30-Sep-16																	
<b>31000 (901NL) Grounding Site NL - Indian Head ( NL )</b>	06-May-13 A	02-Sep-16																	
<b>ENGINEERING</b>	06-May-13 A	11-Feb-15 A																	
<b>PROCUREMENT ( MATERIALS &amp; FABRICATION )</b>	02-Aug-16	25-Aug-16																	
<b>CONSTRUCTION</b>	06-Oct-14 A	29-Aug-16																	
<b>COMMISSIONING</b>	24-Aug-16	02-Sep-16																	
<b>32000 Grounding Site NS - Big Lorraine ( NS )</b>	06-May-13 A	30-Sep-16																	
<b>ENGINEERING</b>	06-May-13 A	02-Nov-15																	
<b>PROCUREMENT ( MATERIALS &amp; FABRICATION )</b>	01-Sep-16	13-Sep-16																	
<b>CONSTRUCTION</b>	01-Dec-14 A	22-Sep-16																	
<b>COMMISSIONING</b>	20-Sep-16	30-Sep-16																	

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Activity Name	Start	Finish	2014				2015				2016				2017			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>CONVERTER STATIONS.</b>																		
<b>41000 (301NL) Bottom Brook Converter Station ( NL )</b>	01-Oct-12 A	28-Sep-17																
ENGINEERING	01-Oct-12 A	31-Jul-17																
PROCUREMENT ( MATERIALS & FABRICATION )	01-Oct-12 A	30-Aug-16																
CONSTRUCTION	03-Nov-14 A	28-Apr-17																
COMMISSIONING	29-Sep-14 A	26-Apr-17																
COMMISSIONING	27-Apr-17	31-Jul-17																
<b>42000 (301NS) Woodbine Converter Station ( NS )</b>	01-Oct-12 A	28-Sep-17																
ENGINEERING	01-Oct-12 A	29-Jun-16																
PROCUREMENT ( MATERIALS & FABRICATION )	29-Sep-14 A	22-Mar-17																
CONSTRUCTION	11-Sep-14 A	11-Apr-17																
COMMISSIONING	12-Apr-17	28-Sep-17																
<b>OVERHEAD TO UNDERGROUND TRANSITION SITES.</b>																		
<b>51000 (701NL) Overhead to Underground Transition Compound at Cape Ray ( NL )</b>	08-Oct-12 A	13-Sep-17																
ENGINEERING	28-Jan-13 A	04-May-17																
PROCUREMENT ( MATERIALS & FABRICATION )	28-Jan-13 A	16-Mar-16																
CONSTRUCTION	02-Sep-14 A	29-Nov-16																
COMMISSIONING	02-Nov-15	04-May-17																
COMMISSIONING	06-Mar-17	27-Apr-17																
<b>52000 (701NS) Overhead to Underground Transition Compound at Point Aconi ( NS )</b>	08-Oct-12 A	04-May-17																
ENGINEERING	08-Oct-12 A	30-Mar-16																
PROCUREMENT ( MATERIALS & FABRICATION )	02-Jul-14 A	25-Nov-16																
CONSTRUCTION	04-Feb-14 A	04-May-17																
COMMISSIONING.	03-Apr-17	28-Apr-17																
<b>53000 (702NS) Woodbine Transition Compound ( NS )</b>	06-May-13 A	13-Sep-17																
ENGINEERING	06-May-13 A	28-Aug-14 A																
PROCUREMENT ( MATERIALS & FABRICATION )	02-Nov-15	13-Aug-16																
CONSTRUCTION	09-Sep-14 A	04-May-17																
COMMISSIONING	25-Jul-17	13-Sep-17																
<b>55000 Telecommunication Links</b>	01-Jan-13 A	29-Jun-17																
ENGINEERING	01-Jan-13 A	31-Oct-14 A																
PROCUREMENT ( MATERIALS & FABRICATION )	02-Nov-15	01-Nov-16																
CONSTRUCTION	04-Jan-16	02-May-17																
COMMISSIONING	03-May-17	29-Jun-17																
<b>56000 Control Center Data Link</b>	29-Nov-13 A	29-Jun-17																
ENGINEERING	29-Nov-13 A	30-Jun-16																
PROCUREMENT ( MATERIALS & FABRICATION )	29-Apr-16	28-Oct-16																
CONSTRUCTION	03-Jan-17	15-Jun-17																
COMMISSIONING	16-Jun-17	29-Jun-17																
<b>58000 Improvement of Access Road Infrastructure.</b>	02-May-13 A	15-Dec-15																
ENGINEERING	02-May-13 A	15-Oct-13 A																
CONSTRUCTION	14-Oct-14 A	15-Dec-15																
COMMISSIONING	02-Nov-15	11-Nov-15																
<b>SUBMARINE CABLE AND TERMINATIONS.</b>																		
<b>61000 Submarine Cable, Land Cable, and Terminations</b>	03-Sep-12 A	22-Nov-17																
MILESTONES	30-Jan-14 A	22-Nov-17																
ADMINISTRATION & QHSER	30-Jan-14 A	22-Nov-17																
ADMINISTRATION & QHSER	30-Jan-14 A	19-Oct-17																

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Activity Name	Start	Finish	2014				2015				2016				2017					
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
ENGINEERING	30-Jan-14 A	22-Oct-17																		
PROCUREMENT	11-Aug-14 A	30-Mar-17																		
MANUFACTURING	17-Jun-15 A	10-Mar-17																		
TRANSPORT	27-Sep-15 A	29-Apr-17																		
CONSTRUCTION INSTALLATION & PROTECTION	29-Jun-15 A	15-Aug-17																		
PRECOMMISSIONING	07-Aug-17	14-Sep-17																		
<b>62000 Landfall HDD</b>	<b>03-Sep-12 A</b>	<b>23-Sep-16</b>																		
HDD ENGINEERING	03-Sep-12 A	10-Nov-15																		
62100 Landfall HDD Point Aconi, NS	04-Feb-14 A	23-Sep-16																		
62200 Landfall HDD Cape Ray, NL	01-Nov-15	28-Jun-16																		
<b>63000 Marine Consultancy Services</b>	<b>22-Mar-13 A</b>	<b>29-Sep-17</b>																		
63100 Marine Warranty Survey Services	03-Mar-16	29-Sep-17																		
63200 Marine 3rd Party Engineering Verification Services	08-Dec-15	29-Sep-17																		
63300 Engineering Studies (finalize cable protection studies, design rock berm, etc.)	22-Mar-13 A	04-Apr-14 A																		
<b>20000 NSPI</b>	<b>07-Feb-14 A</b>	<b>30-Aug-17</b>																		
<b>20100 NSPI - L6513 - Onslow to Springhill Rebuild</b>	<b>07-Feb-14 A</b>	<b>10-Nov-16</b>																		
ENGINEERING	07-Feb-14 A	29-Jan-16																		
PROCUREMENT ( MATERIALS & FABRICATIONS )	26-Jan-15 A	31-May-16																		
CONSTRUCTION	01-Dec-15	31-Oct-16																		
COMMISSIONING	17-Oct-16	10-Nov-16																		
<b>20200 NSPI - Strait of Canso Crossing/Separate L-8004/L-7005</b>	<b>17-Mar-14 A</b>	<b>17-Nov-16</b>																		
ENGINEERING	17-Mar-14 A	15-Mar-16																		
PROCUREMENT ( MATERIALS & FABRICATIONS )	02-Nov-15	29-Apr-16																		
CONSTRUCTION	01-Feb-16	31-Oct-16																		
COMMISSIONING	01-Nov-16	17-Nov-16																		
<b>20300 NSPI - L-6511/L-7019</b>	<b>01-Oct-14 A</b>	<b>30-Nov-16</b>																		
ENGINEERING	01-Oct-14 A	04-Dec-15																		
PROCUREMENT ( MATERIALS & FABRICATIONS )	01-Apr-15 A	02-Nov-15																		
CONSTRUCTION	02-Nov-15	31-Mar-16																		
COMMISSIONING	23-Nov-15	30-Nov-16																		
<b>20400 NSPI - L-8001 &amp; L-8002 Node Swap at 67N-Onslow (Onslow to NB, Onslow to La</b>	<b>10-Feb-14 A</b>	<b>27-Jan-16</b>																		
ENGINEERING	10-Feb-14 A	31-Mar-15 A																		
PROCUREMENT 9 MATERIALS & FABRICATIONS )	05-Jan-15 A	24-Apr-15 A																		
CONSTRUCTION	01-Dec-14 A	02-Nov-15																		
COMMISSIONING	02-Nov-15	27-Jan-16																		
<b>20600 NSPI - Transmission Line (7015 pinch Points)(E12-50)(overlap with 13000)</b>	<b>11-Mar-14 A</b>	<b>30-Jan-15 A</b>																		
ENGINEERING	11-Mar-14 A	30-Sep-14 A																		
PROCUREMENT ( MATERIALS & FABRICATIONS )	14-Apr-14 A	31-Oct-14 A																		
CONSTRUCTION	16-Sep-14 A	30-Jan-15 A																		
COMMISSIONING	29-Jan-15 A	30-Jan-15 A																		
<b>20700 NSPI - SPS Modification</b>	<b>02-Nov-15</b>	<b>30-Aug-17</b>																		
ENGINEERING	02-Nov-15	02-Feb-17																		
PROCUREMENT ( MATERIALS & FABRICATIONS )	03-Oct-16	24-Mar-17																		
CONSTRUCTION	01-Apr-16	03-Aug-17																		
COMMISSIONING	03-Aug-17	30-Aug-17																		

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			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>OWNER'S SCHEDULE.</b>																		
<b>90100 Project Management</b>	15-Mar-11 A	02-Oct-17																
ENL Finance	15-Mar-11 A	02-Oct-17																
DG3 Deliverables	02-Jan-14 A	30-Apr-14 A																
Project Controls	21-Jan-13 A	26-May-14 A																
Integrated Commission Planning	15-Mar-11 A	02-Oct-17																
HS and S Program	22-May-13 A	21-May-14 A																
Quality Management Program	04-Jun-12 A	27-Sep-13 A																
Purchasing (Contracts)	23-Sep-13 A	29-Sep-17																
Marine EPC 1 (E11-18)	15-Mar-11 A	02-Mar-16																
Marine	15-Mar-11 A	30-Jan-14 A																
	15-Jun-12 A	02-Mar-16																
Marine 3rd Party Engineering Verification Services E13-155	04-Nov-13 A	07-Dec-15																
Marine Warranty Services E12-75	05-Nov-12 A	02-Mar-16																
HDD Geotech and Detail Design Program E12-51	15-Jun-12 A	14-Feb-14 A																
HDD Directional Drilling and Casing Installation E13-156	06-Jan-14 A	24-Feb-16																
HDD Services E13-157	06-Jan-14 A	29-Jan-16																
HDD Marine Intervention Services E13- 158	06-Jan-14 A	05-Jan-16																
Cable Study E13-159	13-Jan-14 A	03-Feb-14 A																
Converter Stations (EPC2) E12-74	09-Oct-12 A	30-Jun-14 A																
Land Assets	18-Jun-12 A	21-Jan-16																
Environment	22-Jun-11 A	04-Dec-15																
Project Control Office	09-Jul-12 A	16-Jul-14 A																
Land Acquisition Services	29-Oct-12 A	22-Feb-13 A																
Risk Assessments	09-Sep-13 A	23-Jan-17																
<b>90200 External Services</b>	04-Jan-12 A	02-Feb-16																
Legal Services	25-Jun-12 A	02-Feb-16																
Insurance Services	03-Jul-12 A	10-Dec-14 A																
Regulatory (UARB) Affairs	02-Jan-13 A	24-Jun-14 A																
Independent Project Reviews	08-Jul-13 A	06-Jan-16																
Human Resources, Diversity and Gender Equity and Benefits Strategy	01-Aug-12 A	30-Sep-14 A																
CBOD/BoD Hatch	04-Jan-12 A	22-Jan-13 A																
<b>93000 Environmental</b>	02-Apr-12 A	18-Aug-17																
EA Approval	11-Jan-13 A	09-Sep-13 A																
Environmental Studies	02-Apr-12 A	30-Dec-16																
Permits	14-Jan-13 A	30-Dec-16																
Environmental Protocol Documents	01-Aug-13 A	02-Nov-15																
Aboriginal Relations	11-Jun-12 A	02-Nov-15																
Other Stakeholder Relations	28-Jan-13 A	30-Dec-16																
Post EA Environmental Monitoring Program	01-Jun-13 A	18-Aug-17																
Environmental Program 14001	31-Jan-13 A	02-Nov-15																
<b>94000 Land Acquisition</b>	15-Jul-12 A	31-May-16																
<b>90500 Other NLH System Upgrades</b>	31-Aug-12 A	04-Nov-15																
Engineering (TL201, Bay D'Esprit, Upper Salmon)	31-Aug-12 A	14-Aug-13 A																
Procurement (Materials & Fabrication)	02-Nov-15	02-Nov-15																
Construction	02-Nov-15	03-Nov-15																
Commissioning	02-Nov-15	04-Nov-15																
<b>Dynamic Commissioning (90100)</b>	31-Aug-17	15-Sep-17																

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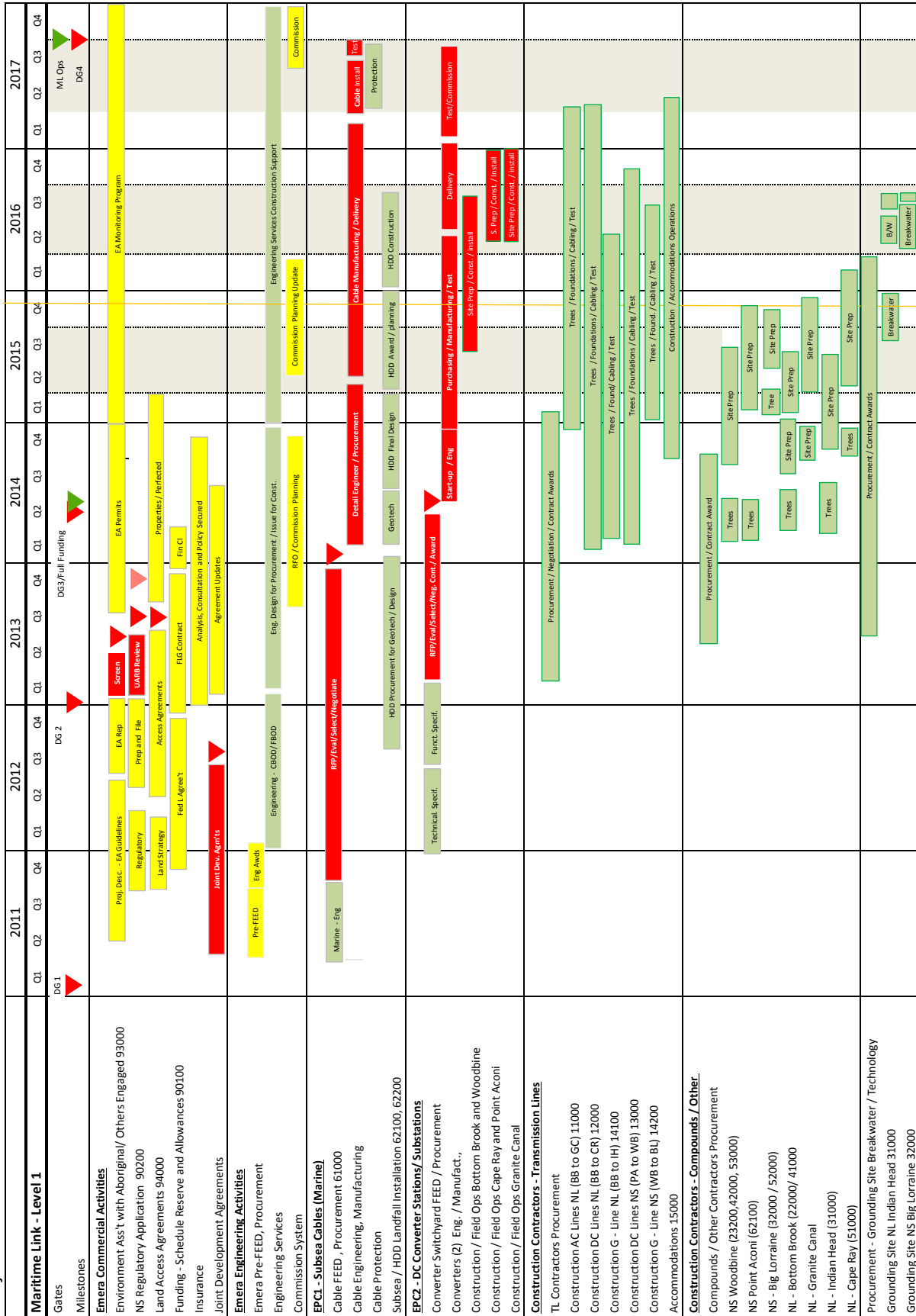
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Maritime Link Project  
Level 1 Project Schedule

Project Level 1 Schedule

Nov 1



## SCHEDULE "Q"

### DRAW CONFIRMATION CERTIFICATE BY INDEPENDENT ENGINEER

#### ML PROJECT FINANCING

This Draw Confirmation Certificate is provided by MWH Canada, Inc. (the "Independent Engineer") to The Toronto-Dominion Bank (the "Collateral Agent") in connection with the credit agreement dated February 24, 2014, between NSP Maritime Link Incorporated (the "Borrower"), Maritime Link Financing Trust (the "Lender") and the Collateral Agent (said agreement, as same may be amended, supplemented or restated from time to time, is hereinafter referred to as the "ML Credit Agreement"). Capitalized terms used in this Draw Confirmation Certificate not defined herein shall have the meanings assigned to them in Exhibit A of the ML Credit Agreement.

The Independent Engineer has (i) discussed matters believed pertinent to this Draw Confirmation Certificate with the Borrower and any relevant Material Project Participants, (ii) made such other inquiries as we have determined appropriate and (iii) reviewed:

- (a) the Construction Report dated October 20, 2015 (the "Construction Report"); and
- (b) the Borrower's funding request dated October 26, 2015 (the "Funding Request").

On the basis of the foregoing limited review procedures and on the understanding and assumption that the factual information contained in the Construction Report and Funding Request is true, correct and complete in all material respects, the Independent Engineer makes the following statements in favour of the Collateral Agent and to the best of its knowledge, information and belief, as of the date hereof that:

1. Construction of the Project is progressing in a satisfactory manner and in accordance with the terms of the applicable Material Project Documents with the following exceptions:

NO EXCEPTIONS NOTED

2. All payments to the Material Project Participants to be paid with the proceeds of the ML Construction Loan (including any payments using advances from the Working Capital Reserve Account during the period from the last Draw Confirmation Certificate to this Draw Confirmation Certificate) requested to be made pursuant to the Funding Request are allowed under the payment terms of the applicable Material Project Documents and the ML Credit Agreement as to the advance requirements of Section 7.3, with the following exceptions:

NO EXCEPTIONS NOTED

3. Assuming the Borrower exercises proper engineering and construction management throughout the remainder of the Project, we have no reason to believe that the




Commissioning Date will not occur prior to the Date Certain, or that the total Project Costs will exceed [\$1,577,354,028] with the following exceptions:

NO EXCEPTIONS NOTED

This Draw Confirmation Certificate is solely for the information and assistance of the Collateral Agent, the Lender and Canada in connection with the Funding Request and shall not be used, circulated or relied upon for any other purpose or by any other party.

Dated: Oct 28, 2015

**MWH CANADA, INC.**

A handwritten signature in blue ink, appearing to be 'MWH', is written over a horizontal line.

By: \_\_\_\_\_

Title: IE Team Leader

## SCHEDULE "Q"

### DRAW CONFIRMATION CERTIFICATE BY INDEPENDENT ENGINEER

#### ML PROJECT FINANCING

This Draw Confirmation Certificate is provided by MWH Canada, Inc. (the "Independent Engineer") to The Toronto-Dominion Bank (the "Collateral Agent") in connection with the credit agreement dated February 24, 2014, between NSP Maritime Link Incorporated (the "Borrower"), Maritime Link Financing Trust (the "Lender") and the Collateral Agent (said agreement, as same may be amended, supplemented or restated from time to time, is hereinafter referred to as the "ML Credit Agreement"). Capitalized terms used in this Draw Confirmation Certificate not defined herein shall have the meanings assigned to them in Exhibit A of the ML Credit Agreement.

The Independent Engineer has (i) discussed matters believed pertinent to this Draw Confirmation Certificate with the Borrower and any relevant Material Project Participants, (ii) made such other inquiries as we have determined appropriate and (iii) reviewed:

- (a) the Construction Report dated November 20, 2015 (the "Construction Report"); and
- (b) the Borrower's funding request dated November 20, 2015 (the "Funding Request").

On the basis of the foregoing limited review procedures and on the understanding and assumption that the factual information contained in the Construction Report and Funding Request is true, correct and complete in all material respects, the Independent Engineer makes the following statements in favour of the Collateral Agent and to the best of its knowledge, information and belief, as of the date hereof that:

1. Construction of the Project is progressing in a satisfactory manner and in accordance with the terms of the applicable Material Project Documents with the following exceptions:

NO EXCEPTIONS NOTED

2. All payments to the Material Project Participants to be paid with the proceeds of the ML Construction Loan (including any payments using advances from the Working Capital Reserve Account during the period from the last Draw Confirmation Certificate to this Draw Confirmation Certificate) requested to be made pursuant to the Funding Request are allowed under the payment terms of the applicable Material Project Documents and the ML Credit Agreement as to the advance requirements of Section 7.3, with the following exceptions:

NO EXCEPTIONS NOTED

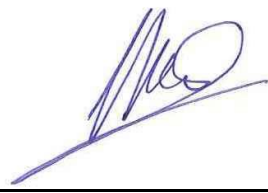
3. Assuming the Borrower exercises proper engineering and construction management throughout the remainder of the Project, we have no reason to believe that the Commissioning Date will not occur prior to the Date Certain, or that the total Project Costs will exceed [\$1,577,354,028] with the following exceptions:

NO EXCEPTIONS NOTED

This Draw Confirmation Certificate is solely for the information and assistance of the Collateral Agent, the Lender and Canada in connection with the Funding Request and shall not be used, circulated or relied upon for any other purpose or by any other party.

Dated: November 24, 2015

**MWH CANADA, INC.**

By:  \_\_\_\_\_

Title: IE Team Leader

# PLANT VISIT AND MANUFACTURING INSPECTION NEXANS FABRICATION FACILITY IN HALDEN, NORWAY AND ABB FABRICATION FACILITY IN LUDVIKA, SWEDEN AUGUST 18 AND 19, 2015

Prepared for: Natural Resources Canada and Emera

Project Lead: Nik Argirov

Date: October 28, 2015

## *Quality Assurance Statement*

<b>Office Address</b>	740-1185 W Georgia Street, Vancouver BC, V6E 4E6
<b>Prepared by</b>	Vladimir Kahle and Nik Argirov
<b>Reviewed by</b>	Nik Argirov and Howard Lee
<b>Approved for Issue by</b>	Howard Lee

---

## *Disclaimer*

*This document contains information from MWH which may be confidential or proprietary. Any unauthorized use of the information contained herein is strictly prohibited and MWH shall not be liable for any use outside the intended and approved purpose.*

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# 1. NEXANS NORWAY AS - Cable Manufacturing Facility

## 1.1. General

On August 18, 2015, the Independent Engineer (IE), MWH, represented by Nik Argirov and Vladimir Kahle, together with two senior management representatives from Emera met with the Nexans' Halden plant management and conducted a tour and inspection of the Nexans' production facilities in Halden, Norway.

Nexans Norway AS has been contracted (Contract E11-18) to carry out a turnkey project for the Maritime Link Project that consists of supply of two 200kV submarine cables, land cables, spare cables, joints and terminations, integrated fiber in PE-sheath at cable ends and two DTS (distributed temperature sensing) fiber optic cables, as well as transportation to site, marine and land cables installation and associated civil works.

The purpose of this plant inspection was to verify the status of Nexans' work and to review their QA/QC process relative to the manufacturing of the equipment supplied under this Contract.

## 1.2. Orientation meeting

The meeting started with a thorough safety briefing followed by overview presentation of the Halden facility's history, policies, products and operations. Emphasis on the safety procedures indicates sound management of the facility and care for its staff.

The scope of the offered services include engineering/ design, type testing, production and land as well as marine installation. Technical content of the presentation covered:

- Description and diagram of the cable and its terminations
- Detail description of the NOVA-L 200kV 1x1000 mm<sup>2</sup> copper cable
- An overview of the project and scope of material supply
- Cable installation phases.

The project management overview consisted of:

- Project plan (key tasks and their schedule)
- Project status and cumulative process indices
- Graphic representation of the progress

## 1.3. Factory tour

Submarine and High Voltage (HV) Underground Cable manufacturing is a continuous, conveyer-based process that requires extreme precision, controlled and in many occasions (stations) a dust free environment.

The tour started at the Drawing and Stranding operation where the profiled copper wires are fed into the conveyer in a proper sequence forming a tightly wound internal core – the main copper conductor. Following this is the Paper Lapping operation where the main insulation layer (multiple layers of high-density craft paper) is created. The process continues into the Drying and Impregnation operation. The passage from paper lapping into the drying tank is a dust-free and contamination controlled operation and requires an air controlled and process isolation environment.

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The cable then moves into the PE (polyethylene) Taping, galvanized steel wire Armoring and finally lead sheathing and PE Jacketing operation. After the PE tape installation, and before the steel armoring, a fiber optic cable is also fed into the conveyer and integrated into the both ends of the submarine cable system. The fiber optic cables function as the temperature monitoring system (DTS). Upon completion of the Jacketing and Armoring operations, the cable is ready for testing.

The IE was introduced to the High Voltage Lab as well as the outdoor bending/tension test yards. Although photography was not permitted, the technical staff freely shared the process information and answered our questions in detail.

The general observations include:

- Continuous quality monitoring appears to be in place throughout the plant. Hardcopy documentation is kept at the work stations.
- Appropriate signage and cleanliness of the workplace are evident
- Personal protection equipment is worn by the workers
- Maintenance was discussed at length with the plant manager. In order to facilitate cable manufacturing to tight tolerances, Predictive Maintenance program of the machinery is in place. Machine condition monitoring is apparent.
- Production and maintenance tools are kept at the workstations on well laid out boards or in dedicated tool holders.
- Plant manager indicated that most of the production staff are locals who are in- house trained. Technical staff and engineers come with requisite qualifications and are then trained for their roles. Continuous training program is in place to ensure maintenance of the staff skills. In order to retain the qualified staff, skills upgrading and promotions are in place and are encouraged.
- Testing lab appears adequately equipped to perform all of the required type and pre- delivery testing.

## 1.4. Comments and Conclusions

The following comments and conclusions are presented:

- Nexans' staff key competencies, organization, project management and production facilities are appropriate for carrying out the contracted scope of work.
  - The IE found the workmanship of the manufacturing very good. All of the different operations along the conveyer length were found to be of impressive precision and excellent quality.
  - The manufacturing process thus far has been carried out in compliance with very high standards of safety, quality and environmental criteria.
  - While this contract is slightly behind schedule at this time, the forecast indicates that they will be ahead of their schedule in early 2016 and the ML Project schedule will be fully met.
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## 2. ABB LUDVIKA - High Voltage Products Facility

### 2.1. General

On August 19, 2015, the Independent Engineer (IE), MWH, represented by Nik Argirov and Vladimir Kahle, together with two senior management representatives from Emera met with members of ABB's senior and Ludvika plant management. A tour was conducted for the inspection of the ABB's production facilities in Ludvika, Sweden.

ABB has been contracted (Contract E12-74) to carry out the HVDC converter facilities turnkey project for the Maritime Link. The bulk of the HVDC equipment will be manufactured in ABB's High Voltage Products facility.

The purpose of the plant visit / inspection was to verify the status of ABB's work and to review their QA/QC process relative to the manufacturing of the equipment supplied under this Contract.

### 2.2. Orientation meeting

Meeting started with a thorough safety briefing followed by a presentation which overviewed ABB history, organization, HVDC and Power Products, including the equipment produced at ABB Ludvika for Maritime Link and a description of the High Voltage Products plant. Emphasis on the safety procedures indicates sound management of the facility and care for its staff.

The scope of the HVDC converter stations supply includes engineering/ design, production, installation, commissioning and integration into the utilities grids. The presentation covered:

- History and locations of ABB's HVDC projects and overview of their worldwide facilities and divisions.
- Line commutated (Thyristor based) as well as voltage source or IGBT (Insulated Gate Bipolar Transistor) based converters are produced in Ludvika.
- Final assembly and pre-delivery testing of the HVDC valves and their control panels are done in Ludvika. Components for the controls come from ABB plant in Vasteros, IGBT's are supplied from ABB's Swiss plants.
- Redundancy, as well as the possible failure modes of the IGBT's and their controls were explored in detail. We were assured that the IGBT's always fail in 'ON' state effectively creating a short. Due to the installed redundancy this is not an issue for the valve performance. Similarly, failure of the gate controls will result in IGBT 'latch-up', i.e. a short.
- Maintainability of the valve modules was explored. Individual IGBT can be replaced in situ obviating a need to remove the valve module from the assembly.
- Reactive equipment such as AC transformers, converter transformers, reactors and instrument transformers are produced in Ludvika.
- The plant is expanding to handle power equipment at ultra-high voltage levels of 2000kV DC and 1700kV AC. High Voltage test facilities are equipped to handle that voltage class.

The project management of the Maritime Link contract was not covered in detail but it was indicated that Ludvika High Voltage Products plant can meet the ML project schedules:

- Transformer works manager advised that once the transformer manufacture is assigned to the workshop, the unit takes 100 days to complete. At this time there appears to be an adequate lead time. In a post meeting note ABB confirmed that the converter transformers, reactors and instrument transformers have already been slotted into the High Voltage Products plant production schedules.
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- Manufacture of the HVDC converter controls relies on supply of third party electronic components to Vasteros where the production of the control cubicles takes place. ABB confirmed there is no risk to deliveries of the third party components and that the Vasteros facility has the capacity and schedules to produce the control panels on time. Final pre-delivery testing takes place in Ludvika. That facility appears to be well equipped to handle the final assembly and testing of the controllers.
- HVDC converter power modules use IGBT's produced in ABB plant in Switzerland. Since the Swiss facility is a part of the ABB's internal supply chain, there should be little risk to on-time delivery of those components.

## 2.3. Factory tour

Plant tour consisted of visits to valve assembly section, fiber optic shop, reactive equipment manufacturing, control panel assembly and testing lab and the High Voltage testing bay. Sections' managers/ work leaders were on hand to participate in the interviews and answer technical enquiries in detail. Key parts of the valve assembly and transformer manufacturing processes were viewed. Although photography is not permitted, the technical staff freely shared the process information and answered our questions in detail. General observations include:

- Health and safety attention is obvious throughout the production areas. Appropriate signage, floor markings and cleanliness of the workplace are evident. Clean environment is maintained by housekeeping and personal protection equipment worn by the workers.
- Continuous quality monitoring appears to be in place throughout the plant. Hardcopy documentation is kept at the work stations, log entries are hand written, signed and date stamped.
- Discussions with the managers indicated there is a well established coordination between the engineering and production sections.
- Technical competence and subject matter knowledge of the production senior staff is apparent. We were advised that if there is a lack of specific manufacturing skill, qualified workers are brought in from outside of the company.
- Production and maintenance tools are kept at the workstations on well laid out boards or in dedicated tool holders.
- Testing lab appears adequately equipped to perform all of the required type and pre-delivery testing.

## 2.4. Comments and Conclusions

The following comments and conclusions are presented:

The orientation meeting and the following tour and interviews with the production staff indicated that ABB's staff key competencies, organization and management and production facilities are appropriate for carrying out the EPC contract to supply and install the ML's HVDC facilities. HV test lab and control panel lab are equipped and staffed to perform the requisite pre-delivery tests.

While the project timelines were not discussed in detail, it was indicated that the ML Project schedule will be fully met. Since the converter equipment manufacturing project schedule was not presented at the orientation meeting, the IE is unable to assess any potential risk to delivery timelines.

As for the applied HVDC technology, ABB valves are a standard, albeit state of the art, design that is being successfully used in other HVDC installations.

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## 2.5. Post Meeting Notes

Emera may wish to follow up on the following recommendations with their engineering staff to verify the issues below have been adequately addressed:

- Arc-flash hazard identification and mitigation/ risk reduction measures. Good reference standard is IEEE 1584-2002. Both the converter building and AC substations station service systems should be reviewed.
- ABB designed and manufactured electronics are presumably sufficiently hardened to be impervious to radio frequency interference. However, discussions in Ludvika indicated there are third party suppliers of the electronic components for the control systems. It is recommended that ABB demonstrates to Emera adequate tests of the assembled systems will be performed to ensure those systems are impervious to radio (especially UHF frequency) signals and to the RF noise generated by the substation power apparatus switching operations.
- Valve hall Fire detection and suppression systems were not discussed. Similarly, there was no mention of transformer deluge system. There may be insufficient combustibles present in the valve modules to sustain fire and a converter transformer fire is not perceived to be likely. It is recommended that Emera request ABB to share their design philosophy with Emera in order to provide additional clarity on the issue.

ABB provided a response to the aforementioned concerns; they will be adequately addressed with the necessary standard of care during the design stage.

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