

**PEI-NB Cable Interconnection
Upgrade Project - Volume 3,
New Brunswick**

Project No. 121811475



Prepared for:

Maritime Electric Company,
Limited

Prepared by:

Stantec Consulting Ltd.
165 Maple Hills Avenue
Charlottetown PE C1C 1N9

September 30, 2015

TABLE OF CONTENTS

ABBREVIATIONS	VII
1.0 INTRODUCTION	1.1
1.1 DESCRIPTION OF PROJECT COMPONENTS IN NEW BRUNSWICK	1.2
1.1.1 Landfall Site	1.2
1.1.2 Termination Site.....	1.2
1.1.3 Overhead Transmission Lines	1.2
1.1.4 Substation Upgrade	1.3
1.1.5 Project Footprint	1.3
1.2 PROJECT PHASES AND SCHEDULE	1.3
2.0 ENVIRONMENTAL SETTING AND POTENTIAL INTERACTIONS	2.1
2.1 POTENTIAL INTERACTIONS	2.1
2.1.1 Groundwater Resources.....	2.2
2.1.2 Atmospheric Environment	2.4
3.0 ENVIRONMENTAL EFFECTS ASSESSMENT	3.1
3.1 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON THE FRESHWATER ENVIRONMENT.....	3.1
3.1.1 Scope of Assessment	3.1
3.1.2 Existing Conditions of the Freshwater Environment	3.11
3.1.3 Project Interactions with the Freshwater Environment	3.22
3.1.4 Assessment of Residual Environmental Effects on the Freshwater Environment.....	3.23
3.1.5 Determination of Significance	3.30
3.1.6 Prediction Confidence	3.30
3.1.7 Follow-up and Monitoring	3.30
3.2 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON THE TERRESTRIAL ENVIRONMENT.....	3.30
3.2.1 Scope of Assessment	3.31
3.2.2 Existing Conditions for the Terrestrial Environment	3.39
3.2.3 Project Interactions with the Terrestrial Environment	3.61
3.2.4 Assessment of Residual Environmental Effects on the Terrestrial Environment.....	3.64
3.2.5 Determination of Significance	3.73
3.2.6 Prediction Confidence	3.74
3.2.7 Follow-up and Monitoring	3.74
3.3 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON LAND USE	3.74
3.3.1 Scope of Assessment	3.74
3.3.2 Existing Conditions for Land Use	3.78
3.3.3 Project Interactions with Land Use	3.83
3.3.4 Assessment of Residual Environmental Effects on Land Use	3.84
3.3.5 Determination of Significance	3.86
3.3.6 Prediction Confidence	3.87
3.3.7 Follow-up and Monitoring	3.87

3.4	ASSESSMENT OF POTENTIAL EFFECTS ON SOCIOECONOMIC ENVIRONMENT.....	3.87
3.4.1	Scope of Assessment	3.87
3.4.2	Existing Socioeconomic Environment.....	3.93
3.4.3	Project Interactions with Socioeconomic Environment	3.104
3.4.4	Assessment of Residual Environmental Effects on Socioeconomic Environment.....	3.105
3.4.5	Summary of Residual Project Environmental Effects	3.109
3.4.6	Determination of Significance	3.110
3.4.7	Prediction Confidence	3.111
3.4.8	Follow-up and Monitoring	3.111
3.5	ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON HERITAGE RESOURCES.....	3.111
3.5.1	Scope of Assessment	3.111
3.5.2	Existing Conditions for Heritage Resources	3.116
3.5.3	Project Interactions with Heritage Resources.....	3.118
3.5.4	Assessment of Residual Environmental Effects on Heritage Resources	3.120
3.5.5	Summary of Residual Project Environmental Effects	3.122
3.5.6	Determination of Significance.....	3.123
3.5.7	Prediction Confidence	3.123
3.5.8	Follow-up and Monitoring	3.124
3.6	ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES BY ABORIGINAL PERSONS.....	3.124
3.6.1	Scope of Assessment	3.124
3.6.2	Existing Conditions for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.....	3.131
3.6.3	Project Interactions with Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.....	3.137
3.6.4	Assessment of Residual Environmental Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.....	3.139
3.6.5	Determination of Significance.....	3.142
3.6.6	Prediction Confidence	3.143
3.6.7	Follow-up and Monitoring	3.143
4.0	EFFECTS OF THE ENVIRONMENT ON THE PROJECT.....	4.1
4.1	SCOPE OF ASSESSMENT	4.1
4.1.1	Regulatory and Policy Setting	4.1
4.1.2	The Influence of Consultation and Engagement on the Assessment.....	4.2
4.1.3	Potential Environmental Effects, Pathways and Measurable Parameters	4.2
4.1.4	Boundaries.....	4.2
4.1.5	Residual Environmental Effects Description Criteria	4.3
4.2	EXISTING CONDITIONS FOR EFFECTS OF THE ENVIRONMENT ON THE PROJECT	4.3
4.2.1	Climate.....	4.3
4.2.2	Climate Change.....	4.10
4.2.3	Seismic Activity.....	4.12
4.2.4	Forest Fires.....	4.16
4.2.5	Marine Hazards	4.17
4.3	ASSESSMENT OF EFFECTS OF THE ENVIRONMENT ON THE PROJECT	4.17
4.3.1	Effects of Climate on the Project	4.17

4.3.2	Effects of Climate Change on the Project	4.20
4.3.3	Effects Seismic Events on the Project.....	4.22
4.3.4	Effects of Forest Fires on the Project.....	4.23
4.3.5	Effects of Marine Hazards on the Project.....	4.24
4.4	DETERMINATION OF SIGNIFICANCE.....	4.24
5.0	ACCIDENTS, MALFUNCTIONS, AND UNPLANNED EVENTS.....	5.1
5.1	APPROACH.....	5.1
5.1.1	Significance Definition	5.1
5.1.2	Identification of Accidents, Malfunctions, and Unplanned Events.....	5.1
5.2	POTENTIAL INTERACTIONS	5.1
5.3	FIRE.....	5.2
5.3.1	Potential Event	5.2
5.3.2	Risk Management and Mitigation.....	5.3
5.3.3	Potential Environmental Effects and their Significance	5.3
5.4	HAZARDOUS MATERIAL SPILL	5.3
5.4.1	Potential Event	5.3
5.4.2	Risk Management and Mitigation.....	5.4
5.4.3	Potential Environmental Effects and their Significance	5.4
5.5	VEHICLE ACCIDENT.....	5.5
5.5.1	Potential Event	5.5
5.5.2	Risk Management and Mitigation.....	5.5
5.5.3	Potential Environmental Effects and their Significance	5.5
5.6	EROSION PREVENTION AND/OR SEDIMENT CONTROL FAILURE	5.6
5.6.1	Potential Event	5.6
5.6.2	Risk Management and Mitigation.....	5.6
5.6.3	Potential Environmental Effects and their Significance	5.7
5.7	WILDLIFE ENCOUNTER.....	5.7
5.7.1	Potential Event	5.7
5.7.2	Risk Management and Mitigation.....	5.7
5.7.3	Potential Environmental Effects and their Significance	5.8
5.8	DISCOVERY OF A HERITAGE RESOURCE.....	5.8
5.8.1	Potential Event	5.8
5.8.2	Risk Management and Mitigation.....	5.8
5.8.3	Potential Environmental Effects and their Significance	5.9
5.9	DETERMINATION OF SIGNIFICANCE.....	5.9
6.0	CUMULATIVE ENVIRONMENTAL EFFECTS: NEW BRUNSWICK.....	6.1
6.1	INTRODUCTION.....	6.1
6.2	ASSESSMENT OF CUMULATIVE EFFECTS: NEW BRUNSWICK.....	6.2
7.0	SUMMARY	7.1
7.1	SCOPE OF THE EIA.....	7.1
7.2	ENVIRONMENTAL EFFECTS ASSESSMENT.....	7.1
7.3	OVERALL CONCLUSION.....	7.2
8.0	REFERENCES	8.1

LIST OF TABLES

Table 2.1 Interactions between Potential Valued Components and Project Components Located in New Brunswick 2.2

Table 3.1 Relevant Directives under the *Fisheries Act* 3.3

Table 3.2 Federal and Provincial Freshwater Fish Species Listed as at Risk in New Brunswick 3.4

Table 3.3 Issues Raised by Aboriginal Groups and Stakeholders 3.5

Table 3.4 Potential Environmental Effects, Effect Pathways and Measurable Parameters for the Freshwater Environment 3.6

Table 3.5 Characterization of Residual Environmental Effects on the Freshwater Environment 3.9

Table 3.6 Freshwater Fish Species Presence 3.13

Table 3.7 Fish Habitat Presence within the LAA 3.14

Table 3.8 Freshwater Habitat Summary at Centerline of Proposed Watercourse Crossings 3.16

Table 3.9 Water Quality Summary from Centerline of Proposed Watercourse Crossings 3.19

Table 3.10 Potential Project-Environment Interactions and Effects on the Freshwater Environment 3.22

Table 3.11 Summary of Project Residual Environmental Effects on Freshwater Populations 3.29

Table 3.12 Potential Environmental Effects, Effects Pathways and Measurable Parameters for Terrestrial Environment 3.33

Table 3.13 Characterization of Residual Environmental Effects on the Terrestrial Environment 3.37

Table 3.14 Land Classification within the PDA and LAA 3.42

Table 3.15 Vascular Plant Species of Conservation Concern Observed within the Project Development Area and Surrounding Surveyed Area 3.43

Table 3.16 Bird Species at Risk and Species of Special Concern Observed near the Local Assessment Area (ACCDC, ACNOS, BBS, CBC, and MBBA Records) 3.45

Table 3.17 Summary of Wetland Habitat within the Project Development Area by Class, Type (subtype) and Form (subform) 3.57

Table 3.18 Potential Project-Environment Interactions and Effects on the Terrestrial Environment 3.62

Table 3.19 Summary of Project Residual Environmental Effects on the Terrestrial Environment 3.73

Table 3.20 Potential Environmental Effects, Effects Pathways and Measurable Parameters for Land Use 3.76

Table 3.21 Characterization of Residual Environmental Effects on Land Use 3.77

Table 3.22 Potential Project-Environmental Interactions and Effects on Land Use 3.83

Table 3.23 Summary of Project Residual Environmental Effects on Land Use 3.86

Table 3.24 Potential Environmental Effects, Effects Pathways and Measurable Parameters for Socioeconomic Environment 3.88

Table 3.25 Characterization of Residual Effects on Socioeconomic Environment 3.89

Table 3.26 Population by Gender, RAA and LAA 3.94

Table 3.27 Population Data (percent change 2006-2011) 3.94

Table 3.28	Aboriginal Population	3.95
Table 3.29	Gross Domestic Product 2004-2013.....	3.97
Table 3.30	Labour Force Data (2011)	3.97
Table 3.31	Employment - Industries (2011)	3.98
Table 3.32	Employment - Occupations (2011)	3.100
Table 3.33	Median Income (2010)	3.101
Table 3.34	Potential Project-Environment Interactions and Effects on Socioeconomic Environment.....	3.104
Table 3.35	Summary of Project Residual Environmental Effects on Socioeconomic Environment.....	3.110
Table 3.36	Experts Consulted	3.112
Table 3.37	Potential Environmental Effects, Effects Pathways and Measurable Parameters for Heritage Resources	3.113
Table 3.38	Characterization of Residual Environmental Effects on Heritage Resources ...	3.115
Table 3.39	Registered Historic Period Archaeological Sites within the PDA.....	3.118
Table 3.40	Potential Project-Environment Interactions and Effects on Heritage Resources.....	3.118
Table 3.41	Summary of Project Residual Environmental Effects on Heritage Resources ...	3.123
Table 3.42	Potential Environmental Effects, Effects Pathways and Measurable Parameters for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.....	3.126
Table 3.43	Characterization of Residual Environmental Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons	3.129
Table 3.44	Location of Mi'kmaq Communities in Close Proximity to the Project	3.132
Table 3.45	Potential Project-Environment Interactions and Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.....	3.137
Table 3.46	Summary of Project Residual Environmental Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.....	3.142
Table 4.1	Air Temperature and Precipitation Climate Normals, Sackville, NB (1981-2010)	4.5
Table 4.2	Visibility - Climate Normals, Moncton (1981-2010)	4.7
Table 4.3	Projected Mean Annual Maximum and Minimum Temperature Change for Moncton, and Precipitation Percent Change for both SDSM and CGCM2 Model Results	4.21
Table 5.1	Potential Interactions for Land-Based Project Activities in New Brunswick.....	5.2
Table 6.1	Potential Cumulative Effects.....	6.2

LIST OF FIGURES

Figure 2.1	Acoustic Environment Local Assessment Area in New Brunswick	2.7
Figure 3.1	Freshwater Environment Project Development Area, Local Assessment Area and Regional Assessment Area	3.7
Figure 3.2	Terrestrial Environmental Assessment Area Boundaries (PDA and RAA only)	3.35
Figure 3.3	Land Use Project Development Area.....	3.81
Figure 3.4	Socioeconomic Environment Assessment Area Boundaries	3.91
Figure 3.5	Population Data 2011 (males, females)	3.95

Figure 3.6	Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons	3.127
Figure 3.7	Mi'kmaq Traditional Territory	3.133
Figure 3.8	New Brunswick and Prince Edward Island First Nation Communities.....	3.135
Figure 4.1	Predominant Monthly Wind Direction, Monthly Mean, Maximum Hourly and Maximum Gust Wind Speeds (1981 to 2010) at Moncton Weather Station, NB	4.8
Figure 4.2	Coastal Erosion from 1944 to 2011 at Cape Tormentine	4.13
Figure 4.3	Northern Appalachians Seismic Zone	4.15
Figure 4.4	Average Fire Weather Index for the Month of July (1981-2010)	4.16

LIST OF APPENDICES

Appendix A	Freshwater VC Map Book
Appendix B	Terrestrial VC Mapbook
Appendix C	Plant List
Appendix D	Bird List

Abbreviations

ACCDC	Atlantic Canada Conservation Data Council
ACNOS	Atlantic Canada Nocturnal Owl Surveys
AIA	Archaeological Impact Assessment
BBS	Breeding Bird Survey
CBC	Christmas Bird Count
CEAA	<i>Canadian Environmental Assessment Act</i>
CO ₂ e	Carbon Dioxide Equivalent
DU	Ducks Unlimited
ECMC	Ecological Communities of Management Concern
EIA	Environmental Impact Assessment
EIW	Ecologically Important Wetland
EMF	Electromagnetic Fields
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GHG	Greenhouse Gas
H-Frame	Horizontal Frame
iBoF	Inner Bay of Fundy
ICT	Information and Communications Technology
kV	Kilovolt
LAA	Local Assessment Area
LiDAR	Light Detection and Ranging
MBBA	Maritime Breeding Bird Atlas
MECL	Maritime Electric Company, Limited
mG	Milligauss
MW	Megawatt
NB	New Brunswick
NB CEA	<i>New Brunswick Clean Environment Act</i>

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

NB Power	New Brunswick Power
NBATVF	New Brunswick All-terrain Vehicle Federation
NBDELG	New Brunswick Department of Environment and Local Government
NBFSC	New Brunswick Federation of Snowmobile Clubs
NBTFHF	New Brunswick Trappers and Fur Harvesters Federation
NS	Nova Scotia
PDA	Project Development Area
PEI	Prince Edward Island
PEIDCLE	Prince Edward Island Department of Communities, Land and Environment
PSW	Provincially Significant Wetland
RAA	Regional Assessment Area
RFA	Recreational Fishing Area
RoW	Right-of-way
SAR	Species at Risk
SOCC	Species of Conservation Concern
VC	Valued Component

1.0 INTRODUCTION

Prince Edward Island Energy Corporation (PEIEC), with Maritime Electric Company, Limited (MECL) serving as construction agent, proposes to upgrade the electrical power interconnection between Prince Edward Island (PEI) and New Brunswick.

The PEI-NB Cable Interconnection Upgrade Project (the "Project") includes construction and operation of a high voltage alternating current transmission system. The main Project components are:

- two 180 megawatt, 138 kilovolt submarine cables
- two landfall sites (where the submarine cable trenches are brought ashore)
- two termination sites (for converting submarine cables to overhead transmission lines or substation);
- three-phase, 138 kilovolt transmission lines within New Brunswick
- expansion of the existing MECL substation in Borden-Carleton, PEI and upgrading of the New Brunswick Power Corporation (NB Power) substation in Memramcook, NB

The Project will span three geographic regions as shown in Volume 1, Figure 1.1 including:

- PEI – a landfall site will be constructed adjacent to the expanded MECL substation in Borden-Carleton, and a termination site will be located within the substation
- The Northumberland Strait – two high voltage alternating current submarine cables will span approximately 16.5 km from Cape Tormentine to Borden-Carleton
- New Brunswick – a landfall site and termination site will be constructed in Cape Tormentine as well as approximately 57 km of overhead transmission lines within new and existing easements to the existing NB Power substation in Memramcook

To reflect the three geographic regions, the environmental impact statement (EIS) for the Project is divided into four volumes:

- Volume 1 includes a detailed description of the overall Project, regulatory framework, consultation activities, and an overview of EIA methodology.
- Volume 2 includes an assessment of potential environmental effects associated with land-based Project components and activities located in PEI.
- Volume 3 (this volume) includes an assessment of potential environmental effects associated with land-based Project components and activities located in New Brunswick.
- Volume 4 includes an assessment of potential environmental effects associated with marine based Project components and activities located in the Northumberland Strait.

The following sub-sections provide an overview of Project components and activities located within New Brunswick. A detailed description of all components and activities related to the Project is provided in Volume 1, Chapter 2.

1.1 DESCRIPTION OF PROJECT COMPONENTS IN NEW BRUNSWICK

Within New Brunswick, the Project includes construction of a landfall site and termination site, overhead transmission lines, and upgrading of an existing substation.

1.1.1 Landfall Site

The submarine cable will make landfall at Cape Tormentine, NB, located approximately 3 km east of the Confederation Bridge on land that is currently owned by the Cape Tormentine Community Development Corporation.

The landfall site is anticipated to be approximately 10 m wide, include one trench for both cables, and potentially a concrete structure to facilitate landfall. The trench will be approximately 1 to 2 m deep and 200 m in length, and will connect the submarine cable to the termination site. The trench may intersect a paved section of Route 955, a highway maintained by the New Brunswick Department of Transportation.

1.1.2 Termination Site

A cable termination site is required to facilitate the transition from submarine cable to overhead transmission. The termination site in New Brunswick will be located at Cape Tormentine, approximately 200 m from the shoreline. The site will be similar in appearance to a substation and will include a riser pole, ground grid, overhead switches, and perimeter fence. A climate-controlled metering building will be constructed on site to house weather sensitive equipment. This building covers a footprint of approximately 18 m² (3.5 m x 5 m) and will be located inside the perimeter fence.

1.1.3 Overhead Transmission Lines

Approximately 57 km of land-based transmission line will be built within New Brunswick, originating in Memramcook and terminating in Cape Tormentine. These transmission lines will be three-phase 138 kV lines and will tie into NB Power's existing substation in Memramcook and the termination site in Cape Tormentine.

Approximately 17 km of the total 57 km of overhead transmission line corridor between Melrose and Cape Tormentine will be new-build construction within a combination of new and existing easements on which there is no existing transmission line. This 17 km section of transmission line will be twinned (i.e., two lines running parallel) and will require clearing of a 60 m wide corridor.

The remaining 40 km of overhead transmission line in New Brunswick will be new-build construction adjacent to existing twinned transmission lines between Memramcook and Melrose, requiring widening of existing cleared corridors by 30 m.

INTRODUCTION
September 30, 2015

1.1.4 Substation Upgrade

Upgrades required at the Memramcook, NB existing substation include addition of one new 138 kV line termination point, and requires a single circuit breaker, disconnect switches, instrument transformers, protection and control, and telecommunications equipment.

1.1.5 Project Footprint

The total Project footprint, or Project Development Area (PDA) within New Brunswick is approximately 225.6 ha.

1.2 PROJECT PHASES AND SCHEDULE

The Project includes three phases: construction, operation, and decommissioning and abandonment.

Construction in NB is scheduled to begin in March 2016 with clearing of the RoW for transmission line between Melrose and Cape Tormentine. Key Project timelines are provided in Volume 1, Section 2.5. The operation phase will begin with energizing of the submarine cable, scheduled for December 2016. Project completion is expected in June 2017 with the commissioning of the transmission line between Melrose and Memramcook. The operation phase duration is based on the predicted useful service life of the Project, which is estimated to be 40 years.

Land-based infrastructure will be decommissioned at the end of its useful service life, in accordance with the applicable standards and regulations at that time. Most site infrastructure will be decommissioned, removed and sold or disposed of.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

INTRODUCTION
September 30, 2015

2.0 ENVIRONMENTAL SETTING AND POTENTIAL INTERACTIONS

New Brunswick is the largest of Canada's three Maritime Provinces, and lies adjacent to the Gaspé Peninsula of Quebec and the American state of Maine. New Brunswick has an estimated population of 751,171 and was one of the first provinces to join together to form the Dominion of Canada in 1867 (Historica Canada 2015; Statistics Canada 2012).

The Province covers roughly 73,440 square kilometres, ranging from about 242 kilometres east to west and 322 kilometres north to south. The northern part of the province is dominated by mountains that are part of the Appalachian Mountain Range. Approximately 5% of New Brunswick's land is used for farming, with the majority of suitable agricultural land located along major rivers. 83% of the Province is forested. The remaining land is used for residential, commercial/industrial, and institutional. The geology of New Brunswick consists mainly of rock layers that were formed in the Palaeozoic, Ordovician, and Carboniferous periods. These rocks include granites; red, green, and grey sandstones; and combinations of limestone, gypsum, salt, and shale (Historica Canada 2015).

New Brunswick's climate is typical of a coastal area and of an inland province. January is generally the coldest month and July is the warmest, with the interior experiencing warmer summers and colder winters. Summers typically average daytime highs between 20 and 22°C around the Bay of Fundy. These temperatures increase towards 25°C in the interior of the province. In winter, the interior often experiences average temperatures between -20°C to -30°C, while the southern coast temperatures average -7.5°C. Spring and early summer are fairly dry in the province, but New Brunswick receives a large amount of rainfall during the summer months, with the interior receiving roughly 1,200 millimetres of rainfall per year (Historica Canada 2015; World Atlas 2015).

Wildlife in New Brunswick is similar to that of the terrestrial environments in the other Maritime Provinces. The forests provide suitable habitat for herds of both moose and white tailed deer, and smaller animals such as porcupines, raccoons, chipmunks and squirrels, lynx, bobcats, coyotes, foxes, and a variety of others. Along the coast of the Northumberland Strait and the Bay of Fundy, there are a number of different bird species that can be seen such as plovers, sandpipers, cormorants, terns, eagles, osprey, herrons, ducks, and gulls (Canadian Geographic 2015; AMEC 2007; JWEL 2001).

The Project location within New Brunswick includes a cable landfall site along the northeastern shore of New Brunswick in Cape Tormentine. This land is currently owned by the Cape Tormentine Community Development Corporation. The Cape Jourimain National Wildlife Area, is approximately 1.5 km west of the cable landfall site in New Brunswick. It was designated in 1980 due to the variety of waterfowl and shorebirds that inhabit the area.

2.1 POTENTIAL INTERACTIONS

Potential valued components (VCs) were reviewed to determine if there was potential for interaction with Project components located in New Brunswick (Table 2.1). This volume considers only Project interactions in New Brunswick. Potential interactions in PEI are considered separately in Volume 2 (PEI)

and marine-based components of the environment are considered in Volume 4 (Northumberland Strait).

Table 2.1 Interactions between Potential Valued Components and Project Components Located in New Brunswick

Valued Component	Interaction with Project Components Located in New Brunswick?
Atmospheric Environment	No
Groundwater Resources	No
Freshwater Environment	Yes
Terrestrial Environment	Yes
Marine Environment	N/A
Land Use	Yes
Commercial, Recreational and Aboriginal Fisheries	N/A
Socioeconomic Environment	Yes
Heritage Resources	Yes
Other Marine Users	N/A
Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons	Yes
Note: N/A - Not applicable to New Brunswick volume.	

Freshwater Environment, Terrestrial Environment, Land Use, Socioeconomic Environment, Heritage resources, and Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons are carried through this environmental assessment as VCs (Chapter 3).

The following sub-sections provide rationale for not including Atmospheric Environment and Groundwater Resources.

2.1.1 Groundwater Resources

2.1.1.1 Existing Conditions

Groundwater is the source of drinking water for the residents and businesses along the transmission line corridor in New Brunswick. Residents along the majority of the transmission line corridor obtain their groundwater from individual water wells drilled on their properties, with the exception of residents in Port Elgin where municipal wells are used as the water supply. There are plans to provide a municipal water supply to residents in the east end of Memramcook which would also be provided by municipal wells.

Wellfield Protected Areas have been delineated for the municipal supply wells in Port Elgin, and will be delineated for the future municipal water supply in the east end of Memramcook. Three protection zones are typically defined that restrict land-use activities that are potentially hazardous to groundwater quality.

These zones are established based on groundwater travel time to a well, and they are designed to be protective against three types of groundwater contaminants: bacterial, petroleum products and chlorinated solvents. Zones include:

- Zone A lies closest to the wellhead and therefore poses the highest risk of pollution. The Designation Order states that septic tanks, sewer lines, petroleum products, chlorinated solvents, pesticides and similar chemicals or activities must be controlled or in some cases restricted within this zone. Its outer boundary surrounds the area where the potential for living organisms such as bacteria or viruses exists which could reach a supply well prior to their expected natural die-off. Potential bacterial contaminant sources such as manure or new septic tanks are more restricted in this zone.
- Zone B lies more distant from the wellhead and surrounds Zone A. The risk of bacterial contamination from land use is greatly reduced in Zone B, but significant pollution risks still persist from petroleum products, chlorinated solvents or other persistent chemicals or activities.
- Zone C surrounds Zones A and B and is located furthest from the wellhead. Controls on some chemicals or activities are much less stringent in Zone C, but are still required for the more persistent contaminants such as chlorinated solvents, some petroleum products and groundwater extraction.

2.1.1.2 Potential Interactions with Project Components

The transmission corridor passes through Zone C of the northern Port Elgin Wellfield Protected Area. The construction and operation of an overhead power transmission line is not listed as a restricted activity within the wellfield.

Trenching will be required for the installation of the cables to the proposed termination site at the landfall site. This may also require some dewatering within the trenches during the construction of the Project. However, as the depth to groundwater (estimated to be 3.0 to 4.5 m below ground between the substation and the coastline) is greater than the expected depth of the excavation for the cable (approximately 2 m), these activities are not expected to interact with the existing uses of groundwater resources.

Operation of the transmission line will require vegetation management. A combination of mechanical and chemical means may be used as appropriate. The use of chemical vegetation management will be conducted in accordance with government regulations, and thus are not anticipated to interact with Groundwater Resources along the transmission corridor.

2.1.1.3 Summary

Based on the lack of interactions noted above, there are no substantive interactions between the Project and Groundwater Resources anticipated. Groundwater Resources is therefore not considered as a VC in New Brunswick for the purpose of environmental assessment.

2.1.2 Atmospheric Environment

The Atmospheric Environment can be characterized by three components; air quality, climate, and sound quality. The Atmospheric Environment is typically described as:

- Air quality, characterized by the measure of the constituents of ambient air, and includes the presence and the quantity of air contaminants in the atmosphere.
- Climate, which is characterized by the composite or generally prevailing meteorological conditions of a region, including temperature, air pressure, humidity, precipitation, sunshine, cloudiness, and winds, throughout the seasons, averaged over a number of years (typically a 30 year period of record). In relation to climate change, climate is understood to be influenced by releases of greenhouse gases (GHGs) from human activities as well as natural sources, Project-based releases of GHGs are typically used as an indicator of potential environmental effects on Climate. The assessment of potential environmental effects of Climate on the Project is addressed in Chapter 4 (Effects of the Environment on the Project Chapter).
- Sound quality, which is characterized by the type, character, frequency, intensity, and duration of noise (unwanted sound) in the outdoor environment. The audible frequencies for humans are in the range of 20 - 20,000 Hertz (Hz). Vibration, identified as oscillations in matter that may lead to unwanted sound or stress in materials, is also typically considered as part of sound quality.

In this EIA, combustion gases, particulate matter and electric and magnetic fields (EMF) are considered in relation to air quality and GHGs released during combustion processes are considered in relation to climate change as those are the primary air contaminants associated with this type of project. Noise is evaluated based on sound pressure levels and consideration of vibration levels. Project phases include construction, operation, and decommissioning and abandonment and the area of assessment is within 1 km of the Project Development Area (PDA) for air quality and noise. For this Project, the PDA is limited to the anticipated area of physical disturbance associated with the construction or operation of the Project. The PDA includes the Memramcook substation expansion, the 30 m wide overhead transmission line corridor twinning from Memramcook to Melrose, the new 60 m wide corridor from Melrose to Cape Tormentine, and the Cape Tormentine landfall site above the high water mark. The area of assessment for climate change is global.

The *New Brunswick Clean Air Act* applies to the Project for air quality objectives. There are no applicable sound quality or greenhouse gas regulations governing the Project.

2.1.2.1 Existing Conditions

Air Quality

The existing air quality in the vicinity of the Project is mainly influenced by traffic and nearby farming activities. Contributors to air pollution include combustion emissions from vehicle traffic (mainly related to the Confederation Bridge) and combustion and fugitive emissions, agricultural contaminant emissions, and the generation of airborne dust during agricultural activities such as plowing.

In general, air quality of the area of the Project meets the provincial air quality objectives, established under the *Clean Air Act*, most of the time. During most times of the year, wind patterns in the area tend to disperse most pollutants released in the region. Generally, climate conditions provide good dispersion of air contaminants and frequent rainfall scavenges air contaminants from the atmosphere. The ambient air quality also benefits from the infusion of relatively clean oceanic air masses from the North Atlantic. Occasionally, air masses from central Canada or the eastern seaboard to the south may transport contaminants such as ozone into the area, causing a reduction in air quality. At other times, the weather is dominated by high-pressure air masses that produce low wind speed and poor dispersion of local emissions, which can lead to elevated concentrations of air contaminants and reduced air quality.

There were no exceedance events of the provincial air quality objectives (measuring carbon monoxide, hydrogen sulphide, nitrogen dioxide, sulphur dioxide, and total suspended particulate) in 2012 or 2013 near Moncton, NB (NBDELG 2015).

The Canadian Ambient Air Quality Standards (CAAQS) record long-term trends for particulate matter and ground level ozone across Canada. In Moncton, the 2015 CAAQS target was met, from data collected in 2011 to 2013 (NBDELG 2015).

Greenhouse Gas (GHG) Emissions

The quantities of greenhouse gases (GHGs) released to the atmosphere have been reported in Canada's national inventory report for 2013 as 15.7 million tonnes CO₂e for the province of NB, and 726 million tonnes for Canada (Environment Canada 2015). On this basis, NB represents a small fraction of Canada's GHG releases annually (2.2%).

Global emissions of GHGs were estimated to be 44 billion tonnes of carbon dioxide equivalent (CO₂e) in 2011 (latest available data), excluding land use change and forestry (World Resources Institute 2014). Therefore, on this basis Canada's contribution to global GHG emissions is approximately 1.6%.

Environment Canada's Facility Greenhouse Gas Emissions Reporting Program (GHGRP) provides information on greenhouse gas (GHG) emissions from Canadian facilities over the reporting threshold. Any facility with annual GHG emissions of 50,000 tonnes of CO₂e or higher is required to report to the program.

Information and data are taken from the Environment Canada website found at:

<http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=F81C9414-1&offset=2&toc=show>.

There are 12 facilities in NB which exceed the Environment Canada reporting threshold, producing 7,475,000 tonnes CO₂e in 2013. This accounts for approximately 3% of the total reported provincially and approximately 1% of the national reported total for 2013.

Climate

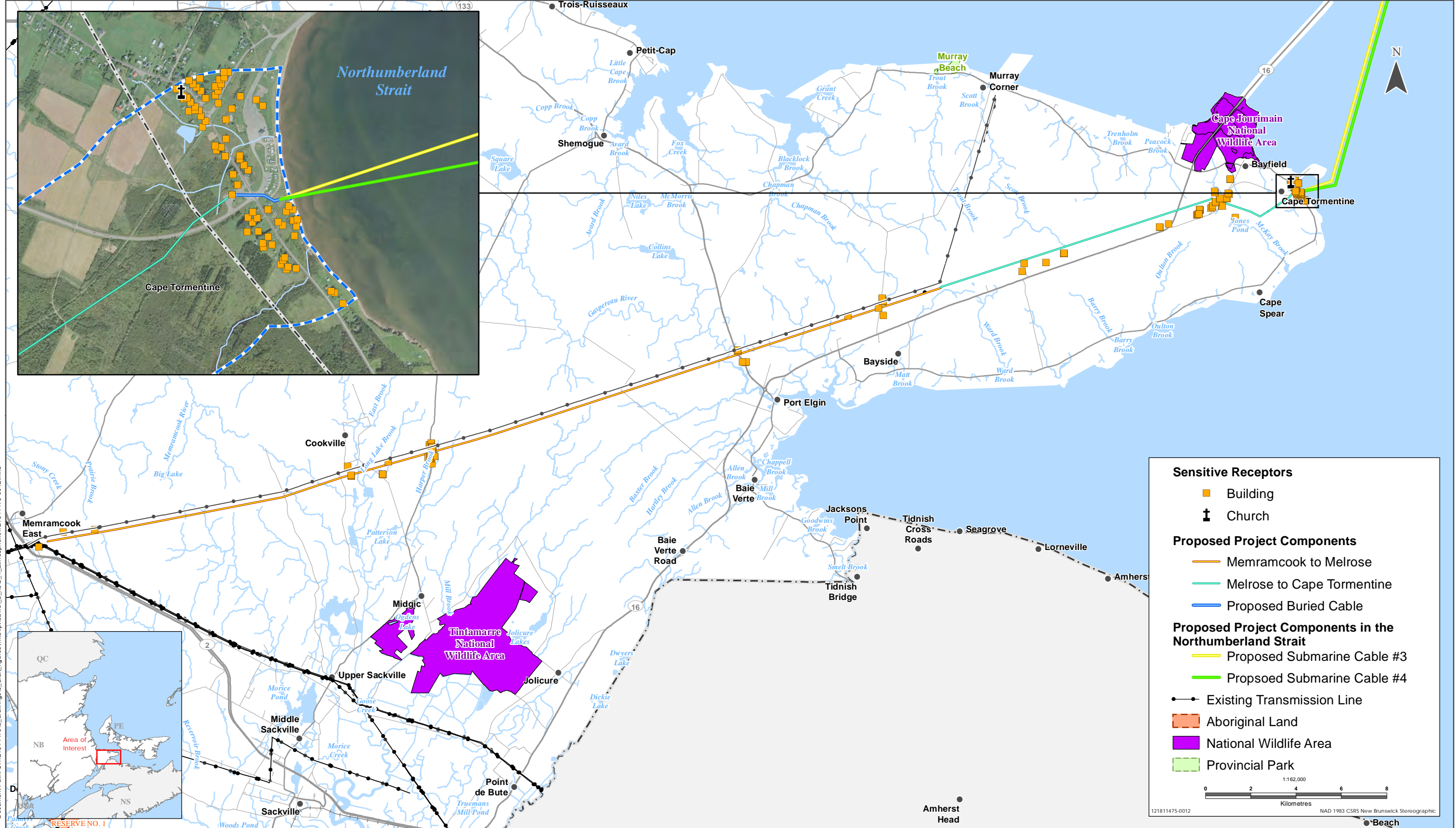
The closest weather station to the PDA with available historical data is in Sackville, NB, located approximately 15 km south of the PDA (where the proposed transmission line travels near Cookville). Limited historical climate data for wind speed and wind direction are available for the Sackville station; therefore, wind data from the Moncton weather station, located approximately 30 km from the Memramcook substation, are also reviewed to provide some indication of the magnitude of winds experienced in the region.

Annual climate normals for the nearest weather station (Sackville) indicate that January is typically the coldest month, with a mean daily temperature of -7.5 degrees Celsius (°C). August is typically the hottest month, having a mean daily temperature of 17.6°C. The mean annual precipitation is 1,146.5 millimeters (mm). October is typically the rainiest month with an average rainfall amount of 105.4 mm, while January is the snowiest month with an average recorded snowfall of 62.6 centimeters (cm). The prevailing winds in Moncton are generally from the west during November to March, with winds predominantly blowing from the north during April, and from the southwest during May to October (Government of Canada 2015). The average annual wind speed is approximately 16.8 km/hr. The maximum wind speeds occur in January with average speeds of 19.2 km/hr and minimum wind speeds occur in August with an average speed of 13.2 km/hr (Government of Canada 2015).

Sound Quality

The area near the substation in Memramcook is in a rural area with residential dwellings (Figure 2.1). Sound quality in this vicinity of the substation is expected to be mainly influenced by vehicle traffic due to the presence of an existing highway, as well as from operating farm machinery, and existing NB Power infrastructure (substation, transmission lines). The PDA, along the transmission right-of-way is in a rural area along forested land. Sound quality in the vicinity of the transmission line is expected to be mainly influenced by wildlife activity and nearby roadways in some locations. The area near the landing site in Cape Tormentine is also in a rural area with a number of residential dwellings and a local church (Figure 2.1). Sound quality in this area of the Project is expected to be mainly influenced by vehicle traffic due to the presence of the Confederation Bridge and an existing highway, as well as from operating farm machinery and noise from the ocean near the shoreline. No other noise sensitive areas were identified proximate to the PDA.

Overall, existing sound pressure levels are expected to be typical of rural ambient levels. Based on past research conducted in Alberta, the average rural ambient sound level in Alberta was about 35 dBA at night and 45 dBA during day (AER 2007). Measurements conducted in other areas of NB generally agree with these values and based on the limited interaction expected from the Project on sound quality, no background monitoring was conducted for the Project.



Sources: Base Data - Natural Earth, Thematic Data - ERBC, Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011), Project Data from Stantec or provided by NB Power / MECL. Buildings digitized from survey of aerial imagery.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

2.1.2.2 Potential Interactions with Project Components

Project-related releases of air contaminants to the atmosphere will include small amounts of combustion gases from the operation of on-site construction equipment and large trucks used to deliver equipment to the site. There may also be some dust generated as a result of excavation activities and equipment traveling on unpaved surfaces.

Releases of greenhouse gases (GHGs) will occur in small quantities from fuel combustion in heavy equipment and trucks used for project activities. No substantive emissions of air contaminants or GHGs will occur during Project operation. Emissions during eventual decommissioning and abandonment are expected to be similar or less than those that would occur during construction.

Combustion gases from the Project are not likely to cause any notable or substantive changes in air quality with the use of well-maintained equipment.

Dust is typically the primary concern in relation to air quality during construction; however standard mitigation can control dust to below regulatory objectives. Mitigation includes timely re-vegetation of exposed soil to limit dust generation as well as the use of dust suppressants (typically water sprays) on unpaved areas during dry periods.

Topsoil and overburden stockpiled during construction will be seeded and re-vegetated periodically. The generation of airborne dust from these sources is therefore considered to be nominal. Topsoil and overburden are transferred by trucks to stockpiles. While material handling may generate dust, it is assumed that the material is wet and that minimal dust is generated. The emissions will remain largely confined to the Project area and the immediately adjacent areas and will be of short duration.

The construction phase is short in duration and will be transient (i.e., carried out to install one part of the line, then moving on to another area) along the transmission corridor (and the contractor will be required to follow a preventative maintenance schedule for equipment. As a result, Project-related releases of air contaminants to the atmosphere are not likely to cause the ambient air quality standards to be exceeded. On this basis, no further assessment of Project interactions with air quality is required.

The quantities of greenhouse gases released to the atmosphere during Project construction are expected to be very small in comparison to provincial and national totals. These can be partially mitigated through the use of well-maintained equipment and implementation of an idling awareness program to reduce unnecessary idling. During operation, no substantive GHGs would be released from the Project.

During construction, sound emissions and vibration will result from the operation of heavy equipment (for excavating and vegetation clearing) and from transportation vehicles on Project access roads. Noise will, however, remain largely confined to the PDA and the immediately adjacent areas, and will be transient and short in duration. If noise complaints from local residents are received, the information will be evaluated and additional mitigation may be required. Construction will be limited to daytime hours, if possible, to reduce disturbance and annoyance to the nearest residences.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL SETTING AND POTENTIAL INTERACTIONS

September 30, 2015

During operation, sound quality is not expected to be influenced by the upgrades to the existing substation in Memramcook, NB (addition of one new 138 kV line termination point, requiring a single circuit breaker, disconnect switches, instrument transformers, protection and control and telecommunications equipment) or operation of the transmission lines. The Project substation is expected to produce noise that is similar in nature (frequency and level) to noise from the existing substation, as the upgrades are not expected to affect noise levels. Detailed engineering specifications for equipment are not yet available to predict the change in noise; however based on the upgrades to the substation, noise is not expected to be a concern.

Noise levels will be reviewed in relation to the final design prior to installation, in consideration of the nearest residence (approximately 150 m away). The remainder of the Project is not expected to contribute to or generate noise at the nearest residences.

During operation, the effects of EMFs are not expected to be a concern. Several studies have been done to assess the potential effects of electric and magnetic fields (or EMF) at extremely low frequencies (ELF in the range of 30-300 Hertz, where power frequency is 50-60 Hertz) on human health.

Related specifically to electrical transmission lines, a federal-provincial territorial committee in

Canada has reviewed the evidence and prepared a response statement in 2008 and updated it in 2009, on public concerns regarding EMF. The main conclusions are that, "In the context of power frequency EMFs, health risks to the public from such exposures have not been established" and secondly, "there is insufficient evidence showing exposure to EMFs from power lines can cause adverse health effects" (Health Canada 2009).

It is also noted that a warning to the public to avoid living near or spending time in proximity to power lines is not required (Health Canada 2009). Therefore, based on the above, no substantive interactions between the Project and the effects of EMFs are anticipated.

Based on the reasons explained above and the planned implementation of known and proven mitigation, no substantive interactions between the Project and the Atmospheric Environment are anticipated. Atmospheric Environment is therefore not considered as a VC in NB for the purpose of environmental assessment.

2.1.2.3 Summary

Based on the lack of interactions noted above, there are no substantive interactions between the Project and Atmospheric Environment anticipated. Atmospheric Environment is therefore not considered as a VC in New Brunswick for the purpose of environmental assessment.

3.0 ENVIRONMENTAL EFFECTS ASSESSMENT

3.1 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON THE FRESHWATER ENVIRONMENT

The Project has the potential to interact with waterbodies along the overhead transmission line corridor. Construction, operation, and decommissioning and abandonment activities have the potential to change the freshwater environment through alteration of freshwater habitats, increased risk of fish mortality or changes in water quality. The Freshwater Environment was selected as a VC for environmental assessment due to the importance of freshwater habitat as an ecosystem component and the associated regulatory protection afforded it as well as its social importance.

The Freshwater Environment VC considers project environmental effects on freshwater fish species and water quality within areas that may be affected by the project. Fish includes all species of fish and shellfish that are fished commercially, recreationally or by Aboriginal groups and reside within the PDA or use the associated habitat during any lifestage. Water quality is assessed in relation to guidelines for the protection of aquatic life and freshwater habitats.

The applicable regulations and policies, potential environmental effects, and temporal and spatial boundaries used in the assessment are identified and defined further in Section 3.2.1.1.

The Freshwater Environment VC is intrinsically linked to Section 3.3: Terrestrial Environment through riparian vegetation and wetlands and Section 3.1: Marine Environment (Volume 4 – Marine Assessment) through anadromous or catadromous species.

3.1.1 Scope of Assessment

The assessment of the Freshwater Environment takes into account the importance of freshwater habitat as an ecosystem component and the associated regulatory protection and social importance. This section describes the regulatory and policy setting, the social topics included in the assessment from consultation and engagement with stakeholders and First Nations, and the boundaries of the assessment. The potential environmental effects and their pathways are identified along with the measurable parameters and the significance criteria for the evaluation of environmental effects on Freshwater Environment.

3.1.1.1 Regulatory and Policy Setting

Effects on Freshwater Environment associated with the Project are subject to federal and provincial regulatory requirements. The key regulatory requirements are each described in brief.

Key acts and regulations are supported by additional federal, provincial and non-governmental policies and guidelines which are not described, these supporting policies include:

- The Fisheries Protection Policy Statement (DFO 2013)

- Watercourse Alterations Technical Guidelines (GNB 2012)
- Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (CCME 1990)

Fisheries Act

The *Jobs, Growth and Prosperity Act* came into force on November 25, 2013 and resulted in changes to several sections of the *Fisheries Act*, most notably Section 35 which defines serious harm to fish and their habitat. Changes were also made to Sections 6, 20, 21 of the *Fisheries Act*, which pertain to the regulatory review process and fish passage or obstructions. An updated Fisheries Protection Policy Statement was released, replacing the previous Fish Habitat Policy. The amendments in Section 35 of the *Fisheries Act* adopt "serious harm to fish" replacing "harmful alteration, disruption or destruction (HADD), of fish habitat".

The updated Fisheries Protection Policy Statement interprets "serious harm" to commercial, recreational or Aboriginal (CRA) fish and fish that support a fishery as:

- the death of fish
- a permanent alteration to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes
- the destruction of fish habitat of a spatial scale, duration, or intensity that fish can no longer rely upon such habitats for use as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes

The definitions of fish and fish habitat established under the *Fisheries Act* are:

- "Fish" includes (a) parts of fish, (b) shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals and (c) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.
- "Fish habitat" means spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly to carry out their life processes.

CRA fishery species are primarily protected under federal legislation and regulations, and are socially and economically important. They are defined by the *Fisheries Act* as follows:

- Commercial fisheries are recognized as fish species harvested under license for the purpose of sale.
- Recreational fisheries are recognized as fish species targeted by anglers for personal use or sport, as well as coarse and forage fish which support this fishery.
- Aboriginal fisheries are recognized as fish species caught by Aboriginal groups for subsistence, social or ceremonial purposes. In the absence of supporting information regarding Aboriginal fisheries, Aboriginal fisheries are considered to include all fish species, including those fished recreationally and commercially, and those that support those fisheries.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

With the recent amendments, the requirement under the Act to gain authorization will apply only where a project results in “serious harm” to a CRA fishery, any species which are not part of or contribute to a fishery are not protected under the *Fisheries Act*. An alteration of fish habitat must be deemed to be permanent to be of regulatory consequence under the Act. This assessment of “serious harm” to fish and fish habitat within the Local and Regional Assessment Areas is described in Section 3.1.1.4.

Table 3.1 outlines the relevant requirements for the Project under the federal *Fisheries Act* and regulations.

Table 3.1 Relevant Directives under the *Fisheries Act*

Regulations	Nature of Directive	Relevance to Project	Federal Authority
Section 20(1)	Regulate designs that provide the free passage of fish without harm and maintain a flow of water sufficient to allow the free passage of fish.	Watercourse crossing designs and provision of fish passage.	DFO
Section 35(1)	Provide protection of fish and fish habitat.	Watercourse crossing designs	DFO
Section 35(2)	Permit authorizations for the alteration of fish habitat.	Permit <i>Fisheries Act</i> authorizations for habitat alterations, if required.	DFO
Section 36	Implement mitigation as per guidelines to prevent introduction of deleterious substances into fish bearing waters.	All heavy equipment work within watercourse buffers (30 m) and need to prevent erosion and sedimentation of watercourses, or fuel spills from reaching watercourses.	DFO/Environment Canada

Species at Risk Acts

Seven species, and 10 populations, are currently included in the Federal *Species at Risk Act (SARA)* registry and the New Brunswick *Species at Risk Act (NB SARA)* list, with ranges in New Brunswick. These species, along with the Federal SARA and NB SARA status' are listed in Table 3.2.

Species listed provincially as extirpated, endangered, threatened or of special concern are formally protected under NB SARA. Federally, species listed under Schedule 1 as extirpated, endangered or threatened are formally protected under the Federal SARA. Species at risk are formally protected through prohibitions on killing, harassing or capturing a listed species, unless otherwise approved through a ministerial order (i.e., license or permit). Habitat critical to the survival of any listed species at risk is protected by prohibitions on destruction or alteration. A Recovery Strategy outlines what needs to be done to arrest or reverse the decline of a species this is generally prepared by Environment Canada on behalf of the minister.

Table 3.2 Federal and Provincial Freshwater Fish Species Listed as at Risk in New Brunswick

Common Name	Scientific Name	Federal Status ¹	Provincial Status ²
American Eel	<i>Anguilla rostrata</i>	-	Threatened
Atlantic Salmon (Inner Bay of Fundy Population)	<i>Salmo salar</i>	Schedule 1-Endangered	Endangered
Atlantic Salmon (Gaspé-Southern Gulf of St. Lawrence population)	<i>Salmo salar</i>	-	Special Concern
Brook Floater	<i>Alasmidonta varicosa</i>	Special Concern	Special Concern
Rainbow Smelt (Lake Utopia small-bodied population)	<i>Osmerus mordax</i>	Threatened	Threatened
Rainbow Smelt (Lake Utopia large-bodied population)	<i>Osmerus mordax</i>	-	Threatened
Striped Bass (Bay of Fundy Population)	<i>Morone saxatilis</i>	-	Endangered
Striped Bass (Southern Gulf of St. Lawrence Population)	<i>Morone saxatilis</i>	-	Special Concern
Yellow Lampmussel	<i>Lampsilis cariosa</i>	Special Concern	Special Concern
<p>Notes: ¹ Government of Canada. June 2015. Species at Risk Public Registry according to <i>Species at Risk Act</i> – Schedule 1 ² Department of Environment, New Brunswick 2015 – <i>Species at Risk Act</i>, 2013. - Not listed under the respective Act</p>			

The potential of a SAR species to use the freshwater habitat within the PDA will result in an assessment of the potential effects of the Project on the species. This assessment will review any critical habitat identified in the species' Recovery Strategy and provide mitigation measures to comply with the federal and provincial *Species at Risk Acts*.

New Brunswick Clean Water Act—Watercourse and Wetland Alteration Regulations

The purpose of the *Watercourse and Wetland Alteration Regulation* (WAWA Regulation) is to protect the water quality and aquatic habitat of the streams, rivers, lakes and wetlands of New Brunswick from unmitigated works in or near watercourses and wetlands. The regulation requires the issuance of a permit by the New Brunswick Department of Environment and Local Government (NBDELG).

A Watercourse and Wetland Alteration Permit is required before:

- the physical modification of the bed or banks of a watercourse
- the modification of flow of water, or
- any disturbance of the ground or removal of vegetation within 30 m of a watercourse

New Brunswick Clean Environment Act—Water Quality Regulation

The *Water Quality Regulation* is the main regulatory instrument in New Brunswick for regulating the release of effluents to the waters of the Province, which include surface water within the jurisdiction of the Province. Section 3(1) of the regulation requires that any source of substances that may directly or

indirectly cause water pollution or release of substances to the waters of the Province must apply for and obtain a Certificate of Approval under that regulation.

The Regulation defines “water pollution” as “(a) any alteration of the physical, chemical, biological or aesthetic properties of the waters of the Province, including change of the temperature, colour, taste or odour of the waters, or (b) the addition of any liquid, solid, radioactive, gaseous or other substance to the waters of the Province or the removal of such substance from the waters of the Province, which renders or is likely to render the waters of the Province harmful to the public health, safety or welfare or harmful or less useful for domestic, municipal, industrial, agricultural, recreational, or other lawful uses or harmful or less useful to animals, birds or aquatic life.”

3.1.1.2 The Influence of Consultation and Engagement on the Assessment

The consultation program in support of this EIS focused primarily on the areas most likely to be affected by the Project. Issues or concerns regarding the Freshwater Environment identified during consultation and engagement (Table 3.3) informed baseline data collection and are addressed through the effects assessment.

Table 3.3 Issues Raised by Aboriginal Groups and Stakeholders

Question /Issue	Community / Organization	Summary of Comments	Response
The Project has the potential to result in 'serious harm' to fish.	Fisheries and Oceans Canada (DFO) – Ecosystem Management	DFO requested detail on the description of any in-water works or watercourse fording and mitigation measures utilized to avoid impacts to fish and fish habitat.	No in-water works are anticipated to occur in New Brunswick. The mitigation and effects assessment on watercourse crossings are described in Section 3.2.4.

3.1.1.3 Potential Environmental Effects, Pathways and Measureable Parameters

Throughout the life of the Project (construction, operation, and decommissioning and abandonment), there will be interactions with the Freshwater Environment. These interactions are grouped and assessed as a change in the freshwater environment. Unmitigated construction, operation, and decommissioning and abandonment of the Project have the potential to induce a change in the freshwater environment. The loss of fish habitat quality or quantity, a decrease in water quality or an increase in mortality risk to fish species can result from an interaction between the Project and the Freshwater Environment. The potential environmental effect pathways are listed in Table 3.4 along with the associated measurable parameters, which will serve to inform the characterization of the potential residual environmental effects related to a change in the Freshwater Environment.

Table 3.4 Potential Environmental Effects, Effect Pathways and Measurable Parameters for the Freshwater Environment

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in the Freshwater Populations	<ul style="list-style-type: none"> • Destruction or alteration of habitat arising from disturbance of the watercourse during clearing, grubbing, pole installation or access road crossings during construction and operation. • Direct mortality of fish resulting from installation of infrastructure within watercourses during construction or operation. • Direct mortality or injury to freshwater fish resulting from acute changes in nutrient, sediment or contaminant concentrations (water quality) from sedimentation or accidental releases during construction, operation or decommissioning and abandonment. 	<ul style="list-style-type: none"> • Areal extent of altered or lost fish habitat (m²). • Baseline water quality (pH, dissolved oxygen, temperature, turbidity and total suspended solids (TSS)). • Mortality of fish (number of fish killed).

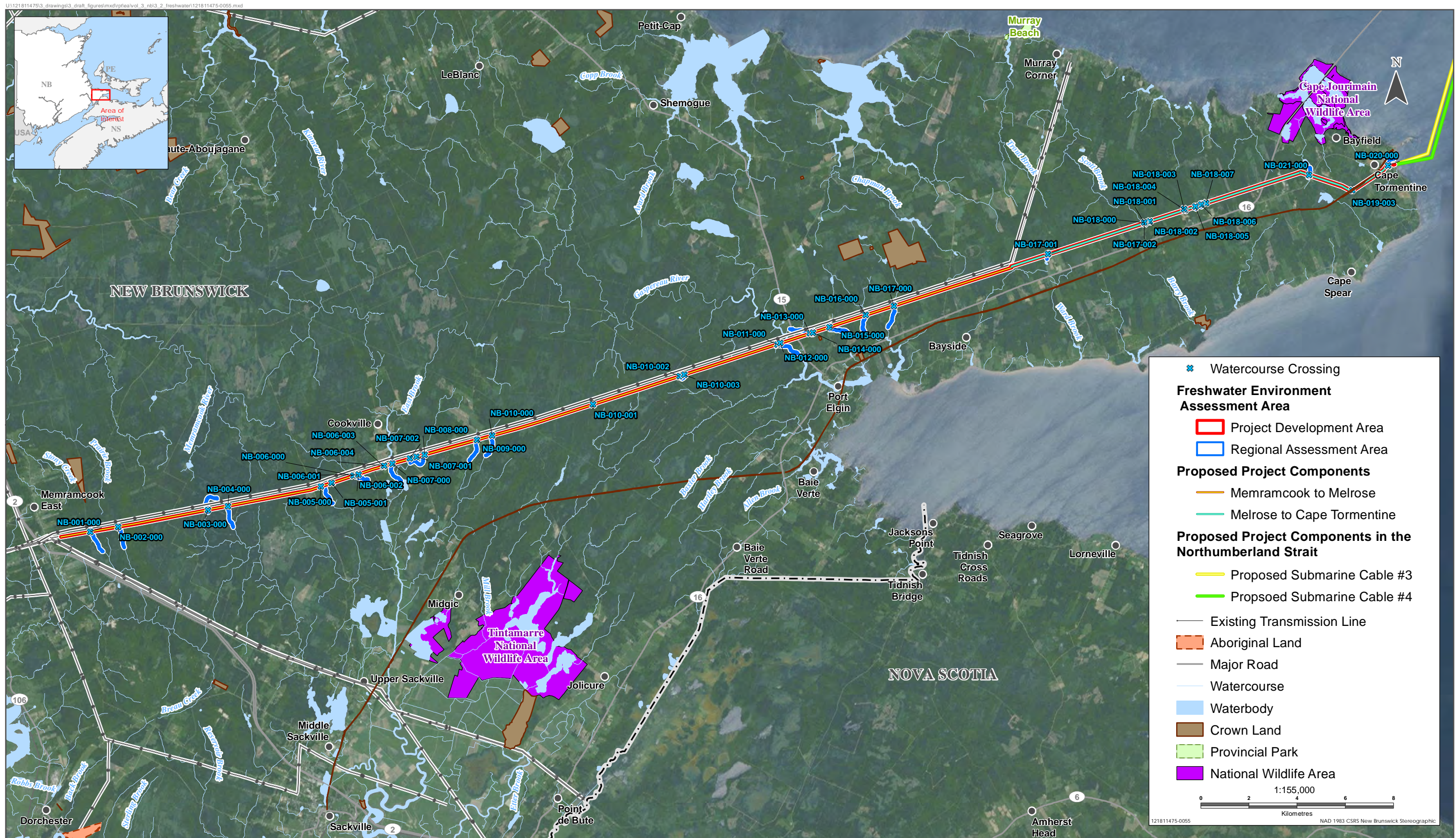
3.1.1.4 Boundaries

The spatial boundaries for the environmental effects assessment of fish and fish habitat are defined below, and take into account the scale and spatial extent of potential environmental affects, existing scientific and traditional knowledge, current land and resource use, and biological and ecological considerations.

3.1.1.4.1 Spatial Boundaries

The spatial boundaries for the Freshwater Environment VC have been divided into three assessment areas as presented in Figure 3.1 and the freshwater mapbook, Appendix A. The Project Development Area (PDA), the Local Assessment Area (LAA) and the Regional Assessment Area (RAA) are defined below.

- Project Development Area (PDA): The PDA includes the immediate area of physical disturbance associated with the construction and operation of the Project. The PDA includes: the existing substation in Memramcook where upgrades to the existing substation will occur within the substation footprint; a 40 km long, 30 m wide transmission line RoW from Memramcook to Melrose and a 17 km long, 60 m wide transmission line RoW from Melrose to Cape Tormentine; a cable termination site; and a 10 m easement around cable lines. The PDA is illustrated in Figure 3.1 as it applies to the Freshwater Environment.



Sources: Base Data - Natural Resources (2011). Project Data from Stantec or provided by NB Power / MECL. Imagery - ArcGIS Map Service World Imagery, Natural Resources (2011).

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



- **Local Assessment Area (LAA):** The LAA includes a portion of the watercourse measuring 100 m upstream and 200 m downstream of the corridor centerline. The LAA was selected to encompass all areas with the potential to have indirect loss of fish habitat. The LAA is where environmental effects are reasonably expected to occur and are measurable to a high degree of confidence. For example, the LAA includes sufficient upstream and downstream freshwater habitat at all crossings to evaluate anticipated measurable environmental effects from construction, operation, and decommissioning and abandonment. The LAA is illustrated in the freshwater mapbook in Appendix A.
- **Regional Assessment Area (RAA):** The RAA includes the area that establishes the context for determining significance of project-specific effects. It is also the area within which potential cumulative effects—the residual effects from the Project in combination with those of past, present and reasonably foreseeable projects—are assessed (Figure 3.1). The RAA encompasses the PDA and the LAA.

3.1.1.4.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on Freshwater Environment include construction, operation, and decommissioning and abandonment. Construction is expected to occur over a period of 16 months. Construction of the landfall site and transmission line from Melrose to Cape Tormentine is expected to be completed over 9 to 10 months, between March and December 2016. Construction of transmission line between Melrose and Memramcook is expected to begin in September 2016 with completion expected to take place in June 2017. Operation will begin following construction and is anticipated to continue for the life of the Project (approximately 40 years). Decommissioning and abandonment would take place following the useful service life of the Project and which would be carried out in accordance with regulations in place at that time.

3.1.1.5 Residual Environmental Effects Description Criteria

Table 3.5 provides the criteria that are used to characterize residual environmental effects on the Freshwater Environment.

Table 3.5 Characterization of Residual Environmental Effects on the Freshwater Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect.	<p>Positive—an environmental effect that moves measurable parameters in a direction beneficial to the Freshwater Environment relative to baseline.</p> <p>Adverse—an environmental effect that moves measurable parameters in a direction detrimental to the Freshwater Environment relative to baseline.</p> <p>Neutral—no net change in measurable parameters for the Freshwater Environment relative to baseline.</p>

Table 3.5 Characterization of Residual Environmental Effects on the Freshwater Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of change in the freshwater environment relative to existing conditions.	<p>Negligible—no measurable change in the Freshwater Environment.</p> <p>Low—a measurable change anticipated in low-sensitivity habitats and no measurable mortality risk to non-listed species.</p> <p>Moderate—measurable change in fish habitat or anticipated mortality risk to non-listed species.</p> <p>High—measurable change in the Freshwater Environment from a change in sensitive habitat or habitat designated as important to listed species or anticipated mortality to listed species.</p>
Geographic Extent	The geographic area in which an environmental effect occurs.	<p>PDA—residual environmental effects are restricted to the PDA.</p> <p>LAA—residual environmental effects extend into the LAA.</p> <p>RAA—residual environmental effects interact with those of other projects in the RAA.</p>
Frequency	Identifies when the residual environmental effect occurs and how often during the Project or in a specific phase.	<p>Single event—occurs only once during the life of the project.</p> <p>Multiple irregular event—occurs more than once at no set schedule.</p> <p>Multiple regular events—occurs more than once at regular intervals.</p> <p>Continuous—occurs continuously.</p>
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived.	<p>Short-term—residual environmental effect restricted to the construction or operation phase of the Project. Includes effects to the Freshwater Environment of less than 1 year.</p> <p>Medium-term—residual environmental effect restricted to the construction or operation phase of the Project. Includes effects to the Freshwater Environment of between 1 and 5 years.</p> <p>Long-term—residual environmental effect extends beyond the life of the project (i.e., beyond decommissioning and abandonment).</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases.	<p>Reversible—the environmental effect will cease during or after the Project is complete, the results of the effect will allow the Freshwater Environment to recover to baseline.</p> <p>Irreversible—the environmental effect will persist after the life of the Project, even after mitigation measures are enacted. The Freshwater Environment will not recover to baseline.</p>

Table 3.5 Characterization of Residual Environmental Effects on the Freshwater Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Ecological and Socioeconomic Context	Existing condition and trends in the area where environmental effects occur.	<p>Undisturbed—the area is relatively undisturbed or not adversely affected by human activity.</p> <p>Disturbed—area has been substantially previously disturbed by human development or human development is still present.</p>

3.1.1.6 Significance Definition

A significant adverse residual environmental effect on the Freshwater Environment is one that:

- causes increased mortality of CRA or species at risk fish
- causes a permanent alteration to or the destruction of fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats and results in a decrease in the sustainability of the populations or the local fisheries
- decreases water quality to a level which induces mortality or diminishes the ability of fish to use such habitats and results in a decrease in the sustainability of the populations or the local fisheries

Applicable legislation and regulations used to characterize the significance determinations for the alteration or destruction of fish habitat or changes in water quality include the *Canadian Environmental Protection Act*, New Brunswick's WAWA Regulations, The Fisheries Protection Policy Statement (DFO 2013), New Brunswick Watercourse Alterations Technical Guidelines (GNB 2012), Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (CCME FAL – CCME 1990).

3.1.2 Existing Conditions of the Freshwater Environment

In this section the existing conditions of the Freshwater Environment are described for the LAA, the understanding of the PDA conditions enables a more accurate assessment of potential project environmental effects on the Freshwater Environment. This section also describes the methods used to obtain data on the existing conditions and an overview of freshwater habitat, fish presence and water quality.

3.1.2.1 Methods

A review of relevant fish, and fish habitat data from various sources (NBDNR, UNB, ACCDC, COSEWIC, etc.) was undertaken which included previous environmental assessments and publically available reports from various freshwater groups, researchers and government. Although the review of previous studies and existing information provided some information on the Freshwater Environment in the Project location, and specifically at the regional and local spatial scales, it was determined additional information and data were required to support the assessment for the currently proposed Project. Specifically, freshwater fish habitat data, and water quality were required in the Freshwater

Environment along the transmission line corridor. Field studies were undertaken in the spring of 2015 to supplement the existing data.

Data and information collected during field studies described below were used to characterize the existing conditions for the Freshwater Environment.

Field Methods

During the spring of 2015 a fish and fish habitat survey was conducted within the new-build transmission line right-of-way in NB. This survey was conducted to characterize the Freshwater Environment. The potential interaction between the construction of the transmission line corridor and watercourses would be limited to work within the riparian zone and watercourse crossings for equipment; therefore, the standard Stantec approach was modified to focus on this zone. At each watercourse, fish and fish habitat assessments were conducted 200 m downstream and 100 m upstream of the transmission line centerline. Data collected included substrate type, degree of embeddedness, stream width and depth, flow velocity, and riparian zone characteristics. During the field habitat assessments in-situ water quality data were collected at the centerline of each watercourse crossing using a Hanna multi-parameter water quality meter. Water quality data collected included pH, conductivity, salinity, temperature, dissolved oxygen and turbidity. Water velocity data were collected in streams with detectable water velocity (i.e., where water was flowing at rate at which it could be measured).

There was no electrofishing conducted along the proposed corridor. During planning and development of the survey it was assumed that all watercourses which provided fish habitat either contain or support CRA fisheries. Incidental observations on fish presence were noted where fish were observed.

3.1.2.2 Overview

The Project components in New Brunswick cover an area of approximately 225.6 ha and cross 31 watercourses and four ephemeral channels (Figure 3.1). The PDA is situated along a drainage divide. Watercourses in the southwestern portion of the corridor drain into the Bay of Fundy, either through Cumberland Basin or Shepody Bay. The watercourses along the northeastern portion of the corridor drain into the Northumberland Strait. For the overview of the Freshwater Environment, fish species composition is described in terms of environmental assessment boundaries while fish habitat and water quality is described on a watercourse by watercourse basis.

3.1.2.2.1 Fish Presence

As noted above, fish community sampling within the PDA was not conducted as part of the Freshwater Environment baseline studies. Information on fish species presence was obtained from a literature review of the area and existing knowledge. Fish inhabiting the PDA are expected to include species of cyprinids (minnows), salmonids, perches, herring, shad, eel, and sucker (Curry et al. n.d.). Table 3.6 lists the species anticipated to occur within the PDA, LAA and RAA. Freshwater mussels are expected to be present within the larger watercourses such as Tantrammar River, Musquash Brook, Gasperau River and Timber River. Table 3.7 lists the watercourses to be crossed by the project and whether fish are expected to be present.

3.1.2.2.2 Species at Risk

Seven species, and 10 populations are currently included in the Federal SARA registry and the NB SARA list with home ranges in New Brunswick (Table 3.2). Of these species Atlantic salmon (inner Bay of Fundy (iBoF) population), and American eel are the two species which may be encountered in the RAA. The remaining species and populations listed in Table 3.2 are limited to home ranges outside the Project's RAA and therefore are not included as part of the description of the existing environment. Due to the sensitive nature of the Inner Bay of Fundy (iBoF) Atlantic salmon stocks, watercourses which drain into the iBoF have been identified in the table.

Table 3.6 Freshwater Fish Species Presence

Common Name	Scientific Name	Potential Presence in:		
		PDA	LAA	RAA
Alewife (Gaspereau)	<i>Alosa pseudoharengus</i>	✓	✓	✓
American Eel	<i>Anguilla rostrata</i>	✓	✓	✓
American Shad	<i>Alosa sapidissima</i>	-	✓	✓
Atlantic Salmon	<i>Salmo salar</i>	✓	✓	✓
Atlantic Tomcod	<i>Microgadus tomcod</i>	-	-	✓
Banded Killifish	<i>Fundulus diaphanus</i>	✓	✓	✓
Blacknose Dace	<i>Rhinichthys atratulus</i>	✓	✓	✓
Blacknose Shiner	<i>Notropis heterolepis</i>	✓	✓	✓
Brook Trout	<i>Salvelinus fontinalis</i>	✓	✓	✓
Brown Bullhead	<i>Ameiurus nebulosus</i>	✓	✓	✓
Common Shiner	<i>Notropis cornutus</i>	✓	✓	✓
Fourspine Stickleback	<i>Apeltes quadracus</i>	-	-	✓
Golden Shiner	<i>Notemigonus crysoleucas</i>	✓	✓	✓
Lake Chub	<i>Coesius plumbeus</i>	✓	✓	✓
Mummichog	<i>Fundulus heteroclitus</i>	-	-	✓
Ninespine Stickleback	<i>Pungitius pungitius</i>	✓	✓	✓
Northern Redbelly Dace	<i>Chrosomus eos</i>	✓	✓	✓
Rainbow Smelt	<i>Osmerus mordax</i>	-	-	✓
Slimy Sculpin	<i>Cottus cognatus</i>	✓	✓	✓
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	✓	✓	✓
White Perch	<i>Morone americana</i>	✓	✓	✓
White Sucker	<i>Catostomus commersoni</i>	✓	✓	✓
Yellow Perch	<i>Perca flavescens</i>	✓	✓	✓

Note: Data adapted from Curry et al. n.d., and Scott and Crossman 1998.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Table 3.7 Fish Habitat Presence within the LAA

Project Site ID	Watercourse Name	Stream Order	Channel Width (m)	Wetted Width (m)	Fish Bearing Potential	iBoF Waters
NB-001-00	Tributary to Breau Creek	1	1.70	0.50	✓	✓
NB-002-00	Tributary to Breau Creek	Ephemeral	Interstitial Flow			
NB-003-00	Tributary to Joe Brook	1	1.23	5.00	✓	✓
NB-004-00	Tributary to Joe Brook	2	1.02	0.92	✓	✓
NB-005-00	Tributary to Musquash Brook	1	1.20	0.95	✓	✓
NB-005-01	Tributary to Musquash Brook	1	3.30	1.00	✓	✓
NB-006-00	Musquash Brook	2	4.07	3.59	✓	✓
NB-006-01	Tributary to Musquash Brook	1	1.30	1.00	✓	✓
NB-006-03	Tributary to Tantramar River	1	1.30	0.80	✓	✓
NB-007-00	Tantramar River	4	18	128	✓	✓
NB-007-01	Tributary to Tantramar River	1	0.89	0.45	✓	✓
NB-007-02	Tributary to Tantramar River	1	0.78	0.54	✓	✓
NB-008-00	Tributary to Tantramar River	1	3.10	2.80	✓	✓
NB-009-00	Harper Brook	1	0.94	0.80	✓	✓
NB-010-01	Tributary to Robinson Brook	1	0.88	0.69	✓	✓
NB-010-02	Tributary to Crystal Brook	1	0.82	0.78	✓	-
NB-010-03	Tributary to Crystal Brook	1	2.35	2.08	✓	-
NB-011-00	Tributary to Gasperau River	1	0.85	0.70	✓	-
NB-012-00	Gasperau River	2	18.0	15.0	✓	-
NB-013-00	Tributary to Gasperau River	1	5.00	4.00	✓	-
NB-014-00	Tributary to Gasperau River	1	0.95	0.95	✓	-
NB-015-00	Timber River	2	1.04	0.90	✓	-
NB-016-00	Tributary to Timber River	2	2.40	2.36	✓	-
NB-017-00	Tributary to Timber River	2	4.10	2.80	✓	-
NB-017-01	Tributary to Matt Brook	1	1.30	0.55	✓	-
NB-017-02	Tributary to Scott Brook	Ephemeral	Interstitial Flow		-	-
NB-018-00	Scott Brook	1	0.50	0.40	✓	-
NB-018-01	Tributary to Scott Brook	1	0.48	0.42	✓	-
NB-018-04	Tributary to Trenholm Brook	1	0.55	0.50	✓	-
NB-018-05	Tributary to Trenholm Brook	1	4.00	0.51	✓	-
NB-018-06	Tributary to Trenholm Brook	1	0.49	0.42	✓	-
NB-018-07	Tributary to Trenholm Brook	Ephemeral	Interstitial Flow		-	
NB-019-03	Tributary to the Northumberland Strait	Ephemeral	Interstitial Flow		-	-

Table 3.7 Fish Habitat Presence within the LAA

Project Site ID	Watercourse Name	Stream Order	Channel Width (m)	Wetted Width (m)	Fish Bearing Potential	iBoF Waters
NB-020-00	Tributary to the Northumberland Strait	1	0.82	0.57	✓	-
NB-021-00	Tributary to the Northumberland Strait	1	10.0	10.0	✓	-

3.1.2.2.3 Stream Habitat

Overall, for the watercourses assessed, stream gradients are low and the habitats are primarily depositional. Run type habitats are prevalent with few higher gradient riffles or rapids. As a result of active or inactive beaver dams, wide, deep, flat water sections are present in several watercourses. These impoundments often result in wide and deep sections of habitat often with fine sediment and undetectable water velocity. These beaver dams result in habitat that is uncharacteristic of undammed watercourses.

The majority (n=24) of the watercourses along the proposed transmission line corridor are 1st order, narrow (mean channel width = 1.86 m), shallow (mean channel depth = 0.21 m) and perennial. These watercourses are generally associated with wetlands and have small drainage areas and water flow velocities (mean water velocity = 0.15 m/s) were low at the time of the field study. There were seven 2nd order or higher order watercourses assessed during the field habitat assessment. These watercourses are wider (mean channel width = 6.95 m) and deeper (mean channel depth = 0.75 m) with a greater range of water velocities (<0.05 to 0.74 m/s). In addition to the watercourses previously mentioned, there are four ephemeral channels crossed by the Project.

The majority of the 1st order water crossings (20 of 24 watercourse crossings) have substrate predominantly composed of fines and organic material. These watercourse crossings are generally located within or adjacent to wetlands along the overhead transmission line corridor. The 2nd order and higher streams are fewer in number (n=7) and have a greater proportion of gravel and cobble substrate.

Riparian vegetation varied within the Project assessment area both along the proposed corridor and between watercourses. At the proposed centerline of the overhead transmission line, the riparian vegetation is composed primarily of grasses (58% of sites), shrubs (29% of sites) and immature forest (10% of sites). These values are based on data from the 31 watercourses crossed by the Project and exclude the data collected from the ephemeral channels. The dominant riparian vegetation is representative of the wetland habitat that envelopes the watercourses along the corridor. Descriptions of the wetland habitats are included in Section 3.3 (Terrestrial Environment).

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Table 3.8 Freshwater Habitat Summary at Centerline of Proposed Watercourse Crossings

Project Site ID	Watercourse Name	Stream Order	Channel Width	Wetted Width	Channel Depth	Habitat Type	Substrate								
							O	F	G	LG	C	B	LB	Br	Embed.
NB-001-00	Tributary to Breau Creek	1	1.70	0.50	0.07	Shallow Run	100	-	-	-	-	-	-	-	N
NB-002-00	Tributary to Breau Creek	Ephemeral	Interstitial Flow				Not Applicable								
NB-003-00	Tributary to Joe Brook	1	1.23	5.00	0.46	Flat	100	-	-	-	-	-	-	-	N/A
NB-004-00	Tributary to Joe Brook	2	1.02	0.92	0.33	Shallow Run	95	5	-	-	-	-	-	-	N/A
NB-005-00	Tributary to Musquash Brook	1	1.20	0.95	0.32	Shallow Run	5	95	5	-	-	-	-	-	L
NB-005-01	Tributary to Musquash Brook	1	3.30	1.00	0.11	Riffle	10	20	45	15	10	-	-	-	M
NB-006-00	Musquash Brook	2	4.07	3.59	0.18	Shallow Run	-	-	10	30	50	10	-	-	L
NB-006-01	Tributary to Musquash Brook	1	1.30	1.00	0.20	Shallow Run	-	95	-	-	5	-	-	-	H
NB-006-03	Tributary to Tantramar River	1	1.30	0.80	0.03	Shallow Run	10	90	-	-	-	-	-	-	N/A
NB-007-00	Tantramar River	4	18	128	2.00	Flat	90	10	-	-	-	-	-	-	N/A
NB-007-01	Tributary to Tantramar River	1	0.89	0.45	0.04	Shallow Run	-	90	10	-	-	-	-	-	M
NB-007-02	Tributary to Tantramar River	1	0.78	0.54	0.09	Shallow Run	-	90	10	-	-	-	-	-	M
NB-008-00	Tributary to Tantramar River	1	3.10	2.80	0.28	Moderate Run	-	40	30	20	10	-	-	-	L
NB-009-00	Harper Brook	1	0.94	0.80	0.15	Shallow Run	-	70	30	-	-	-	-	-	H
NB-010-01	Tributary to Robinson Brook	1	0.88	0.69	0.37	Shallow Run	10	90	-	-	-	-	-	-	N/A
NB-010-02	Tributary to Crystal Brook	1	0.82	0.78	0.09	Shallow Run	-	80	5	15	-	-	-	-	M
NB-010-03	Tributary to Crystal Brook	1	2.35	2.08	0.33	Impoundment	100	-	-	-	-	-	-	-	N/A
NB-011-00	Tributary to Gasperau River	1	0.85	0.70	0.09	Riffle	-	95	5	-	-	-	-	-	H
NB-012-00	Gasperau River	2	18.0	15.0	2.00	Deep Run	-	20	-	5	70	5	-	-	M
NB-013-00	Tributary to Gasperau River	1	5.00	4.00	0.75	Flat	100	-	-	-	-	-	-	-	N/A
NB-014-00	Tributary to Gasperau River	1	0.95	0.95	0.13	Shallow Run	-	20	20	60	-	-	-	-	M

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Table 3.8 Freshwater Habitat Summary at Centerline of Proposed Watercourse Crossings

Project Site ID	Watercourse Name	Stream Order	Channel Width	Wetted Width	Channel Depth	Habitat Type	Substrate								
							O	F	G	LG	C	B	LB	Br	Embed.
NB-015-00	Timber River	2	1.04	0.90	0.23	Shallow Run	-	100	-	-	-	-	-	-	N/A
NB-016-00	Tributary to Timber River	2	2.40	2.36	0.37	Moderate Run	20	80	-	-	-	-	-	-	N/A
NB-017-00	Tributary to Timber River	2	4.10	2.80	0.14	Riffle	-	10	30	30	30	-	-	-	M
NB-017-01	Tributary to Matt Brook	1	1.30	0.55	0.07	Shallow Run	20	80	-	-	-	-	-	-	N/A
NB-017-02	Tributary to Scott Brook	Ephemeral	Interstitial Flow			Not Applicable									
NB-018-00	Scott Brook	1	0.50	0.40	0.12	Shallow Run	-	-	40	60	-	-	-	-	L
NB-018-01	Tributary to Scott Brook	1	0.48	0.42	0.10	Shallow Run	20	80	-	-	-	-	-	-	N/A
NB-018-04	Tributary to Trenholm Brook	1	0.55	0.50	0.10	Shallow Run	5	45	50	-	-	-	-	-	L
NB-018-05	Tributary to Trenholm Brook	1	4.00	0.51	0.04	Shallow Run	20	80	-	-	-	-	-	-	L
NB-018-06	Tributary to Trenholm Brook	1	0.49	0.42	0.08	Shallow Run	50	50	-	-	-	-	-	-	N/A
NB-018-07	Tributary to Trenholm Brook	Ephemeral	Interstitial Flow			Not Applicable									
NB-019-03	Tributary to the Northumberland Strait	Ephemeral	Interstitial Flow			Not Applicable									
NB-020-00	Tributary to the Northumberland Strait	1	0.82	0.57	0.13	Shallow Run	15	85	-	-	-	-	-	-	N/A
NB-021-00	Tributary to the Northumberland Strait	1	10.0	10.0	0.80	Flat	100	-	-	-	-	-	-	-	N/A
KEY															
O – Organic, F – Fines, G – Gravel, LG – Large Gravel, C – Cobble, B – Boulder, LB – Large Boulder, Br – Boulder.															

A summary of the habitat characteristics associated with each stream crossing is provided in Table 3.8. The data included in Table 3.8 was collected at the centerline of the proposed overhead transmission lines; the complete summary of data for each watercourse is included in Appendix A. Within the PDA, there are six named brooks or rivers which will be crossed by the overhead transmission lines, the remaining watercourse crossings are unnamed tributaries; therefore, all watercourse crossings were given project ID numbers for the purpose of the assessment.

3.1.2.2.4 Water Quality

During the field habitat assessments in-situ water quality data were collected at each watercourse with flowing water using a Hanna multi-parameter water quality meter. Results obtained from these measurements are presented in Table 3.9 and are representative of conditions at the time of measurement. Water velocity data were collected in streams with detectable water velocity.

Overall, the average water quality values measured in the 1st order (n=24) watercourses indicated a temperate (12.4°C), moderately well oxygenated (8.4 mg/L) environment with low conductivity (65 µS/cm^A) and turbidity (2.8 NTU). The pH values ranged from 5.50 to 8.15 with a mean of 7.34. Water velocity measurements ranged from <0.05 to 0.38 m/s.

The 2nd order and larger watercourses (n=7) had a higher mean temperature (13.9°C) and dissolved oxygen concentration (9.4 mg/L). The mean conductivity and turbidity values were lower at 33 µS/cm^A and 2.7 NTU, respectively. The pH values in the larger watercourses ranged from 6.05 to 8.12 with a mean of 6.90. Water velocity measurements ranged from <0.05 m/s to 0.74 m/s.

Water quality in the Freshwater Environment is often compared to the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG FAL) published by the Canadian Council for the Ministers of the Environment (CCME). Values for dissolved oxygen pH and turbidity are listed under the CWQG FAL.

The CWQG FAL value for dissolved oxygen is based on fish life stage (early life stage or all other life stages) and temperature preference (cold water species or warm water species). For this assessment the cold water early life stage guideline was used, which is also the most stringent. This guideline indicates that the lowest acceptable dissolved oxygen concentration in a Freshwater Environment is 9.5 mg/L.

The CWQG FAL value for pH is listed as an optimal range for fish habitat 6.5 to 9.0 pH units, this range was used to assess water quality at watercourse crossings.

The generally accepted turbidity criteria are based on an increase from the existing conditions. The CWQG FAL recommend an increase of less than 8 NTU at any one time when baseline values are less than 80 NTU and an average increase of less than 2 NTU in a 30 day period. The provincial governments of Alberta and British Columbia have adopted this guideline as their provincial criteria.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Table 3.9 Water Quality Summary from Centerline of Proposed Watercourse Crossings

Project Site ID	Watercourse Name	Stream Order	Water Temp. (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	pH (pH units)	Turbidity (NTU)	
NB-001-00	Tributary to Breau Creek	1	10.1	33	9.81	8.73	3.4	
NB-002-00	Tributary to Breau Creek	Ephemeral	Not Applicable					
NB-003-00	Tributary to Joe Brook	1	17.1	26	6.84	8.14	1.6	
NB-004-00	Tributary to Joe Brook	2	16.5	22	7.54	8.12	0.6	
NB-005-00	Tributary to Musquash Brook	1	11.8	5	8.91	6.81	2.3	
NB-005-01	Tributary to Musquash Brook	1	9.8	26	8.90	5.50	0.9	
NB-006-00	Musquash Brook	2	11.4	30	8.76	6.40	0.7	
NB-006-01	Tributary to Musquash Brook	1	12.1	26	10.20	7.30	1.5	
NB-006-03	Tributary to Tantramar River	1	11.9	28	7.30	7.45	1.6	
NB-007-00	Tantramar River	4	9.9	30	9.83	6.78	0.9	
NB-007-01	Tributary to Tantramar River	1	7.8	35	8.42	7.05	1.4	
NB-007-02	Tributary to Tantramar River	1	8.6	29	9.61	7.15	1.2	
NB-008-00	Tributary to Tantramar River	1	12.1	35	7.86	7.05	1.9	
NB-009-00	Harper Brook	1	11.9	34	8.61	7.35	2.0	
NB-010-01	Tributary to Robinson Brook	1	11.8	33	6.86	7.65	1.8	

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Table 3.9 Water Quality Summary from Centerline of Proposed Watercourse Crossings

Project Site ID	Watercourse Name	Stream Order	Water Temp. (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	pH (pH units)	Turbidity (NTU)
NB-010-02	Tributary to Crystal Brook	1	12.2	45	7.74	7.05	2.8
NB-010-03	Tributary to Crystal Brook	1	13.1	45	7.66	8.15	2.8
NB-011-00	Tributary to Gasperau River	1	13.1	13	8.67	7.43	0.9
NB-012-00	Gasperau River	2	11.9	47	9.33	7.09	4.8
NB-013-00	Tributary to Gasperau River	1	11.1	56	6.83	7.85	1.2
NB-014-00	Tributary to Gasperau River	1	14.1	27	7.82	7.79	1.9
NB-015-00	Timber River	2	12.6	35	8.94	6.78	0.9
NB-016-00	Tributary to Timber River	2	17.4	13	6.86	6.05	5.7
NB-017-00	Tributary to Timber River	2	17.8	58	14.36	7.21	5.0
NB-017-01	Tributary to Matt Brook	1	13.8	181	11.03	6.59	0.1
NB-017-02	Tributary to Scott Brook	Ephemeral	Not Applicable				
NB-018-00	Scott Brook	1	11.5	101	10.18	6.76	3.8
NB-018-01	Tributary to Scott Brook	1	14.5	57	8.17	7.43	3.1
NB-018-04	Tributary to Trenholm Brook	1	15.7	63	9.98	7.87	2.9
NB-018-05	Tributary to Trenholm Brook	1	15.1	23	8.48	7.83	2.2
NB-018-06	Tributary to Trenholm Brook	1	14.6	31	8.47	7.65	2.3

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT

September 30, 2015

Table 3.9 Water Quality Summary from Centerline of Proposed Watercourse Crossings

Project Site ID	Watercourse Name	Stream Order	Water Temp. (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	pH (pH units)	Turbidity (NTU)
NB-018-07	Tributary to Trenholm Brook	Ephemeral	Not Applicable				
NB-019-03	Trib to the Northumberland Strait	Ephemeral	Not Applicable				
NB-020-00	Trib to the Northumberland Strait	1	11.9	350	7.55	6.85	6.3
NB-021-00	Trib to the Northumberland Strait	1	12.6	265	6.89	6.88	17

Using the CWQG FAL criteria the water quality at the watercourse crossings was within guideline values for pH in 28 of 31 watercourses with a mean pH of 7.18. The dissolved oxygen was within guideline values for 8 of 31 watercourses with a mean dissolved oxygen concentration of 8.66 mg/L. Generally, areas with slow moving water or impounded areas such as wetland channels, beaver impoundments or debris dams were associated with low dissolved oxygen, the majority of the high energy environments 2nd order and above streams contained a higher dissolved oxygen content. The water quality values (Table 3.9) in concert with the stream habitat characteristics (Table 3.8) indicate a high potential for fish presence in the 35 watercourses crossed by the Project.

3.1.3 Project Interactions with the Freshwater Environment

The Project will interact with the Freshwater Environment through construction, operation and decommissioning and abandonment. These interactions between the Project and the Freshwater Environment may result in a change in freshwater populations. Table 3.10 identifies the project physical activities that might interact with freshwater populations to result in the environmental effects. These interactions are indicated by check marks, and are discussed in detail in Section 3.1.4 in the context of effects pathways, standard and project-specific mitigation, and residual environmental effects. A justification is also provided for non-interactions (no check marks).

Table 3.10 Potential Project-Environment Interactions and Effects on the Freshwater Environment

Project Components and Physical Activities	Potential Environmental Effect
	Change in Freshwater Populations
Construction	
Site Preparation for Land Based Transmission Lines	✓
Physical Construction of Land Based Transmission Lines	✓
Landfall Construction	-
Upgrading of Electrical Substation	-
Inspection and Energizing of the Transmission Lines	-
Clean-up and Re-vegetation of the Transmission Corridor	✓
Emissions and Wastes	✓
Transportation	-
Employment and Expenditure	-
Operation	
Energy Transmission	-
Vegetation Management	✓
Infrastructure Inspection, Maintenance and Repair	✓
Access Road Maintenance	✓

Table 3.10 Potential Project-Environment Interactions and Effects on the Freshwater Environment

Project Components and Physical Activities	Potential Environmental Effect
	Change in Freshwater Populations
Emissions and Wastes	✓
Transportation	-
Employment and Expenditure	-
Decommissioning and Abandonment	
Decommissioning	✓
Reclamation	✓
Emissions and Wastes	✓
Employment and Expenditure	-
Notes: ✓ = Potential interactions that might cause an effect. - = Interactions between the project and the Freshwater Environment are not expected.	

3.1.4 Assessment of Residual Environmental Effects on the Freshwater Environment

This section describes the interactions between the Project and the Freshwater Environment (those potential interactions identified in Section 3.1.3). Interactions between the Project and the Freshwater Environment that could result in a change in freshwater populations were assessed for each Project phase using the identified analytical assessment techniques. Accidents, Malfunctions, and Unplanned Events are discussed separately in Section 5.

Project activities that have the potential to interact with the Freshwater Environment will utilize avoidance or mitigation measures to manage environmental effects during construction, operation, and decommissioning and abandonment. The use of standard mitigation measures and an EPP will assist in managing environmental effects. Using the mitigation measures, temporal avoidance and Best Management Practices (BMPs) described in the EPP the Proponent will reduce residual environmental effects on the Freshwater Environment.

During construction, it is anticipated that no interaction will occur between the freshwater environment from landfall construction, transportation, upgrading of the electrical substation or inspection and energization. During operation, interaction between the Freshwater Environment and energy transmission, or transportation is not anticipated.

Project employment and expenditures, which are a component of most or all components and physical activities, are the main drivers of many socioeconomic effects. Activities relating to employment and expenditures are addressed in the Socioeconomic Environment VC (Section 3.5). Employment and expenditure, therefore, will not be addressed with respect to the Freshwater Environment.

3.1.4.1 Analytical Assessment Techniques

The assessment of change in freshwater populations includes potential project environmental effects such as:

- direct or indirect loss or alteration of habitat during construction and operation resulting from disturbance of the watercourse during clearing, grubbing, pole installation or access road crossings
- direct mortality of fish resulting from installation of water crossing structures and transmission line poles below the waterline during construction or operation
- direct mortality or injury to freshwater fish resulting from acute changes in nutrient, sediment or contaminant concentrations (water quality) from sedimentation or accidental releases during construction, operation, or decommissioning and abandonment

Environmental effects discussed in this section focus on interactions with species which are part of a CRA fishery, or Species at Risk. These two groups of species are protected by provisions of the *Fisheries Act*, *Canadian Environmental Protection Act*, and federal or provincial SARA. The environmental effects are assessed on the basis of the project description, collected field data and quantified using peer reviewed literature and existing knowledge.

3.1.4.2 Assessment of a Change in Freshwater Populations

A change in freshwater populations may result from interactions between the Freshwater Environment and the Project during construction, operation, and decommissioning and abandonment. The assessment of change in freshwater populations defines the Project environmental effect pathways for each phase of the Project, the mitigation measures to be put in place to reduce environmental effects on freshwater populations and the resulting residual environmental effects, whether the effects are positive or negative.

3.1.4.2.1 Project Pathways for Freshwater Populations

The Project is expected to interact with the Freshwater Environment throughout the life of the Project. The pathways for a change in freshwater populations are discussed in terms of the project phases starting with construction.

Construction

During construction it is anticipated that site preparation, physical construction of the transmission lines, and clean-up and re-vegetation of the transmission corridor will directly interact with the Freshwater Environment. Surface run-off may also indirectly interact with the Freshwater Environment.

Site preparation, especially clearing has the potential to decrease the abundance of riparian vegetation along watercourses, which may reduce bank stability, increase erosion, suspended sediment concentrations and nutrient concentrations in the watercourse (DFO 2010). The loss of stream shading may result in increased stream temperatures during summer months (Teti 1998). Reducing riparian vegetation may reduce the diversity and abundance of the aquatic food supply through the reduction of invertebrates and their food sources (DFO 2010).

The use of equipment within 30 m of the watercourse for site preparation, physical construction of the transmission lines and clean-up and re-vegetation of the transmission line corridor may result in increased suspended sediment concentrations and physical alteration of watercourse habitats. Soil may be mobilized by equipment working within 30 m of the watercourses which may enter the watercourses and alter ecological conditions such as water quality and stream habitat. Sediment entering watercourses may reduce visibility affecting predator or prey awareness or, if concentrations of sediment are high enough, damage gill structures (DFO 2010). Direct conduits to the watercourse may be created from equipment rutting; these ruts may create a pathway for sediment or contaminants to enter the watercourse. The crossing of watercourses by clearing equipment and crews offer the potential for the physical alteration of watercourse bed and banks. The alteration of bed and banks may change fish habitat quality and the suitability for life processes.

During re-vegetation, the use of hydraulically applied seed mixes (hydro-seeding) within 30 m of a watercourse may change water quality by increasing nutrient concentrations. An increase in nutrient concentration may lead to eutrophication of watercourses which is generally evident by increased growth of aquatic plants and algae.

Emissions and wastes for the construction stage apply to soil erosion from Project activities and contamination from the loss of hydrocarbons (lube, fuel, oil) or vehicle fluids. The operation of equipment within 30 m of a watercourse increases the risk of contaminants entering the watercourse. The ecological effects from hydrocarbons or vehicle fluids can range from alteration of the watercourse habitats to mortality of freshwater fish.

Operation

During operation transmission line corridor maintenance activities such as vegetation management and access road grading may directly change freshwater populations. The management of vegetation within the transmission line corridor, (i.e., cutting and removal) will be completed with machinery with hand clearing adjacent to watercourses. Decreasing riparian vegetation along watercourses may reduce bank stability and increase erosion, suspended sediment concentrations and nutrient loading on the watercourse (DFO 2010). The loss of stream shading may result in increased stream temperatures during summer months (Teti 1998). Reducing riparian vegetation may reduce the diversity and abundance of aquatic food supply through the reduction of invertebrates and their food sources (DFO 2010).

The maintenance of access roads (i.e., grading and leveling) has the potential to mobilize soil or roadbed material which may enter the watercourses and increase suspended sediments. The increase in suspended sediments may alter ecological conditions such as water quality and stream habitat. Sediment entering the watercourse may reduce visibility effecting predator or prey awareness or, if concentrations of sediment are high enough, damage gill structures (DFO 2010).

Decommissioning and Abandonment

Changes to freshwater populations during decommissioning and abandonment may occur from similar pathways as were identified during the construction phase. Decommissioning and reclamation of the

transmission corridor will occur at the end of the useful life of the Project. At the time of decommissioning most of the site infrastructure will be de-energized and removed. Removable assets will be taken from site and sold or disposed of. Access roads, power supplies, and other utilities, will be decommissioned unless required for care and maintenance of the site during closure and post closure. On-site power supplies and utility poles no longer needed will be decommissioned and removed from the site to approved off-site facilities.

The removal of utility poles within 30 m of a watercourse may result in increased sediment concentrations and physical alteration of watercourse habitats. On-site equipment may mobilize soil that may then enter the watercourses and increase suspended sediment. Increased suspended sediment may alter ecological conditions such as water quality and spawning habitat. Sediment entering the watercourse may reduce visibility effecting predator or prey awareness or, if concentrations of sediment are high enough, damage gill structures (DFO 2010). Direct conduits to the watercourse may be created from equipment rutting; these ruts may create a pathway for sediments or contaminants to enter the watercourse. The crossing of watercourses by clearing equipment and crews offer the potential for the physical alteration of watercourse bed and banks. The alteration of bed and banks may change fish habitat quality and the suitability for life processes.

During reclamation of the transmission line corridor, the use of hydraulically applied seed mixes (hydro-seeding) within 30 m of a watercourse may change water quality by increasing nutrient concentrations. An increase in nutrient concentration may lead to eutrophication of watercourses which is generally evident by increased growth of aquatic plants and algae.

The Project pathways described above identify potential interactions and changes to freshwater populations from development of the Project. Mitigation measures established based on the identified Project pathways are described in the following section. The mitigation measures will be incorporated into the Project stages (construction, operation and decommissioning and abandonment). Any residual environmental effects on the Freshwater Environment resulting after the implementation of the identified mitigation measures are described in Section 3.1.4.3.

3.1.4.2.2 Mitigation for Freshwater Populations

The following section outlines regulations (i.e., *NB Watercourse and Wetland Alteration Regulations*) ,codified measures (DFO Measures to Avoid Harm), proven mitigation and industry best management practices. The following measures will be implemented to reduce the environmental effects of the interactions between the Project and the Freshwater Environment during all stages of the Project:

- Plan temporary access roads to avoid watercourses, where possible.
- Span all watercourses and there will be no in-stream work.
- The EPP includes general construction BMPs, a spill management plan and an erosion and sediment control plan. All employees and contractors working on the Project will be trained on the EPP prior to starting work.
- During planning and siting of the transmission line structures NB Power will avoid, where possible, the placement of a transmission line structure within 30 m of a watercourse.

- Clearing of vegetation within the transmission line corridor will occur by hand within 30 m of a watercourse. Where practical, a riparian buffer with a width of 10 m will remain on each bank.
- Temporary watercourse crossings will be installed where required to allow equipment to cross over each watercourse, the temporary crossings will be designed in accordance with the Watercourse and Wetland Alteration Program and completely span the watercourse. No watercourses will be forded by equipment.
- If rutting is observed leading up to a watercourse crossing, brush matting or log corduroy will be installed at the approaches.
- If required, transmission line structure construction within 30 m of a watercourse will be constructed in accordance with the Watercourse and Wetland Alteration Regulations, including any recommendations made under approval from NBDELG.
- No washing, fueling or maintenance of vehicles or equipment will occur within 30 m of a watercourse without secondary containment.
- No storage of fuel will occur within 30 m of a watercourse or wetland.
- Machinery will arrive on-site in a clean condition and be maintained free of fluid leaks, invasive species and noxious weeds.
- Vegetation clearing during operation will not occur within 30 m of a watercourse unless the vegetation height violates the clearance requirements for reliability standards to be met by NB Power.

3.1.4.2.3 Residual Project Environmental Effects for Freshwater Populations

Residual Project environmental effects on the Freshwater Environment from construction, and operation are anticipated to occur during initial site clearing and vegetation management. These activities will result in a change in water quality via an increase in stream temperature and a change in the diversity and abundance of aquatic food supply. These environmental effects are the result of clearing the riparian vegetation during construction and periodically during operation as needed for maintenance.

Freshwater aquatic species such as fish are cold-blooded and have preferred temperature ranges, if temperatures exceed these ranges additional stress is put on that species (DFO 2010). For fish species water temperature is the primary factor that regulates their metabolism, increased water temperature will decrease energy reserves and create stress on fish (PNW 2005). Additionally, water warming decreases the saturation of dissolved oxygen and increases algae growth (Ducharme 2008) both of which may increase stress on aquatic species.

In 1st and 2nd order streams shade provided by riparian vegetation and groundwater inputs are the most important stream characteristics to influence water temperature outside of air temperature (EPA 2001). The increase in summertime (June to Sept) stream temperature from the loss of riparian vegetation was quantified in several studies and ranged from +1 to +6 °C. The stream temperatures rose between [1 to 3°C in Oregon (Cole 2013), 4 to 5°C in coastal BC (Burton and Likens 1973), 3.6 °C in Idaho (Gravelle and Link 2007), up to 6 °C in interior BC (Rex et al. 2012) and 1.4-4.4 °C in Maine (Wilkerson et al. 2006)]. The data generated by Wilkerson et al. (2006) is closest in proximity and best compares to meteorological conditions expected in the PDA. This data suggests an increase in stream temperatures of 1.4 to 4.4°C can be expected during stages of the Project where riparian vegetation is removed. The management of vegetation along the transmission line corridor will periodically remove riparian vegetation in a

section of 30 to 60 m of stream habitat. A 30 m wide area of vegetation will be removed for the construction of the transmission line corridor from Memramcook to Melrose and a 60 m wide corridor will be created from Melrose to Cape Tormentine. The area of vegetation removal along the corridor is narrower than the 250 to 400 m wide sections of clearcut studied by Wilkerson et al. (2006). Based on the more northern conditions and the smaller amount of riparian vegetation lost it can be expected that the increase in stream temperature will be on the lower end of the temperature range published. Additionally, Blann et al. (2002) found the narrower the stream reach the lower the height of the vegetation required to achieve shade. Blann et al. (2002) noted little difference in stream water temperatures in Minnesota streams where grasses completely cover the channel. This is relative to the Project as the field data indicated grass was the dominant riparian vegetation type for 16 of the 29 1st order watercourses, the thermal regimes for these watercourses are expected to be less effected and will return to baseline conditions sooner after clearing.

NB Power will include a 10 m riparian buffer zone around watercourses within transmission line corridors, vegetation management at these locations will be less periodic and consist of managing the height of vegetation, not complete clearing. The width of the buffer which is left after clearing appears to mitigate temperature increases. In coastal British Columbia, Gomi et al. (2006) reported increases of 0.1 to 0.8 °C with 10 m buffers and no significant temperature increases at 30 m width, whereas Wilkerson et al. (2006) reported maximum increases of 1.0 to 1.4 °C with 11 m buffers and negligible increases with 23 m or partially cut buffers in Maine.

The return of stream temperatures downstream of a clearcut, to preharvest or baseline conditions, was studied by Zwieniecki and Newton (1999). A reduction of stream temperature was identified to occur within 150-300 m of the watercourse entering habitat with riparian vegetation (Zwieniecki and Newton 1999). Cole and Newton (2008) also assessed water temperature decreases within riparian zones downstream of clearcut tree harvesting. The study determined water temperatures decreased within 300 m of entering habitat with mature riparian vegetation (Cole and Newton 2008). The Cole and Newton (2008) study indicated that the shade produced by mature riparian vegetation decreased water temperatures within 300 m of the clearcut in all streams, though did not decrease water temperatures completely to preharvest or baseline conditions for three out of four streams.

In relation to the Project, these studies indicate during periods of vegetation management an increase in stream temperatures of 1.4 to 4.4°C can be expected within the PDA, these temperatures will decrease within 300 m of the transmission line corridor, though may not decrease completely to baseline levels. Vegetation management (tree and brush clearing) will occur once during construction and more frequently during the operation of the transmission line corridor. During periods of vegetation management an increase in stream temperatures can be expected within the PDA. These increased water temperatures will begin to decrease within 300 m of the transmission line corridor, though may not decrease completely to baseline levels within 300 m.

A change in the diversity and abundance of aquatic food supply may occur from the temporary loss of riparian vegetation. The loss of riparian vegetation can result in decreased leaf litter input and result in changes in the invertebrate assemblage (Jaywardana 2010). Hynes (1970) indicated that invertebrates are the most widespread and important food for fish inhabiting moving waters. Richardson's (1993) literature review found that salmonid productivity was limited by the presence of benthic invertebrates.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

The resulting effect on fish from reducing riparian vegetation is dependent on the scale of disturbance (Horwitz et al. 2008). Jones et al. (1999) found little change in fish assemblages where riparian zones were absent for < 3 km, but did find a change in fish assemblages for non-forested stream reaches greater than 3 km. Johnson and Covich (1997) indicated that the amount of detritus in the stream best related to riparian cover 500 to 1,000 m upstream of their study sites. Fitzpatrick et al. (2001) indicated that the total area of riparian cover in a watershed was more important than local riparian width for fish assemblages.

In relation to the Project, the temporary loss of riparian vegetation may result in a change in the aquatic food supply for freshwater fish. The temporary nature and limited spatial scale of the removal of riparian vegetation is not anticipated to reduce the productivity of the watercourses crossed by the Project nor modify the fish assemblages within.

3.1.4.3 Summary of Residual Project Environmental Effects on Freshwater Populations

The residual Project environmental effects for the Freshwater Environment described above are summarized in Table 3.11

Table 3.11 Summary of Project Residual Environmental Effects on Freshwater Populations

Residual Environmental Effect	Residual Environmental Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socioeconomic Context
Change in Freshwater Populations	C	A	L	PDA	ST	S	R	D/U
	O	A	L	PDA	ST	R	R	D
	D	P	L	PDA	LT	S	R	D
KEY See Table 3.5 for detailed definitions. Project Phase: C: Construction O: Operation D: Decommissioning and Abandonment Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High			Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Duration: ST: Short-term; MT: Medium-term LT: Long-term P: Permanent NA: Not applicable			Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible Ecological/Socioeconomic Context: D: Disturbed U: Undisturbed R: Resilient NR: Not resilient		

3.1.5 Determination of Significance

3.1.5.1 Significance of Residual Project Effects

The residual Project environmental effects as a result of construction and operation of the Project on freshwater populations are adverse, low in magnitude and spatially limited to the PDA. These residual Project environmental effects will occur once during construction of the overhead transmission corridor and more frequently during operation, the duration of these effects is based on regeneration of the riparian vegetation and is considered short term. Once the Project is complete and decommissioned or abandoned, the freshwater habitats will return to baseline conditions. The residual Project environmental effects as a result of decommissioning and abandonment are characterized as positive, low in magnitude and spatially limited to the PDA. The effects are considered positive as riparian regeneration of the vegetation to baseline conditions will occur after decommissioning is complete. With the mitigation outlined and the environmental protection measures described, the residual environmental effects on the VC are predicted to be not significant.

3.1.6 Prediction Confidence

The prediction confidence is high for the determination of significance on environmental effects to freshwater populations. With the current state of knowledge on the potential effects to fish and fish habitat, the limited spatial scale of effects in a relatively small PDA, and the implementation of proven mitigation measures which reflect accepted best management practices, effects to freshwater populations are expected to be minimal.

3.1.7 Follow-up and Monitoring

There are no suggested follow-up or monitoring activities for the Freshwater Environment.

3.2 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON THE TERRESTRIAL ENVIRONMENT

The Terrestrial Environment, including vegetation, wildlife, and wetlands, is an important environmental component that is valued by the people of New Brunswick for environmental, recreational, aesthetic and socioeconomic importance. The Terrestrial Environment has therefore been selected as a valued component (VC) based on potential interactions between the Project and vegetation and wildlife, including Species at Risk (SAR) and species of conservation concern (SOCC), and wetlands, including wetland area and wetland function. This VC also addresses Ecological Communities of Management Concern (ECMC), which are communities that fulfill special management objectives on Crown land in New Brunswick or have been identified as supporting unique ecological features, either through field work, or by local conservation organizations (e.g., Environmentally Significant Areas (ESA)). The Terrestrial Environment VC is closely linked to the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, and is also linked to Land Use, and the Freshwater Environment VCs.

3.2.1 Scope of Assessment

This section defines and describes the scope of the assessment of potential environmental effects on Terrestrial Environment.

3.2.1.1 Regulatory and Policy Setting

3.2.1.1.1 Vegetation and Wildlife Species

With respect to vegetation and wildlife, this VC focuses on Species at Risk (SAR) and species of conservation concern (SOCC). SAR species include those listed as endangered, threatened or special concern by the federal *Species at Risk Act* (SARA), the New Brunswick *Species at Risk Act* (NB SARA), or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC assesses and designates the status of species and recommends this designation for legal protection under SARA. On lands under provincial jurisdiction, federal SARA goals are typically reflected through provincial legislation, policy, and guidelines.

While some species included as SAR in this assessment currently have regulatory protection under Schedule 1 of the federal SARA or the *Prohibitions Regulation* of NB SARA, the definition above also includes those species on the NB SARA *List of Species at Risk Regulation* and those listed by COSEWIC that are candidates for further review and may become protected within the timeframe of this Project.

SARA serves several purposes: to prevent the extirpation or extinction of wildlife species; to provide recovery strategies for species that are extirpated, endangered or threatened due to human activity; and to manage species of special concern so they do not become threatened or endangered. Under SARA, it is forbidden to kill, injure, harass, destroy the residence of, destroy the critical habitat of, capture or take an individual designated as extirpated, endangered, or threatened on federally regulated lands or designated critical habitat elsewhere.

SOCC are not listed under federal or provincial legislation but are considered rare in New Brunswick, or the long-term sustainability of their populations has been evaluated as tenuous. SOCC are defined here as species ranked S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) in New Brunswick by the Atlantic Canada Conservation Data Centre (ACCDC) (ACCDC 2015a). Unlike SAR, SOCC are not afforded any direct protection by either federal or provincial legislation. SOCC are included in this VC as a precautionary measure, reflecting observations and trends in their provincial population status, and are often important indicators of ecosystem health and regional biodiversity. Rare species are often an indicator of the presence of unusual and/or sensitive habitat; their protection as umbrella species can confer protection on their associated unusual habitats and co-existing species.

The *Migratory Birds Convention Act* (MBCA) protects and conserves migratory bird populations, individuals, and their nests within all lands in Canada. All birds are covered under the MBCA in Canada, with the exception of some bird families (e.g., cormorants, pelicans, grouse, quail, pheasants, ptarmigan, hawks, owls, eagles, falcons, kingfishers, crows, and jays). The MBCA is the enabling statute for the *Migratory Birds Regulations*. Section 6 of the *Migratory Birds Regulations* states that without the authorization of a permit, the disturbance, destruction, or taking of a nest, egg, nest shelter, eider duck

shelter, or duck box of a migratory bird, or possession of a migratory bird, carcass, skin, nest, or egg of a migratory bird are prohibited. As there are no authorizations to allow construction-related effects on migratory birds and their nests, best management practices and guidelines (e.g., Migratory Birds Convention Act: A Best Management Practice for Pipelines (Canadian Energy Pipeline Association and Stantec 2013), Incidental Take Avoidance Guidelines (EC 2015)) are available to facilitate compliance with the MBCA.

3.2.1.1.2 Wetlands

Wetlands are defined in federal and provincial policies as land permanently or temporarily submerged or saturated by water near the soil surface, for long enough that the area maintains aquatic processes. These aquatic processes are characterized by plants that are adapted to saturated soil conditions, wet or poorly drained soils, and other biotic conditions found in wet environments (Government of Canada 1991; NBDNRE and NBDELG 2002).

A federal mandate for wetland conservation is provided by The Federal Policy on Wetland Conservation (Government of Canada 1991). Policy goals are intended to apply on federal lands and waters or to federal programs where wetland loss has reached critical levels. They also apply to federally designated wetlands, such as Ramsar sites, of which there are none affected by the Project.

Wetlands in New Brunswick are managed by the New Brunswick Department of Environment and Local Government (NBDELG), and their management is guided by the New Brunswick Wetlands Conservation Policy (NBDNRE and NBDELG 2002). This policy aims to protect wetlands through securement, stewardship, education and awareness, and to maintain wetland function within New Brunswick. Legislation that supports the policy includes the New Brunswick *Clean Water Act* and associated *Watercourse and Wetland Alteration (WAWA) Regulation*, and the New Brunswick *Clean Environment Act* and associated *Environmental Impact Assessment Regulation* (EIA Regulation).

NBDELG maintains the official map of known wetlands in the province; it is available to the public on the GeoNB website (SNB 2011). As of November 2011, NBDELG considers the GeoNB map to represent the extent of "regulated" wetlands within the province. Any wetlands labelled as "Provincially Significant Wetlands" (PSW) in this database are subject to a greater level of protection, as outlined in the New Brunswick Wetland Conservation Policy (NBDNRE and NBDELG 2002).

The *WAWA Regulation* applies to all wetlands of 1 hectare (ha) or greater in size, or any wetland contiguous to a watercourse. Pending changes to the wetland policy implementation, this assessment has been conducted according to current requirements (i.e., wetlands that are greater than 1 ha in size or are contiguous with a watercourse are regulated as per the *New Brunswick Clean Water Act*).

Due to the relative complexity and subjectivity of measuring wetland function, area of wetland loss is used in New Brunswick and other Canadian jurisdictions as a surrogate for loss of wetland function. This assessment will identify noteworthy wetland functions where they occur, but the change will be reported in terms of area affected. It is assumed that wetland compensation may be required for any permanent loss of wetland area, which would facilitate no net loss of wetland function as stipulated under the provincial policy.

3.2.1.2 The Influence of Consultation and Engagement on the Assessment

As outlined in Volume 1, Section 3.2 (Consultation and Engagement), scoping documents were sent to provincial regulators in PEI and New Brunswick, in addition to Public Works and Government Services Canada (PWGSC). Responses were received from provincial regulators and Environment Canada. For the Terrestrial Environment in New Brunswick, concerns were raised and mitigation measures were suggested regarding migratory birds, particularly in terms of site lighting and collisions with transmission lines.

3.2.1.3 Potential Environmental Effects, Pathways and Measurable Parameters

Based on knowledge of the terrestrial conditions within the Project Development Area (PDA) and surroundings, and the Project and its associated activities, the following potential environmental effects were selected for the assessment of the Terrestrial Environment: change in vegetation and wildlife; and change in wetland area and function.

Table 3.12 summarizes the potential effects, effect pathways, and measurable parameters for the Terrestrial Environment VC.

Table 3.12 Potential Environmental Effects, Effects Pathways and Measurable Parameters for Terrestrial Environment

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change In Vegetation and Wildlife	<ul style="list-style-type: none"> Vegetation clearing and ground disturbance along the transmission line, for pole placement, at landing sites, and for line maintenance may have an effect on vegetation and wildlife SAR/SOCC, if they are present, and will change vegetation communities (including ECMC) and habitat for wildlife (e.g., through fragmentation). Sensory disturbance related to construction activities can lead to avoidance by wildlife species. 	<ul style="list-style-type: none"> Loss of vascular plant or wildlife SAR or SOCC (number of individuals or populations). Loss of vegetation communities (ha). Loss or alteration of wildlife habitat (ha). Fragmentation of interior forest (ha). Habitat avoidance. Loss or alteration of ECMC (ha).
	<ul style="list-style-type: none"> Collisions with transmission lines are a cause of mortality for many avian species. The Project may interact with wildlife movement between NB and NS (Chignecto Isthmus) and near Cape Tormentine. 	<ul style="list-style-type: none"> Mortality of wildlife.
Change In Wetland Area or Function	<ul style="list-style-type: none"> Vegetation clearing within the RoW and excavation for pole placement, and vegetation maintenance during operation may change wetland area and function. 	<ul style="list-style-type: none"> Loss of wetland area (ha). Change in wetland function.

3.2.1.4 Boundaries

3.2.1.4.1 Spatial Boundaries

The spatial boundaries for the environmental effects assessment of the Terrestrial Environment are defined below, and illustrated in Figure 3.2 and in the Terrestrial mapbook in Appendix B.

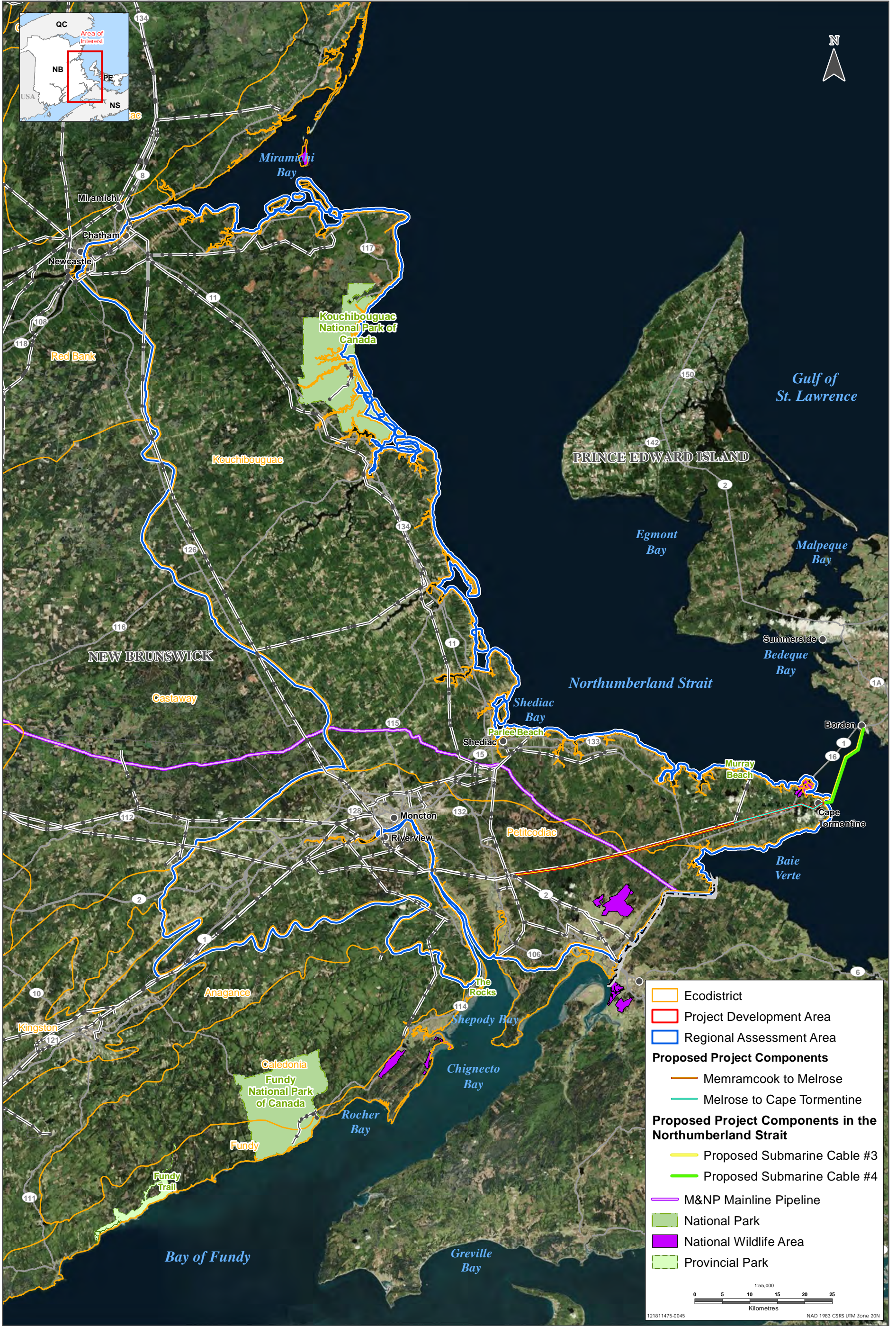
- **Project Development Area (PDA):** The PDA comprises the immediate area of physical disturbance associated with the construction and operation of the Project. The PDA includes the existing substation in Memramcook where upgrades to the existing substation will occur within the substation footprint; a 40 km long, 30 m wide transmission line RoW from Memramcook to Melrose and a 17 km long, 60 m wide transmission line RoW from Melrose to Cape Tormentine; a cable termination site; and a 10 m easement around cable lines. The total area of the PDA is approximately 225.6 ha. See Figure 3.2 and the Terrestrial mapbook in Appendix B, highlighting the PDA for the Terrestrial Environment.
- **Local Assessment Area (LAA):** The LAA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence, and encompassing the likely zone of influence. For the Terrestrial Environment specifically, this area includes the PDA plus an additional 500 m perimeter around the PDA. The LAA is primarily defined by wildlife and wildlife habitat where noise may penetrate wildlife habitats. Edge effects are often thought to extend up to 300 m in forested landscapes for some avian species, although are typically reported to be most pronounced at lower distances to the edge (Batáry and Báldi 2004;); thus, this LAA is considered conservative. The area of potential direct or indirect effects on vegetation and wetlands is expected to be much smaller than that for wildlife and wildlife habitat. The LAA is illustrated in the terrestrial mapbook in Appendix B.
- **Regional Assessment Area (RAA):** The RAA is the area within which Project-related environmental effects may overlap or accumulate with the environmental effects of other projects or activities that have been or will be carried out (i.e., cumulative effects). The RAA also accommodates a wider geographic area for ecological context. For the Terrestrial Environment, the RAA is defined as the two ecodistricts that surround the Project, the Kouchibouguac and Petitcodiac Ecodistricts. These ecodistricts are both within the Eastern Lowlands Ecoregion and together total 7,370.1 km² (Figure 3.3.).

3.2.1.4.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on the Terrestrial Environment include construction, operation, and decommissioning and abandonment.

Construction in the Terrestrial Environment is expected to occur over a period of 16 months.

Construction of the landfall site and transmission line from Melrose to Cape Tormentine is expected to be completed over 9 to 10 months, between March and December 2016. Construction of transmission line between Melrose and Memramcook is expected to begin in September 2016 with completion expected to take place in June 2017. Operation will begin following construction and is anticipated to continue for the life of the Project (approximately 40 years). Decommissioning and abandonment would take place following the useful service life of the Project and which would be carried out in accordance with regulations in place at that time.



Terrestrial Environment Assessment Area Boundaries (PDA and RAA Only)

3.2.1.5 Residual Environmental Effects Description Criteria

Criteria used to characterize and describe residual environmental effects for the assessment of Terrestrial Environment are provided in Table 3.13.

Table 3.13 Characterization of Residual Environmental Effects on the Terrestrial Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	<p>Positive—an effect that moves measurable parameters in a direction beneficial to the Terrestrial Environment relative to baseline conditions.</p> <p>Adverse—an effect that moves measurable parameters in a direction detrimental to the Terrestrial Environment relative to baseline conditions.</p> <p>Neutral—no net change in measurable parameters for the Terrestrial Environment relative to baseline conditions.</p>
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	<p>Negligible—no measurable change from baseline conditions.</p> <p>Low—a measurable change from baseline conditions, but below regulatory thresholds and does not affect the ongoing viability of terrestrial populations.</p> <p>Moderate—measurable change from baseline conditions that is above regulatory thresholds, but does not affect the ongoing viability of terrestrial populations.</p> <p>High—measurable change from baseline conditions that is above regulatory thresholds, and adversely affects the ongoing viability of terrestrial populations.</p>
Geographic Extent	The geographic area in which an environmental effect occurs	<p>PDA—residual effects are restricted to the PDA.</p> <p>LAA—residual effects extend into the LAA.</p> <p>RAA—residual effects extend beyond the LAA, into the RAA.</p>
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	<p>Single event—occurs once.</p> <p>Multiple irregular event—occurs at no set schedule.</p> <p>Multiple regular event—occurs at regular intervals.</p> <p>Continuous— occurs continuously.</p>
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	<p>Short-term—residual effect restricted to the duration of proposed construction.</p> <p>Medium-term—residual effect extends through two or more growing/breeding seasons.</p> <p>Long-term—residual effect extends beyond the life of the Project.</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	<p>Reversible—the effect is likely to be reversed after activity completion and reclamation.</p> <p>Irreversible—the effect is unlikely to be reversed.</p>

Table 3.13 Characterization of Residual Environmental Effects on the Terrestrial Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Ecological and Socioeconomic Context	Existing condition and trends in the area where environmental effects occur	Undisturbed —area is relatively undisturbed or not adversely affected by human activity. Disturbed —area has been substantially previously disturbed by human development or human development is still present.

3.2.1.6 Significance Definition

3.2.1.6.1 Change in Vegetation and Wildlife

For a change in vegetation and wildlife, a significant adverse residual environmental effect on the Terrestrial Environment is defined as one or more of the following:

- one which alters the terrestrial habitat in such a way as to cause decline in the distribution or abundance of a viable population of SAR/SOCC
- one which results in direct mortality of individuals or communities of SAR/SOCC such that long-term survival within the RAA is substantially reduced as a result
- one which results in a non-permitted contravention of any of the prohibitions stated in Sections 32-36 of SARA, or in contravention of any of the prohibitions stated in Section 28 of NB SARA
- in the case of any SAR/SOCC, any non-compliance with the management plans (developed as a result of Section 65 of SARA or Section 20 of the NB SARA) currently in place
- one which results in direct mortality of individuals such that long-term survival of wildlife populations within the RAA is substantially reduced as a result
- one which results in a reduction in wildlife dispersal or migration such that long-term survival of wildlife populations within the RAA is substantially reduced as a result
- one which affects vegetation communities and wildlife habitat in such a way as to cause a decline in abundance or change in distribution of common and secure populations such that the populations will not be sustainable within the RAA
- one which affects ECMC such that they experience a change in function, and can no longer support any special populations they contain

3.2.1.6.2 Change in Wetland Area or Function

For a change in wetland area or function, a significant adverse residual environmental effect on the Terrestrial Environment is defined as:

- one which results in an unauthorized permanent net loss of wetland area, or loss of wetland function in a PSW, after consideration of planned mitigation or provincially required compensation for unavoidable wetland losses
- one which results in the loss of important function (i.e., one that would result in a significant effect on another VC that relies upon wetlands) at the RAA level, provided by a wetland that cannot be avoided or mitigated

3.2.2 Existing Conditions for the Terrestrial Environment

3.2.2.1 Methods

3.2.2.1.1 Information Sources

Vegetation and Wildlife

Records for vegetation, wildlife, and ECMCs occurring within the LAA and surrounding area were obtained from various sources, including the ACCDC, the North American Breeding Bird Survey (BBS), the Maritimes Breeding Bird Atlas (MBBA), and the Atlantic Canada Nocturnal Owl Surveys (ACNOS).

Atlantic Canada Conservation Data Centre

The ACCDC is a registered charity that was established in 1997, and has the following mission statement, *"To assemble and provide objective and understandable data and expertise about species and ecological communities of conservation concern, including those at risk, and to undertake field biological inventories in support of decision-making, research, and education in Atlantic Canada."* (ACCDC 2015b). ACCDC data, including SAR, SOCC, and managed areas, were obtained within 5 km of the Project (ACCDC 2014b).

North American Breeding Bird Survey

The BBS began in 1966 and is now one of the longest-running breeding bird surveys in North America. The BBS database is extensive and can be used to determine long-term population trends of breeding bird species in Canada. A search of the BBS database was conducted to obtain records of bird species observed near the PDA (EC 2014).

Maritimes Breeding Bird Atlas

The second MBBA 2006-2010 was a five-year project to update the distribution and abundance of all bird species breeding in the three Maritimes provinces. The first MBBA was conducted from 1986-1990. The MBBA database provides information including species presence, breeding evidence, and relative abundance in a given 10 km by 10 km area (known as an "atlas square"). Data were obtained for the atlas squares 20LR89, 20LR99, 20MR09, 20MS00, 20MS10, 20MS20, and 20MS30, which encompass the Project.

Atlantic Canada Nocturnal Owl Surveys

The ACNOS was initiated in 2001 to help monitor trends in the abundance of relatively common owls. The survey seeks to monitor the region's owl populations and gather information about the distribution of owls in Atlantic Canada.

The ACNOS database from Bird Studies Canada, accessed via the NatureCounts website (BSC 2015), provides basic information about the presence of owl species detected from specific points on survey

routes (called "survey stops") in a given year. Data are available from 2001 to 2007. Data were obtained from Route 69 (Migic) and Route 70 (Bourgeois Mills), which are crossed by the Project.

Wetlands

The LAA contains wetlands and PSWs mapped by NBDELG on the GeoNB website (GeoNB-mapped wetlands, SNB 2011). Wetlands within New Brunswick are also mapped by the Department of Natural Resources (NBDNR) and the New Brunswick Hydrographic Network (NBHN). These spatial data were used to quantify wetlands within the LAA (i.e., where wetlands were not field-delineated).

3.2.2.1.2 Field Surveys

Vegetation and Wetlands

Field surveys for vegetation and wetlands were conducted between August 18 and September 10, 2014. Surveys were conducted within the PDA with the exception of the landing site, which was not available at the time of the surveys and portions of the Upper Tantramar Marsh that are not accessible by foot. These areas were surveyed in August, 2015, and the results of these surveys will be described in a supplemental report.

Wetlands were delineated and classified according to the Canadian Wetland Classification System (CWCS, NWWG 1997). This system classifies wetlands to three levels: class, form/subform, and type. There are five wetland classes: bog, fen, swamp, marsh, or shallow water. Form and subform indicate the physical morphology and hydrological characteristics of the wetland. Wetland type distinguishes wetland communities based on one of eight groups of dominant vegetation. Information on wetland function was also recorded for each wetland, and geographic coordinates and field notes were recorded for wetland boundaries. Any wetlands demonstrating exceptional examples of important wetland functions that could be affected by a change in vegetation cover, such as the support of SAR, numerous SOCC, or sensitive ecological communities, were noted. Hydrological functions can be inferred by the CWCS forms of each wetland.

Wildlife

In June and July of 2015, baseline wildlife surveys were conducted within the LAA and surrounding area to characterize wildlife use of the area. The results of these surveys were not available at the time of writing, and will be described in a supplemental report. Incidental wildlife observations from 2014 vegetation and wetland surveys are reported.

Nomenclature for all taxa follows that used by the ACCDC (ACCDC 2014a).

3.2.2.2 Overview

The LAA lies within the Eastern Lowlands Ecoregion, crossing two of its ecodistricts: the Kouchibouguac Ecodistrict, and the Petitcodiac Ecodistrict. The ecoregion has the highest percentage of wetlands of all the New Brunswick ecoregions as a product of its uniquely low relief and poor drainage. This ecoregion also has the largest area of peatlands, which occur both inland and along the coast. The forests in the

ecoregion primarily appear boreal in character; although the two ecodistricts where the LAA is situated have a somewhat more temperate, mixedwood character.

The Kouchibouguac Ecodistrict encompasses the eastern coastline of the province from Cape Tormentine to Miramichi Bay. This flat, low ecodistrict experiences only a 30 m difference in elevation from its highest to its lowest point. Widespread, early-successional hardwood forests are present as a result of 300 years of settlement in this ecodistrict, and contain trembling aspen (*Populus tremuloides*), red maple (*Acer rubrum*), and white birch (*Betula papyrifera*). Later successional forests are primarily coniferous and mixedwood stands consisting of spruce, hemlock, red maple, sugar maple (*Acer saccharum*), and beech (*Fagus grandifolia*). Black spruce (*Picea mariana*) stands grow on the edges of widespread peatlands.

The Petitcodiac Ecodistrict is a low-lying, gently rolling area which encompasses the Petitcodiac River basin. The Petitcodiac River is the dominant feature of the landscape in this ecodistrict. Boreal-type coniferous forests are common in the ecodistrict, with red spruce being the most abundant species. White spruce (*Picea glauca*), black spruce, balsam fir (*Abies balsamea*), red maple, white birch, and trembling aspen are also common. Hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), and tamarack (*Larix laricina*) may also be present in smaller numbers. Tolerant hardwood stands of beech, sugar maple, and yellow birch (*Betula alleghaniensis*) are only found on ridgetops and upper slopes.

The PDA stretches from Memramcook to Cape Tormentine through predominantly forested habitat of a variety of age classes. It crosses through scattered patches of development and agriculture which tend to be concentrated around major watercourses such as the Tantramar River, Harper Brook, and the Gaspereau River. Agricultural areas are also common along the eastern end of Route 16 and near Cape Tormentine. The PDA follows along the southern edge of an existing transmission line corridor for approximately 71% of its length with the final 29% crossing through forest and developed landscape in the east.

The eastern end of the LAA is close to a number of large marsh complexes that serve as important migratory stopover locations and breeding areas for waterfowl. While there are a large number of forested wetlands within the PDA, exceeding 30% of the landscape, there are few larger open wetland types intersected by the PDA. Along the Tantramar River, the Upper Tantramar Marsh which is an Ecologically Significant Area (ESA) and part of a National Wildlife Area (NWA) is crossed at its northern extent by the PDA. The majority of wetlands in the LAA are dominated by mixed deciduous and coniferous tree species such as black spruce, balsam fir, red maple, and white ash (*Fraxinus americana*).

3.2.2.2.1 Vegetation

Land classification in the PDA and LAA is dominated by forests, representing 70.5 and 70.9%, respectively (Table 3.14). The majority of this forested land is in a young-immature age class. Softwood stands are more common than hardwood or mixedwood stands.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Wetlands are more common within the PDA than the LAA, comprising 22.7% of the PDA vs. 15.7% of the LAA. This is likely because field delineation of wetlands, which is more accurate than air photo interpretation, only occurred within the PDA and immediately adjacent areas.

Table 3.14 Land Classification within the PDA and LAA

Land classification	PDA		LAA	
	hectares	%	hectares	%
Agricultural	9.0	4.0	312.2	5.1
Anthropogenic	3.6	1.6	95.3	1.6
Beach	0.01	0.004	1.1	0.02
Forest	159.1	70.5	4,469.5	73.7
Clearcut	1.5	0.7	19.8	0.3
Regen-sapling Hardwood	21.6	9.6	527.3	8.7
Regen-sapling Mixedwood	15.8	7.0	387.6	6.4
Regen-sapling Softwood	3.1	1.4	168.9	2.8
Young-immature Hardwood	23.4	10.4	538.2	8.9
Young-immature Mixedwood	17.8	7.9	516.7	8.5
Young-immature Softwood	63.3	28.0	1,721.2	28.3
Mature-overmature Hardwood	1.8	0.8	131.1	2.2
Mature-overmature Mixedwood	4.2	1.8	199.0	3.3
Mature-overmature Softwood	6.6	2.9	248.2	4.1
Forestry Other	-	-	3.6	0.06
No Data/Private Land	0.02	0.01	7.9	0.1
Industrial	1.1	0.5	42.7	0.7
Tidal Flat	-	-	0.1	0.002
Transmission Line	1.7	0.7	198.5	3.3
Waterbody	0.1	0.07	5.5	0.1
Wetland	50.9	22.7	955.7	15.7
Bog	0.3	0.1	2.6	0.04
Fen	0.2	0.1	19.7	0.3
Marsh	0.6	0.3	51.5	0.9
Shallow Water	1.1	0.5	12.8	0.2
Shrub Swamp	17.3	7.7	298.5	4.9
Treed Bog	1.2	0.6	2.5	0.04
Treed Swamp	30.2	13.4	568.1	9.3
Total	225.6	100.0	6,080.6	100.0

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

The ACCDC data for the Project (ACCDC 2014b) indicated the potential for six vascular plant SOCC within or near the LAA: northern blueberry (*Vaccinium boreale*; S1), Greene's rush (*Juncus greenei*; S1), red-disked yellow pond-lily (*Nuphar lutea* spp. *rubrodisca*; S2), slender cottongrass (*Eriophorum gracile*; S2), dwarf ginseng (*Panax trifolius*; S3) and seaside brookweed (*Salmolus valerandi* spp. *parviflorus*; S3) (Appendix B, Sheet 10 and 37).

During the 2014 field surveys, 396 vascular plant species were observed within the PDA and surrounding surveyed area (Appendix A), including 17 SOCC (Table 3.15; Appendix B, Sheets 4-9, 11-13, 15-16, 18, 21, 24, 27, 30, 31, 34, 35, 39, and 40).

Table 3.15 Vascular Plant Species of Conservation Concern Observed within the Project Development Area and Surrounding Surveyed Area

Common Name	Scientific Name	ACCDC S-Rank ¹	Occurrences within the PDA
Blood Milkwort	<i>Polygala sanguinea</i>	S2	0
Dotted Smartweed	<i>Polygonum punctatum</i>	S3	3
Dwarf Clearweed	<i>Pilea pumila</i>	S3	0
Halberd-leaved Tearthumb	<i>Polygonum arifolium</i>	S3	11
Hop Sedge	<i>Carex lupulina</i>	S3	0
Kalm's Hawkweed	<i>Hieracium kalmii</i>	S1	1
Large Purple Fringed Orchid	<i>Platanthera grandiflora</i>	S3	3
Red-Disked Yellow Pond-lily	<i>Nuphar lutea</i> ssp. <i>rubrodisca</i>	S2	1
Showy Lady's-slipper	<i>Cypripedium reginae</i>	S3	1 large population
Slender Cottongrass	<i>Eriophorum gracile</i>	S2	1
Small Yellow Pond-lily	<i>Nuphar lutea</i> ssp. <i>pumila</i>	S3	1
Swamp Rose	<i>Rosa palustris</i>	S3	0
Thyme-leaved Speedwell	<i>Veronica serpyllifolia</i> ssp. <i>humifusa</i>	S3	1
White Fringed Orchid	<i>Platanthera blephariglottis</i>	S3	7
White Fringed Orchid	<i>Platanthera blephariglottis</i> var. <i>blephariglottis</i>	S3	1
Wiegand's Sedge	<i>Carex wiegandii</i>	S3	3
Yellow Ladies'-tresses	<i>Spiranthes ochroleuca</i>	S1	3
Notes:			
¹ S1 = critically imperiled, S2 = imperiled, S3 = vulnerable(ACCDC 2015a)			

Although not the focus of these surveys, one bryophyte SOCC was observed within the Upper Tantramar Marsh. Floating crystalwort (*Riccia fluitans*) is a liverwort that is ranked S2S4 by the ACCDC (Appendix B, Sheet 11). Purple-fringed liverwort (*Ricciocarpos natans*), a liverwort with no S-rank, was also observed within the Upper Tantramar Marsh.

There is potential for southern twayblade (*Listera australis*) in the Memramcook to Melrose portion of the PDA. This plant is listed as endangered under the NB SARA. These sites will be visited in early June, 2016 (during the flowering period for this species), prior to construction.

Ecological Communities of Management Concern

The LAA contains several ECMC [i.e., communities that fulfill special management objectives on Crown land in New Brunswick or have been identified as supporting unique ecological features, either through field work, or by local conservation organizations (e.g., Environmentally Significant Areas (ESA))]. The Upper Tantramar Marsh ESA and Upper Tantramar Eastern Habitat Joint Venture site both refer to extensive wetland complex habitat on the upper reaches of the Tantramar River (Appendix B Sheet 11). South of the LAA, this wetland complex reaches over 1 km in width, with extensive open water habitat. Within the PDA, the wetland is approximately 640 m wide, and includes floating aquatic shallow water, graminoid marsh, tall shrub swamp and coniferous treed swamp wetland types. The Upper Tantramar Marsh is considered to be an important waterfowl staging area, and represents important waterfowl breeding habitat. This wetland is also considered to be an Ecologically Important Wetland (EIW).

MacDonald's Pond Ducks Unlimited (DU) site, also known as Jones Pond, is located near the eastern end of the Project, south of Bayfield. At this freshwater marsh and shallow water wetland complex, DU has added level ditching and nesting islands to enhance waterfowl habitat.

3.2.2.2 Wildlife

The portion of the Project from Memramcook to approximately Timber River lies within the Chignecto Isthmus, an area of New Brunswick and Nova Scotia which represents the only terrestrial route for wildlife species to move between New Brunswick and Nova Scotia (SCI 2015). At its narrowest, the Chignecto Isthmus is approximately 21 km wide. Maintaining connectivity within the isthmus is a conservation priority for the area (CPAWS 2007; NCC 2015), in part because many wildlife species are less common in Nova Scotia than in New Brunswick (e.g., moose (*Alces americanus*) and Canada lynx (*Lynx canadensis*) (MacKinnon and Kennedy 2009; NCC 2015)). The portion of the Project within the Chignecto Isthmus parallels an existing transmission line.

Although the Chignecto Isthmus is a major movement route for terrestrial species, it is also crossed by the Atlantic Flyway, a major North American migration route for birds migrating along the Atlantic coast (including the Bay of Fundy) to and from the north Atlantic Ocean, as far as Greenland (Bird Nature n.d.). Larger wetlands and mudflats within the isthmus are used as staging areas for a variety of shorebirds and water birds during migration periods (CPAWS 2007; IBA Canada 2015).

Birds

Information sources, including the ACCDC, ACNOS, BBS, Christmas Bird Count (CBC), and MBBA, indicate 201 species of birds that have been recorded near the LAA (i.e., within 5 km of the PDA, or within the MBBA squares crossed by the project, Appendix B). Of the species recorded, 17 are SAR and 34 are SOCC (Table 3.16).

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Table 3.16 Bird Species at Risk and Species of Special Concern Observed near the Local Assessment Area (ACCDC, ACNOS, BBS, CBC, and MBBA Records)

Common Name	Scientific	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
American Coot	<i>Fulica americana</i>			not at risk	S2B	ACCDC
American Golden-plover	<i>Pluvialis dominica</i>				S3M	ACCDC
American Wigeon	<i>Anas americana</i>				S3B	ACCDC, BBS, MBBA
Bald Eagle	<i>Haliaeetus leucocephalus</i>		endangered	not at risk	S3B	ACCDC, MBBA
Bank Swallow	<i>Riparia riparia</i>	no schedule, no status		threatened	S3B	ACCDC, BBS, MBBA
Barn Swallow	<i>Hirundo rustica</i>	no schedule, no status	threatened	threatened	S3B	ACCDC, BBS, MBBA
Black Tern	<i>Chlidonias niger</i>			not at risk	S2B	ACCDC, BBS, MBBA
Black-headed Gull	<i>Larus ridibundus</i>				S2M,S1N	ACCDC
Bobolink	<i>Dolichonyx oryzivorus</i>	no schedule, no status	threatened	threatened	S3S4B	ACCDC, BBS, MBBA
Boreal Owl	<i>Aegolius funereus</i>				S1S2B	ACNOS
Brant	<i>Branta bernicla</i>				S2S3M,S2S3N	ACCDC
Brown-headed Cowbird	<i>Molothrus ater</i>				S3B	ACCDC, BBS, MBBA
Bufflehead	<i>Bucephala albeola</i>				S3N	ACCDC
Canada Warbler	<i>Wilsonia canadensis</i>	schedule 1, threatened	threatened	threatened	S3S4B	ACCDC, BBS, MBBA
Chimney Swift	<i>Chaetura pelagica</i>	schedule 1, threatened	threatened	threatened	S2S3B	BBS
Common Nighthawk	<i>Chordeiles minor</i>		threatened		S3B	ACCDC, BBS, MBBA
Common Tern	<i>Sterna hirundo</i>			not at risk	S3B	ACCDC, MBBA
Eastern Meadowlark	<i>Sturnella magna</i>	no schedule, no status	threatened	threatened	S1S2B	BBS
Eastern Wood-pewee	<i>Contopus virens</i>	no schedule, no status	special concern	special concern	S4B	ACCDC, BBS, MBBA
Gadwall	<i>Anas strepera</i>				S2B	ACCDC, MBBA
Greater Scaup	<i>Aythya marila</i>				S1B,S2N	ACCDC

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Table 3.16 Bird Species at Risk and Species of Special Concern Observed near the Local Assessment Area (ACCDC, ACNOS, BBS, CBC, and MBBA Records)

Common Name	Scientific	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Green Heron	<i>Butorides virescens</i>				S1S2B	ACCDC
Horned Lark	<i>Eremophila alpestris</i>				S2B	BBS
House Wren	<i>Troglodytes aedon</i>				S1B	ACCDC, MBBA
Killdeer	<i>Charadrius vociferus</i>				S3B	ACCDC, BBS, MBBA
Long-eared Owl	<i>Asio otus</i>				S2S3	ACCDC
Marsh Wren	<i>Cistothorus palustris</i>				S2B	ACCDC
Northern Mockingbird	<i>Mimus polyglottos</i>				S3B	ACCDC, BBS, MBBA
Northern Pintail	<i>Anas acuta</i>				S3B	ACCDC, MBBA
Northern Shoveler	<i>Anas clypeata</i>				S2B	ACCDC, BBS, MBBA
Olive-sided Flycatcher	<i>Contopus cooperi</i>	schedule 1, threatened	threatened	threatened	S3S4B	ACCDC, BBS, MBBA
Pine Grosbeak	<i>Pinicola enucleator</i>				S2S3B,S4S5N	ACCDC, BBS
Piping Plover (Melodus Subspecies)	<i>Charadrius melodus melodus</i>	schedule 1, endangered	endangered	endangered	S2B	ACCDC
Purple Sandpiper	<i>Calidris maritima</i>				S3M,S3N	ACCDC
Red Crossbill	<i>Loxia curvirostra</i>				S3	ACCDC, BBS
Red Knot (Rufa Subspecies)	<i>Calidris canutus rufa</i>	schedule 1, endangered	endangered	endangered	S3M	ACCDC
Red-breasted Merganser	<i>Mergus serrator</i>				S3B,S4S5N	ACCDC, MBBA
Red-necked Phalarope	<i>Phalaropus lobatus</i>			special concern	S3M	ACCDC
Red-shouldered Hawk	<i>Buteo lineatus</i>	schedule 3, special concern		not at risk	S2B	ACCDC
Ring-billed Gull	<i>Larus delawarensis</i>				S3B	ACCDC

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Table 3.16 Bird Species at Risk and Species of Special Concern Observed near the Local Assessment Area (ACCDC, ACNOS, BBS, CBC, and MBBA Records)

Common Name	Scientific	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Rusty Blackbird	<i>Euphagus carolinus</i>	schedule 1, special concern	special concern	special concern	S3B	BBS
Sedge Wren	<i>Cistothorus platensis</i>				S1B	ACCDC
Short-Eared Owl	<i>Asio flammeus</i>	schedule 1, special concern	special concern	special concern	S3B	CBC
Turkey Vulture	<i>Cathartes aura</i>				S3B	ACCDC, MBBA
Upland Sandpiper	<i>Bartramia longicauda</i>				S1B	ACCDC, MBBA
Vesper Sparrow	<i>Poocetes gramineus</i>				S2B	BBS
Virginia Rail	<i>Rallus limicola</i>				S3B	ACCDC, BBS
Willet	<i>Tringa semipalmata</i>				S2S3B	ACCDC, MBBA
Willow Flycatcher	<i>Empidonax traillii</i>				S1S2B	ACCDC, MBBA
Wilson's Phalarope	<i>Phalaropus tricolor</i>				S1B	ACCDC
Wood Thrush	<i>Hylocichla mustelina</i>	no schedule, no status	threatened	threatened	S1S2B	BBS, MBBA

Note: SAR are indicated in bold text.

Maritimes Breeding Bird Atlas

Information about the presence of breeding bird species within the LAA was requested from the MBBA via the NatureCounts Website (www.birdscanada.org/birdmon). The search results generated a list of species and records of highest breeding evidence for each species within the atlas squares occupied by the Project.

The LAA lies within MBBA region 14 (Tintamarre), within seven atlas squares (20LR89, 20LR99, 20MR09, 20MS00, 20MS10, 20MS20, and 20MS30). During the atlas period (2006 to 2010) a total of 131 species of bird were recorded across the four squares. The highest recorded breeding status of the 131 species detected in these squares is presented in Table D.1 in Appendix D. Of the 131 recorded species, 70 were confirmed as breeding, 37 were probable breeders, and 24 were possible breeders.

Atlantic Canada Nocturnal Owl Surveys

The LAA crosses two ACNOS survey routes: Route 69 (Migic) and Route 70 (Bourgeois Mills), with one stop as close as 1.7 km from the PDA. The following four owl species have been recorded along these routes:

- barred owl (*Strix varia*)
- boreal owl (*Aegolius funereus*)
- great horned owl (*Bubo virginianus*)
- northern saw-whet owl (*Aegolius acadicus*)

American woodcock and Wilson's snipe have also been detected along both of the routes crossed by the Project.

Barred owl was the most commonly detected species along both Route 69 and Route 70, with 20 detections along Route 69, and 14 detections along Route 70 over six survey years. Boreal owl (ranked S1S2B by the ACCDC) was the least commonly detected species, with only one observation over the six survey years, which occurred on Route 69, approximately 2 km south of the PDA. This species has not been recorded on Route 70. Great horned owl was the second most commonly detected species along Route 70, with nine detections over six survey years. Northern saw-whet owl was the second most commonly detected species along Route 69, with nine detections over six survey years.

Bird Species at Risk (SAR)

Based on data provided by the ACCDC, MBBA, and BBS, 16 SAR have potential to be found within the LAA; these are described below.

Bald eagle

The bald eagle is a large, distinctive bird of prey found across Canada, and much of North America. This species is listed as endangered under NB SARA and S3B by the ACCDC.

Bald eagles build the largest nest of any bird in North America, and prefer nesting sites near open water (NBDNR 2015). During winter, individuals from the resident population are often found in the

southwestern part of the province, where they have access to the Bay of Fundy for fishing. Suitable habitat, for this species, particularly forested areas near waterbodies, is found within the PDA and LAA. There is potential for this species to be found within the PDA.

The BBS (EC 2014) reports that this species has been increasing in population in Canada and at the province level in NB. The main factors which were once responsible for the species decline include trapping, shooting and poisoning of the birds, as well as the use of the pesticide DDT which contributed to reproductive failure. Continuing threats to this species include lead poisoning from ammunition in hunter-shot prey, collisions with motor vehicles and stationary structures and destruction and alteration of their habitat (Cornell Lab of Ornithology 2015).

Bank swallow

The bank swallow is a small, highly social songbird which feeds primarily on flying or jumping insects (COSEWIC 2013a). This species occurs on every continent except Antarctica and Australia. In North America this species breeds in every province with the possible exception of Nunavut (COSEWIC 2013a). Bank swallow is ranked as threatened by COSEWIC, and has no SARA status or schedule. The ACCDC ranks bank swallow as S3B.

Bank swallows breed in a wide variety of natural and anthropogenic sites including riverbanks, aggregate pits, road cuts, and vertical sand banks or stock piles of soil. Nesting sites are generally situated adjacent to open terrestrial habitat used for aerial foraging (COSEWIC 2013a). No suitable nesting habitat was noted in the PDA, although some may be present in the LAA. There is potential for this species to be found within the LAA.

The BBS (EC 2014) reports that this species is in decline in Canada and at the province level in NB. The main factors thought to be responsible for the decline of this species includes the loss of breeding and foraging habitat, and the loss of food sources through the widespread use of pesticides (COSEWIC 2013a).

Barn swallow

The barn swallow is a mid-sized passerine that is closely associated with rural human settlements. This species is the most widespread swallow in the world, and is known to breed in all provinces and territories in Canada (COSEWIC 2011a). The barn swallow is ranked as threatened by COSEWIC and NB SARA, and S3B by the ACCDC. It has no SARA rank at this time.

Following European settlement of North America, barn swallows shifted from nesting in caves and on ledges to nesting largely in human-made structures. This insectivorous species prefers open habitats for foraging such as pastoral lands, shorelines, and cleared rights-of-way. Foraging habitat for this species exists within the PDA and LAA, No nesting habitat was noted within the PDA, but it is likely that some occurs within the LAA. There is potential for this species to be found within the LAA.

The BBS (EC 2014) indicates that this species is undergoing a decline in population, although the species is still common and widespread (COSEWIC 2011a). The main threats to the species include loss of

nesting and foraging habitat, and the large-scale declines in some insect populations which provide food for this species.

Bobolink

Bobolink is a medium-sized passerine that breeds in the southern part of all Canadian provinces from British Columbia to Newfoundland and Labrador. Bobolink is ranked as threatened by COSEWIC and NB SARA, and S3B by the ACCDC. It has no SARA rank at this time.

Bobolink originally nested in the tall-grass prairie of the mid-western US and south central Canada. As this habitat was converted to agricultural land, and forests of eastern North America were cleared to hayfields and meadows, the range of bobolink expanded (COSEWIC 2010a). Bobolink presently nest in a variety of forage crop habitats, and natural grassland habitats including wet prairie, graminoid peatlands, and abandoned fields dominated by tall grasses. Suitable habitat for this species, particularly agricultural areas, is found within the PDA and LAA. There is potential for this species to be found within the PDA.

The BBS (EC 2014) indicates that this species is in decline at a Canada-wide and province-wide level. The main threats to this species include land-use change, especially the loss of meadows and hay fields, and the early mowing of hay fields in which the species is nesting.

Canada warbler

Canada warbler is a small and brightly colored passerine. Approximately 80% of the entire breeding range of this species is located in Canada (COSEWIC 2008a), where it can be found breeding in every province and territory except Newfoundland and Labrador and Nunavut. Canada warbler is ranked as threatened on Schedule 1 of SARA, and under NB SARA, and S3B by the ACCDC.

Canada warblers breed in a wide range of forest types, including deciduous, coniferous and mixedwood forests. It is often associated with moist mixedwood forest and riparian shrub forests on slopes and ravines (COSEWIC 2008a). The presence of a well-developed shrub layer also seems to be associated with preferred Canada warbler habitat. Suitable habitat for this species, such as shrub swamps, is found within the PDA and LAA. There is potential for this species to be found within the PDA.

The BBS (EC 2014) reports that this species is in decline Canada-wide and at a province-wide level. Key threats to this species are unclear, but loss of primary forest in the wintering grounds in South America is a potential cause.

Chimney swift

The chimney swift is a small slender bird, with long, narrow wings. The breeding range of this species is limited to eastern North America, with approximately one quarter of the breeding range located in Canada (COSEWIC 2007a). This species is considered threatened under Schedule 1 of SARA, and under NB SARA. The ACCDC lists this species as S2S3B.

The chimney swift is primarily associated with urban and rural areas where chimneys are available for nesting and roosting. This species is an aerial insectivore, and often concentrates near water, where insects are abundant (COSEWIC 2007a). No suitable nesting habitat for this species was noted in the PDA, but some is likely present in the LAA. This species could potentially be found within the LAA.

The BBS (EC 2014) reports that this species is in decline at a Canada-wide and NB-wide level. The main factor thought to be responsible for the decline of this species is the rapidly falling number of suitable breeding and roosting sites including old abandoned buildings and traditional chimneys (COSEWIC 2007a). Pesticide spraying which reduces the availability of insect prey may also be a factor.

Common nighthawk

The common nighthawk is a medium-sized bird which nests in almost all of North America, and in some parts of Central America. This species occurs in all of the Canadian provinces and territories with the exception of Nunavut (COSEWIC 2007b). The common nighthawk is considered threatened under Schedule 1 of SARA and under NB SARA.

Common nighthawks are most commonly observed in a wide range of open, vegetation-free habitats including beaches, recently cleared forests, rocky outcrops, and grasslands (SARA 2015). The species has probably benefited from newly-opened habitats created by the forestry industry (COSEWIC 2007b). Suitable habitat for common nighthawk, particularly clear cut areas, exists within the PDA and LAA. There is potential for this species to be found within the PDA.

The BBS (EC 2014) reports that this species is in decline at a Canada-wide and NB-wide level. The exact causes of the decline of this species are not well understood, however it may be related to the widespread decline in insect populations which this species relies upon for food. This theory is supported by the widespread declines observed among many other insectivorous bird species (COSEWIC 2007b).

Eastern meadowlark

A medium-sized bird, the eastern meadowlark is a member of the blackbird family. In Canada, this species is found in Ontario, Quebec, New Brunswick, and southern Nova Scotia (COSEWIC 2011b). The eastern meadowlark is ranked as threatened by COSEWIC and under NB SARA. The ACCDC ranks this species as S1S2B.

Eastern meadowlarks prefer to nest in grassland habitats including native and non-native pastures, hayfields and weedy meadows. Nests are placed directly on the ground, concealed within the vegetation (COSEWIC 2011b). Suitable agricultural habitat exists within the PDA and LAA, thus there is potential that this species could be found within the PDA.

The BBS (EC 2014) reports that this species is in decline at a Canada-wide and NB-wide level. The main factors thought to be responsible in the decline of the eastern meadowlark include loss of breeding habitat, and the intensification and modernization of agricultural techniques (COSEWIC 2011b).

Eastern wood-pewee

The eastern wood-pewee is a small passerine which breeds in much of Canada from Saskatchewan to the Maritimes provinces (COSEWIC 2012a). This species is ranked as threatened by COSEWIC and NB SARA. The ACCDC ranks this species as S4B.

During breeding, the eastern wood-pewee is generally associated with the mid-canopy layer within forest clearings and edges of hardwood and mixed forest stands (COSEWIC 2012a). In migration periods this species utilizes a variety of habitats including edges, and clearings (COSEWIC 2012a). Suitable habitat for this species is found within the PDA and LAA. This species is likely to be found within the PDA.

The BBS (EC 2014) reports that this species is in decline at a Canada-wide and NB-wide level. The main factors thought to be responsible in the decline of the eastern wood-pewee have not been clearly identified, due largely, to a lack of research. Possible threats include loss of habitat, and degradation of habitat quality, changes in availability in flying-insect prey, and changes in forest structure due to white-tailed deer over-browsing (COSEWIC 2012a).

Olive-sided flycatcher

The olive-sided flycatcher is a stout, medium-sized passerine which breeds in scattered locations throughout most of forested Canada (COSEWIC 2007c). This species is listed as threatened under Schedule 1 of SARA and NB SARA. The ACCDC lists the olive-sided flycatcher as S3B.

Olive-sided flycatchers are most often associated with open areas, where they are found foraging for flying insects, and perching in tall live trees (COSEWIC 2007c). Suitable habitat for this species is found within the PDA and LAA. There is potential for this species to be found within the PDA.

The BBS (EC 2014) reports that this species is in decline at a Canada-wide and NB-wide level. The main factors thought to be associated with the decline of olive-sided flycatchers are habitat loss and alteration (COSEWIC 2007c). Declining insect populations on breeding and wintering grounds may also be a contributing factor.

Piping plover (*melodus* subspecies)

The piping plover is a small shorebird found only in North America. The *melodus* subspecies is listed as endangered on Schedule 1 of SARA and NB SARA. The ACCDC ranks this species as S2B.

Piping plover nest on wide sandy beaches with little to no vegetation and on various substrates including pebbles, gravel, shells and fine woody material. On the Atlantic coast, they are most often associated with sandy beaches on barrier islands, ocean fronts, bays and sand bars (COSEWIC 2013b). Known piping plover habitat closest to the PDA is at the Cape Jourimain NWA, located approximately 4 km north of the PDA (ACCDC 2014b; EC 2012). Although there is a small amount of beach habitat within the PDA, no plovers were observed in this area during any biophysical surveys.

The BBS (EC 2014) reports that there is insufficient data to estimate trends for this species; however, annual surveys for this subspecies shows a non-significant decline of 13% on the long-term (1991-2013)

and a significant decline of 23% over the most recent 10 years (2003-2013) (COSEWIC 2013b). The key threats to piping plovers are predation of eggs and chicks, human disturbance, and habitat loss and degradation (COSEWIC 2013b).

Red knot (*rufa* ssp.)

The red knot is a medium-sized shorebird which breeds in the central Canadian Arctic, and winters in Tierra del Fuego at the southern tip of South America. Consequently, this species migrates thousands of kilometers, with many passing along the north shore of the St. Lawrence in Quebec (COSEWIC 2007d). This species is listed as endangered on Schedule 1 of SARA and NB SARA. The ACCDC ranks this species as S3M.

During migration, red knots utilize coastal zones swept by tides, usually sand flats, but also lagoons, mangrove areas, and mussel beds, where they feed to refuel to continue migration (COSEWIC 2007d). No suitable habitat for this species was noted within the PDA, and it is unlikely that red knot would be found within the PDA.

The BBS (EC 2014) reports that there is insufficient data to estimate population trends for this species. The key threats to red knot (*rufa* ssp.) include the overfishing of horseshoe crabs in Delaware Bay, which has decimated the supply of this invertebrate's eggs, and the decreased availability of wetland habitats during the migration in eastern North America (COSEWIC 2007d).

Red-necked phalarope

The red-necked phalarope is a small shorebird species, which may be found along marine coasts, bays, lakes ponds, and tundra during the summer months (Audubon n.d.). This species is listed as special concern by NB SARA and as S3M by the ACCDC. It has no federal SARA rank at this time.

This species spends up to nine months at a time at sea. Nesting occurs in the low Arctic on tundra ponds with marshy shores and bogs (Audubon n.d.). No suitable habitat for this species was noted within the PDA, and it is unlikely that red-necked phalarope would be found within the PDA.

The BBS (EC 2014) reports that this species is in decline in Canada. The main threat to this species is direct and indirect habitat loss at staging areas used during migration (Audubon n.d.).

Red-shouldered hawk

The red-shouldered hawk is a medium-sized hawk with broad, rounded wings. In Canada, it may be found in the southern most areas of the eastern provinces. This species is ranked as special concern on Schedule 3 of SARA. The ACCDC ranks red-shouldered hawk as S2B.

Red-shouldered hawks are typically found in bottomland hardwood stands, flooded deciduous swamps, and upland mixed deciduous-conifer forests. Stands with open subcanopy are favored by this species, which hunts within the forest habitat (Cornell Laboratory of Ornithology 2015). Suitable habitat for this species exists within the PDA and LAA. There is potential for red-shouldered hawk to be found within the PDA.

The BBS (EC 2014) reports that this species population is increasing slightly at the Canada-wide level. The key threat to the red-shouldered hawk is the continued clearing of habitat for development and the forestry industry (Cornell Laboratory of Ornithology 2015).

Rusty blackbird

The rusty blackbird is a medium-sized passerine most commonly associated with forest wetlands. This species is listed as special concern on Schedule 1 of SARA and under NB SARA. The ACCDC ranks the rusty blackbird as S3B.

The rusty blackbird nests in boreal forests, generally near the shores of forest wetlands, slow-moving streams, beaver ponds, and pasture edges (COSEWIC 2006). This species' main diet in its breeding range consists primarily of aquatic invertebrates, and occasionally salamanders and small fish. Some habitat for rusty black bird exists within the PDA and LAA. There is potential for this species to be found within the PDA.

The BBS (EC 2014) reports that this species is in decline Canada-wide and at the provincial level in NB. The main factor thought to be associated with the decline of Rusty blackbirds is the conversion of its main wintering grounds (forests in Mississippi Valley flood plains) into agricultural lands or human habitation (COSEWIC 2006). Other factors include destruction of wetlands within the species breeding range, and the spread of dominant, competing, species such as the red-winged blackbird.

Short-eared owl

The short-eared owl is a medium-sized owl of open grasslands. This species may be found across North America, and is known in every province in Canada. Short-eared owl is currently listed on Schedule 1 of SARA as special concern, and is also listed as special concern by COSEWIC and under NB SARA. The ACCDC ranks short-eared owl as S3B.

This species breeds sporadically in arctic areas, coastal marshes, and interior grasslands where small rodents are abundant (COSEWIC 2008b). A wide variety of open habitats are used for foraging, including arctic tundra, grasslands, peat bogs, old pastures, marshes, and occasionally agricultural fields. Some of these types of habitats, particularly agriculture, but also marshes and bogs, are found within the PDA and LAA. There is potential for this species to be found within the PDA.

The BBS (EC 2014) reports that this species is in decline at a Canada-wide level. There is insufficient data to report a provincial trend in NB. The main threat to this species is thought to be loss and alteration of habitat. Coastal marshland and grassland habitats, which were formerly heavily used by this species, have been especially vulnerable to loss and alteration through drainage of wetlands, urban development and agricultural activity (COSEWIC 2008b).

Wood thrush

The wood thrush is a medium sized bird which breeds in southeastern Canada from southern Ontario east to Nova Scotia (COSEWIC 2012b). This species is listed as threatened by COSEWIC and NB SARA, and S1S2B by the ACCDC.

Wood thrush nest mainly in second-growth and mature forests, both deciduous and mixed wood, with saplings and well-developed understory layers. There is suitable habitat for wood thrush within the PDA and LAA. There is potential for this species to be found within the PDA.

The BBS (EC 2014) reports that this species is in decline in Canada and in NB. The main factors thought to be responsible in the decline of this species include habitat degradation and fragmentation due to over-browsing by white-tailed deer and human development (COSEWIC 2012b). High rates of nest predation and parasitism by species such as brown-headed cowbird are also contributing to the decline of the wood thrush.

Other Incidental Wildlife Observations

Evidence of the following mammals was seen in the PDA and surrounding area during the vegetation and wetland surveys:

- American beaver (*Castor canadensis*)
- black bear (*Ursus americanus*)
- eastern chipmunk (*Tamias striatus*)
- eastern coyote (*Canis latrans*)
- meadow vole (*Microtus pennsylvanicus*)
- mink (*Neovison vison*)
- moose (*Alces americanus*)
- muskrat (*Ondatra zibethicus*)
- North American porcupine (*Erethizon dorsatum*)
- northern raccoon (*Procyon lotor*)
- northern river otter (*Lutra canadensis*)
- red squirrel (*Tamiasciurus hudsonicus*)
- snowshoe hare (*Lepus americanus*)
- star-nosed mole (*Condylura cristata*)
- striped skunk (*Mephitis mephitis*)
- white-tailed deer (*Odocoileus virginianus*)
- woodland jumping mouse (*Napaeozapus insignis*)

Evidence of the following herpetiles was seen in the PDA and surrounding area during the vegetation and wetland surveys:

- American toad (*Bufo americanus*)
- blue-spotted salamander (*Ambystoma laterale*)
- bullfrog (*Rana catesbeiana*)
- common garter snake (*Thamnophis sirtalis*)
- green frog (*Rana clamitans*)
- maritime garter snake (*Thamnophis sirtalis pallidulus*)
- northern leopard frog (*Rana pipiens*)
- spring peeper (*Hyla crucifer*)
- wood frog (*Rana sylvatica*)

- yellow spotted salamander (*Ambystoma maculatum*)

Each of these mammal and herpetile species is listed as S5 by the ACCDC, which is considered secure, or “common, widespread, and abundant in the province,” with the exception of blue-spotted salamander, which is ranked S4, and considered apparently secure, or “uncommon but not rare; some cause for long-term concern due to declines or other factors” (ACCDC 2015a).

Monarch (*Danaus plexippus*) butterflies were noted at three locations in the LAA, all within 20 m of the PDA (Appendix B, Sheets 12 and 23). Two of the observations were made north of the PDA in the adjacent transmission line RoW, between Cookville Road and Route 940. A third observation was made south of the PDA in a low shrub basin swamp, approximately 600 m east of Route 15. Monarchs are a SAR, listed as special concern on Schedule 1 of SARA and NB SARA. They are dependent on milkweed plants (*Asclepias* spp.) where they lay their eggs, and which the caterpillars eat after hatching (COSEWIC 2010b). There are two species of milkweed in New Brunswick: common milkweed (*Asclepias syriaca*, S4S5), which grows in open areas such as abandoned agricultural areas, meadows, ditches, and roadsides; and swamp milkweed (*Asclepias incarnata*, S4) which grows in marshes, the edges of swamps, shorelines, and other wet areas (COSEWIC 2010b; Haines 2011). Neither of these species were observed within the PDA or adjacent areas surveyed for vegetation in 2014.

Interior Forest

There are 16 patches of approximately 378.5 ha of interior forest contiguous with the LAA (i.e., at least a portion of the interior forest patch is within the LAA). Interior forest are areas relatively free from fragmentation and defined as patches of mature forest greater than 10 ha in size, and at least 100 m from an “edge” (e.g., clearcut, industrial or other anthropogenic area, linear features such as roads or transmission lines, or waterbodies and open wetlands) (Appendix B, Sheets 7-10, 14, 15, 22-25, 27-29, 33-35, 37, and 38). Patches of interior forest in the LAA range from 10.2 ha to 56.1 ha. Some wildlife species are sensitive to fragmentation and prefer or require interior forest habitat. These species, known as interior species, include bay-breasted warbler, black-throated blue warbler, eastern wood-pewee, Cape May warbler, Canada warbler, and wood thrush (Emera Brunswick Pipeline Company Ltd. 2006), all of which have been observed in the LAA or surrounding area (Appendix D).

3.2.2.2.3 Wetlands

In total, 50.8 ha of wetland habitat were delineated within the PDA, which represents 22.5% of the PDA (Appendix B). The total area of each wetland class is given in Table 3.17. The wetlands identified within the PDA fall within five classes (swamp, bog, marsh, fen, and shallow water), four broad types (treed, shrub, graminoid, and aquatic), and six forms (basin, drainageway, flat, lacustrine riparian, riverine riparian, and unconfined slope). Of the 50.8 ha of wetland within the PDA, 46.2 ha (90.9%) is classified as swamp wetland. The majority of the swamp wetlands are tall shrub type (14.1 ha) followed closely by mixedwood treed swamp (11.2 ha). The wetland classes in the PDA are described below.

Table 3.17 Summary of Wetland Habitat within the Project Development Area by Class, Type (subtype) and Form (subform)

Wetland Types and Forms	Area (ha) by Wetland Class					
	Bog	Fen	Marsh	Swamp	Shallow Water	Total
Coniferous Treed	1.8			9.7		11.5
Basin	1.8			5.6		7.5
Drainageway				0.7		0.7
Flat				0.4		0.4
Lacustrine Riparian				0.04		0.04
Riverine Riparian				0.1		0.1
Unconfined Slope				2.8		2.8
Mixedwood Treed		0.4		11.2		11.7
Basin				3.6		3.6
Drainageway		0.4		2.2		3.7
Flat				1.3		1.3
Riverine Riparian				0.8		0.8
Unconfined Slope				3.2		3.2
Deciduous Treed				8.0		8.0
Basin				0.5		0.5
Drainageway				1.0		1.0
Flat				0.4		0.4
Unconfined Slope				6.2		6.2
Tall Shrub		0.2		14.1		14.3
Basin				0.6		0.6
Drainageway		0.2		3.9		4.1
Flat				1.2		1.2
Lacustrine Riparian				0.1		0.1
Riverine Riparian				2.8		2.8
Unconfined Slope				5.5		5.5
Low Shrub				3.1		3.1
Basin				3.1		3.1
Graminoid	0.3	0.2	0.6			1.1
Basin	0.3	0.2				0.5
Riverine Riparian			0.5			0.5
Unconfined Slope			0.02			0.02
Floating Aquatic					1.1	1.1
Basin					0.02	0.02

Table 3.17 Summary of Wetland Habitat within the Project Development Area by Class, Type (subtype) and Form (subform)

Wetland Types and Forms	Area (ha) by Wetland Class					
	Bog	Fen	Marsh	Swamp	Shallow Water	Total
Lacustrine Riparian					0.7	0.7
Riverine Riparian					0.4	0.4
Total (ha)	2.2	0.8	0.6	46.2	1.1	50.8

Bog

Bogs are uncommon in the PDA, comprising only 2.2 ha or 4.2% of the wetland habitat in the PDA. All of the four bogs encountered are basin forms and are characterized by accumulated peat, a dependence on precipitation as the water source, and are typically dominated by sphagnum mosses (*Sphagnum* spp.), ericaceous shrubs, and coniferous tree species. Within the PDA, three of the four bogs encountered are coniferous treed subtypes and the fourth is a sedge/graminoid type. The treed bogs are dominated by black spruce and tamarack. Dominant graminoid species include cottongrass (*Eriophorum* spp.), and various sedges including bog sedge (*Carex magellanica*), three-seeded sedge (*Carex trisperma* var. *billingsii*), and few-seeded sedge (*Carex pauciflora*). Treed bogs can provide habitat for plant SAR including southern twayblade (*Listera australis*), which is listed as endangered under NB SARA. Open bogs sometimes provide nesting habitat for common nighthawks and rusty blackbirds.

Fen

A fen is a peatland with a fluctuating water table with waters that are generally rich with dissolved minerals. Fens occupy 1.7% of the wetland habitat within the PDA and are mostly small and disturbed and not typical of larger, naturally formed fens in New Brunswick. Fens in the PDA are either graminoid or shrub dominated nutrient-poor fens that fall within existing cleared areas. Under natural conditions these wetlands would be forested and classified as treed swamps but now are covered with graminoids including sedges and grasses such as blue-joint reed grass, nodding sedge, and mannagrass (*Glyceria* spp.). Fens are often highly diverse and can support a number of SOCC, but all of the fens in the PDA are in disturbed areas lacking the typical high fen diversity.

Marsh

Marshes comprise only 1.1% of wetlands in the PDA (0.6 ha) by area and only one form (graminoid) and two subforms (riverine riparian and unconfined slope). Marshes typically have shallow, but fluctuating water levels and are typically dominated by graminoid species including grasses, sedges (*Carex* spp.), cattails (*Typha* spp.), or rushes (*Juncus* spp.), and may include some shrub cover. The fluctuating water levels and changes in water depth and duration of flooding often result in distinct zones of vegetation (NWWG 1997). The single unconfined slope marsh is very small, occupying less than 0.02 ha, and is in a disturbed area adjacent to the existing transmission line. The three riverine riparian marshes together comprised 0.6 ha in total area and are part of the Upper Tantramar Marsh complex.

Marshes can be highly diverse and support several avian SAR, including rusty blackbird, olive-sided flycatcher, and a variety of wading birds and waterfowl. The Upper Tantramar riverine marsh within the PDA contains two vascular plant SOCC: red disked yellow pond lily (*Nuphar lutea ssp. rubrodisca*; S2), dotted smartweed (*Polygonum punctatum*; S3); and one liverwort SOCC: crystalwort (*Riccia fluitans*; S2S4). Additional botanical surveys are scheduled for this area in August of 2015 to be summarized in a supplemental report. When this marsh was established as an ESA, it was known to represent one of the few known breeding locations in New Brunswick for Virginia rail and marsh wren (Tims and Craig 1995). Riverine marshes and adjacent watercourses provide breeding and nursery habitat for a variety of fish, invertebrate, reptile, and amphibian species, and feeding and reproductive habitat for a variety of birds and other species. The Upper Tantramar Marsh is characterized as an EIW based on its large size, important role in supporting SOCC, status as an ESA and an Eastern Habitat Joint Venture site, and hydrological function.

Swamp

Swamp wetlands are generally dominated by at least 30% woody vegetation (trees or tall shrubs) and may occur on organic or mineral soils, and may overlay minerotrophic groundwater (NWWG 1997). The water table is typically at or near the surface and they are not as wet as marshes, fens, or bogs. Swamps are the most abundant class in the PDA (46.2 ha) with multiple forms and types. Approximately 90.9% of the wetland habitat in the PDA is classified as swamp which is typical for Brunswick.

Swamp Forms

The most abundant subforms of swamp in the PDA are unconfined slope (17.8 ha), unconfined basin (13.4 ha), and drainageway (7.8 ha). Less common wetland forms are riverine riparian (3.7 ha), flat swamps (3.2 ha), and lacustrine riparian (0.1 ha). Drainageway swamps and unconfined slope swamps are subforms of slope swamps which characteristically drain across a gradient. In the PDA these are typically fed by a combination of surface and groundwater that drains slowly across a hummocky surface. In drainageway swamps, surface drainage tends to follow more defined tracks. Unconfined slope swamps, tend to be broader and drainage is poorly defined and less obvious. Often there is a small amount of peat accumulation in some areas, but in the PDA, these wetlands are largely on mineral soils with a sub-surface confining layer with elevated clay content. Both subforms can be present in a single wetland in combination with other classes, types and forms, and can have seasonal surface water collecting in hollows between hummocks.

Basin swamps in the PDA tend to have greater peat accumulation, less nutrient supply, and lower pH as evident by the typically coniferous tree and/or ericaceous shrub dominated vegetation cover. Peat accumulation also tends to be somewhat greater in the basin swamps in the PDA. There are some richer, basin swamps (5 ha) that had mixedwood forest cover as a result of heavier groundwater inputs.

Other forms of swamp that occurred in the PDA include lacustrine and riverine riparian swamps that occurred within the flood zones of lakes and watercourses in the PDA that are typically dominated by alder or black spruce and balsam fir. There are also a small number of flat swamps which are a subform of basin swamps and are similar to unconfined slope swamps except there is no obvious direction of drainage across a gradient.

Swamp Types

Within the PDA, the majority of swamps are treed swamps dominated by mixedwood forest or coniferous forest with black spruce and, less commonly, deciduous forest typically dominated by red maple. The coniferous swamps tend to be concentrated on the western half of the PDA while shrub swamps are more common on the eastern half. Deciduous and mixedwood treed swamps tend to be scattered along the PDA in clusters.

Of all wetlands surveyed, treed swamps are the most common type, comprising 57.0% of all wetlands within the PDA. Treed swamps in New Brunswick most often have a water table that is below the surface, and are fed by seepage, rainwater, or runoff with relatively stable hydrology, except in floodplains where treed swamps occur in areas with fluctuating hydrology. Treed swamps occur along sloping seepage tracks and where gently rolling topography provides slower drainage to wide flat valleys. Peat accumulation is typically minor in the treed swamps within the PDA, which include the subtypes coniferous treed, mixedwood treed and deciduous treed swamps.

Shrub swamps cover approximately 27.8% of the wetland area in the PDA (17.2 ha). Tall shrub swamps are the most abundant subtype (14.1 ha) and are typically dominated by speckled alder (*Alnus incana*) sometimes in combination with black ash (*Fraxinus nigra*) and other wetland shrub species such as wild raisin (*Viburnum nudum*), winterberry (*Ilex verticillata*), and ericaceous shrubs. These wetlands are most often found in disturbed areas or along watercourses and in drainage swales where the disturbance regime favors species adapted to flooding, ice scouring, beaver activity and widely fluctuating water tables. Low shrub swamps are less abundant (only 3.1 ha) and occur in boggy basins with some peat accumulation and are dominated by ericaceous shrubs.

Coniferous treed swamps are the second most abundant subtype of swamp (at 19.1% of total area) in the PDA after shrub swamps, and are typically dominated by black spruce, with smaller amounts of balsam fir, eastern white cedar, or tamarack. These wetlands are somewhat more concentrated in the western half of the PDA where mixedwood swamps are more abundant in the eastern half. Common understory species include ericaceous and other wetland shrub species such as wild raisin, winterberry, mountain holly (*Nemopanthus mucronata*), as well as various fern species. Coniferous treed swamps have potential to provide habitat for some plant SAR, including southern twayblade. Avian SAR that use this habitat type include olive-sided flycatcher, which commonly nests near the forested edge of a more open wetland type. These wetlands can also provide habitat for game species such as white-tailed deer and moose, as well as various fur-bearers.

Mixedwood treed swamps can contain a variety of tree species, such as red maple, birches, balsam fir, eastern white cedar, and spruces. The understory is typically dominated by regenerating tree species and mixed fern assemblages. Mixedwood treed and deciduous swamps are typically drainage way or slope forms and are more common on productive soils or have heavier groundwater inputs. Avian SAR such as the eastern wood-peewee, Canada warbler, and olive-sided flycatcher may use this habitat type.

Hardwood treed swamps are the least common subtype, and are generally dominated by red maple and white ash in the overstory, and have a wide variety of species in the understory.

Shallow Water

Shallow water wetlands are transitional between deep water bodies and wetlands that are saturated or periodically wet and have standing water that is less than 2 m deep. This wetland class comprises 1.1 ha or 2.1% of wetland habitat in the PDA. One small shallow water wetland (0.02 ha) is in a disturbed excavated pit and is a basin form and floating aquatic type. The remaining shallow water wetland is part of the Upper Tantramar Marsh complex and is identified as an ecologically important wetland as discussed below. These wetlands can serve as important breeding areas for fish, birds, reptiles, and amphibians. Part of the shallow water wetland in this complex on the eastern side, is classified as lacustrine riparian subform. The portion on the western side is riverine riparian. Both are of the floating aquatic subtype and are dominated by floating aquatic species such as pond lilies (*Nuphar* spp.), duckweed, and pickerelweed (*Pontedaria* sp.). Supplemental botanical surveys are planned for this area in August 2015 to be summarized in supplemental reporting.

Provincially Significant Wetlands and Ecologically Important Wetlands

There are no PSWs within the LAA; however, the Upper Tantramar Marsh is considered an EIW. This riparian wetland complex of shallow water, marsh, and swamp classes along the Tantramar River supports a range of valued functions for SOCC. It is also part of a larger wetland complex that is designated as an ESA and an Eastern Habitat Joint Venture site. It is one of few known breeding locations for Virginia rail, sedge wren, and marsh wren within New Brunswick (Tims and Craig 1995). The Upper Tantramar marsh is a mixture of dykeland, bog, shallow marsh, wooded islands and open water lakes, of which only the upper reaches are intersected by the PDA. The islands and surrounding uplands are forest, shrub, and hayland which provide abundant bird nesting habitat. The upper end of the marsh also contains habitat suitable for several species of nesting and staging waterfowl. Several plant SOCC were identified in this wetland during field surveys and additional botanical field surveys occurred in August 2015.

3.2.3 Project Interactions with the Terrestrial Environment

Potential Project interactions with Terrestrial Environment are presented in Table 3.18. These interactions are indicated by check marks, and are discussed in Section 3.2.4 in the context of effects pathways, standard and project-specific mitigation/enhancement, and residual effects. Following the table, justification is provided for non-interactions (no check marks).

Table 3.18 Potential Project-Environment Interactions and Effects on the Terrestrial Environment

Project Components and Physical Activities	Potential Environmental Effects	
	Change in Vegetation and Wildlife	Change in Wetland Area or Function
Construction		
Site Preparation for Land Based Transmission Lines	✓	✓
Physical Construction of Land-Based Transmission Lines	✓	✓
Landfall Construction	✓	–
Upgrading of Electrical Substation	–	–
Inspection and Energizing of the Transmission Lines	–	–
Clean-Up and Re-vegetation of the Transmission Corridor	✓	✓
Emissions and Wastes	✓	–
Transportation	–	–
Employment and Expenditure	–	–
Operation		
Energy Transmission	✓	–
Vegetation Management	✓	✓
Infrastructure Inspection, Maintenance and Repair (Transmission Lines and Substations)	–	–
Access Road Maintenance	✓	–
Emissions and Wastes	–	–
Transportation	–	–
Employment and Expenditure	–	–
Decommissioning and Abandonment		
Decommissioning	✓	–
Reclamation	✓	✓
Emissions and Wastes	✓	–
Employment and Expenditure	–	–
<p>Notes: ✓ = Potential interactions that might cause an effect. – = Interactions between the project and the VC are not expected.</p>		

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT

September 30, 2015

Landfall construction occurs in an area that has yet to be surveyed for vegetation and wetlands, as this project component was not finalized at the time of these surveys in 2014. However, aerial imagery indicates there are no wetlands within this part of the Project footprint. Therefore, no interactions are expected between landfall construction and wetland area and function.

Upgrading of the electrical substation will not interact with the Terrestrial Environment in a substantive way. This Project activity will occur within the footprint of the existing substation where no terrestrial features are found.

Inspection and energizing of the transmission lines will occur following other construction activities such as site preparation and physical construction of transmission lines, and will occur over a short period of time within areas that were previously disturbed during these other Project activities. Therefore, no interactions are expected between this Project activity and the Terrestrial Environment.

During all phases, transportation and employment and expenditure are not anticipated to interact with the Terrestrial Environment in a substantive way. Although transportation may result in vehicle collisions with wildlife; these interactions are considered accidental events and are addressed as such in Section 5.

During operation, infrastructure inspection, maintenance, and repair are not anticipated to interact with the Terrestrial Environment in a substantive way. This Project activity will occur periodically using existing roads and will not result in further disturbance to the Terrestrial Environment.

During operation, emissions and wastes are also not anticipated to interact with the Terrestrial Environment in a substantive way. Emissions and wastes can include air contaminants, sound and vibration, surface runoff, and waste disposal. The predicted infrequency and low levels of these emissions and wastes during operation and decommissioning and abandonment phases will limit any interaction with the Terrestrial Environment. During construction, emissions and wastes are not anticipated to interact with wetland area and function. Wetlands are not expected to be responsive to air contaminants or sound and vibration emissions, and wastes will not be disposed of in wetlands. Though wetland function could interact with surface runoff, standard erosion and control measures used on all construction projects will limit this potential interaction.

Project components and activities will interact with wetland area and function. With the exception of vegetation clearing activities, the remaining wetlands outside of the PDA will not be disturbed during operation and decommissioning and abandonment phases.

The environmental effects of these Project activities on the Terrestrial Environment (or portions thereof) will not be considered further.

3.2.4 Assessment of Residual Environmental Effects on the Terrestrial Environment

3.2.4.1 Analytical Assessment Techniques

The assessment of potential environmental effects on the Terrestrial Environment was conducted using desktop information. Vegetation and wetlands field surveys were also conducted within the PDA and surrounding area during the growing season by qualified biologists with experience in botany, wetland delineation and classification, and wildlife surveys. Bird surveys were conducted within the breeding bird season by a qualified avian biologist who conducted an area search of the PDA and surroundings, and will be reported on in a supplemental report.

3.2.4.2 Assessment of Change in Vegetation and Wildlife

3.2.4.2.1 Project Pathways for Change in Vegetation and Wildlife

Construction

The construction of the Project has potential to result in adverse environmental effects resulting in the loss of vascular plant SOCC, the loss of vegetation communities and wildlife habitat, sensory disturbance to wildlife resulting in habitat avoidance, and mortality of wildlife through collisions with construction equipment.

Site preparation of the land-based transmission lines includes preparation of temporary access roads, clearing of the corridor, and grubbing of pole locations, and has potential to result in the direct loss of vascular plant SOCC, vegetation communities, and wildlife habitat. Clearing will remove trees and shrubs and damage other plants. Grubbing will completely remove vegetation, where it occurs. Depending on the extensiveness of the grubbing, topsoil and the associated seedbank could be removed, and machinery working on site will compact remaining soil layers. Removing soil can change the habitat quality for any plants that may later regenerate within the corridor. If these activities occur during the breeding bird season, there is potential that the Project will result in the direct loss of young birds that are unable to leave the nest.

Construction activities are expected to result in a change in a minimum of 190.5 ha of vegetation communities and wildlife habitat; all forested upland, treed swamps, and treed bogs within the PDA will require vegetation clearing. Some tall shrub swamps may also require clearing, which could amount to an additional 17.3 ha of vegetation communities and wildlife habitat cleared. The majority of vegetation communities and wildlife habitat with the potential to experience change resulting from clearing are common within the LAA, with the exception of some wetland types discussed in Section 3.3.2.2. Construction activities will also result in the permanent loss of a minimum of 0.06 ha of vegetation communities and wildlife habitat associated with the footprints of approximately 279 H-Frame structures (totalling 0.04 ha, some of which will likely occur within wetland habitat), and the 0.02 ha footprint of the termination site.

Site preparation activities, can have indirect interactions on adjacent areas beyond potential direct effects on vascular plant SOCC and vegetation communities and wildlife habitat within the corridor, through edge effects. Edge effects can include changes in abiotic factors such as light availability, humidity, wind, and temperature, which can change which plants are able to grow and thrive in an area. Vegetation communities in the PDA and adjacent areas can also change as a result of the introduction of invasive or exotic plants. Many invasive and exotic plants are strong competitors that thrive in disturbed habitats, and could out-compete native vegetation in the area.

Edge effects can also result in changes in indirect mortality through herbivory or predation (i.e., through increasing access for larger herbivores and predators), or through nest parasitism. Nest predators and brown headed cowbirds (nest parasites) occur more frequently closer to forest edges (Lloyd et al. 2005; Rich et al. 1994). Although changes resulting from edge effects will not be as great as those resulting from direct disturbance within the corridor, they represent a change from pre-Project conditions.

Site preparation activities will result in the loss of approximately 7.9 ha of interior forest contiguous with the LAA. The majority of patches within the LAA (10 of 16) will not be affected by the Project. The Project will reduce the average area of the patches from 23.7 ha to 23.2 ha. None of the interior forest patches will be reduced below the 10 ha threshold. The largest patch will be reduced from 56.1 to 54.2 ha, and the largest reduction (of 2.7 ha) is from 22.1 ha to 19.4 ha. The amount of fragmentation of interior forest is relatively low for a project of this size, because the majority of the Project is paralleling an existing transmission line. The section where the Project parallels an existing transmission line is also where it crosses the Chignecto Isthmus. Therefore, the Project does not represent a new source of fragmentation in this area. It will, however, result in a wider cleared area for species to cross.

The physical construction of land-based transmission lines will require excavation of two holes for each pole location. These areas will have been previously cleared and grubbed, so the potential changes to vascular plant SOCC, vegetation communities, and wildlife habitat will be minimal, but these areas represent a permanent loss, whereas vegetation within the majority of the corridor will be allowed to regenerate, although community composition will change. Heavy machinery used for excavation will result in further soil compaction around the excavated areas.

Site preparation and physical construction activities have potential to change ECMC. Although the boundaries are not well-delineated, it is assumed that the Upper Tantramar Marsh ESA encompasses portions of the freshwater marsh and shallow water wetland portions of the larger complex that are crossed by the PDA. Clearing will occur within adjacent treed and shrub swamp portions of the wetland complex, but none is expected to occur within the ESA portion of the wetland. Potential Project pathways with this wetland are further discussed in Section 3.3.4.3.

Construction activities such as clearing, grubbing at pole locations and excavation will produce sensory disturbance in the form of light and noise. This disturbance has potential to result in temporary habitat loss as a result of reduced habitat effectiveness (i.e., avoidance). Breeding and rearing success for some wildlife species could potentially be affected by sensory disturbance (Bayne et al. 2008).

The Project may lead to increased bird mortality resulting from collision with construction equipment. Although birds can collide with non-illuminated structures, light sources have been shown to be an attractant to migrating birds. This phenomenon is worse at night or during inclement weather (Avery *et al.* 1976; Ogden 1996; Wiese *et al.* 2001; Longcore and Rich 2004). This interaction would be of short duration, limited in extent to areas near active construction, and would cease at the completion of construction activities.

Increased activity, noise, and illumination at night during construction activities could also cause an increase in indirect mortality risk. Sensory disturbance could result in certain wildlife species suffering reduced productivity and nest abandonment. Some wildlife, including small mammals, reptiles, and amphibians, might move out from cover in response to disturbance (particularly noise or vibration) which could increase mortality risk from exposure to predation.

Operation

During operation, vegetation management, access road maintenance (particularly, vegetation control), and increased ATV use have potential to result in adverse environmental effects resulting in the alteration of vegetation communities and wildlife habitat. These areas will have been disturbed during initial construction activities. Vegetation within these corridors may provide nesting habitat for some bird species. If vegetation management occurs during the breeding bird season, there is potential that the Project will result in the direct loss of young birds that are unable to leave the nest.

The presence of transmission lines has potential to result in wildlife mortality through wildlife strikes. Transmission line collisions have recently been estimated to be the third leading cause of human-related mortality of birds in Canada, behind predation by feral cats and domestic cats (Calvert *et al.* 2013). In particular, waterfowl and waterbirds are more susceptible to transmission line collisions due to high wing loading (i.e., body weight divided by wing area), which limits their reaction time (APLIC 2012; Bevanger 1998; Rioux *et al.* 2013). Mortality resulting from transmission line strikes and other wires (such as guywires on communication towers) is a known issue in the Chignecto Isthmus, particularly where lines are perpendicular to migration flightpaths, as occurs in the larger, more southern portions of the Tantramar Marsh (approximately 10.5 km south of the PDA) (MacKinnon and Kennedy 2011).

Birds which are attracted to transmission lines may be electrocuted when there is inadequate separation between energized conductors or energized conductors and grounded hardware. Most electrocutions occur on medium-voltage distribution lines (4 to 34.5 kilovolts (kV)), in which the spacing between conductors may not be adequate to allow birds to pass through (APLIC and USFWS 2005). Poles with energized hardware such as transformers can be especially hazardous, even to small birds, as the numerous energized parts are closely-spaced. Dry feathers can act as insulation, so contact must be made between fleshy parts, such as the wrists, feet, or other skin, for electrocution to occur (APLIC and USFWS 2005). The Project will use H-frame structures with 3.8 m between conductors, 3 m vertical separation between conductors, and overhead ground wires. These structures are considered relatively "avian-safe" as they provide adequate clearances to accommodate a large bird between energized and/or grounded parts (APLIC and USFWS 2005).

In general, nocturnal migrants (i.e., passerines) are high-flyers and are not prone to collision during flight. In contrast, diurnal migrants (e.g., waterfowl, waterbirds, raptors) have flight heights that are more varied. Waterfowl are the species group most susceptible to wire collision (Erickson *et al.* 2001); however, in the absence of potential staging areas (e.g., shallow water wetlands, lakes), they are likely to be flying higher than the height of the transmission lines. Sections of the PDA that are relatively close to potential staging areas include the Upper Tantramar Marsh and near MacDonald's Pond DU site (i.e., Jones Pond). Because of the location of the Project in relation to the Atlantic Flyway, these open water wetlands may be used as stopover and staging areas for migrating birds, especially waterfowl (Bird Nature n.d.). The Upper Tantramar Marsh is currently crossed by an existing transmission line. The Project will parallel this existing line, and therefore does not represent a new interaction with wildlife in the area; however, if the new poles are not lined up with existing poles, the lines will result in increased vertical stratification. Migrating birds that may stop in MacDonald's Pond DU site may need to cross the Project when either arriving or leaving the area.

Decommissioning and Abandonment

It is well known that birds (especially ospreys, but also crows, owls, and hawks) nest on transmission structures. The termination site and transmission line poles could present nesting locations for larger birds, as they are typically the highest point in an area, are stable, and are easily accessible to birds. Decommissioning the termination site and poles may interact with nesting birds, if any are present.

Similar to construction, decommissioning and abandonment activities may also produce sensory disturbance such as light and noise. Such disturbance has potential to result in temporary habitat loss as a result of reduced habitat effectiveness (i.e., avoidance). Breeding and rearing success for some wildlife species could potentially be affected by sensory disturbance (Bayne *et al.* 2008).

Reclamation activities associated with decommissioning will result in an increase in native vegetation communities and wildlife habitat.

3.2.4.2.2 Mitigation for Change in Vegetation and Wildlife

The following well-established practices to reduce the interaction between the Project and vegetation and wildlife will be implemented during Project construction and operation.

- Flag and avoid known locations of individuals of SOCC, when possible.
- Avoid construction, particularly clearing activities, in areas of native vegetation during the breeding season for most migratory birds (April 1 to August 31), if possible.
- If completion of clearing outside the breeding season is not possible, work will be conducted according to an avian management plan which will include breeding bird surveys to determine if any nesting activity is occurring at this time. If active nests are observed in the area to be cleared, additional mitigation will be employed such as flagging the area and avoidance of nests until the young have fledged.
- Use appropriate avian avoidance devices (such as line markers) near potential staging areas, such as Upper Tantramar Marsh and near MacDonald's Pond DU site (Jones Pond).

- Use approved noise arrest mufflers on equipment to reduce potential environmental effects of noise.
- Use full cut-off lighting to reduce attraction to migrating birds, where possible.
- Confine clearing to PDA footprint.
- Reduce grading in native vegetation communities.
- Ensure equipment arrives at the site clean and free of soil or vegetative debris.
- Operate vehicles and equipment on previously disturbed areas, wherever feasible.
- Limit size of temporary workspaces.
- Properly store and dispose of construction site wastes that might attract wildlife.
- Allow for natural regeneration when possible, and when not possible, use a native seed mix for revegetation.
- Restrict vegetation management to necessary areas.
- Restrict travel through wetlands for inspection or maintenance activities, when possible.
- Comply with the conditions of the vegetation management permit received from NBDELG.
- Use existing Environmental Protection Plan.
- Provide a nesting platform during and following decommissioning if any bird species are nesting on the termination site.
- Avoid decommissioning and abandonment activities during the breeding season for migratory birds (April 1 to August 31).
- Restore temporarily disturbed areas to pre-construction conditions.

The mitigation described above will limit the reduction of vegetation communities and wildlife habitat, and will also reduce wildlife mortality that could be caused by the Project. Some loss of vegetation communities and wildlife habitat and mortality of wildlife is predicted, but the mitigation will reduce potential interactions with vegetation and wildlife. Vegetation communities and habitat for wildlife species will remain available in the surrounding landscape.

3.2.4.2.3 Residual Project Environmental Effect for Change in Vegetation and Wildlife

Construction activities will result in a temporary disturbance (single event) during construction to between 190.5 and 207.8 ha of vegetation communities and wildlife habitat. All forested upland, treed swamps, and treed bogs, and potentially tall shrub swamps will require clearing. The majority of this habitat will represent a change, but not permanent loss, of vegetation communities and habitat. With mitigation, permanent habitat loss will be restricted to approximately 0.06 ha of vegetation communities and wildlife habitat within the footprints of permanent structures. The Project will result in a low amount of fragmentation, reducing the amount of interior forest contiguous with the LAA by 7.9 ha, from 378.5 ha to 371.6 ha. This reduction is relatively small for a project of this size, and is not expected to interact with species in the LAA which use interior-forest, or with wildlife migration.

With mitigation, the construction of the Project is expected to interact minimally with SAR or SOCC, e.g., surveys have identified locations of SOCC which will largely be avoided during pole placement and access road upgrades, but will result in low adverse changes to vegetation communities and wildlife habitat within the PDA and LAA, and will increase fragmentation slightly within the LAA which are medium-term (for cleared areas) and permanent (for areas within the permanent footprint) in duration. These changes will occur in a single event, and will be reversible after decommissioning.

During operation, vegetation management and access road maintenance will result in disturbance of vegetation communities and wildlife habitat. These areas will have been previously disturbed during construction. With mitigation, this activity will result in low adverse changes restricted to the PDA, long-term in duration, occurring at regular intervals, and will be reversible.

During operation, there is also potential for the presence of the transmission line to result in direct mortality of birds through transmission line strikes. The majority of the Project will run west-east, parallel to an existing transmission line, and thus the operation of the Project will not represent a new environmental effect in this area. The Project is also parallel to the Atlantic Flyway, the major bird migration pathway, which will reduce interactions compared with a transmission line perpendicular to the migration path (APLIC 2012). In areas where the Project is adjacent to potential staging areas, such as the MacDonald's Pond DU site, birds may need to cross the Project to access these sites. In such areas, appropriate avian avoidance devices (such as line markers) will be used, which can lower collision rates by up to 80% (APLIC 2012), although some studies suggest the effectiveness of these avoidance devices is much lower (Barrientos *et al.* 2011). With mitigation, this activity will result in low adverse changes restricted to the LAA, long-term in duration, occurring continuously, and will be reversible.

During and following decommissioning and abandonment, the site will be restored to natural vegetation. This will represent a low magnitude, positive change to vegetation and wildlife within the LAA, which will be medium-term in duration and occurring in a single event, which will be reversible.

3.2.4.3 Assessment of Change in Wetland Area or Function

3.2.4.3.1 Project Pathways for Change in Wetland Area or Function

Construction

The construction of the Project will result in the loss of wetland habitat, and a change from forested wetland types to shrub or graminoid wetland types. The majority of wetlands with the potential to experience change resulting from clearing are common within the LAA, with the exception of treed bogs. According to the land classification mapping that is available approximately 48% of the treed bogs within the LAA are located within the PDA. Because this mapping for wetlands is less accurate than the field-delineated wetlands within the PDA, it's likely that there are additional treed bogs within the LAA that are not currently mapped, and the percentage of treed bogs within the LAA that are within the PDA is much lower.

Site preparation of the land-based transmission lines includes temporary access roads preparation, clearing of the corridor, and grubbing of the pole locations, which have potential to result in the direct loss of wetland habitat. Clearing will remove trees and shrubs and damage other plants. Grubbing will completely remove wetland vegetation and some soil, where it occurs. Machinery working on site will compact remaining soil layers. These construction activities can result in a change in wetland hydrology, though in many of the areas wetland area will be lost. Cross RoW drainage may be altered where roadways and rutting impound water and culverts are used for access road crossing over areas

with heavier surface water flow across the RoW. Removing soil can change the character of wetlands and supported floral and faunal communities.

Site preparation activities can alter wetland habitat directly within the corridor, and indirectly in adjacent areas, through changes in hydrology as well as edge effect. Edge effect results from changes in abiotic factors such as light availability, humidity, wind, and temperature, which can change which plants are able to grow and thrive in an area. The clearing of the corridor and operation of machinery can also provide opportunity for the spread of invasive plants which tend to be strong competitors in disturbed habitats, and could alter the character and habitat suitability of wetlands in and near the RoW.

The physical construction of land-based transmission lines will require excavation of two holes for each pole location. The area around these holes may be subject to additional disturbance that may result in small areas of permanent wetland loss. Although construction activities will result in disturbance to and a small loss of area of wetlands within the PDA, a five year monitoring program on another, larger transmission line project in New Brunswick has demonstrated no long-term loss of wetland function (AMEC 2012).

Site preparation and physical construction activities has potential to change the EIW along the Tantramar River. However, most of this wetland is not currently forested, so alterations will be limited to the areas where pole installation is required and these will be minimized within sensitive wetland areas.

Construction activities are expected to result in a lasting change in approximately 43.6 ha of wetland within the PDA that is currently forested where the trees will be removed. During operation, these wetlands will become shrub, graminoid, or forb-dominated wetlands once vegetation regenerates. This alteration is not considered a significant effect as this wetland area will not be permanently lost, but shifted from the most common wetland type (forested wetlands comprise more than 60% of wetland habitat in the PDA), to less common wetland types. The remaining 28.9 ha of wetland with low vegetation cover such as graminoids or shrubs may be temporarily altered where avoidance is not possible, but recovery is expected where permanent installations such as access roads are not present.

Operation

During operation, vegetation management, access road maintenance (particularly, vegetation control), and increased ATV use have the potential to result in adverse environmental effects resulting in the alteration of wetland habitat. These areas will have been disturbed during initial construction activities but recovery may be impeded by any of these activities. Continued traffic on the corridor can lead to ongoing alterations to cross RoW drainage, vegetation regeneration, and continual or periodic reversion to early successional stages in and around traffic areas. Ongoing disturbance can also provide continued opportunities for invasive species introduction. However, given that most of the PDA follows existing transmission line for most of its length, it is not likely that ATV traffic will increase within the new RoW.

Decommissioning and Abandonment

Decommissioning and abandonment activities have the potential to result in positive environmental effects to wetlands. Vegetation management will no longer be required, and trees will be allowed to regenerate within wetlands. Pole removal will require temporary and localized disturbance to wetlands where poles are located; however, following this, these areas will be allowed to naturally restore to wetland habitat, resulting in a net neutral environmental effect on wetlands.

3.2.4.3.2 Mitigation for Change in Wetland Area or Function

The following well-established practices to reduce the interaction between the Project and wetland area and function will be implemented during construction and operation.

- Restrict clearing activities to the minimum amount required, particularly around wetlands.
- Employ standard erosion and sedimentation control measures, particularly to avoid silt laden runoff into wetlands.
- Implement standard dust control measures to avoid siltation of wetlands.
- Use quarried, crushed material for temporary road access in and near wetlands, to reduce the risk of introducing or spreading exotic and/or invasive vascular plant species.
- Flag wetlands outside of the PDA and restrict additional disturbance such as temporary work areas to upland areas.
- Restrict grading to essential areas when working in or near wetlands.
- Reduce road construction in wetland areas with the use of brush mats and corduroy roads.
- Manage invasive species through minimizing operation activities in wetland areas and clean equipment before entering a wetland.
- Use mechanical clearing in wetlands and adjacent areas.
- If required, compensate for the loss of wetland and EIW function according to a plan to be developed in coordination with, and approved by, NBDELG.
- Monitor the Upper Tantramar Marsh to observe recovery of vegetation and wildlife.

3.2.4.3.3 Residual Project Environmental Effects for Change in Wetland Area or Function

There are approximately 50.8 ha of wetlands within the PDA that may be disturbed during construction. Some wetlands within the PDA will be reclaimed to approximately pre-construction topography and hydrology conditions following construction. In particular, there are 19.5 ha of wetland habitat in the PDA that falls within low-growing vegetation types; if disturbed, this wetland type will likely make a recovery to pre-construction vegetation conditions. There are an additional 31.4 ha of forested wetlands within the PDA that will shift from treed wetlands types to lower growing vegetation types. Transmission line pole and access road upgrades are expected to permanently remove wetlands from the PDA for the duration of operation and will require compensation.

The PDA (and likely LAA) is 22.7% wetland; of this amount, approximately 60% is forested wetland. While coastal wetlands in New Brunswick are thought to have reached critical levels of loss since European settlement, there are no coastal wetlands within the PDA. With 22.7% of the PDA and over 15% of the LAA as wetland habitat, critical levels of loss have not occurred in this area. With forested wetlands as

the most common type of wetland in the area, the alteration of some portions of these to other types of wetlands will not result in a net loss of wetland function provided areas of permanent loss are compensated for.

With the proper implementation of mitigation, it is likely that wetlands with low-growing vegetation types will recover, forested wetlands will recover to other native vegetation communities, and pre-disturbance hydrological functions will be restored. However, monitoring will be necessary in the Upper Tantramar Marsh to observe recovery of vegetation and wildlife values in that wetland. Mitigation will be re-evaluated should recovery be impeded or reversed as a result of residual effects of Project-related disturbance.

Although monitoring of other transmission line projects in New Brunswick has indicated that loss of wetland function related to construction is temporary (AMEC 2012), all permanently lost wetland function within the footprint of installations such as poles, temporary access roads, or changes in grade that prevent wetland recovery, will be compensated for (if required) according to a wetland compensation plan developed in cooperation with NBDELG.

Although the Project will result in the small permanent loss of some wetland area within the PDA during the construction phase (amount to be calculated following the final design process), which will not be reversible, the Project is not expected to result in a net loss of wetland function within the RAA. Thus the loss of wetland area and wetland function will be medium-term (restricted to the period between the start of construction and the completion of wetland compensation (if required) or the return of the wetland to its pre-construction functionality). With successful wetland mitigation the change in wetland area and function during construction will be adverse, low magnitude, and medium term (aside from a small amount of permanent loss associated with pole footprints), restricted to a single event, and reversible.

During operation of the Project there will be integrated vegetation management along the RoW. Mechanical cutting will occur within wetlands along the RoW, which will be managed as shrub, forb, graminoid, or other wetland types. With mitigation, this disturbance will result in a change in wetland area and function that will be adverse, low magnitude, within the LAA, and medium-term in duration, occurring at regular (or slightly irregular) intervals (i.e., depending on the growth rate of the vegetation), and reversible.

During decommissioning and abandonment, vegetation management will cease and trees will be allowed to regenerate within wetlands. During pole removal, there will be temporary and localized disturbance to wetlands where poles are located, but following this, these areas will be allowed to naturally restore to wetland habitat. This activity will be positive, low magnitude, within the PDA, long-term in duration, restricted to a single event, and reversible.

3.2.4.4 Summary of Residual Project Environmental Effects

A summary of residual environmental effects on the Terrestrial Environment is provided in Table 3.19.

Table 3.19 Summary of Project Residual Environmental Effects on the Terrestrial Environment

Residual Effect	Residual Environmental Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socioeconomic Context
Change in Vegetation and Wildlife	C	A	L	LAA	P/MT	S	R	D/U
Change in Vegetation and Wildlife	O	A	L	PDA	LT	R/C	R	D
Change in Vegetation and Wildlife	D	P	L	LAA	MT	S	R	D
Change in Wetland Area or Function	C	A	L	LAA	MT	S	R	D/U
Change in Wetland Area or Function	O	N	L	PDA	LT	R/IR	R	D
Change in Wetland Area or Function	D	N	L	LAA	LT	S	R	D
KEY See Table 3.13 for detailed definitions. Project Phase: C: Construction O: Operation D: Decommissioning and Abandonment Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High	Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Duration: ST: Short-term; MT: Medium-term LT: Long-term P: Permanent NA: Not applicable			Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible Ecological/Socioeconomic Context: D: Disturbed U: Undisturbed				

3.2.5 Determination of Significance

3.2.5.1 Significance of Residual Project Effects

The construction phase of the Project will result in both temporary and permanent disturbance to vegetation communities and wildlife habitat, including wetland, within the PDA. With the exception of treed bogs (and to a lesser extent, bogs), these are limited to vegetation communities and habitat types which are abundant within the LAA. The total amount of these habitats within the PDA is relatively low (1.2 ha and 0.3 ha respectively). Any permanent loss of wetland will be compensated for; therefore, no net loss of function is predicted. With mitigation, the Project is not expected to interact directly with SAR or SOCC. The operation and decommissioning and abandonment phases of the Project will result in limited changes to vegetation, wildlife, and wetlands, through vegetation clearing and some soil

disturbance (during pole removal) of a previously disturbed area. With mitigation and environmental protection measures, residual environmental effects on the Terrestrial Environment during all phases of the Project are predicted to be not significant.

3.2.6 Prediction Confidence

Prediction confidence in the assessment of vegetation, wildlife habitat, and wetlands is high because of the quality of the desktop and field data available and application of well-established and proven mitigation and environmental protection measures. Prediction confidence in the assessment of wildlife (specifically birds) is medium because of the lack of results of field data. If the results of the 2015 bird survey work support the results of this environmental assessment, the prediction confidence will then be high.

3.2.7 Follow-up and Monitoring

Follow-up work for this assessment of environmental effects on the Terrestrial Environment will include analysis of 2015 bird survey work, vegetation and wetland field surveys of the landing site at Cape Tormentine, vegetation and wetland surveys of areas of the Upper Tantram Marsh that were not accessible during the 2014 vegetation and wetland work, and pre-construction southern twayblade surveys in appropriate habitat within the Memramcook to Bayview section of the Project.

Monitoring is suggested for the Upper Tantram Marsh area to observe recovery of vegetation and wildlife values in that wetland. No monitoring is currently deemed necessary in any other areas for this assessment, but this will be re-evaluated after the above mentioned follow-up work.

3.3 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON LAND USE

Land Use refers to the current and future use of public and private land and resources. It includes industrial and commercial use, private ownership, and use of the land for recreational purposes. Land Use was selected as a VC in consideration of the potential Project interactions with current uses of land in the immediate vicinity of the Project.

3.3.1 Scope of Assessment

The scope of the Land Use VC is based on applicable regulations and policies, professional judgement of the study team, and knowledge of and potential interactions.

Current Use of Land and Resource Use for Traditional Purposes by Aboriginal Persons is addressed separately in Section 3.6. Other VCs linked to the Land Use VC are described in Section 3.1 (Freshwater Environment) and Section 3.2 (Terrestrial Environment).

3.3.1.1 Regulatory and Policy Setting

In New Brunswick, use of Crown Land (e.g., forestry) is managed by the New Brunswick Department of Natural Resources (NBDNR). NBDNR also manages wildlife harvesting on both public and private land.

Land use planning in New Brunswick is based on the *New Brunswick Community Planning Act*. Within incorporated areas, the *New Brunswick Municipalities Act* also applies. Within un-incorporated areas, Regional Service Commissions provide planning and management services including regional and local planning, solid waste management, regional policing, regional emergency measures planning, and regional sport, recreational and cultural infrastructure (GNB 2012).

Additional provincial legislation and regulations relevant to Land Use include:

- *Crown Lands and Forests Act*: Regulates development, use, protection, and management of Crown lands resources.
- *Fish and Wildlife Act*: Regulates hunting, fishing and trapping on private and public land, and establishes protected areas under *Wildlife Refuges and Wildlife Management Areas Regulation*.
- *Protected Natural Areas Act*: Protects the biological diversity of fauna and flora within the Province and the relationship between such fauna and flora and the environment by protecting, conserving and managing natural landscapes and habitat.

Federal regulations relevant to Land Use include the *MBCA*, *SARA*, and the *Navigation Protection Act* (NPA). Migratory birds and their habitats, as well as their hunting, is managed by the Canadian Wildlife Service (CWS) under the *MBCA*. CWS is also responsible for the protection of listed species under *SARA*. The *NPA* is administered by Transport Canada.

3.3.1.2 The Influence of Consultation and Engagement on the Assessment

At the time of writing, there are no consultation or engagement results relevant to land and resource use activities within the RAA. NB Power will continue its ongoing consultation and engagement with potentially affected parties in the region.

3.3.1.3 Potential Environmental Effects, Pathways and Measurable Parameters

Based on knowledge of land uses in the vicinity of the Project, and an understanding of the Project and its associated activities, the following potential environmental effect was selected for the assessment of Land Use: change in land use.

Table 3.20 summarizes the potential effects, effect pathways, and measurable parameters for the Land Use VC.

Table 3.20 Potential Environmental Effects, Effects Pathways and Measurable Parameters for Land Use

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in Land Use	<ul style="list-style-type: none"> • Project activities during construction will result in temporary access restrictions. • Project activities will result in disturbance to and loss of private land. • Project footprint will be cleared of merchantable timber and will no longer be available for forestry activities during operations. • Operation activities for the Project (e.g., maintenance of the RoW) will result in permanent loss of habitat for small mammals that are hunted in the area. 	<ul style="list-style-type: none"> • Area (ha) of land use affected (e.g., recreational use). • Habitat loss associated with the Project (ha). • Attribute data on land uses (e.g., forestry, hunting) within area affected (ha/km²). • Change in Sound Level.

3.3.1.4 Boundaries

3.3.1.4.1 Spatial Boundaries

The spatial boundaries for the environmental effects assessment of Land Use are defined below.

- **Project Development Area (PDA):** The PDA comprises the immediate area of physical disturbance associated with the construction and operation of the Project. The PDA includes: the existing substation in Memramcook where upgrades to the existing substation will occur within the substation footprint; a 40 km long, 30 m wide transmission line RoW from Memramcook to Melrose and a 17 km long, 60 m wide transmission line RoW from Melrose to Cape Tormentine; a cable termination site; and a 10 m easement around cable lines. The total area of the PDA is approximately 225.6 ha (Figure 3.4).
- **Local Assessment Area (LAA):** The LAA is the maximum area within which Project-related environmental effects can be predicted to occur or measured with a reasonable degree of accuracy and confidence, and encompassing the likely zone of influence. For Land Use, this area includes the PDA plus an additional 500 m buffer around the PDA (see Appendix B for Figures outlining the assessment area).
- **Regional Assessment Area (RAA):** The RAA is the area within which Project-related environmental effects may overlap or accumulate with the environmental effects of other projects or activities that have been or will be carried out. For this VC, the RAA is defined as the two ecodistricts that surround the Project (i.e., Kouchibouguac and Petitcodiac Ecodistricts). These ecodistricts are both within the Eastern Lowlands Ecoregion and together total 7,370.1 km². The RAA encompasses the terrestrial portion of the PDA, and was selected to be consistent with the assessment areas for the Terrestrial Environment (Section 3.2), because it is of central importance to land use (Figure 3.2)).

3.3.1.4.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on Land Use include construction, operation, and decommissioning and abandonment. Construction in the terrestrial environment is expected to occur over a period of 16 months. Construction of the landfall site and transmission line from Melrose to Cape Tormentine is expected to be completed over 9 to 10 months, between March and December 2016. Construction of transmission line between Melrose and Memramcook is expected to begin in September 2016 with completion expected to take place in June 2017. Operation will begin following construction and is anticipated to continue for the life of the Project (approximately 40 years). Decommissioning and abandonment would take place following the useful service life of the Project and which would be carried out in accordance with regulations in place at that time.

3.3.1.5 Residual Environmental Effects Description Criteria

Table 3.21 provides the criteria that are used to characterize and describe Project residual environmental effects on Land Use.

Table 3.21 Characterization of Residual Environmental Effects on Land Use

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect.	Positive —an effect that moves measurable parameters in a direction beneficial to Land Use relative to baseline. Adverse —an effect that moves measurable parameters in a direction detrimental to Land Use relative to baseline. Neutral —no net change in measureable parameters for the Land Use relative to baseline.
Magnitude	The amount of change in measurable parameters (including area of land available for activity, or level of disturbance,) relative to existing conditions.	Negligible —affects a minimal number of land users. Low —affects a small number of land users. Moderate —measurable change but less than the majority of land users. High —affects the majority of land users.
Geographic Extent	The geographic area in which an environmental, effect occurs.	PDA —residual effects are restricted to the PDA. LAA —residual effects extend into the LAA. RAA —residual effects extend into the RAA.
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase.	Single event —occurs once. Multiple irregular event —occurs at no set schedule. Multiple regular event —occurs at regular intervals. Continuous —occurs continuously.

Table 3.21 Characterization of Residual Environmental Effects on Land Use

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived.	Short-term —limited to the construction phase. Long-term —effects continue throughout the operations phase. Permanent —effects continue beyond the life of the Project.
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases.	Reversible —the effect is likely to be reversed after activity completion and reclamation. Irreversible —the effect is unlikely to be reversed.
Ecological and Socioeconomic Context	Existing condition and trends in the area where environmental effects occur.	Undisturbed —area is relatively undisturbed or not adversely affected by human activity. Disturbed —area has been substantially previously disturbed by human development or human development is still present.

3.3.1.6 Significance Definition

A significant adverse residual environmental effect on Land Use will occur if proposed activities for the Project are not compatible with land use activities as designated through a regulatory land use process, and/or the proposed use of the land will create a change or disruption that widely restricts or degrades present land uses to a point where the activities cannot continue at current levels and for which this change is not mitigated.

3.3.2 Existing Conditions for Land Use

3.3.2.1 Methods

A combination of spatial analysis and baseline research was used to characterize the types and extent of land use activity in the LAA and RAA. Baseline research included a review of online sources, as well as directed interviews with representatives of relevant groups and organizations. Information on existing conditions was drawn from the following sources:

- GIS databases
- published maps and aerial photography
- Department of Natural Resources
- Department of Energy and Mines
- municipal governments
- community organizations

Existing conditions with respect to VCs linked to Land Use are described in Volume 4, Sections 2.1.2 (Atmospheric Environment), 3.2 (Freshwater Environment), and 3.3 (Terrestrial Environment).

3.3.2.2 Overview

The New Brunswick Project components are entirely located in Westmorland County. An existing substation in Memramcook will be upgraded. The overhead transmission line follows an existing transmission line RoW until it reaches the community of Melrose. The corridor between Melrose and Bayfield, NB, follows an existing and unused NB Power easement approximately 12 km in length. Land easements will be required for the remainder of the transmission line corridor in NB.

The majority of the PDA is forested land, and accounts for 160 ha, or approximately 70% of the PDA. The presence of actively managed woodlots for forest harvesting in the PDA were noted by archaeological field crews during walkover activities in 2014. The crew noted the presence of clear-cutting equipment, as well as recently used logging roads. Within the LAA, forested area accounts for 4,442 ha, or approximately 73% of the LAA.

With the exception of forestry related activity, industrial activity within the PDA is limited. While there are no NBDNR registered gravel pits or quarries within the LAA, sand and rock quarries were identified by field crews during archaeological walkover activities in 2014 near the communities of Bayfield and Malden and where Woodlot and Burnside Road intersects the RoW (Figure 3.2). Petroworth Resources Inc. has a registered shale gas tenure that overlaps the PDA which is noted as being under review. Recently, the New Brunswick government decreed a moratorium on shale gas development.

Agricultural land within the PDA is limited, with a total of 8.9 ha, or approximately 4% of the PDA, irregularly distributed in patches throughout the PDA. Farming activity within the PDA includes raising livestock and crop production, including fruits and vegetables. Based on aerial photo interpretation and site reconnaissance along the existing RoW, a number of potential agricultural areas were noted within the LAA. This area has been calculated at 312 ha, or approximately 5% of the LAA, with areas concentrated near major watercourses and along the eastern end of Route 16 near Cape Tormentine (Ken Holyoke 2015).

Both the PDA and LAA are within Wildlife Management Zone (WMZ) 25. This zone is open to big game and furbearer recreational hunting as well as fur bearer harvesting. No antlerless deer permits were issued for WMZ 25 in 2014 (NBDNR 2015). Cape Jourimain National Wildlife Area (NWA) borders the Northumberland Strait, 2 km northwest of the village of Cape Tormentine, approximately 1.3 km from the PDA. The NWA provides protection of habitats at the coastal site through wildlife habitat and resource management (Cape Jourimain Nature Centre 2015).

Wildlife harvesting occurs within the LAA with rabbit, coyote, fox, weasel, raccoon, mink, muskrat, otter, beaver, fisher, skunk, and squirrel are among the furbearer species trapped or snared (NBDNR 2014). Detailed information regarding the extent of traplines in the LAA is not available. The New Brunswick Trappers and Fur Harvesters Federation (NBTFHF) provides information and education to trappers and facilitates the management of furbearer resources in the Province. Objectives of the NBTFHF include cooperation with national, provincial and regional public authorities (NBTFHF 2015).

Recreational fishing refers to angling, sport fishing and other non-commercial fishing activity. The Province is divided into eight Recreational Fishing Areas (RFAs). The Project is located in the Southeast

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT

September 30, 2015

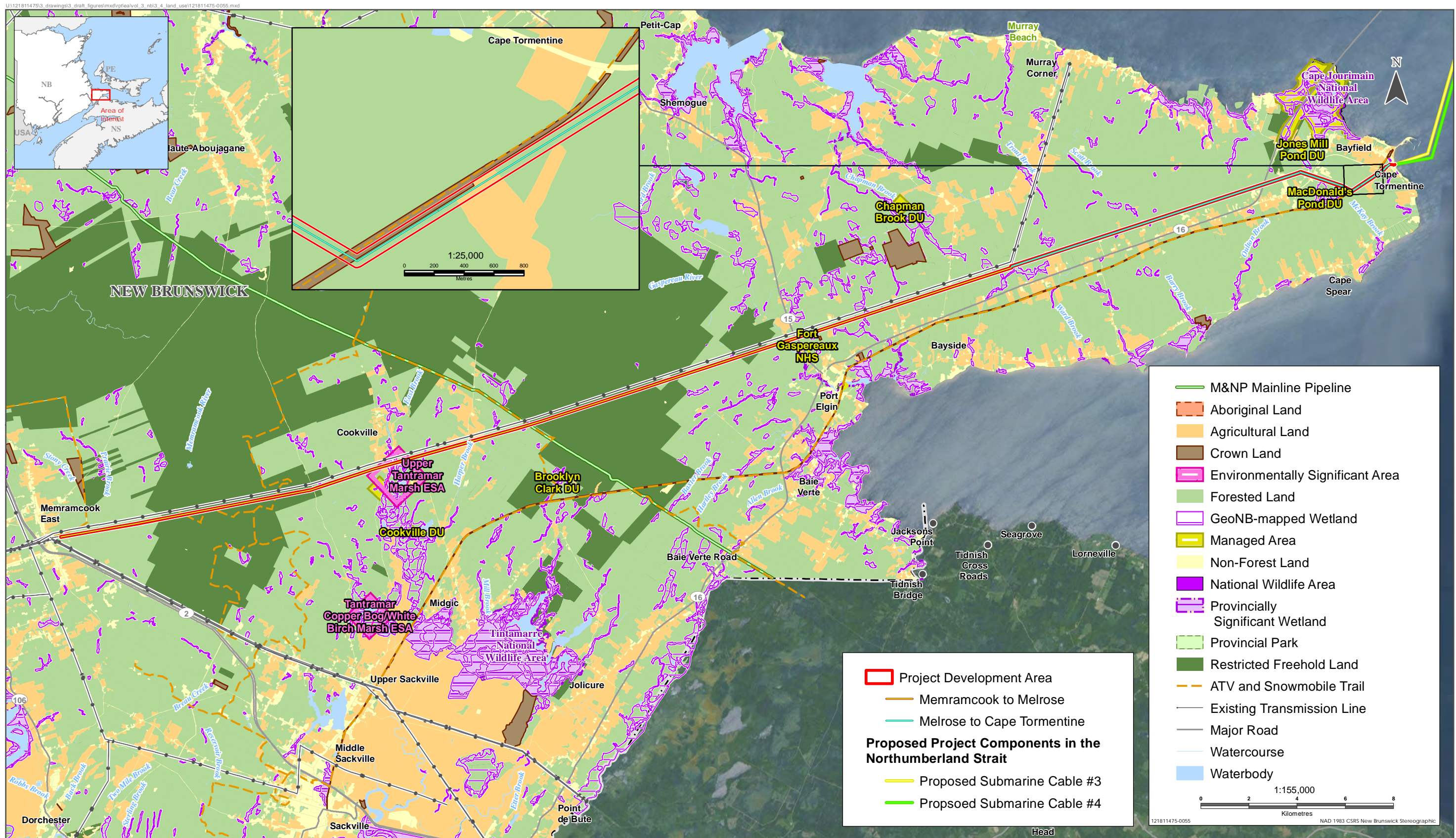
RFA (RFA 4), and the Lower Saint John RFA (RFA 6). Both the Tantramar River and the Gasperau River have the potential for recreational fishing. Limited access to the Tantramar River was noted by aquatic field crews. Access to the Tantramar River in the PDA is limited by wetlands in the riparian zone. There is likely little to no fishing in the area of the River that intersects the PDA. The Gasperau River intersects the PDA, and is noted as having potential for American shad, American eel, brook trout, gaspereau, striped bass and rainbow smelt within 1 km of the crossing. There is likely fishing for American shad and brook trout within the PDA (Matt Steeves, pers. Comm., Stantec 2015, Aquatic Biologist). Walking trails were noted by aquatic field crews adjacent to the watercourse. Presence of Atlantic salmon may occur in each of the watercourses, though currently there is a moratorium on all anadromous Atlantic salmon fisheries in the RFA (GNB 2015). Additionally, there is a bag limit for American shad and brook trout set at five individual fish per day (GNB 2015).

Crown land within the PDA is limited to three properties (Figure 3.3). Three properties designated as crown land are managed by NBDNR and form part of the NB Trail system. Collectively, this area totals approximately 1.6 ha, or less than 10% of the total PDA. These three trails form a portion of the TransCanada Trail, an approximately 58 km route that links Sackville with Port Elgin via the original right-of-way of the New Brunswick and PEI Railway and meets the existing transmission line corridor near Cape Tormentine, and travels along the RoW where it ends at the Cape Tormentine lighthouse (Figure 3.3) (NBTC 2015a).

The New Brunswick All-terrain Vehicle Federation (NBATVF) is the designated trail manager for the New Brunswick trail network, which is divided into seven regions (GNB 2011). The RAA is fully contained within Region 5, which includes 14 individual clubs covering trail territory from Miramichi to Saint John. Some of the club trails are known to cross the PDA; however official maps are not available.

The New Brunswick Federation of Snowmobile Clubs (NBFSC) is a non-profit organization that manages the snowmobile trails on behalf of the province (GNB 2009). Club-maintained trails are widespread throughout the RAA. These are maintained by NBFSC. Both officially designated provincial and local NBFSC trails cross the PDA (Figure 3.3). The NBFSC trail network is divided into eight zones and the RAA is located in Zone 8. In addition to the NBFSC network, there are two connector trails, maintained by local clubs which cross the existing transmission line at two locations (Figure 3.3).

An analysis of aerial photography for the area indicates that residential land use is limited in the PDA, and is concentrated in three areas: Memramcook, Bayfield, and Cape Tormentine. There are standalone homes and farms visible from the existing transmission corridor. These properties contain small clusters of four or five buildings, including houses, barns, and other out-buildings.



Sources: Base Data - Natural Resources (2011), Project Data from Stantec or provided by NB Power / MECL, Imagery - ArcGIS Map Service World Imagery, Natural Resources (2011).

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



3.3.3 Project Interactions with Land Use

Potential Project interactions with Land Use are presented in Table 3.22. Following the table, justification is provided for non-interactions (no check marks).

Table 3.22 Potential Project-Environmental Interactions and Effects on Land Use

Project Components and Physical Activities	Potential Environmental Effects
	Change in Land Use
Construction	
Site Preparation for Land-Based Transmission Lines in New Brunswick	✓
Physical Construction of Land-Based Transmission Lines in New Brunswick	✓
Landfall Construction (New Brunswick)	✓
Upgrading of Electrical Substation (New Brunswick)	✓
Inspection of and Energizing of the Transmission Lines	—
Clean-up and Re-vegetation of the Transmission Corridor	✓
Emissions and Wastes	✓
Transportation	—
Employment and Expenditure	—
Operation	
Energy Transmission	✓
Vegetation Management	✓
Infrastructure and Inspection, Maintenance and Repair (Transmission Lines and Substations)	✓
Access and Road Maintenance	✓
Emissions and Wastes	✓
Transportation	—
Employment and Expenditure	—
Decommissioning and Abandonment	
Decommissioning	✓
Reclamation	✓
Emissions and Wastes	✓
Employment and Expenditure	—

During construction, inspection and energizing of the transmission lines will occur within the cleared RoW. This is a non-invasive activity and the physical presence of inspectors will not interfere with the presence of other land users in the area.

During both construction and operation, the transportation of people and materials is anticipated to be within current traffic norms and as a result will not interfere with land and resource users. Due to the relatively short timeline for construction, employment and expenditures are not expected to interact

with land and resource use during construction. During operation, there will be no interaction as a result of the small number of employees. Other Project effects related to the Socioeconomic Environment are assessed in Section 3.4.

3.3.4 Assessment of Residual Environmental Effects on Land Use

3.3.4.1 Analytical Assessment Techniques

Potential Project effects have been identified through a combination of spatial analysis and baseline research into the extent of land use activity in the LAA and RAA. The assessment of potential Project residual effects references, as appropriate, other assessment sections including Sections 2.1.2 (Atmospheric Environment), Section 3.1 (Freshwater Environment), and Section 3.2 (Terrestrial Environment). The analytical methods for these VCs are therefore indirectly applied to the Land Use assessment.

3.3.4.2 Assessment of Change in Land Use

3.3.4.2.1 Project Pathways for Land Use

Approximately 70% of the PDA consists of forested lands, including actively managed private woodlots within the PDA. The PDA also includes agricultural lands and, based on aerial photo interpretation, farmed properties have been identified within the LAA. However, only 4% of the PDA has been classified as agricultural land by Service New Brunswick (SNB 2015). Both woodlots and agricultural properties within the PDA will experience disturbance as a result of site preparation, physical construction of the transmission lines and landfall construction. These activities include vegetation clearing and grubbing that will result in the alteration of lands within the PDA during the construction phase. This disturbance will include harvesting of merchantable timber where required. This disturbance will continue throughout operation as a result of vegetation management activities, which will include regular cutting.

There are a number of trails that intersect the PDA, including portions of TransCanada Trail and individual club trails managed by the NBATVF and NBFSC. These trails are used for a variety of activities, including walking, cycling, and snowmobiling (NBTC 2015b). Outside of established trails, transmission corridors are frequently used as informal trails for a variety of recreational activities, including use of recreational vehicles, cross country skiing and snowshoeing. Site preparation and construction activities noted above will result in temporary access restrictions to trail segments that intersect the PDA. However, maintenance activities during operations will result in increased access throughout the RoW, which can provide additional opportunities for a wide variety of recreational activities including trail use. While not officially permitted by NB Power, it is acknowledged that power transmission RoWs are widely used for a variety of recreational activities by people at their own risk. The RoW also has the potential to improve access to areas used for consumptive recreation (i.e. hunting, fishing, and trapping). The maintenance of roads and access associated with the Project will also provide additional and/or improved access throughout operation.

Site preparation and other construction activities are expected to result in a permanent loss of 0.06 ha of vegetation communities and wildlife habitat, and change/disturbance to a minimum of 190.5 ha of

vegetation communities and wildlife habitat. This change/disturbance has the potential to reduce opportunities for trapping in the area and the availability of resources. During operations vegetation management will continue to affect trapping activity as a result of continued habitat disturbance.

Within WMZ 25, big game hunting has been identified as a popular activity and the loss of habitat has the potential to affect target big game species. However, following construction, the presence of the transmission line may provide additional opportunities to access big game hunting areas due to the use of the cleared area by both big game and hunters.

In addition to the disturbance and access restrictions noted above, the Project will result in temporary noise disturbances within the PDA that have the potential to affect the presence of wildlife in the area. Throughout both construction and operations, atmospheric emissions were found to be transient and short term and no adverse effects on users or wildlife were identified. Construction will be limited to daytime hours, if possible, to reduce disturbance and annoyance to the nearest residences.

3.3.4.2.2 Mitigation for Land Use

Interaction with tenured land use will be managed through the use of standard mitigation measures. These measures are described below:

- owners of private land will be consulted and accommodated prior to construction
- if available, local tree harvesters will be used for vegetation clearing, where possible
- all cleared merchantable timber will become the property of the contractor and any remaining vegetation will be stockpiled and/or chipped on site
- access restrictions will be defined in advanced and access restrictions will be limited in size to reduce the interactions with land and resource users
- in order to reduce disturbance, sites requiring little or no modification, such as forestry landings or harvested fields, will be used for temporary staging areas
- activities will be managed by MECL and NB Power in accordance with each company's EPPs and the HSE policies

3.3.4.2.3 Residual Project Environmental Effect for Land Use

Construction will result in the loss of 0.6 ha of lands available for forestry or agricultural activities, with change or disturbance affecting 190.5 ha lands. This area subject to disturbance represents 0.03% of the LAA. However, both disturbance and loss will be mitigated through the measures described in Section 3.3.4.2.

Access restrictions resulting from construction activities will result in short term restrictions to portions of the PDA. These will be limited in extent as a result of Project scheduling. Communication with users regarding access restrictions will allow users to plan activities in advance and reduce the magnitude of lost opportunities. In the long term, the presence of the Project will result in increased access. This is a positive effect on trails in the PDA and LAA, possibly also including increased opportunities for consumptive land use activities (i.e. hunting, fishing and trapping).

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

Both hunting and trapping have been identified as occurring in the area. However, both the potential loss/disturbance of habitat cannot be quantified at this time and the effect on specific traplines is not known. This will be managed through consultation and engagement; as a result of the lack of information, a conservative approach to characterization has been taken.

As a result of the nature of the Project pathways and the mitigation measures defined in Section 3.3.3, the residual effects on land use are anticipated to be positive and adverse, moderate in magnitude, limited to the PDA, and reversible.

3.3.4.3 Summary of Residual Project Environmental Effects

The residual Project environmental effects for Land Use are summarized in Table 3.23.

Table 3.23 Summary of Project Residual Environmental Effects on Land Use

Residual Effect	Residual Environmental Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socioeconomic Context
Change in Land Use	C/O	A/P	M	PDA	ST/P	C	R	D
KEY See Table 3.21 for detailed definitions. Project Phase: C: Construction O: Operation D: Decommissioning and Abandonment Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High		Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Duration: ST: Short-term; MT: Medium-term LT: Long-term NA: Not applicable			Frequency: S: occurs only once MIR: Multiple irregular event MR: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible Ecological/Socioeconomic Context: D: Disturbed U: Undisturbed			

3.3.5 Determination of Significance

3.3.5.1 Significance of Residual Project Effects

Based on the predicted characterization of mitigation measures and residual effects described above, it is anticipated that Project activities will not cause a disruption, wide restriction, or degradation of use

to a point where it cannot continue at current levels. Therefore, the residual effects on Land Use are predicted to be not significant.

3.3.6 Prediction Confidence

The level of confidence in the predictions for project-related residual effects on Land Use is high, based upon the understanding of current baseline conditions, the level and nature of the described interaction, and the known effectiveness of mitigation measures.

3.3.7 Follow-up and Monitoring

Follow-up and monitoring programs are not considered necessary for this assessment.

3.4 ASSESSMENT OF POTENTIAL EFFECTS ON SOCIOECONOMIC ENVIRONMENT

Socioeconomic Environment is selected as a VC because of potential interactions between the Project and the local, regional, and provincial economies, accommodations and public services. Project employment and purchases of goods and services from local and regional businesses in New Brunswick (NB) will provide new employment and sources of income for residents and businesses. Interactions between the Project and local, regional, and provincial economies could also have negative consequences in terms of potential for wage inflation, labour shortages, increased demand for accommodations and increased demand for public services (unaccounted for through current municipal planning).

3.4.1 Scope of Assessment

3.4.1.1 Regulatory and Policy Setting

Pursuant to Schedule A of the NB EIA Regulation—*Clean Environment Act* the Project is considered an 'undertaking' and therefore requires registration under the EIA Regulation. Outlined in 'A Guide to Environmental Impact Assessment in New Brunswick' the registration document must consider socioeconomic effects which could result from the Project such as changes in housing availability, income levels, employment opportunities, municipal income, and municipal expenditures, among others (A Guide to Environmental Assessment in New Brunswick 2012).

3.4.1.2 The Influence of Consultation and Engagement on the Assessment

Issues related to the Socioeconomic Environment identified during consultation and engagements activities have been related to employment opportunities for local First Nations.

3.4.1.3 Potential Environmental Effects, Pathways and Measurable Parameters

Potential effects on the Socioeconomic Environment associated with the Project derive from changes in demand for labour (includes consideration of wage inflation and population growth) and Project expenditures on goods and services. Project demands for labour and goods and services can result in

both beneficial and adverse effects. The distribution of beneficial effects may not be evenly distributed among populations with some residents in a better position to receive economic benefits than others. Similarly, adverse effects may affect some residents more than others.

Potential environmental effects, effect pathways and measurable parameter(s) and units of measurement are provided in Table 3.24.

Table 3.24 Potential Environmental Effects, Effects Pathways and Measurable Parameters for Socioeconomic Environment

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in Employment and Economy	<ul style="list-style-type: none"> Project associated demand for labour (direct, indirect, and induced) and goods and services will create employment and business within the LAA and RAA and will generate revenue for governments. The Project will contribute to GDP in NB and Canada. The Project will contribute to municipal and provincial government revenue through increased tax revenue. 	<ul style="list-style-type: none"> Direct employment. Project expenditures on goods and services.
Change in Accommodations	<ul style="list-style-type: none"> The non-resident construction workforce will be housed in short-term accommodations in NB potentially affecting the availability of accommodations (Project camps will not be constructed). Project-related demographic changes have the potential to affect demand for accommodations throughout the life of the Project. 	<ul style="list-style-type: none"> Availability of accommodations (vacancy rates, inventory levels).
Change in Public Services	<ul style="list-style-type: none"> The Project workforce has the potential to increase demand for public services (emergency and protective services, health care infrastructure and services and community and municipal services). 	<ul style="list-style-type: none"> Demand and supply of public services (police, fire, paramedic services, hospitals).

3.4.1.4 Boundaries

3.4.1.4.1 Spatial Boundaries

The spatial boundaries for the environmental effects assessment of the Socioeconomic Environment are defined below.

- Project Development Area (PDA): The PDA comprises the immediate area of physical disturbance associated with the construction and operation of the Project. The PDA includes: the existing substation in Memramcook where upgrades to the existing substation will occur within the substation footprint; a 40 km long, 30 m wide transmission line RoW from Memramcook to Melrose and a 17 km

long, 60 m wide transmission line RoW from Melrose to Cape Tormentine; a cable termination site; and a 10 m easement around cable lines encompasses the Project footprint.

- Local Assessment Area (LAA): The LAA encompasses the communities that will potentially experience effects related to Project requirements for labour, goods, and services (see Figure 3.4). The LAA encompasses the PDA and, the Parish of Botsford, the Village of Port Elgin, the Parish of Westmorland, the Village of Cap-Pele, the Rural Community of Beaubassin East, the Parish of Sackville, the Town of Sackville, the Town/Ville of Shediac, and the urban and rural communities comprising the Moncton Census Metropolitan Area (CMA).
- Regional Assessment Area (RAA): The RAA encompasses an area that both establishes context for the determination of the significance of Project effects as well as encompasses an area from which interactions between the Project and past, present, and reasonably foreseeable projects (cumulative effects) could occur (see Figure 3.4). The RAA includes the urban and rural communities comprising the Albert Census Division and the Westmorland Census Division.

3.4.1.4.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on socioeconomic include construction, operation, and decommissioning and abandonment. Construction in the terrestrial environment is expected to occur over a period of 16 months. Construction of the landfall site and transmission line from Melrose to Cape Tormentine is expected to be completed over 9 to 10 months, between March and December 2016. Construction of transmission line between Melrose and Memramcook is expected to begin in September 2016 with completion expected to take place in June 2017. Operation will begin following construction and is anticipated to continue for the life of the Project (approximately 40 years). Decommissioning and abandonment would take place following the useful service life of the Project and which would be carried out in accordance with regulations in place at that time.

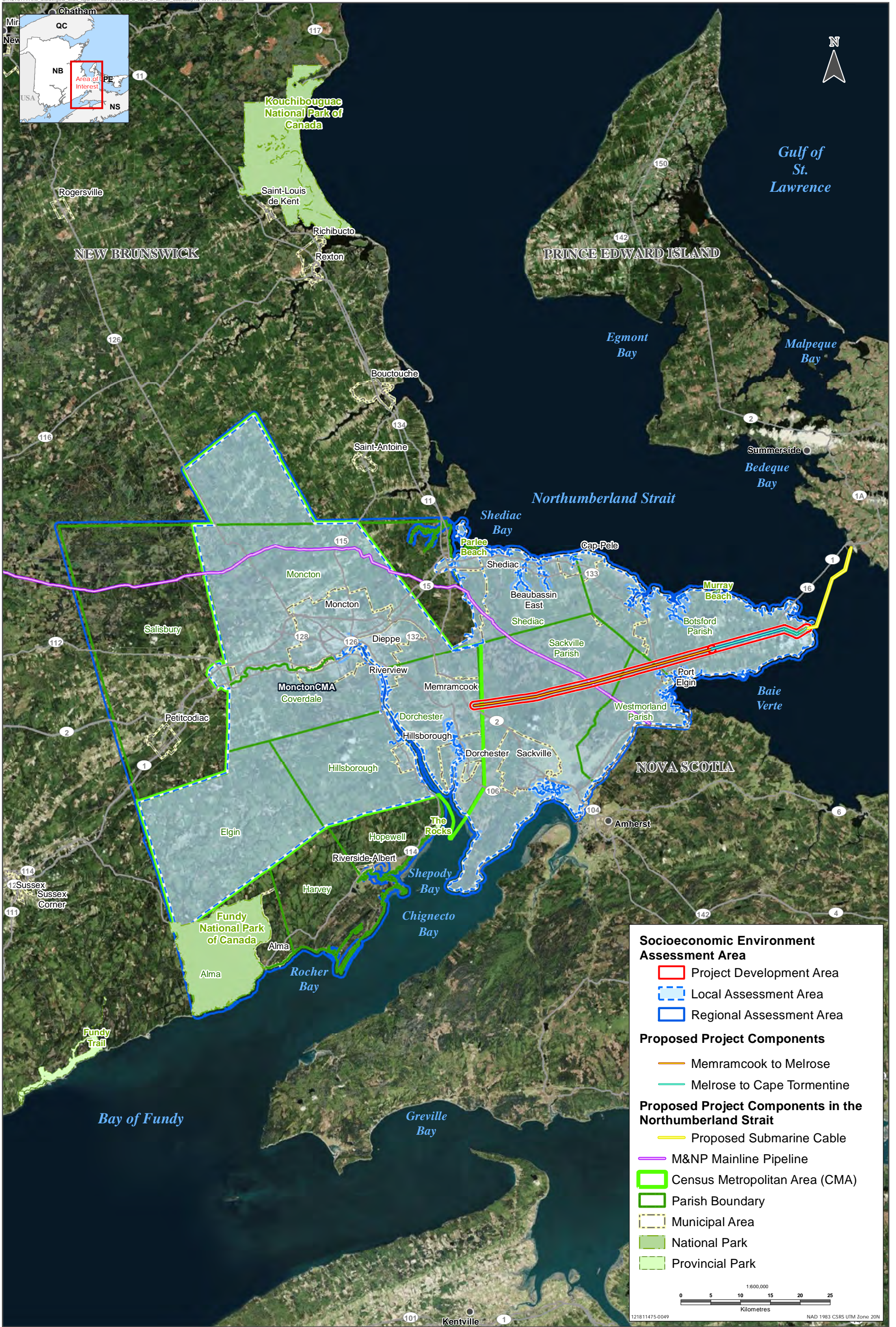
3.4.1.5 Residual Environmental Effects Description Criteria

Table 3.25 Characterization of Residual Effects on Socioeconomic Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	<p>Positive—an effect that moves measurable parameters in a direction beneficial to economic conditions relative to baseline.</p> <p>Adverse—an effect that moves measurable parameters in a direction detrimental to economic conditions relative to baseline.</p> <p>Neutral—no net change in measureable parameters for the economic conditions relative to baseline.</p>

Table 3.25 Characterization of Residual Effects on Socioeconomic Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	<p>Negligible—no detectable effects.</p> <p>Low—a measurable change but within the normal range of variability; cannot be distinguished from baseline conditions</p> <p>Moderate—measurable change but unlikely to pose a serious risk or benefit to the VC or to represent a management challenge.</p> <p>High—measurable change that is likely to pose a serious risk to the selected VC and, if negative, represents a management challenge.</p>
Geographic Extent	The geographic area in which an environmental effect occurs	<p>PDA—residual effects are restricted to the PDA.</p> <p>LAA—residual effects extend into the LAA.</p> <p>RAA—residual effects interact with those of other projects in the RAA.</p>
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	<p>Single event – occurs once.</p> <p>Multiple irregular event—occurs sporadically at irregular intervals throughout construction, operations or decommissioning and abandonment phases.</p> <p>Multiple regular event—occurs on a regular basis and at regular intervals throughout construction, operations, or decommissioning and abandonment phases.</p> <p>Continuous— occurs continuously throughout the life of the Project.</p>
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	<p>Short-term—residual effect restricted to the duration of the construction period or less.</p> <p>Medium-term—residual effect extends through the construction period but less than the life of the Project.</p> <p>Long-term—residual effect extends beyond the life of the Project.</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the Project activity ceases	<p>Reversible—the effect is likely to be reversed after activity completion and reclamation.</p> <p>Irreversible—the effect is unlikely to be reversed.</p>
Socioeconomic Context	Existing condition and trends in the area where environmental effects occur	<p>Low Socioeconomic Resiliency—Sparsely populated region with relatively few service centres.</p> <p>Medium Socioeconomic Resiliency—A mix of sparsely populated areas along with more populated, urban centres.</p> <p>High Socioeconomic Resiliency—Densely populated area with several urban centres.</p>



Socioeconomic Environment Assessment Area Boundaries

3.4.1.6 Significance Definition

There are no defined thresholds for assessing the significance of residual effects on the Socioeconomic Environment. The context for assessing residual effects is whether Project-related changes are consistent with reasonably expected changes in future economic conditions that are anticipated or planned for by municipal, regional, and provincial governments; Aboriginal groups; private businesses; or households; and, if not, the extent to which they will be able to cope with adverse effects associated with the Project.

The following criteria are used to determine significance thresholds for residual effects on economic conditions:

- A significant residual effect is one that is adverse, of high magnitude, is distinguishable from normal variability, and cannot be managed with current or anticipated plans, programs, policies, or mitigation measures.

3.4.2 Existing Socioeconomic Environment

This section describes existing socioeconomic conditions within the assessment areas.

3.4.2.1 Methods

Information on baseline conditions was primarily obtained from statistical data sources and published reports. Principal sources of statistical information included Statistics Canada (Census 2006, Census 2011 and National Household Survey 2011) and the NB Department of Finance. Additional and more recent baseline information was collected from the review of community and regional reports from government agencies, community profiles produced by municipalities, community and regional websites, and socioeconomic community profiles.

3.4.2.2 Overview

3.4.2.2.1 Demographics

Total Population

The 2011 Census (Statistics Canada 2011) reported a total population of 751,171 for the Province of NB. This represents a growth of 2.9% from the numbers recorded in the 2006 census. This is below the national average growth of 5.9% over the same period (Statistics Canada 2013a; 2013d; 2007a). Of the total population of NB, 51.0% were female and 49.0% were male.

Table 3.26 shows the 2011 data for the population by gender for the province and for the LAA and RAA. Table 3.26 shows the population change for the province, LAA and RAA, from 2006 to 2011.

Table 3.26 Population by Gender, RAA and LAA

Location	Total Population	Female*	Male*
Provincial Total	751,171	384,735	366,440
Total RAA	173,003	88,855	84,150
Total LAA	167,420	85,965	81,460

Notes:
 * Numbers are rounded by Statistics Canada and are reported herein exactly as they are reported by Statistics Canada. Totals may not necessarily add up as a result of rounding.
Source: Statistics Canada 2012a; 2013a

Table 3.27 Population Data (percent change 2006-2011)

Location	Population 2011*	Population 2006*	Percent Change*
Provincial Total	751,171	729,997	2.9
Total RAA	173,003	160,411	7.8
Total LAA	167,420	154,628	8.3

Notes:
 * Numbers are rounded by Statistics Canada and are reported herein exactly as they are reported by Statistics Canada. Totals may not necessarily add up as a result of rounding.
Source: Statistics Canada 2012a; 2013a

Population Distribution

The population in NB continues to age, following a similar trend to that experienced between 2001 and 2006. Between 2006 and 2011, the median age of the population increased by 2.2 years, from 41.5 to 43.7 (Statistics Canada 2013a; 2007a). Females outnumber males in NB in all age groups above 20 years (Figure 3.5).

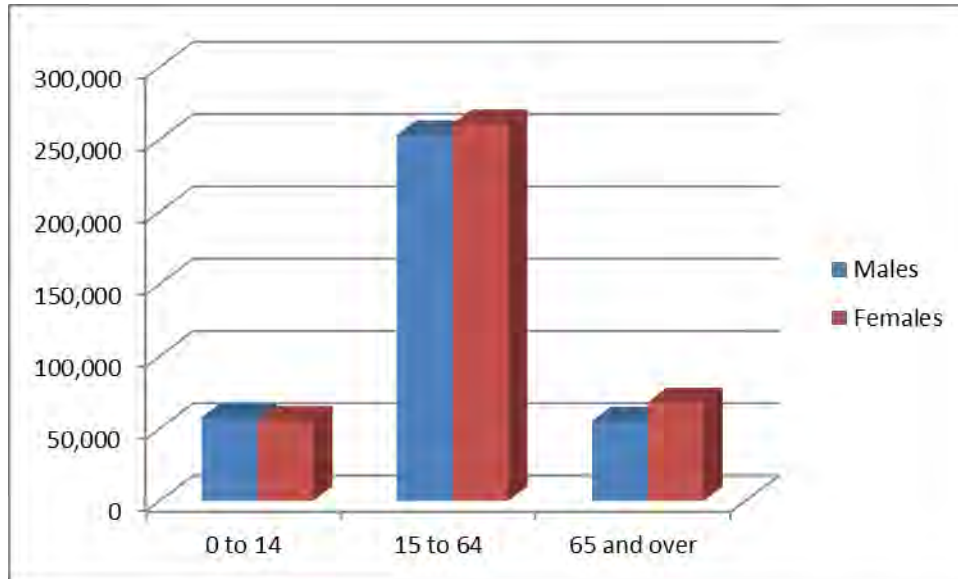


Figure 3.5 Population Data 2011 (males, females)

In 2011, approximately 23% of the provincial population lived within the RAA (Albert and Westmorland Counties). The population of the RAA rose from 160,411 in 2006 to 173,003 in 2011; this represents a change of 7.8%, while the provincial population only grew by 2.9% over the same time frame (Statistics Canada 2013a; 2013b; 2013c). The Population projections for Canada, Provinces and Territories predict that these trends will continue from 2010-2036, with the median age of the population increasing steadily (Statistics Canada 2012b).

Aboriginal Population

As of 2011, about 3.0% of people (22,620 individuals) living in NB identified themselves as being of Aboriginal descent. Aboriginal population data for the LAA and RAA are presented in Table 3.28.

Table 3.28 Aboriginal Population

Location	Aboriginal*
Provincial Total	22,620
Westmorland County	2,650
Botsford Parish	-
Port Elgin	-
Westmorland Parish	-
Cap-Pelé	-
Beaubassin East	205
Town of Sackville	45
Sackville Parish	-
Town of Shediac	70

Table 3.28 Aboriginal Population

Location	Aboriginal*
Shediac Parish	10
Moncton	2,435
Albert County	345
<p>Notes: * Numbers are rounded by Statistics Canada and are reported herein exactly as they are reported by Statistics Canada. Totals may not necessarily add up as a result of rounding. - Data not available Source: Statistics Canada 2013</p>	

The Aboriginal communities located closest to the Project are all Mi'kmaq First Nations; there are nine Mi'kmaq First Nations communities in NB:

- Mi'kmaq Nation at Eel River Bar
- Mi'kmaq Nation at Pabineau
- Mi'kmaq Nation at Esgenoopetitj
- Mi'kmaq Nation at Metepenagiag
- Mi'kmaq Nation at Eel Ground
- Mi'kmaq Nation at Indian Island
- Mi'kmaq Nation at Elsipogtog
- Mi'kmaq Nation at Bouctouche
- Mi'kmaq Nation at Fort Folly

The only Aboriginal community located within the RAA is Fort Folly in Westmorland County. It lies about 40 km east of Moncton and has a registered population of 106 (Aboriginal Affairs and Northern Development Canada 2014; Fort Folly First Nations 2014).

3.4.2.2.2 Economy

NB has consistently seen an increase in its GDP from 2004 to 2013; with a 14.0% increase from 2006 to 2010 (Table 3.29). However, GDP has since slowed having grown only 0.8% compared to 4.0% in 2011 and 4.4% in 2010. The year 2013 followed the same trend, with GDP only increasing by 0.5%. This fell short of the Canadian economic growth rate of 3.3% for the same year (NBDF 2014). GDP grew 1.9% in 2014, indicating improvement from the previous year (NBDF 2015a).

Traditionally the NB economy been based on natural resource development, and it centers on its energy, natural resources and manufacturing industries. Tourism and communication technology industries also make substantial contributions to the provincial economy. Although forests occupy 85.0% of the province's land (equivalent to 6.1 million hectares) and have supported an important economic sector for NB, the forestry sector has recently become less of an economic driver within the province due to a decreasing contribution to employment. This decline has occurred over the past decade with the closure of several lumber and pulp and paper mills throughout the province. Within the RAA,

employment in the forestry industry is limited; however, it has become a regional centre from which support services such as transportation and distribution are located.

Table 3.29 Gross Domestic Product 2004-2013

Economic Indicator	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Gross Domestic Product (millions of Canadian dollars)	24,116	25,272	26,378	27,869	28,422	28,825	30,082	31,409	31,751	31,900
Source: Statistics Canada 2014										

The Province's major employment sectors are:

- Mining, energy, oil and gas
- Commercial fisheries and aquaculture
- Forestry
- Agriculture
- Tourism
- Military

3.4.2.2.3 Labour and Employment, Income, and Education

Labour and Employment

In 2011, NB had a total labour force of 395,420 persons; 24.6% or 97,300 within the RAA (Table 3.30). The participation rate in the province (*i.e.*, the percentage of the working-age population employed or actively seeking employment) was 63.5%, a slight decrease from 63.7% in 2006. The RAA had a participation rate of 68.1%, a slight increase from 67.5% in 2006 (Statistics Canada 2013a; 2007a).

Table 3.30 Labour Force Data (2011)

Location	Total Population 15 years and Over	Labour Force	Employed	Participation Rate (%)	Employment Rate (%)	Unemployment Rate (%)
Provincial Total	622,435	395,425	351,935	63.5	56.5	11.0
LAA Total	N/A	N/A	N/A	N/A	N/A	N/A
RAA Total	142,910	97,300	89,145	68.1	62.4	8.4
Notes:						
Numbers are rounded by Statistics Canada and are reported herein exactly as they are reported by Statistics Canada. Totals may not necessarily add up as a result of rounding.						
N/A - not available due to limited publically available data specific to communities within the LAA.						
Source: Statistics Canada 2013a, 2013b, 2013c						

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

From 2006 to 2011, the number of persons employed in NB increased by 14.7% from 344,770 to 395,425, while the number of persons employed in the RAA increased by 8.0% from 82,540 to 89,145. In 2011 the employment rate for the RAA was 62.4%, 56.5% for the province, and 60.9 for Canada (Statistics Canada 2013a; 2013d; 2007a).

NB's unemployment rate increased from 10.0% in 2006 to 11.0% in 2011; within the RAA from 7.5% to 8.4%. These rates are higher than the national averages of 6.6% in 2006 and of 7.8% in 2011 (Statistics Canada 2013a; 2007a; and 2013d). Moncton-Richibucto (the most populated area within the RAA) posted the highest employment growth of any region in the province in 2014. The Moncton-Richibucto region saw a gain of 3,100 jobs in 2014 and the unemployment rate dropped to 7.8%, the lowest in the province (NBDF 2015a).

Table 3.31 provides information on employment by sector for NB as of 2011. In 2011, the largest employers in the province included the Irving Group of Companies, the McCain Group, NB Public Service, NB Power, and the Horizon Health Network (Martell Homebuilders, 2011). For the province, in 2011 49,660 persons of a total 395,420 (12.6%) were employed in the health care and social assistance industry (North American Industry Classification System [NAICS]). The second highest industry was retail trade (46,285, or 11.7%), followed by manufacturing (33,325 or 8.4%).

Table 3.31 Employment - Industries (2011)

	NB		RAA	
	Number of Persons	Percent Employed in the Province (%)	Number of persons	Percent Employed within the RAA (%)
Total labour force population aged 15 years and over by industry	395,420	100.0	97,300	100.0
Industry - not applicable	6,350	1.6	1,090	1.1
All industries	389,070	98.4	96,210	98.9
Agriculture, Forestry, Fishing and Hunting	15,480	3.9	1,335	1.4
Mining, Quarrying, and Oil and Gas Extraction	4,860	1.2	830	0.9
Utilities	4,005	1.0	200	0.2
Construction	29,340	7.4	6,180	6.4
Manufacturing	33,325	8.4	7,230	7.4
Wholesale Trade	12,230	3.1	4,560	4.7
Retail Trade	46,285	11.7	12,020	12.4
Transportation and Warehousing	19,240	4.9	6,080	6.2

Table 3.31 Employment - Industries (2011)

	NB		RAA	
	Number of Persons	Percent Employed in the Province (%)	Number of persons	Percent Employed within the RAA (%)
Information and Cultural Industries	7,475	1.9	2,520	2.6
Finance and Insurance	13,065	3.3	5,135	5.3
Real estate and Rental and Leasing	4,200	1.1	1,170	1.2
Professional, Scientific and Technical Services	16,205	4.1	4,170	4.3
Management of Companies and Enterprises	250	0.1	75	0.1
Administrative and Support, Waste Management and Remediation Services	19,025	4.8	5,755	5.9
Educational Services	27,045	6.8	6,485	6.7
Health Care and Social Assistance	49,660	12.6	11,855	12.2
Arts, Entertainment and Recreation	6,170	1.6	2,045	2.1
Accommodation and Food Services	23,805	6.0	6,490	6.7
Other Services (except public administration)	17,895	4.5	3,945	4.1
Public Administration	39,515	10.0	8,125	8.4
Notes:				
Numbers are rounded by Statistics Canada and are reported herein exactly as they are reported by Statistics Canada. Totals may not necessarily add up as a result of rounding.				
Source: Statistics Canada 2013a				

The labour force of NB is concentrated in three major occupations: sales and service (24.3%), trades and transport (16.6%), and business finance and administration (14.3%) as classified by the National Occupational Classification (NOC) system (Table 3.32).

Table 3.32 Employment - Occupations (2011)

	RAA		NB	
	Number of Persons	Percentage employed in the RAA (%)	Number of Persons	Percentage employed in NB (%)
Total labour force population aged 15 years and over by occupation	97,295	100.0	395,425	100.0
Occupation - Not Applicable	1,090	1.1	6,350	1.6
All occupations	96,210	98.9	389,075	98.4
Management Occupations	9,720	10.0	35,930	9.1
Business, Finance and Administration Occupations	15,570	16.0	55,670	14.1
Natural and Applied Sciences and Related Occupations	5,765	5.9	21,290	5.4
Health Occupations	7,110	7.3	28,720	7.3
Occupations in Education, Law and Social, Community and Government Services	11,200	11.5	48,780	12.3
Occupations in Art, Culture, Recreation and Sport	2,190	2.3	7,285	1.8
Sales and Service Occupations	26,100	26.8	94,655	23.9
Trades, Transport and Equipment Operators and Related Occupations	13,465	13.8	64,555	16.3
Natural Resources, Agriculture and Related Production Occupations	1,575	1.6	13,660	3.5
Occupations in Manufacturing and Utilities	3,510	3.6	18,520	4.7
Notes:				
Numbers are rounded by Statistics Canada and are reported herein exactly as they are reported by Statistics Canada. Totals may not necessarily add up as a result of rounding.				
Source: Statistics Canada 2013a				

Income

In 2010, the median income for all census families in NB was \$65,384, while the median income for all persons aged 15 and older was \$26,582 (Table 3.33). Within the RAA, Albert County had a higher median income for both census families and for individuals aged 15 and older compared to Westmorland County. Throughout the RAA, where information was available, males had a higher median income than females.

Table 3.33 Median Income (2010)

Location	Median Income - All Census Families*	Median Income - Persons 15 Years and Over	Male	Female
Provincial Total	65,384	26,582	32,859	21,649
Westmorland County	68,967	28,778	34,268	23,973
Botsford Parish	-	-	-	-
Port Elgin	-	-	-	-
Westmorland Parish	-	-	-	-
Cap-Pelé	-	-	-	-
Beaubassin East	72,395	29,031	35,479	22,076
Town of Sackville	66,597	26,842	33,482	20,815
Sackville Parish	-	-	-	-
Town of Shediac	66,838	28,396	34,353	23,238
Shediac Parish	72,705	30,960	37,673	26,912
Moncton	71,290	29,720	35,017	25,105
Albert County	72,731	30,403	36,222	25,398

Notes:
Numbers are rounded by Statistics Canada and are reported herein exactly as they are reported by Statistics Canada. Totals may not necessarily add up as a result of rounding.
* Data for median income was collected in 2010.
- Data not available.
Source: Statistics Canada 2013a

Education

In 2011, 24.9% of NB's population had not completed their high school education, with males making up 51.0% of that total. Within the RAA 20.4% had not completed their high school education, with males making up about 50.8%. This was higher than the Canadian national average of 20.1% and second only to Newfoundland and Labrador (28.0%) for highest in the Atlantic Canadian provinces. Out of NB's working population (those aged 25-64), 56.6% had received some type of post-secondary education or training (61.3% in the RAA), while 18.8% had obtained a university diploma or degree at the bachelor level or higher (22.2% in the RAA).

Within the RAA there are five post-secondary educational institutions: Université de Moncton, Crandall University, Mount Allison University, NB Community College, Collège Communautaire du Nouveau-Brunswick - Dieppe. This allows the RAA to be one of the major providers of post-secondary education in the province, and provides post-secondary educational opportunities to both the Westmorland and Albert Counties (City of Moncton 2014). As a result, 62.0% of Westmorland County's working population had some form of post-secondary education or training, while Albert County had 60.0% with post-secondary education. Both of these totals were above the provincial average (Statistics Canada 2013b; Statistics Canada 2013c).

3.4.2.2.4 Housing

Private Dwellings (Owner-Occupied and Tenant-Occupied)

In 2011, there were 314,035 occupied private dwellings within the province of NB, 72,615 of which were in the RAA. Of the 314,035 occupied private dwellings in NB, 75.7% were owned, 23.8% were rented, and 0.6% were Band owned. Within the RAA, 73.0% of occupied private dwellings were owned, 27.1% were rented, and 0.01% were Band owned.

Housing stock within the RAA is generally of newer construction than the provincial average. In 2011, 13.8% (43,325) of occupied private dwellings were constructed between 2001-2011 (10 years old or newer), 28.1% (88,180) between 1981 and 2000 (11 to 30 years old), 31.4% (98,750) between 1961 and 1980 (31 to 50 years old), and 26.7% (83,775) on or before 1960 (50 years old or greater). Within the RAA, 21.5% (15,615) were constructed between 2001-2011 (10 years old or newer), 28.0% (20,335) between 1981 and 2000 (11 to 30 years old), 27.7% (20,125) between 1961 and 1980 (31 to 50 years old), and 22.8% (16,545) on or before 1960 (50 years old or greater). Condominiums represent a small percentage of occupied private dwellings within NB and the RAA respectively representing 2.9% and 4.2% of the total housing stock. Overall housing in NB and the RAA only require regular maintenance or minor repairs with only 9.8% requiring major repairs within NB and 7.3% in the RAA.

In 2011, 19.0% of households (58,430 of 309,160) spent more than 30% of total household income on shelter costs with 3.3% having spent more than 100% of total household income on shelter costs.

According to the CMHC 2015 Spring Rental Market Survey, the overall vacancy rate for NB's urban centres was 8.0%. This is a decrease from 9.1% in 2014. Of the province's three largest regional centres (Moncton, Saint John, and Fredericton), Moncton has the highest vacancy rate at 8.8%. Between 2010 and 2013, there was a high level of rental market activity in Moncton that resulted from demand generated by significant net migration gains in the local market.

The inventory of available homes is currently at high levels in NB's large urban centres. This trend which is expected to remain due to weaker demand will impact price growth over the forecast period. The MLS average price is expected to move down moderately in 2015 with prices within a range of \$153,000 to \$167,400. With the possibility of slower sales growth and higher inventory levels in 2016 prices are expected to range from \$148,000 to \$172,000 (CMHC 2015a). In 2013, The Moncton CMA had an average home price \$166,476, making it one of the most affordable housing markets in Canada (City of Moncton 2014).

Temporary Accommodations

In 2013, 1.6 million room nights were sold in NB, a 3.0% decline compared to 2012. The number of room nights available in the province also declined by 5.0% between 2012 and 2013, resulting in an increase of 1.0% in the provincial accommodation occupancy rate (Government of New Brunswick 2014).

The occupancy rate throughout NB was relatively stable from 2011-2013, staying at 50.0% between 2011 and 2012, increasing to 51.0% in 2013 due to the decrease in total rooms available in the province. While the occupancy rate has remained stable during this time frame, there has been a consistent

decline in room nights sold, room nights available, and in the average daily rate (Government of New Brunswick 2014). The occupancy rate increased in the southeastern region of NB (where the RAA is located), from 36.0% in 2012 to 42% in 2013 (Government of New Brunswick 2014).

3.4.2.2.5 Public Services

Emergency and Protective Services

Police

The NB RCMP, or "J" Division, is comprised of a variety of professional employees specifically trained to address policing needs in NB communities. In 2013, it employed 898 regular members, 86 civilian members, and had 156.5 public service employee positions (NB Department of Public Safety 2013). "J" Division operates out of 12 district offices, 57 satellite offices, and seven federal offices. Its provincial headquarters are located in Fredericton. Based on a regional policing model, each district consists of several detachments located within a specified geographic region of the province. There are 11 RCMP districts, or regional police forces, in NB. The Codiac Regional RCMP headquarters is in Moncton has 145 regular members, 24 emergency dispatchers and 25 municipal support staff. It polices Dieppe, Moncton and Riverview and service is provided on a contract basis between the communities and the RCMP. The Codiac Regional RCMP is the primary police force within the RAA with support from rural RCMP detachments.

Fire

Fire protection services within the RAA are primarily supported through the City of Moncton's Fire Department, the City of Dieppe's Fire Department, the Town of Riverview's Fire and Rescue Department, the Village of Memramcook's Fire Department, the Town of Shediac's Fire Brigade, the Town of Sackville's Fire Brigade and local volunteer firefighting brigades throughout more rural areas of the RAA. The largest fire department is that of the City of Moncton's.

The City of Moncton has five fire stations which are located to allow firefighters to arrive at the scene of an emergency as quickly as possible. The department consists of 120 members as well as 40 volunteer firefighters who are on call 24 hours a day (Moncton Industrial Development 2014).

Sackville's fire department has 42 volunteer firefighters and maintains a fleet of modern vehicles.

Health Care

There are two major regional hospitals in the RAA: the Moncton Hospital and the Dr. Georges-L.-Dumont University Hospital Centre. The Moncton Hospital has 381 beds and is the major referral hospital serving communities throughout NB, PEI and northern Nova Scotia (NS). It is part of a large network of hospitals, health centres, services and programs under the direction of the regional health authority Horizon Health Network, which provides health services to the southern, central, and eastern regions of NB (Moncton Industrial Development 2014). The Dr. Georges-L.-Dumont University Hospital Centre, which falls under the regional health authority Vitalité Health Network, offers ambulatory and elevated

secondary and primary care, has 302 beds, employs about 180 physicians, 2,000 employees and has a volunteer base of 315.

The Vitalité Health Network, the only francophone regional health authority in the country, provides health care and services to residents residing in northern and southeastern NB. The southeastern coverage area overlaps with services offered by Horizon Health and includes communities within the RAA. Two hospitals, two health centres, one veterans' unit, two community mental health centres, four public health offices, and two extra-mural program offices under the Vitalité Health Network fall within the RAA.

3.4.3 Project Interactions with Socioeconomic Environment

Table 3.3 identifies Project/VC interactions for each potential effect. These interactions are indicated by check marks, and are discussed in detail in Section 3.4.4 in the context of effects pathways, standard and Project-specific mitigation/enhancement, and residual effects. A justification is also provided for non-interactions (no check marks).

Table 3.34 Potential Project-Environment Interactions and Effects on Socioeconomic Environment

Project Components and Physical Activities	Potential Environmental Effects		
	Change in Employment and Economy	Change in Accommodations	Change in Public Services
Land-Based Infrastructure – New Brunswick and PEI			
Construction			
Landfall Construction	–	–	–
Expansion of Electrical Substation	–	–	–
Emissions and Wastes	–	–	–
Transportation	–	–	–
Employment and Expenditure*	✓	✓	✓
Operation			
Energy Transmission	–	–	–
Vegetation Management	–	–	–
Infrastructure Inspection, Maintenance and Repair (Transmission Lines and Substations)	–	–	–
Emissions and Wastes	–	–	–
Transportation	–	–	–
Employment and Expenditure*	✓	✓	✓

Table 3.34 Potential Project-Environment Interactions and Effects on Socioeconomic Environment

Project Components and Physical Activities	Potential Environmental Effects		
	Change in Employment and Economy	Change in Accommodations	Change in Public Services
Decommissioning and Abandonment			
Decommissioning	NA	NA	NA
Reclamation	NA	NA	NA
Emissions and Wastes	NA	NA	NA
Employment and Expenditure*	NA	NA	NA
Notes: ✓ = Potential interactions that might cause an effect. – = Interactions between the Project and the VC are not expected. NA = Not applicable * = All Project activities requiring the presence of workers and/or expenditures.			

While all of the Project activities for each Project phase will have labour requirements that could affect the Socioeconomic Environment, it is not possible to isolate the effects of individual activities and so these effects are addressed cumulatively as part of an “employment and expenditure” activity.

The Project has the potential to result in effects on the Socioeconomic Environment through the expenditures on supplies and services and the employment that are involved in all of the Project activities and works. These effects are addressed further in the following sections.

During Project decommissioning and abandonment, the scale of employment will be smaller and of shorter duration than construction and operation; therefore further assessment for this phase is not considered necessary.

3.4.4 Assessment of Residual Environmental Effects on Socioeconomic Environment

3.4.4.1 Analytical Assessment Techniques

Project-related employment and income effects during construction and operation phases are estimated based on Project demand for labour and consideration of estimates of capital expenditures within NB. Demand for accommodations associated with demographic change (stemming from direct, indirect, and induced employment) is compared to the available capacity of short-term accommodations within the LAA and RAA. Demand for select public services associated with demographic change (stemming from direct, indirect, and induced employment) is compared to the available capacity of public services within the LAA and RAA.

3.4.4.2 Assessment of Change in Employment and Economy

3.4.4.2.1 Project Pathways for Change in Employment and Economy

Project associated demand for labour (direct, indirect, and induced) and goods and services will create employment and business opportunities within the LAA and RAA and will generate revenue for governments. Project employment will peak at approximately 200 workers during construction, including approximately 175 for construction of NB components. These workers will be employed by New Brunswick-based construction or engineering firms, where possible. Adverse effects are related to increased demand for skilled labour and changes in labour supply, potentially contributing to wage inflation. Project expenditures on goods and services could generate positive economic effects through contracts with local companies in NB. The Project will also contribute to municipal and provincial government revenue through increased tax revenue.

Operation in NB will require only one FTE, therefore, no residual effects on employment and economy are anticipated.

3.4.4.2.2 Mitigation and Enhancement for Change in Employment and Economy

Project effects on employment and economy are anticipated to be largely beneficial because employment and business opportunities will be created within the LAA and RAA during all Project phases, and taxes will be paid to municipal and provincial government. Where the Project competes for skilled labour and goods and services potential exists for increased labour costs and price inflation. Since anticipated Project demands for labour and goods and services are small and short-term the magnitude of potential adverse effects on labour costs and price inflation are anticipated to be low. Mitigation measures, therefore, work to enhance beneficial effects of the Project.

NB Power commits to the following mitigation and enhancement measures related to employment and economy:

- Develop and implement a strategy to encourage local and Aboriginal content. The strategy will ensure local residents, Aboriginal groups and businesses are informed of job and procurement opportunities and will encourage a hire-local first approach.

3.4.4.2.3 Residual Project Environmental Effect for Change in Employment and Economy

Construction

Land-based construction in NB consists of the development of approximately 57 km of transmission line, a cable termination site and landfall site in Cape Tormentine and the upgrade of a substation in Memramcook. The total capital expenditure for the NB portion of the Project is estimated at \$25 million.

175 full-time equivalent (FTE) jobs are anticipated to be generated including construction workers and administrative, engineering and support personnel. The majority of employees will be local with some specialists coming from other parts of Canada or from abroad. Workers are anticipated to be employed on a rotational work shift that will likely be 10-hour days for five days. This is a multi-million

dollar project and includes expenditures on such goods and services as construction materials, equipment, consumables (e.g., fuel, food), and accommodations. Purchases of labour, goods, and services needed for construction would beneficially affect other sectors of the NB economy.

Due to the relatively small number of FTEs (175), the Project is not anticipated to result in labour shortages or affect the supply of goods and services such that wage or price inflation occurs. Residual effects on employment and economy during Project construction are expected to be positive in direction, low in magnitude, to extend throughout the RAA, to be short-term in duration occurring continuously within a moderately resilient socioeconomic context and to be reversible following Project decommissioning and abandonment.

Operation

Since Project operation is anticipated to require approximately only one FTE, no residual effects on public services are anticipated during Project operation.

3.4.4.3 Assessment of Change in Accommodations

3.4.4.3.1 Project Pathways for Change in Accommodations

The construction workforce will be housed in nearby lodging in NB, potentially affecting the availability of short-term accommodations (Project camps will not be constructed). Demographic changes related to In-migrant workers satisfying demand for indirect and induced employment also have the potential to affect demand for accommodations throughout the life of the Project.

3.4.4.3.2 Mitigation for Change in Accommodations

During Project construction, non-local workers will be housed in nearby accommodations in NB. Since no Project camps will be constructed, demand for nearby accommodations will increase. NB Power commits to the following mitigation measures related to accommodations of non-local workers:

- develop preferred accommodations providers, informed through engagement with local community officials
- communicate with community officials where workers are accommodated, as a means of responding to potential community grievances

3.4.4.3.3 Residual Project Environmental Effects for Change in Accommodations

Construction

Peak construction will require approximately 200 workers in New Brunswick and PEI. It is estimated that 175 of these will be required in NB and the majority of these will be local hires. Based on the spatial extent of the RAA, a majority of individuals (representing potential local hires) are estimated to reside within an average of a 1.5-hour commute of Cape Tormentine (the furthest commute being approximately two-hours). These individuals are anticipated to commute from their personal residences

to the worksite, and will not increase demand for temporary accommodations as they are already accommodated within the RAA.

Some specialists from outside the RAA may be required for Project construction. These workers will require short-term accommodation while engaged in construction activities. Potential demand for accommodations related to indirect and induced employment during Project construction is not expected to exceed the current availability of accommodations. Based on the size of the construction workforce requiring temporary accommodation, the availability of temporary accommodations within the LAA and RAA, the timing of construction activities, and mitigation measures, the availability of existing temporary accommodations are considered sufficient to meet increased Project-related demand during Project construction. Residual effects on temporary accommodation during Project construction are considered neutral in direction, low to moderate in magnitude, to extend throughout the RAA, to be short-term in duration, to occur regularly, are reversible following the completion of the Project construction and to occur within a moderate socioeconomic resiliency.

Operation

Since Project operation is anticipated to require approximately only one FTE, no residual effects on public services are anticipated during Project operation

3.4.4.4 Assessment of Change in Public Services

3.4.4.4.1 Project Pathways for Change in Public Services

The construction workforce will have a presence in nearby communities potentially increasing demand for public services. Demographic changes related to In-migrant workers satisfying demand for indirect and induced employment also have the potential to increase demand for public services in nearby communities throughout the life of the Project.

3.4.4.4.2 Mitigation for Change in Public Services

During Project construction workers will be housed in nearby accommodations in NB and therefore could increase demand on public services. To manage potential demand on public services NB Power commits to the following mitigation measures:

- encourage carpooling among workers to reduce effects on daily traffic volumes and transportation infrastructure
- require employees and subcontractors to adhere to code of conduct and health and safety programs

3.4.4.4.3 Residual Project Environmental Effects for Change in Public Services

Approximately 175 Project-related jobs are anticipated during Project construction. The majority of these are expected to be satisfied by local hires within the RAA; some specialist hires may be required to come from outside of the RAA. A temporary increase in population can lead to increases in demand for public services.

Construction

Construction workers residing within the RAA are anticipated to choose to commute (daily) to the PDA from their current residences. These workers contribute to the funding of public services through municipal tax payments and pay-per-use services in their home communities; demand from these individuals is already accounted for through municipal planning. Workers who reside within the RAA but outside the LAA may increase demand for public services in communities near the PDA as a result of commuting or from their presence while on-shift (demand from these residents would not be accounted for through current municipal planning). However, considering these workers will only be present in communities near the PDA for a limited duration (while commuting or on-shift), increased demand for public services is not expected to be distinguishable from the normal variability of demand. In general, Cape Tormentine is an entry point to NB and is subject to fluctuations in demand associated with tourism; similarly, the Moncton CA has an established tourism industry and is accustomed to fluctuations in demand for public services. Adverse effects from these workers are therefore expected to be negligible in magnitude. As such no residual effects on public services are anticipated to result from RAA resident workers during Project construction.

During Project construction, temporary and in-migrating workers have the potential to increase demand for public services. Since temporary and in-migrating workers (until they have established residency in the RAA) do not contribute to public funding of services through municipal tax and pay-per-use fees, demand from these individuals may be unaccounted for through municipal and provincial planning. However, considering baseline conditions, the size of the construction workforce, the timing of major construction activities, the duration of construction workers' presence in nearby communities, the normal variability of demand for public services in communities within the LAA, and the application of mitigation measures, increased demand associated with temporary and in-migrant workers during Project construction is expected to result in adverse effects that are negligible in magnitude. As such no residual effects on public services are anticipated during Project construction.

Operation

Since Project operation is anticipated to require only one additional FTE, no residual effects on public services are anticipated during Project operation.

3.4.5 Summary of Residual Project Environmental Effects

The residual Project environmental effects for Socioeconomic Environment are summarized in Table 3.35.

Table 3.35 Summary of Project Residual Environmental Effects on Socioeconomic Environment

Residual Effect	Residual Environmental Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Socioeconomic Context
Change in Employment and Economy	C	P	L	RAA	S	C	R	M
Change in Accommodation	C	N	L-M	RAA	S	R	R	M
Change in Public Services	C	NA						
KEY See Table 3.25 for detailed definitions. Project Phase: C: Construction O: Operation D: Decommissioning and Abandonment Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High		Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Duration: ST: Short-term; MT: Medium-term LT: Long-term P: Permanent NA: Not applicable			Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible Ecological/Socioeconomic Context: L: Sparsely populated region with relatively few service centres M: A mix of sparsely populated areas along with more populated, urban centres H: Densely populated area with several urban centres			

3.4.6 Determination of Significance

3.4.6.1 Significance of Residual Project Effects

For change in employment and economy, a significant adverse residual effect would only occur if the Project results in an adverse effect that is of high magnitude, distinguishable from normal variability, and of which cannot be managed with current or anticipated programs, policies, or mitigation measures. Project residual effects on employment and economy are largely anticipated to be beneficial, creating employment and business opportunities within the RAA. Since Project demands for labour and goods and services are anticipated to be small and short-term in nature with adverse effects on wage and price inflation low and limited to the construction phase of the Project, effects are anticipated to be not significant.

For change in accommodations and public services, a significant adverse residual effect would only occur if the Project results in demand that is not within normal variability and of which exceeds current capacity and cannot be managed with current or anticipated programs, policies or mitigation measures. Considering the available capacity of accommodations and public services, the short-term and low to medium magnitude of potential demand for accommodations and public services, and proposed mitigation measures targeted at managing the variability of demand for accommodations and public services, effects are anticipated to be not significant.

3.4.7 Prediction Confidence

Prediction confidence is considered moderate to high based on available data, NB Power's experience with similar projects in NB and their effects, and proposed mitigation measures. There exist inherent uncertainties about future economic conditions in the LAA and RAA and the extent to which local residents will choose to be involved in project construction, operation, and decommissioning and abandonment.

3.4.8 Follow-up and Monitoring

Follow-up and monitoring programs are not required.

3.5 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON HERITAGE RESOURCES

Heritage Resources are those resources, both human-made and naturally occurring, related to human activities from the past that remain to inform present and future societies of that past. Heritage Resources are relatively permanent, although tenuous, features of the environment; if they are present, their integrity is susceptible to construction and ground-disturbing activities. Heritage Resources has been selected as a valued component (VC) because of interest from: provincial and federal regulatory agencies who are responsible for the effective management of these resources; the general public; and Aboriginal people that have an interest in the preservation and management of Heritage Resources related to their history and culture. For this VC, Heritage Resources include consideration of historical, archaeological, built heritage, and palaeontological resources.

3.5.1 Scope of Assessment

This section defines the scope of the Heritage Resources VC in consideration of the regulatory setting, potential Project-VC interactions, and the existing knowledge of the Project Development Area (PDA).

3.5.1.1 Regulatory and Policy Setting

Known heritage resources in New Brunswick are regulated under the *Heritage Conservation Act*. The regulatory management of heritage resources falls under the New Brunswick Department of Tourism, Heritage and Culture, and is administered by the Heritage Branch. Within the Heritage Branch are the offices of Archaeological Services; Historic Places; and the New Brunswick Museum.

The review for heritage resources has been undertaken through the completion of historical, archaeological, built heritage, and palaeontological research. The Province of New Brunswick provides guidance for conducting heritage assessments, such as the *Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick* (the Archaeological Guidelines, Archaeological Services 2012).

3.5.1.2 The Influence of Consultation and Engagement on the Assessment

Consultation and engagement activities have been on-going as part of the research for the heritage resources assessment. During the background research, various regional experts, historical societies and regulatory agencies were contacted (Table 3.36).

Table 3.36 Experts Consulted

Name of Expert	Affiliation
Archaeological Services Staff Members (various)	Archaeological Services – New Brunswick Department of Tourism, Heritage and Culture
Geological Surveys Branch-Variou Staff	New Brunswick Department of Energy and Mines, Geological Surveys Branch
Dr. Randall Miller	Curator, Geologist, New Brunswick Museum
Mr. Peter Hicklin	Editor, White Fence Newsletter, Tantramar Heritage Trust
Dr. Allan Seaman	Quaternary Geologist, Geological Surveys Branch New Brunswick Department of Energy and Mines
Local Historians	Tantramar Heritage Trust
Gilles Bourque	Manager, Historic Places Branch- New Brunswick Department of Tourism, Heritage and Culture
Representative	Westmorland Historical Society, Keilor House Museum, Dorchester, NB.

Several local landowners were also contacted to gain a better understanding of the general and specific history of the PDA. Details surrounding these contacts are provided in the Archaeological Impact Assessment (AIA) Final Report (Stantec 2015) for the land-based portions of the Project.

NB Power has initiated Aboriginal consultation for the New Brunswick portion of the Project on behalf of the Province to facilitate the Crown's Duty to Consult. As the consultation and engagement process progresses, any areas of interest and concern regarding archaeological resources within the PDA expressed by Aboriginal representatives will be reviewed and considered for the heritage resources assessment. Details outlining NB Power's Aboriginal consultation and engagement process are located in Section 3.2 of Volume 1.

No issues by regulators, regional experts or historians have been raised with respect to heritage resources to date during these consultations. Multiple meetings and discussions with the Provincial regulator, Archaeological Services, have occurred since initiation of the archaeological work in 2014 to discuss the archaeological survey methods.

Consultation with Dr. Randall Miller, Curator, at the New Brunswick Museum revealed no specific concerns with respect to palaeontological resources within the PDA (Miller 2014). A fossilized tree was noted in an abandoned quarry near the PDA and the exact location will be confirmed.

No other issues were raised by individuals or groups who were contacted regarding the assessment of Heritage Resources for the Project.

3.5.1.3 Potential Environmental Effects, Pathways and Measurable Parameters

The environmental assessment of Heritage Resources focuses on the following environmental effect:

- Change in heritage resources

The environmental effect has been selected with recognition of the interest of regulatory agencies, the general public, and potentially affected Aboriginal groups. In general, heritage resources are defined as *“any structure, site or thing that is of historical, archaeological, paleontological or architectural significance”* (CEAA 2012).

The measurable parameter used for the assessment of the environmental effect presented above and the rationale for its selection is provided in Table 3.37.

Table 3.37 Potential Environmental Effects, Effects Pathways and Measurable Parameters for Heritage Resources

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in Heritage Resources	<ul style="list-style-type: none"> • Disturbance or alteration of whole or part of a heritage resource from Project ground disturbance during construction and operation. 	<ul style="list-style-type: none"> • Presence/absence of a Heritage Resource.

3.5.1.4 Boundaries

3.5.1.4.1 Spatial Boundaries

The spatial boundaries for the environmental effects assessment of Heritage resources are defined below.

- Project Development Area (PDA): The PDA comprises the immediate area of physical disturbance associated with the construction and operation of the Project. The PDA includes: the existing substation in Memramcook where upgrades to the existing substation will occur within the substation footprint; a 40 km long, 30 m wide transmission line RoW from Memramcook to Melrose and a 17 km long, 60 m wide transmission line RoW from Melrose to Cape Tormentine; a cable termination site; and a 10 m easement around cable lines.

- Local Assessment Area (LAA): The LAA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA for Heritage Resources is limited to the PDA.
- Regional Assessment Area (RAA): The RAA is the area within which the Project's environmental effects may overlap or accumulate with the environmental effects of other projects or activities. The RAA is defined as an area of the southeast of the province located within the Eastern Lowlands Ecoregion and the Petitcodiac and Kouchibouguac Ecodistricts. The project transects a topographical divide between watersheds and estuaries draining to the Bay of Fundy to the south, including the Tantramar, Memramcook, and Petitcodiac Rivers and the Northumberland Strait to the east, including the Gaspereau River, east to Cape Tormentine.

3.5.1.4.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on Heritage Resources include construction and operation. Construction in the terrestrial environment is expected to occur over a period of 16 months. Construction of the landfill site and transmission line from Melrose to Cape Tormentine is expected to be completed over 9 to 10 months, between March and December 2016. Construction of transmission line between Melrose and Memramcook is expected to begin in September 2016 with completion expected to take place in June 2017. Operation will begin following construction and is anticipated to continue for the life of the Project (approximately 40 years). Decommissioning and abandonment would take place following the useful service life of the Project and which would be carried out in accordance with regulations in place at that time.

Particular emphasis is placed on construction as that is the phase where most ground disturbing activities of surface soils associated with the Project are conducted. There is also the potential for encountering heritage resources during operation via heavy equipment during activities associated with vegetation control and access road maintenance.

Ground disturbing activities are not anticipated during decommissioning and abandonment, therefore there is not anticipated to be potential to encounter heritage resources during this phase of the Project.

3.5.1.5 Residual Environmental Effects Description Criteria

This assessment considers residual effects on Heritage Resources after the implementation of recommended mitigation. Definitions for the characterization of these residual effects are presented in Table 3.38.

Table 3.38 Characterization of Residual Environmental Effects on Heritage Resources

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	Positive —an effect that moves measurable parameters in a direction beneficial to Heritage Resources relative to baseline. Adverse —an effect that moves measurable parameters in a direction detrimental to Heritage Resources relative to baseline. Neutral —no net change in measurable parameters for Heritage Resources relative to baseline.
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	Negligible —no measurable change to Heritage Resources. Low to Moderate —if Heritage Resources are encountered within the PDA and cannot be avoided, mitigation (e.g., removal) will create change to Heritage Resources. High —a measurable change resulting in a permanent loss of information relating to Heritage Resources (e.g., destruction that occurs without mitigation).
Geographic Extent	The geographic area in which an environmental, effect occurs	PDA —residual effects are restricted to the PDA.
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	Single event —an effect on Heritage Resources occurs only once (i.e., disturbance results in the loss of context).
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	Short-term —the residual effect is restricted to the construction phase. Long-term —the residual effect will extend for the life of the Project. Permanent —Heritage Resources cannot be returned to its existing condition.
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	Reversible —the effect is likely to be reversed. Irreversible —the effect cannot be reversed as damage or removal will result in a change to Heritage Resources.
Ecological and Socioeconomic Context	Existing condition and trends in the area where environmental effects occur	Undisturbed —area is relatively undisturbed or not adversely affected by human activity. Disturbed —area has been substantially previously disturbed by human development or human development is still present.

3.5.1.6 Significance Definition

A significant adverse residual environmental effect on Heritage Resources is one that results in a permanent Project-related disturbance to, or destruction of, all or part of a heritage resource (i.e., archaeological, architectural or palaeontological resource) considered by the provincial heritage regulators and other stakeholders to be of major importance due to factors such as rarity, undisturbed condition, spiritual importance, or research importance, and that cannot be mitigated or compensated.

3.5.2 Existing Conditions for Heritage Resources

3.5.2.1 Methods

As part of the archaeological assessment, background research was undertaken to: determine the location of any known heritage resources within the PDA; to identify likely locations for unknown resources; and to gain an understanding of the general and specific history of the PDA and surrounding area. Consultation was also undertaken as noted in Volume 1, Section 3.2.

The background research included the following activities:

- A review of provincial archaeological potential maps and map data (Archaeological Services 2014a and b) was conducted to identify registered archaeological sites and heritage resources in the Archaeological Services Sites Database, any potential Palaeo-shorelines, and areas of elevated archaeological potential within, or potentially interacting with, the PDA.
- A review of the provincial archaeological site files for any known archaeological sites within or in proximity of the PDA.
- Meetings with representatives from Archaeological Services and regional experts.
- A review of a variety of published, unpublished, and on-line works and databases on relevant local history and environment, and previous archaeological work carried out in the general area surrounding the PDA.
- Review of various documents located in the New Brunswick Provincial Archives.
- Professional experience and judgment of the Stantec Archaeology Team.

An archaeological assessment (walkover) was conducted in consideration of the results of the Archaeological Potential Map information (Archaeological Services 2014a; 2014b). The field assessment followed the Archaeological Guidelines (Archaeological Services 2012).

3.5.2.2 Overview of Existing Conditions

Existing conditions (i.e., baseline) for archaeological resources (Pre-Contact Period and Historic Period), palaeontological resources and built heritage are summarized in the following sections.

3.5.2.2.1 Pre-Contact Period

In general, the PDA transects an area within the traditional Mi'kmaq territory of *Sigenigteoag*, *Sigunitk*, or *Siknikt* (Hamilton 1996:62; NBDNR 2007; Miller 2004:253) which includes the entire area of southeast New Brunswick from Memramcook to the Cumberland County region of Nova Scotia, or, the Chignecto Basin/Chignecto Isthmus (Chute 2002:66; Miller 2004:253). The area was part of an important portage and overland travel route while the coastal and estuarine environments provided both marine and terrestrial resources for Aboriginal peoples (NBDNR 2007).

Although there is limited physical evidence to date for Pre-Contact settlement in and around the PDA, place names suggest Aboriginal use of the region. Several communities close to the PDA, including Memramcook (*Amlamcook*, meaning "variegated"), Aboushagan/Aboujagan (*Naboujagan*, meaning unknown), Midjic (*Midjic*, "point of highland into a marsh"), and Shemogue (*Simooaquik* or *Sim-oo-a-*

quik meaning “horned river” or “a good place for geese”) all derive their names from earlier Mi'kmaq terms, translated to French, and English and then to their modern spellings (Ganong 1896, 1899; Hamilton 1996; NBPA 2014; Rayburn 1975).

Ethnohistoric literature pertaining to the Mi'kmaq suggests Aboriginal peoples were well-adapted for both terrestrial and aquatic subsistence and travelled overland and by canoe throughout this region frequently and on seasonal rounds (Leonard 1996). Although no substantial village sites have been discovered, ethnohistoric literature suggests that large villages existed, for example at Midgic [Midjic], which Ganong (1899) suggests was “...said... to have been formerly one of [the] most important camping grounds”. Archaeological evidence suggests, at a minimum, occupation by ancestral Mi'kmaq peoples in this area as far back as the Palaeoindian Period and continuing through to the Protohistoric and Historic Period (Leonard 1996; NBDNR 2007; M. Nicholas, Pers. comm., 2014; 2015).

3.5.2.2.2 Historic Period

The first non-Aboriginal settlers in the general area surrounding the PDA were the Acadians, who arrived in the area of *Beaubassin* in ca. 1671 from Port Royal, Nova Scotia (Ganong 1983[1899]; NBDNR 2007). Numerous Acadian-era villages are depicted on historic maps of the region, and Ganong (1983[1899]:66–76) describes 13 villages of varying size located between modern-day Moncton and Baie Verte. An early post-Expulsion British map shows churches (presumably associated with villages) extending to Fort Gaspereau/Fort Monckton (Montresor 1768). In the mid-1700's, the Acadians were pushed off of the land by the British and Pennsylvanian Germans and Planters (NBDNR 2007) and in 1761, New Englanders from Rhode Island (Ganong 1983[1899]) arrived in Sackville. The majority of the villages within 5 km of the PDA were agricultural and lumbering communities (Hamilton 1996; NBPA 2014; Rayburn 1975) that were settled in the mid-1800's and were home to local post offices or stops along the railway.

3.5.2.2.3 Archaeological Resources

A review of the Archaeological Potential Map (Archaeological Services 2014a; 2014b) identified ten Pre-Contact Period archaeological sites and 15 Historic Period sites within 7 km of the PDA; however, no archaeological sites were registered within the PDA at the time of the review. The Archaeological Potential Map also identified five Multi-Component sites (*i.e.*, a site consisting of one or more components from more than one archaeological period). These sites include four Pre-Contact/Historic Period sites and one Proto-historic/Historic Period site located within 15 km of the PDA. Two portage/traditional travel routes were also identified on the Archaeological Potential Map located within 15 km of the PDA. None of these Multi-Component sites or portage/traditional travel will be affected by the Project.

In addition to the background research, an archaeological assessment (walkover) survey was conducted in 2014 for the land-based portions of the PDA in New Brunswick. During the course of the 2014 walkover, a total of seven Historic Period archaeological sites were identified and registered with the Province of New Brunswick. Table 3.39 provides a list of registered archaeological sites within the PDA.

Table 3.39 Registered Historic Period Archaeological Sites within the PDA

Site (Borden No.)	Type/Description	Location (General Area)
CaCx-1	Cultural Feature/Linear Stone Feature	Bayfield
CaDb-1	Historic Cultural Feature/Rock Lined Depression	Centre Village
CaDb-2	Historic Cultural Feature/Stone Hearth and old bellows	Cookville
CaCx-4	Cultural Feature/Linear Stone Feature	Malden
CaCx-5	Cultural Feature/Circular Stone Pile	Malden
CaCx-3	Cultural Feature/Irregularly shaped rock pile	Malden/Bayfield
CaCx-2	Cultural Feature/Linear Stone Feature	Malden/Bayfield

3.5.2.2.4 Palaeontological Resources

A palaeontological report based on known data sources within the PDA, was prepared by the New Brunswick Museum (Miller 2014). The report states there are no known fossil localities located within the PDA; however, the PDA is underlain by Late Carboniferous sedimentary rocks in the Boss Point, Salisbury and Richibucto formations which are known to contain fossils in other locations (Miller 2014). A report cited by Miller (2014) also notes that a fossilized tree was identified in an abandoned quarry off of Highway 16 on Cape Tormentine. Although the exact locality of the fossilized tree was not identified in the report, Miller (2014) noted that it could be located in a quarry near Melrose, south of the PDA.

3.5.2.2.5 Built Heritage

A search of the Canadian Register of Historic Places (CRHP) revealed 23 registered designated historic places in or around Memramcook; however, no there are none located within the PDA.

3.5.3 Project Interactions with Heritage Resources

Table 3.40 identifies, for each potential effect, the Project physical activities that might interact with the VC. These interactions are indicated by check marks, and are discussed in detail in Section 3.6.4 in the context of effects pathways, standard and Project-specific mitigation/enhancement, and residual effects. A justification is also provided for non-interactions (no check marks).

Table 3.40 Potential Project-Environment Interactions and Effects on Heritage Resources

Project Components and Physical Activities	Potential Environmental Effects
	Change in Heritage Resource
Construction	
Site Preparation for Land-Based Transmission Lines in New Brunswick	✓
Construction of Land-Based Transmission Lines in New Brunswick	✓
Landfall Construction (New Brunswick and Prince Edward Island)	✓
Upgrading of Electrical Substation (New Brunswick)	–

Table 3.40 Potential Project-Environment Interactions and Effects on Heritage Resources

Project Components and Physical Activities	Potential Environmental Effects
	Change in Heritage Resource
Inspection and Energizing of the Transmission Lines	–
Clean-Up and Re-vegetation of the Transmission Corridor	–
Emissions and Wastes	–
Transportation	–
Employment and Expenditure	–
Operation	
Energy Transmission	–
Vegetation Management	✓
Infrastructure Inspection, Maintenance and Repair (Transmission Lines and Substations)	–
Access Road Maintenance	✓
Emissions and Wastes	–
Transportation	–
Employment and Expenditure	–
Decommissioning and Abandonment	
Decommission	–
Reclamation	–
Emissions and Waste	–
Employment and Expenditure	–
Notes:	
✓ = Potential interactions that might cause an effect.	
– = Interactions between the project and the VC are not expected.	

The Project will not result in the disturbance to or loss of any buildings of architectural significance. No records of built heritage resources or any buildings of architectural or historical significance within, or immediately near, the PDA were identified (Stantec 2015) and no buildings were encountered during the field assessments of the PDA. Therefore, the environmental effects of the Project on built heritage resources as a component of Heritage Resources during all phases of the Project is not considered further in this assessment.

The Project will not result in the disturbance to or loss of palaeontological resources of significance. There are no known fossil occurrences located along the corridor and any fossils present would likely be coalified, poorly preserved plant fossils (Miller 2014). Therefore, the environmental effects of the Project on palaeontological resources as a component of Heritage Resources during all phases of the Project is not considered further in this assessment.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT

September 30, 2015

During construction, activities that have the potential to interact with Heritage Resources include site preparation for land-based transmission lines in New Brunswick, construction of land-based transmission lines in New Brunswick, and landfall construction. Archaeological resources, where present, are typically located in the upper soil layers of the earth and therefore potential interactions between these resources and the Project will most likely take place during the initial ground breaking phases of construction. Any potentially adverse environmental effects due to construction activities on Heritage Resources will be permanent, as no archaeological site can be returned to the ground in its original state. During site preparation for the land-based transmission lines, clearing, minimal grubbing near pole locations, and grading are required and have the potential to interact with Heritage Resources as these activities will result in ground disturbance. During the construction of the land-based transmission lines, pole placement is carried out by excavation which has the potential to interact with Heritage Resources. During landfall construction, trenching of the submarine cable will be required at Cape Tormentine, NB and a portion will be located on a shoreline.

Activities listed under construction in Table 3.40 that are not anticipated to interact with Heritage Resources include: upgrading of electrical substation, inspection and energizing of the transmission lines, clean-up and re-vegetation of the transmission corridor, emissions and wastes, transportation, and employment and expenditure. The upgrading of the electrical substation will occur within the existing footprint and thus, no new ground disturbing activities will occur. Inspection and energizing of the transmission lines and clean-up and re-vegetation of the transmission corridor will not involve ground breaking activities; therefore, no interaction with Heritage Resources will occur. Emissions and wastes generated by the Project will not involve ground breaking activities; therefore, no interaction with Heritage Resources will occur. Transportation generated by the Project will be via the existing road network and therefore will not result in an interaction with Heritage Resources. Employment and expenditure are related to the amount of employment generated and positive economic activity as a result of the Project and will not involve ground breaking activities, thus interaction with Heritage Resources is not anticipated.

During operation, it is possible that maintenance equipment brought onto the RoW and clearing activities associated with vegetation management and temporary access road maintenance could cause ground disturbance, thus potentially affecting Heritage Resources. Other routine activities associated with operation will not result in ground disturbance; therefore, interaction with Heritage Resources is not anticipated.

All activities in the decommissioning phase of the Project will not result in ground breaking activities outside areas already disturbed by the Project and thus not interact with Heritage Resources.

3.5.4 Assessment of Residual Environmental Effects on Heritage Resources

3.5.4.1 Analytical Assessment Techniques

The assessment of potential effects to Heritage Resources was compiled using background research and an archaeological assessment (walkover) of the PDA. The background research included a review of previous archaeological assessments done in the region, review of historic aerial photography, and information received from regulators. The archaeological assessment was undertaken over the past

year and involved examining existing conditions within PDA in order to determine the archaeological potential.

3.5.4.2 Project Pathways for Heritage Resources

Heritage resources are generally located on surface or below ground; therefore any construction or operation activity that disturbs the ground has potential to interact with Heritage Resources.

3.5.4.3 Mitigation for Heritage Resources

Mitigation will be required to avoid or reduce the adverse effects on heritage resource. The primary measure to be taken is to conduct of an archaeological assessment (walkover) in the PDA to accurately determine the existence or potential existence of heritage resources potentially disturbed by Project activities and make site specific recommendations to satisfy Provincial regulatory officials. Seven Historic-Period archaeological sites were identified within the PDA during the archaeological assessment (walkover) conducted in 2014/2015 and were registered with the Province of New Brunswick. Areas of elevated archaeological potential were also identified during the walkover that will be subject to mitigation prior to construction. It is possible that a heritage resource could be encountered during construction or operation even after mitigation has been implemented. The EPP contingency plan for a chance find of a heritage resource during construction and operation phases will also be followed.

The following mitigation measures are recommended arising from the archeological assessment (walkover) of the PDA:

- Planned avoidance of registered archaeological sites located within the PDA and areas determined during walkover survey of the PDA to have elevated potential for archaeological resources.
- Shovel testing, where avoidance is not feasible, to identify potential sites in areas determined to have elevated potential (including potential palaeo-shorelines) for archaeological resources.
- Shovel testing, mapping and recording for age and characterization of recorded Historic Period archaeological sites that cannot be avoided.
- Archaeological monitoring of areas where shovel testing is not practicable.
- Additional mitigation, as required, to be developed with provincial regulators.
- A heritage resource discovery response procedure (i.e., for a chance find of previously unidentified resource) will follow the EPP Contingency Plans during Project-related construction and operation activities.

3.5.4.4 Residual Project Environmental Effect for Heritage Resources

With the implementation of the proposed mitigation, the Project will not result in the unauthorized permanent disturbance to, or destruction of, a heritage resource considered by the provincial heritage regulators to be of major importance that is not mitigated. All archaeological mitigation will be carried out under provincial legislation and authorization and with the knowledge of applicable Aboriginal groups. Any chance finds of previously undetected heritage resources will be limited to the PDA and be

managed according to a discovery response procedure to protect the knowledge associated with those resources.

Background research for the presence of Heritage Resources within the PDA, the archaeological assessment (walkover), and the implementation of any additional mitigation required by provincial regulators will reduce the potential for adverse residual effects to Heritage Resources.

Construction and Operation

The mitigation described is intended to identify heritage resources within the PDA before construction activities are initiated. Should any heritage resources be identified during the field assessment, appropriate mitigation up to and including avoidance, would be implemented prior to construction activities. Therefore the only residual environmental effects would be the unplanned discovery of a heritage resource during construction, or, during vegetation management and access road maintenance activities associated with operation. While mitigation is recommended to address this possibility, the discovery of a heritage resource during construction or operation is likely to result in some adverse environmental effect (i.e., disturbance) to the resource.

In the unlikely case of a Project-related interaction with Heritage Resources, during construction, the effects are characterized as follows: adverse in direction as the unmitigated disturbance of a heritage resource may result in the loss of information. The magnitude of the effect would be rated low to moderate, dependent upon the nature of the heritage resource, the extent of the disturbance, and the ability to implement mitigation following the identification of a heritage resource. This effect would occur as a single event, the duration would be permanent and would be irreversible as heritage resources can only be adversely affected once, and when that occurs, it may result in the permanent loss of some information and context relating to the heritage resource. The geographic extent of this effect would be limited to the PDA, as it is the area of physical disturbance during this phase of the Project where archaeological resources could potentially be located. The socioeconomic context of the PDA is disturbed/undisturbed for construction activities; most of the area has been subject to forestry, agricultural, and industrial quarrying activities in the relatively recent past, but there remains some areas where disturbance is minimal. Operation activities have not been assessed as the entire PDA will have been previously disturbed during construction.

3.5.5 Summary of Residual Project Environmental Effects

Table 3.41 summarizes the Project Residual Environmental Effects on Heritage Resources by the Project phases.

Table 3.41 Summary of Project Residual Environmental Effects on Heritage Resources

Residual Effect	Residual Environmental Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socioeconomic Context
Change in Heritage Resources	C	A	L-M	PDA	P	S	I	D/U
Change in Heritage Resources	O	A	L-M	PDA	P	S	I	D
KEY See Table 3.38 for detailed definitions. Project Phase: C: Construction O: Operation D: Decommissioning and Abandonment Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High		Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Duration: ST: Short-term; MT: Medium-term LT: Long-term P: Permanent NA: Not applicable			Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible Ecological/Socioeconomic Context: D: Disturbed U: Undisturbed R: Resilient NR: Not resilient			

3.5.6 Determination of Significance

3.5.6.1 Significance of Residual Project Effects

The Project has the potential to interact with Heritage Resources during ground breaking activities required during construction, and during activities associated with vegetation management and access road maintenance during operation. With the implementation of the proposed mitigation, the Project will not result in the unauthorized permanent disturbance to, or destruction of, heritage resources considered by the provincial regulators or other stakeholders to be of importance. Therefore, the residual environmental effects of the Project on Heritage Resources during all Project phases are rated not significant.

3.5.7 Prediction Confidence

This assessment is made with a high level of confidence due to the comprehensiveness of the background research, completeness of the field assessment, and the proposed mitigation for within the PDA.

3.5.8 Follow-up and Monitoring

Follow-up archaeological monitoring may be required during ground-breaking construction activities in proximity to locations where archaeological resources were discovered. All monitoring will be done by an archaeologist permitted by the Province and the results reported to the Province and Aboriginals, as applicable. In the event that the archaeological monitoring identifies any additional archaeological resources, an archaeological resource discovery response procedure will be followed. The procedure will include provisions to halt the work in the areas of the discovery and implement mitigation in consultation with the Province and in accordance with provincial heritage legislation.

3.6 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES BY ABORIGINAL PERSONS

Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is defined as the known current use of lands, and resources, that are within the footprint of the Project or on adjacent lands where those uses are potentially affected by the Project.

Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is a valued component (VC) because of current and past use of the land and resources by Aboriginal persons in carrying out their traditional activities as an integral part of their lives and culture. Included, are the right to hunt, trap, fish, gather and follow Aboriginal customs, practices and traditions on ancestral lands. Current Use is considered "living memory" of the use of land and resources within the PDA.

The focus of this section is on current use for traditional activities specifically by Aboriginal persons; uses by non-Aboriginal people, such as the effect on recreational fisheries, are addressed in the Land Use VC (Section 3.3). Other relevant VCs used to inform preliminary conclusions in this VC include Section 3.1 (Freshwater Environment VC) and Section 3.2 (Terrestrial Environment VC).

3.6.1 Scope of Assessment

The scope of the VC considers potential interactions between the Project and Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons. These interactions are based on an evaluation of the activities being undertaken by Aboriginal people within the PDA.

Although the Project lies within the traditional territory of the Mi'kmaq First Nations, the majority of the PDA is located on land that is currently privately owned and has been privately owned for several decades (Stantec 2015). The one exception is a former CN Rail right-of-way (RoW) that has been converted into a recreational trail (Sentiers NB Trails) and is now owned by the Province of New Brunswick (i.e., Crown land). Thus, any current use activities that are taking place on privately-owned land on the RoW are anticipated to be incidental (subject to certain terms and conditions related to landowner permission) and not directly related to the rights by Aboriginal people to pursue traditional uses.

The watercourses within the PDA are also considered Crown land; therefore the ability to access and fish watercourses is the primary focus for the discussion of current use of land and resources for traditional purposes by Aboriginal persons for this VC.

3.6.1.1 Regulatory and Policy Setting

A provincial environmental assessment registration is required for this project under the New Brunswick *Clean Environment Act – Environmental Impact Assessment Regulation*. The guidance on this process states that any traditional uses by First Nations must be considered in the registration.

As a Crown agency, New Brunswick Department of Environmental and Local Government (NBDELG) has a duty to consult with First Nations on such regulatory applications. As a Crown corporation, NB Power is also responsible to implement consultation with First Nations. The New Brunswick Duty to Consult Policy (2011) provides direction to the provincial government on consultation with the Mi'kmaq and Maliseet First Nations.

3.6.1.2 The Influence of Consultation and Engagement on the Assessment

The Proponent has initiated consultation with First Nation communities, and will continue to do so during the EIA process. Details of the consultation plan are presented in Volume 1 (Section 3.2). The political leadership (i.e., Chief and Council) within First Nations communities in proximity to the Project location were notified of the Project details (e.g., the location, details, and schedule of the Project) via a letter to determine if these communities have any questions or concerns about the Project and to solicit information regarding Aboriginal traditional uses in the study areas. Should any information regarding First Nations current use of the Project Site be identified during the regulatory approval process for the Project, this information will be presented to NBDELG, the provincial department responsible for the environmental assessment, for consideration in environmental decision-making.

3.6.1.3 Potential Environmental Effects, Pathways and Measurable Parameters

The Project could have an effect on traditional activities where they occur in proximity to the PDA, and there is the potential for an interaction to cause a change in current use of the freshwater environment and resources for traditional purposes.

During the construction and decommissioning and abandonment phases of the Project, there may be a period of time where access to fishing/gathering/hunting/ceremonial grounds is restricted within a localized area.

Table 3.36 outlines the potential environmental effects, pathways and measurable parameters associated with the current use of land and resources for traditional purposes by Aboriginal persons as they relate to this Project.

Table 3.42 Potential Environmental Effects, Effects Pathways and Measurable Parameters for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

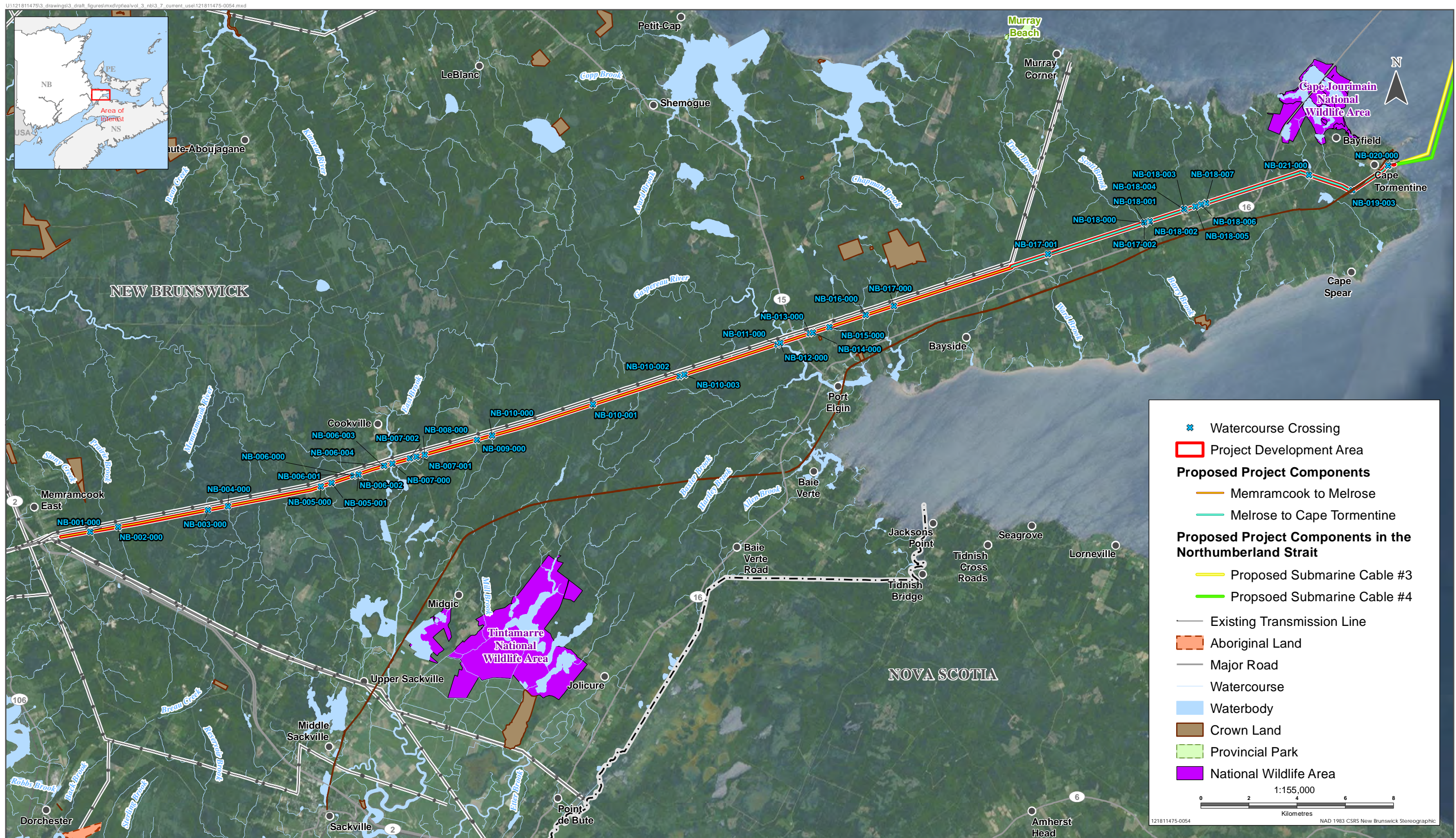
Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in Current Use of Land and Resources for Traditional Purposes by Aboriginal persons	<ul style="list-style-type: none"> Temporary or permanent loss of access to resources on Crown land. The Project may change availability of resources in Crown waters or access to these locations. 	<ul style="list-style-type: none"> Change in ability to participate in traditional activities due to change in access to watercourses. Change in ability to participate in traditional activities due to changes in availability of resources (e.g., change in fish species or populations).

3.6.1.4 Boundaries

3.6.1.4.1 Spatial Boundaries

The spatial boundaries for the environmental effects assessment on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons are defined below (Figure 3.6).

- Project Development Area (PDA): The PDA comprises the immediate area of physical disturbance associated with the construction and operation of the Project. The PDA includes: the existing substation in Memramcook where upgrades to the existing substation will occur within the substation footprint; a 40 km long, 30 m wide transmission line RoW from Memramcook to Melrose and a 17 km long, 60 m wide transmission line RoW from Melrose to Cape Tormentine; a cable termination site; and a 10 m easement around cable lines. The PDA crosses a 55 m wide section of the NB trail network and then parallels the trail for approximately 685 m. The PDA overlaps with approximately 1.6 ha of the NB Trails.
- Local Assessment Area (LAA): The LAA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons for this Project is based on the areas of Crown Land including the 1.6 ha area of the NB trails RoW that overlaps with the proposed Project, and the portion of the watercourses measuring 100 m upstream and 200 m downstream of the corridor centreline (including a riparian buffer of 30 m on each side of the watercourse). For additional, refer to the Freshwater Environment VC (Section 3.2).
- Regional Assessment Area (RAA): The RAA is the area within which the Project's environmental effects may overlap or accumulate with the environmental effects of other projects or activities that have been or will be carried out. Similarly to the LAA, the RAA for the assessment of Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is based on the areas of Crown Land defined watercourse crossed by the Project. This is estimated to include a section of stream up to 2 km downstream of the transmission line corridor, as well as the NB trails RoW that crosses the proposed Project.



Sources: Base Data - Natural Resources (2011). Project Data from Stantec or provided by NB Power / MECL. Imagery - ArcGIS Map Service World Imagery, Natural Resources (2011).

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

3.6.1.4.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons include period of potential interaction; that is the three phases of the Project: construction, operation, and decommissioning and abandonment. Construction in the terrestrial environment is expected to occur over a period of 16 months. Construction of the landfall site and transmission line from Melrose to Cape Tormentine is expected to be completed over 9 to 10 months, between March and December 2016. Construction of transmission line between Melrose and Memramcook is expected to begin in September 2016 with completion expected to take place in June 2017. Operation will begin follow construction and is anticipated to continue for the life of the Project (approximately 40 years). Decommissioning and abandonment would take place following the useful service life of the Project and which would be carried out in accordance with regulations in place at that time.

The temporal boundaries for the establishment of existing conditions for the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons will be for the period of consultation and engagement of the First Nation by the Proponent as well as the period of “living memory” of Aboriginal Persons or communities engaged in current use activities on Crown land. Details that emerge from the engagement with First Nations will be reflected in the Final EIA Report and/or supplemental reports.

3.6.1.5 Residual Environmental Effects Description Criteria

Table 3.43 provides the criteria that are used to characterize residual environmental effects on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.

Table 3.43 Characterization of Residual Environmental Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	<p>Positive—an effect that moves measurable parameters in a direction beneficial to Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons relative to baseline.</p> <p>Adverse—an effect that moves measurable parameters in a direction detrimental to Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons relative to baseline.</p> <p>Neutral—no net change in measureable parameters for the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons relative to baseline.</p>
Magnitude	The amount of change in measurable parameters or variable relative to existing conditions	<p>Negligible—no measurable change from existing baseline conditions.</p> <p>Low—a measurable change from existing baseline conditions, but results in no net loss in the availability of or access to water and/or resources currently used for traditional purposes.</p> <p>Moderate—measurable change (but less than high) from existing baseline conditions, in the availability of or access to water and/or resources currently used for traditional purposes.</p> <p>High—measurable change from existing baseline conditions that is a non-compensated substantive and permanent loss in</p>

Table 3.43 Characterization of Residual Environmental Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
		the availability of or access to water and/or resources currently used for traditional purposes.
Geographic Extent	The geographic area in which an environmental, effect occurs	PDA —residual effects are restricted to the PDA. LAA —residual effects extend into the LAA. RAA —residual effects interact with those of other projects in the RAA.
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	Single event —Effect occurs once during the construction and operation phases of the Project. Multiple irregular event —occurs at irregular intervals during construction and infrequently during the operation phases of the Project. Multiple regular event —occurs at regular intervals during the operation phases of the Project. Continuous —occurs continuously during the construction and operation phases of the Project.
Duration	The period of time required until the measurable parameter or the Use of Land and Resources for Traditional Purposes by Aboriginal Persons returns to its existing condition, or the effect can no longer be measured or otherwise perceived	Short-term —residual effect restricted to the construction period (effects are measurable for days to a few months). Medium-term —residual effect extends throughout the construction and up to 50 years during operation. Long-term —residual effect extends beyond the life of the project.
Reversibility	Pertains to whether a measurable parameter can return to its existing condition after the project activity ceases	Reversible —the effect is likely to be reversed after activity completion and reclamation. Irreversible —the effect is unlikely to be reversed.
Ecological and Socioeconomic Context	Existing condition and trends in the area where environmental effects occur	Undisturbed —area is relatively undisturbed or not adversely affected by human activity. Disturbed —area has been substantially previously disturbed by human development or human development is still present.

3.6.1.6 Significance Definition

A significant adverse residual environmental effect on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is defined as a long-term (one full season for a specific species) loss of the availability of, or access to, land and resources used by Aboriginal persons for traditional purposes within the assessment area that cannot be mitigated. This includes an environmental effect that results in a long-term (more than one season) loss of the availability of, or access to, water resources, the

aquatic environment, the terrestrial (wildlife, vegetation, and wetlands) environment, and ceremonial sites on crown land located within the assessment area that cannot be mitigated.

3.6.2 Existing Conditions for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

There are many areas in New Brunswick which have historical and cultural significance to Aboriginal people. These areas include locations where Aboriginal people continue to pursue traditional activities that are an element of a practice, custom, or tradition integral to the distinctive culture of the Aboriginal group. The following sections present the general environmental setting for the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.

3.6.2.1 Methods

Information regarding Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons relevant to this assessment was obtained through review of existing literature, online public resources, engagement with stakeholders and formal data requests.

Engagement and consultation activities in First Nations communities in New Brunswick have been initiated and will be on-going. The exact nature, scope and detail of First Nation consultation will be determined with the First Nations involved.

Pending information received from consultation, the preliminary conclusions in this section are derived primarily from the information included in biophysical assessments associated with other VCs, in combination with information from a literature review, past project experience, and professional judgment. The reliance on the other VC assessments is based on the assumption that assessments of resources such as wildlife, fish, and vegetation species can inform an assessment of traditional land and resource use activities. The assessments of effects on fish species may not capture the conditions that influence the act of harvesting (e.g., personal choice). However, the abundance of a species that may be used for traditional purposes and the potential effects on that abundance by the Project will directly affect the current use of that species.

As additional information becomes available through the consultation and engagement process, it will be used to update the relevant conclusions in supplemental reports, as necessary.

3.6.2.2 Overview

Mi'kmaq traditional territory (Figure 3.7) is understood to be comprised of all of Nova Scotia and PEI and the eastern shore of New Brunswick, extending north to the Gaspé. Mi'kmaq territory in New Brunswick extends west, where it meets the neighboring Maliseet nations; the divide is generally understood to be the Saint John River watershed as far north as the Gulf of St. Lawrence and south to the Bay of Fundy (Paul n.d., Berneshawi 1997).

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT
September 30, 2015

There are 15 First Nations communities within the province of New Brunswick, consisting of six Maliseet Nation communities and nine Mi'kmaq Nation communities (Figure 3.8). Based on ethno-historical accounts, oral histories, archaeological research, and historical texts, the Maliseet and Mi'kmaq Nations and their ancestors have lived and used the land and resources of what is now New Brunswick since the retreat of the glaciers.

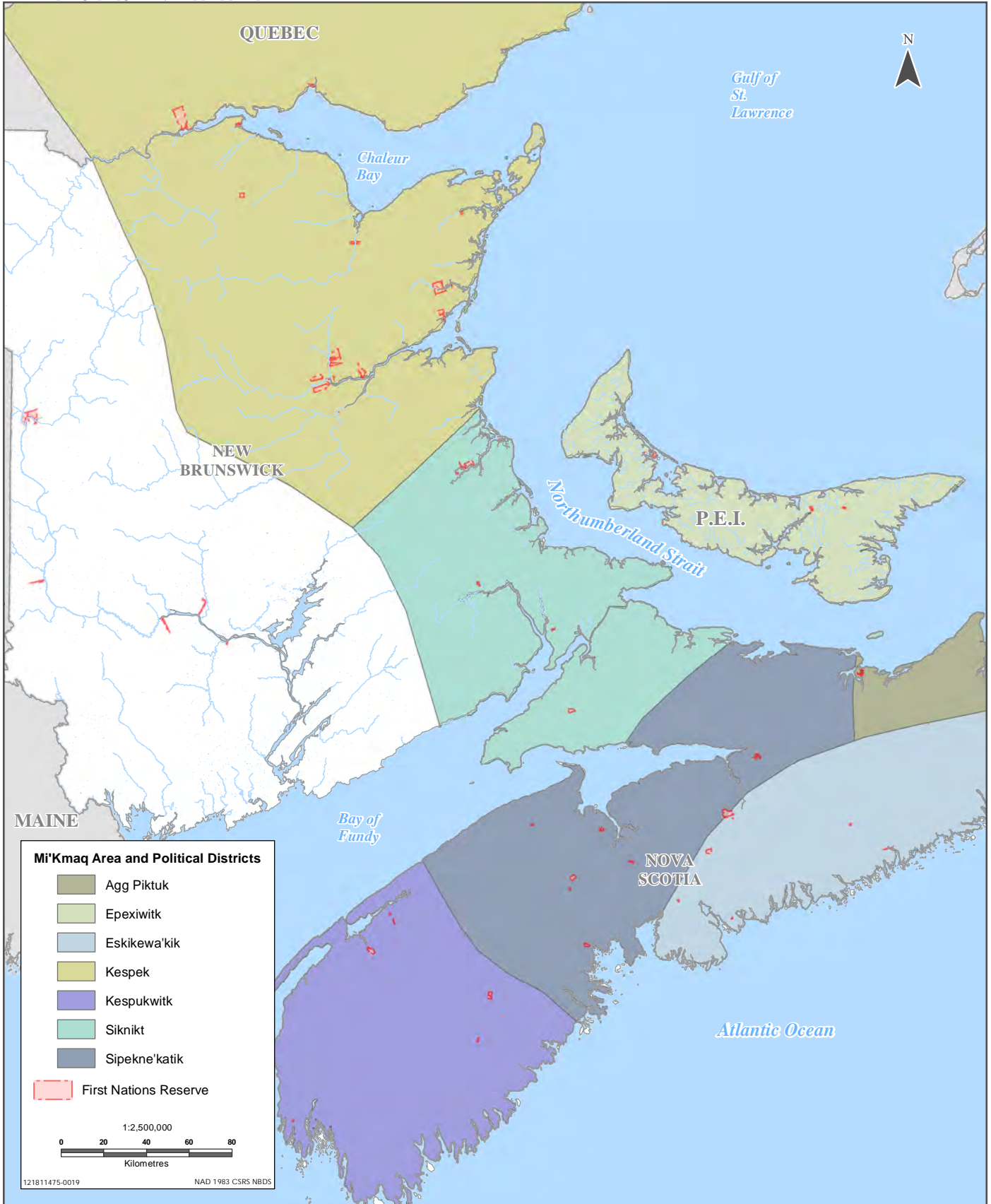
Of the nine Mi'kmaq communities in New Brunswick, four communities fall within close proximity to the Project: Fort Folly First Nation, Bouctouche First Nation, Elsipogtog First Nation and Indian Island First Nation. An overview of these communities is presented in Table 3.44.

Table 3.44 Location of Mi'kmaq Communities in Close Proximity to the Project

Reserve	Size (ha)	Location	Total Population as of January 2015 (On and Off-Reserve)
Fort Folly First Nation			
Fort Folly 1	56.10	11 km southwest of PDA	130
Bouctouche First Nation			
Buctouche 16	62.30	52 km northwest of PDA	118
Indian Island First Nation			
Indian Island 28	38.40	74 km northwest of PDA	183
Elsipogtog First Nation			
Richibucto 15	1742.10	77 km northwest of PDA	3,260
Soegao No. 35	104.5	44 km northwest of PDA	
Source: AANDC, 2014.			

The PDA is located within traditional Mi'kmaq territory. The area from Memramcook to Cumberland County in Nova Scotia was part of a network of portage and overland travel routes and these coastal and estuarine areas provided marine and terrestrial resources for the Aboriginal people. Two portage/traditional travel routes were located within 15 km of the PDA (Stantec 2015); neither of these locations will be affected by the Project.

Based on information gathered to date, the PDA is located mainly on privately owned lands and any use of the lands or resources for traditional purposes is anticipated to be incidental and not related to the right and freedoms of Aboriginal Peoples. The Crown owned land within the Project is limited to the waterways within the PDA and a small section of the provincially owned NB trail near Cape Tormentine. For the purpose of this VC, the potential current use activities are limited to fishing and access via the water ways and the area of the trail.



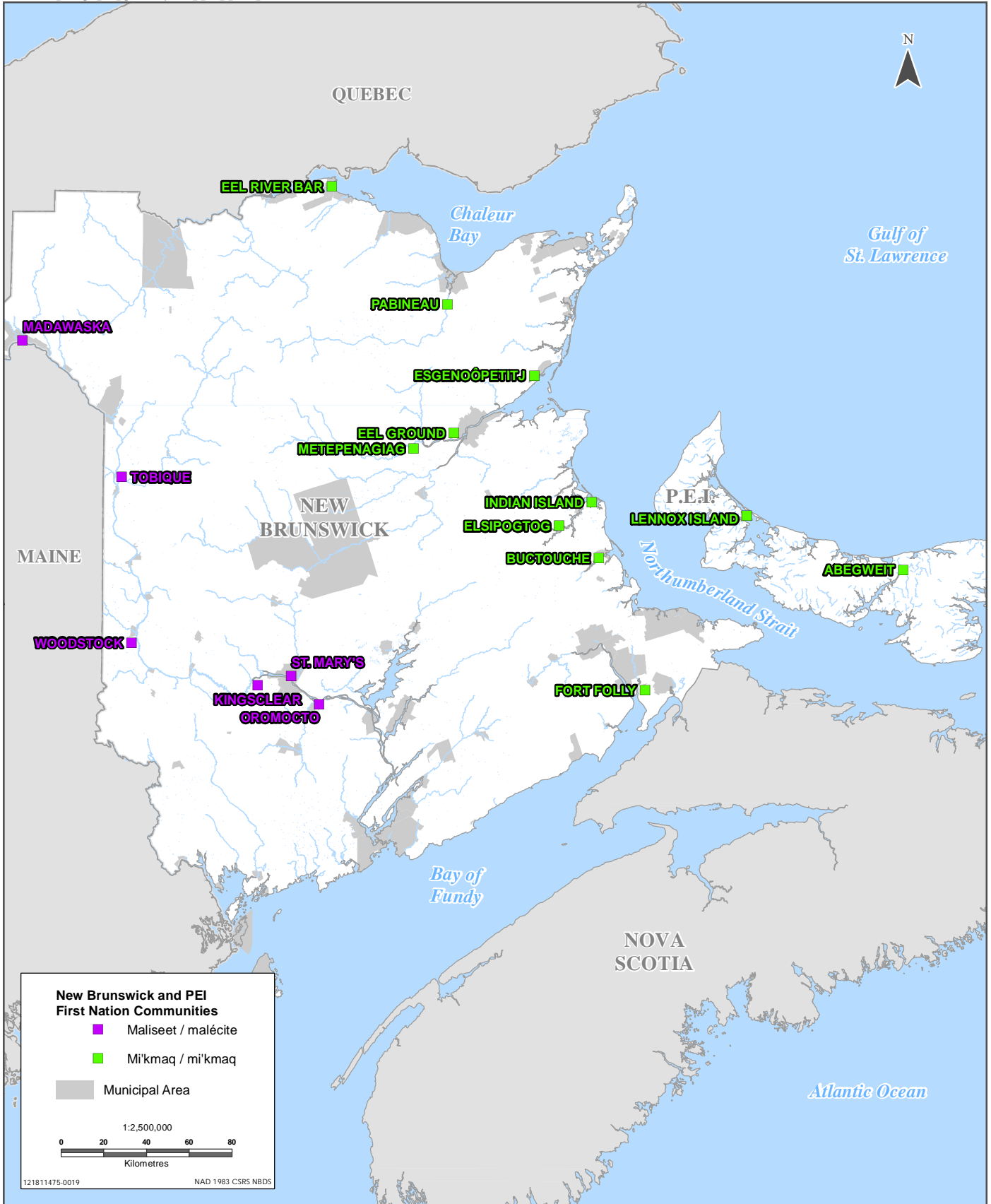
Sources: Base Data - SNB, NBDNR; Mi'kmaq Areas Data - Paul, Daniel: <http://www.danielpaul.com/Map-Mi'kmaq/Territory.html>; Ganong, W.F. 1899. *Map of New Brunswick in Prehistory (Indian) Period*; Natural Resources (2011) Project Data from Stantec or provided by NB Power / MECL.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT

September 30, 2015



Sources: Mi'kmaq Areas Data - Paul, Daniel: <http://www.danielnpaul.com/Map-Mi'kmaq/territory.html>, Natural Resources (2011). Project Data from Stantec or provided by NB Power / MECL.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT

September 30, 2015

3.6.3 Project Interactions with Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Table 3.45 identifies potential Project-Environment interactions and effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons. These interactions are indicated by check marks, and are discussed in detail in Section 3.7.4 in the context of effects pathways, standard and Project-specific mitigation/enhancement, and residual effects.

Table 3.45 Potential Project-Environment Interactions and Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Project Components and Physical Activities	Potential Environmental Effects
	Change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons
Construction	
Site Preparation for Land Based Transmission Lines	✓
Physical Construction of Land Based Transmission Lines	✓
Landfall Construction	-
Upgrading Electrical Substation	-
Inspection and Energizing of the Transmission Lines	-
Clean-Up and Re-vegetation of the Transmission Corridor	-
Emissions and Wastes	-
Transportation	-
Employment and Expenditure	-
Operation	
Energy Transmission	-
Vegetation Management	-
Infrastructure Management, Maintenance and Repair	-
Access Road Maintenance	-
Emissions and Wastes	-
Transportation	-
Employment and Expenditure	-
Decommissioning and Abandonment	
Decommissioning	✓
Reclamation	-
Emissions and Wastes	-
Notes:	
✓ = Potential interactions that might cause an effect.	
- = Interactions between the project and the VC are not expected.	

3.6.3.1.1 Construction and Operation

Since the landfall and substation are located on private land, and the substation area is fenced, there is no interaction with current use activities and the landfall construction and upgrading of the electrical substation.

Inspection and energizing of the transmission lines will occur immediately following construction and since the Transmission Lines are suspended overhead, no interaction with current use activities is anticipated.

During the construction of the transmission corridor, emissions and wastes in the form of dust, noise, surface water runoff and erosion may occur as a result of project activities. However, with the appropriate mitigation measures and best management practices in place (as described in Section 3.6.4.2), these interactions are considered Accidents, Malfunctions, and Unplanned Events and assessed in Section 5.0.

The movement of equipment and personnel to and from the PDA is limited to the use of this existing road infrastructure. As described in Section 3.1, temporary watercourse crossings, if required, will be installed to allow equipment to cross over each watercourse. These temporary crossings would be designed in accordance with the Watercourse and Wetland Alteration Program and completely span the watercourse. No watercourses will be forded by equipment. This may result in a temporary restriction to access within the watercourse.

Employment and expenditure includes the procurement of equipment, supplies and materials, taxation and royalties, and employment and income as related to the Project. The Project-related employment and expenditure will not affect the ability of First Nations people to fish, gather, or carry out other traditional activities.

The operation phase of the transmission line is not expected to have an interaction with Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons since the transmission lines are suspended overhead with associated infrastructure located outside of the riparian zone of the water courses. Temporary access restrictions/habitat disturbance due to vegetation clearing will be of very short duration at any given location; areas immediately adjacent to the PDA will remain unaffected by Project activities and will be available for traditional uses. Interactions with fish or wildlife populations due to operation activities is largely discussed in the Freshwater Environment VC (Section 3.1) and Terrestrial Environment VC (Section 3.2); therefore these interactions are not carried forward in this assessment.

3.6.3.1.2 Decommissioning and Abandonment

Decommissioning and abandonment will be assessed at the end of the useful life of the Project. The expected life of the Project is 40 years, at which time it may be decommissioned; however, it is more likely that at that time the Project will be refurbished and will continue to operate on a similar basis in perpetuity. Any decisions made regarding decommissioning and abandonment will be completed in accordance with the applicable regulations at that time and could include either the abandonment or removal of the transmission cables.

Since the available Crown land is generally limited to the water courses and riparian zone, and a 1.6 ha of an active trail, interaction with transportation during construction and decommissioning will be limited to the temporary disruption of access within the watercourses and the trail to allow for the installation/abandonment of the transmission lines and are therefore carried forward in this assessment.

3.6.4 Assessment of Residual Environmental Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Potential residual effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons include a change to traditional hunting, fishing or gathering opportunities within the LAA due to construction or decommissioning activities.

Potential residual environmental effects on recreational fisheries are discussed in the Land Use VC (Section 3.4), effects on fish species are discussed in the Freshwater Environment VC (Section 3.1) and effects on wildlife and vegetation is discussed in the Terrestrial Environment VC (Section 3.2).

3.6.4.1 Analytical Assessment Techniques

Information regarding Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons in and along the Project PDA was obtained through review of existing literature and online public resources. The conclusions in this section are derived primarily from the conclusions from relevant biophysical assessments, past project experience, and professional judgment. As additional information becomes available through the consultation and engagement process, it will be used to update the relevant conclusions in supplemental reports, as necessary.

3.6.4.2 Assessment of a Change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

3.6.4.2.1 Project Pathways for a Change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

The overhead transmission line corridor from Cape Tormentine to Memramcook will cross 48 watercourses (and associated riparian areas) and a 1.6 ha area of NB Trail, which is Crown land. During construction, it is anticipated that site activities may result in temporary restrictions to access to the watercourses in the PDA for fishing and plant harvesting (within 30 m of the riparian zone). This restricted access to the Project site could constrain Aboriginal fishing, hunting, gathering opportunities, and ceremonial activities, if practiced, during the construction phase.

3.6.4.2.2 Mitigation for a Change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Mitigation for effects related to a change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is closely linked to mitigation measures for the Land Use VC (Section 3.3) and the Freshwater Environment VC (Section 3.1). It is expected that this mitigation will protect habitats and species of traditional importance to the Aboriginal people.

As a general mitigation measure, consultation has been initiated and will continue with Aboriginal communities to avoid or reduce the environmental effects (i.e., temporary access restrictions) of the Project on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.

Activities will be managed by MECL and NB Power in accordance with each company's EPP and the company's HSE policies.

The following mitigation measures will be implemented for changes in freshwater population, and will be applied during Project construction. They include compliance with regulations, (i.e., *NB Watercourse and Wetland Alteration Regulations*), codified measures (DFO Measures to Avoid Harm), proven mitigation and industry best management practices:

- Span all watercourses and there will be no in-stream work.
- The EPP includes general construction BMPs, a spill management plan and an erosion and sediment control plan. All employees and contractors working on the project will be trained on the EPP prior to starting work. During planning and siting of the transmission line towers NB Power will avoid, where possible, the placement of a transmission line tower within 30 m of a watercourse.
- Clearing of vegetation within the transmission line corridor will occur by hand within 30 m of a watercourse or wetland. Where practical, a riparian buffer with a width of 10 m will remain on each bank.
- Temporary watercourse crossings will be installed to allow equipment to cross over each watercourse, the temporary crossings will be designed in accordance with the Watercourse and Wetland Alteration Program and completely span the watercourse. No watercourses will be forded by equipment.
- If rutting is observed leading up to a watercourse crossing, brush matting or log corduroy will be installed at the approaches.
- If required, transmission line tower construction within 30 m of a watercourse will be constructed in accordance with the *Watercourse and Wetland Alteration Regulations*, including any recommendations made under approval from NBDELG.
- No washing, fueling or maintenance of vehicles or equipment will occur within 30 m of a watercourse or wetland without secondary containment.
- No storage of fuel will occur within 30 m of a watercourse or wetland.

- Machinery will arrive on-site in a clean condition and be maintained free of fluid leaks, invasive species and noxious weeds.
- Vegetation clearing during operation will not occur within 30 m of a watercourse unless the vegetation height violates the clearance requirements for reliability standards to be met by NB Power.

As further mitigation for the potential environmental effects of the Project on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, the Proponent is committed to continuing engagement of, and dialogue with, First Nations about the Project and its potential environmental effects throughout the life of the Project. Should additional interaction be identified, appropriate mitigation will be developed in consultation with the affected First Nations and regulatory agencies, as warranted.

3.6.4.2.3 Residual Project Environmental Effect for a Change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

A residual environmental effect leading to a change in current use of land and resources for traditional purposes by Aboriginal persons may occur during construction, operation and decommissioning of the Project. The construction and decommissioning may result in disruptions to access to fishing, hunting, gathering, and ceremonial activities, if practiced, within the PDA. Potential interactions will be short in duration and confined to the PDA. With the implementation of mitigation measures such as implementation of a Communications Plan and mitigation for freshwater habitat, the magnitude of the effect of the Project on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is anticipated to be low. This potential effect on traditional fishing, hunting and gathering activities is anticipated to occur at multiple irregular events during the construction and decommissioning of the Project. Based on existing conditions and past evidence, this environmental effect is anticipated to be reversible and short in duration. After completion of Project construction and decommissioning, it is expected that traditional fishing, hunting and gathering activities within the PDA will return to pre-construction conditions (subject to certain terms and conditions related to landowner permission).

3.6.4.3 Summary of Residual Project Environmental Effects

A summary of the environmental effects assessment and prediction of residual environmental effects resulting from interactions with Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is provided in Table 3.46 and discussed below.

Table 3.46 Summary of Project Residual Environmental Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Residual Effect	Residual Environmental Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socioeconomic Context
Change in Current Use of Land And Resources for Traditional Purposes by Aboriginal Persons	C	A	L	PDA	ST	IR	R	U
	D	A	L	PDA	ST	IR	R	U
KEY See Table 3.43 for detailed definitions. Project Phase: C: Construction O: Operation D: Decommissioning and Abandonment Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High		Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Duration: ST: Short-term; MT: Medium-term LT: Long-term P: Permanent NA: Not applicable			Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible Ecological/Socioeconomic Context: D: Disturbed U: Undisturbed			

3.6.5 Determination of Significance

3.6.5.1 Significance of Residual Project Effects

A change in current use of land and resources for traditional purposes by Aboriginal persons within the LAA is not expected to be significant during the construction, operation or decommissioning phases of the Project provided mitigation measures are implemented and in consideration of the following:

- The Project is located on private land, with the exception of the Crown Land associated with the water courses within the PDA (including the 30 m wide riparian zone) and the existing NB Trail.
- The small size of the PDA compared to the available fishing/hunting/gathering grounds within the RAA.
- The short timeframe anticipated for the completion of the construction or decommissioning activities of the Project.

With the implementation of the proposed mitigation, the Project will not result in a change in an Aboriginal person's ability to participate in traditional activities due to changes in availability of resources (e.g., change in fish species or populations), with the possible exception of a very small area within the PDA during Project construction. Areas immediately adjacent to the PDA will remain unaffected by Project activities and will be available for traditional uses. Therefore, the residual environmental effects of the Project on Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons during all Project phases are predicted to be not significant.

3.6.6 Prediction Confidence

Confidence in these conclusions is moderate based on reliance on secondary sources for traditional land use information within the PDA. However, regarding the potential environmental effects on freshwater life and terrestrial environment, there is a high level of understanding of the potential environmental effect pathways, and anticipated effectiveness of the mitigation and project planning measures. The overall prediction confidence associated with this VC therefore is moderate to high.

As consultation is ongoing, should Traditional Knowledge information become available, this information will be considered and residual effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons will be reviewed. Given the qualitative and subjective nature of assessing the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, the views of Aboriginal groups may differ from this assessment. Should concerns regarding residual effects be identified through ongoing Aboriginal engagement this information will be provided through additional reporting.

3.6.7 Follow-up and Monitoring

There is no follow up or monitoring proposed for this VC.

The Proponent will continue to consult with the Aboriginal communities to reasonably address Project-specific issues related to residual effects and additional work and/or monitoring may be required pending the results of the engagement process.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ENVIRONMENTAL EFFECTS ASSESSMENT

September 30, 2015

4.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Effects of the environment on the Project are associated with risks of natural hazards and influences of nature on the Project. These effects may arise due to forces of nature associated with weather, climate, climate change, seismic activity, forest fires, or marine hazards. Potential effects of the environment on any project are typically addressed through design and operational procedures developed in consideration of expected normal and extreme environmental conditions. Effects of the environment, if unanticipated or unmanaged, could result in adverse changes to Project components, schedule, and/or costs.

As a matter of generally accepted engineering practice, designs and design criteria tend to consistently overestimate and account for possible forces of the environment. Engineering design therefore inherently incorporates a considerable margin of safety so that a project is safe and reliable throughout its lifetime. NB Power will monitor any observed effects of the environment on the Project, and take action, as necessary, to repair and upgrade Project infrastructure and modify operations to permit the continued safe operation of the facility.

4.1 SCOPE OF ASSESSMENT

Potential effects of the environment on the Project relevant to conditions potentially found in New Brunswick include:

- climate, including weather and weather variables such as:
 - air temperature and precipitation
 - fog and visibility
 - winds
 - extreme weather events
 - storm surges and waves
- climate change (including sea level rise and coastal erosion)
- seismic events
- forest fire from causes other than the Project
- marine hazards

4.1.1 Regulatory and Policy Setting

Direction on the scoping of effects of the environment on the Project for this assessment has been provided by the New Brunswick government, as noted in the following section.

4.1.2 The Influence of Consultation and Engagement on the Assessment

As outlined in Volume 1, Section 3.2 (Consultation and Engagement), scoping documents were sent to provincial regulators in New Brunswick and PEI, in addition to PWGSC.

The New Brunswick Department of Environment and Local Government (NBDELG) Technical Review Committee (TRC) has requested that future climate conditions be considered by the Proponent with respect to location, design and construction of the transmission line and its associated infrastructure.

4.1.3 Potential Environmental Effects, Pathways and Measurable Parameters

Potential effects of the environment on the Project may include:

- reduced visibility and inability to manoeuvre construction and operation equipment
- delays in receipt of materials and/or supplies (e.g., construction materials) and/or in delivering products
- changes to the ability of workers to access the site (e.g., if a road were to wash out)
- damage to infrastructure
- increased structural loading
- corrosion of exposed oxidizing metal surfaces and structures, perhaps weakening structures and potentially leading to malfunctions
- loss of electrical power resulting in potential loss of production

These and other changes to the Project can result in delays or damage to the Project processes, equipment, and vehicles. The effects assessment is therefore focused on the following effects:

- change in Project schedule
- damage to infrastructure

Some effects, such as damage to infrastructure, can also result in consequential effects on the environment (e.g., spills); these environmental effects are addressed as Accidents, Malfunctions, and Unplanned Events in Chapter 5.

4.1.4 Boundaries

4.1.4.1 Spatial Boundaries

The spatial boundaries for the assessment of effects of the environment on the Project include the areas where Project-related activities are expected to occur. For the purpose of this assessment, the spatial boundaries for effects of the environment on the Project in New Brunswick are limited to the Project Development Area (PDA), as described below.

- Project Development Area (PDA): The PDA comprises the immediate area of physical disturbance associated with the construction and operation of the Project. The PDA includes: the existing substation in Memramcook where upgrades to the existing substation will occur within the substation footprint; a 40 km long, 30 m wide transmission line RoW from Memramcook to Melrose and a 17 km

long, 60 m wide transmission line RoW from Melrose to Cape Tormentine; a cable termination site; and a 10 m easement around cable lines.

Where consequential environmental effects are identified, they are considered within the boundaries of the specific zone of influence of those consequences. Accidental events that could arise as a result of effects of the environment (e.g., spills) are addressed in Section 5.0.

4.1.4.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the effects of the environment on the project include construction, operation, and decommissioning and abandonment. Construction in the terrestrial environment is expected to occur over a period of 16 months. Construction of the landfall site and transmission line from Melrose to Cape Tormentine is expected to be completed over 9 to 10 months, between March and December 2016. Construction of transmission line between Melrose and Memramcook is expected to begin in September 2016 with completion expected to take place in June 2017. Operation will begin following construction and is anticipated to continue for the life of the Project (approximately 40 years). Decommissioning and abandonment would take place following the useful service life of the Project and which would be carried out in accordance with regulations in place at that time.

4.1.5 Residual Environmental Effects Description Criteria

A significant adverse residual effect of the environment on the Project is one that would result in:

- a substantial change of the Project schedule (e.g., a delay resulting in the construction period being extended by one season)
- a long-term interruption in service (e.g., interruption in power transmission activities such that electricity demands cannot be met)
- damage to Project infrastructure resulting in a significant environmental effect
- damage to the Project infrastructure resulting in a substantial increase in a health and safety risk to the public or business interruption
- damage to the Project infrastructure resulting in repairs that could not be technically or economically implemented

4.2 EXISTING CONDITIONS FOR EFFECTS OF THE ENVIRONMENT ON THE PROJECT

4.2.1 Climate

Climate is defined as the statistical average (mean and variability) of weather conditions over a substantial period of time (typically 30 years), accounting for the variability of weather during that period (Catto 2006). The relevant parameters used to characterize climate are most often surface variables such as temperature, precipitation, and wind, among others.

The current climate conditions are generally described by the most recent 30 year period (1981 to 2010; Government of Canada 2015a) for which the Government of Canada has developed statistical summaries, referred to as climate normals. The closest weather station to the Project with available historic data is the Sackville station, located approximately 20 km south-east of the Memramcook substation. Limited historic climate data are available for the Sackville station; therefore, data from the Moncton weather station, located approximately 30 km from the Memramcook substation, are also used to supplement information on regional conditions relevant to the PDA in New Brunswick.

4.2.1.1 Air Temperature and Precipitation

The average monthly temperature in Sackville has ranged between -7.5°C (January) and 17.6°C (August) (Table 4.1). Extreme maximum temperature was 31.5°C (August 1993) and the extreme minimum temperature was -31.0 °C (January 1982).

Sackville averages 1,146.5 mm of precipitation per year, of which, approximately 915.2 mm fell as rain and 231.2 cm as snow. Extreme daily precipitation at Sackville ranged from 34.6 mm (February) to 74.2 mm (July). On average, there have been 7.4 days each year with rainfall greater than 25 mm, and snowfalls greater than 25 cm occur on average 0.66 day per year (Government of Canada 2015a).

Table 4.1 Air Temperature and Precipitation Climate Normals, Sackville, NB (1981-2010)

Month	Temperature (°C)					Precipitation (mm)					Mean No. of Days with							
	Averages			Extreme		Rainfall (mm)	Snowfall (cm)	Precipitation (mm)	Extreme daily Rainfall (mm)(Year)	Extreme Daily Snowfall (mm)(Year)	Temperature (°C)				Snow (cm)		Rain (mm)	
	Max	Min	Avg	Max (Year)	Min (Year)						>=30*	>=20*	<=-20	<=-30	>=10	>=25	>=10	>=25
Jan	-3.1	-11.8	-7.5	14 (2000)	-31 (1982)	40.8	62.6	103.4	49.8 (1998)	45 (1982)	0	0	2.9	0.09	2.1	0.32	1.4	0.41
Feb	-2.2	-10.8	-6.5	13 (2000)	-29 (1993)	30.4	44.2	74.6	34.6 (1984)	30 (1992)	0	0	2.3	0	1.6	0.09	1.1	0.18
Mar	1.9	-6.2	-2.2	17.5 (1999)	-25.5 (1989)	47.1	45.4	92.5	37 (1983)	30 (1987)	0	0	0.5	0	1.6	0.05	1.9	0.18
Apr	7.6	-0.7	3.5	23 (1994)	-13 (1995)	68	21.4	89.4	37.2 (2001)	30 (1997)	0	0.19	0	0	0.67	0.05	2.2	0.52
May	14.5	4.4	9.5	28 (1992)	-3.5 (1984)	105.1	3.3	108.4	41.8 (2000)	15 (1995)	0	3.6	0	0	0.19	0	3.2	0.86
Jun	19.2	9.1	14.2	28 (1983)	-0.5 (1992)	94	0	94	52.4 (1995)	0 (1981)	0	12.5	0	0	0	0	3	0.62
Jul	22.4	12.6	17.5	30.5 (1999)	5 (1992)	86.5	0	86.5	74.2 (1983)	0 (1981)	0.05	23.6	0	0	0	0	2.9	0.81
Aug	22.3	12.9	17.6	31.5 (1993)	4.5 (1991)	81.6	0	81.6	51 (1990)	0 (1981)	0.1	23.4	0	0	0	0	2.5	0.71
Sep	18.2	9.4	13.8	30.5 (1999)	-2 (1989)	107	0	107	69.6 (1999)	0 (1981)	0.05	8.1	0	0	0	0	3.1	1.2
Oct	12.2	4.1	8.2	23.5 (2001)	-4.5 (1985)	105.4	0.1	105.5	60 (1998)	2 (1997)	0	0.52	0	0	0	0	3.5	1
Nov	6	-1	2.5	22 (1982)	-16 (1989)	94.9	13.1	108.1	63.6 (1991)	25 (1997)	0	0.05	0	0	0.19	0.05	3.5	0.48
Dec	0	-7.7	-3.8	15.5 (1990)	-27 (1980)	54.5	41	95.5	53.4 (1990)	25 (1991)	0	0	0.81	0	1.3	0.1	2	0.48
Annual	9.9	1.2	5.6	-	-	915.2	231.2	1146.5	-	-	0.2	72	6.5	0.09	7.7	0.66	30.3	7.4

Source: Government of Canada 2015a

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

EFFECTS OF THE ENVIRONMENT ON THE PROJECT
September 30, 2015

4.2.1.2 Fog and Visibility

Fog is defined as a ground-level cloud. It consists of tiny water droplets suspended in the air and reduced visibility to less than 1 km (Environment Canada 2014a). “Days with fog” are days when fog occurs and horizontal visibility is less than 1 km (thick fog) and 10 km (fog) (Phillips 1990). Limited historical climate data for fog and visibility are available for the Sackville station; therefore, fog data from the Moncton weather station, located approximately 30 km from the Memramcook substation, are presented to provide some indication of the magnitude of fog experienced in the region. The hours with the measured increase in hours of reduced visibility (< 1 km) is between January and April (Government of Canada 2015b) (Table 4.2). During the winter, the Petitcodiac River does not fully freeze over, which leaves a source of moisture for cloud or fog to form. A combination of cool temperatures and low winds will lead to fog formation over the river with the tide and travel towards the Moncton area. This can occur during the spring and early summer as well, when warm air flows over the cool water (NAV CANADA 2001). The Moncton weather station has experienced, on average, 171.8 hours (7.2 days) per year when visibility is less than 1 km.

Table 4.2 Visibility - Climate Normals, Moncton (1981-2010)

Visibility (hours with)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
< 1 km	18	19.5	24.2	18.4	12.5	10.4	11.3	9.5	9.8	9.7	12.6	15.7	171.8
1 to 9 km	107.8	96	111.2	109.6	80.9	69.2	64.5	72	56.4	53.4	82	106.1	1009.1
> 9 km	618.1	562.4	608.6	592	650.6	640.5	668.2	662.5	653.8	680.9	625.4	622.2	7585.1
Source: Government of Canada 2015b													

4.2.1.3 Wind

Monthly average wind speeds measured at the Moncton weather station range from 13.2 to 19.2 km/h (Figure 4.1). From November to March, the dominant wind direction is from the west, with winds predominantly blowing from the north during April, and from the southwest during May to October (Government of Canada 2015b). Maximum hourly wind speeds measured at the Moncton weather station range from 56 km/hr to 103 km/hr, while maximum gusts for the same period range from 89 km/hr to 161 km/hr (Government of Canada 2015b). Occurrences of extreme winds do occur at the Moncton weather station. Over the last three decades, there has been an average of 23.6 days per year with winds greater than or equal to 52 km/h and 6.4 days per year with winds greater than or equal to 63 km/h (Government of Canada 2015b).

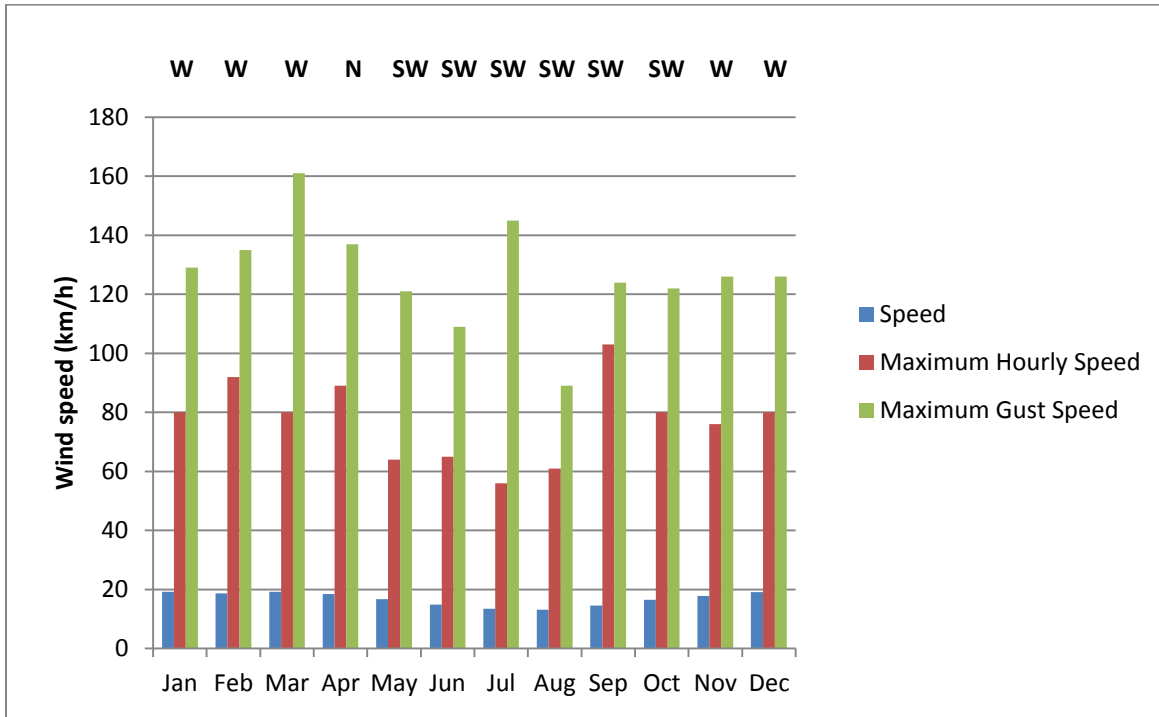


Figure 4.1 Predominant Monthly Wind Direction, Monthly Mean, Maximum Hourly and Maximum Gust Wind Speeds (1981 to 2010) at Moncton Weather Station, NB

4.2.1.4 Extreme Weather Events

Extreme precipitation and storms can occur in NB throughout the year, but tend to be more common and severe during the winter. Winter storms generally bring high winds and combination of snow and rain. Freezing rain has been observed on approximately 12 days a year in New Brunswick, with an average of 59 hours at Moncton.

One of the most noteworthy storms in recent history struck eastern New Brunswick on January 4, 1989, where Moncton experienced 110 km/h winds and 67 cm of snow over a 24 hour period. The Groundhog Day storm in February 1976 was another intense winter storm that caused a great deal of damage in southern New Brunswick (Phillips 1990).

On January 21, 2000, a storm produced a 2.0 m storm surge along the Northumberland Strait coast of New Brunswick. This storm was a result of extremely low atmospheric pressure and powerful onshore winds (R J Daigle Enviro 2011).

Extreme storm events in December 2010 affected much of New Brunswick, where some areas received as much as 200 mm of rain; these events threatened public safety and transportation systems, and damages were estimated to be approximately \$50 million (Government of New Brunswick 2015).

In the summer and fall, southern New Brunswick is expected to experience at least one heavy rainstorm every one to two years (Phillips 1990).

In New Brunswick, river valleys and flood plains can pose a risk because of ice jams, harsh weather and the floods of annual spring thaw (Government of Canada 2015). Flooding in New Brunswick is rather common, especially along the Saint John River (Phillips 1990). Therefore, flooding is listed as one of the regional hazards in New Brunswick through the federal governments "Get Prepared" campaign (Government of Canada 2015), and the New Brunswick Emergency Measures Organization monitors flooding as a natural risk and hazard through its "River Watch" program (http://www2.gnb.ca/content/gnb/en/news/public_alerts/river_watch.html).

Electrical storms, or thunderstorms, which are more frequent in New Brunswick than the rest of Atlantic Canada, occur on average 10 to 20 times a year (Phillips 1990). Generally, only one of these storms (per year) is extreme enough to produce hail. Thunderstorms can produce extremes of rain, wind, hail and lightning; however, most of these storms are relatively short-lived (Phillips 1990).

Tornadoes are rare, but do occur in New Brunswick. There have been 85 confirmed and probable F3 Tornadoes¹ in eastern New Brunswick between 1729 and 2009 (Environment Canada 2011). Of Canada's ten worst tornadoes on record, an F3 tornado, occurred in eastern New Brunswick at Bouctouche on August 6, 1879 (CBC News 2013 May 21), which killed 5 people and injured 10.

4.2.1.5 Storm Surges and Waves

Rising sea levels and more frequent and severe weather has also brought about an increase in frequency of storm surges. Storm surges are defined as the elevation of water resulting from meteorological effects on sea level. During the past 15 years, storm surges have resulted in property destruction in all four Atlantic Provinces (Vasseur and Catto 2008). In Atlantic Canada, storm surges have been higher in coastal waters and highest in the Gulf of St. Lawrence (Bernier et al. 2006).

In southeastern New Brunswick, storm surges range from 0.6 m to 2 m in height and surges above 0.6 m in height occur about two to three times per year along the Canadian Atlantic coast (Parkes et al. 1997). Typically, surges were found to last for an average of 2.2 hours, and occasionally over 12 hours. At Saint John, where the vertical difference between the average high water level and the extreme high water level is in the order of 2.3 m, the risk from storm surge flooding is much less than in areas with lower tidal amplitude. Two important storm surges that happened close to the occurrence of tidal high water caused considerable damage throughout the Bay of Fundy. The Groundhog Day storm in 1976 caused a surge off the coast of Saint John estimated at 1.6 m, with maximum wave heights (trough to crest) of 12 m with swells as high as 10 m. The famous Saxby Gale of 1869 is estimated to have created a storm surge between 1.2 m and 2.1 m (Parkes et al. 1997), with the higher surges occurring in the upper Bay of Fundy between Moncton and Burncoat, Nova Scotia.

¹ Tornadoes are classified on a scale known as the Fujita scale. F3 Tornadoes ("severe tornado") have winds ranging between 253-330 km/h and result in roofs and walls torn off well-constructed houses, trains overturned, and most trees in forests uprooted.

4.2.2 Climate Change

While "climate" refers to average weather conditions over a 30-year period, "climate change" is an acknowledged change in climate that has been documented over two or more periods, each with a minimum duration of 30 years (Catto 2006). The Intergovernmental Panel on Climate Change (IPCC) defines climate change as a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes, external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC 2012). The United Nations Framework Convention on Climate Change makes a distinction between climate change attributed to human activities and climate variability attributable to natural causes. Climate change is a change of climate directly or indirectly attributed to human activity that alters the composition of the global atmosphere, which is in addition to natural climate variability observed over comparable time periods (IPCC 2007).

Prediction of effects of climate change are limited by the inherent uncertainty of climate models in predicting future changes in climate parameters. Global and regional climate models can provide useful information for predicting and preparing for global and macro-level changes in climate; however, the ability of models to pinpoint location-specific changes to climate is still relatively limited.

4.2.2.1 Sea Level Rise

Global sea levels have risen 1.8 mm/year over a 40 year period (1961 to 2003) and a more recent rate of 3.1 mm/year between 1993 and 2003 (Bindoff et al. 2007). The sea level has been slowly and steadily rising in most of Atlantic Canada for centuries due to crustal subsidence, warming trends, and the melting of polar ice caps (Government of Newfoundland and Labrador 2003). In particular, the sea level has been gradually rising along the southeastern coast of New Brunswick for several thousand years. The changes associated with that rise have become especially evident along the Northumberland Strait over the last several decades (Daigle et al. 2006) due to the low coast profile and substantive development near the coast line and on lands near mean sea level. Most of Atlantic Canada is also experiencing some crustal subsidence in coastal areas, thus compounding the rise in sea level (Vasseur and Catto 2008).

Sea level rise sensitivity is defined as the degree to which a coastline may experience physical changes such as flooding, erosion, beach migration, and coastal dune destabilization (Natural Resources Canada 2010).

Sea levels are expected to continue to rise at a greater rate in the 21st Century than was observed between 1961 and 2003 due to more rapid warming; this also increases rate of melting of the ice caps and glaciers. By the mid-2090s, global sea levels are projected to rise at a rate of approximately 4 mm/year, and reach 0.22 m to 0.44 m above 1990 levels (Bindoff et al. 2007). It is generally understood that a rise in sea level, coupled with more frequent and severe weather, are likely to bring about storm surges that could flood areas in Atlantic Canada that were once unlikely to flood (Conservation Corps of Newfoundland and Labrador 2008).

At the current sea level, storm surges of 3.6 m are anticipated annually in the southern Gulf of St. Lawrence by 2100 (Parkes et al. 2006). Over the next 100 years, storm surges in excess of 4.0 m are anticipated to occur once every 10 years (Vasseur and Catto 2008).

Climate systems are highly variable, reducing the certainty with which climate projections can be made. While the directions of some climate conditions are nearly certain, there is greater uncertainty in the projected magnitude or extent of the conditions. For example, while it is expected that temperatures will increase over the next 80 years, determining the extent of that temperature increase becomes progressively more difficult at times further into the future. When investing in infrastructure and industries of the future that will be subject to sea level rise and storm surges, precautions must be taken in their design to ensure consideration of the environmental effects of climate change.

Coastal erosion caused by sea level rise and wave action may also be influenced by the strength of the coastal material. A coastal erosion assessment at the landfall site in Cape Tormentine, NB was conducted in 2015. The objective of this assessment was to determine the present shoreline erosion process and rates in the vicinity of the New Brunswick (Cape Tormentine) cable landing site. The findings from this assessment would be used to provide recommendations on long-term protection of the landing sites.

The assessment consisted of two phases:

- A site visit was conducted with a specific focus on the local physiography. The intent was to help gain an understanding of the dynamics that shaped the present day shoreline. An understanding of the landform history would enable a more accurate prediction of future changes to the shoreline.
- A review and comparison of historical aerial photos was carried out for the cable landing site in Cape Tormentine. A visual representation of the changes in the shoreline is shown on Figure 4.2.

The landing site along the NB coastline is currently a camping area with a beach that gently slopes to the water and has approximately 100 m of seafloor exposed near low water. The surficial geology along the shoreline is consistent and generally consists of sand, with no visible bedrock outcrops, and a small bank that leads to the camping area. Moving off the shore, the surficial geology changes to a thin topsoil layer overlying a reddish brown silty sand with gravel glacial till. The topography along the top of the slope is relatively level.

Since 1944, the south portion of the area has experienced a loss in shoreline through erosion, while the north portion has experienced an increase in shoreline. This may be due to construction activities (infilling over the years) and material being carried from the southern portion of the coastline. The average change in shoreline in this area ranges from 0 to 20 m as shown in the inset to Figure 4.2. At the cable landing site, there has been a smaller change in shoreline, with a decrease of approximately 3 m (see Figure 4.2).

4.2.3 Seismic Activity

Seismic activity is dictated by the local geology of an area and the movement of tectonic plates comprising the Earth's crust. Natural Resources Canada monitors seismic activity throughout Canada and identifies areas of known seismic activity in order to document, record, and prepare for seismic events that may occur.

The New Brunswick Project components lie within the Northern Appalachians seismic zone (Figure 4.3) (NRCan 2013a), which includes most of New Brunswick and extends southwards into New England and Boston. It is one of five seismic zones in southeastern Canada, where the level of historical seismic activity is low. Historical seismic data recorded throughout eastern Canada has identified clusters of earthquake activity. Earthquakes in New Brunswick generally cluster in three regions: the Passamaquoddy Bay region, the Central Highlands (Miramichi) region, and the Moncton region (Burke 2011).



Sources: GeoNB, NB Power, Imagery: Natural Resources (2011), Project Data from Stantec or provided by NB Power.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



Coastal Erosion From 1944 to 2011 at Cape Tormentine

Figure 4.2

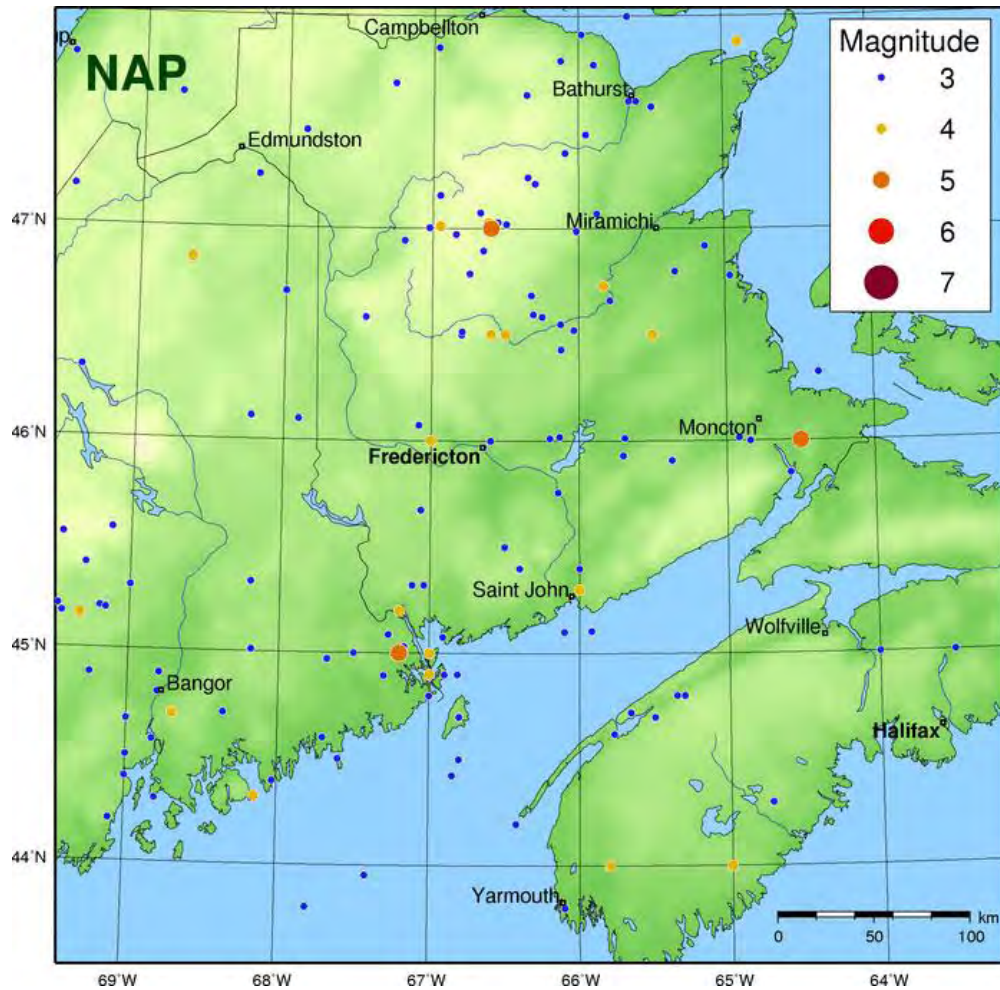


Figure 4.3 Northern Appalachians Seismic Zone

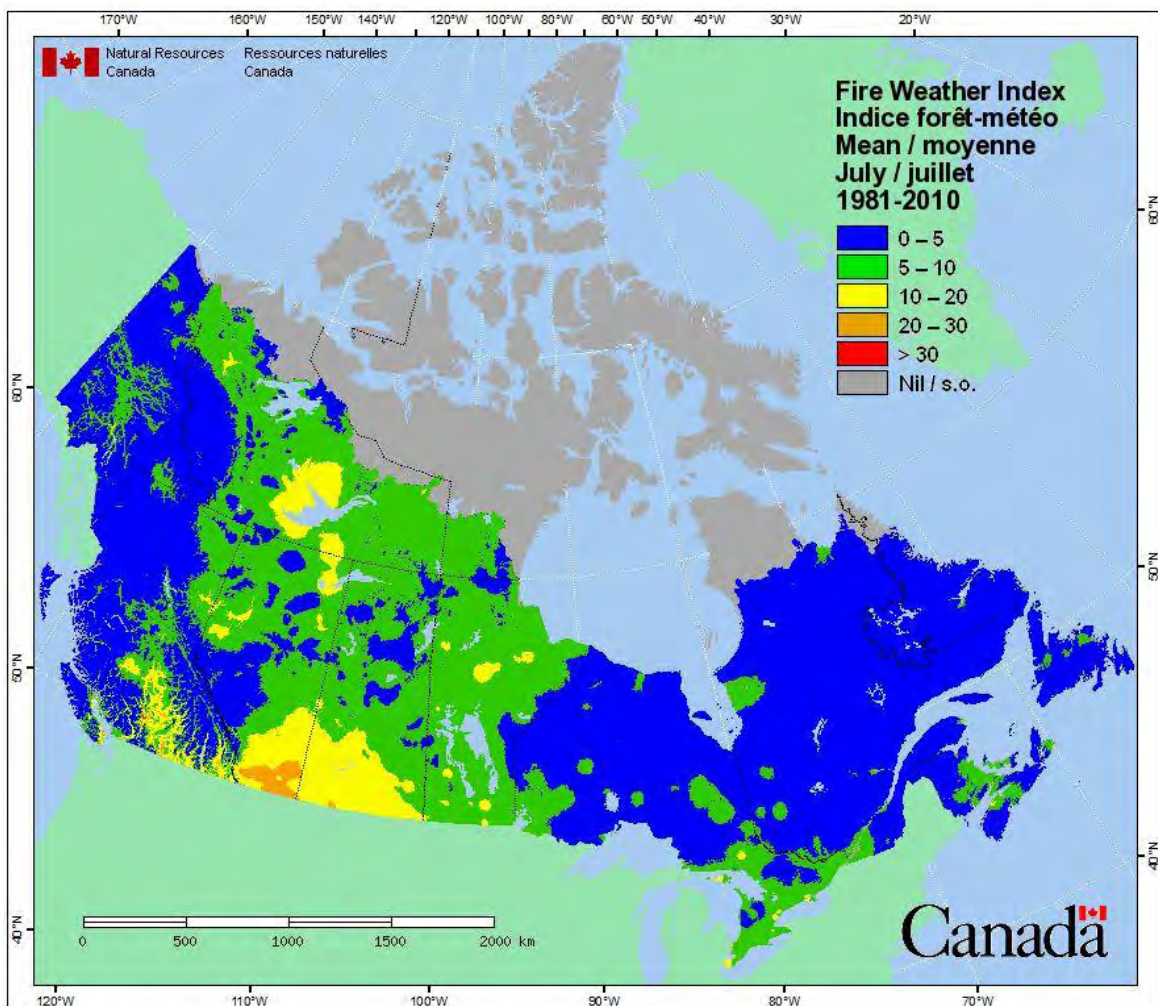
The largest earthquake instrumentally recorded in New Brunswick was a magnitude 5.7 event (on the Richter scale) on January 9, 1982, located in the north-central Miramichi Highlands. This earthquake was followed by strong aftershocks of magnitude 5.1 and 5.4. Prior to 1982, other moderate earthquakes with estimated magnitude in the range of approximately 4.5 to 6.0 occurred in 1855, 1869, 1904, 1922, and 1937 (Basham and Adams 1984). The 1869 and 1904 earthquakes were both located within the Passamaquoddy Bay region, with estimated magnitudes of 5.7 and 5.9, respectively (Fader 2005). The maximum credible earthquake magnitude for the Northern Appalachians region is estimated to be magnitude 7.0, based on historical earthquake data and the regional tectonics (Adams and Halchuk 2003).

There is potential for earthquakes of up to approximately magnitude 7.5 along the fault zones associated with the St. Lawrence River. However, these events would be located more than 200 km from the Project site, and therefore the amplitude of ground motions experienced at the Project site would be low due to attenuation over a large distance. Review of historical earthquake records and regional tectonics indicates that the Project site is situated in a region of low seismicity.

4.2.4 Forest Fires

The Fire Weather Index is a component of the Canadian Forest Fire Weather Index System. It is a numeric rating of fire intensity. It combines the Initial Spread Index and the Buildup Index, and is a general index of fire danger throughout the forested areas of Canada (Natural Resources Canada 2015).

The mean Fire Weather Index for July for New Brunswick (i.e., normally the driest month of the year), when risk of forest fire is typically the greatest, is rated from 5 to 10 (for years 1981 to 2010) (Figure 4.4); this is in the lower range of possible risk which, at the highest range, can exceed 30 on the Fire Weather Index (Natural Resources Canada 2015).



Source: Natural Resources Canada 2015

Figure 4.4 Average Fire Weather Index for the Month of July (1981-2010)

The closest fire protection services to the Project would primarily be supported through the City of Moncton's Fire Department, the City of Dieppe's Fire Department, the Town of Riverview's Fire and Rescue Department, the Village of Memramcook's Fire Department, the Town of Shediac's Fire Brigade, the Town of Sackville's Fire Brigade and local volunteer firefighting brigades throughout more rural areas near the Project.

The largest fire department in the region is that of the City of Moncton. The City of Moncton has five fire stations which are located to allow firefighters to arrive at the scene of an emergency as quickly as possible. The department consists of 120 members, including the fire chief, deputy chiefs, assistant deputy chiefs, captains, lieutenants, firefighters, division chiefs, training officers, fire prevention officers, and administration, as well as 40 volunteer firefighters who are on call 24 hours a day (Moncton Industrial Development 2014). Firefighting equipment includes three engines, three ladder trucks, three pumper tankers, one heavy rescue unit, one hazardous material response unit, one rescue inflatable boat with motor, one fire command unit, one fire investigation van, one rescue hovercraft and eight other vehicles for staff, administration and training (Moncton Industrial Development 2014).

Sackville's fire department has 42 volunteer firefighters and maintains a fleet of modern vehicles.

4.2.5 Marine Hazards

Sea spray, fairly common in the Northumberland Strait, results when high winds carry water droplets suspended in air when waves break over rocks. The effects of sea spray would potentially be felt in the PDA at the landfall sites, and at the cable termination site in Cape Tormentine.

Ice scour by sea ice and landfast ice is also an issue at landing sites for submarine cables in cold climates, as it can disturb landfall site and potential interruption of service.

4.3 ASSESSMENT OF EFFECTS OF THE ENVIRONMENT ON THE PROJECT

4.3.1 Effects of Climate on the Project

4.3.1.1 Project Pathways for Effects of Climate on the Project

The potential effects of climate must be considered during infrastructure development, particularly in close proximity to marine environments. Extreme temperatures and severe precipitation, fog and visibility, winds and extreme weather events could potentially cause:

- reduced visibility and inability to manoeuvre equipment
- delays in construction/operation activities and delays in receipt of materials
- inability of personnel to access the site (e.g., if a road were to wash out)
- damage to infrastructure
- increased structural loading

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

EFFECTS OF THE ENVIRONMENT ON THE PROJECT

September 30, 2015

During construction, extreme low temperatures have the potential to reduce the ductility of construction materials used in Project components (e.g., ancillary facilities) and increase susceptibility to brittle fracture.

Snow and ice have the potential to increase loadings on Project infrastructure (e.g., substation, termination site). Extreme snowfall can also affect winter construction activities by causing a delay in construction or a delay in delivery of materials, and resulting in additional effort for snow clearing and removal.

Extreme precipitation contributing to unusual flooding during snowmelt and extreme rainfall events could potentially lead to flooding and erosion. Flooding and erosion could in turn lead to the release of total suspended solids (TSS) in runoff and related environmental effects. These activities and associated ensuing events are considered accidental events, and are presented in Section 5.0.

During operation or decommissioning and abandonment phases, the PDA could experience heavy rain, snowfall and freezing rain events that are capable of causing an interruption of services such as electrical power for extended periods of time, or increasing structural loading on the Project components.

Reduced visibility due to fog could make manoeuvring of equipment difficult in the early part of the day. However, these short delays are anticipated and can often be predicted, and allowance for them will be included in the construction schedule. Disruption of construction activities and delays to the schedule will be avoided by scheduling tasks that require precise movements for periods when the weather conditions are favourable.

Wind storm events could potentially cause reduced visibility (due to blowing snow or rain) and interfere with maneuvering of equipment or transporting materials or staff movements. Wind also has the potential to increase loadings on Project infrastructure and cause possible damage. During electrical storms, for example, fault currents (defined as an electric current that flows from one conductor to ground or to another conductor owing to an abnormal connection (including an arc) between the two conductors (IESO 2010)) may arise in electrical systems during a lightning strike. This could result in danger to personnel and damage to infrastructure. These types of adverse effects can occur where Project infrastructure is close to the grounding facilities of electrical transmission line structures, substations, generating stations, and other facilities that have high fault current-carrying grounding networks. A lightning strike could also ignite a fire (see Section 5.3 for a discussion of fire as an accidental event, and Section 4.3.4 for a discussion of forest fire).

Results of the coastal erosion assessment indicate that the site of the cable landing in Cape Tormentine has not been susceptible to substantive coastal erosion in the past, and is not likely to change much in the future.

Storm surges and waves could potentially affect land-based Project facilities if not accounted for in the engineering of and design for near sea level structures (i.e., termination site, substation, and associated infrastructure).

4.3.1.2 Mitigation for Climate

To address the potential effects of climate (air temperature, precipitation, fog and visibility, winds, and extreme weather events), all aspects of the Project design, materials selection, planning, and maintenance will consider normal and extreme conditions that might be encountered throughout the life of the Project. Work will also be scheduled, where feasible, to avoid predicted times of extreme weather for the safety of crews and Project infrastructure.

The Project will be constructed to meet applicable building, safety and industry codes and standards for wind, snowfall, extreme precipitation, and other weather variables associated with climate. The engineering design of the Project will consider and incorporate potential future changes in the forces of nature that could affect its operation or integrity.

These standards and codes provide factors of safety regarding environmental loading (e.g., snow load, high winds), and Project specific activities and events. Design requirements address issues associated with environmental extremes, such as:

- wind loads
- storm water drainage from rain storms and floods
- weight of snow and ice, and associated water
- erosion protection of slopes, embankments, ditches, and open drains

To account for potential weather extremes, engineering specifications of the National Building Code of Canada contains design specific provisions, such as:

- critical structures, piping, tanks and steel selection to prevent brittle fracture at low ambient temperatures
- electrical grounding structures for lightning protection
- maximum motor ambient temperature
- ice and freeze protection

Other mitigation measures implemented as part of the planning process will reduce the potential for adverse effects of the environment on the Project, including:

- adherence to engineering design codes and standards (e.g., power lines, will be built to codes and standards that reduce the likelihood and effects of fault currents, during lightning strikes)
- care in selection of applicable construction materials and equipment
- careful planning of operation activities such as receipt of materials and supplies, and product deliveries
- implementation of a maintenance and safety management program
- contingency plans, including emergency back-up power for necessary operations

4.3.1.3 Residual Effects of Climate on the Project

The potential effects of climate on the Project during the construction, operation, and decommissioning and abandonment phases will be considered and incorporated in the planning and design of Project infrastructure. This will be done to reduce the potential for Project delays and long-term damage to infrastructure, taking into account the existing and predicted climate conditions. Inspection and maintenance programs will reduce the deterioration of the infrastructure and will help to maintain compliance with applicable design criteria and reliability of the transmission system. Significant residual adverse effects of climate on the Project, or interruption to the Project schedule, are not anticipated.

4.3.2 Effects of Climate Change on the Project

4.3.2.1 Project Pathways for the Effects of Climate Change on the Project

Long term increases in temperature and precipitation as a result of climate change predicted for Atlantic Canada can result in changes to conditions that could affect the long term integrity and reliability of Project-related land-based infrastructure through changing extremes in temperature and intense precipitation.

4.3.2.2 Climate Change Predictions

Predicting the future environmental effects of climate change for a specific area using global data sets is problematic due to generic data and larger scale model outputs that do not take into account local climate. Accurate regional and local projections require the development of specific regional and local climate variables and climate change scenarios (Lines et al. 2005). As a result, downscaling techniques have emerged over the last decade as an important advancement in climate modelling. Downscaling is used to introduce micro-scale interactions by including the local climate variables. Downscaling techniques are particularly important for Atlantic Canada due to the inherent variability associated with the predominantly coastal climate. Statistical downscaling uses global climate model (GCM) projections as well as historic data from weather stations across the region, and studies the relationship between these sets of data. Downscaling produces more detailed predictions for each of these weather stations (Lines et al. 2005) and has allowed for a better understanding of future climate scenarios based on precise and accurate historic data sets.

Results tend to differ between a Statistical Downscaling Model (SDSM) and Canadian Coupled General Circulation Model Version 2 (CGCM2). The overall mean annual maximum temperature increase projected for Moncton (the nearest location to the Project) between years 2020 and 2080 ranged from 1.99°C to 3.91°C for the SDSM model results and 1.16°C to 2.47°C for the CGCM2 model results (Lines et al. 2008) (Table 4.3).

Table 4.3 Projected Mean Annual Maximum and Minimum Temperature Change for Moncton, and Precipitation Percent Change for both SDSM and CGCM2 Model Results

Period	T _{max}		T _{min}		% Precipitation	
	SDSM	CGCM2	SDSM	CGCM2	SDSM	CGCM2
2020s	1.99	1.16	1.72	1.77	2	-1
2050s	2.80	1.67	2.36	2.40	3	5
2080s	3.91	2.47	3.30	3.36	6	4

Notes:
 1) A positive value denotes an increase, a negative value denotes a decrease.
 SDSM = Statistical Downscaling Model.
 CGCM2 = Canadian Coupled General Circulation Model version 2.
 T_{max} = Mean annual maximum temperature change.
 T_{min} = Mean annual minimum temperature change.
Source: Lines et al. 2008

The SDSM projections for maximum temperature for 2050 at Moncton are for summer, fall, winter, and spring increases (1.9 to 4.4 °C) (Lines et al. 2005). By the year 2080, temperatures are projected to increase in all seasons (4.2 to 7.05 °C) (Lines et al. 2005). This average temperature change is expected to be gradual over the period and is likely to affect precipitation types and patterns. The warmer fall and winter temperatures could mean later freeze up; wetter, heavier snow; more liquid precipitation occurring later into the fall; and possibly more freezing precipitation during both seasons. Changes to precipitation patterns due to warmer weather over the fall and winter months could lead to stronger spring run-off (Natural Resources Canada 2001).

There is less agreement among the global circulation and regional downscaling models regarding changes in precipitation. Annual precipitation increases projected for Atlantic Canada between the years 2020 and 2080 range from 18% to 21% for the SDSM model results, and -2% to 2% for the Canadian Coupled Global Climate Model version 1 (CGCM1) model results (Lines et al. 2005). Precipitation trends are of more interest when taken together with the temperature increases and the seasonality of the predicted changes. Statistical Downscaling Model trends for the years 2020 to 2080 indicate a temperature increase of 8% to 12% for the winter months and 21% to 35% for the summer months (Lines et al. 2005). It is generally considered that the increased precipitation being projected for portions of western Atlantic Canada may be the result of continued landfall of dying hurricanes and tropical storms reaching into this area in the summer and fall months. While SDSM results highlight an increase in summer and fall precipitation, the CGCM1 results range from no change in the 2020s to a reduction in precipitation over the summer season for 2050 to 2080 (Lines et al. 2005).

The inconsistencies between SDSM and CGCM1 predicted seasonal precipitation changes highlight the inherent variability and uncertainty in climate modelling. Due to the increased precision of localized data used in SDSM relative to global modelling, confidence is considered to be greater in the SDSM results relative to global model results. Results must be interpreted with caution for each of the models, although there is a general consensus in the climatological community concerning the overall

anticipated environmental effects of climate change. For example, over the next 100 years, Atlantic Canada will likely experience warmer temperatures, more storm events, increasing storm intensity, and flooding (Vasseur and Catto 2008).

4.3.2.3 Mitigation for Climate Change

The Project will be designed according to engineering design practices that will consider predictions for climate and climate change. Several publications are available to guide design engineers in this regard, including, for example, the Public Infrastructure Engineering Vulnerability Committee (PIEVC) "Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate" (PIEVC 2011). This protocol outlines a process to assess the infrastructure component responses to changing climate, which assists engineers and proponents in effectively incorporating climate change into design, development and management of their existing and planned infrastructure. This and other guidance will be considered, as applicable, in advancing the design and construction of the Project.

4.3.2.4 Residual Effects of Climate Change on the Project

The potential effects of climate change on the Project will be considered and incorporated in the planning and design of Project infrastructure and scheduling. This will be done to reduce the potential for Project delays and long-term damage to infrastructure and risk to workers, taking into account predictions for climate change in the region. Inspection and maintenance programs will reduce the deterioration of the infrastructure and will help to maintain compliance with applicable design criteria and reliability to the transmission system. Significant residual adverse effects of climate change on the Project, or system reliability, are not anticipated.

4.3.3 Effects Seismic Events on the Project

4.3.3.1 Project Pathways for the Effects of Seismic Activity on the Project

Though the Project lies within one of five seismic zones in southeastern Canada, the level of historical seismic activity near the PDA is low. Other areas of the Province (the Passamaquoddy Bay region, the Miramichi region, and the Moncton region) have historically experienced relatively higher levels of seismic activity, but these are sufficiently distant to the Project that the risk that a major seismic event in these areas could adversely affect the Project in a substantive way is low. Though past occurrence of seismic activity in an area is not necessarily an indicator that a major seismic event could not occur in the future, the likelihood of this to occur in the vicinity of the Project that could cause substantive Project damage or interrupt operations during any phase is low.

4.3.3.2 Mitigation for the Effects of Seismic Activity on the Project

The Project and related facilities and infrastructure will be designed to the applicable standard for earthquakes in this area. The intent of these design standards is to maintain the integrity of the facilities based on the level of risk for an earthquake in the area. An earthquake with a magnitude substantively greater than the design-base earthquake could result in damage to the Project facilities. However,

design-base earthquake magnitude values are elected based on probability, and it would therefore be very unlikely that the design-base earthquake would be exceeded during the life of the Project.

4.3.3.3 Residual Effects of Seismic Events on the Project

Seismicity is considered not to have the potential to substantially damage Project infrastructure or components during any phase of the Project, due to planned design mitigation and the application of the National Building Code of Canada (NRCan 2010) and other applicable guidelines. Therefore, substantial effects of seismic events on the Project are not anticipated.

4.3.4 Effects of Forest Fires on the Project

4.3.4.1 Project Pathways for the Effects of Forest Fires on the Project

The effects of forest fire on the Project may include:

- reduced visibility and inability to manoeuvre construction and operation equipment due to smoke
- delays in receipt of materials and supplies (e.g., construction materials) and in delivering products
- changes to the ability of workers to access the site (e.g., if fire blocks access to transportation routes)
- damage to infrastructure
- loss of electrical power resulting in potential loss of production

4.3.4.2 Mitigation for Forest Fires

In the event of a forest fire in close proximity to Project components, there is potential risk of damage to exposed Project infrastructure. If a forest fire were to break out in direct proximity to the Project, emergency measures would be in place to quickly control and extinguish the flames prior to any contact to flammable structures (i.e., wood).

New Brunswick has a forest fire control program in place to identify and control fires, reducing the potential magnitude and extent of any forest fire, and their potential consequential effects on the Project during any phase. The proposed safety and security programs for the Project are capable of rapid detection and response to any forest fire threat. A cleared buffer will be maintained around Project infrastructure, where feasible, to reduce the potential for a fire to affect the structures (which given the nature of the materials they contain are inherently fire resistant).

Firefighting detection equipment will be used on-site. Safety and security programs will be in place in conjunction with facility, community, and provincial emergency response crews to provide for rapid detection and response to any fire threat. This includes fires that could start within the substation perimeter, as well as fires approaching from outside the substation (i.e., forest fires).

4.3.4.3 Residual Project Environmental Effects of Forest Fires on the Project

If a forest fire were to occur in direct proximity to the Project, emergency measures would be in place to quickly control and extinguish the flames prior to contact with Project components. In addition, the

cleared safety buffer zone established around Project components further decreases the likelihood of a forest or a brush fire causing substantive damage to the Project. Although there is potential for natural forest fires to occur in or near the PDA, it is not likely to have a substantive effect on the Project.

4.3.5 Effects of Marine Hazards on the Project

4.3.5.1 Project Pathways for the Effects of Marine Hazards on the Project

Sea spray, often accompanied with high winds, contains salt that may lead to long-term corrosion on exposed oxidizing metal surfaces and structures of the Project, potentially weakening structures with the possibility of disruptions to electrical connections and transformers.

Ice scour by sea ice and landfast ice is an issue at landing sites for submarine cables in cold climates, and has been considered in Project design and are considered in Volume 4, Chapter 4.

4.3.5.2 Mitigation for the Effects of Marine Hazards

The materials used for construction will be, by design, resistive and tolerant of the effects of sea spray. Further, salt spray effects will be mitigated with operational procedures including regular maintenance (i.e., cleaning) and the use of protective coatings as required.

4.3.5.3 Residual Effects of Marine Hazards on the Project

There is potential for surfaces and structures of the Project to be exposed to sea spray and ice scour during the life of the Project. However, these effects on the Project have been considered in the planning and design of the Project, and substantive damage to the Project or interruption to the Project schedule are not anticipated.

4.4 DETERMINATION OF SIGNIFICANCE

The land-based components of the Project will be designed, constructed and operated to maintain safety, integrity and reliability in consideration of existing and reasonably predicted environmental forces in the PDA in New Brunswick. There are no environmental attributes that, at any time during the Project, are anticipated to result in:

- a substantial change to the Project construction schedule (e.g., a delay resulting in the construction period being extended by one season)
- a substantial change to the Project operation schedule (e.g., an interruption in servicing such that production targets cannot be met)
- damage to Project infrastructure resulting in increased safety risk

NB Power will use an adaptive management approach in its activities throughout the life of the Project to monitor any observed effects of the environment and adapt (e.g., repair/replace) the Project infrastructure or operations and closure as needed. The residual adverse effects of the environment on the Project are therefore rated not significant.

5.0 ACCIDENTS, MALFUNCTIONS, AND UNPLANNED EVENTS

This section provides an assessment of selected accident, malfunction, and unplanned event scenarios potentially associated with Project components and activities within New Brunswick that could, if they occurred, result in adverse environmental effects.

5.1 APPROACH

In this section, the potential Accidents, Malfunctions, and Unplanned Events that could occur during any phase of the Project are described and assessed. The focus is specifically on credible accidents that have a reasonable probability of occurrence, and for which the resulting environmental effects could be significant.

The general approach to assessing the potential environment effects of the selected scenarios involve:

- consideration of the potential event that may occur during the life of the Project
- description of the safeguards established to protect against such occurrences
- consideration of the contingency or emergency response procedures applicable to the event
- significance determination of potential residual adverse environmental effects

5.1.1 Significance Definition

Criteria used for determining the significance of adverse residual environmental effects with respect to Accidents, Malfunctions, and Unplanned Events generally relate to effects on the sustainability of biological and human environments. Where applicable, significance definitions are the same as those for each VC noted in Volume 3.

5.1.2 Identification of Accidents, Malfunctions, and Unplanned Events

5.2 POTENTIAL INTERACTIONS

The Accidents, Malfunctions, and Unplanned Events scenarios considered in this assessment are detailed in Volume 1, Section 2.6.1. The scenarios considered applicable to the New Brunswick-based components of the Project (all phases) are:

- fire
- hazardous material spill
- vehicle accident
- erosion prevention and/or sediment control failure
- wildlife encounter
- discovery of a heritage resource

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ACCIDENTS, MALFUNCTIONS, AND UNPLANNED EVENTS
September 30, 2015

VCs in Volume 3 with reasonable potential to interact with these scenarios causing adverse environmental effects include (Table 5.1):

- Atmospheric Environment
- Freshwater Resources
- Terrestrial Environment
- Land Use
- Socioeconomic Environment
- Heritage Resources
- Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Table 5.1 Potential Interactions for Land-Based Project Activities in New Brunswick

Accident, Malfunction and Unplanned Event	Atmospheric Environment	Groundwater Resources	Freshwater Environment	Terrestrial Environment	Land Use	Socioeconomic Environment	Archaeology and Heritage Resources	Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons
Fire	✓			✓		✓		
Hazardous Material Spill		✓	✓	✓	✓	✓		✓
Vehicle Accident		✓	✓	✓		✓		
Wildlife Encounter				✓		✓		
Erosion Prevention and/or Sediment Control Failure			✓	✓				
Discovery of a Heritage Resource							✓	✓

5.3 FIRE

5.3.1 Potential Event

There is potential that fire could occur during construction or operation of land-based Project components in New Brunswick. A fire affecting Project components would likely involve Project infrastructure (e.g., a substation) or a vehicle or other heavy equipment used during construction and maintenance activities, and result in effects on the Atmospheric, Terrestrial and Socioeconomic Environments.

Naturally occurring forest fires are considered an effect the environment could have on the Project and are addressed Section 4.3.4.

5.3.2 Risk Management and Mitigation

The following mitigation measures should be applied in general to reduce the probability of a fire and any associated adverse effects:

- vehicles and buildings on-site will be equipped with fire extinguishers sized and rated as appropriate
- Project staff should be trained in the use of fire extinguishers and familiar with the location of the nearest extinguisher
- vehicles are to avoid parking in areas with long grass to minimize the risk of fire caused by the heated vehicle undercarriage
- vegetation growth will be controlled within the transmission line corridor to reduce the fire hazard
- waste that may be soaked with flammable materials (i.e., oily rags) should be kept away from flammable materials and should be disposed of in an appropriate manner as soon as possible

Fire response activities will be carried out in accordance with the Environmental Protection Plan (EPP) for New Brunswick Power Corporation Transmission Facilities (NBPTC 2012). As the Project location is not remote, local emergency response services are available. In the unlikely event that a fire does occur, Project staff will contact emergency response services immediately.

A permit from the New Brunswick Department of Natural Resources is required for all construction and operation activities within New Brunswick and will specify required fire suppressant equipment.

Project staff on-site will be at a high level of training and readiness. The safety and security programs will be in place in conjunction with facility, community, and provincial emergency response crews to provide for rapid detection and response to any fire threat.

5.3.3 Potential Environmental Effects and their Significance

If fire were to occur, there is potential for an effect on the Atmospheric and Terrestrial Environments, through smoke and destruction of habitats, and any loss of infrastructure or equipment may have an effect on the Socioeconomic Environment. As a large portion of the transmission line corridor is within wooded areas, fire prevention and rapid extinguishing of fire, if it were to occur, is essential to reduce effects to the Atmospheric and Terrestrial Environments and prevent loss of infrastructure. As the majority of the transmission line follows an existing transmission line corridor, vegetation management practices in this area should further reduce the risk within the area.

The occurrence of a widespread fire is unlikely. However, in the event a fire was widespread, there is potential to result in wildlife mortality or destruction of sensitive habitats, resulting in a significant environmental effect on the Terrestrial Environment.

5.4 HAZARDOUS MATERIAL SPILL

5.4.1 Potential Event

Hazardous material spills can occur in any environment where fuels, lubricants, hydraulic fluid, paints, and corrosion and fouling inhibitors are used or stored. Hazardous materials may be used during both

construction and operation of land-based project components in New Brunswick with construction and maintenance vehicle use being the most common source of hazardous materials on-site. Potential scenarios involving the release of hazardous material would most likely be rupture of a hydraulic line or loss of fuel from a vehicle.

5.4.2 Risk Management and Mitigation

Response to a hazardous material spill will be carried out as outlined in the NB Power EPP (NBPTC 2012). An Emergency Response Plan (ERP) consistent with those used at NB Power's other operations will be developed and will include procedures to prevent and respond to a spill, including:

- relevant staff will be trained in the timely and efficient response to hazardous material spills
- all spills will be dealt with in accordance with the NB Power Spill Response Clean-up and Reporting Procedure (SU2-A65400-0005)
- hazardous materials will not be stored on-site in large quantities
- preventative measures, including routine vehicle inspections and buffers surrounding sensitive areas, will also be implemented

In the unlikely scenario of a hazardous material spill reaching a body of water or other nearby sensitive area, measures will be taken to stop the spill and isolate the affected area as soon as possible. An assessment of the affected area will be conducted and remediation will be completed as required.

5.4.3 Potential Environmental Effects and their Significance

Depending on the quantity and type of material released and the location of the spill, hazardous material spills could potentially affect Groundwater Resources and components of the Terrestrial and Freshwater Environments. Remediation efforts may have an effect on the Socioeconomic Environment (e.g., demand for emergency services). The worst case for a land-based hazardous material spill would likely be a rupture of a hydraulic line near a wetland or watercourse. As hazardous material spills can harm wildlife and fish and fish habitat, efforts will be focused on prevention measures. Any spill, if it occurs, is expected to be a small quantity and rapidly contained and cleaned up.

Given the expected limited spill volume, the likelihood of spill scenarios, and anticipated effectiveness of response plans (including spill containment), it is assumed that none of these spills would result in a release to adjacent properties.

In consideration of the mitigation and response measures to be undertaken, residual adverse environmental effects of a hazardous material spill in New Brunswick are rated as not significant for potentially affected VCs. However, in the unlikely event a protected species was harmed, it could represent a significant adverse environmental effect. A significant effect is considered unlikely.

5.5 VEHICLE ACCIDENT

5.5.1 Potential Event

During the construction phase of the Project, various vehicles will be in motion around the Project site and there is the potential for vehicle-to-vehicle collisions, vehicle accidents with surrounding Project infrastructure, or vehicle collisions with wildlife. Vehicle use is expected to be low during operation and therefore vehicle accidents are not considered likely.

If a vehicle accident were to occur, loss or damage to a vehicle, equipment or Project infrastructure could have an effect on the Socioeconomic Environment. If the incident involved wildlife, it could have an effect on the Terrestrial Environment.

In the event of a vehicle accident there is the potential for loss of life and damage to infrastructure. There is also potential for fire and hazardous materials to be released into the environment. These are addressed in previous sections.

5.5.2 Risk Management and Mitigation

Project related traffic will be controlled as per the NB Power EPP (NBPTC 2012). The following mitigation measures should be applied in general to reduce the probability of a vehicle accident and any associated adverse effects:

- traffic control measures will be implemented, as needed, to reduce the likelihood of vehicle-to-vehicle collisions
- Project staff are expected to operate vehicles with due care and attention while on-site
- Project staff will be appropriately licensed to operate vehicles on-site
- vehicles are to observe traffic rules and trucks will use only designated truck routes
- if a collision does occur, Project staff are to immediately phone local emergency services
- all Project-related vehicles will carefully abide by speed limits to reduce risk of accidents including collisions with wildlife

If a vehicle collision results in a hazardous material spill or fire, a hazardous material spill response (see Section 5.3) or fire response (see Section 5.2) must be implemented in addition to the outlined vehicle accident response.

5.5.3 Potential Environmental Effects and their Significance

The most likely effect of a vehicle accident during construction would be the damage or loss of a vehicle and potential work stoppage. Although the Project area in New Brunswick is through wooded areas, it is anticipated that vehicle speed on the Project site will be low and a substantive collision with wildlife is considered to have low probability. The worst case involving a vehicle collision would most likely involve loss of life of a person or SARA species or the release of a hazardous material.

In consideration of the mitigation and response measures to be undertaken, adverse residual environmental effects of a land-based vehicle accident are rated to be not significant for potentially

affected VCs. A vehicle accident resulting in a serious injury or loss of life for a Project employee or member of the public or SARA listed species would result in a significant effect. However, such an incident is considered unlikely to occur.

5.6 EROSION PREVENTION AND/OR SEDIMENT CONTROL FAILURE

5.6.1 Potential Event

Erosion prevention and/or sediment control failure can occur during construction activities due to the exposure of soil from clearing or excavation of land. If it were to occur in New Brunswick, this would most likely happen during land-based trenching for cable installation or excavation for substation upgrades. Minimal land disruption occurs when erecting transmission line structures. While unlikely, if ground excavation is required during operation, erosion prevention and sediment control measures are expected to be implemented.

This scenario has the potential to interact with the Terrestrial and Freshwater Environments, as failure could result in the unintended erosion of land or the release of silt into the surrounding environment.

5.6.2 Risk Management and Mitigation

For the implementation of erosion and sediment control measures, the focus is on proper installation, maintenance and inspection to avoid the potential for failure. Erosion prevention measures are to be implemented during construction and operation, if necessary, to reduce or eliminate the likelihood of land erosion. On-site control will be carried out as outlined in the NB Power EPP (NBPTC 2012).

Erosion controls may include:

- reducing quantity of open ground on site
- re-vegetating or re-seeding exposed areas
- covering exposed areas with geotextile or mulch until vegetation is established

Sediment controls may include:

- silt fencing – used along contours of exposed land to capture sediment runoff
- silt curtains – used within and along bodies of water to prevent intrusion of sediment into water bodies
- wattles – used on slopes perpendicular to the direction of flow to lessen runoff velocities and capture sediment runoff
- settling ponds – used to capture large volumes of runoff and retain the runoff for a period of time to allow for settling of sediment
- filter bags – used at the discharge point of a settling pond to filter out any remaining suspended sediment

These measures will be reviewed during the detailed engineering phase of Project design. Chosen measures will be installed as per the Project-specific Erosion and Sediment Control Plan (ESCP) and undergo routine inspection, most importantly pre and post rainfall events. Should a failure occur and silt

from the Project site reaches a water source, efforts should be made to control the dispersion of sediment and isolate the affected area from unaffected habitat prior to repairing the source of the failure.

5.6.3 Potential Environmental Effects and their Significance

If a failure of erosion prevention and sediment control measures were to occur, the Freshwater and Terrestrial Environments may be affected as failure could result in the unintended erosion of land or the release of silt into the surrounding environment. The worst case involving a sediment control failure would be the accidental siltation of a wetland or water body environment.

In consideration of the mitigation and response measures to be undertaken, residual adverse environmental effects of a land-based erosion prevention and/or sediment control failure are rated to be not significant for potentially affected VCs. However, in the unlikely event a protected species was harmed, it could represent a significant adverse environmental effect. A significant effect is considered unlikely.

5.7 WILDLIFE ENCOUNTER

5.7.1 Potential Event

As a large section of the Project area in New Brunswick is within potential wildlife habitat, an encounter with wildlife during Project construction and operation is possible. As Project construction or operation phases require the use of vehicles and other maintenance equipment, there is potential for a wildlife encounter with this equipment within the Terrestrial Environment. During operation of the Project, transmission lines will be energized and there is a possibility of birds interacting with the lines. The worst case involving a wildlife encounter would be the death of a wildlife species due to interaction with a transmission line or Project vehicle.

5.7.2 Risk Management and Mitigation

Bird diverters or aerial markers may be installed in areas with high bird activity. Vegetation along the transmission line corridor will be controlled; however, construction and maintenance activities will take place outside of the breeding season, if possible. Nesting atop transmission line structures should be discouraged. As outlined in the NB Power EPP (NBPC 2012), if bird nests are discovered during operation activities, the following will take place:

- the nest location will be clearly marked and a buffer will be left untouched until after the nesting period
- the typical nesting habitat for these species will be investigated for potential nests
- the occurrence of identified nests will be documented

As outlined in the NB Power EPP (NBPC 2012), to reduce the likelihood of contact with or harm to other wildlife species the following mitigation measures will be applied:

- firearms are prohibited on the Project site

- food waste must be removed from the transmission line corridor and disposed of off-site
- wildlife will not be harvested, harassed, harmed or fed by NB Power Transmission personnel and contractors
- clearing will be completed in late fall/winter to avoid critical life stages for many species, where possible.

5.7.3 Potential Environmental Effects and their Significance

A wildlife encounter with a Project component could involve a Project vehicle striking a wildlife species; however, the more probable wildlife encounter would likely involve a bird striking an energized transmission line during the operation phase of the Project. A wildlife encounter could have an effect on the Socioeconomic Environment if damage to Project infrastructure or vehicles were to occur as a result. If a wildlife encounter were to occur and cause the death of an individual species, it is not expected to result in population level changes and therefore, the effect on Terrestrial Environment is considered low.

In consideration of the mitigation and response measures to be undertaken, adverse residual environmental effects of a wildlife encounter are rated to be not significant for potentially affected VCs.

5.8 DISCOVERY OF A HERITAGE RESOURCE

5.8.1 Potential Event

A heritage resource is defined as a site that contains features (non-removable indications of past human use and activity, such as a fire hearth, a living floor, or a burial site) in addition to artifacts determined by the provincial regulatory agency to be substantive. The disturbance of an individual artifact is not normally considered significant.

Heritage resources, if present, are generally discovered during activities involving ground disturbance such as construction related excavation. It is unlikely that a heritage resource will be discovered during operation.

5.8.2 Risk Management and Mitigation

Staff will be trained on response to the discovery of a heritage resource as per the NB Power EPP (NBPTC 2012). In the event that a heritage resource is discovered, Project work will cease in the area of the discovery and the Archaeological Services Unit of the Heritage Branch of the Culture and Sport Secretariat of New Brunswick will be contacted by NB Power immediately. Work in the area will only continue if approval is received from the Archaeological Services Unit of the Heritage Branch of the Culture and Sport Secretariat of New Brunswick to resume these activities, and the Project will continue in compliance with mitigation strategies.

5.8.3 Potential Environmental Effects and their Significance

The discovery of a heritage resource has the potential to interact with Heritage Resources, and Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons. In the event that a heritage resource is discovered, Project work will cease in the immediate area of the discovery and the Socioeconomic Environment may be affected as a result.

With the low probability of encountering heritage resource during Project-related activities, and in consideration of the nature of the Project, planned mitigation, and the contingency response procedures that would be used in the unlikely event of such a discovery, the potential residual adverse effect of a discovery of a heritage resource during the Project are rated not significant.

5.9 DETERMINATION OF SIGNIFICANCE

NB Power and MECL have developed EPPs, contingency plans, and emergency response plans to prevent and efficiently respond to accidental or unplanned events. Given the nature of the Project and credible accident and malfunction scenarios and proposed mitigation and response planning, the residual adverse environmental effects of Project-related Accidents, Malfunctions, and Unplanned Events on all VCs during all phases are rated not significant with a high level of confidence.

A vehicle accident resulting in a serious injury or loss of life for a Project employee or member of the public would result in a significant effect. However, such an incident is considered unlikely to occur.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

ACCIDENTS, MALFUNCTIONS, AND UNPLANNED EVENTS

September 30, 2015

6.0 CUMULATIVE ENVIRONMENTAL EFFECTS: NEW BRUNSWICK

6.1 INTRODUCTION

The residual effects of the Project that may interact cumulatively with the residual environmental effects of other physical activities are identified in this section and the resulting cumulative environmental effects are assessed.

An assessment of cumulative environmental effects is required if:

- the Project is assessed as having residual environmental effects on the VC
- the residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities

Six categories of physical activities in New Brunswick have been identified as having the potential to result in residual environmental effects that may act cumulatively with those of the Project:

- industrial development
- infrastructure development
- forestry and agriculture
- recreation
- residential development
- current use of land and resources for traditional purposes by Aboriginal persons

In New Brunswick the following six VCs are anticipated to have residual effects and a cumulative environmental effects assessment is undertaken:

- Freshwater Environment
- Terrestrial Environment
- Land Use
- Socioeconomic Environment
- Heritage Resources
- Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Interactions between the Project and the remaining six VCs are not anticipated to result in residual effects, and assessment of cumulative environmental effects is therefore not undertaken.

Table 6.1 highlights the potential for interactions between the residual effects of the Project and the existing or future physical activities identified. These interactions are described in further detail below.

Table 6.1 Potential Cumulative Effects

Planned and Future Activity	Freshwater Environment	Terrestrial Environment	Land Use	Socioeconomic Environment	Heritage Resources	Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons
Industrial Development	✓	✓	✓	✓	✓	✓
Infrastructure Development	✓	✓	✓	✓	✓	✓
Forestry and Agriculture		✓	✓	✓	✓	✓
Recreation		✓	✓			
Residential Development	✓	✓	✓	✓	✓	✓
Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons		✓				

6.2 ASSESSMENT OF CUMULATIVE EFFECTS: NEW BRUNSWICK

Past and existing physical activities that have been or are being carried out have influenced the baseline conditions for the assessment of Project effects. Importantly included in this is the existing transmission line corridor. The effects of other physical activities that have been or are being carried out (i.e., past and current effects) in combination with the predicted effects of the Project are therefore considered in the assessment of the residual environmental effects of the Project.

The residual environmental effects of the Project on the Freshwater Environment include a disturbance to riparian vegetation during the short construction period, which would be expected to recover within a short time following disturbance. Future industrial, infrastructure, and residential development activities have the potential to result in similar effects, however it is unlikely that these future activities would occur in the RAA during the short construction phase of the Project or the recovery period. Future activities would be subject to provincial watercourse regulations and approvals which determine the acceptability of their environmental effects and prescribe any required mitigation. Cumulative effects between the Project and industrial, infrastructure, and residential development activities on the Freshwater Environment are therefore not expected to be substantive.

The effects of the Project on the Terrestrial Environment include a temporary and permanent disturbance to vegetation and wildlife habitat, including wetland, in the PDA. Future industrial, infrastructure, and residential development activities are likely to result in similar effects to the Terrestrial Environment. However, the Project follows an existing transmission line corridor where possible and the footprint of disturbance of the Project is small and is likely to be small for any future industrial, infrastructure, or residential developments. The vegetation communities and habitat types within the

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

CUMULATIVE ENVIRONMENTAL EFFECTS: NEW BRUNSWICK
September 30, 2015

PDA are abundant within both the LAA and RAA. Therefore, potential cumulative effects of the Project and industrial, infrastructure, and residential development activities on the Terrestrial Environment are not substantive.

Effects of recreation and the Current Use of Land and Resources for Traditional Purposes by Aboriginal People on the Terrestrial Environment may include wildlife mortality due to hunting and trapping activities. There is also a low likelihood of wildlife mortality as a result of the Project. Given the low magnitude of the effects of both the Project and hunting and trapping activities, substantive cumulative effects are not anticipated.

Much of the transmission line required for the Project follows an existing transmission line corridor. Only a small portion of private land will be converted into a new right of way, representing a small change in land use. Other activities outlined in Table 6.1 also have the potential to result in a change in land use, however given the small area of change as a result of the Project, cumulative effects between the Project and these activities on Land Use are not substantive.

The effects of existing forestry and agriculture activities on the Terrestrial Environment are captured in the baseline information presented in Section 3.3. The cumulative effect of the Project and these activities has therefore been included in the assessment of the effects of the Project. The development of additional lands for new and expanded forestry and agricultural activities is not anticipated; therefore, cumulative effects with future forestry and agriculture are not anticipated.

The Project will affect the Socioeconomic Environment in New Brunswick, resulting in an increase in demand in the local labour force and accommodations. Industrial, infrastructure, and residential development activities have the potential to effect labour and economy in New Brunswick in a similar way. The combined increase in demand for labour and accommodation of the Project and these activities is not expected to exceed the capacity of the labour market or available accommodations. Positive economic effects are also anticipated. As such, cumulative effects are not expected to be substantive.

Industrial, infrastructure, and residential development activities, as well as forestry and agriculture (*i.e.*, activities that result in ground disturbance), have the potential to interact with heritage resources in a similar manner to the residual effects of the Project. These activities would likely require an environmental review and permitting that would reduce the potential for a substantive cumulative effect.

Overall, the Project in New Brunswick primarily follows an existing transmission line corridor, which will reduce residual and cumulative environmental effects as very little habitat outside of this existing corridor will be disturbed. This existing corridor and past forestry and agriculture activities have affected the existing landscape that was considered in the baseline conditions used to assess the residual effects of the Project. Accordingly, substantive cumulative environmental effects in New Brunswick are not anticipated.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

CUMULATIVE ENVIRONMENTAL EFFECTS: NEW BRUNSWICK

September 30, 2015

7.0 SUMMARY

In this EIS, Stantec conducted an EIA of the PEI-NB Cable Interconnection Upgrade Project (the "Project") proposed by PEI Energy Corporation (PEIEC). The Project involves the construction and operation of a high voltage alternating current transmission system, spanning three geographic locations – New Brunswick, the Northumberland Strait, and PEI. Volume 3 (this volume) includes an assessment of potential environmental effects associated with land-based Project components and activities located in New Brunswick.

7.1 SCOPE OF THE EIA

An EIA of the land-based Project components and activities in New Brunswick is required under the Schedule A of the New Brunswick Environmental Impact Assessment Regulations, made under the *New Brunswick Clean Environment Act* (NB CEA). This EIS follows the Stantec EA Method that has been adapted to meet the requirements of the NB CEA.

The EIA evaluated the potential environmental effects of the Project. The scope of the assessment included all activities necessary for the construction and operation of the Project, but excluded the end uses of this electricity. Environmental effects were assessed for each phase of the Project (i.e., construction, operation, and decommissioning and abandonment), where relevant, as well as for credible Accidents, Malfunctions, and Unplanned Events. The assessment was conducted within defined boundaries (spatial and temporal) for the assessment and in consideration of defined residual environmental effects rating criteria aimed at determining the significance of the environmental effects. The EIA considered measures that are technically and economically feasible that would mitigate any significant adverse environmental effects of the Project.

7.2 ENVIRONMENTAL EFFECTS ASSESSMENT

Freshwater Environment, Terrestrial Environment, Land Use, Socioeconomic Environment, Heritage Resources and the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons were the VCs identified for a detailed assessment. These were identified by the Study Team (based on experience and professional judgment) as the key VCs for which substantive interactions with the Project were anticipated or could occur. A separate analysis of the potential Effects of the Environment on the Project was also conducted.

This volume concluded that the potential environmental effects of the Project in New Brunswick for the VCs would be not significant during each phase of the Project and for the activities to be conducted as part of the Project. These conclusions were reached in consideration of the nature of the Project, the nature and extent of its environmental effects, and the planned implementation of proven and effective mitigation. The environmental effects of Accidents, Malfunctions, and Unplanned Events were also rated not significant, with the exception of a large fire. Effects of the Environment on the Project were rated not significant due to design consideration and compliance with codes and standards that will mitigate against a significant adverse effect on the Project. In most cases, the environmental effects and significance predictions were made with a high level of confidence by the Study Team.

SUMMARY

September 30, 2015

7.3 OVERALL CONCLUSION

Based on the results of the EIA for the New Brunswick volume, it is concluded that, with planned mitigation, the residual environmental effects of the Project during each phase is rated not significant.

REFERENCES

September 30, 2015

8.0 REFERENCES

General

AMEC (AMEC Earth and Environmental). 2007. Northumberland Strait Ecosystem Overview Report. Prepared For Fisheries and Oceans by AMEC Earth and Environmental, Moncton, New Brunswick.

AER 2007, Alberta Energy Regulator Directive 038, Noise Control, revised February 16, 2007

Canadian Geographic. 2015. Animal Facts Sheet: New Brunswick. Available online at: <http://www.canadiangeographic.ca/kids/animal-facts/animals.asp?region=nb> Last accessed on August 11, 2015.

Environment Canada. 2015a. Greenhouse Gas Emissions Reporting Program Online Data Search – Facility Reported Data. Available online at: <http://www.ec.gc.ca/ges-ghg/donnees-data/index.cfm?do=search&lang=en>. Last accessed on July 6, 2015.

Environment Canada. 2015b. The National Inventory Report 1990-2013. Greenhouse Gas Sources and Sinks in Canada. The Canadian Government's Submission to the UN Framework Convention on Climate Change. Environment Canada, Gatineau, Quebec. Available online at: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php, accessed on July 8, 2015

Government of Canada. 2015. National Climate Data and Information Archive. Available online at: http://www.climate.weatheroffice.gc.ca/climate_normals/index_e.html. Last accessed on June 16, 2015

Health Canada. 2009. Response Statement to Public Concerns Regarding Electric and Magnetic Fields (EMFs) from Electric Power Transmission and Distribution Lines. Health Canada, Federal-Provincial-Territorial Radiation Protection Committee. Issued November 8, 2008 and updated August 5, 2009. Available online at: <http://www.hc-sc.gc.ca/ewhsemt/radiation/fpt-radprotect/emf-cem-eng.php>. Accessed July 7, 2015.

Jacques Whitford Environmental Limited (JWEL) (2001). Atlas of Ecology and Commercially Important Areas in the Southern Gulf of St. Lawrence. Environmental Studies Research Funds Report (ESRF) 140, Calgary. 76p.

New Brunswick Department of Environment and Local Government. 2015. Air Quality Monitoring Results 2012 & 2013. Available online at: <http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Air-Lair/AirQualityMonitoringResults2013.pdf>

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

Historica Canada. 2015. New Brunswick. Available online at:

<http://www.thecanadianencyclopedia.ca/en/article/new-brunswick/>. Last accessed on August 11, 2015.

World Atlas. 2015. New Brunswick Weather. Available online at:

<http://www.worldatlas.com/webimage/countrys/namerica/province/nbzweather.htm>. Last accessed on August 11, 2015.

World Resources Institute. 2014. Climate Analysis Indicators Tool (CAIT) 2.0. Washington, DC. Available online at: <http://cait2.wri.org>. Last accessed on June 27, 2014

Assessment of Potential Environmental Effects on the Freshwater Environment

Fisheries and Oceans Canada, (2013). Fisheries Protection Policy Statement. Ecosystems Programs Policy. Ottawa, Ontario.

Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life. Canadian Council of Ministers of the Environment Winnipeg, Manitoba.

Government of New Brunswick Department of Environment. 2012. Watercourse and Wetland Alteration Technical Guidelines. Sustainable Development, Planning and Impact Evaluation Branch.

Curry, A., M. Gautrea, G. Yamazaki. No date. Inland Fish of New Brunswick. Accessed July 19th, 2015. Online at: <http://www.unb.ca/research/institutes/cri/links/inlandfishesnb/index.html>.

Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

Scott, W. B., & Crossman, E. J. 1998. Freshwater Fishes of Canada. Oakville, Ont., Canada: Galt House.

Environmental Protection Agency, 2001. Issue Paper 3: Spatial and Temporal Patterns of Stream Temperature. Prepared as part of EPA region 10 temperature water quality criteria guidance development project.

Teti, P. 1998. The Effects of Forest Practices on Stream Temperature: A Review of the Literature. B.C. Ministry of Forests.

Gravelle, J.A., and Link, T.E. 2007. Influence of timber harvesting on headwater peak stream temperatures in a northern Idaho watershed. For. Sci. 53(2): 189–205.

Rex, J.F., Maloney, D.A., Krauskopf, P.N., Beaudry, P.G., and Beaudry, L.J. 2012. Variable-retention riparian harvesting effects on riparian air and water temperature of sub-boreal headwater streams in British Columbia. For. Ecol. Manag. 269: 259–270. doi:10.1016/j.foreco.2011.12.023.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

- Wilkerson, E., Hagan, J.M., Siegel, D., and Whitman, A.A. 2006. The effectiveness of different buffer widths protecting headwater stream temperatures in Maine. *For. Sci.* 52: 221–231.
- Gomi, T., Moore, R.D., and Dhakal, A.S. 2006. Headwater stream temperature response to clear-cut harvesting with different riparian treatments, coastal British Columbia. *Water Resources. Bull.* 42: WO8437. doi:10.1029/ 2005WR004162.
- Blann, K., J.F. Nerbonne, and B. Vondracek, 2002. Relationship of Riparian Buffer Type to Water Temperature in the Driftless Area Ecoregion of Minnesota. *North American Journal of Fisheries Management* 22:441-451.
- Zwieniecki, M., and Newton, M. 1999. Influence of streamside cover and stream features on temperature trends in forested streams of western Oregon. *West. J. Appl. For.* 14: 106–113.
- Cole, E., M. Newton. 2008. Influence of streamside buffers on stream temperature response following clear-cut harvesting in western Oregon. *Can. J. For. Res.* 43: 993–1005 (2013) dx.doi.org/10.1139/cjfr-2013-0138.
- Jayawardana, J.M.C.K. 2010. Thoughts for Stream Restoration: Link Between Riparian, Instream Vegetation and Macroinvertebrates. *Environmental Research Journal* Volume 4 Issue ¾.
- Hynes, H. B. N. 1970. *The Ecology of Running Waters*. Toronto: Univ. Toronto Press.
- Richardson, J. S. 1993. Limits to productivity in streams: evidence from studies of macroinvertebrates. *Canadian Special Publication of Fisheries and Aquatic Sciences* 118, 9-15.
- Horwitz, Richard J., Thomas E. Johnson, Paul F. Overbeck, T. Kevin O'Donnell, W. Cully Hession, and Bernard W. Sweeney, 2008. Effects of Riparian Vegetation and Watershed Urbanization on Fishes in Streams of the Mid- Atlantic Piedmont (USA). *Journal of the American Water Resources Association (JAWRA)* 44(3):724-741. DOI: 10.1111 /j.1752-1688.2008.00201.x
- Jones, III, E.B.D., G.S. Helfman, L.O. Harper, and P.V. Bolstad, (1999). Effects of Riparian Forest Removal on Fish Assemblages in Southern Appalachian Streams. *Conservation Biology* 13:1454-1465.
- Johnson, S.L. and A.P. Covich, 1997. Scales of Observation of Riparian Forests and Distributions of Suspended Detritus in a Prairie River. *Freshwater Biology* 37:163-175.
- Fitzpatrick, F.A., B.C. Scudder, B.N. Lenz, and D.J. Sullivan, 2001. Effects of Multi-Scale Environmental Characteristics on Agricultural Stream Biota in Eastern Wisconsin. *Journal of the American Water Resources Association* 37:1489-1507.

Assessment of Potential Environmental Effects on the Terrestrial Environment

ACCDC (Atlantic Canada Conservation Data Centre). 2014a. Species Ranks. Available at: <http://www.accdc.com/en/ranks.html>. Date updated: December 2014. Date accessed: July 20, 2015.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

ACCDC. 2014b. Data Report 5252: Cape Tormentine, NB. Prepared: August 11, 2014. Sackville, NB.

ACCDC. 2015a. Understanding Ranks. Available at: <http://www.accdc.com/enNew/rank-definitions.html>. Date updated: 2015. Date accessed: July 15, 2015.

ACCDC. 2015b. About the ACCDC. Available at: <http://www.accdc.com/en/about-us.html>. Date updated: 2015. Date accessed: July 17, 2015.

AMEC (AMEC Environmental & Infrastructure). 2012. International Power Line Wetland Environmental Effects Monitoring Program 2012 Saint John and Charlotte Counties, NB. November 9, 2012.

APLIC (Avian Power Line Interaction Committee). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C. Available at: http://www.aplic.org/uploads/files/11218/Reducing_Avian_Collisions_2012watermarkLR.pdf
Date accessed: July 17, 2015.

APLIC and USFWS (U.S. Fish and Wildlife Service). 2005. Avian Protection Plan (APP) Guidelines. USDI Fish and Wildlife Service. Washington, D.C.

Audubon. No Date. Guide to North American Birds: Red-necked Phalarope. Available at: <https://www.audubon.org/field-guide/bird/red-necked-phalarope>. Date accessed: July 29, 2015.

Avery, M., P.F. Springer, and J.F. Cassel. The effects of a tall tower on nocturnal bird migration-a portable ceilometer study. *The Auk* 93(2): 281-291.

Barrientos, R., J.C. Alonso, C. Ponce and C. Palacin. 2011. Meta-analysis of the effectiveness of marked wire in reducing avian collisions with power lines. *Conservation Biology* 25: 893-902.

Batáry, P. and A. Báldi. 2004. Evidence of an edge effect on avian nest success. *Conservation Biology* 18(2): 389-400.

Bayne, L.M., L. Habib., and S. Boutin. 2008. Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. *Conservation Biology* 22: 1186-1193.

Bevanger, K. 1998. Biological and conservation aspects of bird mortality caused by electricity power lines: a review. *Biological Conservation* 86: 67-76.

Bird Nature. No Date. Migration Flyways: Atlantic Flyway. Available at: <http://birdnature.com/upperatlantic.html> Date accessed: July 30, 2015.

Calvert, A.M., C.A. Bishop, R.D. Elliot, E.A. Krebs, T.M. Kydd, C.S. Machtans, and G.J. Robertson. 2013. A synthesis of human-related avian mortality in Canada. *Avian Conservation and Ecology* 18(2): 11.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

Canadian Energy Pipeline Association and Stantec. 2013. Migratory Birds Convention Act: A Best Management Practice for Pipelines. Draft September 2013. Available at: <http://www.cepa.com/wp-content/uploads/2014/01/Migratory-Birds-Sept-26-2013-for-Publication.pdf>.

Cornell Lab of Ornithology. 2015. All About Birds. Available at: <http://www.allaboutbirds.org/Page.aspx?pid=1189>. Date updated: 2015. Date accessed: July 29, 2015.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006. COSEWIC assessment and status report on the Rusty Blackbird *Euphagus carolinus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2007a. COSEWIC assessment and status report on the Chimney Swift *Chaetura pelagica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2007b. COSEWIC assessment and status report on the Common Nighthawk *Chordeiles minor* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2007c. COSEWIC assessment and status report on the Olive-sided Flycatcher *Contopus cooperi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2007d. COSEWIC assessment and status report on the Red Knot *Calidris canutus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa

COSEWIC. 2008a. COSEWIC assessment and status report on the Canada Warbler *Wilsonia canadensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2008b. COSEWIC assessment and update status report on the Short-eared Owl *Asio flammeus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2010a. COSEWIC assessment and status report on the Bobolink *Dolichonyx oryzivorus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2010b. COSEWIC assessment and status report on the Monarch *Danaus plexippus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2011a. COSEWIC assessment and status report on the Barn Swallow *Hirundo rustica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2011b. COSEWIC assessment and status report on the Eastern Meadowlark *Sturnella magna* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2012a. COSEWIC assessment and status report on the Eastern Wood-pewee, *Contopus virens*, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

- COSEWIC. 2012b. COSEWIC assessment and status report on the Wood Thrush *Hylocichla mustelina* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.
- COSEWIC. 2013a. COSEWIC assessment and status report on the Bank Swallow *Riparia riparia* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.
- COSEWIC. 2013b. COSEWIC assessment and status report on the Piping Plover circumcinctus subspecies (*Charadrius melodus circumcinctus*) and the melodus subspecies (*Charadrius melodus melodus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.
- Cornell Lab of Ornithology. 2015. All About Birds. Available at: <http://www.allaboutbirds.org/Page.aspx?pid=1189>. Date updated: 2015. Date accessed: July 29, 2015.
- CPAWS (Canadian Parks and Wilderness Society). 2007. Natural Ecosystem Connectivity across the Chignecto Isthmus – Opportunities and Challenges. Available at: <http://cpawsnb.org/images/upload/ChignectoFinalVersionJune06v2.pdf>. Date Accessed: July 30, 2015.
- EC (Environment Canada). 2012. Recovery Strategy for the Piping Plover (*Charadrius melodus melodus*) in Canada. *Species at Risk Act Recovery Strategy Series*. Environment Canada, Ottawa.
- EC. 2014. North American Breeding Bird Survey - Canadian Trends Website, Data-version 2012. Environment Canada, Gatineau, QC. Available from: <http://www.ec.gc.ca/ron-bbs/P001/A001/?lang=e>. Date updated: January 28, 2015. Date accessed: July 20, 2015.
- EC. 2015. Incidental Take Avoidance Guidelines. Environment Canada, Gatineau, QC. Available from: <http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=AB36A082-1>. Date updated: June 8, 2015. Date accessed: July 22, 2015.
- Emera Brunswick Pipeline Company Ltd. 2006. Written evidence of Environment Canada. Brunswick Pipeline Project NEB Hearing Order GH-1-2006. Submitted to the National Energy Board. Available at: https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90550/408788/408789/414082/417836/430910/C-68-3-a --_A0W1E1 - Written Evidence of Environment Canada.pdf?nodeid=430914&vernum=-2. Date accessed: August 4, 2015.
- Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young Jr., K.J. Sernka, and R.E. Good. 2001. Avian Collision with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States. National Wind Coordinating Committee (NWCC) Resource Document.
- Government of Canada. 1991. The Federal Policy on Wetland Conservation. Director General, Canadian Wildlife Service, Ottawa, Ontario. Available at: <http://publications.gc.ca/collections/Collection/CW66-116-1991E.pdf>. Date Accessed: July 30, 2015.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

Haines, A. 2011. *Flora Novae Angliae*. New England Wildflower Society. Yale University Press.

IBA (Important Bird Areas) Canada. 2015. Upper Cumberland Basin. Available at: <http://www.ibacanada.ca/site.jsp?siteID=NS002&lang=EN>. Date accessed: July 30, 2015.

Lloyd, P., T.E. Martin, R.L. Redmond, U. Langner, and M.M. Hart. 2005. Linking demographic effects of habitat fragmentation across landscapes to continental source-sink dynamics. *Ecological Applications* 15(5): 1504-1514.

Longcore, T. and C. Rich. 2004. Ecological light pollution. *Frontiers in Ecology and the Environment* 2: 191-198.

MacKinnon, C.M., and A. C. Kennedy. 2009. Canada Lynx, *Lynx canadensis*, use of the Chignecto Isthmus and the possibility of gene flow between populations in New Brunswick and Nova Scotia. *Canadian Field-Naturalist* 122: 166-168.

MacKinnon, C.M., and A. C. Kennedy. 2011. Migrant common eider, *Somateria mollissima*, collisions with power transmission lines and shortwave communication towers on the Tantramar Marsh in southeastern New Brunswick. *Canadian Field-Naturalist* 125(1):41-46.

NBDNR (New Brunswick Department of Natural Resources). 2015. New Brunswick Natural Resources – Species at Risk: Bald Eagle. Available at: http://www2.gnb.ca/content/gnb/en/departments/natural_resources/wildlife/content/SpeciesAtRisk/bald_eagle.html Date updated: 2015. Date accessed: March 2, 2015.

NBDNRE (New Brunswick Department of Natural Resources and Energy) and NBDELG (New Brunswick Department of Environment and Local Government). 2002. New Brunswick Wetlands Conservation Policy.

NCC (Nature Conservancy of Canada). 2015. The Moose Sex Project. Available at: <http://www.natureconservancy.ca/en/where-we-work/new-brunswick/featured-projects/help-moose-cross-the-chignecto.html?referrer=https://www.google.ca/#.Vbpl3vlVifh>. Date Accessed: July 30, 2015.

NWWG (National Wetlands Working Group). 1997. Canadian Wetland Classification System. Second edition. Wetlands Research Station, University of Waterloo, Waterloo, ON.

Ogden, L.J.E. 1996. Collision Course: The Hazards of Lighted Structures and Windows to Migrating Birds. Fatal Light Awareness Program (FLAP) and World Wildlife Fund Canada. Toronto, ON.

Parks Canada. No Date. Canada's Historic Places. Fort Gaspereaux National Historic Site of Canada. Available at: <http://www.historicplaces.ca/en/rep-reg/place-lieu.aspx?id=7612>. Date accessed: July 29, 2015.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

- Rioux, S., J.-P. L. Savard, and A. A. Gerick. 2013. Avian mortalities due to transmission line collisions: a review of current estimates and field methods with an emphasis on applications to the Canadian electric network. *Avian Conservation and Ecology* 8(2): 7. <http://www.ace-eco.org/vol8/iss2/art7/ACE-ECO-2013-614.pdf>.
- Rich, A.C., D.S. Dobkin, and L.J. Niles. 1994. Defining Forest Fragmentation by Corridor Width: The Influence of Narrow Forest-Dividing Corridors on Forest-Nesting Birds in Southern New Jersey. *Conservation Biology* 8(4): 1109-1121.
- SARA (*Species at Risk Act*). 2015. Species Profile: Common Nighthawk. Available at: http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=986. Date Accessed: February 12, 2015.
- SCI (Staying Connected Initiative). 2015. Chignecto Isthmus. Date updated: 2015. Date accessed: July 30, 2015.
- SNB (Service New Brunswick). 2011. Data Catalogue: Regulated Wetlands. Available at: <http://www.snb.ca/geonb1/e/DC/RW.asp>. Date updated: January 3, 2011. Date accessed: June 2015.
- Tims, J. and N. Craig. 1995. Environmentally Significant Areas in New Brunswick (NBESA). NB Department of Environment and Nature Trust of New Brunswick Inc.
- Wiese, F.K, W.A. Montevecchi, G.K. Davoren, F. Huettmann, A.W. Diamond, J. Linke. 2001. Seabirds at risk around offshore oil platforms in the North-west Atlantic. *Marine Pollution Bulletin* 42(12): 1285-1290.

Assessment of Potential Environmental Effects on Land Use

- Cape Jourimain Nature Centre. 2015. Available at: <http://capejourimain.ca/en/>
- GNB (Government of New Brunswick). 2009. New Brunswick Snowmobile Tourism Economic Impact Study: 2008-2009 Snowmobile Season. Prepared by The Department of Tourism and Parks. January 28, 2010.
- GNB (Government of New Brunswick). 2011. New Brunswick Impact of ATV Tourism in New Brunswick by NBATVF Trail Permit Holders. 2010-2011. New Brunswick Department of Culture, Tourism and Healthy Living. May 17, 2012.
- NBDNR (New Brunswick Department of Natural Resources). 2015. Available at: <http://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/Wildlife/BigGame.pdf>
- NBDNR (New Brunswick Department of Natural Resources). 2014. New Brunswick Furbearer Harvest Report 2013-2014. Available at: <http://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/Wildlife/FurbearerHarvestReport.pdf>.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

NBFSC (New Brunswick Federation of Snowmobile Clubs). 2015. Available online at: <http://www.nbfsc.com/html/maps.html>.

New Brunswick Trail Council. 2015a. Trail Map Information. Available online at: <http://www.sentiernbtrail.com/index.php/en/the-trails/trail-map>.

New Brunswick Trail Council. 2015b. Trail Locator. Available online at: <http://www.sentiernbtrail.com/>.

NBTFHF (New Brunswick Trappers and Fur Harvesters Federation). 2015. Available at: <http://www.nbtrappers.ca/profile.html>.

SNB (Service New Brunswick). 2015. Real Property Attribute Data Version 2.0. September 2000.

Assessment of Potential Environmental Effects on Socioeconomic Environment

Aboriginal Affairs and Northern Development Canada. 2014. First Nation Profiles New Brunswick. 2014. Available Online at: http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/FNMain.aspx?BAND_NUMBER=9&lang=eng

Canadian Aquaculture Industry Alliance. 2015. Canadian Aquaculture: An Economic Contributor. Available online at: <http://www.aquaculture.ca/files/economic-benefits.php> CBC News. 2014. Moncton Bucks Regional Trend in Declining Tourism. Accessed July 17, 2015 at: <http://www.cbc.ca/news/canada/new-brunswick/moncton-bucks-regional-trend-of-declining-tourism-1.2633205>.

City of Moncton. 2014. Moncton Community Profile 2014. Available online at: <http://www.moncton.ca/Assets/Business+English/Community+Profile+2014.pdf>.

Canada Mortgage and Housing Corporation (CMHC). 2015a. Housing Market Outlook: Atlantic Region Highlights. Second Quarter 2015. Available online at: http://www.cmhc-schl.gc.ca/odpub/esub/64595/64595_2015_Q02.pdf?lang=en.

City of Moncton. 2014. Moncton Statistics. Available online at: http://www.moncton.ca/Business/Moncton_Statistics.htm.

Canada Mortgage and Housing Corporation (CMHC). 2015b. Rental Market Report: New Brunswick Highlights. Available online at: http://www.cmhc-schl.gc.ca/odpub/esub/64495/64495_2015_B01.pdf?lang=en.

City of Fredericton. N.d. City of Fredericton Website. Available online at: <http://www.fredericton.ca/en/index.asp>.

Department of Fisheries and Oceans Canada (DFO). 2008. Economic Impact of the New Brunswick Ocean Sector 2003 - 2008. Available online at: <https://www.gnb.ca/9999/publications/ocean.pdf>.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

Employment and Social Development Canada (ESDC). 2015. Labour Market Bulletin - New Brunswick: February 2015. Available online at:
<http://www.esdc.gc.ca/eng/jobs/lmi/publications/bulletins/nb/feb2015.shtml>.

Fort Folly First Nations. 2014. About Us. Available online at: <http://www.fortfolly.nb.ca/firstpg6.html>.

Government of New Brunswick. 2014. New Brunswick Tourism Indicators Summary Report: 2013. Accessed July 17, 2015 at: <http://www2.gnb.ca/content/dam/gnb/Departments/thc-tpc/pdf/RSP/NBTourismIndicatorsSummaryReport2013.pdf>.

Government of New Brunswick (GNB). 2015. Labour Market Monthly: February 2015. Available online at: <http://www2.gnb.ca/content/dam/gnb/Departments/petl-epft/PDF/LMI/LMIFebruary2015.pdf>.

Matell Homebuilders. 2010. 10 New Brunswick Companies that Create Jobs. Available online at: <http://themartellexperience.com/2010/06/02/10-new-brunswick-companies-that-create-jobs/>.

Moncton Industrial Development. 2014. Moncton Community Profile 2014. Available at: <http://www.moncton.ca/assets/business+english/community+profile+2014.pdf>.

NB Department of Public Safety. 2013. New Brunswick Police Human Resources 2013 Survey Report. Available at: http://www2.gnb.ca/content/dam/gnb/Departments/ps-sp/pdf/Safety_Protection/NBPoliceHumanResources.pdf.

New Brunswick Department of Aboriginal Affairs (2015). First Nations Communities. Available online at: http://www2.gnb.ca/content/gnb/en/departments/aboriginal_affairs/fnc.html.

New Brunswick Department of Agriculture, Aquaculture, and Fisheries (NBDAAF). 2013. Sectors in Review: Agriculture 2013. Available online at: <http://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Publications/Agr/ReviewAgriculture2013.pdf>.

New Brunswick Department of Energy and Mines (NBDEM). 2015. New Brunswick Monthly Royalty Statistics. Available online at: http://www2.gnb.ca/content/dam/gnb/Departments/en/pdf/Minerals-Minerales/Monthly_Royalties.pdf.

New Brunswick Department of Finance (NBDF). 2014. The New Brunswick Economy: 2013 in Review. Available online at: <http://www2.gnb.ca/content/dam/gnb/Departments/fin/pdf/esi/NBEconomy2013InReview.pdf>.

New Brunswick Department of Finance (NBDF). 2015a. The New Brunswick Economy: 2014 in Review. Available online at: <http://www2.gnb.ca/content/dam/gnb/Departments/fin/pdf/esi/NBEconomy2014InReview.pdf>.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

New Brunswick Department of Finance (NBDF). 2015b. Third Quarter Report. Available online at: <http://www2.gnb.ca/content/dam/gnb/Departments/fin/pdf/Publications/2014-2015ThirdQuarterReport.pdf>.

New Brunswick Department of Finance (NBDF). 2011. The New Brunswick Economy: 2010 in Review. Available online at: <http://www2.gnb.ca/content/dam/gnb/Departments/fin/pdf/esi/NBEconomy2010InReview.pdf>.

Statistics Canada. 2007a. New Brunswick (Code 13) (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Released March 13, 2007. <http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E>. Last accessed July 8, 2015.

Statistics Canada. 2012a. Moncton, New Brunswick (Code 305) and New Brunswick (Code 13) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released October 24, 2012. <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E>. Last accessed on July 4, 2015.

Statistics Canada. 2012b. New Brunswick (Code 13) (Table 5). Population by age group and sex, medium-growth - 1988 to 1996 trends scenario (M3), July 1st — New Brunswick, 2010 to 2036. Available online at: <http://www.statcan.gc.ca/pub/91-520-x/2010001/t388-eng.htm>. Last accessed on July 4, 2015.

Statistics Canada. 2013a. New Brunswick (Code 13) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE. Ottawa. Released September 11, 2013. <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E>. Last accessed on July 8, 2015.

Statistics Canada. 2013b. Westmorland, CT, New Brunswick (Code 1307) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE. Ottawa. Released September 11, 2013. <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E>. Last accessed on July 8, 2015.

Statistics Canada. 2013c. Albert, CT, New Brunswick (Code 1306) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE. Ottawa. Released September 11, 2013. Available online at: <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E>. Last accessed on July 8, 2015.

Statistics Canada. 2013d. Canada (Code 01) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE. Ottawa. Released September 11, 2013. <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E>. Last accessed on July 4, 2015.

Statistics Canada 2014. Table 384-0037 - Gross domestic product, income-based, provincial and territorial, annual (dollars), CANSIM (database). Last accessed on July 8, 2015.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

Tourism Industry Association of New Brunswick (TIANB). 2010. Industry Snapshot. Available online at: <http://www.tianb.com/en/factsandfigures/industrysnapshot.asp>.

Assessment of Potential Environmental Effects on Heritage Resources

Archaeological Services. 2012. *Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick*. Archaeological Services, Heritage Branch, New Brunswick Department of Tourism, Heritage and Culture, Fredericton.

Archaeological Services. 2014a. Archaeological Potential Map for the Maritime Electric Transmission Line Project. PDF Map received October 8, 2014.

Archaeological Services. 2014b. Archaeological Potential Map for the Maritime Electric Transmission Line Project. Digital Spatial Data received November 2, 2014.

Ganong, W.F. 1896. A Monograph of the Place-Nomenclature of the Province of New Brunswick. Contributions to the History of New Brunswick No. 2, Transactions of the Royal Society of Canada Second Series:1896–1897, Volume II, Section II:175–289.

Ganong, W.F. 1899. A Monograph of Historic Sites in the Province of New Brunswick. Contributions to the History of New Brunswick No. 4, Transactions of the Royal Society of Canada Second Series – 1899-1900, Volume V, Section II. Ottawa.

Hamilton, William. 1996. Place Names of Atlantic Canada. University of Toronto Press, Toronto.

Hute, Janet E. 2002. Algonquians/Eastern Woodlands. In: Aboriginal Peoples of Canada: A short Introduction, edited by P.R. Magocsi, pp. 38–81. University of Toronto Press, Toronto.

Leonard, Kevin J.M. 1996. Mi'kmaq Culture During the Late Woodland and Early Historic Periods. Unpublished PhD Dissertation, Department of Anthropology, University of Toronto, Toronto.

Miller, Randall F. 2014. New Brunswick Museum – Palaeontology Report 14-03. Report prepared for Stantec Consulting Ltd, October 14, 2014. Natural Science Department, New Brunswick Museum, Saint John.

Miller, Virginia P. 2004. The Mi'kmaq: A Maritime Woodland Group. In: Native Peoples: the Canadian Experience, Part V – The Eastern Woodlands, pp. 248–267. Oxford University Press Canada, Don Mills.

Montresor, John. 1768. *Map of Nova Scotia or Acadia with the Island of Cape Breton and St. John's from actual surveys by Captain Montresor, Engineer*. American Geographical Society Library Digital Map Collection.

NBDNR. 2007. Our Landscape Heritage: The Story of Ecological Land Classification. Prepared by New Brunswick Department of Natural Resources, The Ecosystem Classification Working Group.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

Vincent F. Zelazny, General Editor. 2nd Edition. Originally issued 2003. ISBN 978-1-55396-203-8 in New Brunswick.

New Brunswick Provincial Archives (NBPA). 2014. Where is Home? New Brunswick Communities Past and Present. Accessed online at: <http://archives.gnb.ca/Exhibits/Communities/Home.aspx?culture=en-CA>. Last accessed: October 2014.

Nicholas, Michael. 2014. Personal Communication. October 20 and December 16, 2014. Archaeologist, Archaeological Services, Heritage Branch, New Brunswick Department of Tourism, Heritage and Culture, Fredericton.

Nicholas, Michael. 2015. Personal Communication. February 10, 2015. Archaeologist, Archaeological Services, Heritage Branch, New Brunswick Department of Tourism, Heritage and Culture, Fredericton.

Rayburn, Alan. 1975. Geographical Names of New Brunswick. Surveys and Mapping Branch, Department of Energy, Mines and Resources. Ottawa.

Stantec Consulting Ltd. 2015. 2014 Archaeological Impact Assessment (Walkover) for the New Brunswick- Prince Edward Island Transmission Line Interconnection Project – New Brunswick Land-Based Portion. Prepared for Maritime Electric Company, Limited.

Assessment of Potential Environmental Effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Aboriginal Affairs Secretariat. 2011. Government of New Brunswick, Duty to Consult Policy, November 2011. Available online at: <http://www2.gnb.ca/content/dam/gnb/Departments/aas-saa/pdf/en/DutytoConsultPolicy.pdf>. Last accessed on June 17, 2015

Aboriginal Affairs and Northern Development Canada (AANDC). 2014. First Nation Profiles Available at: <http://fnpim-cippn.aandc-aadnc.gc.ca/index-eng.asp> Last accessed on June 25, 2015.

Berneshawi, Suzanne. 1997. Resource Management and the Mi'kmaq Nation. Available online at: http://www3.brandonu.ca/library/CJNS/17.1/cjns17no1_pg115-148.pdf. Last accessed on June 29, 2015.

Paul, D. n.d. MAP: Land of the Mi'kmaq – Mi'kma'ki, We were not the Savages, First Nation History. Available online at: <http://www.danielnpaul.com/Map-Mi'kmaqTerritory.html>. Last accessed on June 17, 2015.

polygon dataset of Aboriginal Lands, created using ArcGIS software, from sources on Natural Resources Canada, Earth Sciences Sector, Surveyor General Branch. Download 27th April 2015, DSPRY from: <http://geogratiss.gc.ca/api/en/nrcan-rncan/ess-sst/815dd99d-4fbd-47cc-be02-7ad4b03a23ec.html>.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

Stantec Consulting Ltd. (Stantec). 2015. 2014 Archaeological Impact Assessment (Walkover) for the New Brunswick – Prince Edward Island Transmission Line Interconnection Project – New Brunswick Land Based Portion. Fredericton, NB.

Effects of Environment on the Project

Adams, J. and S. Halchuk. 2003. Fourth generation seismic hazard maps of Canada: Values for over 650 Canadian localities intended for the 2005 National Building Code of Canada. Geological Survey of Canada, Open File 4459.

Basham, P.W., and J. Adams. 1984. The Miramichi, New Brunswick Earthquakes: Near-Surface Thrust Faulting in the Northern Appalachians. *Geoscience Canada*, Vol. 11, No. 3, p.115-121.

Bernier, N., J. MacDonald, J. Ou, H. Ritchie, and K. Thompson. 2006. Storm surge and meteorological modelling. In *Impacts of Sea Level Rise and Climate Change on the Coastal Zone of South eastern New Brunswick*, (ed.) R. Daigle, D. Forbes, G. Parkes, H. Ritchie, T. Webster, D. Bérubé, A. Hanson, L. DeBaie, S. Nichols and L. Vasseur, Environment Canada, 613 pp.

Bindoff, N.L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D. Talley and A. Unnikrishnan. 2007. Observations: Oceanic Climate Change and Sea Level. In *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Avery, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available online at: <http://ipcc-wg1.ucar.edu/wg1/wg1-report.html>.

Catto, N.R. 2006. Impacts of Climate Change and Variation on the Natural Areas of Newfoundland and Labrador. Newfoundland Ministry of Environment and Conservation, St. John's NF, 160 pp.

CBC News. 2013 May 21. 10 deadliest tornadoes in Canada and U.S. Available online at: <http://www.cbc.ca/news/canada/10-deadliest-tornadoes-in-canada-and-u-s-1.1358411>

Environment Canada. 2011. Mapping Tornado-Prone Regions for National Building Codes and Standards. Available at: <http://www.ec.gc.ca/scitech/default.asp?lang=En&n=6A2D63E5-1&xsl=privateArticles2,viewfull&po=4008C164>. Accessed on July 14, 2015.

Fader, G. 2005. Seismic Hazard, Faults and Earthquakes, Digby Neck, Bay of Fundy. Atlantic Marine Geological Consulting Ltd., Halifax, Nova Scotia.

Government of Canada (GOC). 2015a. Canadian Climate Normals: Moncton, New Brunswick. Available online at: http://climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html. Last accessed on June 23, 2015.

GOC. 2015b. Canadian Climate Normals: Sackville, New Brunswick. Available online at: http://climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html. Accessed on June 23, 2015.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

GOC. 2015c. Get Prepared; Hazards and Emergencies; Regional Hazards: New Brunswick. Available online at: <http://www.getprepared.gc.ca/cnt/hzd/rgnl/nb-en.aspx>.

Government of New Brunswick (GNB). 2015. Extreme Rainfall. Available online at: http://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/climate_change/content/climate_change_indicators/indicators/climate/extreme_rainfall.html. Accessed on July 3, 2015.

IBC (Insurance Bureau of Canada). 2012. Telling the Weather Story. Prepared by the Institute for Catastrophic Loss Reduction for the Insurance Bureau of Canada, June 2012. Available online at: http://iclr.org/images/Telling_the_weather_story.pdf.

IPCC (Intergovernmental Panel on Climate Change). 2012. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

IPCC. 2007. Appendix I: Glossary; in Climate Change 2007: Impacts, Adaptation and Vulnerability (Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change); (ed.) M.J. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson; Cambridge University Press, Cambridge United Kingdom, p. 869-883, Accessed on June 24, 2015 from <https://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-app.pdf>.

Lines, G.S., M. Pancura, and C. Lander. 2005. Building Climate Change Scenarios of Temperature and Precipitation in Atlantic Canada using the Statistical Downscaling Model (SDSM). Environment Canada, Meteorological Service of Canada, Atlantic Region. Science Report Series No. 2005-9, October 2005.

NAV CANADA. 2001. The Weather of Atlantic Canada and Easter Quebec. Available online at: <http://www.navcanada.ca/EN/media/Publications/Local%20Area%20Weather%20Manuals/LAWM-Atlantic-1-EN.pdf>.

New Brunswick Power Transmission Corporation. 2012. Environmental Protection Plan for New Brunswick Power Corporation Transmission Facilities.

NOAA. 2012. National Sea Grant College Program; Climate Change Services for Citizens. National Oceanic and Atmospheric Administration. Available online at: http://www.seagrant.noaa.gov/focus/documents/fact_sheets_and_synthesis_stories/2011%20Fact%20Sheets/2011ClimateFinal.pdf.

NRCan (Natural Resources Canada). 2015. Canadian Wildland Fire Information System. <http://cwfis.cfs.nrcan.gc.ca/ha/fwnormals?type=fwi&month=7>.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

REFERENCES

September 30, 2015

NRCan. 2013. Seismic Design Tools for Engineers: Ground Motion Parameters for Use with the National Building Code of Canada. Natural Resources Canada, Ottawa, Ontario. 2013. Available online at: <http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index-eng.php>.

NRCan. 2010b. National Building Code of Canada Volume 1. Available online at: http://www.nrc-cnrc.gc.ca/eng/publications/codes_centre/2010_national_building_code.html.

NRCan. 2001. The Tides of Change: Climate Change in the Atlantic Provinces. Shaw, J. Geological Surveys of Canada, Miscellaneous Report no. 75, 2001; 1 sheet, doi:10.4095/212738

Phillips, D. 1990. The Climate of New Brunswick. In *Climates of Canada*. Minister of Supply and Services Canada.

Parkes, G.S., Forbes, D.L., and Ketch, L.A. 2006. Sea-level rise and regional subsidence in southeastern New Brunswick; in *Impacts of Sea Level Rise and Climate Change on the Coastal Zone of Southeastern New Brunswick*, (ed.) R. Daigle, R. Forbes, D., Parkes, G., Ritchie, H., Webster, T., Bérubé, D., Hanson, A., DeBaie, L., Nichols, S. and Vasseur, L. Environment Canada, 24-610.

Phillips, D. 1990. The Climate of New Brunswick. In *Climates of Canada*. Minister of Supply and Services Canada.

PIEVC. 2014. The PIEVC Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate. Public Infrastructure Engineering Vulnerability Committee, Engineers Canada. Available online at: http://www.pievc.ca/e/doc_list.cfm?dsid=43.

R.J. Daigle Enviro. 2012. Sea-Level Rise and Flooding Estimates for New Brunswick Coastal Sections. Available online at: <http://atlanticadaptation.ca/sites/discoveryspace.upei.ca/acasa/files/NB-Sea%20Level%20Rise-Coastal%20Sections-Daigle-2012.pdf>.

Samuel Engineering. 2013. Canadian National Instrument 43-101 Technical Report on the Sisson Project, New Brunswick, Canada. Prepared by Samuel Engineering, Inc. on behalf of Northcliff Resources Ltd., Greenwood Village, Colorado. January 22, 2013.

Vasseur, L. and N. Catto. 2008. Atlantic Canada; In *From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 119-170.

Accidents, Malfunctions, and Unplanned Events

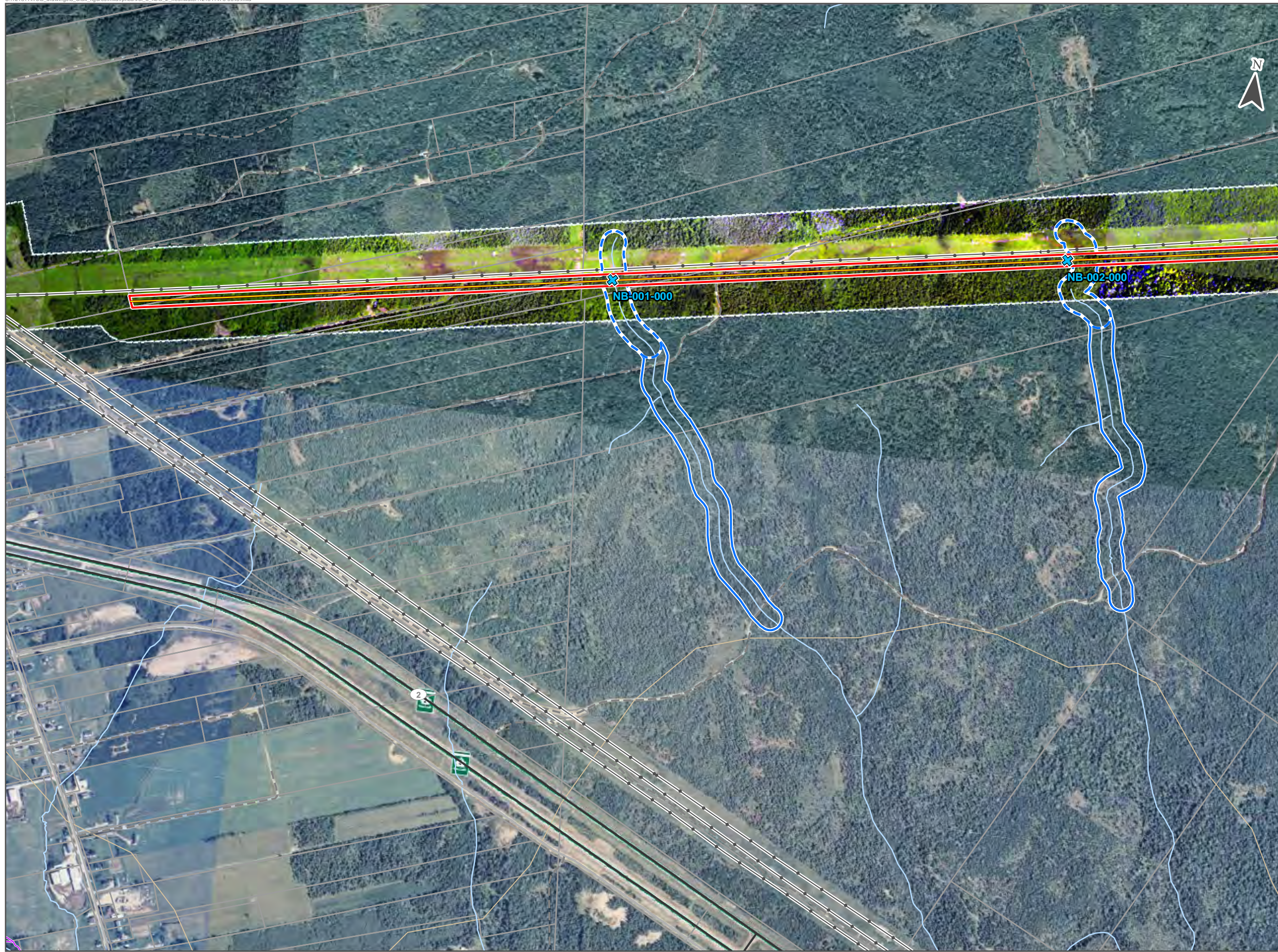
NBPTC. 2012. Environmental Protection Plan for New Brunswick Power Corporation Transmission Facilities, New Brunswick. Prepared by: New Brunswick Power Transmission Corporation (NBPTC). November 1, 2012. Rev. No. 0.

September 30, 2015

APPENDIX A FRESHWATER VC MAPBOOK

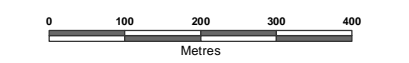
PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015



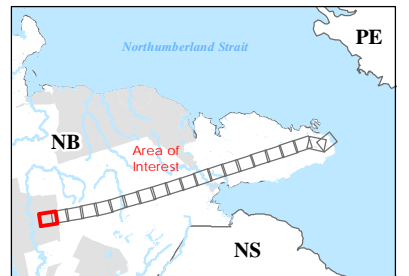
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - GeoNB-mapped Wetland
 - Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010),
 Natural Resources (2011). Base data
 provided by the Governments of Canada and New
 Brunswick. Project Data from Stantec or provided by NB Power / MECL.

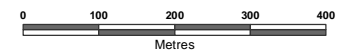


Disclaimer: This map is for illustrative purposes to support this
 Stantec project; questions can be directed to the issuing agency.



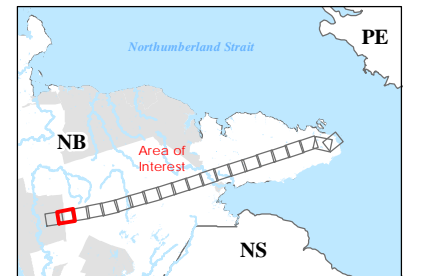
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - GeoNB-mapped Wetland
 - Property Boundary

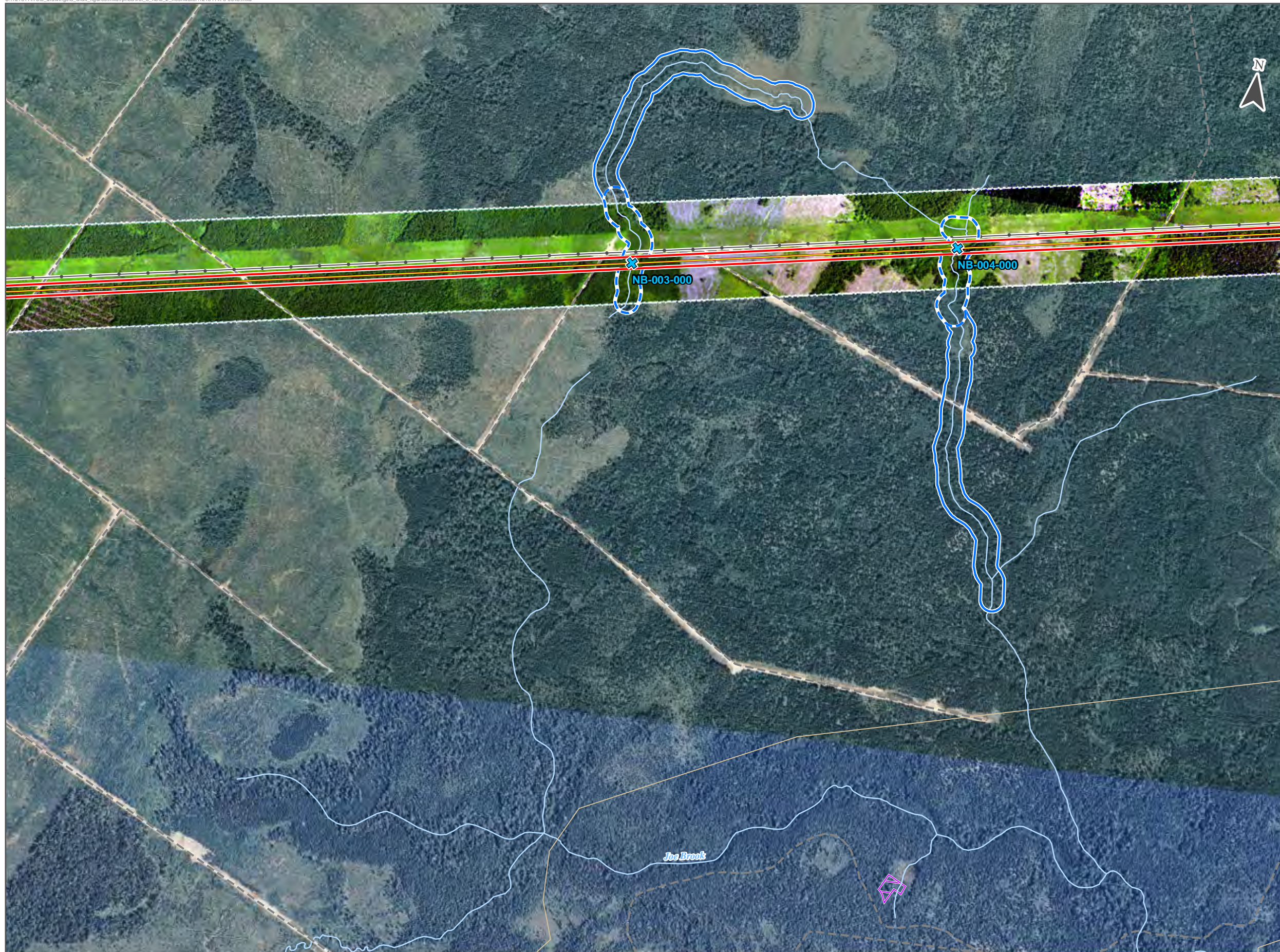


121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

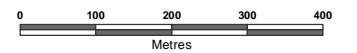


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



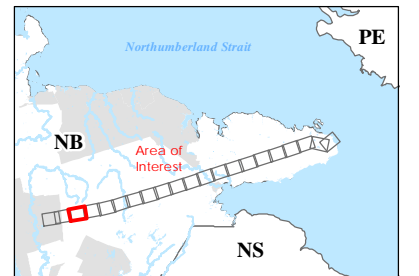
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - GeoNB-mapped Wetland
 - Property Boundary

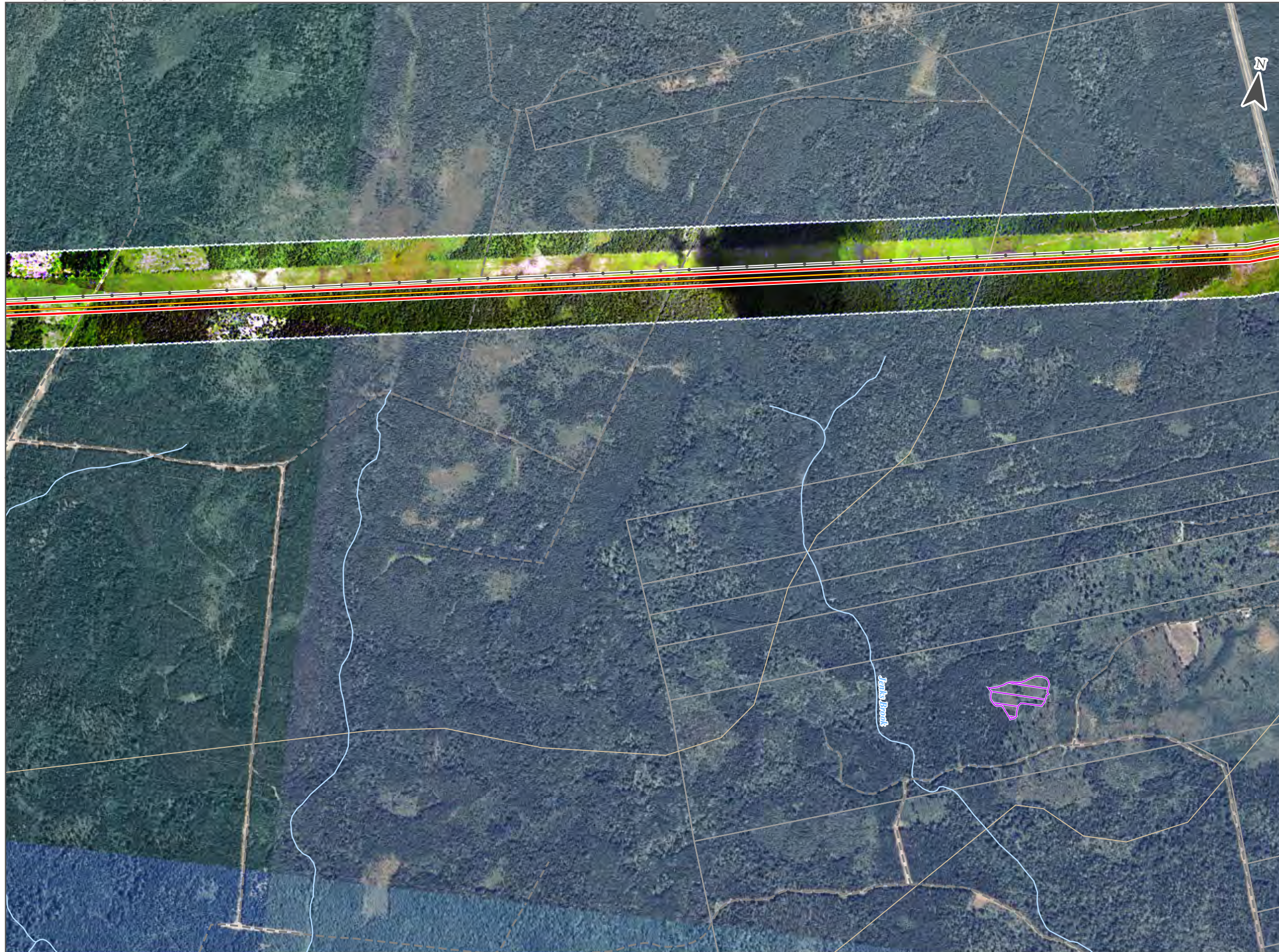


121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010),
Natural Resources (2011). Base data
provided by the Governments of Canada and New
Brunswick. Project Data from Stantec or provided by NB Power / MECL.

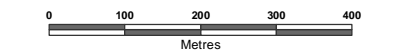


Disclaimer: This map is for illustrative purposes to support this
Stantec project; questions can be directed to the issuing agency.



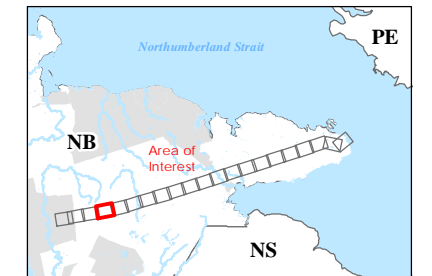
Freshwater Environment Assessment Area Boundaries

- Freshwater Environment Assessment Area**
- Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
- Memramcook to Melrose
 - Existing Transmission Line
 - GeoNB-mapped Wetland
 - Property Boundary

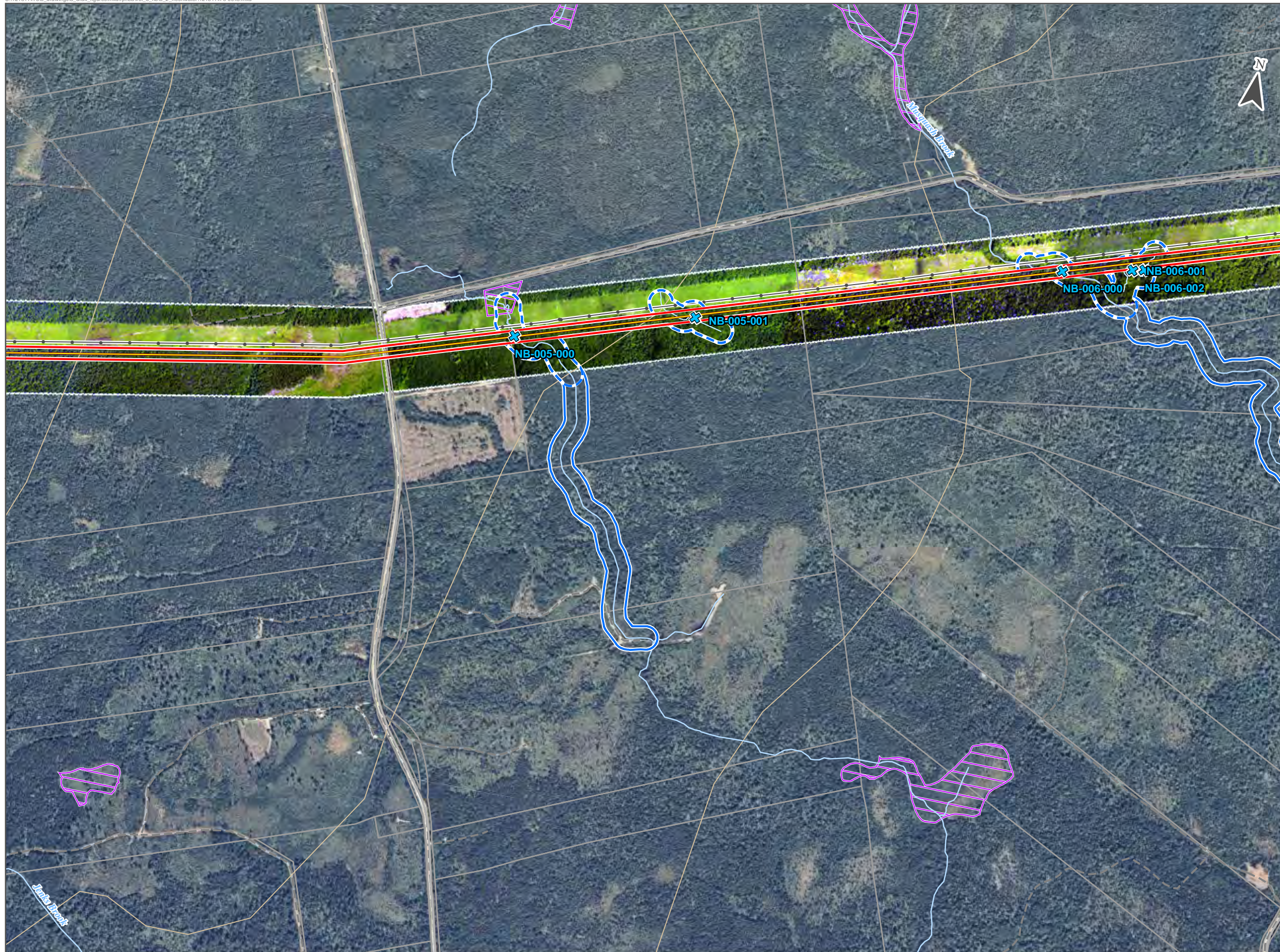


121811475-0043 1:10,000 NAD 1983 CSRS NBDs

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

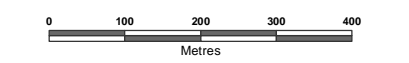


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



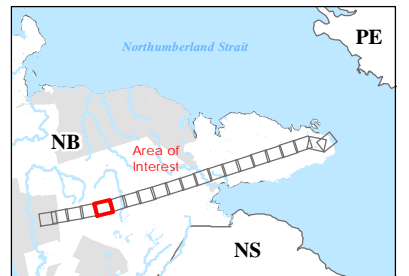
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - GeoNB-mapped Wetland
 - Property Boundary

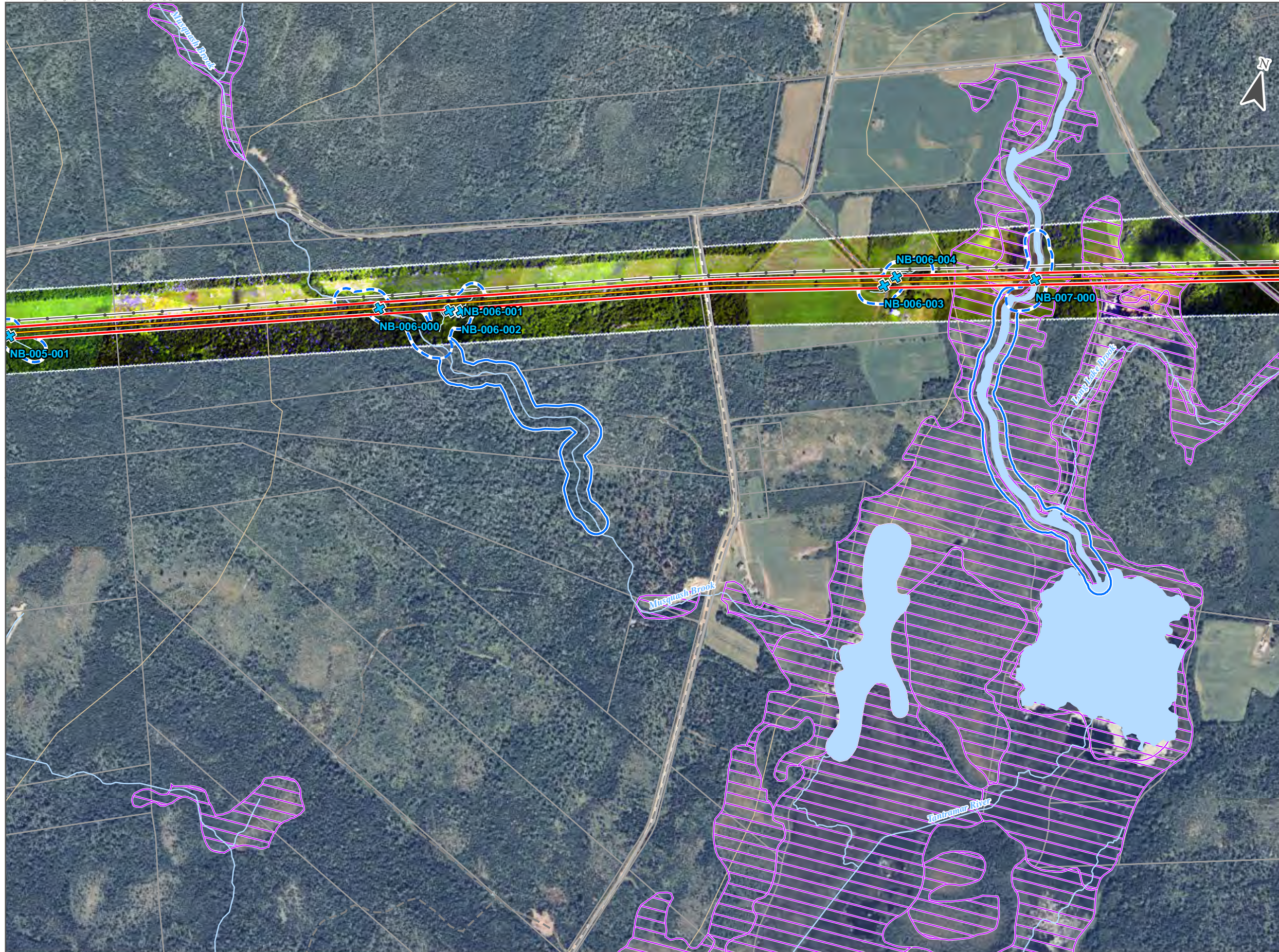


121811475-0043 1:10,000 NAD 1983 CSRS NBDs

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

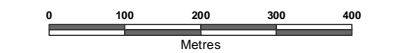


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



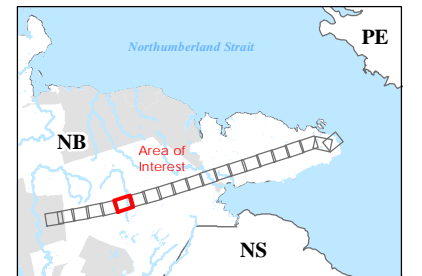
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - GeoNB-mapped Wetland
 - Property Boundary

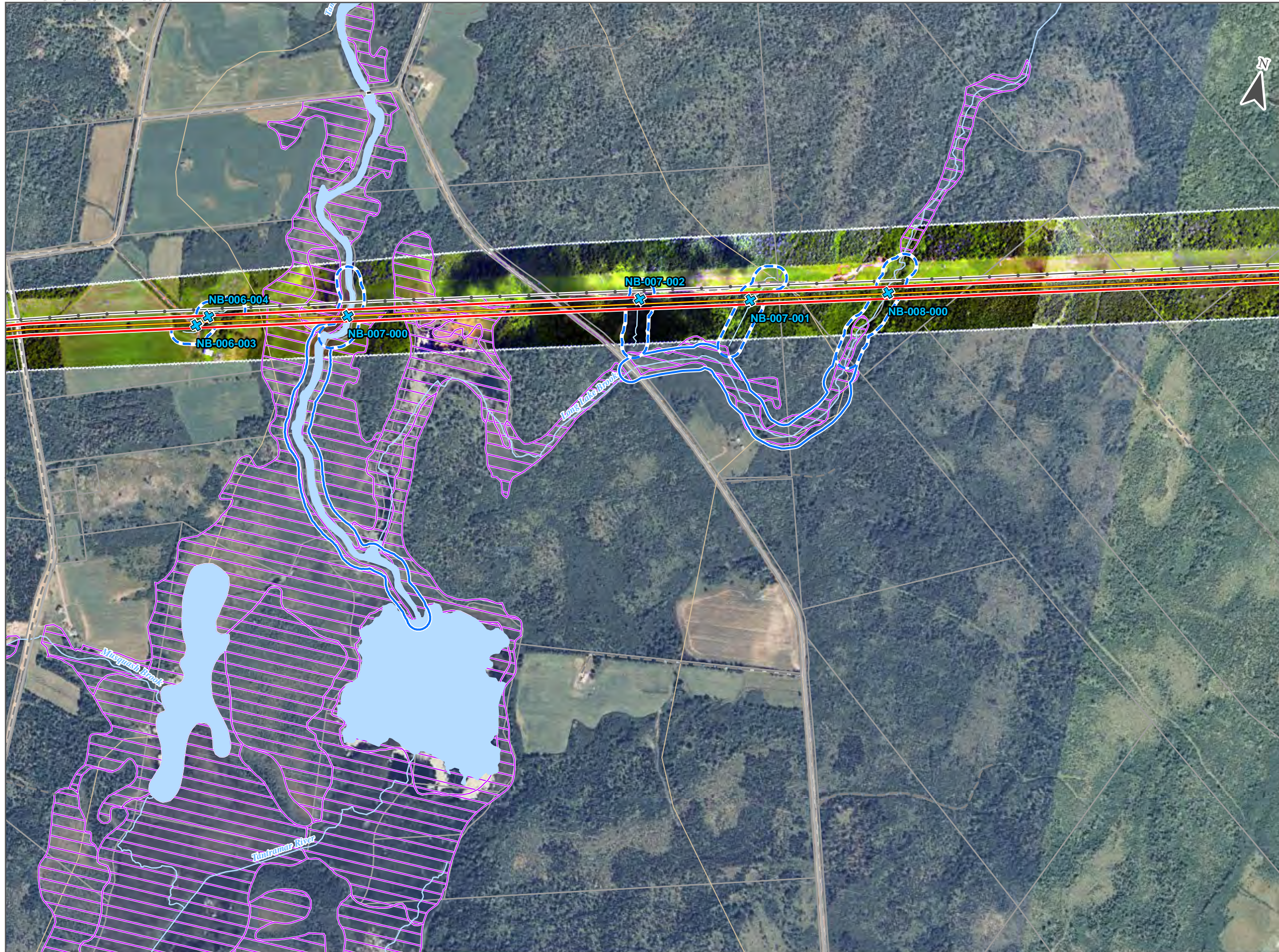


121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

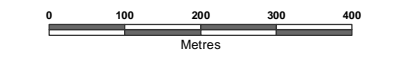


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



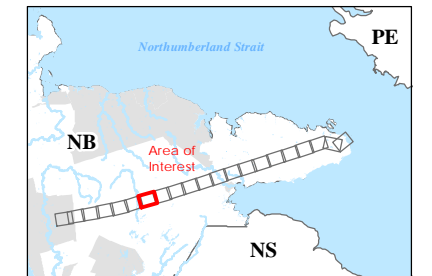
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - GeoNB-mapped Wetland
 - Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

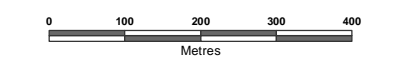


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - GeoNB-mapped Wetland
 - Property Boundary

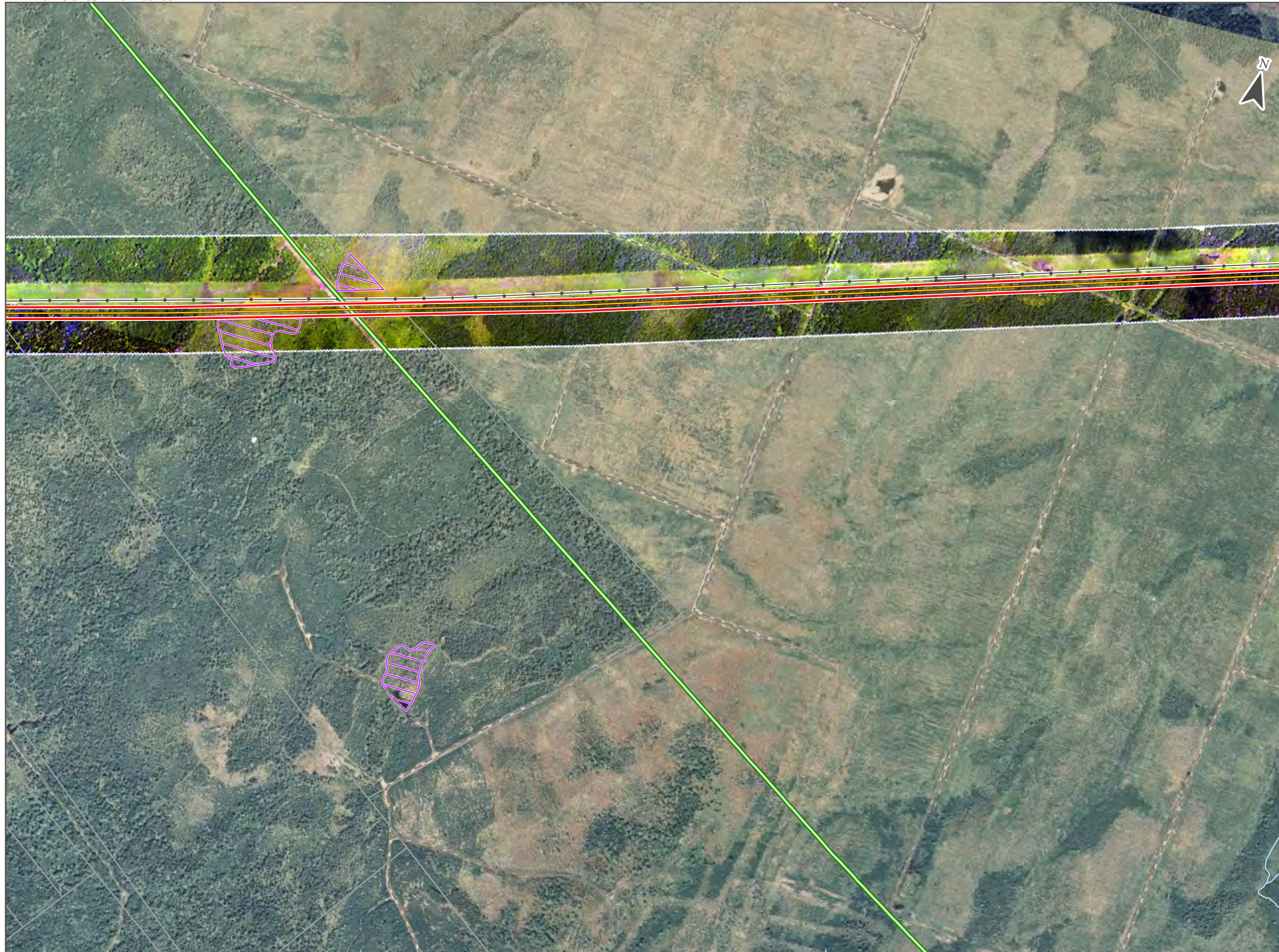


121811475-0043 1:10,000 NAD 1983 CSRS NBDS









Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

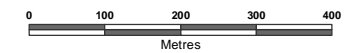


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



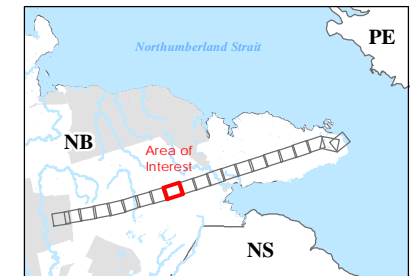
Freshwater Environment Assessment Area Boundaries

- Freshwater Environment Assessment Area**
-  Project Development Area
 -  Local Assessment Area
 -  Regional Assessment Area
- Proposed Project Components**
-  Memramcook to Melrose
 -  Existing Transmission Line
- NAME**
-  M&NP Mainline Pipeline
 -  GeoNB-mapped Wetland
 -  Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010),
Natural Resources (2011). Base data
provided by the Governments of Canada and New
Brunswick. Project Data from Stantec or provided by NB Power / MECL.

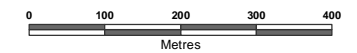


Disclaimer: This map is for illustrative purposes to support this
Stantec project; questions can be directed to the issuing agency.



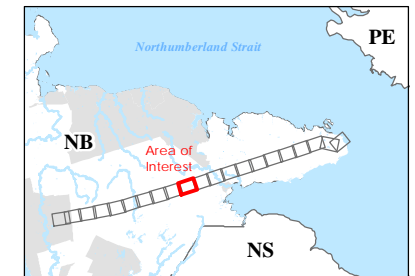
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

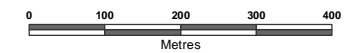


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



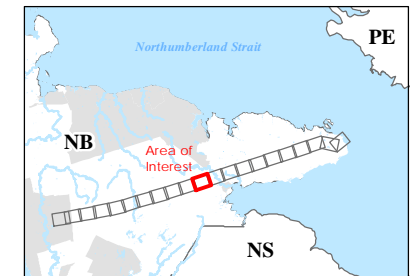
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - GeoNB-mapped Wetland
 - Property Boundary

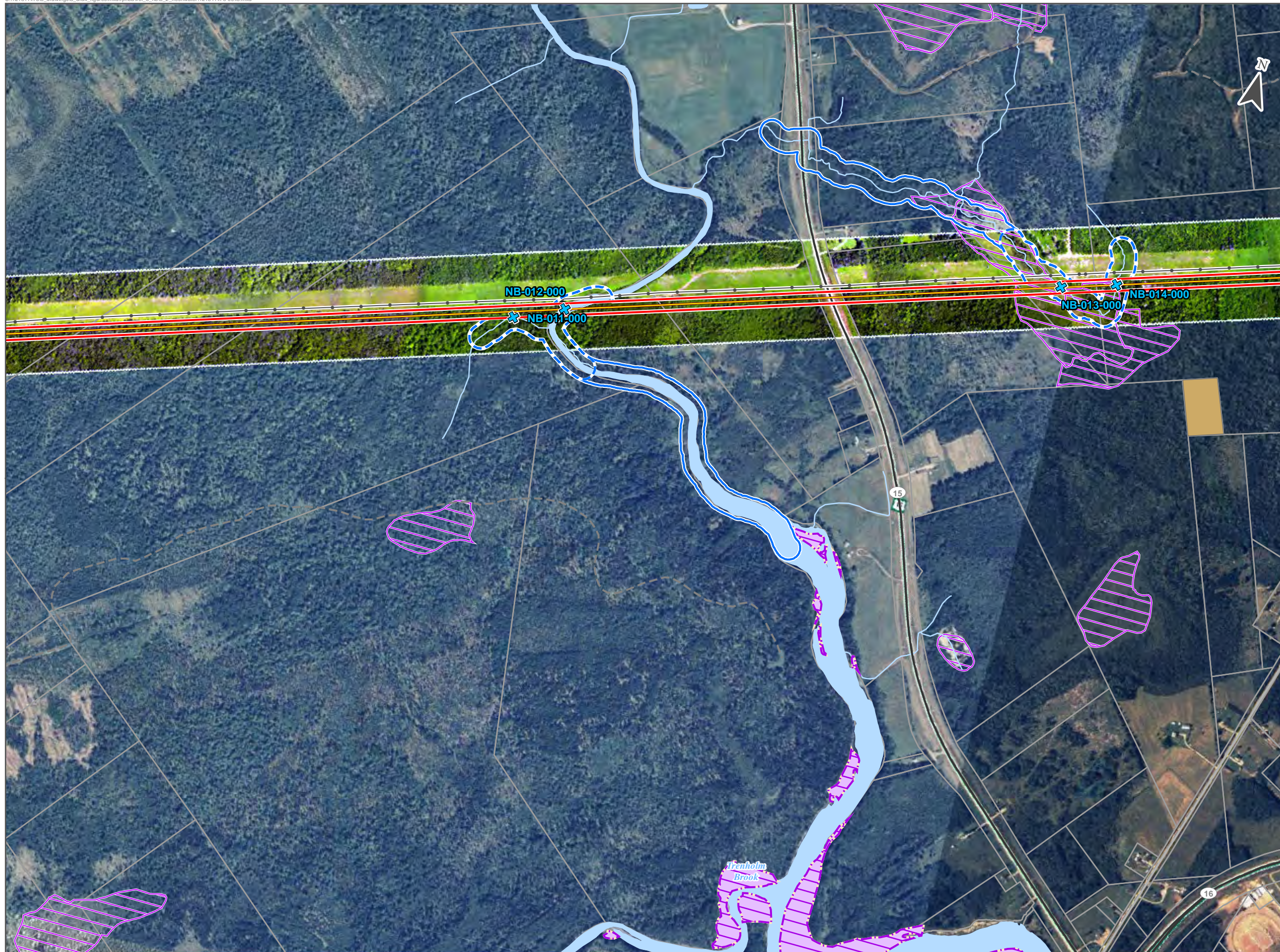


121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service: GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

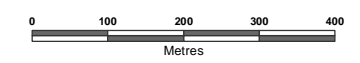


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



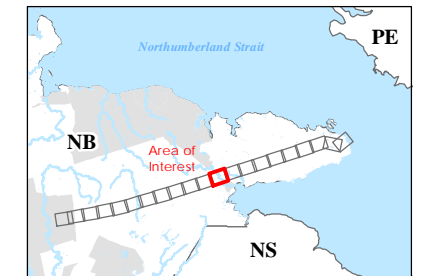
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - Crown Lands
 - GeoNB-mapped Wetland
 - Provincially Significant Wetland
 - Property Boundary

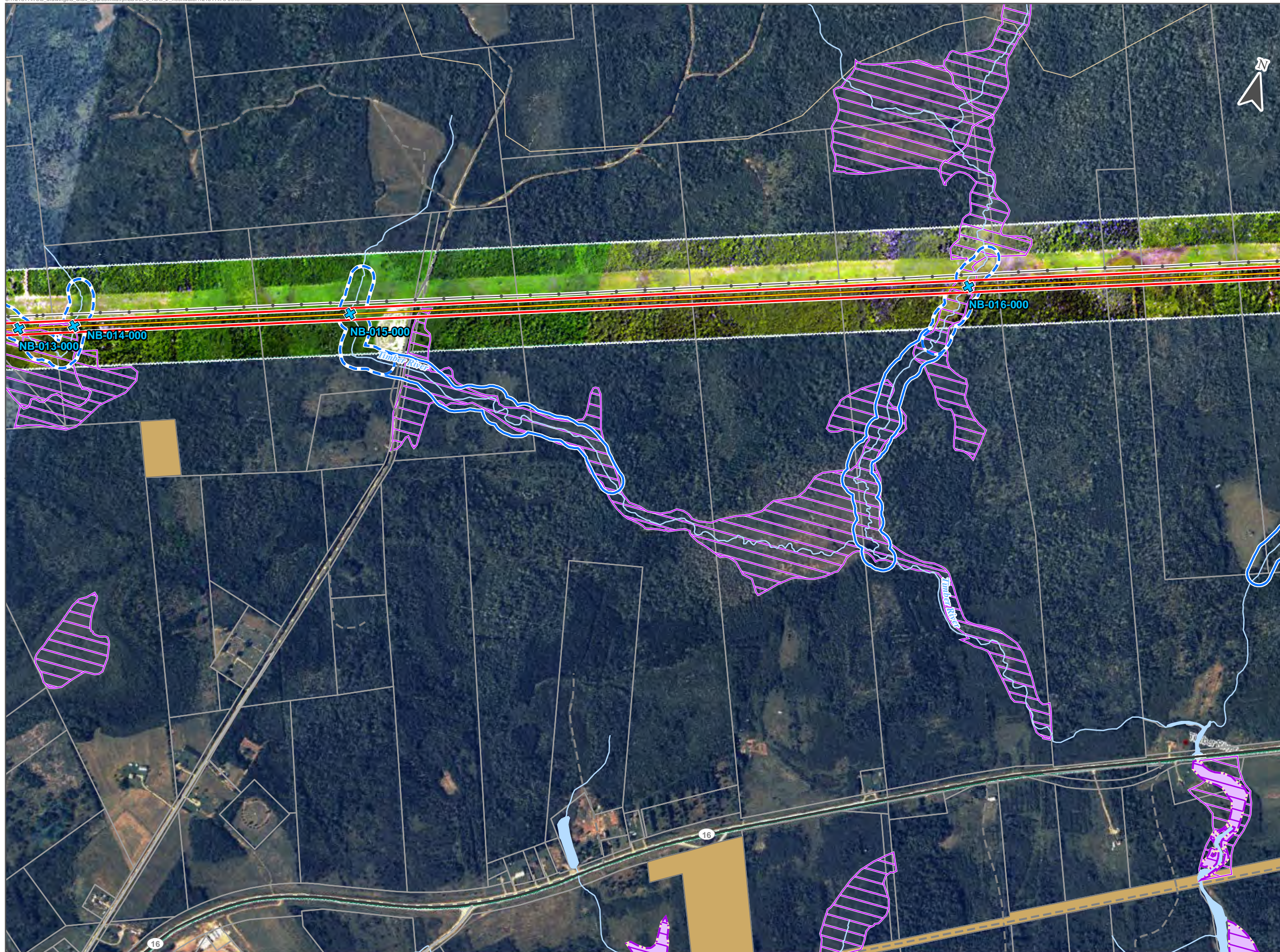


121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

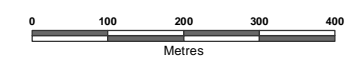


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



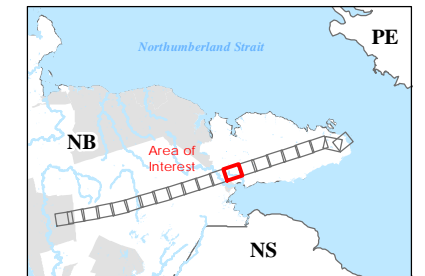
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - Crown Lands
 - GeoNB-mapped Wetland
 - Provincially Significant Wetland
 - Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service: GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

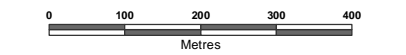


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



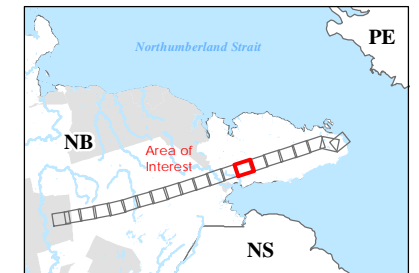
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Memramcook to Melrose
 - Existing Transmission Line
 - Crown Lands
 - GeoNB-mapped Wetland
 - Provincially Significant Wetland
 - Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010),
Natural Resources (2011). Base data
provided by the Governments of Canada and New
Brunswick. Project Data from Stantec or provided by NB Power / MECL.

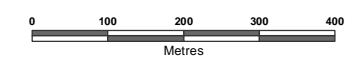


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



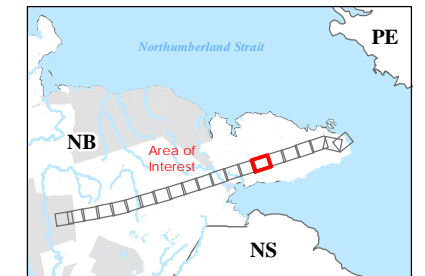
Freshwater Environment Assessment Area Boundaries

- Freshwater Environment Assessment Area**
- Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
- Memramcook to Melrose
 - Melrose to Cape Tormentine
 - Existing Transmission Line
 - Crown Lands
 - GeoNB-mapped Wetland
 - Property Boundary

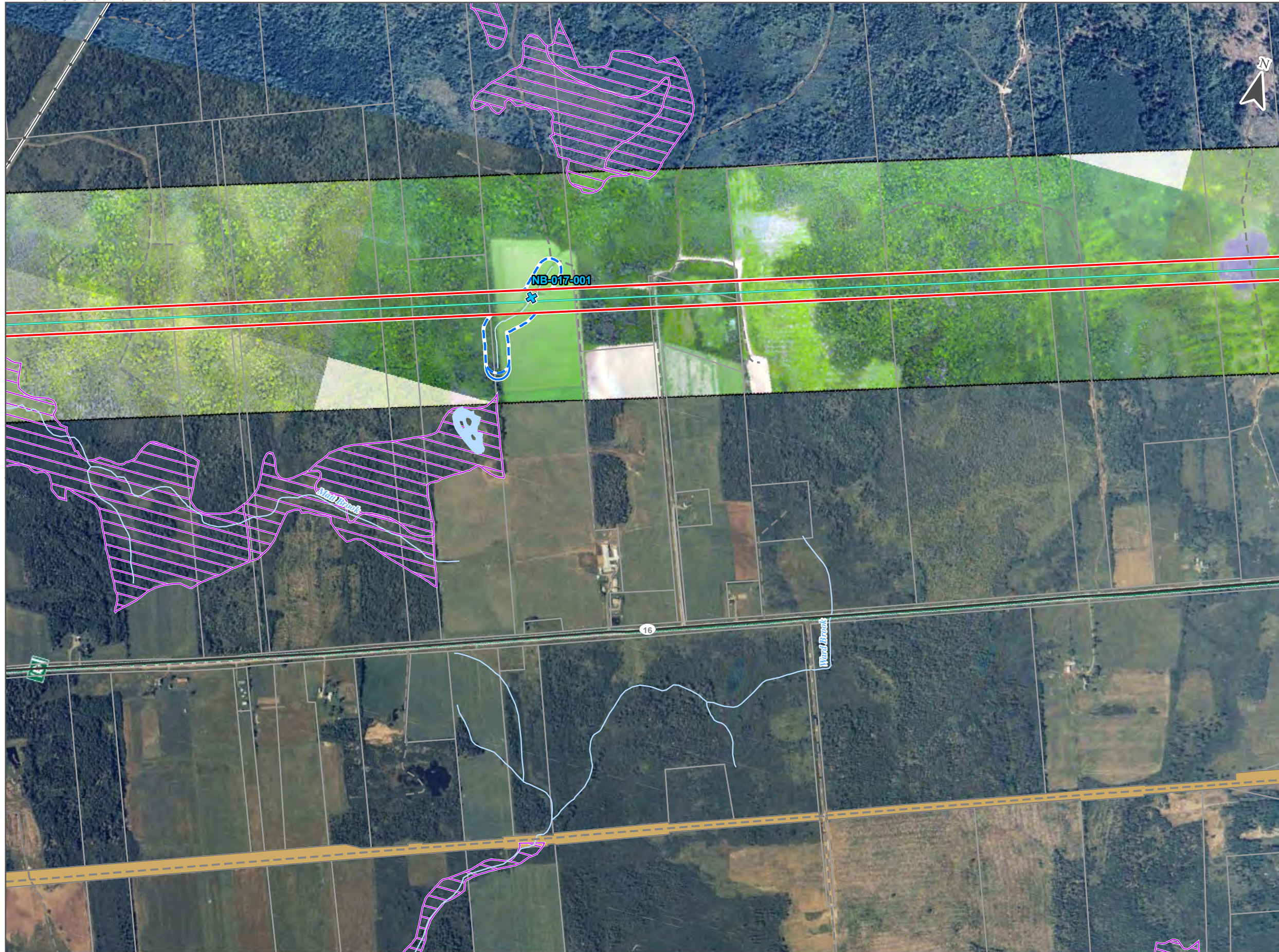


121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

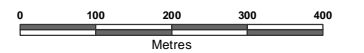


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



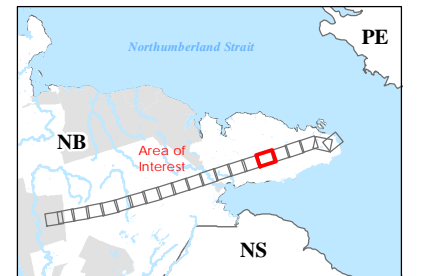
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Melrose to Cape Tormentine
 - Existing Transmission Line
 - Crown Lands
 - GeoNB-mapped Wetland
 - Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010),
Natural Resources (2011). Base data
provided by the Governments of Canada and New
Brunswick. Project Data from Stantec or provided by NB Power / MECL.

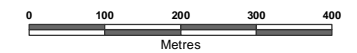


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



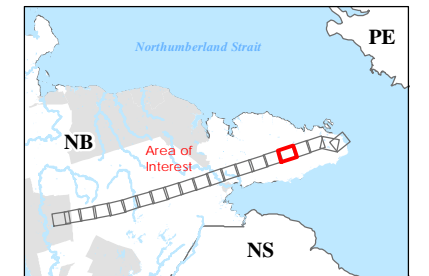
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
- Project Development Area
- Local Assessment Area
- Regional Assessment Area
- Proposed Project Components**
- Melrose to Cape Tormentine
- Crown Lands
- GeoNB-mapped Wetland
- Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDs

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010),
 Natural Resources (2011). Base data
 provided by the Governments of Canada and New
 Brunswick. Project Data from Stantec or provided by NB Power / MECL.

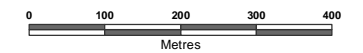


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



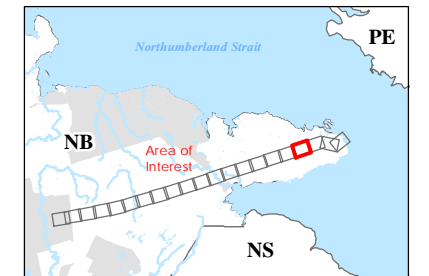
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Melrose to Cape Tormentine
 - Crown Lands
 - GeoNB-mapped Wetland
 - Property Boundary

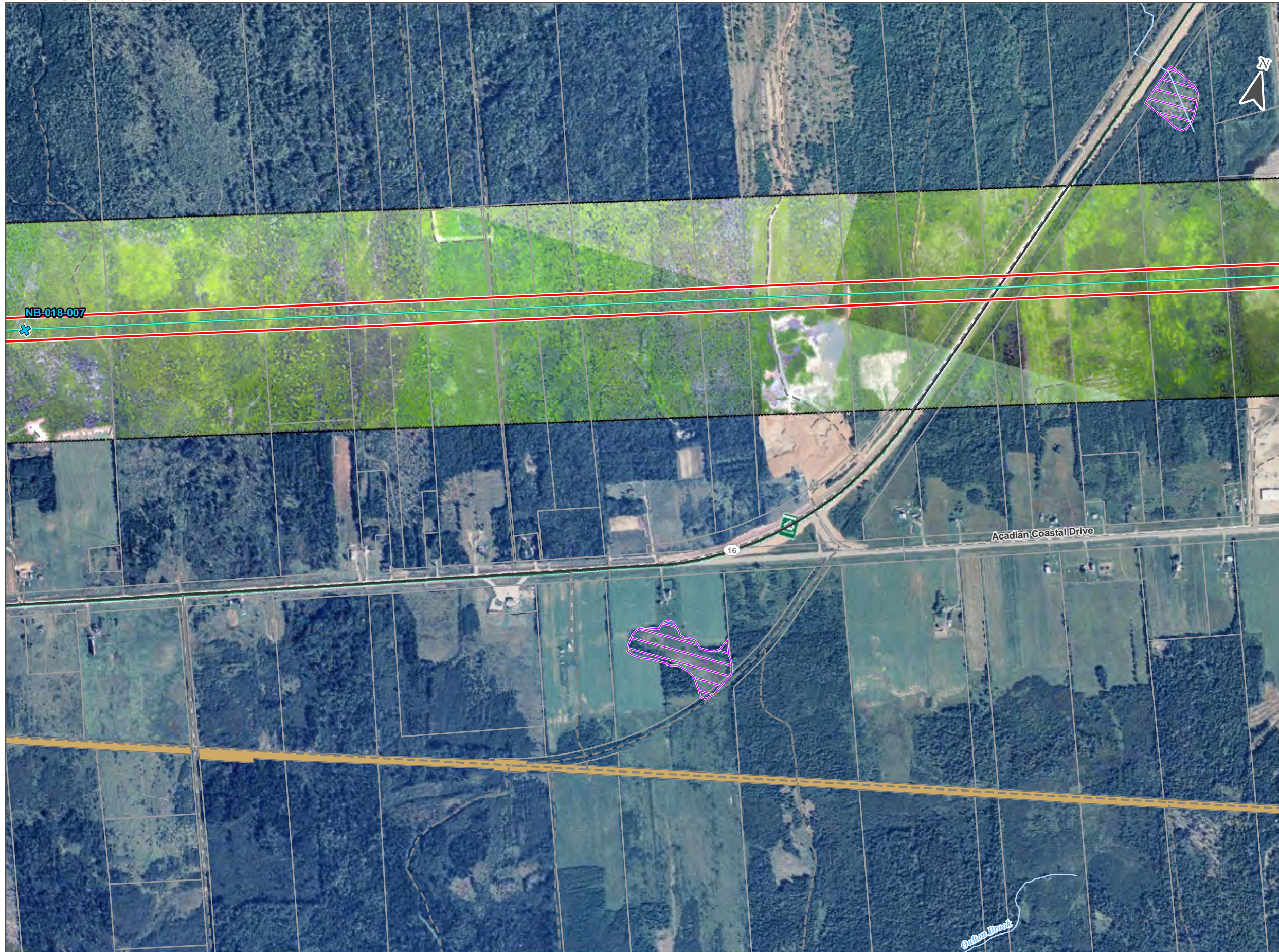


121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



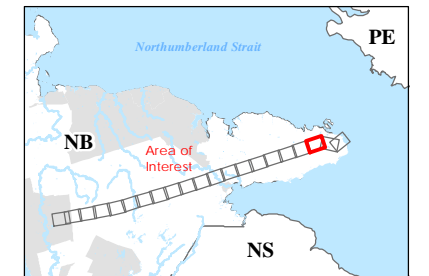
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Melrose to Cape Tormentine
 - Crown Lands
 - GeoNB-mapped Wetland
 - Property Boundary

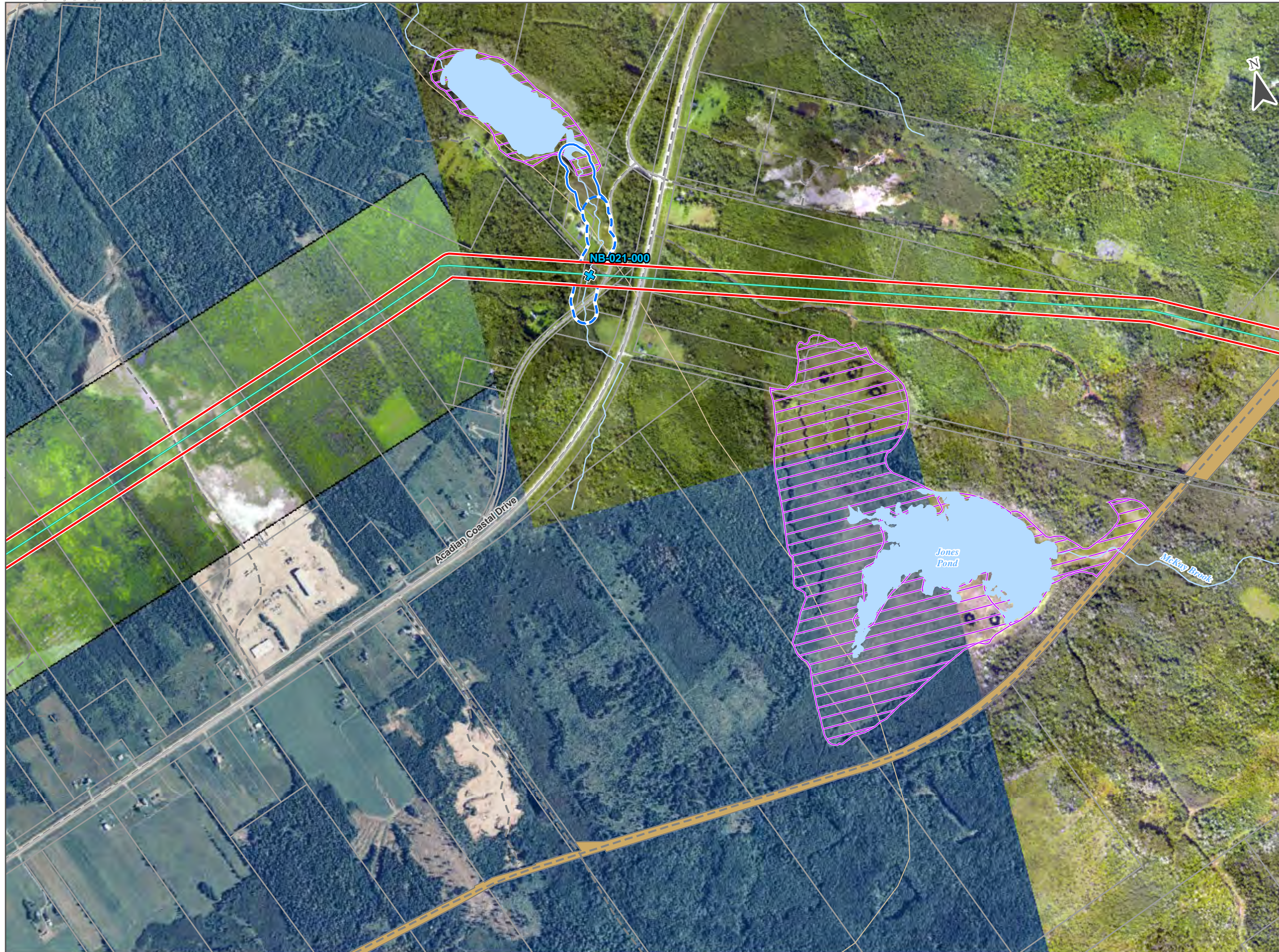


121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

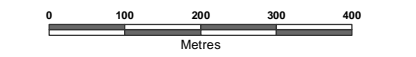


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



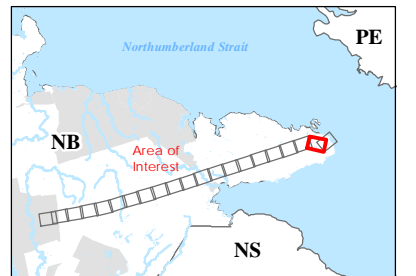
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components**
 - Melrose to Cape Tormentine
 - Crown Lands
 - GeoNB-mapped Wetland
 - Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

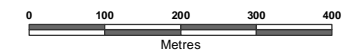


Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.



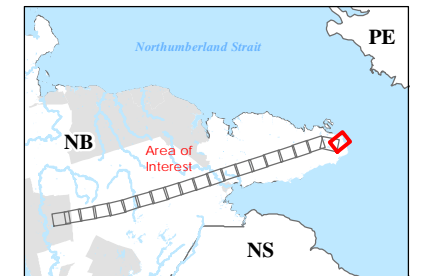
Freshwater Environment Assessment Area Boundaries

- Watercourse Crossing
- Freshwater Environment Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Regional Assessment Area
- Proposed Project Components in the Northumberland Strait**
 - Proposed Submarine Cable #3
 - Proposed Submarine Cable #4
- Proposed Project Components**
 - Melrose to Cape Tormentine
 - Proposed Buried Cable
- Crown Lands
- GeoNB-mapped Wetland
- Property Boundary



121811475-0043 1:10,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB, PEI Government (2010), Natural Resources (2011). Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

September 30, 2015

APPENDIX B TERRESTRIAL VC MAPBOOK

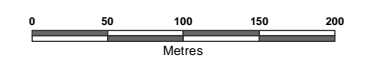
PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015



Terrestrial Environment Assessment Area Boundaries

- Proposed Project Components**
- Memramcook to Melrose
- Terrestrial Assessment Area**
- ▭ Project Development Area
- ▭ Local Assessment Area
- Existing Transmission Line
- ▭ Memramcook Substation



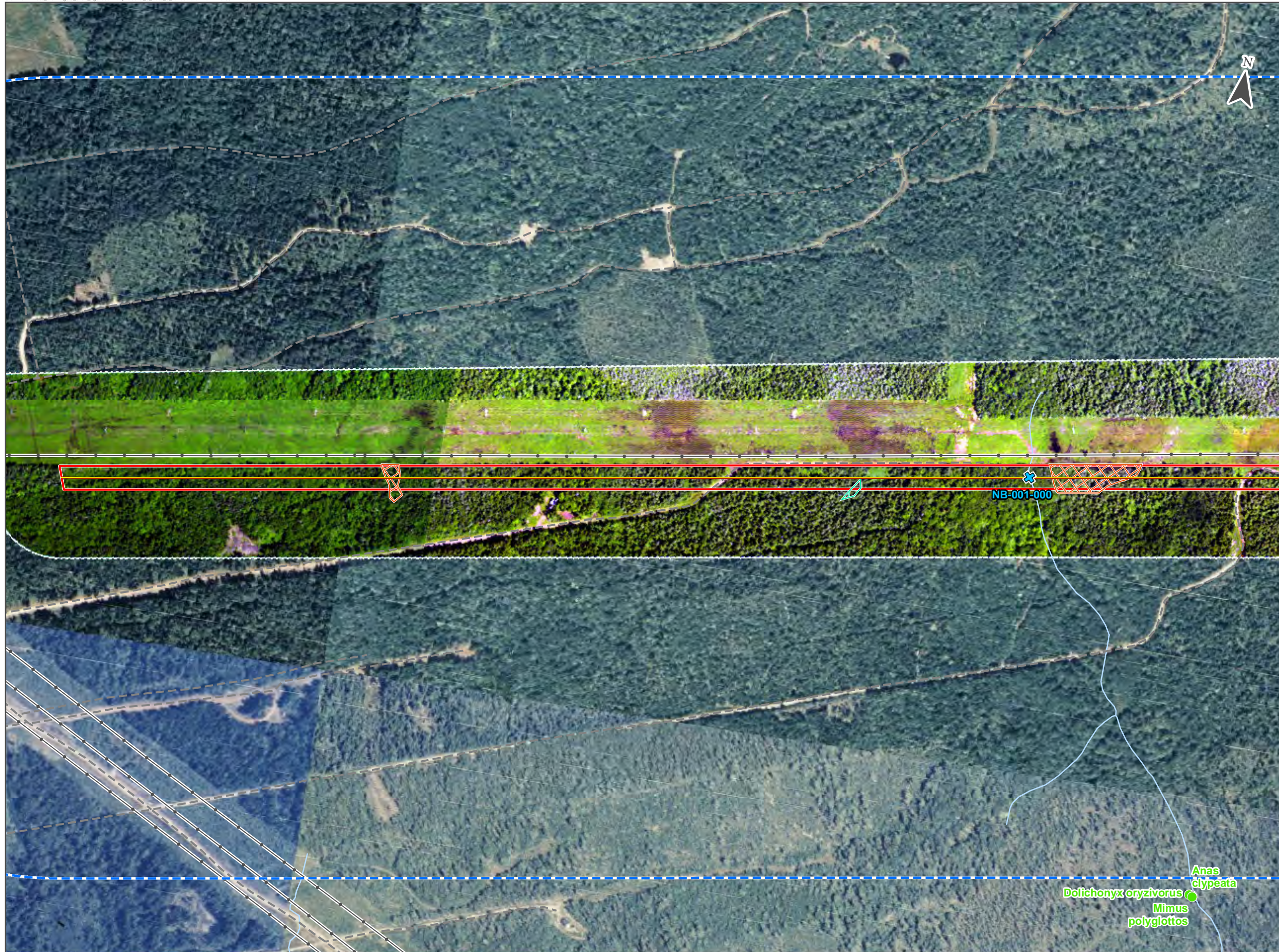
121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



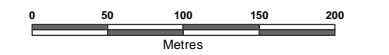
Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

121811475 - PEI-NB Marine Cable Interconnection - Maritime Electric Company Limited



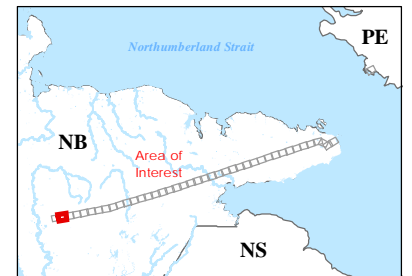
Terrestrial Environment Assessment Area Boundaries

- AC CDC Bird Observation
- ✕ Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - Coniferous Treed Swamp
 - Mixedwood Treed Swamp
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Existing Transmission Line



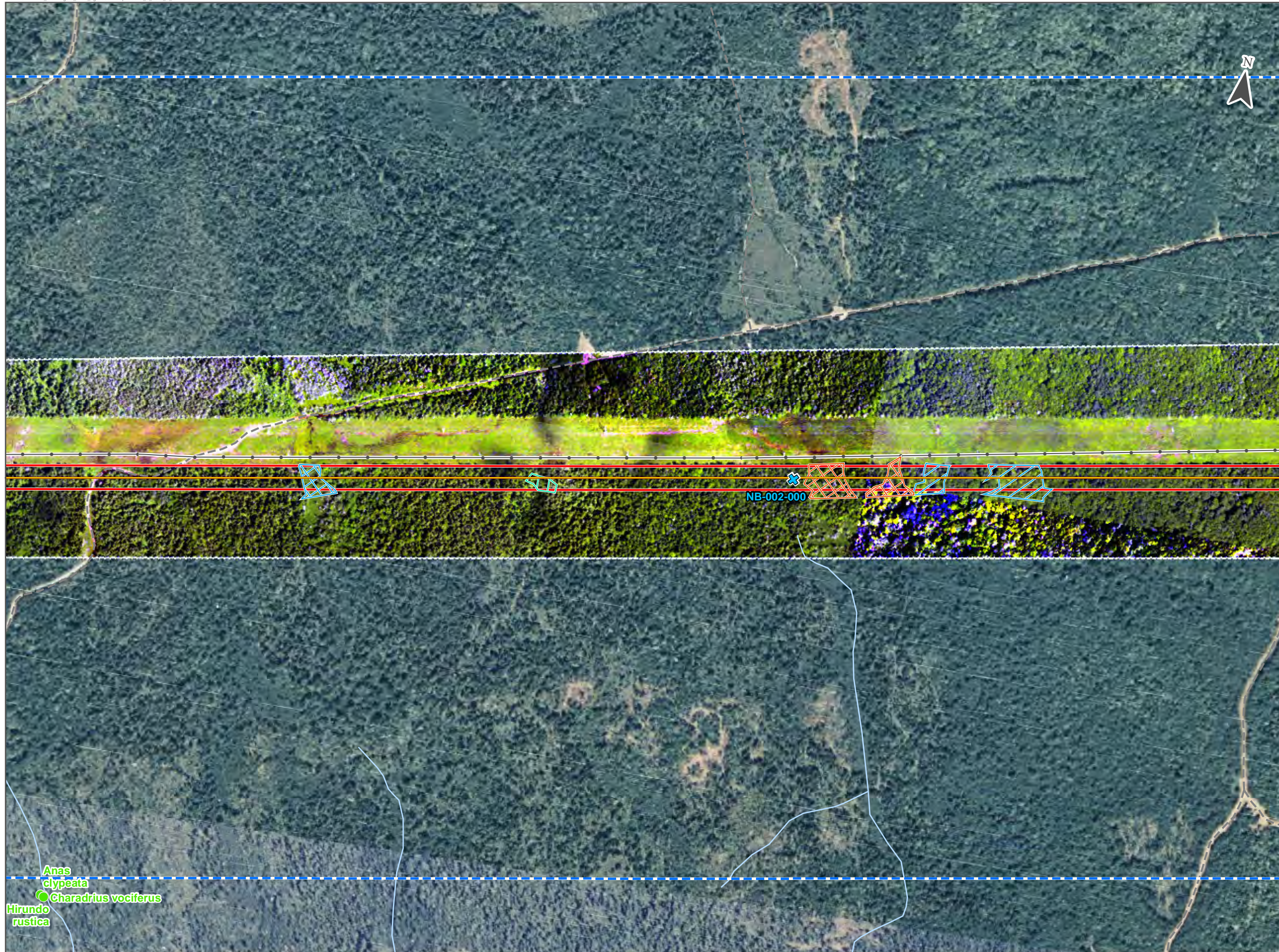
121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



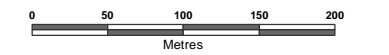
Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

121811475 - PEI-NB Marine Cable Interconnection - Maritime Electric Company Limited



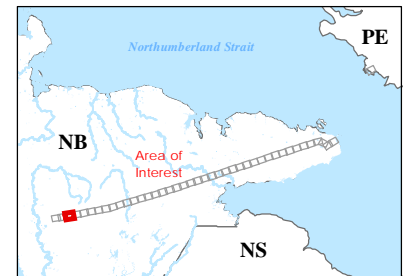
Terrestrial Environment Assessment Area Boundaries

- AC CDC Bird Observation
- ✕ Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - Coniferous Treed Swamp
 - Deciduous Treed Swamp
 - Mixedwood Treed Swamp
 - Tall Shrub Swamp
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Existing Transmission Line

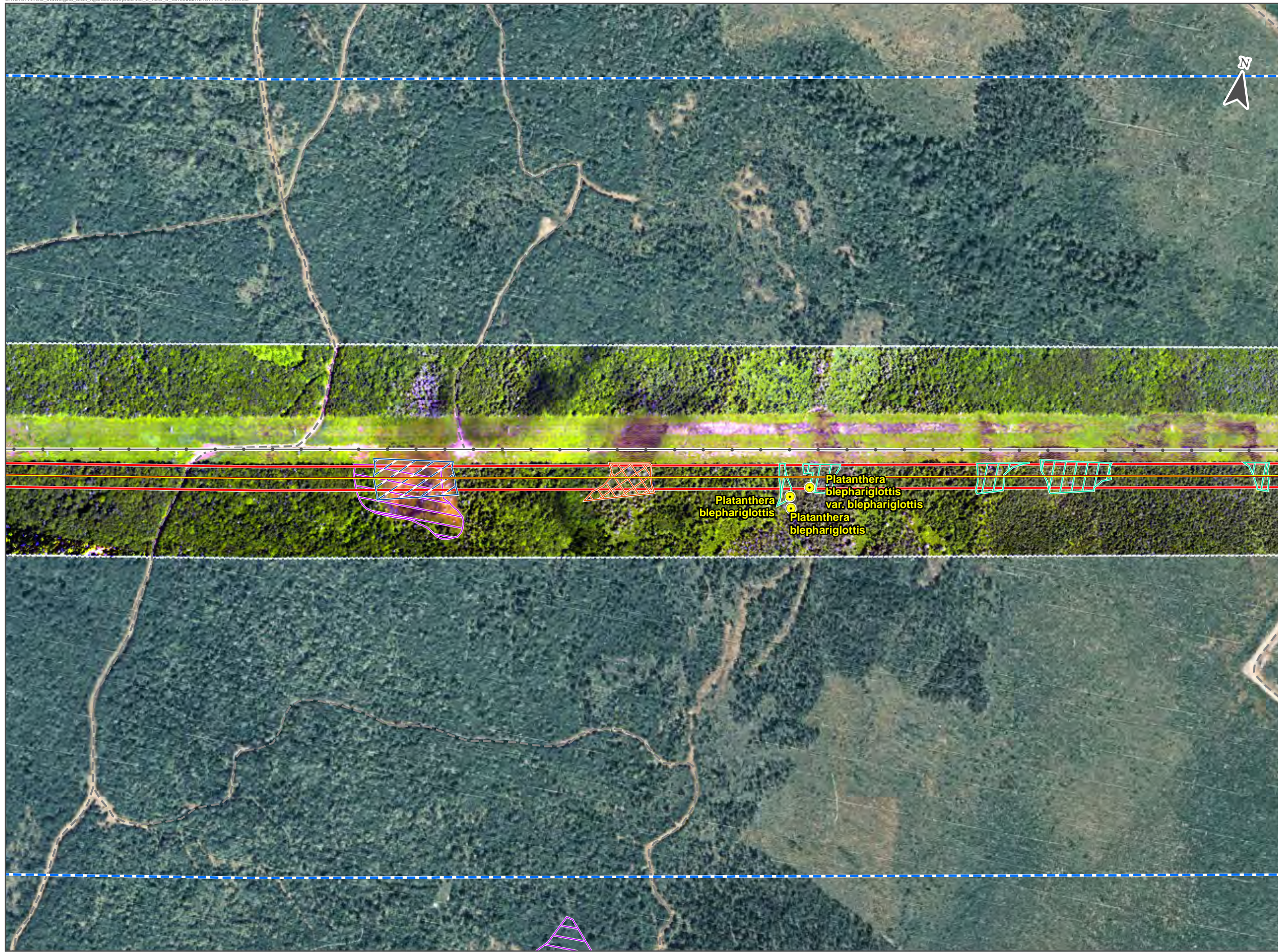


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

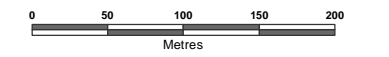


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



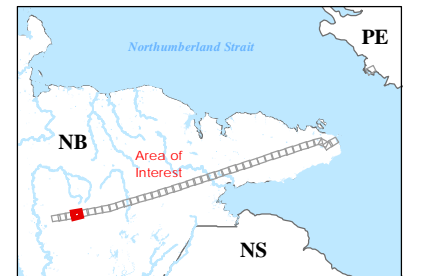
Terrestrial Environment Assessment Area Boundaries

- Plant Field Observation (Species of Conservation Concern)**
 - Vascular
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - ▨ Coniferous Treed Swamp
 - ▨ Graminoid Bog
 - ▨ Mixedwood Treed Swamp
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
 - Existing Transmission Line
 - ▭ GeoNB-mapped Wetland

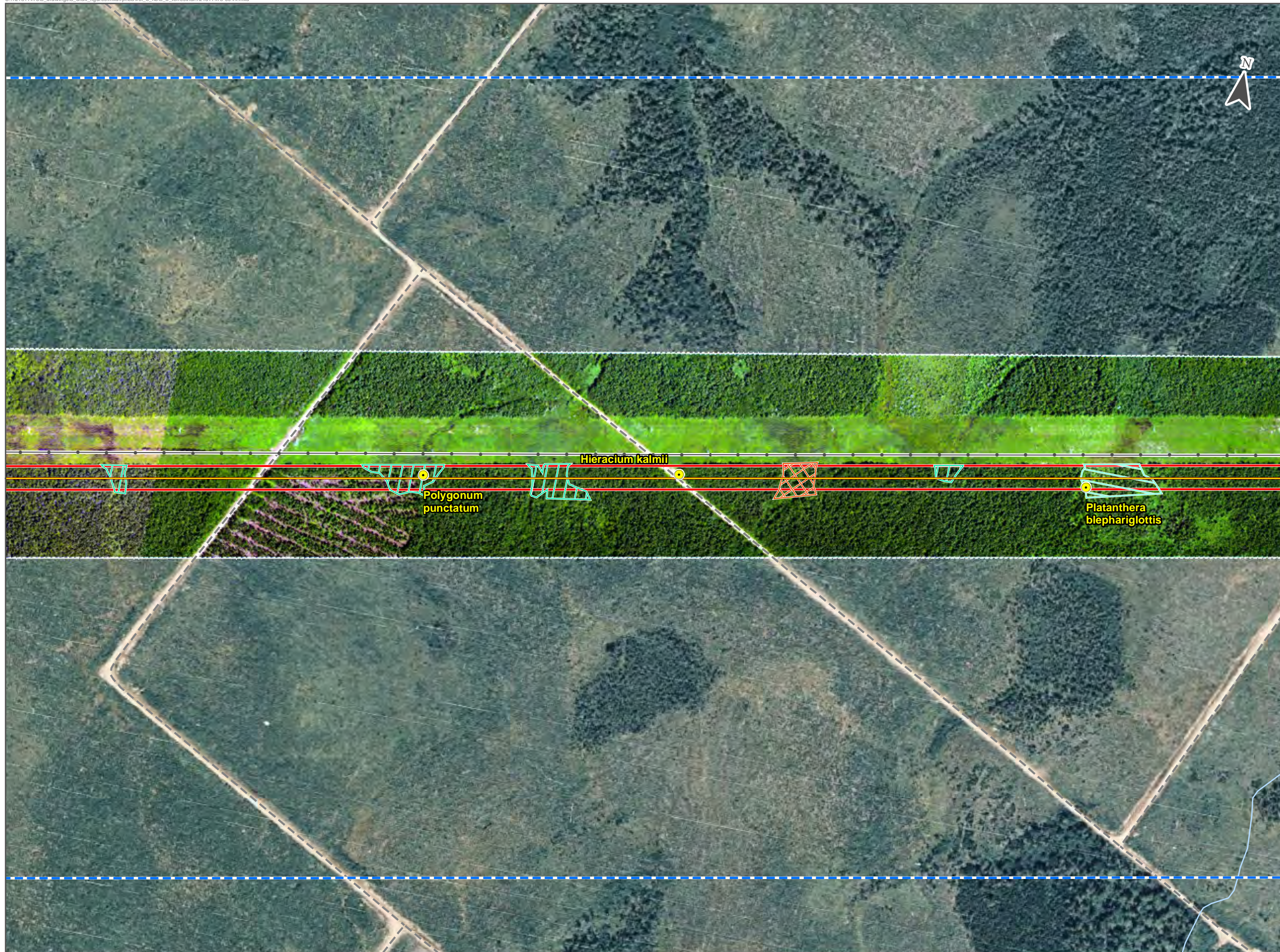


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

Plant Field Observation (Species of Conservation Concern)

- Vascular

Proposed Project Components

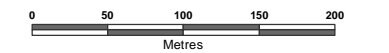
- Memramcook to Melrose

Field Delineated Wetland

- ▨ Coniferous Treed Bog
- ▨ Coniferous Treed Swamp
- ▨ Mixedwood Treed Swamp

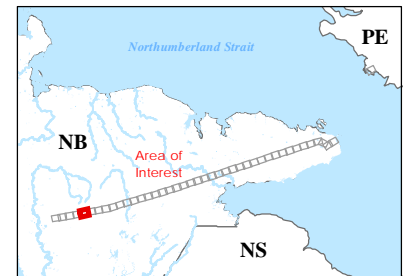
Terrestrial Assessment Area

- ▭ Project Development Area
- ▭ Local Assessment Area
- Existing Transmission Line

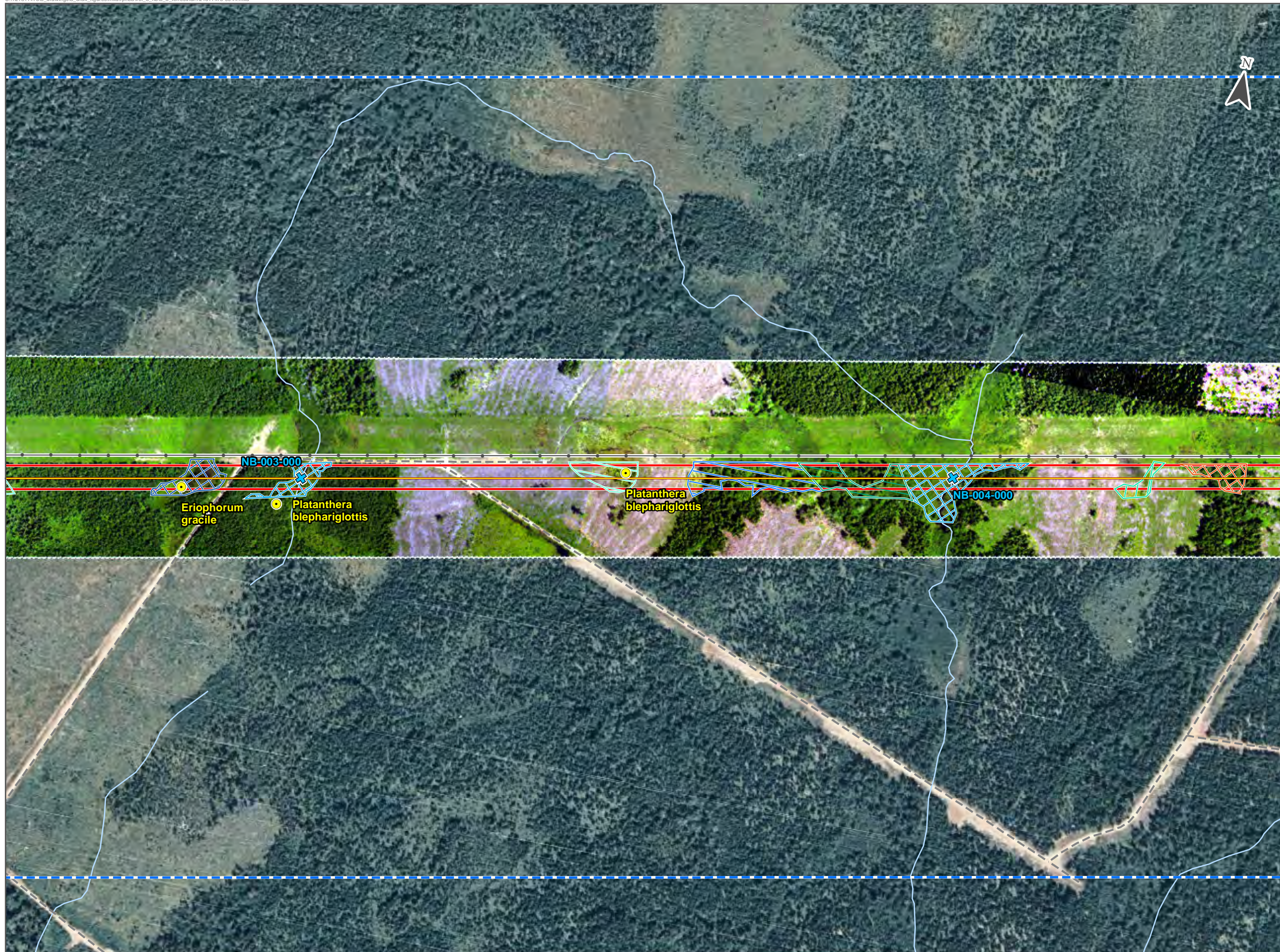


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

Plant Field Observation (Species of Conservation Concern)

● Vascular

⊗ Watercourse Crossing

Proposed Project Components

— Memramcook to Melrose

Field Delineated Wetland

Coniferous Treed Bog

Coniferous Treed Swamp

Graminoid Fen

Mixedwood Treed Fen

Mixedwood Treed Swamp

Tall Shrub Fen

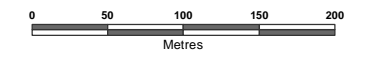
Tall Shrub Swamp

Terrestrial Assessment Area

Project Development Area

Local Assessment Area

Existing Transmission Line

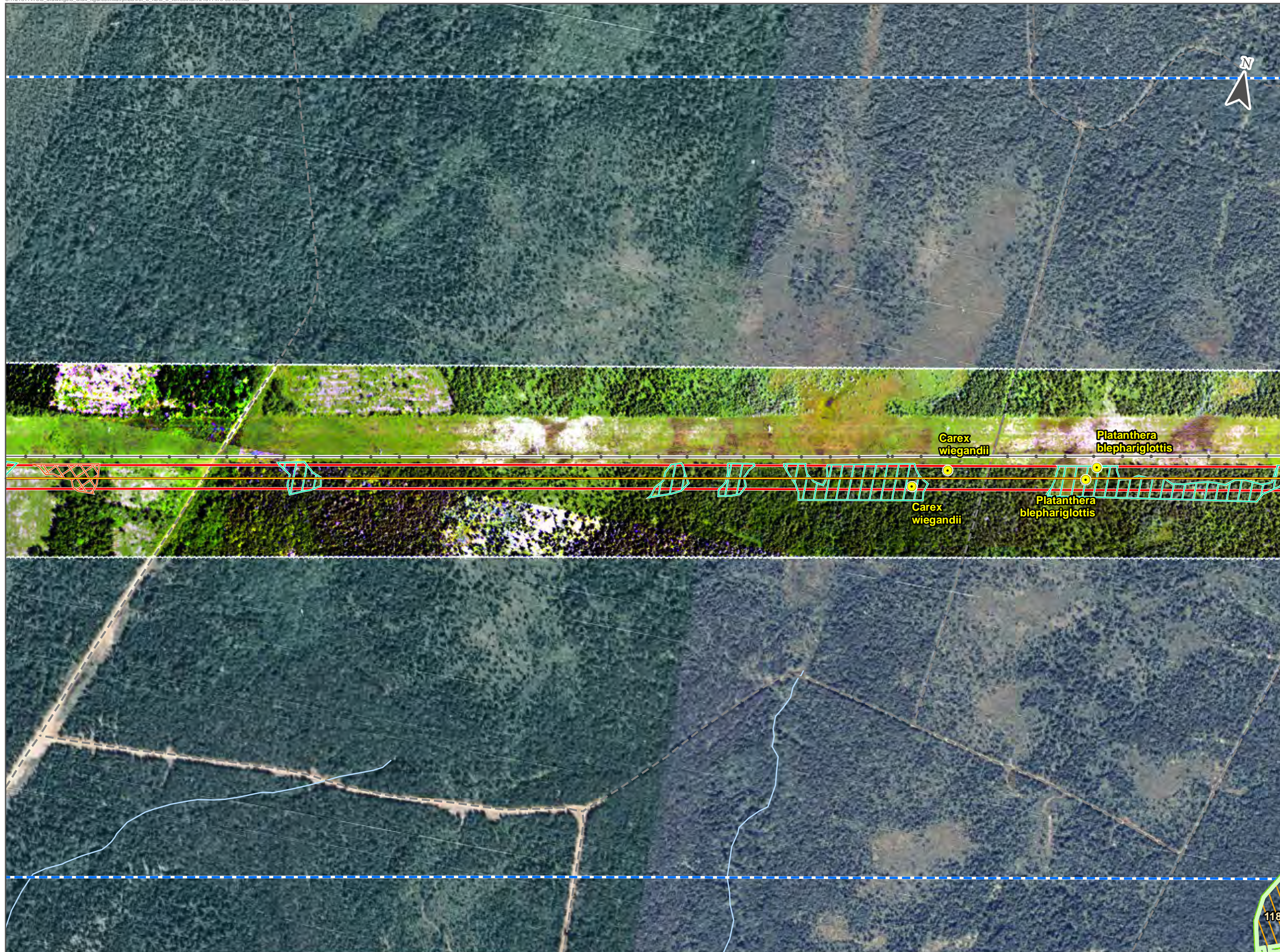


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

Plant Field Observation (Species of Conservation Concern)
 ● Vascular

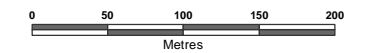
Proposed Project Components
 — Memramcook to Melrose

Field Delineated Wetland
 ▨ Coniferous Treed Swamp
 ▩ Mixedwood Treed Swamp

Interior Forest
 ▨ Pre-Project Interior Forest
 ▨ After Project Interior Forest

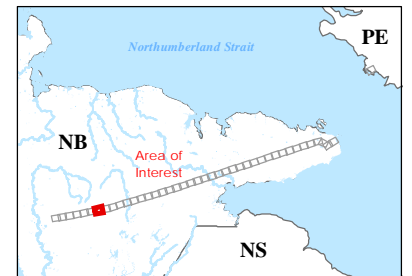
Terrestrial Assessment Area
 ▭ Project Development Area
 ▭ Local Assessment Area

— Existing Transmission Line

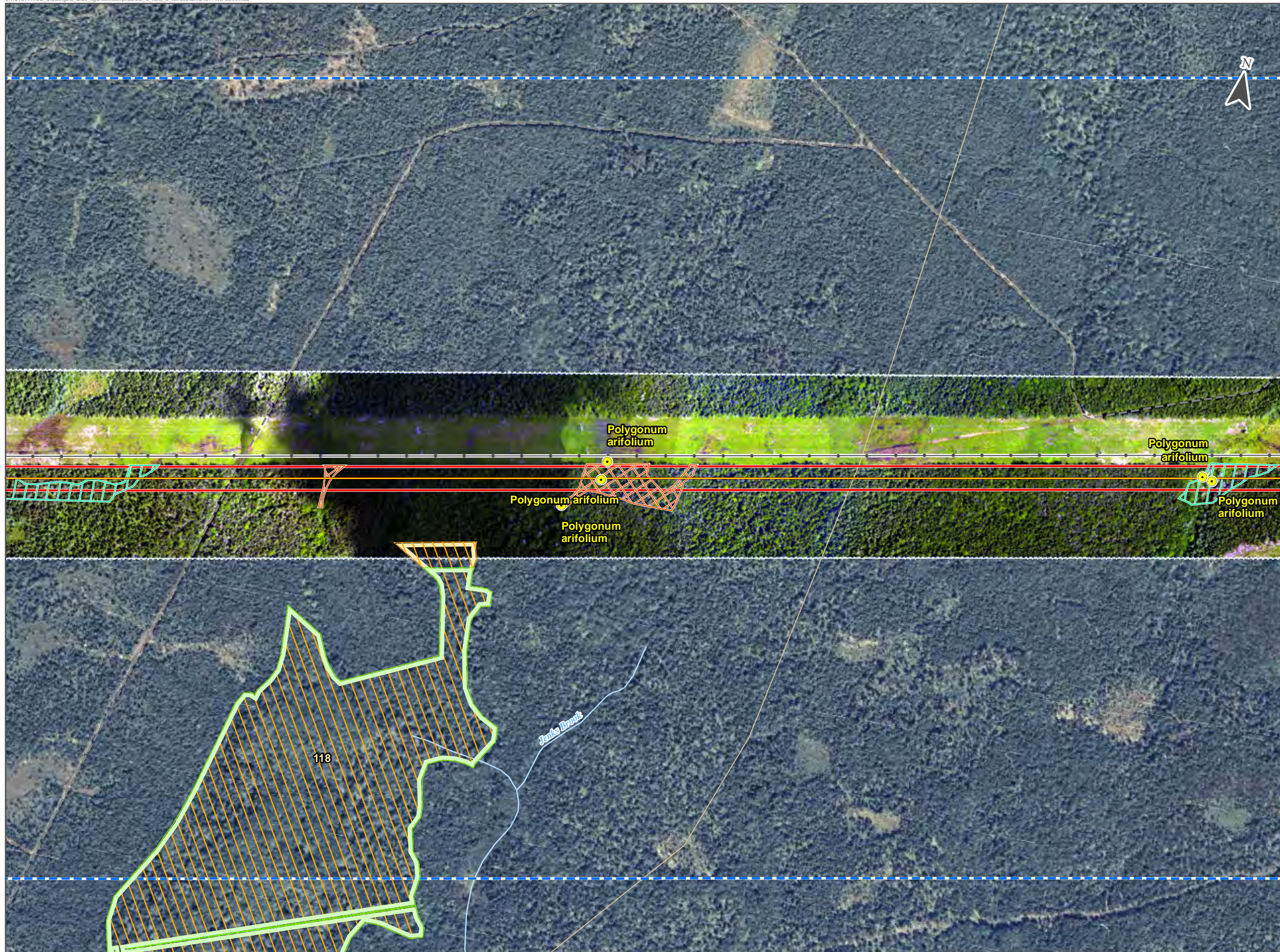


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

Plant Field Observation (Species of Conservation Concern)

- Vascular

Proposed Project Components

- Memramcook to Melrose

Field Delineated Wetland

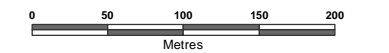
- ▨ Coniferous Treed Swamp
- ▨ Mixedwood Treed Swamp

Interior Forest

- ▨ Pre-Project Interior Forest
- ▨ After Project Interior Forest

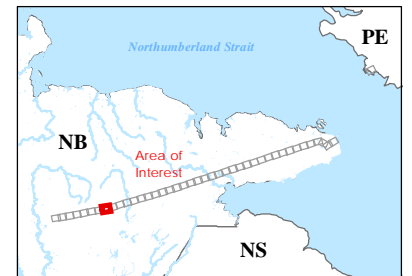
Terrestrial Assessment Area

- ▭ Project Development Area
- ▭ Local Assessment Area
- Existing Transmission Line



121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

Plant Field Observation (Species of Conservation Concern)

● Vascular

⊗ Watercourse Crossing

Proposed Project Components

— Memramcook to Melrose

Field Delineated Wetland

▨ Coniferous Tree Swamp

▨ Mixedwood Tree Swamp

Interior Forest

▨ Pre-Project Interior Forest

▨ After Project Interior Forest

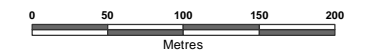
Terrestrial Assessment Area

▭ Project Development Area

▭ Local Assessment Area

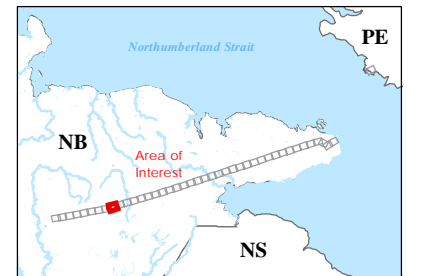
— Existing Transmission Line

▭ GeoNB-mapped Wetland

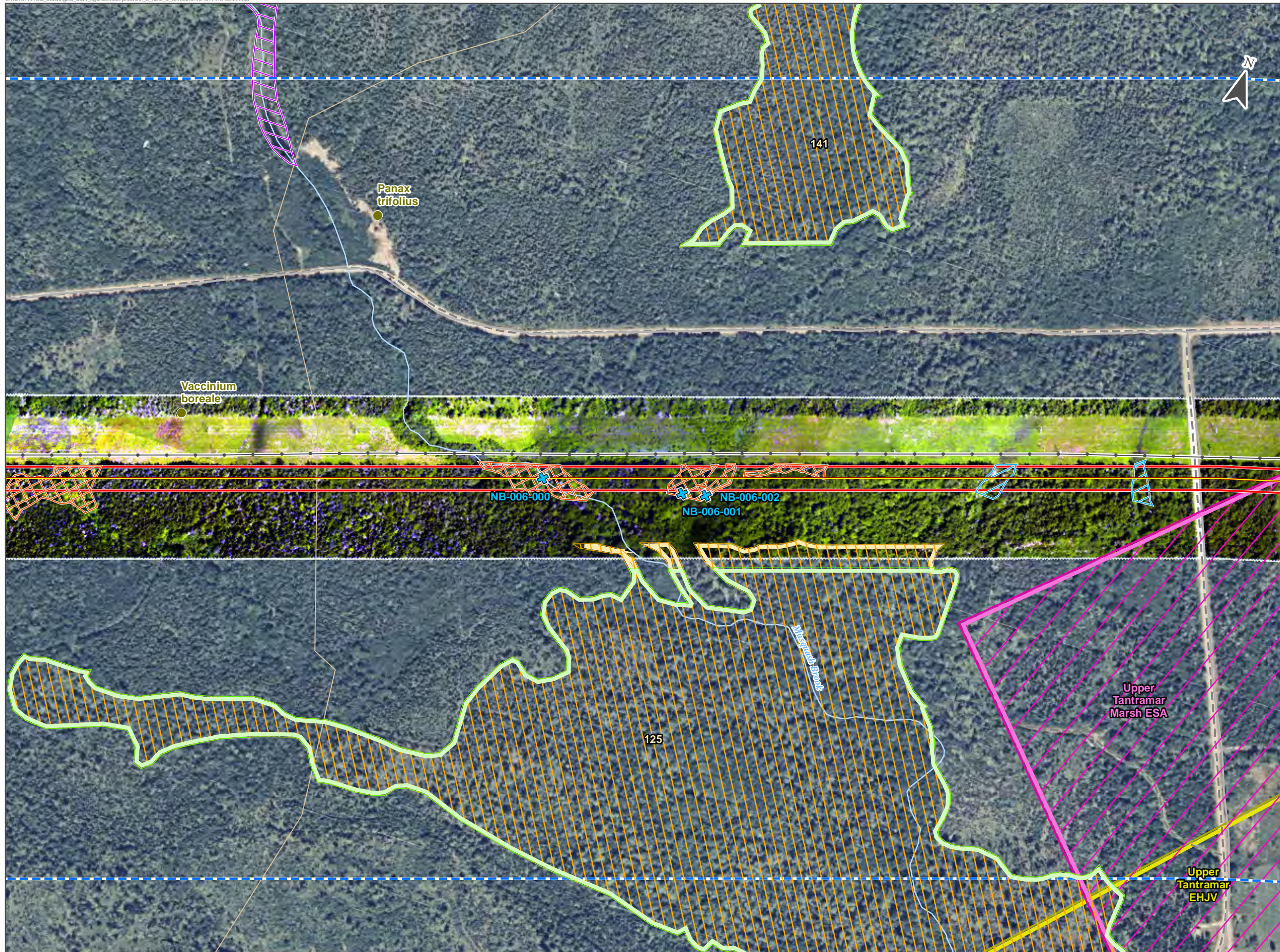


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

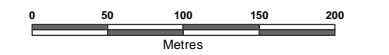


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



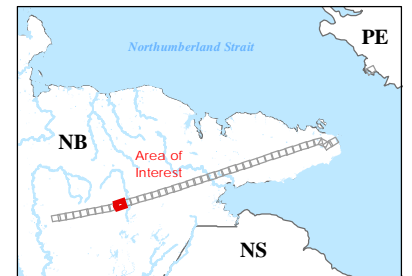
Terrestrial Environment Assessment Area Boundaries

- AC CDC Plant Observation
- ✕ Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - ▨ Deciduous Treed Swamp
 - ▨ Mixedwood Treed Swamp
- Interior Forest**
 - ▨ Pre-Project Interior Forest
 - ▨ After Project Interior Forest
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
- Existing Transmission Line
- ▨ Environmentally Significant Area
- ▨ GeoNB-mapped Wetland
- ▨ Managed Area

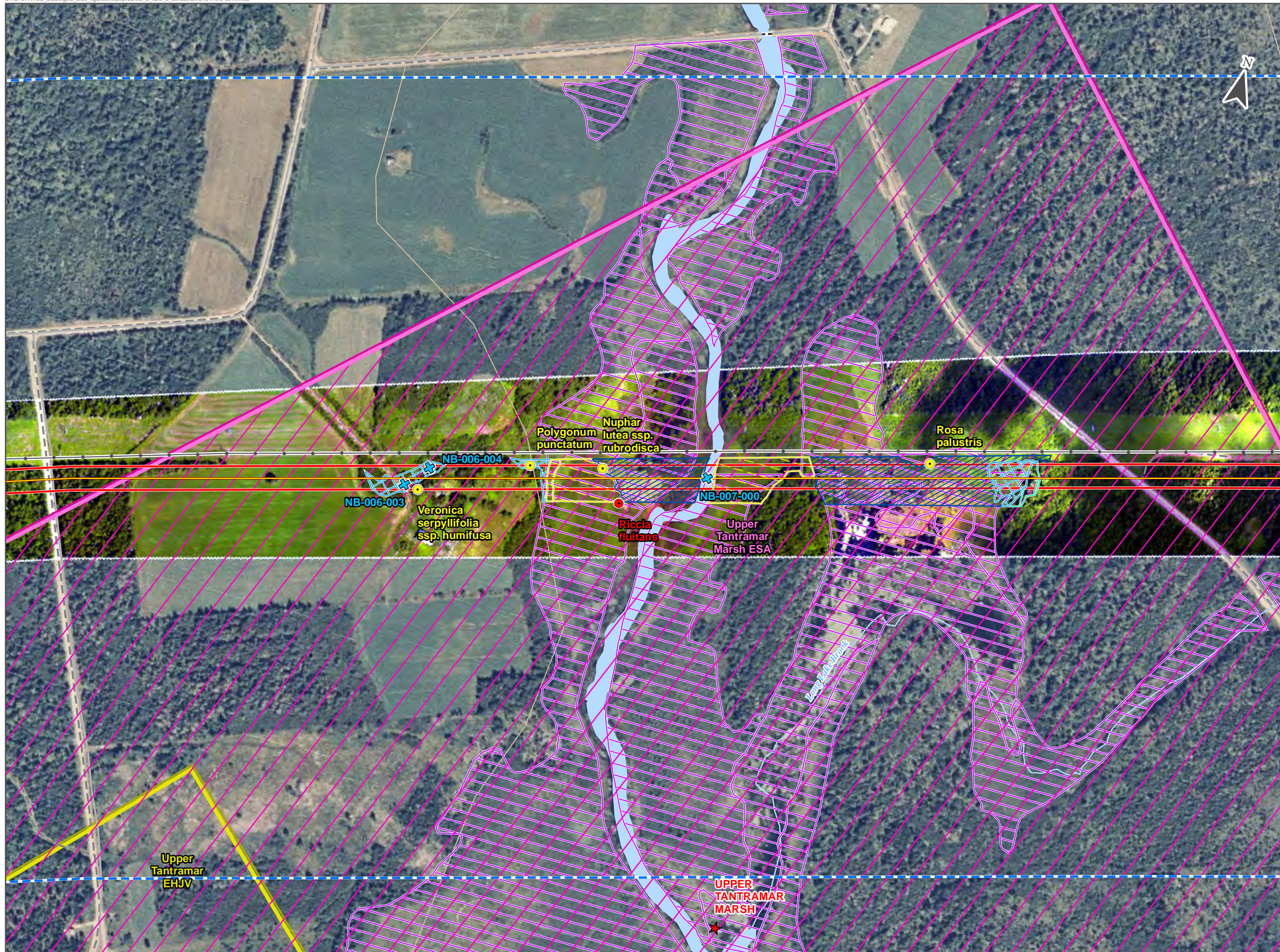


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

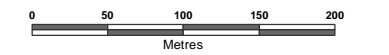


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



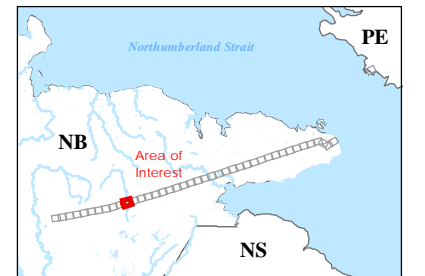
Terrestrial Environment Assessment Area Boundaries

- ★ Environmentally Significant Area
- Plant Field Observation (Species of Conservation Concern)**
 - Non-Vascular
 - Vascular
- ⊕ Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - ▨ Coniferous Treed Swamp
 - ▨ Deciduous Treed Swamp
 - ▨ Floating Aquatic Water
 - ▨ Graminoid Marsh
 - ▨ Tall Shrub Swamp
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
 - Existing Transmission Line
 - Environmentally Significant Area
 - GeoNB-mapped Wetland
 - Managed Area

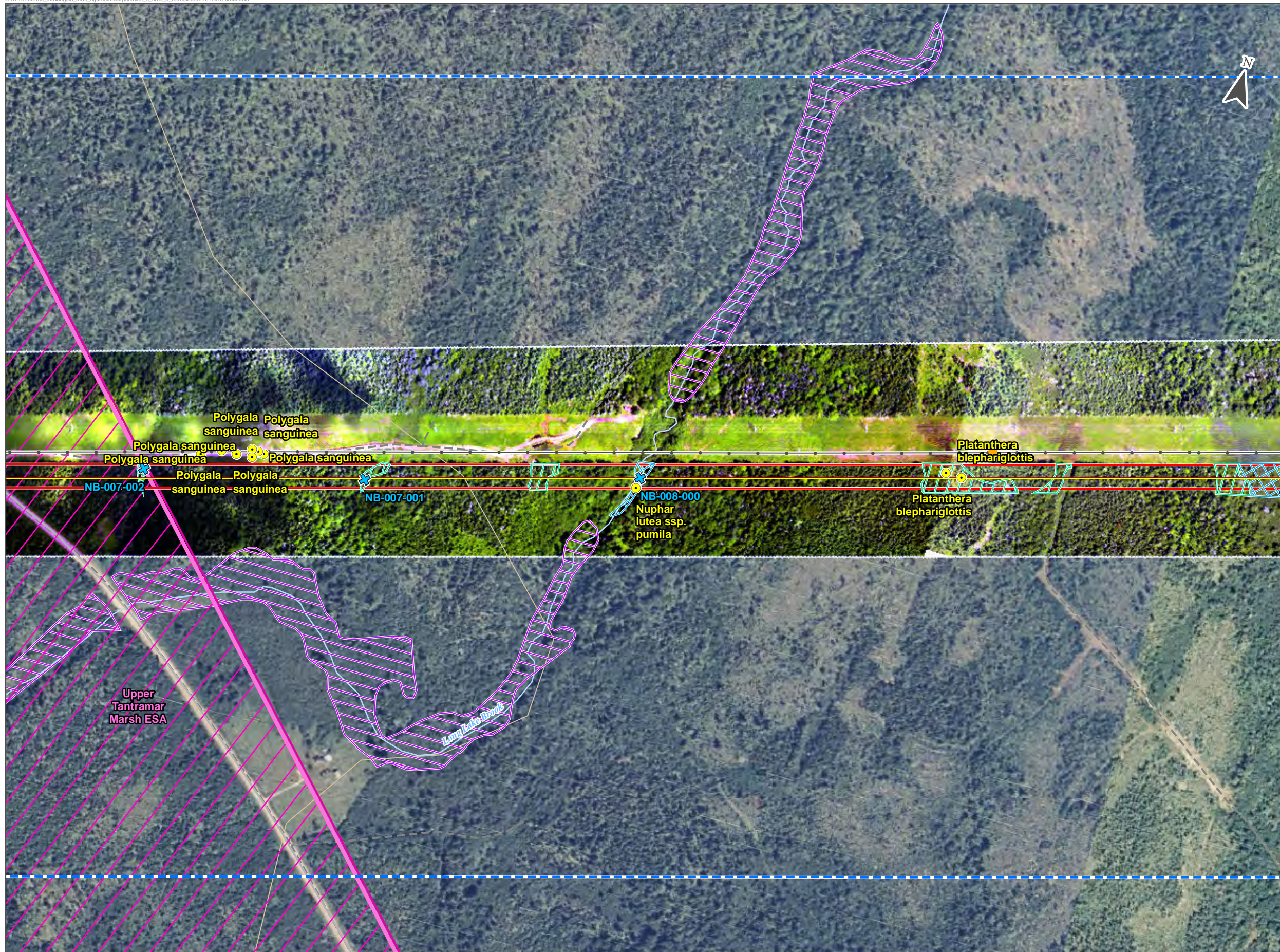


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

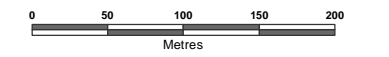


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



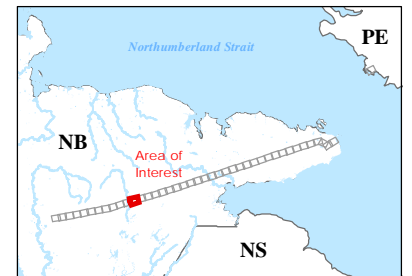
Terrestrial Environment Assessment Area Boundaries

- Monarch Butterfly Observation
- Plant Field Observation (Species of Conservation Concern)**
 - Vascular
- ✕ Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - ▨ Coniferous Treed Swamp
 - ▨ Tall Shrub Swamp
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
- Existing Transmission Line
- ▨ Environmentally Significant Area
- ▨ GeoNB-mapped Wetland

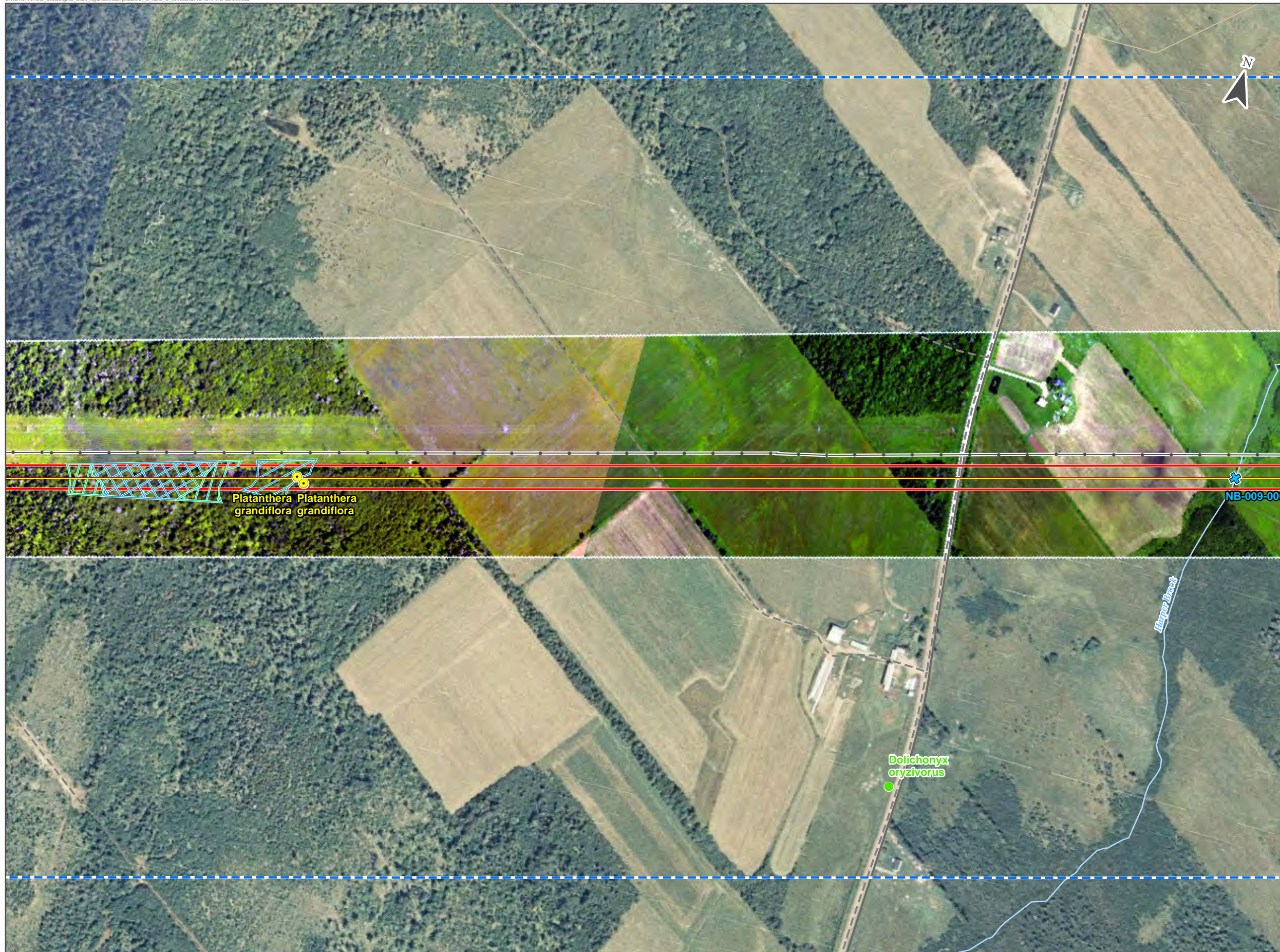


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

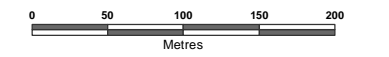


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



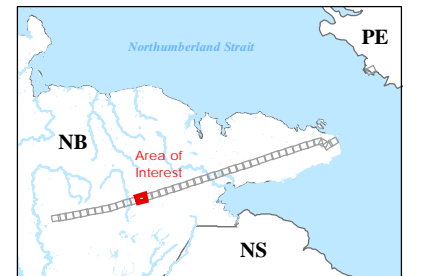
Terrestrial Environment Assessment Area Boundaries

- AC CDC Bird Observation
- Plant Field Observation (Species of Conservation Concern)**
 - Vascular
- ✕ Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - Coniferous Treed Swamp
 - Deciduous Treed Swamp
 - Tall Shrub Swamp
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Existing Transmission Line



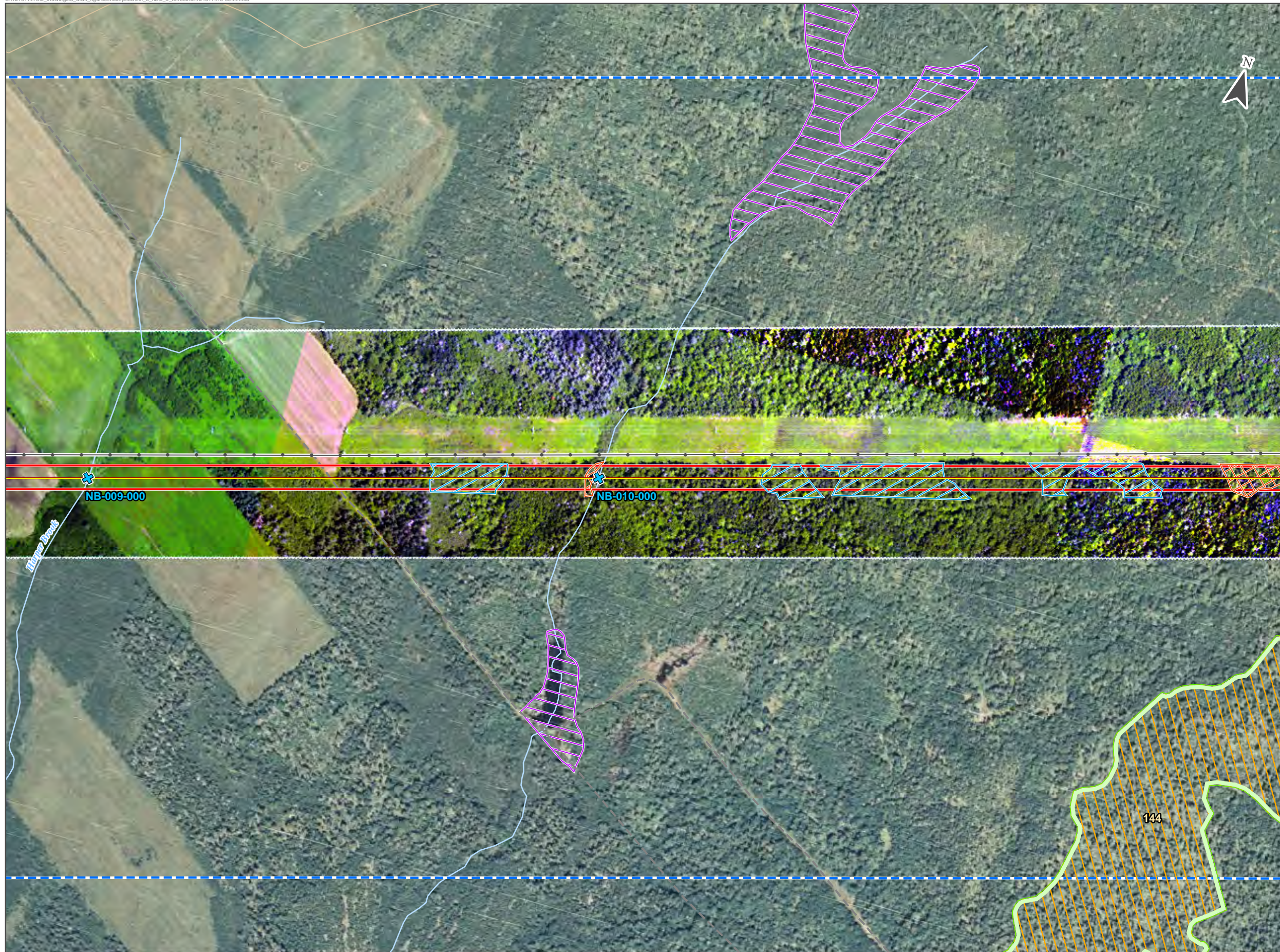
121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



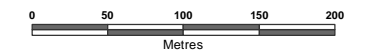
Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

121811475 - PEI-NB Marine Cable Interconnection - Maritime Electric Company Limited



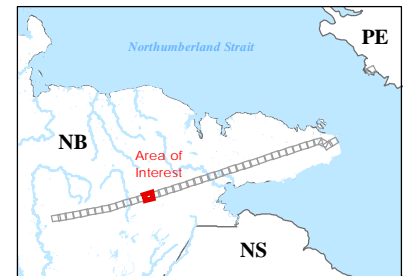
Terrestrial Environment Assessment Area Boundaries

- Watercourse Crossing
- Proposed Project Components**
- Memramcook to Melrose
- Field Delineated Wetland**
- Deciduous Treed Swamp
- Mixedwood Treed Swamp
- Interior Forest**
- Pre-Project Interior Forest
- After Project Interior Forest
- Terrestrial Assessment Area**
- Project Development Area
- Local Assessment Area
- Existing Transmission Line
- GeoNB-mapped Wetland

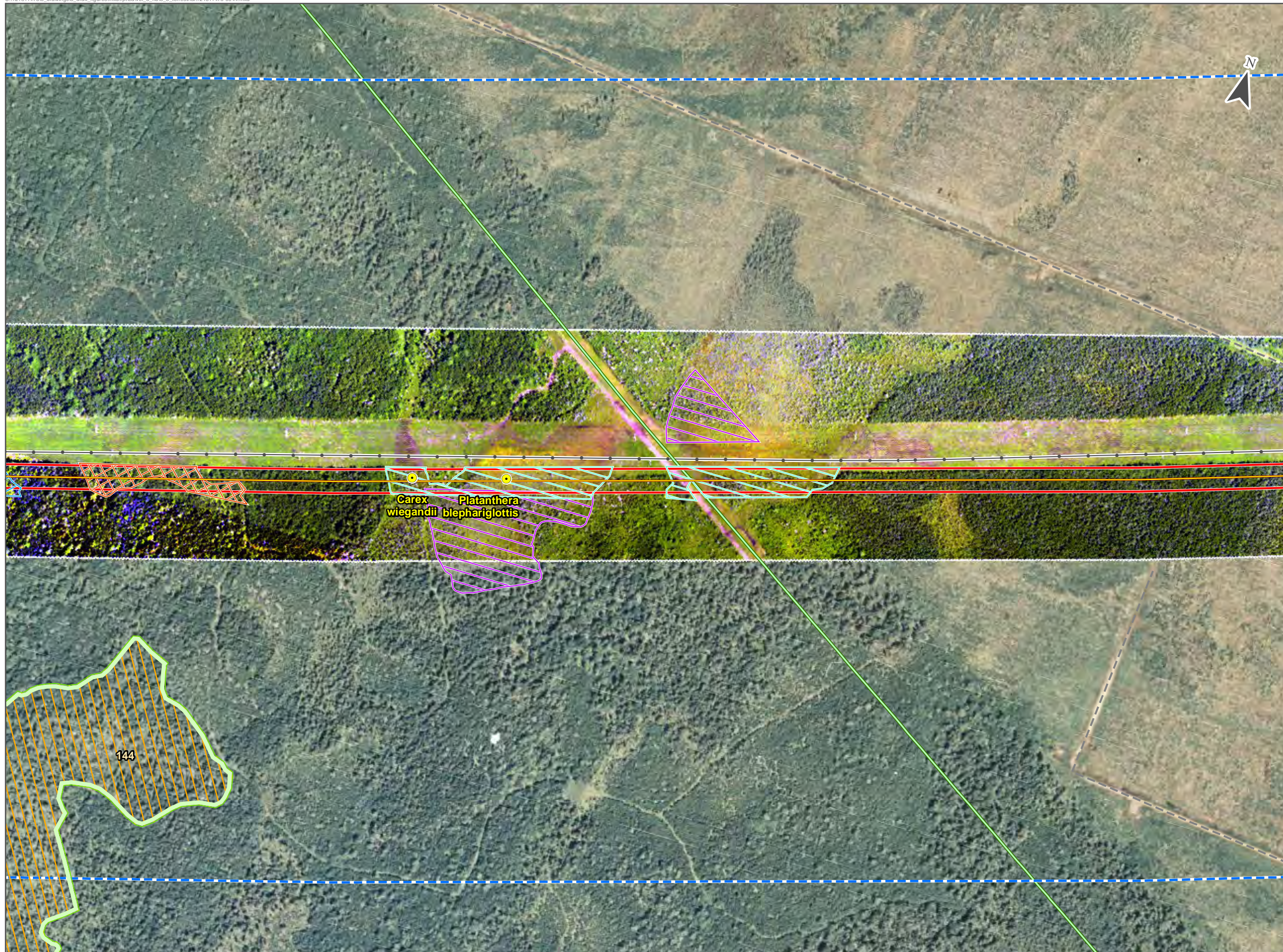


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

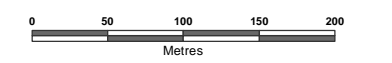


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



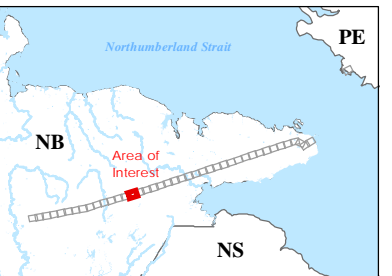
Terrestrial Environment Assessment Area Boundaries

- Plant Field Observation (Species of Conservation Concern)**
 - Vascular
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - ▨ Coniferous Treed Bog
 - ▨ Deciduous Treed Swamp
 - ▨ Mixedwood Treed Swamp
- Interior Forest**
 - ▨ Pre-Project Interior Forest
 - ▨ After Project Interior Forest
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
- Existing Transmission Line
- M&NP Mainline Pipeline
- ▭ GeoNB-mapped Wetland

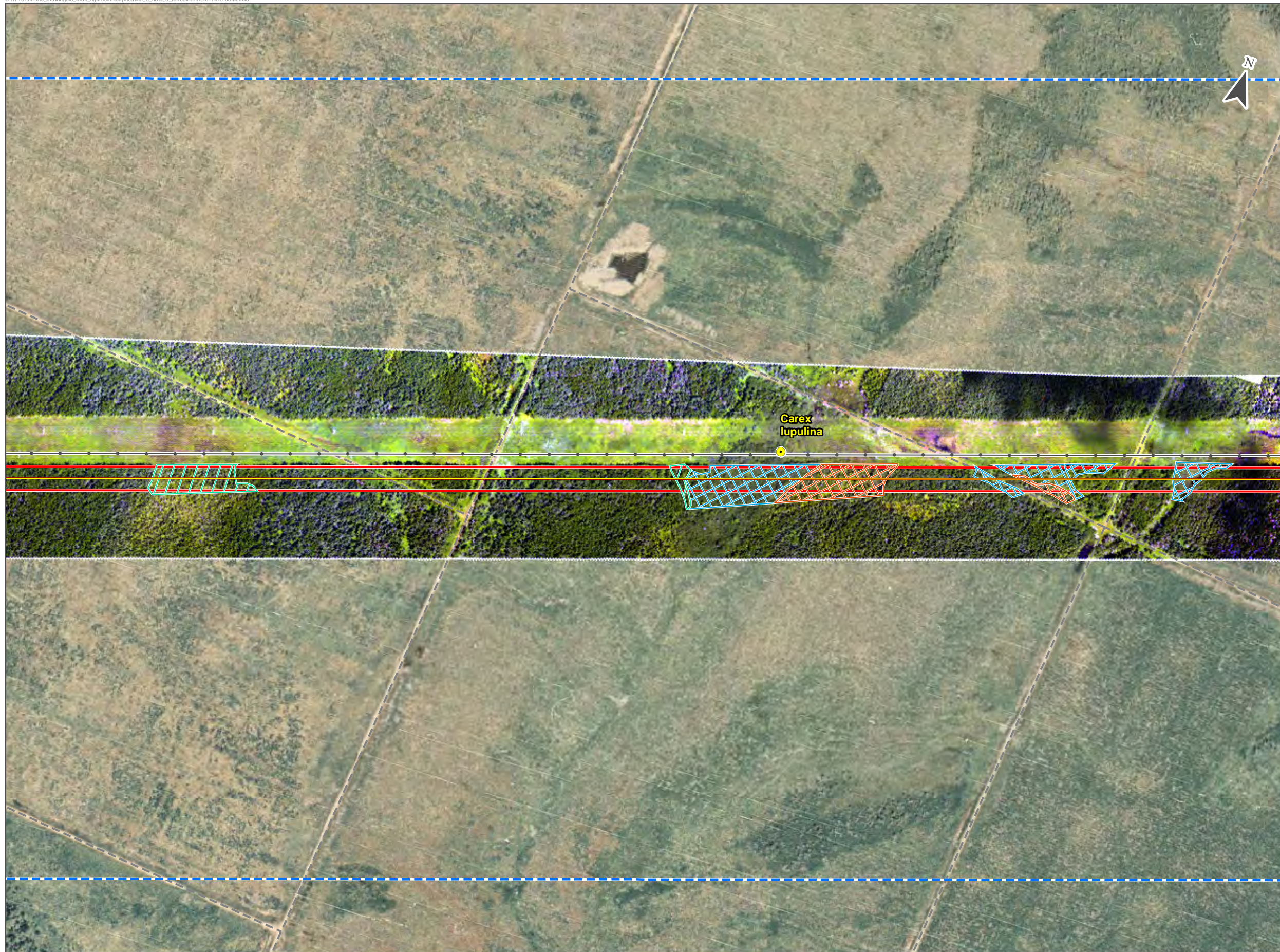


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

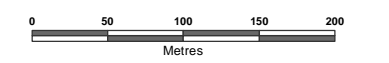


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



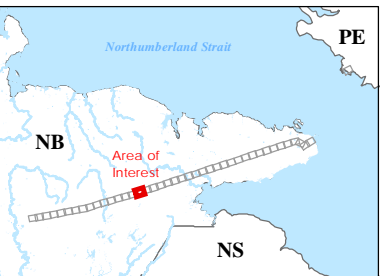
Terrestrial Environment Assessment Area Boundaries

- Plant Field Observation (Species of Conservation Concern)**
 - Vascular
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - ▨ Coniferous Treed Swamp
 - ▨ Mixedwood Treed Swamp
 - ▨ Tall Shrub Swamp
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
 - Existing Transmission Line

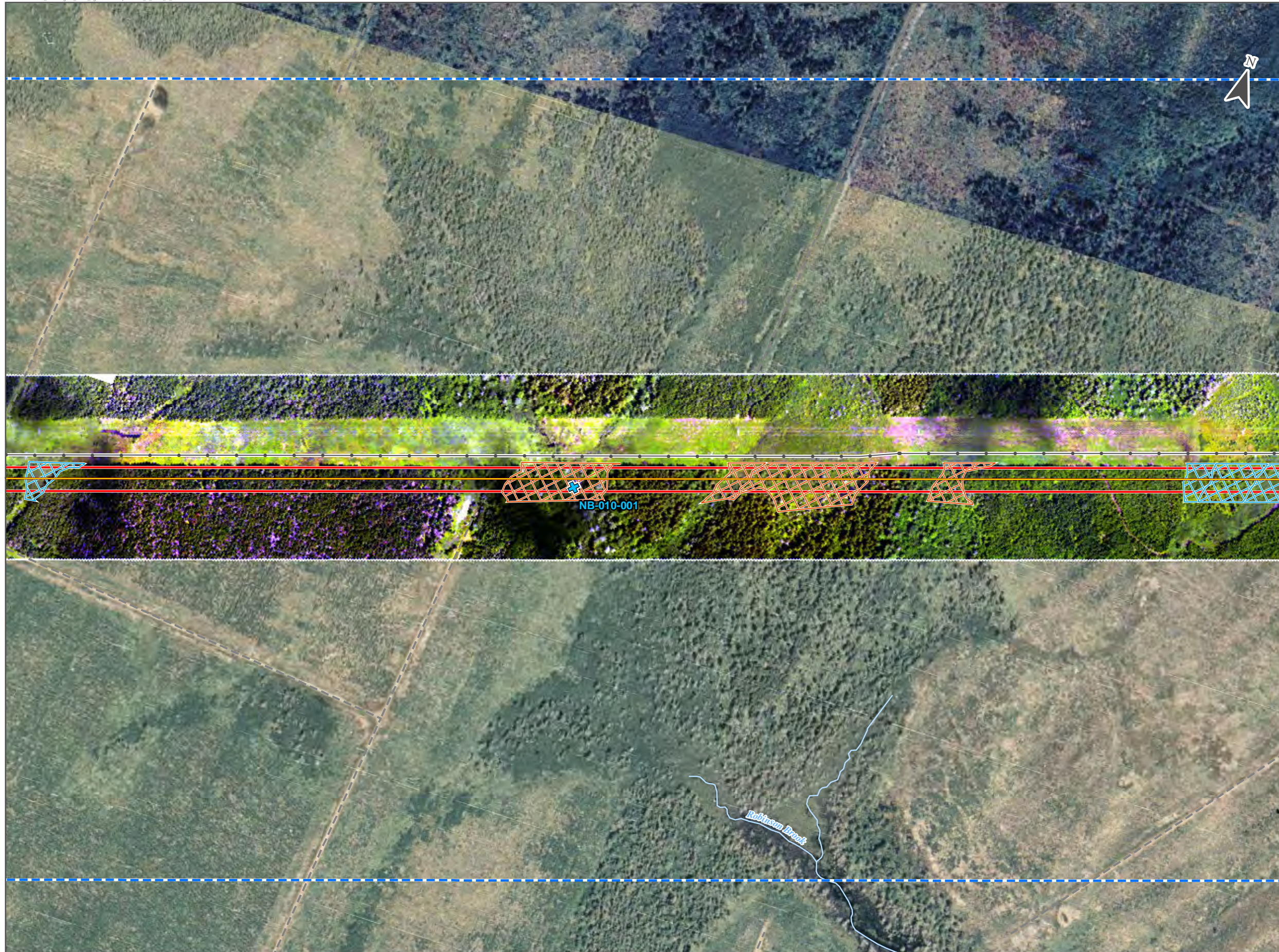


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

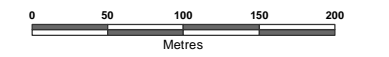


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



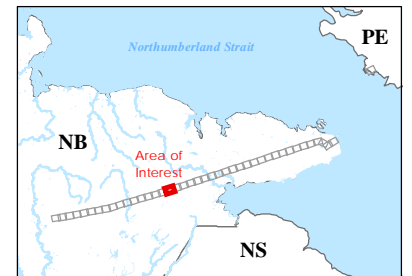
Terrestrial Environment Assessment Area Boundaries

- Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - Mixedwood Treed Swamp
 - Tall Shrub Swamp
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Existing Transmission Line

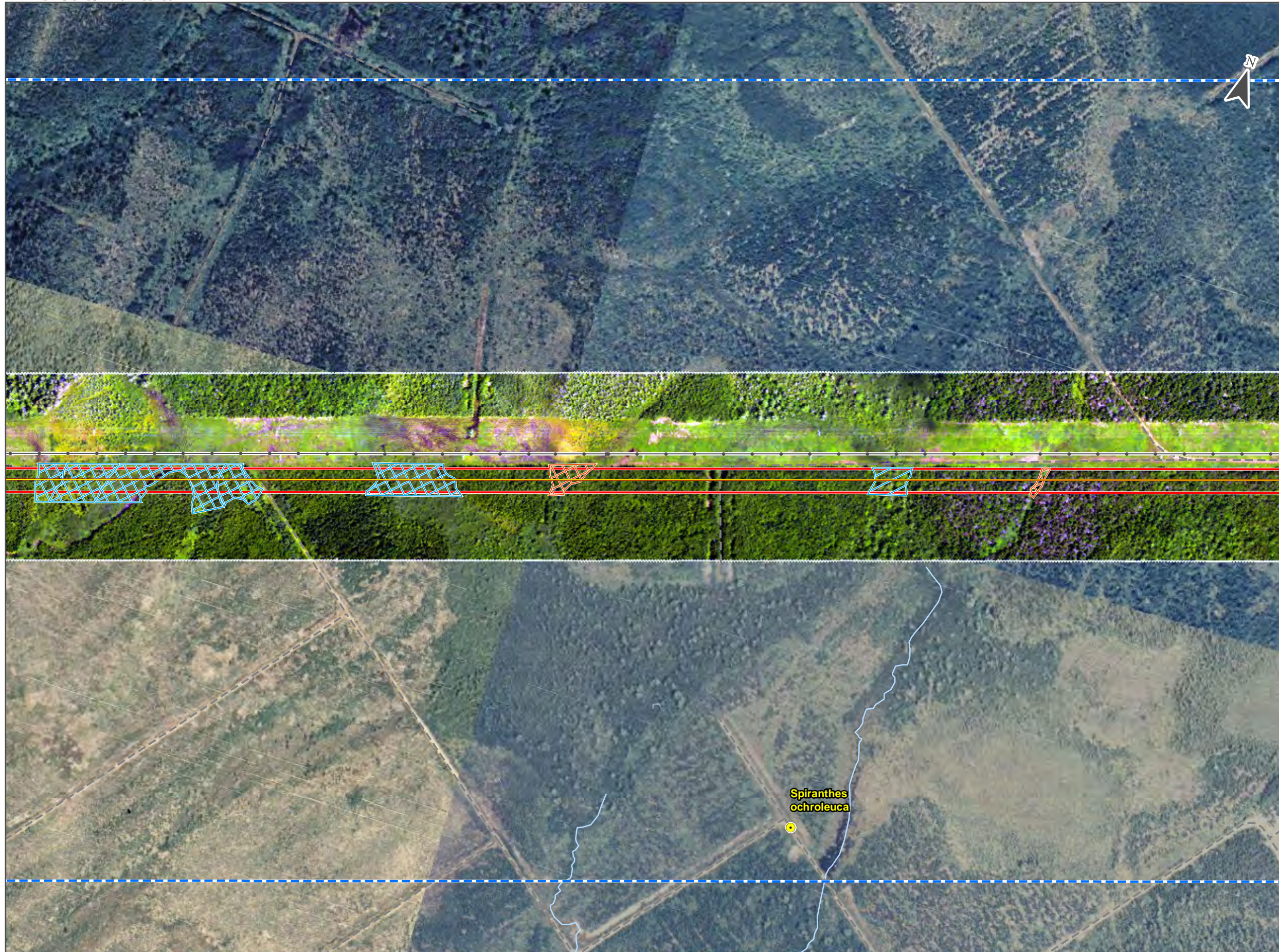


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

Plant Field Observation (Species of Conservation Concern)

- Vascular

Proposed Project Components

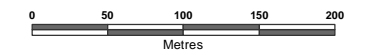
- Memramcook to Melrose

Field Delineated Wetland

- ▨ Deciduous Treed Swamp
- ▨ Mixedwood Treed Swamp
- ▨ Tall Shrub Swamp

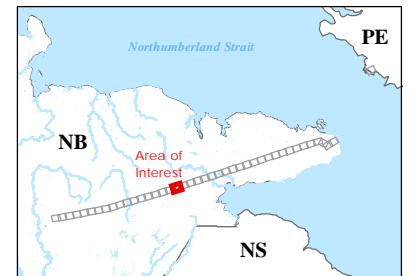
Terrestrial Assessment Area

- ▭ Project Development Area
- ▭ Local Assessment Area
- Existing Transmission Line

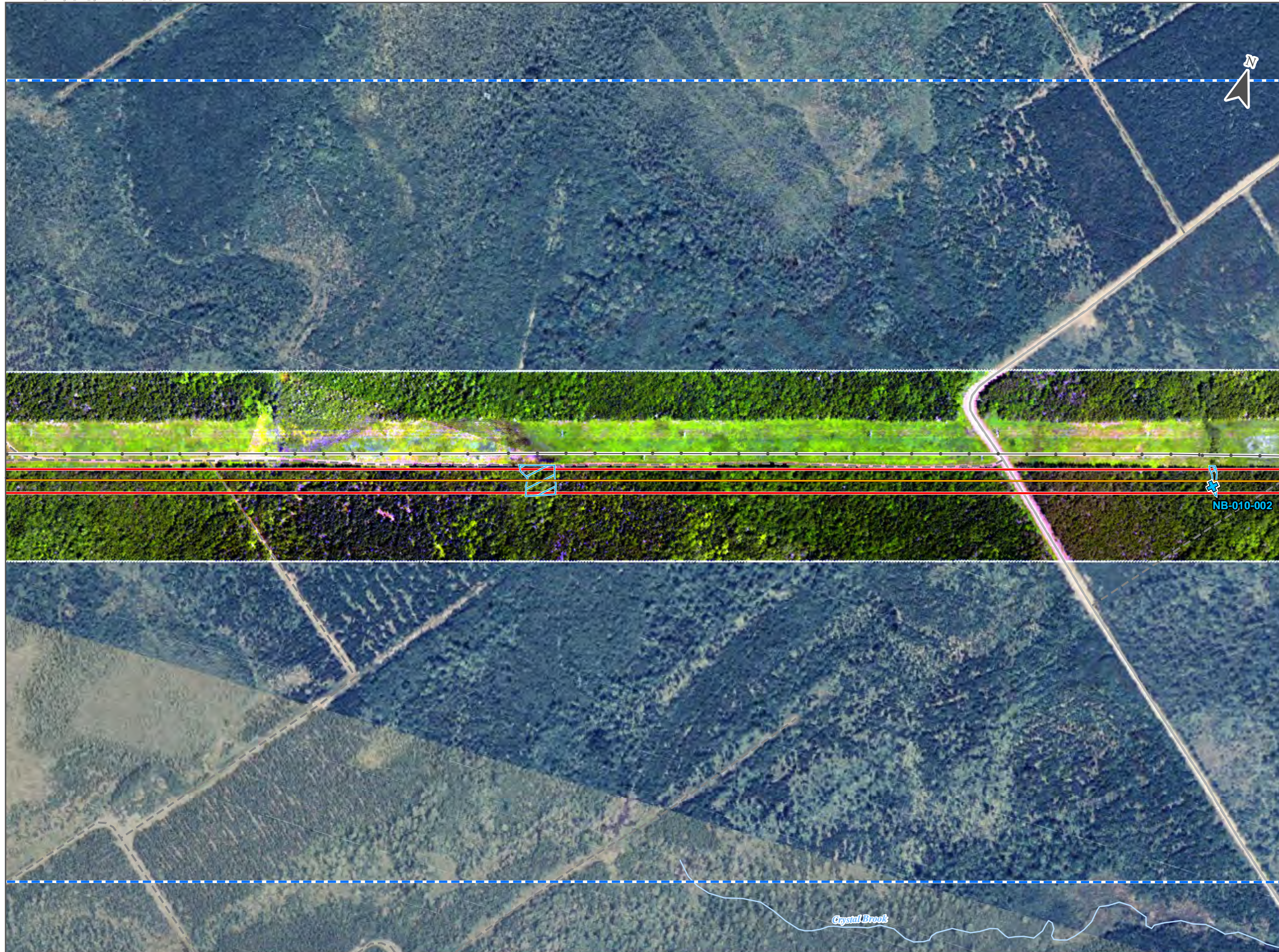


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

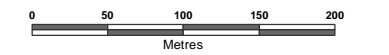


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



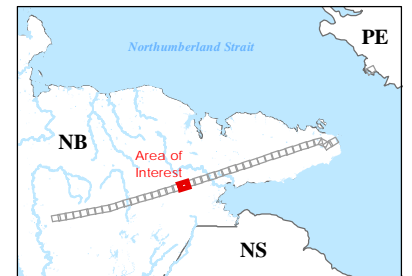
Terrestrial Environment Assessment Area Boundaries

- Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - Deciduous Treed Swamp
 - Tall Shrub Swamp
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Existing Transmission Line



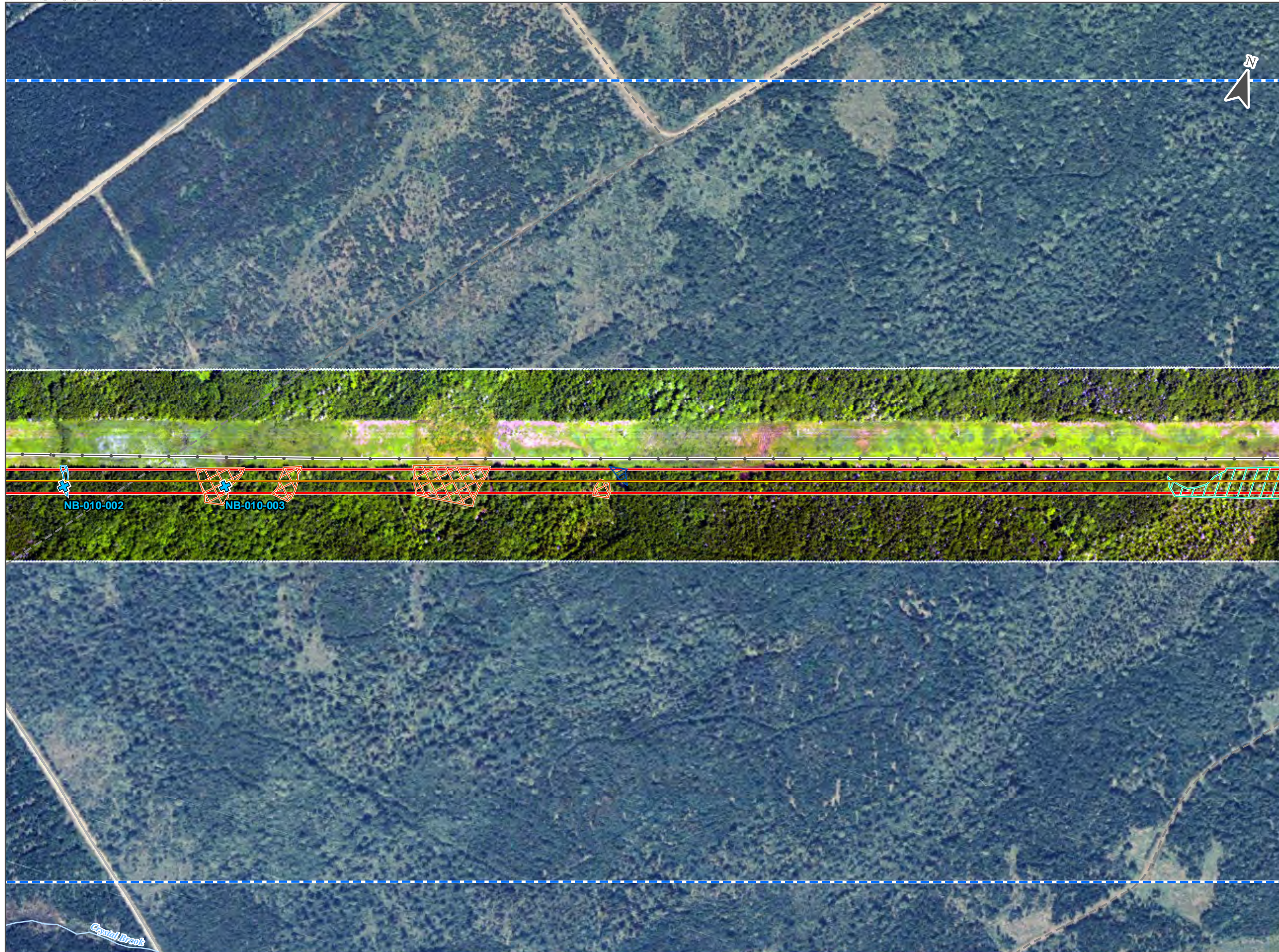
121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



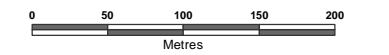
Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

121811475 - PEI-NB Marine Cable Interconnection - Maritime Electric Company Limited



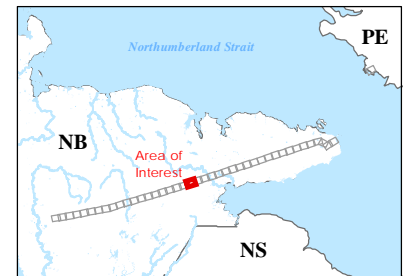
Terrestrial Environment Assessment Area Boundaries

- Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - Coniferous Treed Swamp
 - Floating Aquatic Water
 - Mixedwood Treed Swamp
 - Tall Shrub Swamp
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Existing Transmission Line

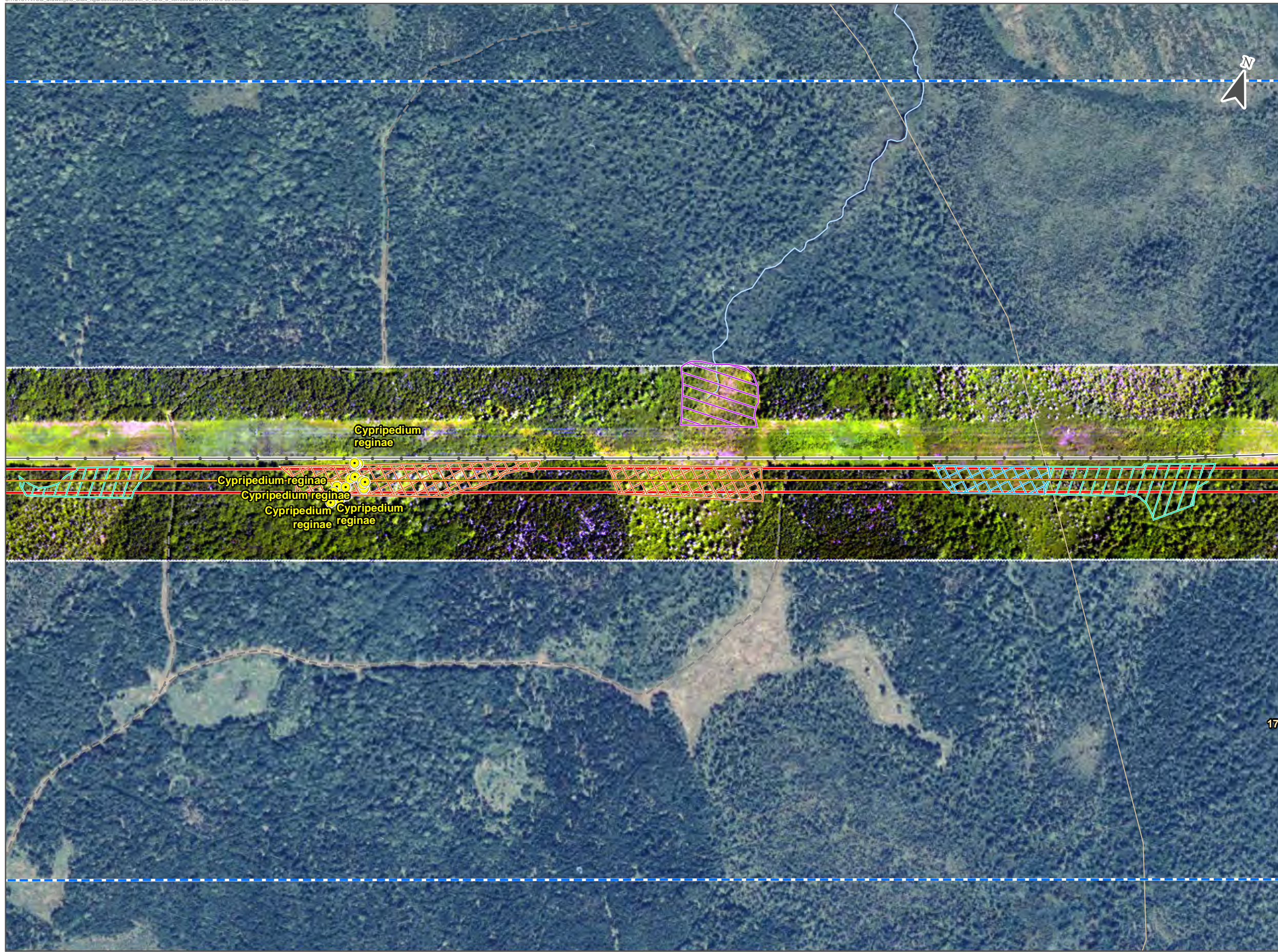


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

Plant Field Observation (Species of Conservation Concern)
 ● Vascular

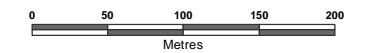
Proposed Project Components
 — Memramcook to Melrose

Field Delineated Wetland
 ▨ Coniferous Treed Swamp
 ▩ Mixedwood Treed Swamp
 ▧ Tall Shrub Swamp

Interior Forest
 ▨ Pre-Project Interior Forest
 ▨ After Project Interior Forest

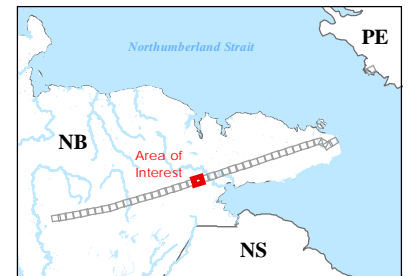
Terrestrial Assessment Area
 ▭ Project Development Area
 ▭ Local Assessment Area

— Existing Transmission Line
 ▭ GeoNB-mapped Wetland

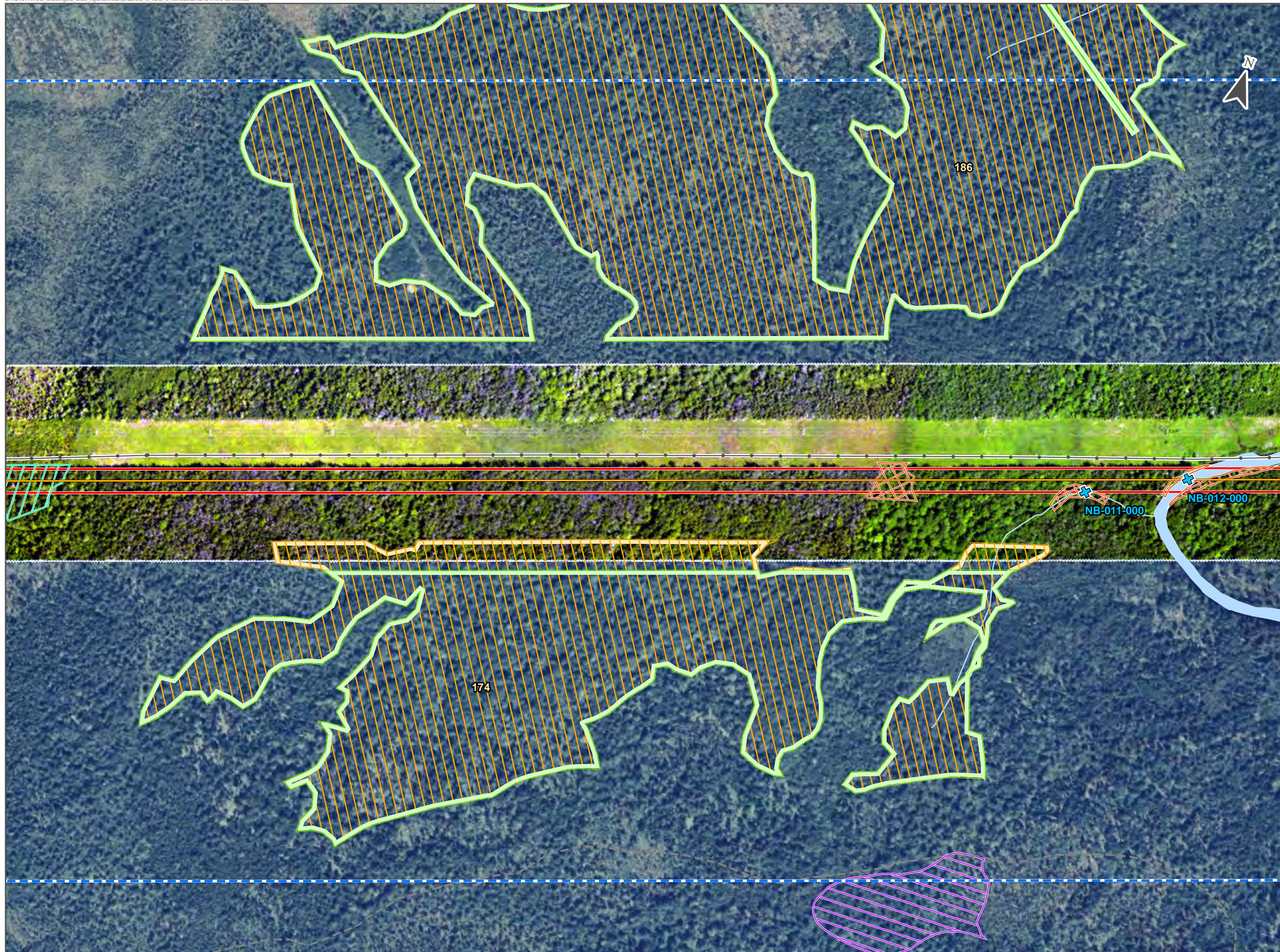


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

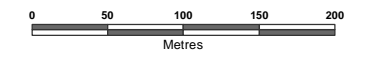


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



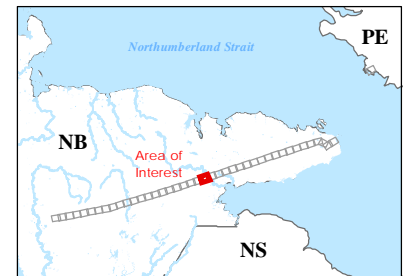
Terrestrial Environment Assessment Area Boundaries

-  Watercourse Crossing
- Proposed Project Components**
-  Memramcook to Melrose
- Field Delineated Wetland**
-  Coniferous Treed Swamp
-  Mixedwood Treed Swamp
- Interior Forest**
-  Pre-Project Interior Forest
-  After Project Interior Forest
- Terrestrial Assessment Area**
-  Project Development Area
-  Local Assessment Area
-  Existing Transmission Line
-  GeoNB-mapped Wetland



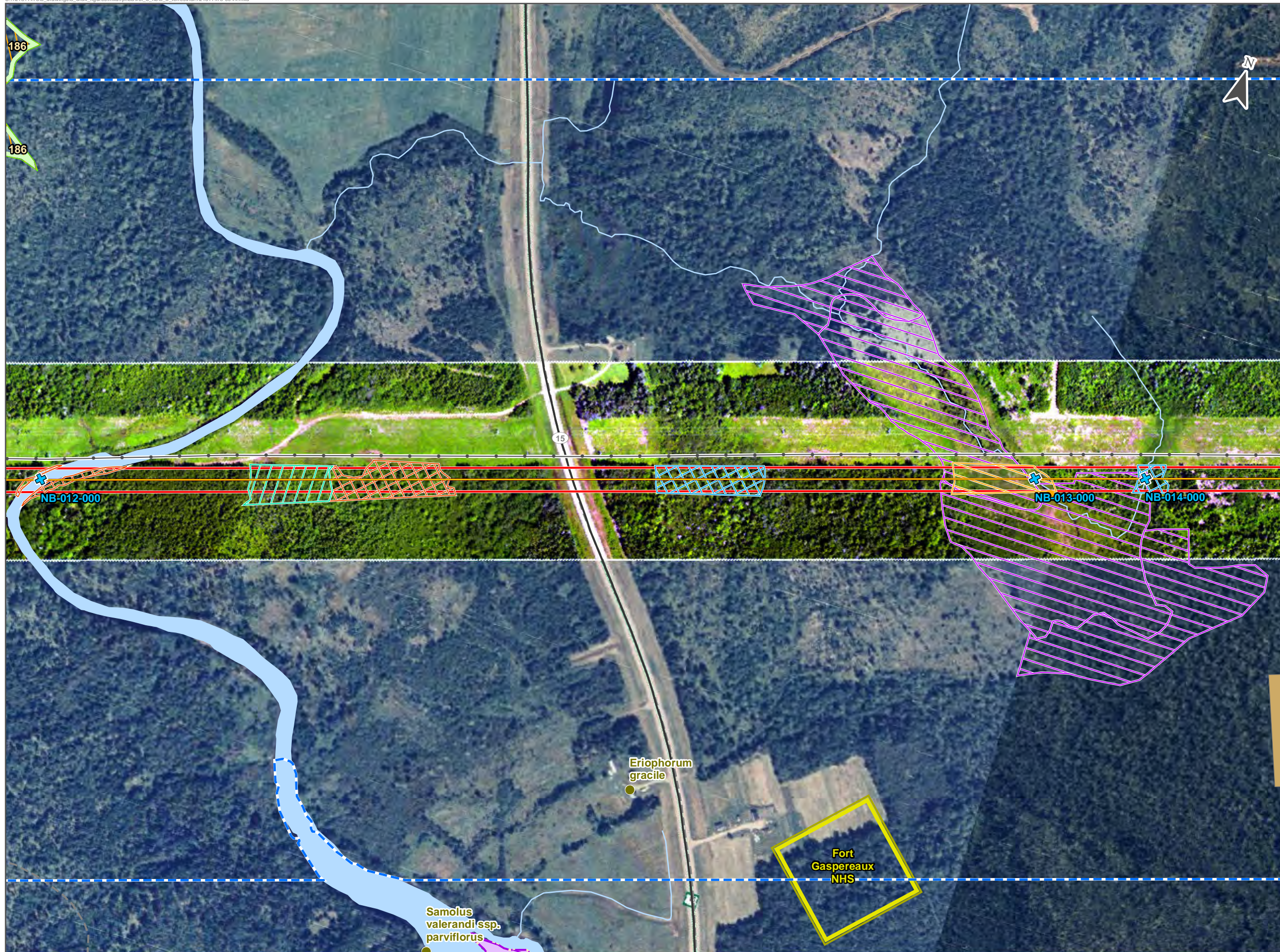
121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



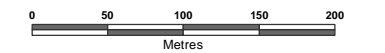
Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

121811475 - PEI-NB Marine Cable Interconnection - Maritime Electric Company Limited



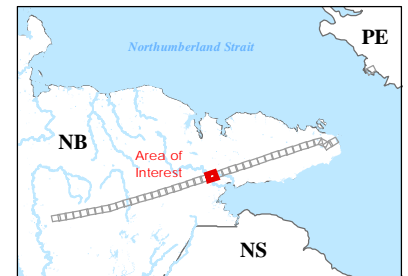
Terrestrial Environment Assessment Area Boundaries

- AC CDC Plant Observation
- Monarch Butterfly Observation
- ✕ Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - Coniferous Treed Swamp
 - Low Shrub Swamp
 - Mixedwood Treed Swamp
 - Tall Shrub Swamp
- Interior Forest**
 - Pre-Project Interior Forest
 - After Project Interior Forest
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
- Existing Transmission Line
- Crown Land
- Provincially Significant Wetland
- GeoNB-mapped Wetland
- Managed Area

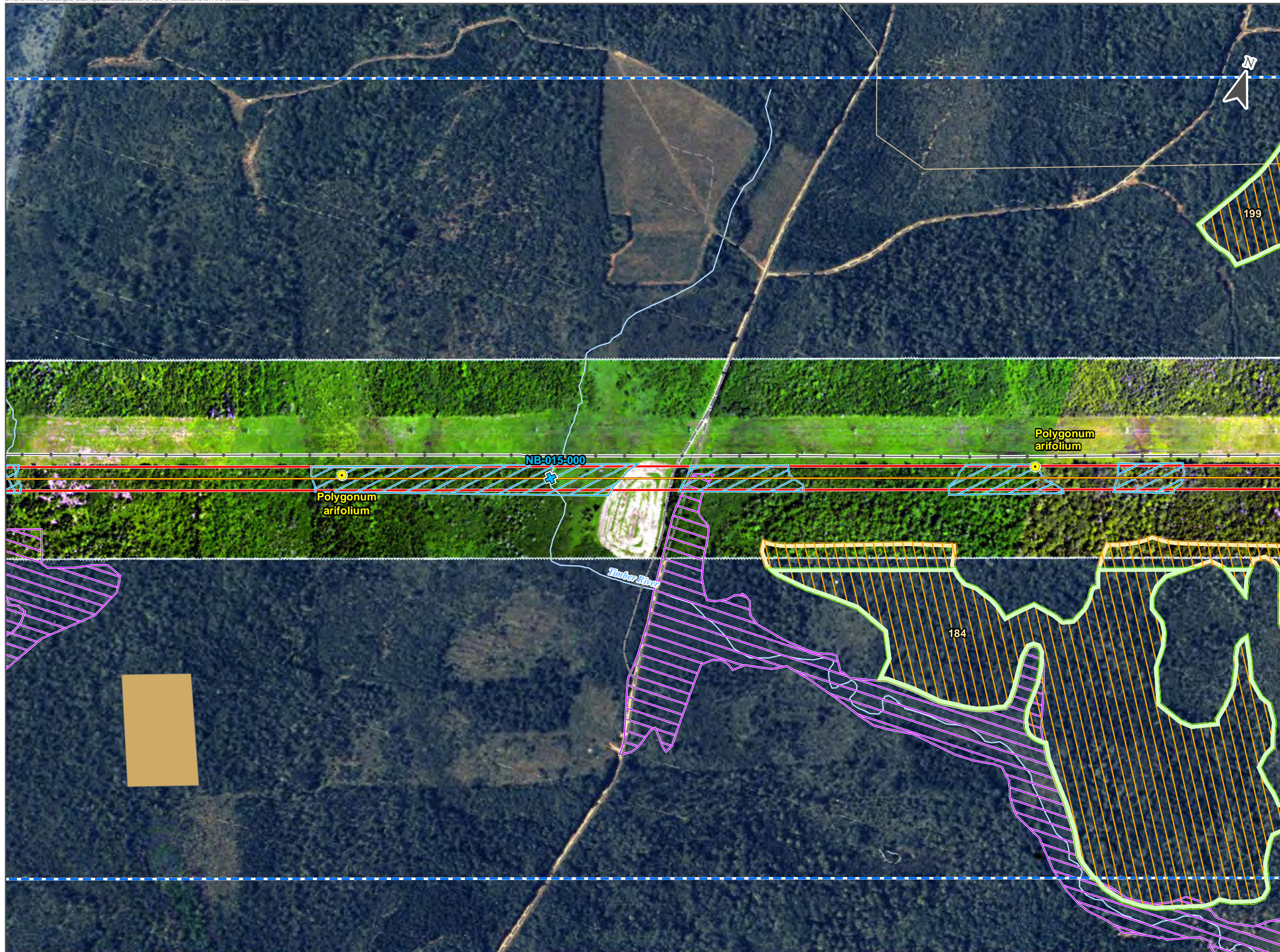


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

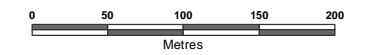


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



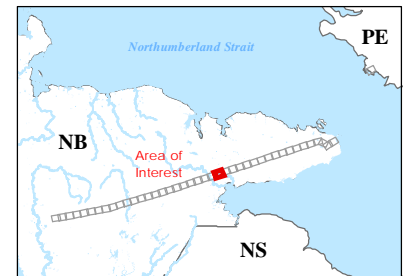
Terrestrial Environment Assessment Area Boundaries

- Plant Field Observation (Species of Conservation Concern)**
- Vascular
- Watercourse Crossing**
- ✕
- Proposed Project Components**
- Memramcook to Melrose
- Field Delineated Wetland**
- ▨ Deciduous Treed Swamp
 - ▩ Tall Shrub Swamp
- Interior Forest**
- ▨ Pre-Project Interior Forest
 - ▭ After Project Interior Forest
- Terrestrial Assessment Area**
- ▭ Project Development Area
 - ▭ Local Assessment Area
- Existing Transmission Line
 - ▭ Crown Land
 - ▭ GeoNB-mapped Wetland

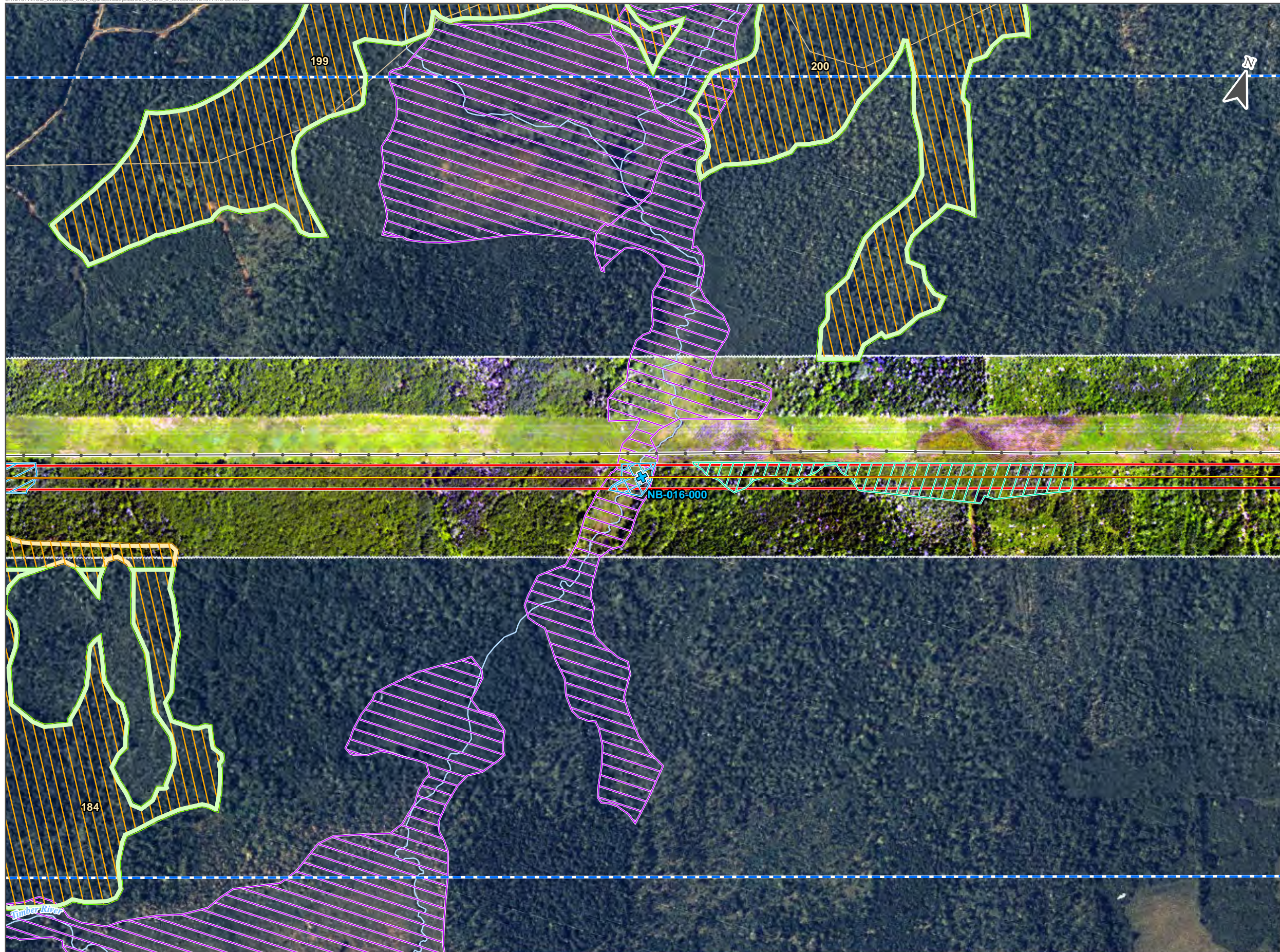


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

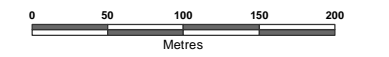


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



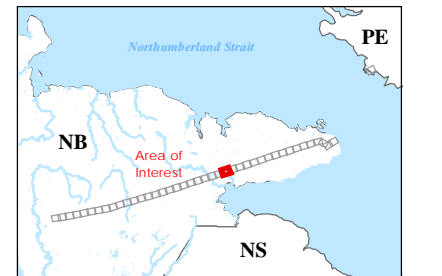
Terrestrial Environment Assessment Area Boundaries

- Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - Coniferous Treed Swamp
 - Deciduous Treed Swamp
 - Tall Shrub Swamp
- Interior Forest**
 - Pre-Project Interior Forest
 - After Project Interior Forest
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Existing Transmission Line
 - GeoNB-mapped Wetland



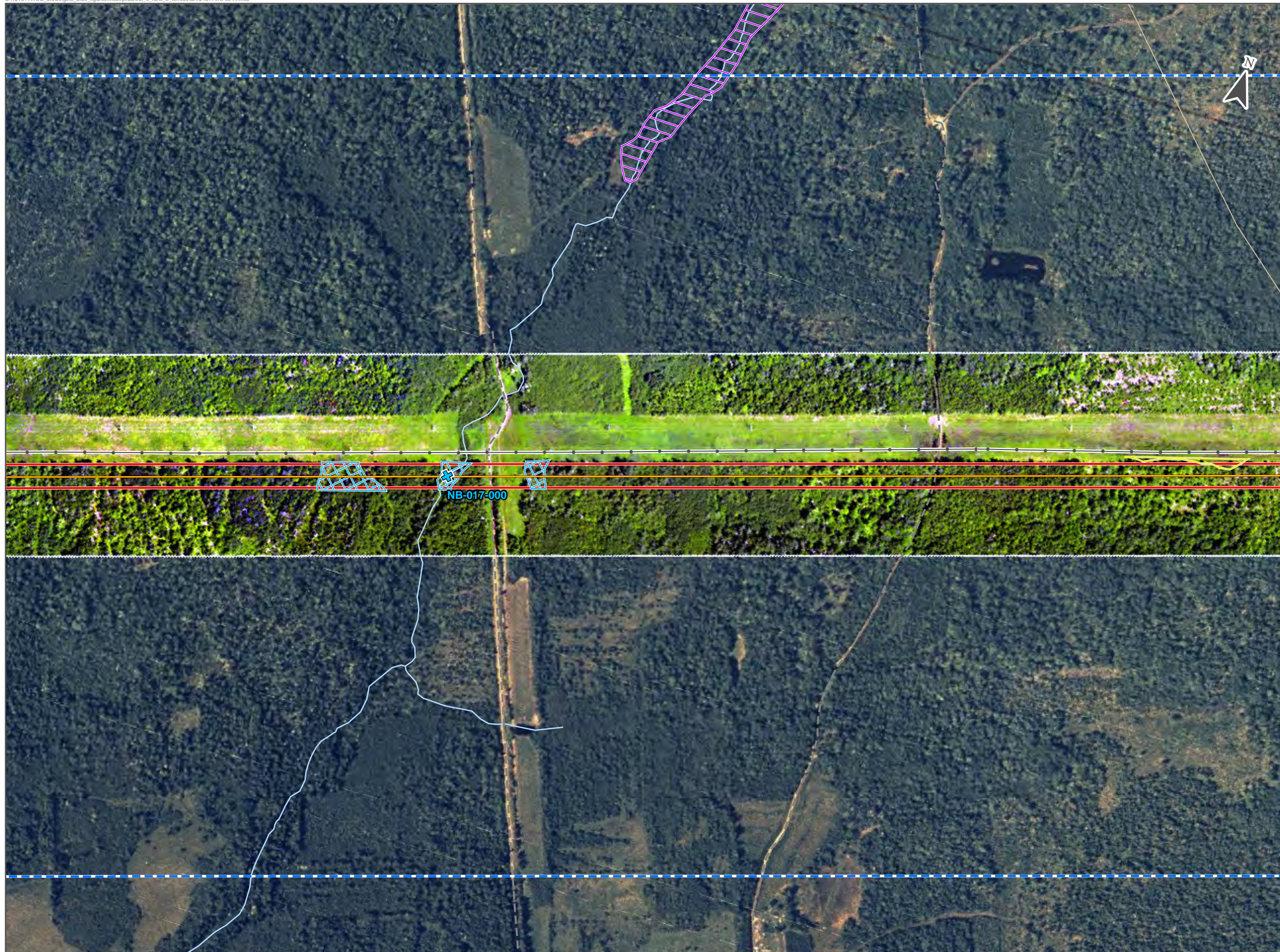
121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



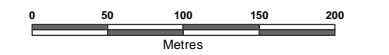
Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

121811475 - PEI-NB Marine Cable Interconnection - Maritime Electric Company Limited



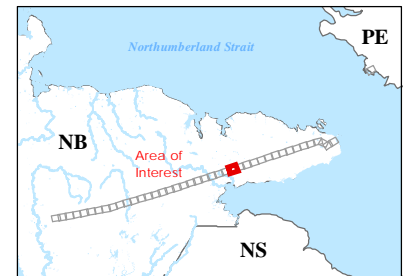
Terrestrial Environment Assessment Area Boundaries

- Watercourse Crossing
- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - Graminoid Marsh
 - Tall Shrub Swamp
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Existing Transmission Line
 - GeoNB-mapped Wetland

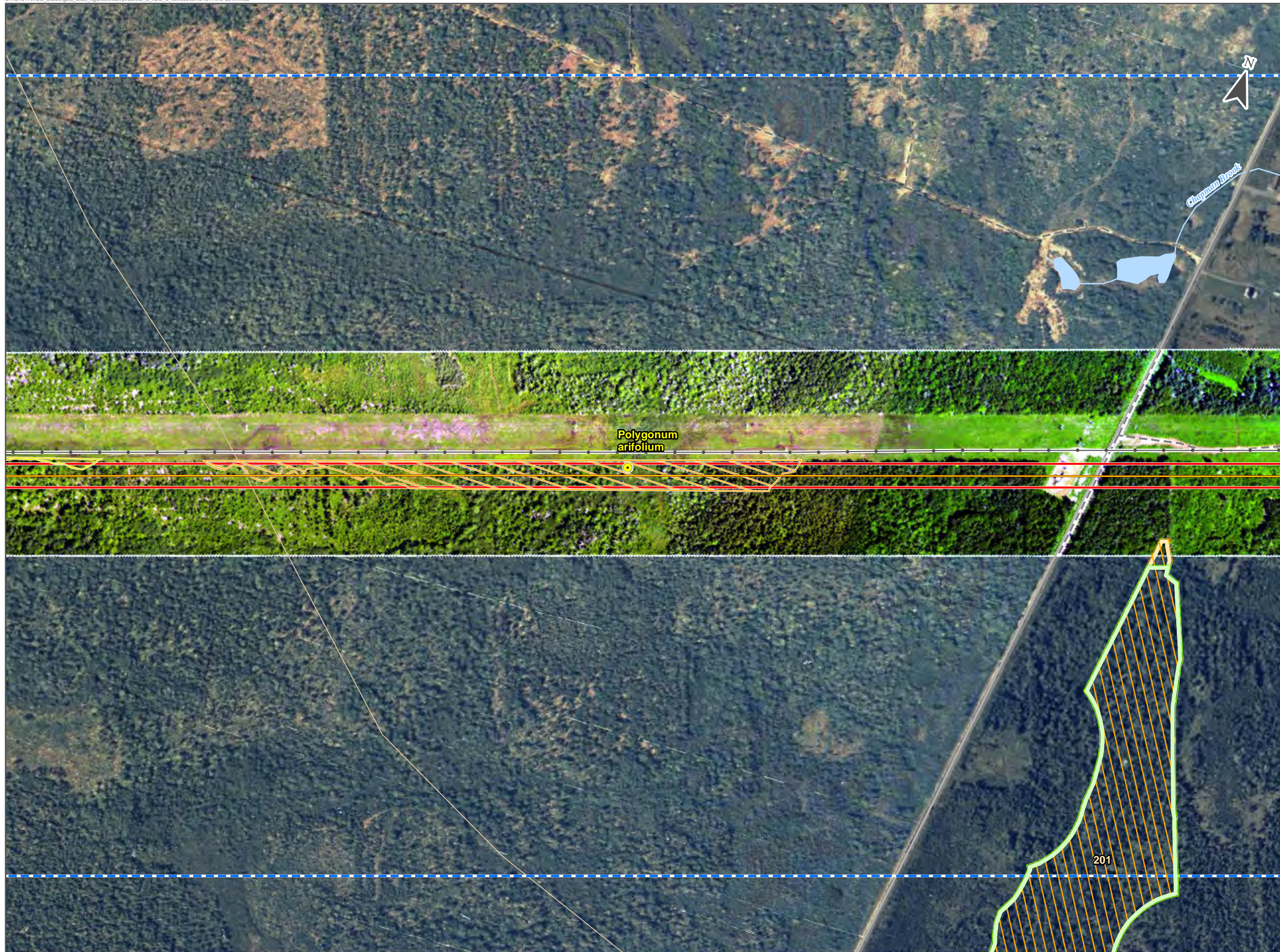


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

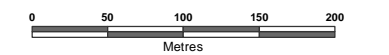
Plant Field Observation (Species of Conservation Concern)
 ● Vascular

Proposed Project Components
 — Memramcook to Melrose

Field Delineated Wetland
 — Graminoid Marsh
 — Low Shrub Swamp

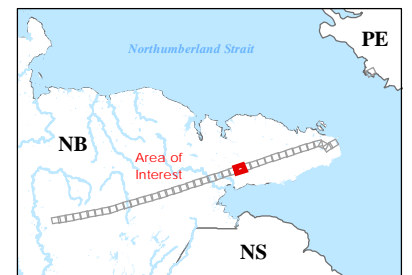
Interior Forest
 — Pre-Project Interior Forest
 — After Project Interior Forest

Terrestrial Assessment Area
 — Project Development Area
 — Local Assessment Area
 — Existing Transmission Line

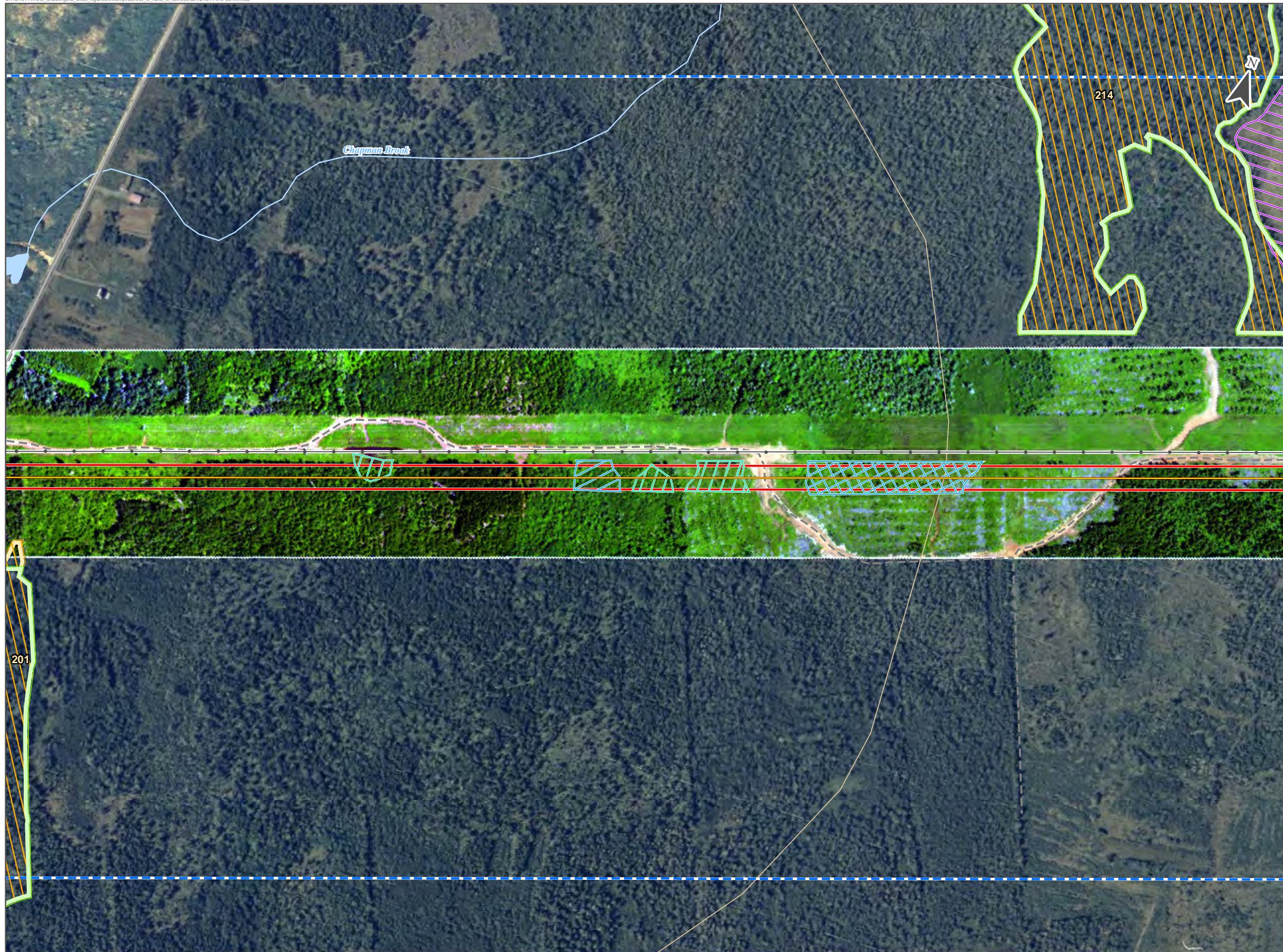


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

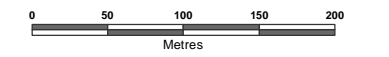


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



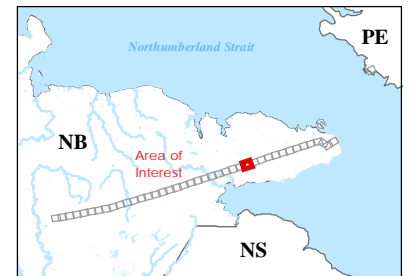
Terrestrial Environment Assessment Area Boundaries

- Proposed Project Components**
 - Memramcook to Melrose
- Field Delineated Wetland**
 - ▨ Coniferous Treed Swamp
 - ▨ Deciduous Treed Swamp
 - ▨ Tall Shrub Swamp
- Interior Forest**
 - ▨ Pre-Project Interior Forest
 - ▨ After Project Interior Forest
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
- Existing Transmission Line
- ▨ GeoNB-mapped Wetland

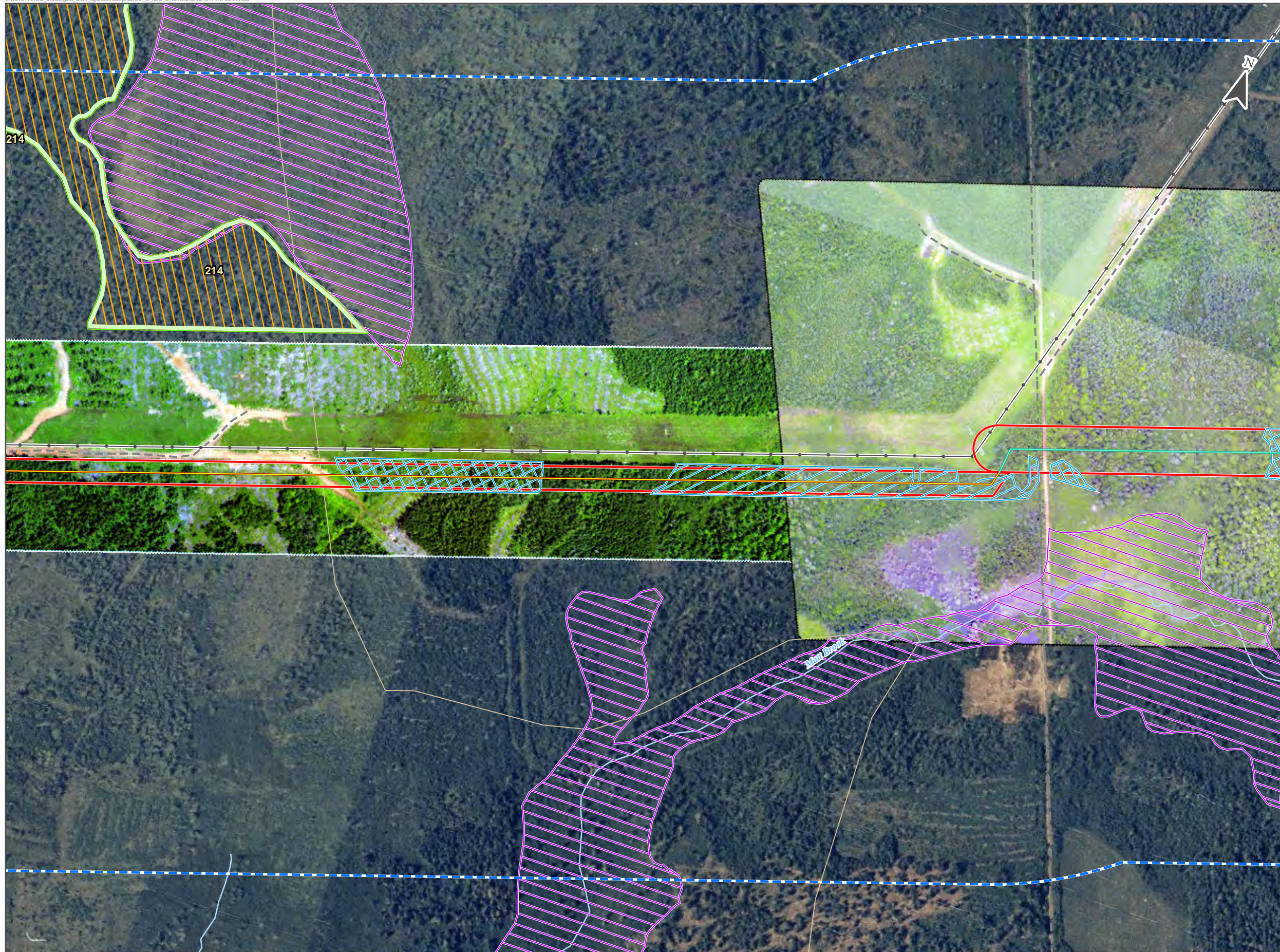


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

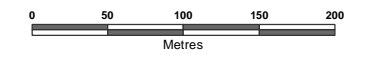


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

- Proposed Project Components**
 - Memramcook to Melrose
 - Melrose to Cape Tormentine
- Field Delineated Wetland**
 - ▨ Deciduous Tree Swamp
 - ▨ Tall Shrub Swamp
- Interior Forest**
 - ▨ Pre-Project Interior Forest
 - ▨ After Project Interior Forest
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
- Existing Transmission Line
- ▭ GeoNB-mapped Wetland

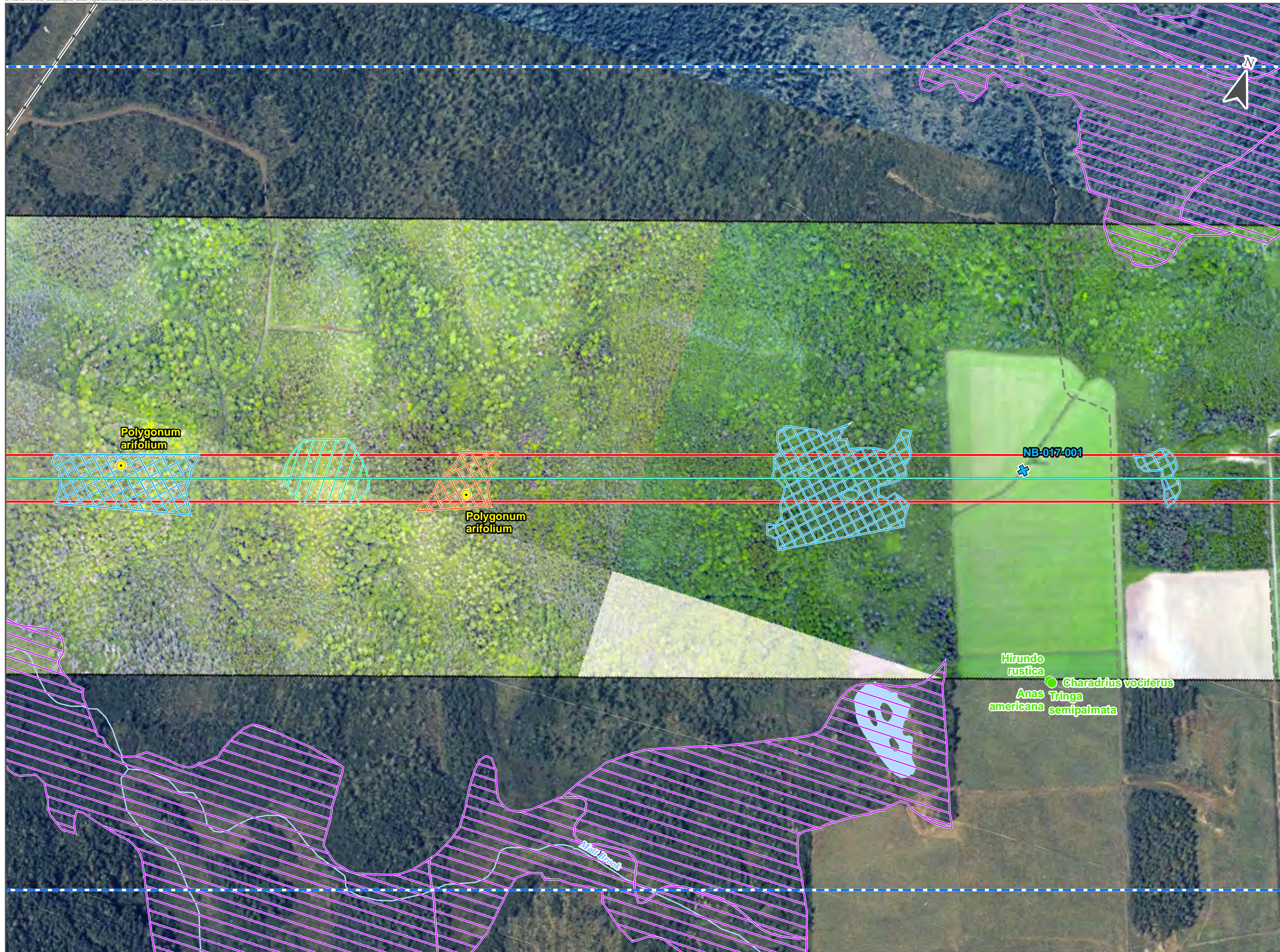


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

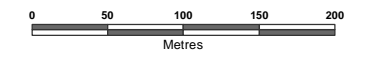


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



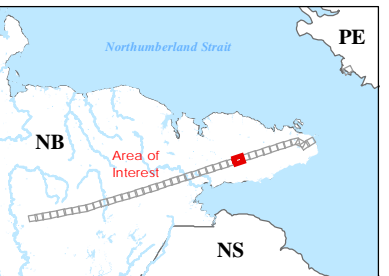
Terrestrial Environment Assessment Area Boundaries

- AC CDC Bird Observation
- Plant Field Observation (Species of Conservation Concern)**
 - Vascular
- ✕ Watercourse Crossing
- Proposed Project Components**
 - Melrose to Cape Tormentine
- Field Delineated Wetland**
 - ▨ Coniferous Treed Swamp
 - ▨ Mixedwood Treed Swamp
 - ▨ Tall Shrub Swamp
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
- Existing Transmission Line
- ▭ GeoNB-mapped Wetland



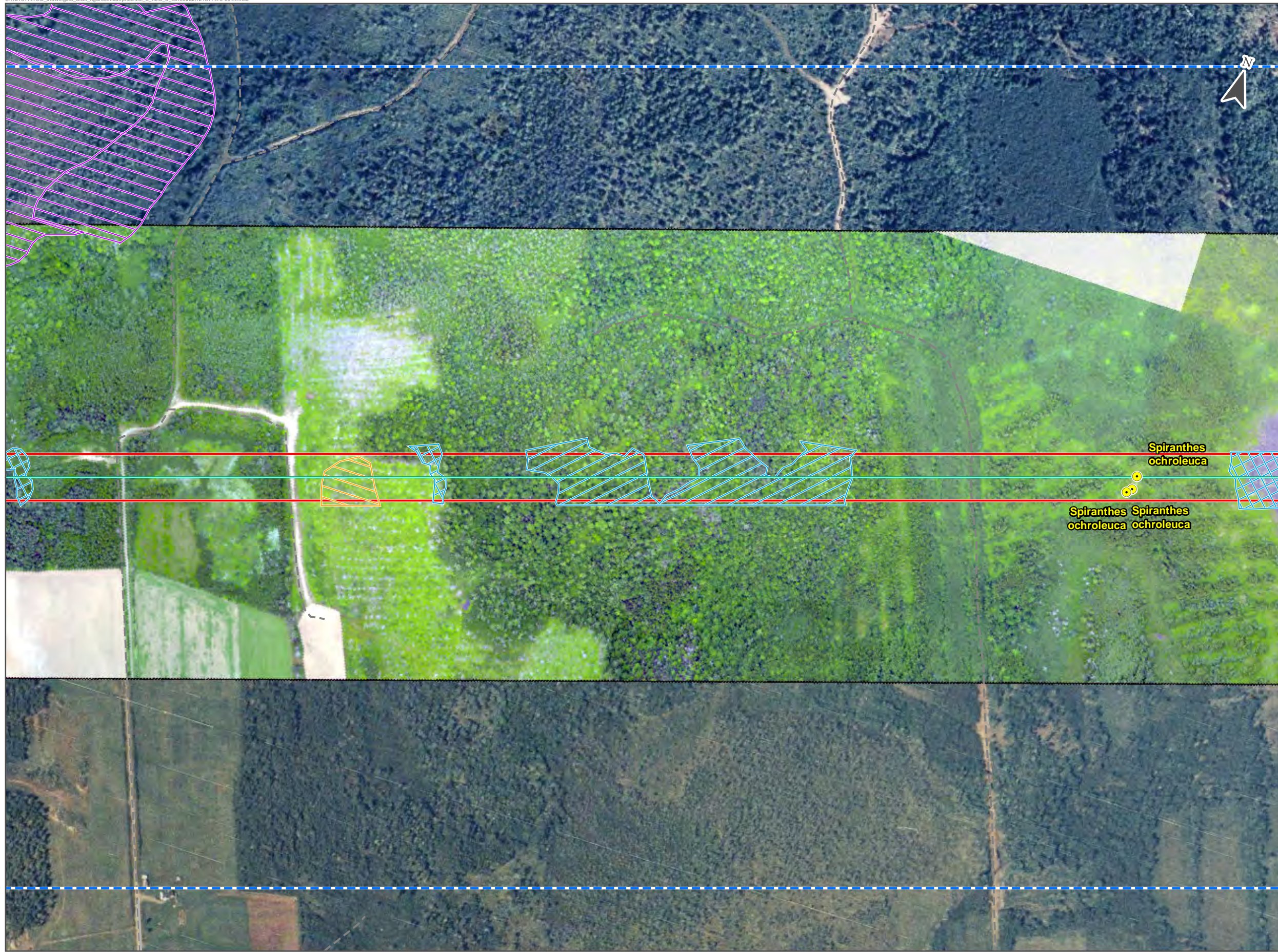
121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

121811475 - PEI-NB Marine Cable Interconnection - Maritime Electric Company Limited



Terrestrial Environment Assessment Area Boundaries

Plant Field Observation (Species of Conservation Concern)

- Vascular

Proposed Project Components

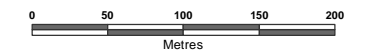
- Melrose to Cape Tormentine

Field Delineated Wetland

- ▨ Deciduous Treed Swamp
- ▨ Low Shrub Swamp
- ▨ Tall Shrub Swamp

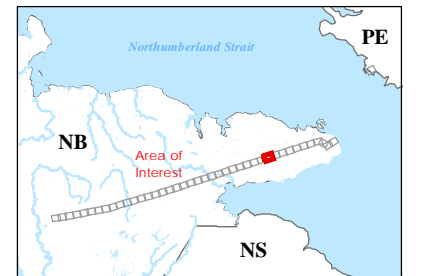
Terrestrial Assessment Area

- ▭ Project Development Area
- ▭ Local Assessment Area
- ▭ GeoNB-mapped Wetland

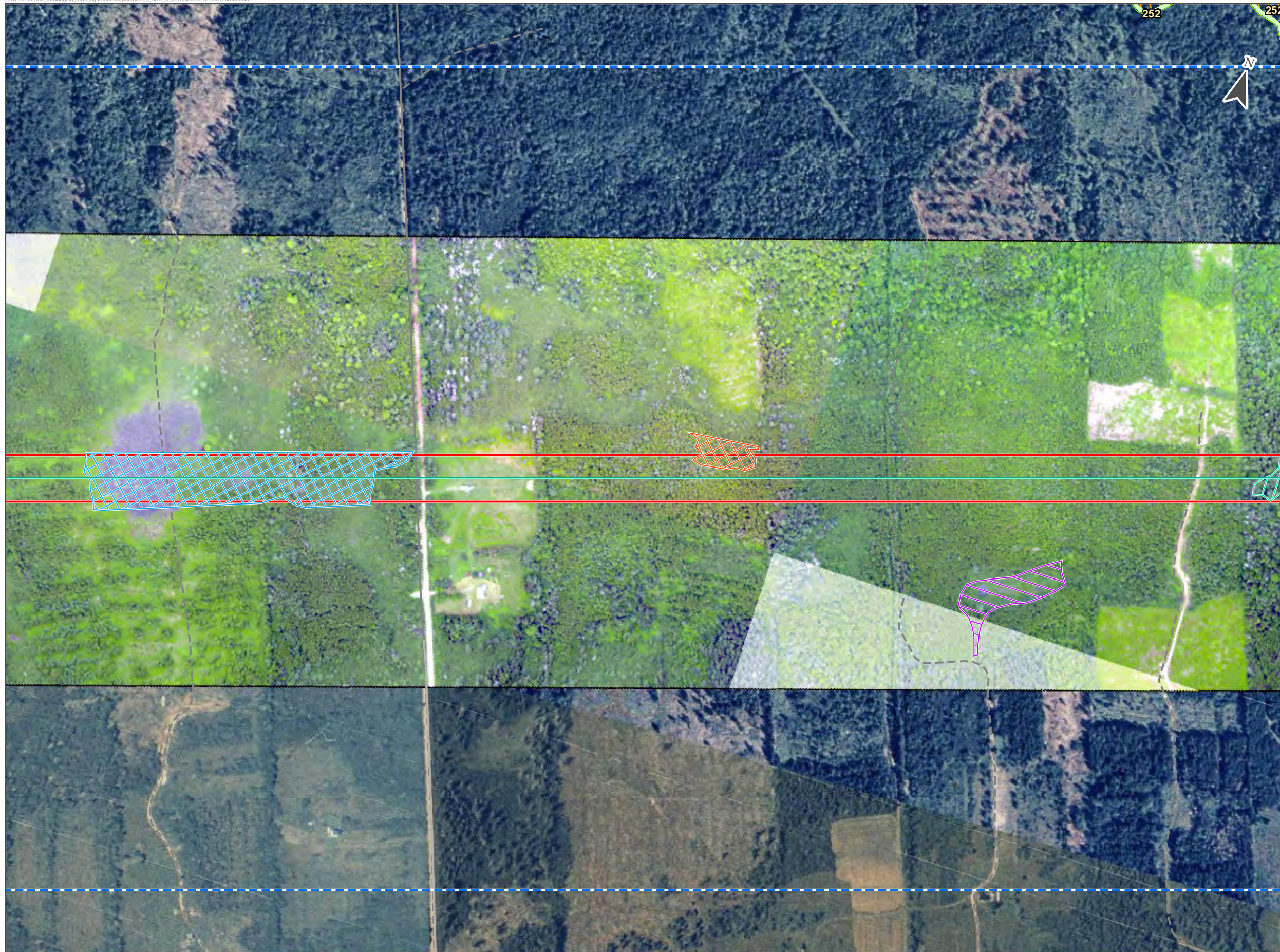


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

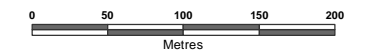


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



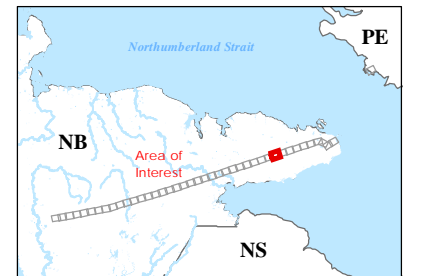
Terrestrial Environment Assessment Area Boundaries

- Proposed Project Components**
- Melrose to Cape Tormentine
- Field Delineated Wetland**
- Coniferous Treed Swamp
 - Mixedwood Treed Swamp
 - Tall Shrub Swamp
- Interior Forest**
- Pre-Project Interior Forest
 - After Project Interior Forest
- Terrestrial Assessment Area**
- Project Development Area
 - Local Assessment Area
 - GeoNB-mapped Wetland

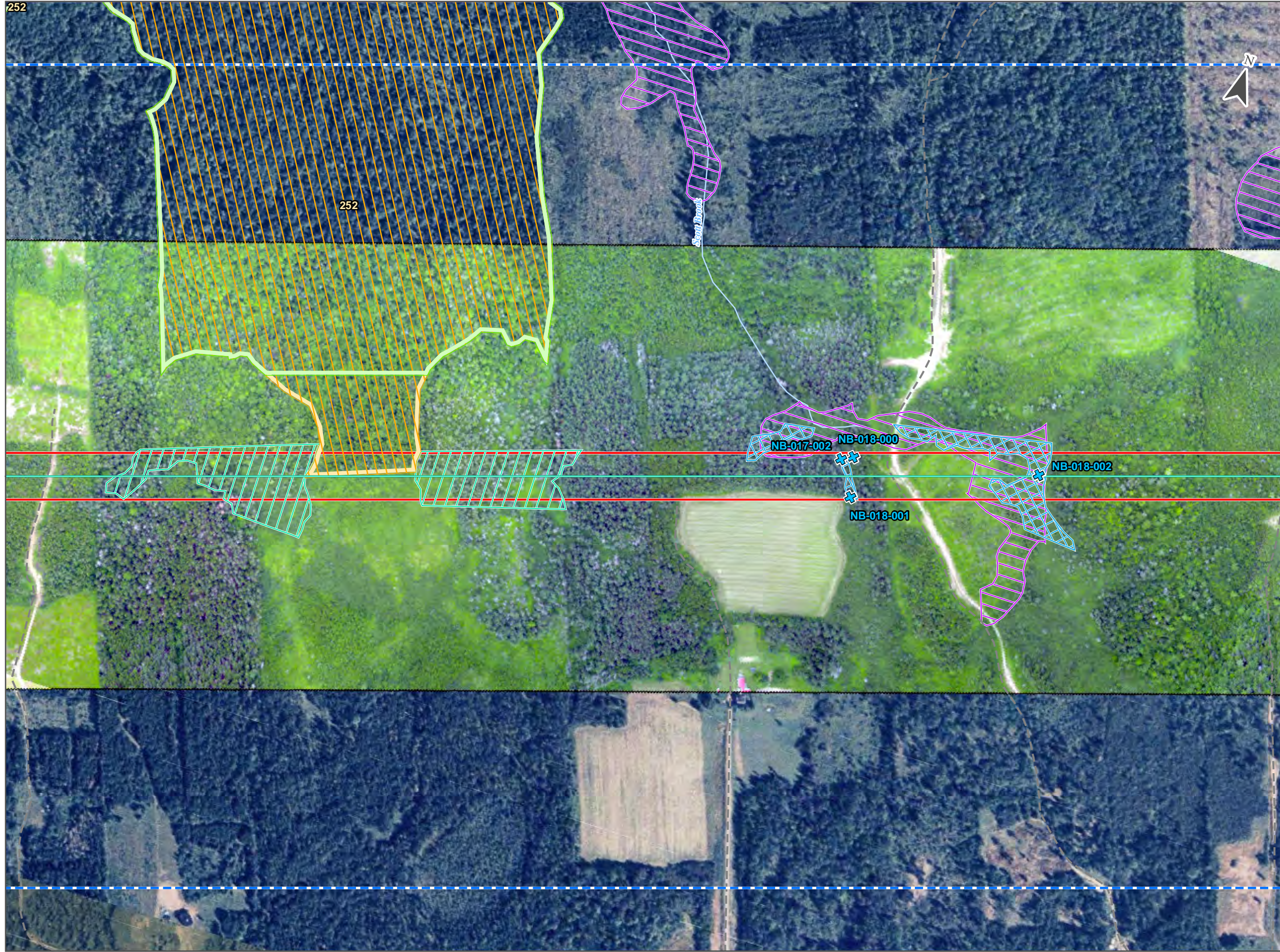


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

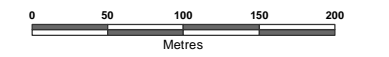


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



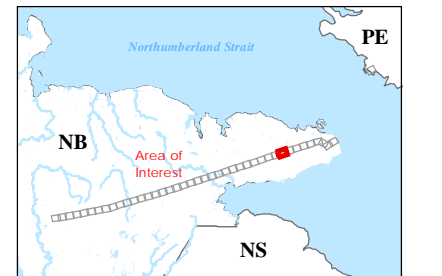
Terrestrial Environment Assessment Area Boundaries

- Watercourse Crossing
- Proposed Project Components**
 - Melrose to Cape Tormentine
- Field Delineated Wetland**
 - Coniferous Treed Swamp
 - Tall Shrub Swamp
- Interior Forest**
 - Pre-Project Interior Forest
 - After Project Interior Forest
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - GeoNB-mapped Wetland

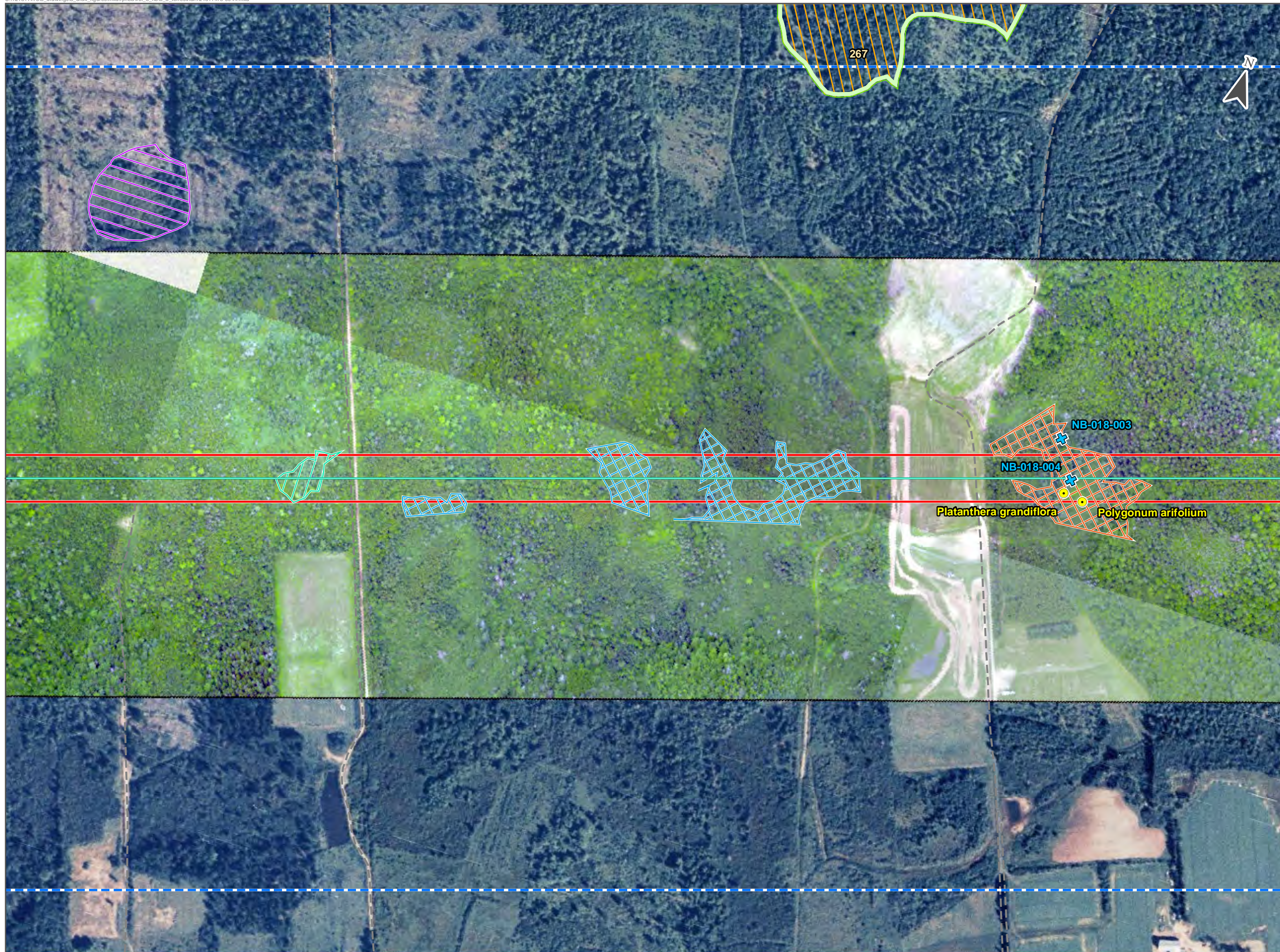


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



Terrestrial Environment Assessment Area Boundaries

Plant Field Observation (Species of Conservation Concern)

● Vascular

⊕ Watercourse Crossing

Proposed Project Components

— Melrose to Cape Tormentine

Field Delineated Wetland

▨ Coniferous Treed Swamp

▨ Mixedwood Treed Swamp

▨ Tall Shrub Swamp

Interior Forest

▨ Pre-Project Interior Forest

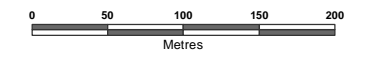
▨ After Project Interior Forest

Terrestrial Assessment Area

▭ Project Development Area

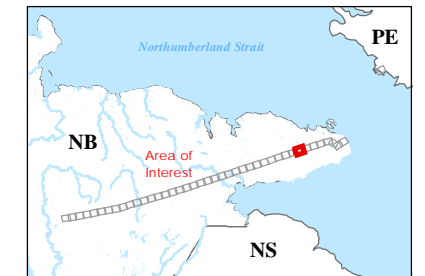
▭ Local Assessment Area

▨ GeoNB-mapped Wetland

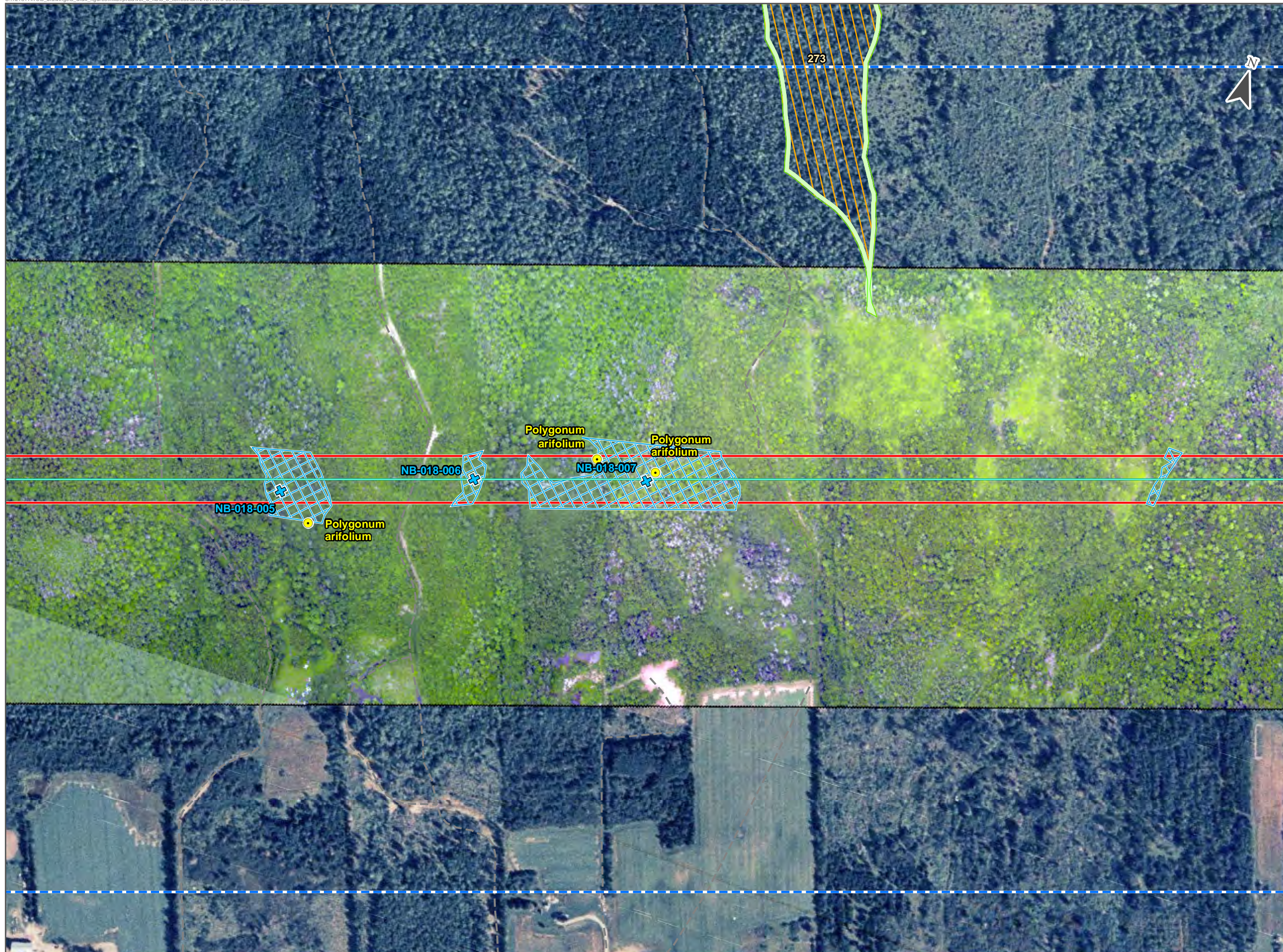


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

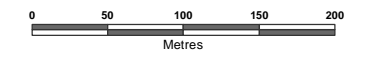


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



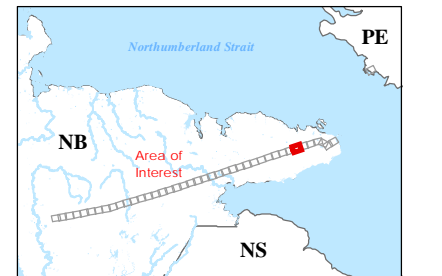
Terrestrial Environment Assessment Area Boundaries

- Plant Field Observation (Species of Conservation Concern)**
- Vascular
 - ⊗ Watercourse Crossing
- Proposed Project Components**
- Melrose to Cape Tormentine
- Field Delineated Wetland**
- ⊗ Tall Shrub Swamp
- Interior Forest**
- ▨ Pre-Project Interior Forest
 - ▨ After Project Interior Forest
- Terrestrial Assessment Area**
- ▭ Project Development Area
 - ▭ Local Assessment Area

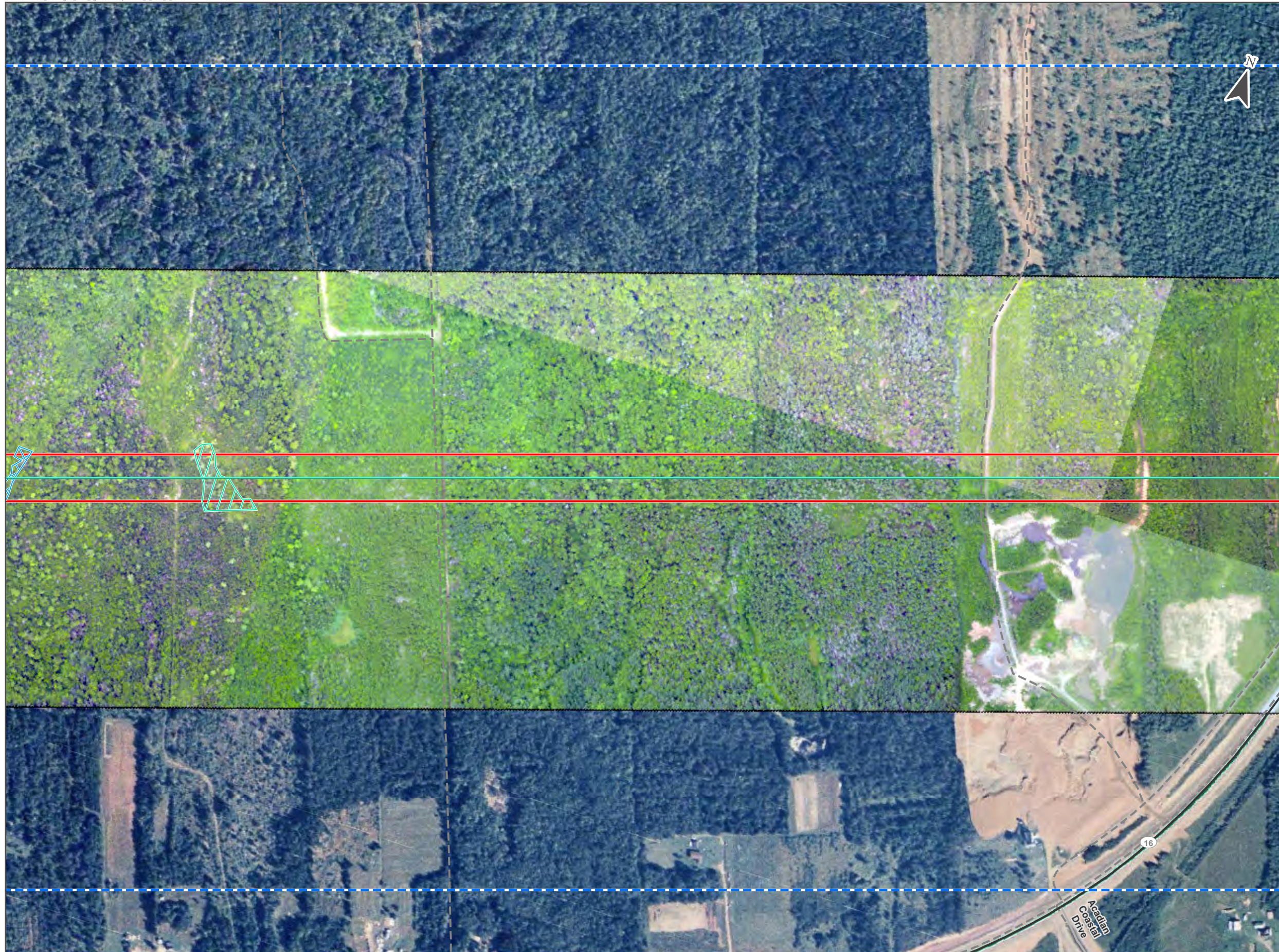


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

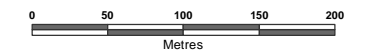


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



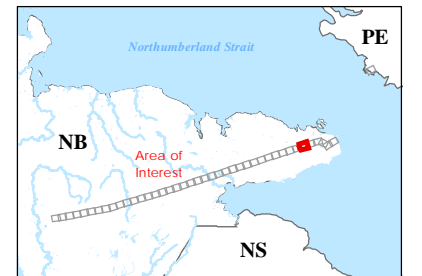
Terrestrial Environment Assessment Area Boundaries

- Proposed Project Components**
- Melrose to Cape Tormentine
- Field Delineated Wetland**
- Coniferous Treed Swamp
 - Tall Shrub Swamp
- Terrestrial Assessment Area**
- Project Development Area
 - Local Assessment Area



121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



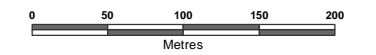
Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

121811475 - PEI-NB Marine Cable Interconnection - Maritime Electric Company Limited



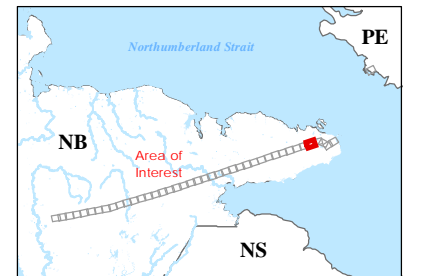
Terrestrial Environment Assessment Area Boundaries

- AC CDC Plant Observation
- Proposed Project Components**
 - Melrose to Cape Tormentine
- Field Delineated Wetland**
 - ▣ Tall Shrub Swamp
- Interior Forest**
 - ▨ Pre-Project Interior Forest
 - ▨ After Project Interior Forest
- Terrestrial Assessment Area**
 - ▭ Project Development Area
 - ▭ Local Assessment Area
 - ▭ GeoNB-mapped Wetland

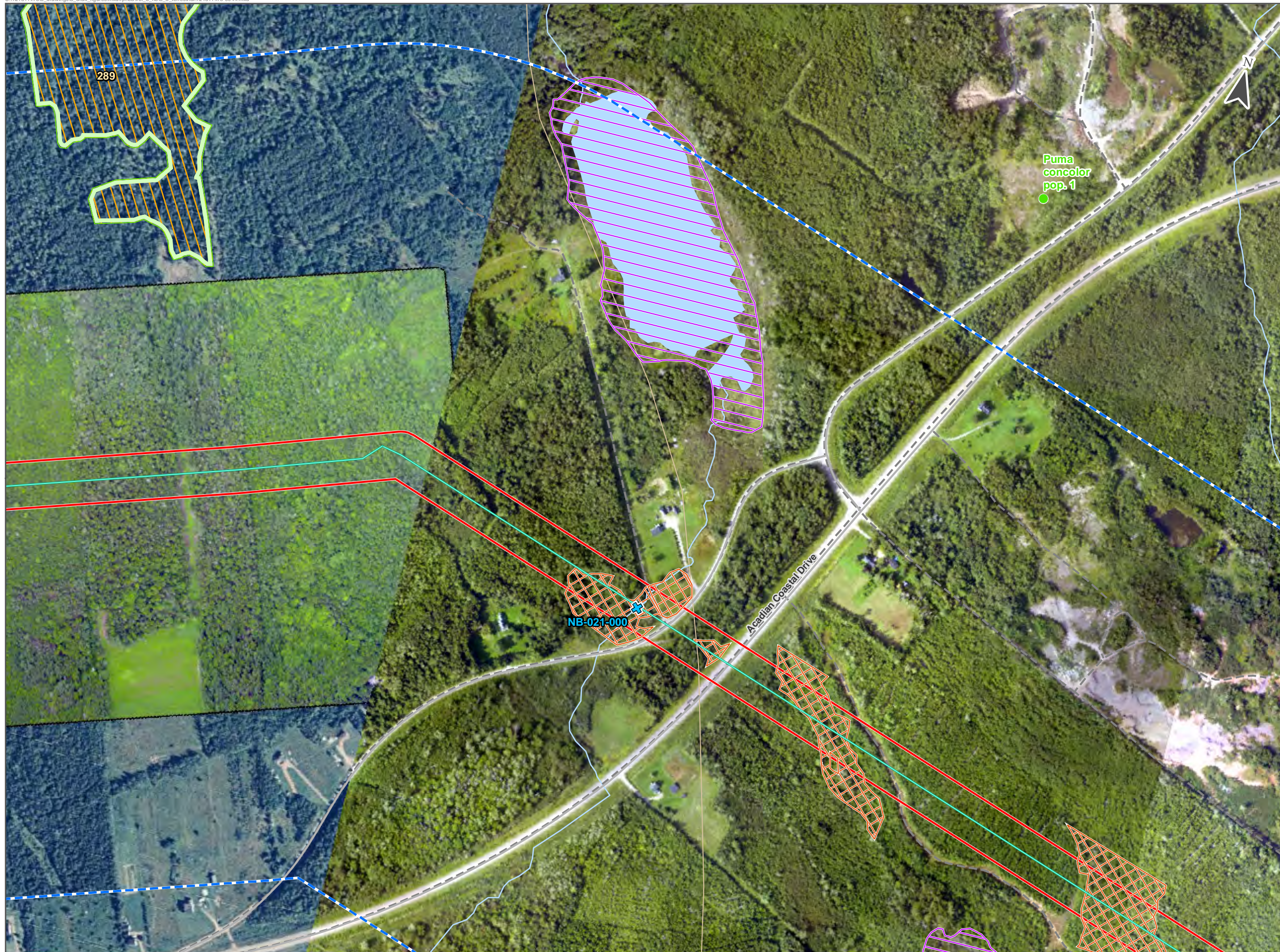


121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

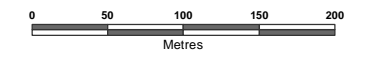


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



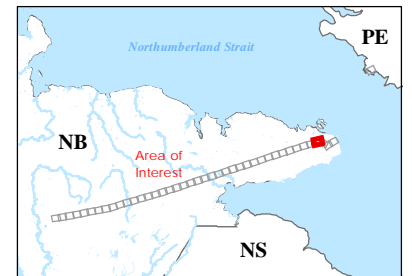
Terrestrial Environment Assessment Area Boundaries

- AC CDC Bird Observation
- Plant Field Observation (Species of Conservation Concern)**
 - Vascular
- ✕ Watercourse Crossing
- Proposed Project Components**
 - Melrose to Cape Tormentine
- Field Delineated Wetland**
 - Mixedwood Treed Swamp
- Interior Forest**
 - Pre-Project Interior Forest
 - After Project Interior Forest
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - GeoNB-mapped Wetland



121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

121811475 - PEI-NB Marine Cable Interconnection - Maritime Electric Company Limited



Terrestrial Environment Assessment Area Boundaries

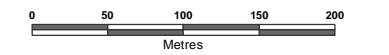
Plant Field Observation (Species of Conservation Concern)
 ● Vascular

Proposed Project Components
 — Melrose to Cape Tormentine

Field Delineated Wetland
 ▨ Mixedwood Treed Swamp

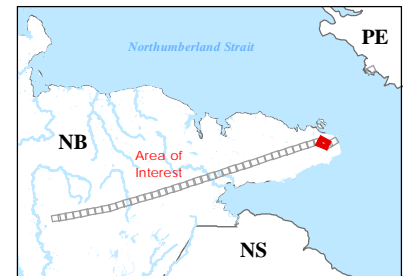
Terrestrial Assessment Area
 ▭ Project Development Area
 ▭ Local Assessment Area

■ Crown Land
 ▭ GeoNB-mapped Wetland



121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

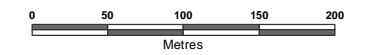


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



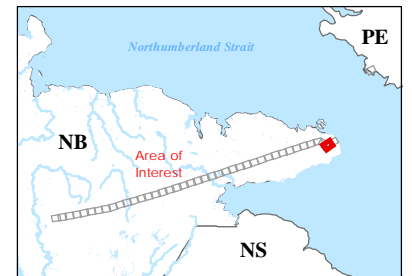
Terrestrial Environment Assessment Area Boundaries

- Plant Field Observation (Species of Conservation Concern)**
 - Vascular
 - ✕ Watercourse Crossing
- Proposed Project Components**
 - Melrose to Cape Tormentine
- Field Delineated Wetland**
 - Low Shrub Swamp
 - Mixedwood Treed Swamp
 - Tall Shrub Swamp
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
 - Crown Land



121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.

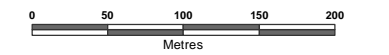


Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.



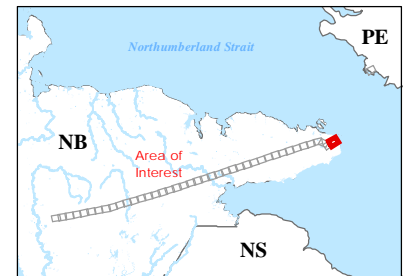
Terrestrial Environment Assessment Area Boundaries

- Watercourse Crossing
- Proposed Project Components**
 - Melrose to Cape Tormentine
 - Proposed Buried Cable
- Proposed Project Components in the Northumberland Strait**
 - Proposed Submarine Cable #3
 - Proposed Submarine Cable #4
- Field Delineated Wetland**
 - Deciduous Treed Swamp
 - Tall Shrub Swamp
- Terrestrial Assessment Area**
 - Project Development Area
 - Local Assessment Area
- Crown Land
- GeoNB-mapped Wetland



121811475-0044 1:5,000 NAD 1983 CSRS NBDS

Imagery from ArcGIS Map Service GeoNB. Base data provided by the Governments of Canada and New Brunswick. Project Data from Stantec or provided by NB Power / MECL.



Disclaimer: This map is for illustrative purposes to support this project; questions can be directed to the issuing agency.

September 30, 2015

APPENDIX C VASCULAR PLANT LIST

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
A Hybrid White Panicked American-Aster	<i>Oclemena x blakei</i>	SNA
A Hybrid Wood-fern	<i>Dryopteris x boottii</i>	SNA
A Hybrid Wood-fern	<i>Dryopteris x triploidea</i>	SNA
A Rose	<i>Rosa sp.</i>	#N/A
Alder-leaved Buckthorn	<i>Rhamnus alnifolia</i>	S4S5
Allegheny Blackberry	<i>Rubus allegheniensis</i>	S5
Alternate-leaved Dogwood	<i>Cornus alternifolia</i>	S5
American Beech	<i>Fagus grandifolia</i>	S5
American Burreed	<i>Sparganium americanum</i>	S5
American Cow Wheat	<i>Melampyrum lineare</i>	S5
American Golden Saxifrage	<i>Chrysosplenium americanum</i>	S5
American Marsh Pennywort	<i>Hydrocotyle americana</i>	S5
American Mountain Ash	<i>Sorbus americana</i>	S5
American Spikenard	<i>Aralia racemosa</i>	S4S5
American Sweetflag	<i>Acorus americanus</i>	S4
American Water Horehound	<i>Lycopus americanus</i>	S5
Arctic Rush	<i>Juncus balticus</i>	S5
Arrow-leaved Smartweed	<i>Polygonum sagittatum</i>	S5
Awl-fruited Sedge	<i>Carex stipata</i>	S5
Balsam Fir	<i>Abies balsamea</i>	S5
Balsam Poplar	<i>Populus balsamifera</i>	S5
Balsam Willow	<i>Salix pyrifolia</i>	S5
Beaked Hazel	<i>Corylus cornuta</i>	S5
Bebb's Willow	<i>Salix bebbiana</i>	S5
Bittersweet Nightshade	<i>Solanum dulcamara</i>	SNA
Black Ash	<i>Fraxinus nigra</i>	S5
Black Chokeberry	<i>Photinia melanocarpa</i>	S5
Black Elderberry	<i>Sambucus nigra ssp. canadensis</i>	S5
Black Huckleberry	<i>Gaylussacia baccata</i>	S5
Black Spruce	<i>Picea mariana</i>	S5
Bladder Sedge	<i>Carex intumescens</i>	S5
Blood Milkwort	<i>Polygala sanguinea</i>	S2
Bog Aster	<i>Oclemena nemoralis</i>	S5
Bog Buckbean	<i>Menyanthes trifoliata</i>	S5
Bog Muhly	<i>Muhlenbergia uniflora</i>	S5

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Boreal Bog Sedge	<i>Carex magellanica</i>	S5
Boreal Stitchwort	<i>Stellaria borealis</i>	S4S5
Bracken Fern	<i>Pteridium aquilinum</i>	S5
Branched Centaury	<i>Centaurium pulchellum</i>	SNA
Bristly Black Currant	<i>Ribes lacustre</i>	S5
Bristly Dewberry	<i>Rubus hispidus</i>	S5
Bristly Sarsaparilla	<i>Aralia hispida</i>	S5
Bristly-stalked Sedge	<i>Carex leptalea</i>	S5
Broad-fruited Burreed	<i>Sparganium eurycarpum</i>	S4S5
Broad-leaved Arrowhead	<i>Sagittaria latifolia</i>	S5
Broad-leaved Cattail	<i>Typha latifolia</i>	S5
Broom Sedge	<i>Carex scoparia</i>	S5
Brown-fruited Rush	<i>Juncus pelocarpus</i>	S5
Brownish Sedge	<i>Carex brunnescens</i>	S5
Bulblet Bladder Fern	<i>Cystopteris bulbifera</i>	S4
Bulbous Water-hemlock	<i>Cicuta bulbifera</i>	S5
Calico Aster	<i>Symphyotrichum lateriflorum</i>	S5
Canada Anemone	<i>Anemone canadensis</i>	S5
Canada Blue Grass	<i>Poa compressa</i>	SNA
Canada Fly Honeysuckle	<i>Lonicera canadensis</i>	S5
Canada Manna Grass	<i>Glyceria canadensis</i>	S5
Canada Rush	<i>Juncus canadensis</i>	S5
Canada St. John's-Wort	<i>Hypericum canadense</i>	S5
Canada Yew	<i>Taxus canadensis</i>	S5
Chokecherry	<i>Prunus virginiana</i>	S5
Christmas Fern	<i>Polystichum acrostichoides</i>	S5
Cinnamon Fern	<i>Osmunda cinnamomea</i>	S5
Clasping-leaved Twisted-Stalk	<i>Streptopus amplexifolius</i>	S5
Club Spur Orchid	<i>Platanthera clavellata</i>	S4
Colonial Bent Grass	<i>Agrostis capillaris</i>	SNA
Coltsfoot	<i>Tussilago farfara</i>	SNA
Common Apple	<i>Malus pumila</i>	SNA
Common Boneset	<i>Eupatorium perfoliatum</i>	S5
Common Buttercup	<i>Ranunculus acris</i>	SNA
Common Eyebright	<i>Euphrasia nemorosa</i>	SNA

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Common Hemp-nettle	<i>Galeopsis tetrahit</i>	SNA
Common Hornwort	<i>Ceratophyllum demersum</i>	S4
Common Labrador Tea	<i>Ledum groenlandicum</i>	S5
Common Lady Fern	<i>Athyrium filix-femina</i>	S5
Common Lilac	<i>Syringa vulgaris</i>	SNA
Common Marsh Bedstraw	<i>Galium palustre</i>	S5
Common Oak Fern	<i>Gymnocarpium dryopteris</i>	S5
Common Plantain	<i>Plantago major</i>	SNA
Common Self-heal	<i>Prunella vulgaris ssp. lanceolata</i>	S5
Common Silverweed	<i>Argentina anserina</i>	S5
Common Speedwell	<i>Veronica officinalis</i>	S5
Common Tall Manna Grass	<i>Glyceria grandis</i>	S5
Common Timothy	<i>Phleum pratense</i>	SNA
Common Valerian	<i>Valeriana officinalis</i>	SNA
Common Water Parsnip	<i>Sium suave</i>	S5
Common Winterberry	<i>Ilex verticillata</i>	S5
Common Wood Sorrel	<i>Oxalis montana</i>	S5
Common Woodrush	<i>Luzula multiflora</i>	S5
Common Woolly Bulrush	<i>Scirpus cyperinus</i>	S5
Common Yarrow	<i>Achillea millefolium</i>	S5
Creeping Bent Grass	<i>Agrostis stolonifera</i>	S5
Creeping Buttercup	<i>Ranunculus repens</i>	SNA
Creeping Snowberry	<i>Gaultheria hispidula</i>	S5
Crested Wood Fern	<i>Dryopteris cristata</i>	S5
Cyperus-like Sedge	<i>Carex pseudocyperus</i>	S5
Devil's Beggarticks	<i>Bidens frondosa</i>	S5
Dewdrop	<i>Dalibarda repens</i>	S5
Dotted Smartweed	<i>Polygonum punctatum</i>	S3
Downy Goldenrod	<i>Solidago puberula</i>	S5
Drooping Wood Reed Grass	<i>Cinna latifolia</i>	S5
Drooping Woodland Sedge	<i>Carex arctata</i>	S5
Dwarf Clearweed	<i>Pilea pumila</i>	S3
Dwarf Red Raspberry	<i>Rubus pubescens</i>	S5
Eastern Burnweed	<i>Erechtites hieraciifolia</i>	S5
Eastern Hay-scented Fern	<i>Dennstaedtia punctilobula</i>	S5

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Eastern Marsh Fern	<i>Thelypteris palustris</i>	S5
Eastern Teaberry	<i>Gaultheria procumbens</i>	S5
Eastern White Pine	<i>Pinus strobus</i>	S5
English Plantain	<i>Plantago lanceolata</i>	SNA
European Black Currant	<i>Ribes nigrum</i>	SNA
European Mountain Ash	<i>Sorbus aucuparia</i>	SNA
European Wood Sorrel	<i>Oxalis stricta</i>	S5
Fall Dandelion	<i>Leontodon autumnalis</i>	SNA
False Waterpepper	<i>Polygonum hydropiperoides</i>	S4
Few-Flowered Sedge	<i>Carex pauciflora</i>	S5
Fibrous-Root Sedge	<i>Carex communis</i>	S5
Fireberry Hawthorn	<i>Crataegus chrysocarpa</i>	S5
Flat-Branched Tree-clubmoss	<i>Lycopodium obscurum</i>	S5
Fowl Manna Grass	<i>Glyceria striata</i>	S5
Fox Sedge	<i>Carex vulpinoidea</i>	S4S5
Fraser's Marsh St. John's-Wort	<i>Triadenum fraseri</i>	S5
Fringed Black Bindweed	<i>Polygonum cilinode</i>	S5
Fringed Sedge	<i>Carex crinita</i>	S5
Garden Stonecrop	<i>Hylotelephium telephium</i>	SNA
Giant Goldenrod	<i>Solidago gigantea</i>	S5
Glossy Buckthorn	<i>Frangula alnus</i>	SNA
Golden Groundsel	<i>Packera aurea</i>	S4S5
Goldthread	<i>Coptis trifolia</i>	S5
Grass-leaved Goldenrod	<i>Euthamia graminifolia</i>	S5
Gray Birch	<i>Betula populifolia</i>	S5
Great Duckweed	<i>Spirodela polyrrhiza</i>	S3S4
Greater Bladderwort	<i>Utricularia macrorhiza</i>	S5
Greater Water Dock	<i>Rumex orbiculatus</i>	S5
Green Alder	<i>Alnus viridis</i>	S5
Green Foxtail	<i>Setaria viridis</i>	SNA
Green-fruited Burreed	<i>Sparganium emersum</i>	S5
Green-keeled Cottongrass	<i>Eriophorum viridicarinatum</i>	S4
Hair Fescue	<i>Festuca filiformis</i>	SNA
Hairy Flat-top White Aster	<i>Doellingeria umbellata</i>	S5
Hairy Sweet Cicely	<i>Osmorhiza claytonii</i>	S5

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Halberd-Leaved Tearthumb	<i>Polygonum arifolium</i>	S3
Harlequin Blue Flag	<i>Iris versicolor</i>	S5
Heart-leaved Birch	<i>Betula papyrifera</i> var. <i>cordifolia</i>	S5
Helleborine	<i>Epipactis helleborine</i>	SNA
Hickey's Tree-clubmoss	<i>Lycopodium hickeyi</i>	S4
Highbush Cranberry	<i>Viburnum opulus</i>	S5
Hobblebush	<i>Viburnum lantanoides</i>	S5
Hop Sedge	<i>Carex lupulina</i>	S3
Humped Bladderwort	<i>Utricularia gibba</i>	S3S4
Indian Cucumber Root	<i>Medeola virginiana</i>	S5
Indian Pipe	<i>Monotropa uniflora</i>	S5
Inland Serviceberry	<i>Amelanchier interior</i>	S5
Interrupted Fern	<i>Osmunda claytoniana</i>	S5
Jack Pine	<i>Pinus banksiana</i>	S5
Jack-in-the-pulpit	<i>Arisaema triphyllum</i>	S5
Jack-in-the-pulpit	<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	S5
Japanese Knotweed	<i>Polygonum cuspidatum</i>	SNA
Kalm's Hawkweed	<i>Hieracium kalmii</i>	S1
Large Cranberry	<i>Vaccinium macrocarpon</i>	S5
Large False Solomon's Seal	<i>Maianthemum racemosum</i>	S5
Large False Solomon's Seal	<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	S5
Large Purple Fringed Orchid	<i>Platanthera grandiflora</i>	S3
Large Sweet Vernal Grass	<i>Anthoxanthum odoratum</i>	SNA
Large Water-starwort	<i>Callitriche heterophylla</i>	S4S5
Large-leaved Aster	<i>Eurybia macrophylla</i>	S5
Large-leaved Avens	<i>Geum macrophyllum</i>	S5
Large-leaved Pondweed	<i>Potamogeton amplifolius</i>	S4
Large-toothed Aspen	<i>Populus grandidentata</i>	S5
Late Lowbush Blueberry	<i>Vaccinium angustifolium</i>	S5
Leatherleaf	<i>Chamaedaphne calyculata</i>	S5
Little Yellow Rattle	<i>Rhinanthus minor</i>	S5
Low Hop Clover	<i>Trifolium campestre</i>	SNA
Low Rough Aster	<i>Eurybia radula</i>	S5
Mad-dog Skullcap	<i>Scutellaria lateriflora</i>	S5
Marsh Blue Violet	<i>Viola cucullata</i>	S5

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Marsh Cinquefoil	<i>Comarum palustre</i>	S5
Marsh Cudweed	<i>Gnaphalium uliginosum</i>	SNA
Marsh Seedbox	<i>Ludwigia palustris</i>	S4
Marsh Skullcap	<i>Scutellaria galericulata</i>	S5
Marsh Water-starwort	<i>Callitriche palustris</i>	S5
Marsh Willowherb	<i>Epilobium palustre</i>	S5
Marshpepper Smartweed	<i>Polygonum hydropiper</i>	SNA
Maryland Sanicle	<i>Sanicula marilandica</i>	S4S5
Meadow Goatsbeard	<i>Tragopogon pratensis</i>	SNA
Meadow Vetchling	<i>Lathyrus pratensis</i>	SNA
Morrow's Honeysuckle	<i>Lonicera morrowii</i>	SNA
Mountain Blue-eyed-grass	<i>Sisyrinchium montanum</i>	S5
Mountain Fly Honeysuckle	<i>Lonicera villosa</i>	S5
Mountain Holly	<i>Nemopanthus mucronatus</i>	S5
Mountain Maple	<i>Acer spicatum</i>	S5
Mouse-ear Chickweed	<i>Cerastium arvense</i>	S4
Multiflora Rose	<i>Rosa multiflora</i>	SNA
Naked Bishop's-Cap	<i>Mitella nuda</i>	S5
Narrow-leaved Burreed	<i>Sparganium angustifolium</i>	S5
Necklace Sedge	<i>Carex projecta</i>	S5
Needle Spikerush	<i>Eleocharis acicularis</i>	S5
New England Sedge	<i>Carex novae-angliae</i>	S5
New York Aster	<i>Symphyotrichum novi-belgii</i>	S5
New York Fern	<i>Thelypteris noveboracensis</i>	S5
Nodding Beggarticks	<i>Bidens cernua</i>	S5
Nodding Ladies'-Tresses	<i>Spiranthes cernua</i>	S2
Nodding Sedge	<i>Carex gynandra</i>	S5
Nodding Trillium	<i>Trillium cernuum</i>	S5
Northern Arrowhead	<i>Sagittaria cuneata</i>	S5
Northern Bayberry	<i>Morella pensylvanica</i>	S5
Northern Beaked Sedge	<i>Carex utriculata</i>	S5
Northern Beech Fern	<i>Phegopteris connectilis</i>	S5
Northern Bog Clubmoss	<i>Lycopodiella inundata</i>	S4S5
Northern Bog Goldenrod	<i>Solidago uliginosa</i>	S5
Northern Bush Honeysuckle	<i>Diervilla lonicera</i>	S5

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Northern Clubmoss	<i>Lycopodium complanatum</i>	S4S5
Northern Long Sedge	<i>Carex folliculata</i>	S4
Northern Manna Grass	<i>Glyceria borealis</i>	S5
Northern Mannagrass	<i>Glyceria laxa</i>	S4?
Northern Panic Grass	<i>Dichanthelium boreale</i>	S5
Northern Pitcher Plant	<i>Sarracenia purpurea</i>	S5
Northern Poison Oak	<i>Toxicodendron rydbergii</i>	S5
Northern Sedge	<i>Carex deflexa</i>	S5
Northern Shorthusk	<i>Brachyelytrum septentrionale</i>	S5
Northern St. John's-wort	<i>Hypericum boreale</i>	S5
Northern Starflower	<i>Trientalis borealis</i>	S5
Northern Stitchwort	<i>Stellaria calycantha</i>	SNA
Northern Sweet Coltsfoot	<i>Petasites frigidus</i>	S4S5
Northern Water Horehound	<i>Lycopus uniflorus</i>	S5
Northern Water Plantain	<i>Alisma triviale</i>	S5
Northern Wild Raisin	<i>Viburnum nudum</i>	S5
Northern Willowherb	<i>Epilobium ciliatum</i>	S5
Northern Willowherb	<i>Epilobium ciliatum ssp. glandulosum</i>	S5
Oak-leaved Goosefoot	<i>Chenopodium glaucum</i>	SNA
Old Field Cinquefoil	<i>Potentilla simplex</i>	S5
One-flowered Wintergreen	<i>Moneses uniflora</i>	S5
One-sided Wintergreen	<i>Orthilia secunda</i>	S5
Orange Hawkweed	<i>Hieracium aurantiacum</i>	SNA
Ostrich Fern	<i>Matteuccia struthiopteris</i>	S5
Oval-leaf Knotweed	<i>Polygonum arenastrum</i>	SNA
Ovate Spikerush	<i>Eleocharis ovata</i>	S5
Oxeye Daisy	<i>Leucanthemum vulgare</i>	SNA
Painted Trillium	<i>Trillium undulatum</i>	S5
Pale Bog Laurel	<i>Kalmia polifolia</i>	S5
Pale False Manna Grass	<i>Torreyochloa pallida</i>	S5
Pale False Manna Grass	<i>Torreyochloa pallida var. fernaldii</i>	S5
Paper Birch	<i>Betula papyrifera</i>	S5
Partridgeberry	<i>Mitchella repens</i>	S5
Path Rush	<i>Juncus tenuis</i>	S5
Pearly Everlasting	<i>Anaphalis margaritacea</i>	S5

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Pennsylvania Bittercress	<i>Cardamine pennsylvanica</i>	S5
Perennial Evening Primrose	<i>Oenothera perennis</i>	S5
Pickeralweed	<i>Pontederia cordata</i>	S5
Pin Cherry	<i>Prunus pennsylvanica</i>	S5
Pineapple Weed	<i>Matricaria discoidea</i>	SNA
Pinesap	<i>Monotropa hypopithys</i>	S4
Pink Lady's-slipper	<i>Cypripedium acaule</i>	S5
Poverty Oat Grass	<i>Danthonia spicata</i>	S5
Prairie Cord Grass	<i>Spartina pectinata</i>	S5
Purple-stemmed Aster	<i>Symphotrichum puniceum</i>	S5
Purple-stemmed Beggarticks	<i>Bidens connata</i>	S4?
Pussy Willow	<i>Salix discolor</i>	S5
Ragged Fringed Orchid	<i>Platanthera lacera</i>	S4
Red Ash	<i>Fraxinus pennsylvanica</i>	S4
Red Baneberry	<i>Actaea rubra</i>	S5
Red Bartsia	<i>Odontites vernus</i>	SNA
Red Clover	<i>Trifolium pratense</i>	SNA
Red Elderberry	<i>Sambucus racemosa</i>	S5
Red Maple	<i>Acer rubrum</i>	S5
Red Osier Dogwood	<i>Cornus sericea</i>	S5
Red Spruce	<i>Picea rubens</i>	S5
Red-disked Yellow Pond-lily	<i>Nuphar lutea ssp. rubrodisca</i>	S2
Redtop	<i>Agrostis gigantea</i>	SNA
Reed Canary Grass	<i>Phalaris arundinacea</i>	S5
Rhodora	<i>Rhododendron canadense</i>	S5
Ribbon-Leaved Pondweed	<i>Potamogeton epihydrus</i>	S5
Rice Cut Grass	<i>Leersia oryzoides</i>	S5
Rose Pogonia	<i>Pogonia ophioglossoides</i>	S4
Rose Twisted-Stalk	<i>Streptopus lanceolatus</i>	S5
Rough Bedstraw	<i>Galium asprellum</i>	S5
Rough Bent Grass	<i>Agrostis scabra</i>	S5
Rough Cottongrass	<i>Eriophorum tenellum</i>	S4S5
Rough Fleabane	<i>Erigeron strigosus</i>	S5
Rough Hawkweed	<i>Hieracium scabrum</i>	S5
Rough Sedge	<i>Carex scabrata</i>	S5

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Rough-Stemmed Goldenrod	<i>Solidago rugosa</i>	S5
Round-Branched Tree-clubmoss	<i>Lycopodium dendroideum</i>	S5
Round-Leaved Sundew	<i>Drosera rotundifolia</i>	S5
Royal Fern	<i>Osmunda regalis</i>	S5
Rugosa Rose	<i>Rosa rugosa</i>	SNA
Running Clubmoss	<i>Lycopodium clavatum</i>	S5
Sallow Sedge	<i>Carex lurida</i>	S5
Satiny Willow	<i>Salix pellita</i>	S4S5
Sensitive Fern	<i>Onoclea sensibilis</i>	S5
Sheep Laurel	<i>Kalmia angustifolia</i>	S5
Shining Firmoss	<i>Huperzia lucidula</i>	S5
Shining Rose	<i>Rosa nitida</i>	S5
Shining Willow	<i>Salix lucida</i>	S5
Shinleaf	<i>Pyrola elliptica</i>	S5
Short-tailed Rush	<i>Juncus brevicaudatus</i>	S5
Showy Blackberry	<i>Rubus elegantulus</i>	S4S5
Showy Lady's-slipper	<i>Cypripedium reginae</i>	S3
Skunk Currant	<i>Ribes glandulosum</i>	S5
Slender Cottongrass	<i>Eriophorum gracile</i>	S2
Slender Ladies'-tresses	<i>Spiranthes lacera</i>	S5
Slender Manna Grass	<i>Glyceria melicaria</i>	S5
Slender Sedge	<i>Carex lasiocarpa</i>	S5
Small Cranberry	<i>Vaccinium oxycoccos</i>	S5
Small Enchanter's Nightshade	<i>Circaea alpina</i>	S5
Small Purple Fringed Orchid	<i>Platanthera psycodes</i>	S4
Small White Violet	<i>Viola macloskeyi</i>	S5
Small Yellow Pond-lily	<i>Nuphar lutea ssp. pumila</i>	S3
Small-fruited Bulrush	<i>Scirpus microcarpus</i>	S5
Smooth Bedstraw	<i>Galium mollugo</i>	SNA
Smooth Blackberry	<i>Rubus canadensis</i>	S5
Smooth Crab Grass	<i>Digitaria ischaemum</i>	SNA
Smooth Gooseberry	<i>Ribes hirtellum</i>	S5
Smooth Serviceberry	<i>Amelanchier laevis</i>	S5
Smooth Twigrush	<i>Cladium mariscoides</i>	S3S4
Sneezeweed	<i>Achillea ptarmica</i>	SNA

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Soft Rush	<i>Juncus effusus</i>	S5
Soft Rush	<i>Juncus effusus</i> var. <i>conglomeratus</i>	SNR
Southern Clubmoss	<i>Lycopodium digitatum</i>	S5
Speckled Alder	<i>Alnus incana</i>	S5
Spinulose Wood Fern	<i>Dryopteris carthusiana</i>	S5
Spoon-Leaved Sundew	<i>Drosera intermedia</i>	S5
Spotted Jewelweed	<i>Impatiens capensis</i>	S5
Spotted Joe-pye-weed	<i>Eupatorium maculatum</i>	S5
Spotted Lady's-thumb	<i>Polygonum persicaria</i>	SNA
Spotted Water-hemlock	<i>Cicuta maculata</i>	S5
Spreading Dogbane	<i>Apocynum androsaemifolium</i>	S5
Square-stemmed Monkeyflower	<i>Mimulus ringens</i>	S4S5
Star Sedge	<i>Carex echinata</i>	S5
Starry False Solomon's Seal	<i>Maianthemum stellatum</i>	S4S5
Steeplebush	<i>Spiraea tomentosa</i>	S5
Stiff Clubmoss	<i>Lycopodium annotinum</i>	S5
Stiff Eyebright	<i>Euphrasia stricta</i>	SNA
Striped Maple	<i>Acer pensylvanicum</i>	S5
Sugar Maple	<i>Acer saccharum</i>	S5
Swamp Rose	<i>Rosa palustris</i>	S3
Swamp Yellow Loosestrife	<i>Lysimachia terrestris</i>	S5
Sweet Gale	<i>Myrica gale</i>	S5
Tall Blue Lettuce	<i>Lactuca biennis</i>	S5
Tall Hawkweed	<i>Hieracium piloselloides</i>	SNA
Tall Meadow-rue	<i>Thalictrum pubescens</i>	S5
Tall Rattlesnakeroot	<i>Prenanthes altissima</i>	S5
Tamarack	<i>Larix laricina</i>	S5
Tawny Cottongrass	<i>Eriophorum virginicum</i>	S5
Thread Rush	<i>Juncus filiformis</i>	S5
Three-flowered Bedstraw	<i>Galium triflorum</i>	S5
Three-leaved False Soloman's Seal	<i>Maianthemum trifolium</i>	S5
Three-LEAVED Rattlesnakeroot	<i>Prenanthes trifoliolata</i>	S5
Three-petaled Bedstraw	<i>Galium trifidum</i> ssp. <i>trifidum</i>	S5
Three-seeded Sedge	<i>Carex trisperma</i>	S5
Three-way Sedge	<i>Dulichium arundinaceum</i>	S5

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Thyme-leaved Speedwell	<i>Veronica serpyllifolia ssp. humifusa</i>	S3
Trailing Arbutus	<i>Epigaea repens</i>	S5
Tuberous Grass Pink	<i>Calopogon tuberosus</i>	S4
Tufted Yellow Loosestrife	<i>Lysimachia thyrsoiflora</i>	S4
Turion Duckweed	<i>Lemna turionifera</i>	S5
Tussock Cottongrass	<i>Eriophorum vaginatum</i>	S5
Tussock Sedge	<i>Carex stricta</i>	S5
Twinflower	<i>Linnaea borealis</i>	S5
Twin-stemmed Bladderwort	<i>Utricularia geminiscapa</i>	S4
Two-seeded Sedge	<i>Carex disperma</i>	S5
Upland Bent Grass	<i>Agrostis perennans</i>	S5
Variegated Horsetail	<i>Equisetum variegatum</i>	S4
Variegated Pond-Lily	<i>Nuphar lutea</i>	S5
Velvet-LEAVED Blueberry	<i>Vaccinium myrtilloides</i>	S5
Virginia Clematis	<i>Clematis virginiana</i>	S5
Virginia Rose	<i>Rosa virginiana</i>	S5
Water Avens	<i>Geum rivale</i>	S5
Water Horsetail	<i>Equisetum fluviatile</i>	S5
Water-shield	<i>Brasenia schreberi</i>	S4
White Ash	<i>Fraxinus americana</i>	S5
White Beakrush	<i>Rhynchospora alba</i>	S5
White Bog Orchid	<i>Platanthera dilatata</i>	S4
White Buttons	<i>Eriocaulon aquaticum</i>	S5
White Fringed Orchid	<i>Platanthera blephariglottis</i>	S3
White Fringed Orchid	<i>Platanthera blephariglottis var. blephariglottis</i>	S3
White Meadowsweet	<i>Spiraea alba</i>	S5
White Spruce	<i>Picea glauca</i>	S5
White Turtlehead	<i>Chelone glabra</i>	S5
White-Edged Sedge	<i>Carex debilis</i>	S5
Whorled Wood Aster	<i>Oclemena acuminata</i>	S5
Wiegand's Sedge	<i>Carex wiegandii</i>	S3
Wild Calla	<i>Calla palustris</i>	S5
Wild Cucumber	<i>Echinocystis lobata</i>	S5
Wild Lily-of-the-valley	<i>Maianthemum canadense</i>	S5
Wild Sarsaparilla	<i>Aralia nudicaulis</i>	S5

September 30, 2015

Table A1 Vascular Plants Observed near the PDA

Common Name	Scientific Name	ACCDC S-Rank
Wild Strawberry	<i>Fragaria virginiana</i>	S5
Woodland Agrimony	<i>Agrimonia striata</i>	S5
Woodland Horsetail	<i>Equisetum sylvaticum</i>	S5
Woolly Blue Violet	<i>Viola sororia</i>	S5
Woolly Panic Grass	<i>Dichanthelium acuminatum</i>	S5
Yellow Birch	<i>Betula alleghaniensis</i>	S5
Yellow Bluebead Lily	<i>Clintonia borealis</i>	S5
Yellow Clover	<i>Trifolium aureum</i>	SNA
Yellow Iris	<i>Iris pseudacorus</i>	SNA
Yellow Ladies'-Tresses	<i>Spiranthes ochroleuca</i>	S1
Yellow Marsh Marigold	<i>Caltha palustris</i>	S4S5
Yellow Sedge	<i>Carex flava</i>	S5
Note: SOCC are indicated in bold text.		

September 30, 2015

APPENDIX D BIRD SPECIES OBSERVED NEAR THE LAA

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Alder Flycatcher	<i>Empidonax alnorum</i>				S5B	ACCDC, BBS, MBBA
American Bittern	<i>Botaurus lentiginosus</i>				S4B	ACCDC, BBS, MBBA
American Black Duck	<i>Anas rubripes</i>				S5B,S4N	ACCDC, BBS, MBBA
American Coot	<i>Fulica americana</i>			not at risk	S2B	ACCDC
American Crow	<i>Corvus brachyrhynchos</i>				S5	ACCDC, BBS, CBC, MBBA
American Golden-plover	<i>Pluvialis dominica</i>				S3M	ACCDC
American Goldfinch	<i>Carduelis tristis</i>				S5	ACCDC, BBS, CBC, MBBA
American Kestrel	<i>Falco sparverius</i>				S4B	ACCDC, BBS, MBBA
American Redstart	<i>Setophaga ruticilla</i>				S5B	ACCDC, BBS, MBBA
American Robin	<i>Turdus migratorius</i>				S5B	ACCDC, BBS, MBBA
American Tree Sparrow	<i>Spizella arborea</i>				S5N	CBC
American Wigeon	<i>Anas americana</i>				S3B	ACCDC, BBS, MBBA
American Woodcock	<i>Scolopax minor</i>				S5B	ACCDC, ACNOS, BBS, MBBA
Baird's Sandpiper	<i>Calidris bairdii</i>				SNAM	ACCDC
Bald Eagle	<i>Haliaeetus leucocephalus</i>		endangered	not at risk	S3B	ACCDC, CBC, MBBA
Bank Swallow	<i>Riparia riparia</i>	no schedule, no status		threatened	S3B	ACCDC, BBS, MBBA
Barn Swallow	<i>Hirundo rustica</i>	no schedule, no status	threatened	threatened	S3B	ACCDC, BBS, MBBA
Barred Owl	<i>Strix varia</i>				S5	ACCDC, ACNOS, BBS, CBC, MBBA
Bay-Breasted Warbler	<i>Dendroica castanea</i>				S4B	ACCDC, BBS, MBBA

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Belted Kingfisher	<i>Megaceryle alcyon</i>				S5B	ACCDC, BBS, MBBA
Black Tern	<i>Chlidonias niger</i>			not at risk	S2B	ACCDC, BBS, MBBA
Black-and-white Warbler	<i>Mniotilta varia</i>				S5B	ACCDC, BBS, MBBA
Black-backed Woodpecker	<i>Picoides arcticus</i>				S4	ACCDC, BBS, MBBA
Black-bellied Plover	<i>Pluvialis squatarola</i>				S4M	ACCDC
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>				S4B	ACCDC, BBS, MBBA
Blackburnian Warbler	<i>Dendroica fusca</i>				S5B	ACCDC, BBS, MBBA
Black-capped Chickadee	<i>Poecile atricapilla</i>				S5	ACCDC, BBS, CBC, MBBA
Black-headed Gull	<i>Larus ridibundus</i>				S2M,S1N	ACCDC
Blackpoll Warbler	<i>Dendroica striata</i>				S4B	ACCDC, BBS, MBBA
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>				S5B	ACCDC, BBS, MBBA
Black-throated Green Warbler	<i>Dendroica virens</i>				S5B	ACCDC, BBS, MBBA
Blue Jay	<i>Cyanocitta cristata</i>				S5	ACCDC, BBS, CBC, MBBA
Blue-Headed Vireo	<i>Vireo solitarius</i>				S5B	ACCDC, BBS, MBBA
Blue-Winged Teal	<i>Anas discors</i>				S4B	ACCDC, BBS, MBBA
Bobolink	<i>Dolichonyx oryzivorus</i>	no schedule, no status	threatened	threatened	S3S4B	ACCDC, BBS, MBBA
Bonaparte's Gull	<i>Larus philadelphia</i>				S5M	ACCDC
Boreal Chickadee	<i>Poecile hudsonica</i>				S4	ACCDC, BBS, CBC, MBBA
Boreal Owl	<i>Aegolius funereus</i>				S1S2B	ACNOS
Brant	<i>Branta bernicla</i>				S2S3M,S2S3 N	ACCDC

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Broad-winged Hawk	<i>Buteo platypterus</i>				S5B	ACCDC, MBBA
Brown Creeper	<i>Certhia americana</i>				S5B	ACCDC, CBC, MBBA
Brown-headed Cowbird	<i>Molothrus ater</i>				S3B	ACCDC, BBS, MBBA
Bufflehead	<i>Bucephala albeola</i>				S3N	ACCDC
Canada Goose	<i>Branta canadensis</i>				SNAB,S4M	ACCDC, BBS, CBC, MBBA
Canada Warbler	<i>Wilsonia canadensis</i>	schedule 1, threatened	threatened	threatened	S3S4B	ACCDC, BBS, MBBA
Cape May Warbler	<i>Dendroica tigrina</i>				S4B	ACCDC, BBS, MBBA
Cattle Egret	<i>Bubulcus ibis</i>				SNA	ACCDC
Cedar Waxwing	<i>Bombycilla cedrorum</i>				S5B	ACCDC, BBS, MBBA
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>				S5B	ACCDC, BBS, MBBA
Chimney Swift	<i>Chaetura pelagica</i>	schedule 1, threatened	threatened	threatened	S2S3B	BBS
Chipping Sparrow	<i>Spizella passerina</i>				S5B	ACCDC, BBS, MBBA
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>				S3S4B	ACCDC, BBS, MBBA
Common Eider	<i>Somateria mollissima</i>				S4	ACCDC, CBC
Common Goldeneye	<i>Bucephala clangula</i>				S4B,S5M,S4N	ACCDC, CBC
Common Grackle	<i>Quiscalus quiscula</i>				S5B	ACCDC, BBS, CBC, MBBA
Common Loon	<i>Gavia immer</i>			not at risk	S4B,S5M,S4N	ACCDC, BBS, CBC, MBBA
Common Merganser	<i>Mergus merganser</i>				S5B,S4N	ACCDC, CBC
Common Nighthawk	<i>Chordeiles minor</i>		threatened		S3B	ACCDC, BBS, MBBA

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Common Raven	<i>Corvus corax</i>				S5	ACCDC, BBS, CBC, MBBA
Common Redpoll	<i>Acanthis flammea</i>				S5N	CBC
Common Tern	<i>Sterna hirundo</i>			not at risk	S3B	ACCDC, MBBA
Common Yellowthroat	<i>Geothlypis trichas</i>				S5B	ACCDC, BBS, MBBA
Dark-Eyed Junco	<i>Junco hyemalis</i>				S5B	ACCDC, BBS, CBC, MBBA
Double-crested Cormorant	<i>Phalacrocorax auritus</i>			not at risk	S5B	ACCDC, BBS, CBC
Downy Woodpecker	<i>Picoides pubescens</i>				S5	ACCDC, BBS, CBC, MBBA
Dunlin	<i>Calidris alpina</i>				S4M	ACCDC
Eastern Bluebird	<i>Sialia sialis</i>			not at risk	S4B	ACCDC, MBBA
Eastern Kingbird	<i>Tyrannus tyrannus</i>				S3S4B	ACCDC, BBS, MBBA
Eastern Meadowlark	<i>Sturnella magna</i>	no schedule, no status	threatened	threatened	S1S2B	BBS
Eastern Phoebe	<i>Sayornis phoebe</i>				S5B	ACCDC, BBS, MBBA
Eastern Towhee	<i>Pipilo erithrophthalmus</i>				SNA	CBC
Eastern Wood-Pewee	<i>Contopus virens</i>	no schedule, no status	special concern	special concern	S4B	ACCDC, BBS, MBBA
European Golden-plover	<i>Pluvialis apricaria</i>					ACCDC
European Starling	<i>Sturnus vulgaris</i>				SNA	ACCDC, BBS, CBC, MBBA
Evening Grosbeak	<i>Coccothraustes vespertinus</i>				S3S4B,S4S5N	ACCDC, BBS, MBBA
Fox Sparrow	<i>Passerella iliaca</i>				S4S5B	CBC
Gadwall	<i>Anas strepera</i>				S2B	ACCDC, MBBA
Glaucous Gull	<i>Larus hyperboreus</i>				S4N	ACCDC, CBC
Golden-crowned Kinglet	<i>Regulus satrapa</i>				S5	ACCDC, BBS, CBC, MBBA

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Gray Catbird	<i>Dumetella carolinensis</i>				S4B	ACCDC, BBS, MBBA
Gray Jay	<i>Perisoreus canadensis</i>				S4B	ACCDC, BBS, CBC, MBBA
Great Black-backed Gull	<i>Larus marinus</i>				S5B,S5N	ACCDC, BBS, CBC, MBBA
Great Blue Heron	<i>Ardea herodias</i>				S4B	ACCDC, BBS, CBC, MBBA
Great Horned Owl	<i>Bubo virginianus</i>				S4S5	ACCDC, ACNOS, MBBA
Greater Scaup	<i>Aythya marila</i>				S1B,S2N	ACCDC
Greater Yellowlegs	<i>Tringa melanoleuca</i>				S5M	ACCDC
Green Heron	<i>Butorides virescens</i>				S1S2B	ACCDC
Green-Winged Teal	<i>Anas crecca</i>				S4S5B	ACCDC, BBS, MBBA
Hairy Woodpecker	<i>Picoides villosus</i>				S5	ACCDC, BBS, CBC, MBBA
Hermit Thrush	<i>Catharus guttatus</i>				S5B	ACCDC, BBS, MBBA
Herring Gull	<i>Larus argentatus</i>				S5B,S5N	ACCDC, BBS, MBBA
Hooded Merganser	<i>Lophodytes cucullatus</i>				S4B	ACCDC, BBS, MBBA
Horned Lark	<i>Eremophila alpestris</i>				S2B	BBS
House Sparrow	<i>Passer domesticus</i>				SNA	ACCDC, BBS, MBBA
House Wren	<i>Troglodytes aedon</i>				S1B	ACCDC, MBBA
Hudsonian Godwit	<i>Limosa haemastica</i>				S4M	ACCDC
Hudsonian Whimbrel	<i>Numenius hudsonicus</i>					ACCDC
Iceland Gull	<i>Larus glaucooides</i>				S4N	ACCDC, CBC
Killdeer	<i>Charadrius vociferus</i>				S3B	ACCDC, BBS, MBBA
Least Flycatcher	<i>Empidonax minimus</i>				S5B	ACCDC, BBS, MBBA
Least Sandpiper	<i>Calidris minutilla</i>				S4M	ACCDC
Lesser Yellowlegs	<i>Tringa flavipes</i>				S5M	ACCDC

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Lincoln's Sparrow	<i>Melospiza lincolni</i>				S4B	ACCDC, BBS, MBBA
Little Gull	<i>Larus minutus</i>				SNA	ACCDC
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>				SNA	ACCDC
Long-Eared Owl	<i>Asio otus</i>				S2S3	ACCDC
Long-Tailed Duck	<i>Clangula hyemalis</i>				S4N	ACCDC, CBC
Magnolia Warbler	<i>Dendroica magnolia</i>				S5B	ACCDC, BBS, MBBA
Mallard	<i>Anas platyrhynchos</i>				S5B,S4N	ACCDC, BBS, MBBA
Marsh Wren	<i>Cistothorus palustris</i>				S2B	ACCDC
Merlin	<i>Falco columbarius</i>			not at risk	S5B	ACCDC, BBS, MBBA
Mourning Dove	<i>Zenaida macroura</i>				S5B	ACCDC, BBS, CBC, MBBA
Mourning Warbler	<i>Oporornis philadelphia</i>				S4B	ACCDC, BBS, MBBA
Nashville Warbler	<i>Vermivora ruficapilla</i>				S5B	ACCDC, BBS, MBBA
Nelson's Sparrow	<i>Ammodramus nelsoni</i>			not at risk	S4B	ACCDC, BBS, MBBA
Northern Flicker	<i>Colaptes auratus</i>				S5B	ACCDC, BBS, CBC, MBBA
Northern Goshawk	<i>Accipiter gentilis</i>				S4	ACCDC, BBS, CBC, MBBA
Northern Harrier	<i>Circus cyaneus</i>			not at risk	S4B	ACCDC, BBS, CBC, MBBA
Northern Mockingbird	<i>Mimus polyglottos</i>				S3B	ACCDC, BBS, MBBA
Northern Parula	<i>Parula americana</i>				S5B	ACCDC, BBS, MBBA
Northern Pintail	<i>Anas acuta</i>				S3B	ACCDC, MBBA
Northern Saw-whet Owl	<i>Aegolius acadicus</i>				S4B,S4N	ACCDC, ACNOS, MBBA
Northern Shoveler	<i>Anas clypeata</i>				S2B	ACCDC, BBS, MBBA
Northern Shrike	<i>Lanius excubitor</i>				S4N	CBC
Northern Waterthrush	<i>Seiurus noveboracensis</i>				S4S5B	ACCDC, BBS, MBBA

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Olive-Sided Flycatcher	<i>Contopus cooperi</i>	schedule 1, threatened	threatened	threatened	S3S4B	ACCDC, BBS, MBBA
Osprey	<i>Pandion haliaetus</i>				S4S5B	ACCDC, BBS, MBBA
Ovenbird	<i>Seiurus aurocapillus</i>				S5B	ACCDC, BBS, MBBA
Palm Warbler	<i>Dendroica palmarum</i>				S5B	ACCDC, BBS, MBBA
Pectoral Sandpiper	<i>Calidris melanotos</i>				S4M	ACCDC
Philadelphia Vireo	<i>Vireo philadelphicus</i>				S5B	MBBA
Pied-Billed Grebe	<i>Podilymbus podiceps</i>				S4B	ACCDC, BBS, MBBA
Pileated Woodpecker	<i>Dryocopus pileatus</i>				S5	ACCDC, BBS, CBC, MBBA
Pine Grosbeak	<i>Pinicola enucleator</i>				S2S3B,S4S5N	ACCDC, BBS
Pine Siskin	<i>Carduelis pinus</i>				S4	ACCDC, BBS, MBBA
Piping Plover (melodus subspecies)	<i>Charadrius melodus melodus</i>	schedule 1, endangered	endangered	endangered	S2B	ACCDC
Purple Finch	<i>Carpodacus purpureus</i>				S4S5B	ACCDC, BBS, MBBA
Purple Sandpiper	<i>Calidris maritima</i>				S3M,S3N	ACCDC
Red Crossbill	<i>Loxia curvirostra</i>				S3	ACCDC, BBS
Red Knot (Rufa Subspecies)	<i>Calidris canutus rufa</i>	schedule 1, endangered	endangered	endangered	S3M	ACCDC
Red-breasted Merganser	<i>Mergus serrator</i>				S3B,S4S5N	ACCDC, MBBA
Red-breasted Nuthatch	<i>Sitta canadensis</i>				S5	ACCDC, BBS, CBC, MBBA
Red-eyed Vireo	<i>Vireo olivaceus</i>				S5B	ACCDC, BBS, MBBA
Red-necked Phalarope	<i>Phalaropus lobatus</i>			special concern	S3M	ACCDC

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Red-shouldered Hawk	<i>Buteo lineatus</i>	schedule 3, special concern		not at risk	S2B	ACCDC
Red-tailed Hawk	<i>Buteo jamaicensis</i>			not at risk	S4B	ACCDC, BBS, CBC, MBBA
Red-winged Blackbird	<i>Agelaius phoeniceus</i>				S4B	ACCDC, BBS, CBC, MBBA
Ring-billed Gull	<i>Larus delawarensis</i>				S3B	ACCDC
Ring-necked Duck	<i>Aythya collaris</i>				S5B	ACCDC, BBS, MBBA
Ring-necked Pheasant	<i>Phasianus colchicus</i>				SNA	ACCDC, BBS, CBC, MBBA
Rock pigeon	<i>Columba livia</i>				SNA	ACCDC, BBS, CBC, MBBA
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>				S4B	ACCDC, BBS, MBBA
Rough-legged Hawk	<i>Buteo lagopus</i>				S4N	ACCDC, CBC
Ruby-crowned Kinglet	<i>Regulus calendula</i>				S4S5B	ACCDC, BBS, MBBA
Ruby-throated Hummingbird	<i>Archilochus colubris</i>				S5B	ACCDC, BBS, MBBA
Ruddy Turnstone	<i>Arenaria interpres</i>				S4M	ACCDC
Ruff	<i>Philomachus pugnax</i>				SNA	ACCDC
Ruffed Grouse	<i>Bonasa umbellus</i>				S5	ACCDC, BBS, CBC, MBBA
Rusty Blackbird	<i>Euphagus carolinus</i>	schedule 1, special concern	special concern	special concern	S3B	BBS, CBC
Sanderling	<i>Calidris alba</i>				S4M,S1N	ACCDC
Savannah Sparrow	<i>Passerculus sandwichensis</i>				S5B	ACCDC, BBS, MBBA
Sedge Wren	<i>Cistothorus platensis</i>				S1B	ACCDC

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Semipalmated Plover	<i>Charadrius semipalmatus</i>				SNRB,S5M	ACCDC
Semipalmated Sandpiper	<i>Calidris pusilla</i>				S4M	ACCDC
Sharp-shinned Hawk	<i>Accipiter striatus</i>			not at risk	S4B	ACCDC, BBS, CBC, MBBA
Short-billed Dowitcher	<i>Limnodromus griseus</i>				S4M	ACCDC
Short-Eared Owl	<i>Asio flammeus</i>	schedule 1, special concern	special concern	special concern	S3B	CBC
Snow Bunting	<i>Plectrophenax nivalis</i>				S5N	CBC
Snowy Egret	<i>Egretta thula</i>				SNA	ACCDC
Snowy Owl	<i>Bubo scandiacus</i>			not at risk	S4N	ACCDC
Song Sparrow	<i>Melospiza melodia</i>				S5B	ACCDC, BBS, CBC, MBBA
Sora	<i>Porzana carolina</i>				S4B	ACCDC, BBS, MBBA
Spotted Sandpiper	<i>Actitis macularius</i>				S4B	ACCDC, BBS, MBBA
Spruce Grouse	<i>Falcipennis canadensis</i>				S5	ACCDC
Stilt Sandpiper	<i>Calidris himantopus</i>				SNA	ACCDC
Swainson's Thrush	<i>Catharus ustulatus</i>				S5B	ACCDC, BBS, MBBA
Swamp Sparrow	<i>Melospiza georgiana</i>				S5B	ACCDC, BBS, MBBA
Tennessee Warbler	<i>Vermivora peregrina</i>				S4B	ACCDC, BBS, MBBA
Tree Swallow	<i>Tachycineta bicolor</i>				S4B	ACCDC, BBS, MBBA
Tricolored Heron	<i>Egretta tricolor</i>				SNA	ACCDC
Turkey Vulture	<i>Cathartes aura</i>				S3B	ACCDC, MBBA
Upland Sandpiper	<i>Bartramia longicauda</i>				S1B	ACCDC, MBBA
Veery	<i>Catharus fuscescens</i>				S4B	ACCDC, BBS, MBBA

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table D1 Bird Species Observed near the LAA (ACCDC, ACNOS, BBS, CBC, and MBBA records)

Common Name	Scientific Name	SARA	NB SARA	COSEWIC	ACCDC S-Rank	Data Source
Vesper Sparrow	<i>Pooecetes gramineus</i>				S2B	BBS
Virginia Rail	<i>Rallus limicola</i>				S3B	ACCDC, BBS
White-breasted Nuthatch	<i>Sitta carolinensis</i>				S5	ACCDC, MBBA
White-rumped Sandpiper	<i>Calidris fuscicollis</i>				S4M	ACCDC
White-throated Sparrow	<i>Zonotrichia albicollis</i>				S5B	ACCDC, BBS, MBBA
White-winged Crossbill	<i>Loxia leucoptera</i>				S4	ACCDC, BBS, CBC, MBBA
Willet	<i>Tringa semipalmata</i>				S2S3B	ACCDC, MBBA
Willow Flycatcher	<i>Empidonax traillii</i>				S1S2B	ACCDC, MBBA
Wilson's Phalarope	<i>Phalaropus tricolor</i>				S1B	ACCDC
Wilson's Snipe	<i>Gallinago delicata</i>				S4B	ACCDC, ACNOS, BBS, MBBA
Wilson's Warbler	<i>Wilsonia pusilla</i>				S4B	ACCDC, BBS, MBBA
Winter Wren	<i>Troglodytes troglodytes</i>				S5B	ACCDC, BBS, MBBA
Wood Duck	<i>Aix sponsa</i>				S4B	ACCDC, BBS, MBBA
Wood Thrush	<i>Hylocichla mustelina</i>	no schedule, no status	threatened	threatened	S1S2B	BBS, MBBA
Yellow Warbler	<i>Dendroica petechia</i>				S5B	ACCDC, BBS, MBBA
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>				S4S5B	ACCDC, BBS, MBBA
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>				S5B	ACCDC, BBS, MBBA
Yellow-rumped Warbler	<i>Dendroica coronata</i>				S5B	ACCDC, BBS, CBC, MBBA

Note: SAR and SOCC are indicated in bold text.

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table B2 Highest Breeding Evidence of Birds within MBBA Squares Crossed by the Project

Common Name	20LR89	20LR99	20MR09	20MS00	20MS10	20MS20	20MS30
Alder Flycatcher	probable	probable	probable	probable	possible	probable	possible
American Bittern		probable	possible	possible	possible	possible	possible
American Black Duck	probable	confirmed			confirmed	confirmed	confirmed
American Crow	probable	probable	confirmed	confirmed	confirmed	confirmed	possible
American Goldfinch	probable	probable	possible	probable	possible	possible	possible
American Kestrel	probable	probable	possible	confirmed	probable	confirmed	confirmed
American Redstart	probable	confirmed	confirmed	probable	confirmed	probable	confirmed
American Robin	confirmed	confirmed	confirmed	confirmed	confirmed	confirmed	confirmed
American Wigeon	confirmed	confirmed				confirmed	
American Woodcock	probable	confirmed	possible	possible	possible	probable	
Bald Eagle	possible			possible			probable
Bank Swallow	confirmed			probable	possible	confirmed	possible
Barn Swallow	confirmed	probable	confirmed	confirmed	probable	confirmed	probable
Barred Owl	possible	possible	probable	possible	probable		probable
Bay-Breasted Warbler	possible	possible	possible	possible	possible	possible	possible
Belted Kingfisher	probable	possible	possible	possible		confirmed	confirmed
Black Tern		probable					
Black-and-white Warbler	probable	probable	confirmed	possible	possible	probable	
Black-backed Woodpecker				possible			
Black-billed Cuckoo			possible	possible		possible	
Blackburnian Warbler	possible	possible	possible	possible	possible	probable	probable
Black-capped Chickadee	probable	probable	probable	probable	confirmed	possible	confirmed
Blackpoll Warbler						possible	
Black-throated Blue Warbler	possible		possible	possible	possible	possible	

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table B2 Highest Breeding Evidence of Birds within MBBA Squares Crossed by the Project

Common Name	20LR89	20LR99	20MR09	20MS00	20MS10	20MS20	20MS30
Black-throated Green Warbler	probable	possible	possible	probable	probable	probable	possible
Blue Jay	probable	possible	confirmed	probable	confirmed	probable	possible
Blue-headed Vireo	probable	probable	confirmed	probable	probable	possible	possible
Blue-winged Teal		confirmed			possible		probable
Bobolink	possible	confirmed	confirmed	probable	possible	probable	probable
Boreal Chickadee	possible			confirmed			possible
Broad-winged Hawk		possible			possible	possible	
Brown Creeper		possible	possible			possible	possible
Brown-headed Cowbird	possible						
Canada Goose	confirmed	confirmed	probable		possible		
Canada Warbler		possible	possible	possible	possible	possible	possible
Cape May Warbler	possible	possible	confirmed	possible	possible	possible	possible
Cedar Waxwing	probable	probable	confirmed	possible	confirmed	confirmed	confirmed
Chestnut-sided Warbler	probable	probable	probable	probable	confirmed	probable	confirmed
Chipping Sparrow	confirmed	probable	confirmed	possible	possible	possible	possible
Cliff Swallow	confirmed	confirmed	confirmed	confirmed	confirmed		confirmed
Common Grackle	confirmed	confirmed	probable	confirmed	possible	confirmed	confirmed
Common Loon	probable	probable	probable	confirmed	confirmed		
Common Nighthawk	possible	possible					
Common Raven	confirmed	possible	probable	confirmed	possible	confirmed	possible
Common Snipe	probable	probable	possible	probable	probable	probable	probable
Common Tern							confirmed
Common Yellowthroat	probable	confirmed	confirmed	probable	confirmed	probable	confirmed
Dark-eyed Junco	confirmed	probable	confirmed	probable	possible	possible	confirmed

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table B2 Highest Breeding Evidence of Birds within MBBA Squares Crossed by the Project

Common Name	20LR89	20LR99	20MR09	20MS00	20MS10	20MS20	20MS30
Downy Woodpecker	probable	probable	possible		probable	possible	possible
Eastern Bluebird	confirmed					confirmed	confirmed
Eastern Kingbird		possible		possible	possible	probable	
Eastern Phoebe		possible	possible				
Eastern Wood-pewee				possible	possible		possible
European Starling	confirmed	confirmed	confirmed	confirmed	confirmed	confirmed	confirmed
Evening Grosbeak	probable						possible
Gadwall				confirmed			
Golden-crowned Kinglet	probable	possible	possible	possible	probable	probable	possible
Gray Catbird		possible	possible	possible	possible	probable	probable
Gray Jay	probable	possible	confirmed	possible	probable		probable
Great Blue Heron			possible				possible
Great Horned Owl				possible			confirmed
Green-Winged Teal	confirmed	confirmed		probable		confirmed	probable
Hairy Woodpecker	confirmed	possible	possible	possible	possible	probable	possible
Hermit Thrush	probable	probable	confirmed	confirmed	possible	possible	confirmed
Hooded Merganser				confirmed		confirmed	
House Sparrow		possible		confirmed			
House Wren	probable						
Killdeer	probable	confirmed	confirmed	confirmed		possible	possible
Least Flycatcher	possible	possible	possible	probable	possible	probable	possible
Lincoln's Sparrow		possible					
Magnolia Warbler	confirmed	probable	confirmed	probable	possible	probable	confirmed
Mallard	probable	confirmed	possible			confirmed	

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table B2 Highest Breeding Evidence of Birds within MBBA Squares Crossed by the Project

Common Name	20LR89	20LR99	20MR09	20MS00	20MS10	20MS20	20MS30
Mallard X Am. Black Duck		confirmed					
Merlin	probable						confirmed
Mourning Dove	probable	probable	possible	confirmed	possible	probable	confirmed
Mourning Warbler	possible			possible		possible	probable
Nashville Warbler	confirmed	confirmed	possible	probable	confirmed	probable	probable
Nelson's Sparrow	possible				confirmed	possible	possible
Northern Flicker	probable	confirmed	confirmed	possible	confirmed	probable	confirmed
Northern Goshawk	probable	possible	possible				
Northern Harrier	possible	probable		possible	probable	confirmed	possible
Northern Mockingbird	possible					possible	confirmed
Northern Parula	probable	probable	confirmed	probable	probable	confirmed	probable
Northern Pintail	probable						
Northern Saw-Whet Owl		possible	possible	possible	possible		
Northern Shoveler	probable						
Northern Waterthrush		possible		possible			
Olive-sided Flycatcher	possible	possible	probable	possible	possible		
Osprey	confirmed	possible	possible	possible	probable	probable	confirmed
Ovenbird	probable	probable	possible	probable	probable	probable	probable
Palm Warbler		probable	possible	probable	possible	possible	
Pied-billed Grebe	confirmed	probable	probable				
Pileated Woodpecker	probable	possible	possible	possible	possible	probable	probable
Pine Siskin	probable	possible		possible	possible		possible
Purple Finch	probable	probable	confirmed	possible	possible	probable	possible
Red-breasted Merganser						probable	

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table B2 Highest Breeding Evidence of Birds within MBBA Squares Crossed by the Project

Common Name	20LR89	20LR99	20MR09	20MS00	20MS10	20MS20	20MS30
Red-breasted Nuthatch	confirmed	possible	possible	possible	possible	probable	possible
Red-eyed Vireo	probable	probable	confirmed	probable	possible	probable	possible
Red-tailed Hawk	probable	possible		possible		possible	
Red-winged Blackbird	confirmed	confirmed	possible	probable	possible	probable	probable
Ring-necked Duck	confirmed	confirmed		possible	probable		probable
Ring-necked Pheasant	probable	confirmed	probable	possible	possible	confirmed	possible
Rock Pigeon	confirmed	probable	probable	confirmed	probable	probable	possible
Rose-breasted Grosbeak		possible			possible	possible	probable
Ruby-crowned Kinglet	possible	possible	probable	probable	probable	probable	probable
Ruby-throated Hummingbird	probable	probable	confirmed	probable		probable	confirmed
Ruffed Grouse	possible	probable	possible	confirmed	probable		confirmed
Savannah Sparrow	possible	confirmed	possible	possible	possible	probable	possible
Sharp-shinned Hawk		possible					
Song Sparrow	confirmed	confirmed	confirmed	probable	probable	confirmed	confirmed
Sora	possible	probable					
Spotted Sandpiper	probable	probable			possible	possible	
Swainson's Thrush	probable	possible	possible	probable	possible	possible	probable
Swamp Sparrow	probable	confirmed	probable	probable	probable	confirmed	confirmed
Tennessee Warbler	possible			possible	possible	probable	possible
Tree Swallow	confirmed	confirmed	probable	confirmed	possible	confirmed	confirmed
Turkey Vulture	possible						
Upland Sandpiper						probable	
Veery	probable			possible	possible	possible	possible
White-breasted Nuthatch		possible					

PEI-NB CABLE INTERCONNECTION UPGRADE PROJECT - VOLUME 3, NEW BRUNSWICK

September 30, 2015

Table B2 Highest Breeding Evidence of Birds within MBBA Squares Crossed by the Project

Common Name	20LR89	20LR99	20MR09	20MS00	20MS10	20MS20	20MS30
White-throated Sparrow	confirmed	probable	confirmed	probable	confirmed	confirmed	confirmed
White-winged Crossbill		probable		possible			possible
Willet					possible	possible	possible
Willow Flycatcher		possible					
Wilson's Warbler		possible	possible		possible	possible	
Winter Wren	possible	possible	possible	possible	possible	possible	
Wood Duck		probable			possible	confirmed	possible
Yellow Warbler	confirmed	confirmed	confirmed	possible	probable	probable	possible
Yellow-bellied Flycatcher		possible	possible	possible			
Yellow-bellied Sapsucker	possible	probable		probable	possible	possible	
Yellow-rumped Warbler	confirmed	probable	confirmed	confirmed	possible	confirmed	possible