SNC•LAVALIN INC.
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St. John's, Newfoundland & Labrador
Canada A1A 4E1
Telephone: (709) 368-0118
Fax: (709) 368-3541

MEMORANDUM

TO:	Darren Debourke	**Date:**	December 13, 2011
C.C.:			
FROM:	Luc Chaussé	**Ref.:**	
Subject:	**Gate 3 Deliverables – Geotechnical Survey, Data Acquisition and Analysis**		

In Stage 2, in order to develop the Gate 3 cost estimates, use was made of existing references:

A. List of all available references from previous Surveys performed on behalf on Nalcor

- SNC Lavalin February 2008 Report
  DC1090 – Site Investigation Converter Stations Gull Island and Soldiers Pond
- SNC Lavalin/BAE New Plan June 2011 Report
  Muskrat Falls 2010 Site Investigations Geotechnical
  Volume 2C – Borehole logs, Test results, Photos and Test Pit logs
  Switchyard, Converter Station, Accomodation Complex
- SNC Lavalin 1998
  Muskrat Falls Hydroelectric Development
  Final Feasibility Study
  Volume 2 – 1998 Geotechnical Investigation
- Lidar Map – Churchills Falls, Muskrat Falls, TAP, Forteau Transition, Shoal Cove Transition, Soldiers Pond
- Aerial Photos – Churchill Falls, Muskrat Falls, TAP, Forteau Transition, Shoal Cove Transition, Soldiers Pond
- AMEC January 2010
  Electrode Site Investigations Dowden's Point, NL

B. Needs for Surveying the different Sites

The list of references used for determining the geotechnical characteristic of the general area are adequate for preliminary site grading and foundation design. However, for a more detailed design it is required to have a more detailed Testing in order to do the final design. The outcome of the detailed geotechnical study will recommend the type of materials that may be used for site site grading, the required slope embankments, access road, and yard fill materials. It will also recommend the type of foundation that may be used, resistivity of the soil, potential problem issues that may be faced, possible alternative solutions, and the construction method.

C. Nature of the Field Campaign intended

Each of the Sites has been reviewed by our Geotechnical Engineer and determined the proposed location, quantity, and depth of the the BH (Bore Hole) to determine the strata of the soil underneath the Site.

The purpose of the Soil Exploration are to obtain as bases for:

1. Selection of type and depth of foundation
2. The determination of bearing capacity of the selected foundation
3. The prediction of settlement of the selected foundation
4. The establishing of the ground water level
5. The evaluation of the earth pressure against walls, abutments
6. The provisions against constructional difficulties
7. The suitability of soil and the degree of compaction of fill
8. Identifying where bedrock level is

The Soil Exploration Program consists of three steps, namely boring (advancing a test hole in the ground), sampling (taking soil or rock sample from the test hole), and testing in the field or laboratory.

Some of the main activities of the field activity involves doing the Standard Penetration Test, Thin-walled Tube (Shelby Tube) Sampling, and Ground water measurement.

The laboratory tests involves determining the unit weight of the soil, grain size analysis, water content, liquid limit, plastic limit, unconfined compression test, direct shear test, consolidation test, and compaction test.

D. Approximate location of Boreholes for each Location (attachment maps next pages)

1. Churchill Falls — 16 Boreholes
   735 kV Extension
   735 kV Addition
   315 kV Switchyard
2. Muskrat FallsTAP — 12 Boreholes
   315 kV Yard
   138 kV Yard
3. Muskrat Falls — 17 Boreholes
   AC Switchyard
   HVDC Converter Station
4. Forteau Point — 8 Boreholes
   Transition Compound
   Labrador
5. Shoal Cove — 8 Boreholes
   Transition Compound
   Newfoundland
6. Soldiers Point — 16 Boreholes
   AC Switchyard
   HVDC Converter Station
7. L' Anse-Au-Diable — 8 Boreholes
   Electrode Compound
   Labrador
8. Dowden's Point — 8 Boreholes
   Electrode Compound
   Newfoundland

E. Soil Resistivity Measurement shall be conducted at each site and shall be as per IEEE 81

F. Possible date for Soil Investigation is between April to June 2012 to use for use in the Earthworks Tender Package which is planned for Tender on June 2012.

1:2000 0 20 60 100 m

NOT FOR CONSTRUCTION

PRELIMINARY

ISSUE	REV.	DATE	DISTRIBUTION & STATUS
1	A1	16-NOV-2011	ISSUED FOR REVIEW

ISSUE REGISTER

No.	REFERENCE DRAWING	No.	DATE	REVISION	MOD.	VER.	APP.

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- ☐ 4.INFORMATION ONLY
- ☐ 5.NOT REVIEWED

LEAD REVIEWER: Date (dd-mmm-yyyy)

NE ECP MANAGEMENT: Date (dd-mmm-yyyy)

AREA MANAGER: Date (dd-mmm-yyyy)

PROFESSIONAL STAMP

SNC·LAVALIN

DESIGNED	O. ASCENCIO
DRAWN	L. MIREAULT
VERIFIED	L. CHAVEZ
DATE	16-NOV-2011
APPROVED	S. SUD, Project Engineer L. CHAUSSE, Project Director

CLIENT: nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: CHURCHILL FALLS LOCATION PLAN EXTENSION OF 765 kV NEW 315 kV SUBSTATION

File No. 505573-480B-41DD-0001-PB

MFA-SN-CD-4100-CV-PL-0001-01 Rev. A1

FORMAT A1 (mm)

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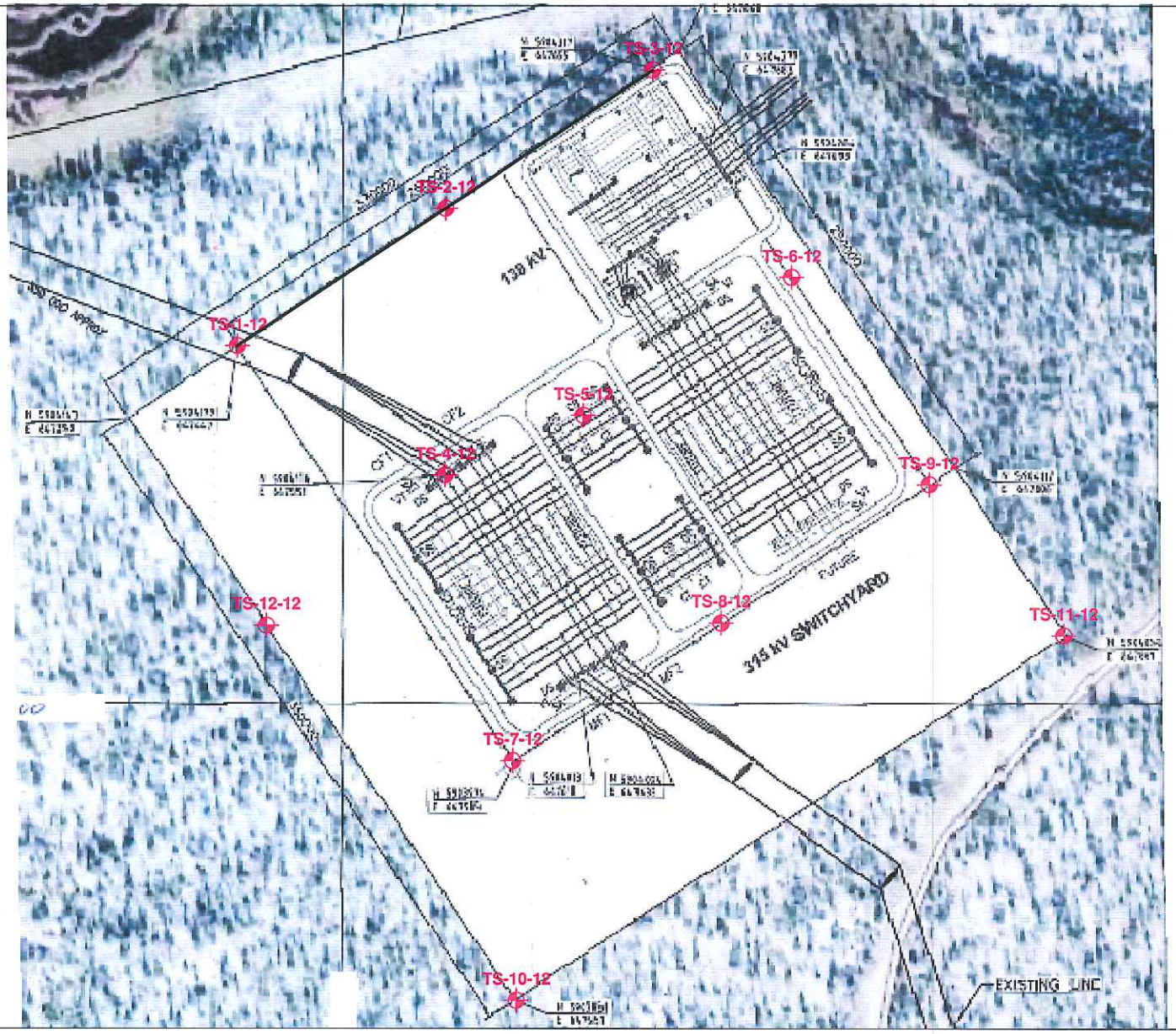
2011.11.15/12:29pm

16 B.H. FOR CHURCHILL FALLS



FOR INFORMATION

BORING	EASTING	NORTHING
TS-1-12	647447	5904179
TS-2-12	647551	5904248
TS-3-12	647655	5904317
TS-4-12	647551	5904114
TS-5-12	647620	5904144
TS-6-12	647725	5904213
TS-7-12	647585	5903971
TS-8-12	647689	5904040
TS-9-12	647794	5904109
TS-10-12	647587	5903851
TS-11-12	647861	5904034
TS-12-12	647462	5904039

LEGEND:

TS-1-12
Borehole and number

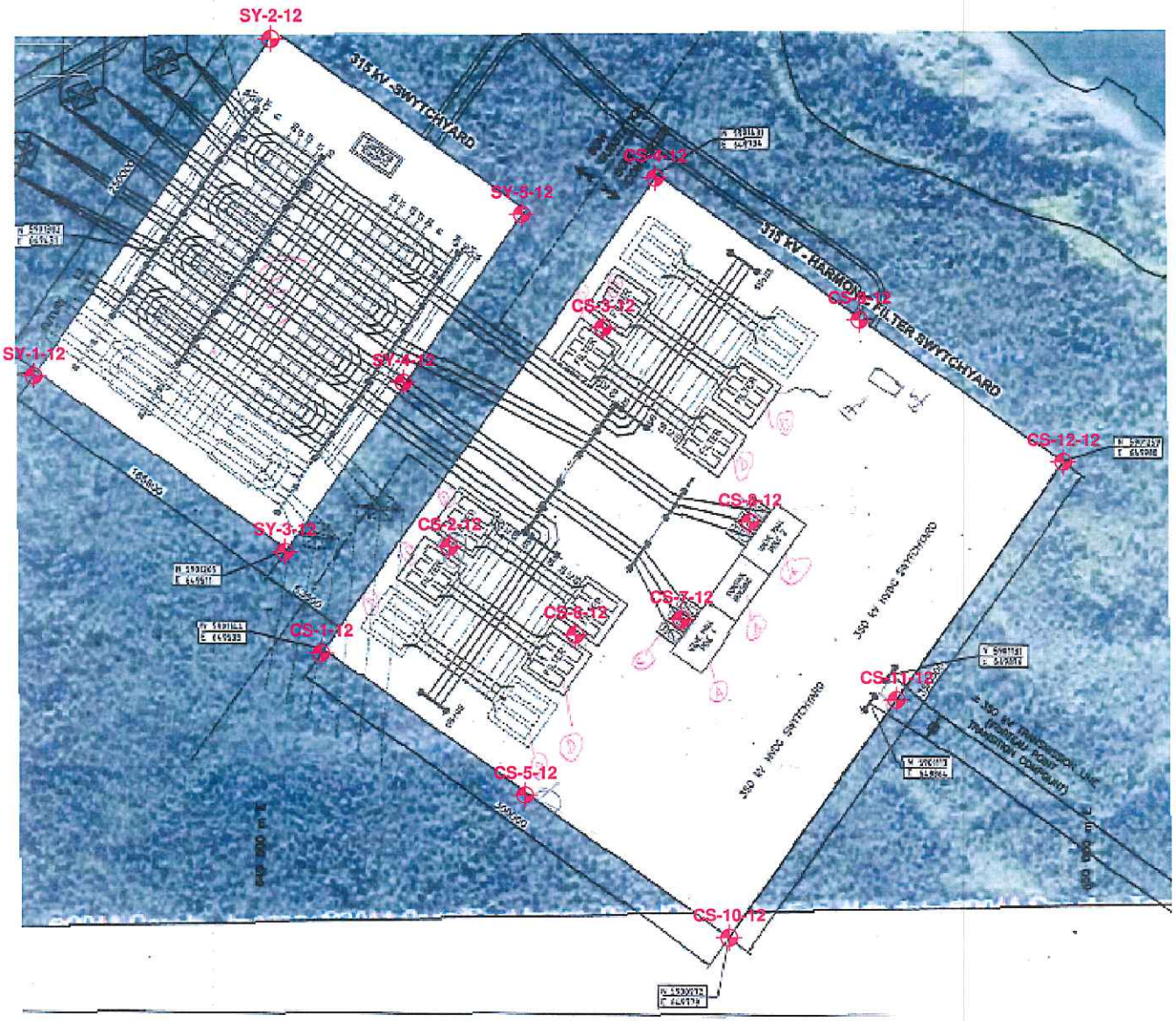
SNC·LAVALIN

TITLE	: Location of proposed boreholes
CLIENT	: NALCOR
PROJECT	: Lower Churchill Project
LOCATION	: Tap Station Muskrat Falls
SCALE	: 1 : 2 000 (20 0 20 40 60 80m)
DATE : November 2011	FILE : G11936
DRAWING : 1 of 2	

PROP BORINGS 2012

X:\Dossiers G1\G11901 à 999\G11936 (Lower Churchill)\Switchyard and Converter Station\PROP BORINGS 2012.dwg

12 B.H. FOR TAP



FOR INFORMATION

BORING	EASTING	NORTHING
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CS-2-12	649610	5901208
CS-3-12	649703	5901340
CS-4-12	649784	5901431
CS-5-12	649656	5901058
CS-6-12	649686	5901155
CS-7-12	649750	5901164
CS-8-12	649791	5901223
CS-9-12	649857	5901345
CS-10-12	649779	5900972
CS-11-12	649880	5901116
CS-12-12	649980	5901259
SY-1-12	649360	5901311
SY-2-12	649502	5901515
SY-3-12	649511	5901205
SY-4-12	649582	5901307
SY-5-12	649654	5901409

LEGEND:

SY-1-12 — Borehole and number

SNC·LAVALIN

TITLE	: Location of proposed boreholes
CLIENT	: NALCOR
PROJECT	: Lower Churchill Project
LOCATION	: Switchyard and Converter Staion Muskrat Falls
SCALE : 1 : 2 500	20 0 20 40 60 80 100m
DATE : November 2011	FILE : G11936
DRAWING : 2 of 2	

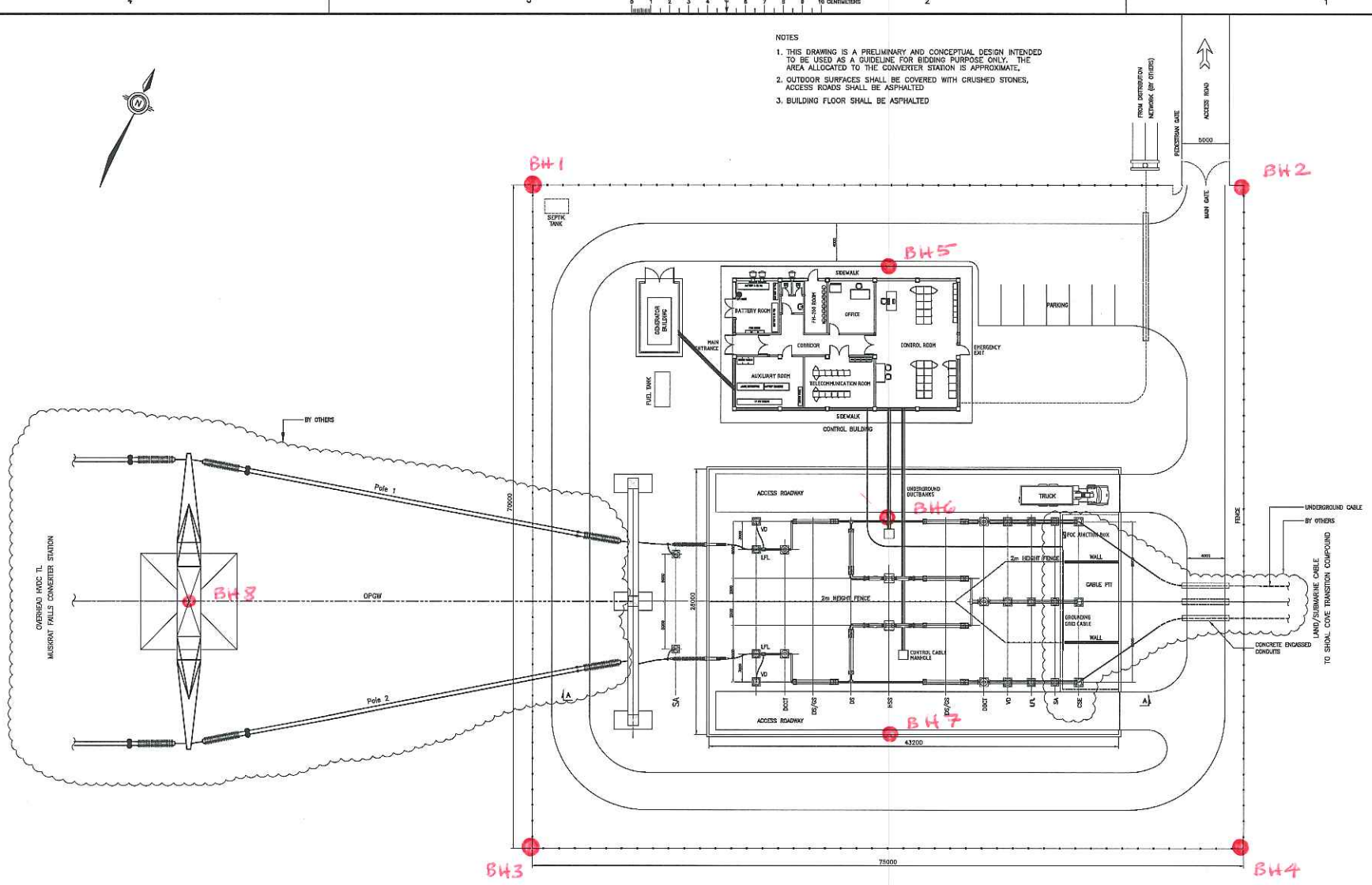
PROP BORINGS 2012

X:\Dossiers G11\G11901 a 999\G11936 (Lower Churchill)\Switchyard and Converter Station\PROP BORINGS 2012.dwg

17 B.H. FOR MUSKRAT FALLS

NOTES

1. THIS DRAWING IS A PRELIMINARY AND CONCEPTUAL DESIGN INTENDED TO BE USED AS A GUIDELINE FOR BIDDING PURPOSE ONLY. THE AREA ALLOCATED TO THE CONVERTER STATION IS APPROXIMATE.
2. OUTDOOR SURFACES SHALL BE COVERED WITH CRUSHED STONES, ACCESS ROADS SHALL BE ASPHALTED
3. BUILDING FLOOR SHALL BE ASPHALTED



PLAN VIEW
1 : 200

ISSUE	REV.	DATE	DISTRIBUTION & STATUS

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No.	REFERENCE DRAWING

No.	DATE	REVISION	MOD.	VER.	APP.

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NE-LCP MANAGEMENT: Date (dd-mmm-yyyy)
AREA MANAGER: Date (dd-mmm-yyyy)

PROFESSIONAL STAMP

SNC·LAVALIN

DESIGNED	D. DEV
DRAWN	L. MIREAULT
VERIFIED	L. CHAVEZ
DATE	20-OCT-2011
APPROVED	S. SUD
Project Engineer	L. CHAUSSE
Project Director	

CLIENT: nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: FORTEAU POINT TRANSITION COMPOUND
LAYOUT
PLAN VIEW AND SECTIONS

File No. 505573-4BDB-47DD-0032 Sh 1 | xxx-SN-CD-CLAS-___-___ 0001-01 | Rev. A1

FORMAT A1 (mm)

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2011.11.07/9:04am

NOT FOR CONSTRUCTION

PRELIMINARY

2000 0 20 60 100 m

PROVINCE OF NEWFOUNDLAND PERMIT HOLDER CLASS "A"
This Permit Allows
SNC-LAVALIN Inc.
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEGNL 30436
which is valid for the year 2012.

REVIEW CLASS: EQUIPMENT TAG NUMBER:

REVIEW DOES NOT CONSTITUTE APPROVAL OF DESIGN DETAILS, CALCULATIONS, TEST METHOD OR MATERIAL DEVELOPMENT OR SELECTED BY CONTRACTOR, NOR DOES IT RELIEVE THE CONTRACTOR FROM FULL COMPLIANCE WITH CONTRACTUAL OR OTHER OBLIGATIONS.

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AREA MANAGER: Date(dd-mmm-yyyy):

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I	A1	16-NOV-2011	ISSUED FOR REVIEW								

SNC·LAVALIN

CLIENT: nalcor energy — LOWER CHURCHILL PROJECT

DESIGNED	O. ASCENCIO	APPROVED: S. SUD
DRAWN	C. RUSSELL	Project Engineer: L. CHAUSSE
VERIFIED	L. CHAVEZ	Project Director:
DATE	16-NOV-2011	

PROJECT: LOWER CHURCHILL PROJECT

TITLE: FORTEAU POINT TRANSITION COMPOUND
LOCATION PLAN

Doc. No.: 505573-480B-41DD-0017-PB | ILK-SN-CD- 8520-CV-PL-0001-01 | Rev.: A1

8 B.H. FOR FORTEAU POINT

NOT FOR CONSTRUCTION

PRELIMINARY

2000 0 20 60 100

PROVINCE OF NEWFOUNDLAND
PERMIT HOLDER
CLASS "A"
This Permit Allows
SNC-LAVALIN Inc.
To practice Professional Engineering in Newfoundland and Labrador. Permit No. as issued by PEGNL which is valid for the year 2011.

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ISSUE	REV	DATE	DISTRIBUTION & STATUS	No.	REFERENCE DRAWING	No.	DATE	REVISION	MOD.	VER.	APP.
1	A1	18-NOV-2011	ISSUED FOR REVIEW								

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- ☐ 3.REVIEWED - NOT ACCEPTED
- ☐ 4.INFORMATION ONLY
- ☐ 5.NOT REVIEWED

LEAD REVIEWER:
RE-LCP MANAGEMENT:
AREA MANAGER:

PROFESSIONAL STAMP

SNC·LAVALIN

CLIENT: nalcor energy

DESIGNED: O. ASCENCIO	APPROVED: S. SUD
DRAWN: C. RUSSELL	Project Engineer: L. CHAUSSE
VERIFIED: L. CHAVEZ	Project Director:
DATE: 16-NOV-2011	

PROJECT: LOWER CHURCHILL PROJECT

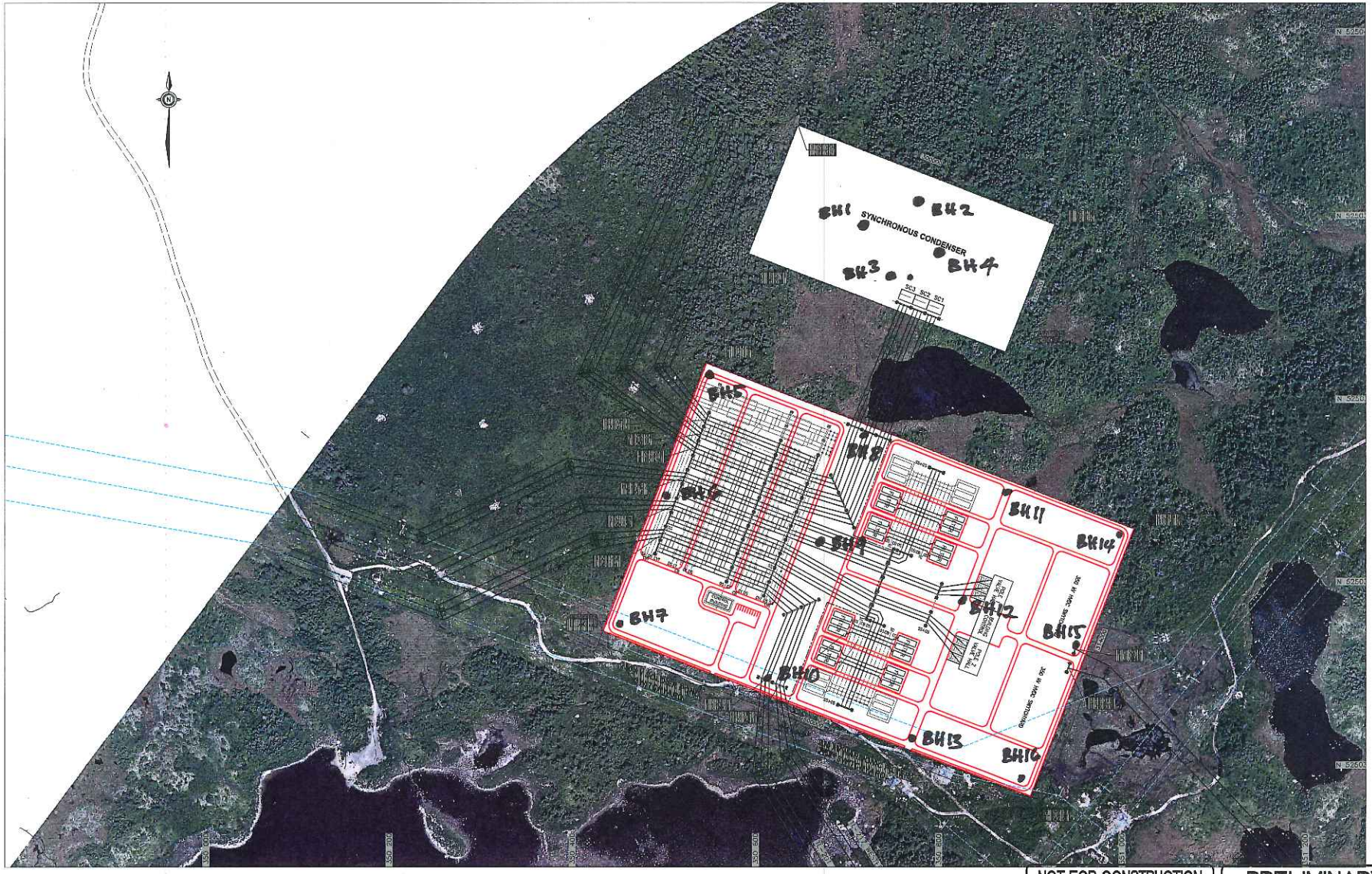
TITLE: SHOAL COVE TRANSITION COMPOUND
LOCATION PLAN

File No: 505573-4B0B-41DD-0021-PB

ILK-SN-CD- 8510-CV-PL-0001-01 | Rev. A1

FORMAT: A1 (594mm x 841mm)

8 B.H. FOR SHOAL COVE



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PRELIMINARY WP: 334D 11-06-07

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1	A1	16-NOV-2011	ISSUED FOR REVIEW

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NE-LCP MANAGEMENT: Date (dd-mmm-yyyy)
AREA MANAGER: Date (dd-mmm-yyyy)

PROFESSIONAL STAMP

SNC·LAVALIN

CLIENT nalcor energy

DESIGNED	O. ASCENCIO
DRAWN	L. MIREAULT
VERIFIED	L. CHAVEZ
DATE	26-SEP-2011
APPROVED	S. SUD, Project Engineer; L. CHAUSSE, Project Director

PROJECT LOWER CHURCHILL PROJECT

TITLE SOLDIER PONDS CONVERTER STATION
LOCATION PLAN
230 kV SWITCHYARD AND CONVERTER SUBSTATION

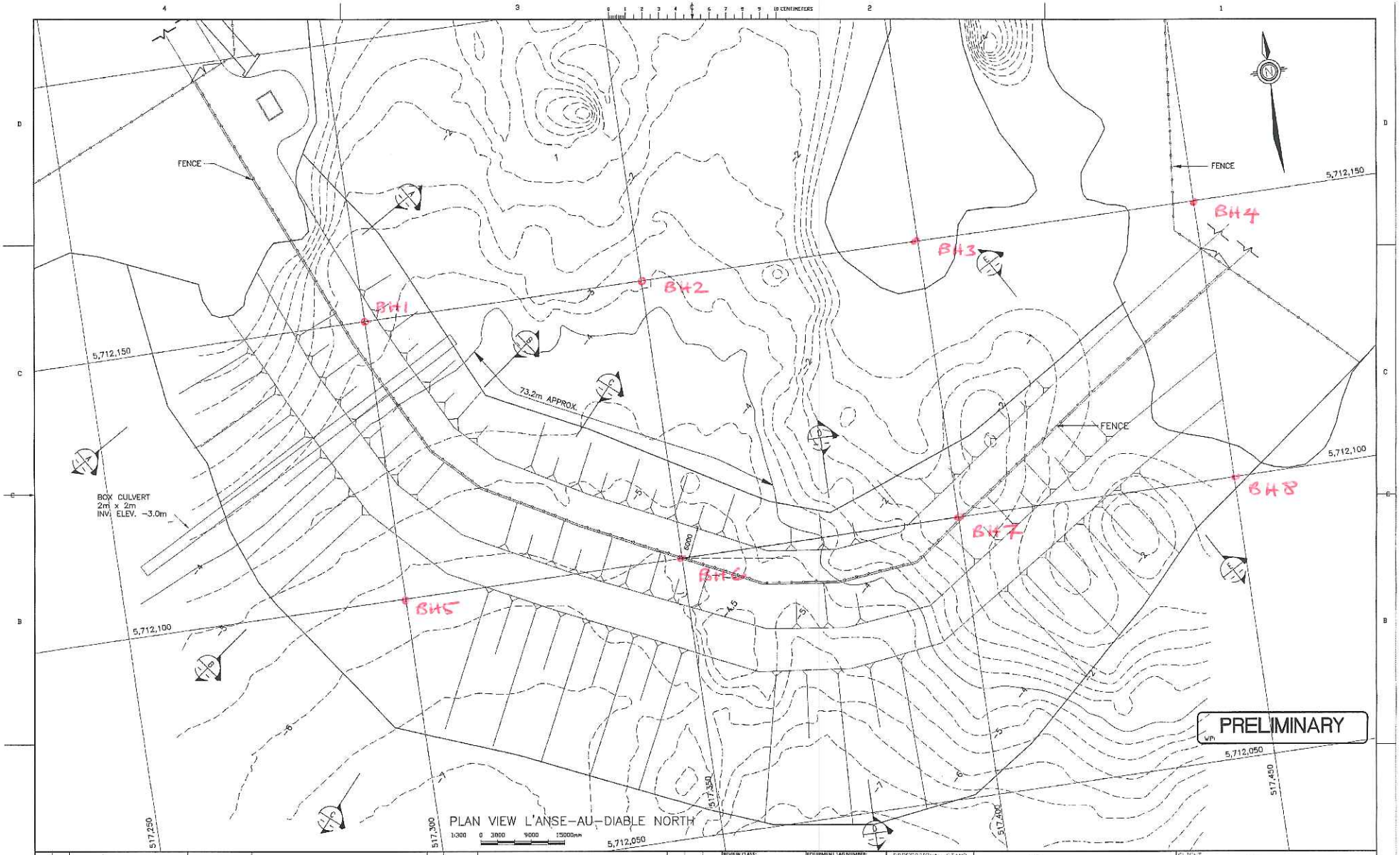
File No. 505573-480B-41DD-0013-PB

ILK-SN-CD- 4500-CV-PL-0001-01 Rev. A1

PLATE FORMAT A1 (mm)

2011.11.21/11:46am

16 B.H. FOR SOLDIERS POND



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1	A1	30-NOV-2011	ISSUED FOR REVIEW

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- ☐ 5.NOT REVIEWED

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NL-LCP MANAGEMENT: Date (dd-mmm-yyyy)
AREA MANAGER: Date (dd-mmm-yyyy)

PROFESSIONAL STAMP

SNC·LAVALIN

DESIGNED	N. GILLIS	APPROVED Discipline Lead Engineer	
DRAWN	B. MURRAY		
VERIFIED	A. KAVANAGH	APPROVED Engineering Manager	
DATE	13-SEP-2011	SCALE	1:300

CLIENT: nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: L'ANSE-AU-DIABLE SHORELINE POND ELECTRODE GENERAL ARRANGEMENT

File No. 505573-480B-47DD-0064-PB | ILK-SN-CD-8610-EL-GA-0001-01 | Rev. A1

FORMAT A1 (mm)

8 BH FOR L'ANSE-AU-DIABLE

NOTES:

1. THE FOLLOWING ARE BASED ON THE BATHYMETRIC SURVEY BY EDWARDS AND ASSOCIATES LTD.:
   - BATHYMETRIC CONTOURS
   - LOCATIONS OF SHORELINE, BANK, EXISTING TRAILS
   - COORDINATES OF POINTS A AND B
   - NORTH ARROW
2. ELEVATION AT TOP OF EXISTING BANK ASSUMED TO BE +9.5m (TO BE VERIFIED).
3. CREST OF BREAKWATER: EL. 8.0m.
4. HIGH WATER LEVEL: EL. 1.5m
5. LOW WATER LEVEL: EL. 0.0m
6. CHANNEL TO BE EXCAVATED AT EL. -4.0m FROM -4.0m CONTOUR IN SEA TO PROPOSED ELECTRODE POND.

PRELIMINARY

DOWDEN'S POINT – PLAN VIEW

1:350 0 3500 10500 17500mm

ISSUE REV.	DATE	DISTRIBUTION & STATUS
1	A1	01-DEC-2011 ISSUED FOR REVIEW

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NL-LCP MANAGEMENT: Date (yyyy-mm-dd)
AREA MANAGER: Date (yyyy-mm-dd)

PROFESSIONAL STAMP

SNC·LAVALIN

DESIGNED N. GILLIS
DRAWN B. MURRAY
VERIFIED A. KAVANAGH
DATE 27-SEP-2011 SCALE 1:350
APPROVED Discipline Lead Engineer
APPROVED Engineering Manager

CLIENT: nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: DOWDEN'S POINT SHORELINE POND ELECTRODE GENERAL ARRANGEMENT

File No. 505573-480B-47DD-0068-PB

ILK-SN-CD-8610-EL-GA-0001-01 Rev. A1

FORMAT: A1 (mm)

8 BH FOR DOWDEN'S POINT