4.0 SUMMARY OF ENVIRONMENTAL EFFECTS

4.1 METHODOLOGY

Baseline and field studies were conducted from April through November, 2016, with the intent of defining the existing environmental conditions with which the Project may interact. The field studies provided ground-truthing for select environmental features and identified additional potential Project-environment interactions that could not be obtained from desktop information, or interviews with representatives of relevant groups and organizations. These studies were conducted largely within 100 m of the centreline of the proposed RoW noted in Section 2.3. Field studies, which are described below, included the Aquatic Environment, Terrestrial Environment, and Heritage Resources.

4.1.1 Valued Components

Based on its professional experience and judgment with similar projects, the Stantec team selected the following seven valued components (VCs) as those that could most interact with the Project:

- Atmospheric Environment
- Water Resources (surface water and groundwater)
- Fish and Fish Habitat
- Terrestrial Environment (including wetlands, vegetation, and wildlife)
- Socioeconomic Environment
- Heritage Resources
- Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Additionally, Effects of the Environment on the Project were selected for evaluation.

4.1.2 VC Rating

A binary qualitative rating system was used to determine the potential for interactions between the Project and the environment. The ratings were prescribed for each individual VC as one of the following:

- An interaction between the Project and the environment may occur
- No interaction occurs between the Project and the environment

Project activities with the potential for interactions with the environment are discussed in Sections 4.2 and 4.3, including a description of existing (baseline) conditions, potential interactions with the Project, and planned mitigation to reduce Project-environment interactions.

4.2 POTENTIAL INTERACTIONS OF THE PROJECT AND THE ENVIRONMENT

Based on the Project Description (Chapter 2), the Environmental Setting (Chapter 3), and the methods described briefly above, the potential interactions between the Project and the environment are summarized in Table 4.1.

Table 4.1 Potential Interactions of the Project with the Environment

Activities / Physical Works Associated with the Project	Atmospheric Environment	Water Resources (Surface Water and Groundwater)	Fish and Fish Habitat	Terrestrial Environment (Including Wetlands, Vegetation, and Wildlife)	Socioeconomic Environment	Heritage Resources	Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons	Effects of the Environment on the Project
Construction								
Vegetation Clearing	✓	✓	✓	✓	✓	✓	✓	
Access and Staging		✓	✓	✓		✓	✓	
Excavation	✓	✓	✓	✓		✓	✓	✓
Pole Placement	✓	✓				✓	✓	✓
Structure Assembly							✓	✓
Anchoring	✓						✓	✓
Conductor Stringing	✓						✓	✓
Inspection and Energization				✓				✓
Cleanup / Revegetation	✓			✓				✓
Operation and Maintenance								
Operation	✓			✓				✓
Maintenance of Hardware	✓							✓
Vegetation Management	✓			✓			✓	✓

Table 4.1 Potential Interactions of the Project with the Environment

Activities / Physical Works Associated with the Project	Atmospheric Environment	Water Resources (Surface Water and Groundwater)	Fish and Fish Habitat	Terrestrial Environment (Including Wetlands, Vegetation, and Wildlife)	Socioeconomic Environment	Heritage Resources	Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons	Effects of the Environment on the Project
Decommissioning and Abandonment								
Decommissioning of Facilities	✓						✓	✓
Site Reclamation	✓			✓	✓			✓
✓ - indicates an interaction between the Project and the environment may occur.								

In the table above, the interaction with a particular VC is identified when the interaction first occurs. For example, while all activities during the Construction phase have the potential to affect Heritage Resources, the highest potential to encounter heritage resources (*e.g.*, artifacts, fossils) would be during initial ground breaking activities (*i.e.*, Vegetation Clearing, Access and Staging, and Excavation), after which it would be less likely (though still possible) to encounter heritage resources. In that example, interactions are not noted for other subsequent activities that may occur after ground breaking has occurred (*e.g.*, Anchoring, Conductor Stringing) as any heritage resources that might have been present would have likely been discovered during the earlier ground breaking activities. This is to avoid accounting for the same environmental effect multiple times during the same phase of the Project.

4.3 ENVIRONMENTAL EFFECTS ASSESSMENT

4.3.1 Atmospheric Environment

This section assesses the potential environmental interactions between Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project and the Atmospheric Environment VC. The Atmospheric Environment was included as a VC because of the potential for the Project activities to interact with air quality, climate and greenhouse gases (GHG), and sound quality.

4.3.1.1 Scope of Assessment

Air quality is characterized by the breakdown of components in ground-level air. Air quality is described as good or bad in consideration of the amount of air contaminants present in the atmosphere at ground-level in comparison to applicable standards.

Climate is characterized by the meteorological conditions of a region, (including temperature, air pressure, humidity, precipitation, sunshine, cloudiness, and winds) throughout seasonal periods. Data are commonly presented as an average over a period of 30 years (ECCC, 2016a). Climate change is thought to be affected by the release of GHGs (including carbon dioxide, methane, and nitrous oxide) from human activities and from natural processes/sources. GHGs produced by Project-based activities are evaluated in consideration of the influence of GHG releases on climate change, although it is understood that individual projects alone would not contribute sufficient GHG releases to measurably influence climate change on a global scale.

Sound quality is characterized by the type, frequency, intensity, and duration of noise (unwanted sound) in the ambient environment. Vibration, or the oscillations in matter that may lead to unwanted sound or stress in materials, is also considered to be a component of sound quality.

Electromagnetic fields (EMF) are defined as invisible forces that surround electrical equipment and wires used to transport electricity, including outdoor power lines (Government of Canada 2016). EMF may originate from transmission lines.

Air contaminants that will be considered in the assessment of this VC are those that are typically linked to this project type such as those produced during construction by fuel combustion and operation of heavy equipment/machinery. Combustion gases and particulate matter (dust) are the primary contaminants of concern pertaining to Project components and activities described in Section 2.5. GHG production from fuel combustion in heavy equipment is considered pertaining to environmental effects on climate change. Sound pressure levels and vibration levels are considered in the assessment of sound quality.

Ambient air quality objectives applicable to the Project are defined by the *Air Quality Regulation 97-133* under the *New Brunswick Clean Air Act* and noise is defined as a contaminant under the same Act (though no noise standards or objectives are specifically defined). Currently, no applicable requirements to limit emissions of GHG exist. There are no established national guidelines or exposure levels for EMF due to insufficient scientific evidence linking EMF exposure to health problems (Health Canada 2009).

4.3.1.1.1 Potential Environmental Effects, Pathways, and Measurable Parameters

Activities and components of the Project have the potential to interact with the Atmospheric Environment. In consideration of these potential interactions, the assessment of Project-related environmental effects on the Atmospheric Environment is therefore focused on the following potential environmental effect:

- Change in air quality, GHGs, sound quality, or EMF

Table 4.2 outlines the potential environmental effects, pathways and measurable parameters associated with the Atmospheric Environment as they relate to the Project.

Table 4.2 Potential Environmental Effects, Environmental Effects Pathways, and Measurable Parameters for the Atmospheric Environment

Potential Environmental Effect	Environmental Effect Pathways	Measurable Parameter(s) and Units of Measurement
Change in Air Quality, GHGs, Sound Quality or EMF	• Construction activities and heavy equipment creating airborne dust (particulate matter) and combustion gas emissions. • Construction activities and heavy equipment causing GHGs. • Construction activities and heavy equipment creating noise or vibration or decreased sound quality. • Operation of the transmission line and substation causing potential EMF.	• Change in combustion gases, particulate matter, and/or GHGs in the atmosphere (units of measure are parameter specific). • Change in sound pressure levels and/or vibration (units of measure are parameter specific). • Change in EMF (volts/metre).

Electricity transmission through overhead power lines is expected to generate EMFs; however, Health Canada reviewed current EMF information and concluded that there is inadequate evidence correlating EMF and risk to human health for the frequencies associated with electrical transmission lines (Health Canada 2009). As such, EMF will not be discussed further in this assessment. Its environmental effects are not significant, with a moderate level of confidence given the uncertainties in the body of evidence relating to environmental effects of EMF.

4.3.1.1.2 Boundaries

4.3.1.1.2.1 Spatial Boundaries

The assessment of potential environmental effects on the Atmospheric Environment encompasses two spatial boundaries: the PDA and LAA. These are described below.

Project Development Area (PDA)

The PDA is the immediate area encompassing the Project footprint, and is limited to the expected area of physical disturbance associated with the Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project. The PDA includes the footprint of the 15.7 km-long, 30 m-wide RoW for the new 69 kV transmission line to be constructed and the 0.4 ha footprint of the new substation. The PDA is illustrated in Figure 2.1.

Local Assessment Area (LAA)

The LAA for Atmospheric Environment is the area within 1 km on either side of the transmission line and new substation. The LAA defines the area where the most prominent potential environmental effects could arise. Dust and noise from Construction dissipates with distance from the PDA. The LAA as it applies to the Atmospheric Environment is illustrated in Figure 4.1 The LAA is not applicable when considering GHG releases and climate change because the environmental effects of GHG emissions are experienced globally.

4.3.1.1.2.2 Temporal Boundaries

Temporal boundaries identify when an environmental effect is evaluated in relation to specific project phases and activities. The temporal boundaries for the assessment of the potential environmental effects of the Project on the Atmospheric Environment include the following periods:

- Construction – anticipated to occur in 2019
- Operation and Maintenance – approximately 50 years or the end of service life
- Decommissioning and Abandonment – anticipated to be three months in duration following the end of service life

There is potential for the Project to interact with the Atmospheric Environment during all phases of the Project.

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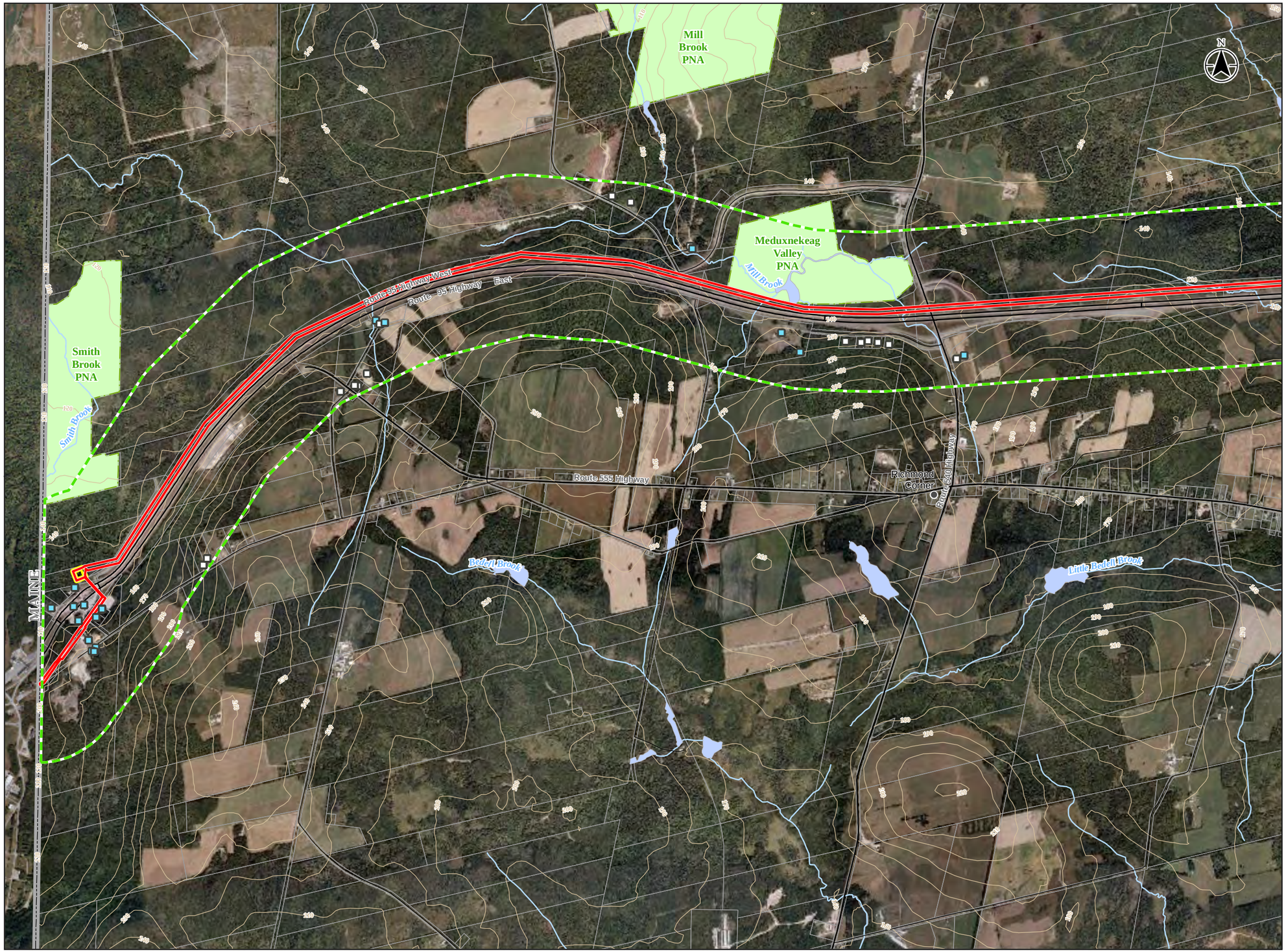
Local Assessment Area for the Atmospheric Environment



Sensitive Receptor

- Building
- Residence
- Local Assessment for the Atmospheric Environment
- Project Development Area
- Proposed Substation
- Contour (10 m)
- Watercourse
- Property Boundary
- Protected Natural Area
- Waterbody

Sources: Base Data obtained from Service New Brunswick.

0 0.25 0.5 0.75 1

Kilometres

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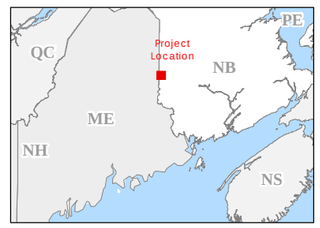
NAD 1983 CSRS NBDS



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Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

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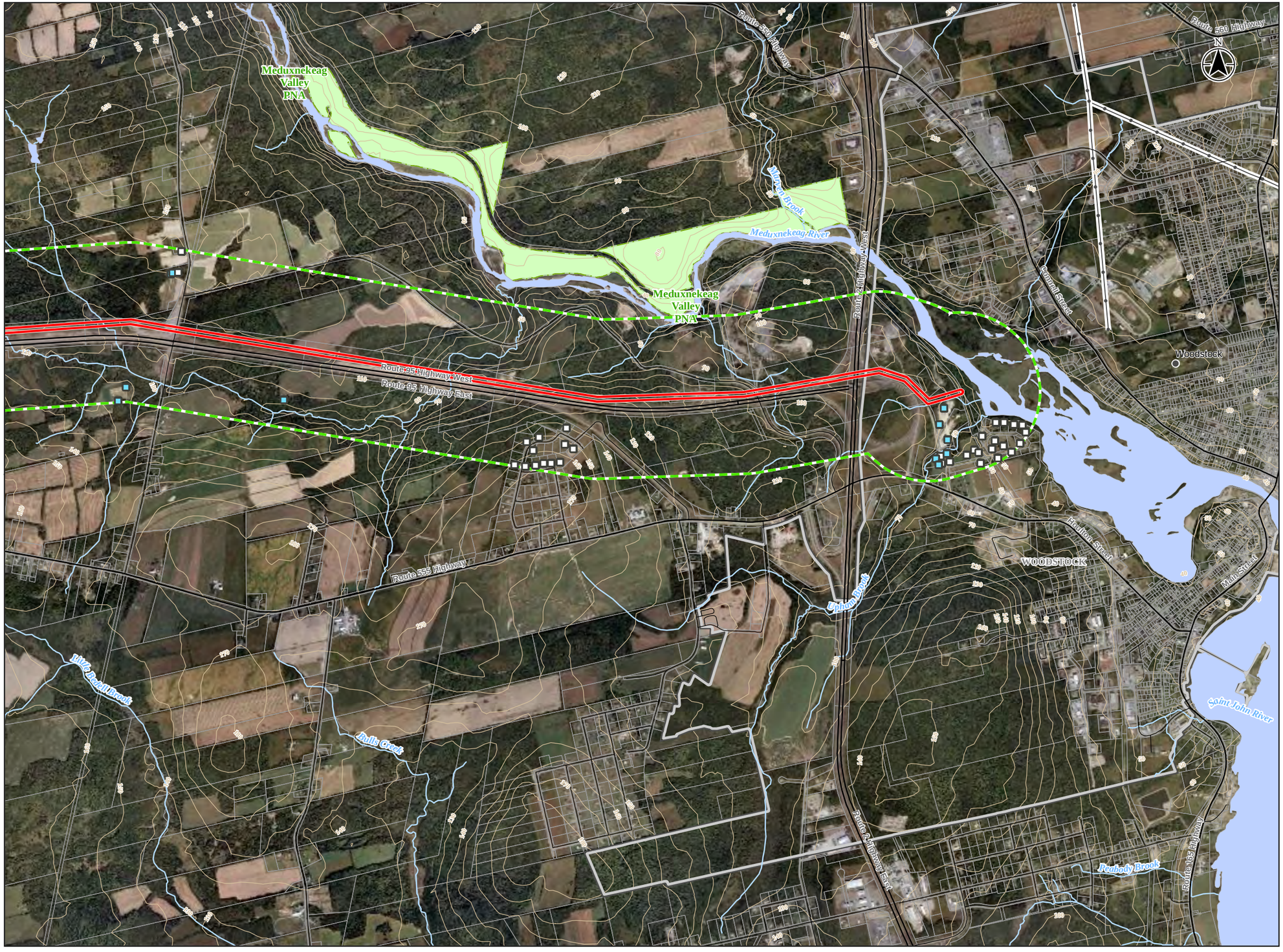

Local Assessment Area for the Atmospheric Environment

Sensitive Receptor

- Building
- Residence
- Local Assessment for the Atmospheric Environment
- Project Development Area
- Contour (10 m)
- Existing Transmission Line
- Watercourse
- Municipal Boundary
- Property Boundary
- Protected Natural Area
- Waterbody

Sources: Base Data obtained from Service New Brunswick.

0 0.25 0.5 0.75 1

Kilometres

NAD 1983 CSRS NBDS

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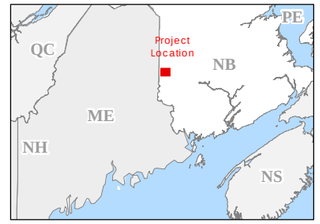

121812277 - HOULTON INTERNATIONAL TRANSMISSION LINE

Stantec

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

4.3.1.1.3 Significance Criteria

A significant adverse residual environmental effect on the Atmospheric Environment is defined as one that results in:

- Releases of air contaminants and/or particulate matter that cause frequent exceedances of air quality standards or objectives
- Long-term increases of sound pressure levels in the LAA to levels that are likely to interfere with normal enjoyment of life or the use or enjoyment of personal property

For GHG emissions, it is recognized that it is not possible to assess significance related to a measured environmental effect on climate change on a project-specific basis. The magnitude of the Project GHG emissions (on a tonnes CO_2e per annum basis) is based on the following criteria from the Canadian Environmental Assessment Agency (CEA Agency 2003):

- Less than 10,000 tonnes CO_2e per annum is considered "low" (since below this level, reporting to the federal program will not be required)
- Between 10,000 and 500,000 tonnes CO_2e per annum is considered "medium"
- Greater than 500,000 tonnes CO_2e per annum is considered "high"

As per the CEA Agency guidance, where the GHG emissions are either "medium" or "high", a GHG Management Plan must be prepared for the Project.

4.3.1.2 Existing Conditions for the Atmospheric Environment

4.3.1.2.1 Air Quality

There are no nearby industrial sources of air pollution to the Project. Activities contributing to air contaminant emissions in the PDA include combustion emissions from vehicles, aircraft, and farming equipment, and dust generated from farming activities such as plowing and travel on unpaved roads. Contaminants produced from sources in other regions have the potential to be transported long distances and could affect atmospheric air quality in the area.

The air quality monitoring station closest to the PDA is in Canterbury, New Brunswick, approximately 34 km southeast of the PDA. Air quality reports issued by the Province indicate that there were no exceedances of the air quality objectives for ozone or fine particulate matter in 2010, 2011, 2012, 2013, or 2014 (NBDELG 2012b; 2013; 2015; 2016). Not all air quality parameters are monitored at the Canterbury air quality monitoring station; however, based on air quality data collected at numerous locations around the province, exceedances for these or other measured parameters typically occur only in areas near large industrial sources of air contaminants. It is expected that provincial air quality objectives are being achieved within the LAA because the area is largely rural with no large industrial sources nearby.

The Canadian Ambient Air Quality Standards (CAAQS) document long-term trends for fine particulate matter and ground-level ozone across Canada. At the Canterbury monitoring

station, the 2015 CAAQS objectives were met from data collected in 2012, 2013, and 2014 (NBDELG 2016). Therefore, air quality in the LAA is considered good.

4.3.1.2.2 Climate

There is an Environment and Climate Change Canada (ECCC) weather station with available historical data located in Woodstock, approximately 5 km east of the LAA. Climate normals at the Woodstock ECCC station were discussed in Section 3.2.1.

4.3.1.2.3 Greenhouse Gas Emissions

In 2014, total Canada-wide GHG emissions were 732 million tonnes of carbon dioxide equivalent (tCO_2e). With 15.0 million tCO_2e being released in New Brunswick in 2014, the province represents a small portion (approximately 2.0%) of Canada's total annual GHG emissions (ECCC 2016b).

The most recently available data estimates for global GHG emissions are from 2013 and indicate that global GHG releases are 45.2 billion tCO2e, excluding land use change and forestry. Therefore, Canada contributes approximately 1.6% to global GHG emissions (World Resources Institute 2017).

4.3.1.2.4 Sound Quality

The LAA consists of rural and agricultural land with residential dwellings (Figure 4.1). Woodstock and Richmond Corner are the areas within the LAA that are the most densely populated. No other receptors were identified near the Project. Sound quality in the LAA is expected to be mainly influenced by vehicle traffic, aircraft, and the operation of farming equipment.

Typical ambient sound levels for a rural setting with similar population densities to the PDA is 35 A-weighted decibels (dBA) at night, and 45 dBA during the day (AER 2007). The existing ambient sound pressure levels within the PDA are expected to be greater than typical ambient sound levels due to proximity of the Houlton International Airport, located approximately 5 km from the PDA, and traffic on Route 95, located within 0.50 km from the PDA. Based on a study conducted at the Boston Logan International Airport, noise readings taken at a distance of 5 km from the airport measured approximately 60 dBA (Massport and the Environment 2014) and the typical sound level produced from highway traffic is 75 dBA at a distance of 15 m (AER 2007).

No background sound pressure level monitoring was conducted for this Project.

4.3.1.3 Assessment of Potential Environmental Effects on the Atmospheric Environment

4.3.1.3.1 Project-Effect Pathways for the Atmospheric Environment

Construction

Construction of the new transmission line and substation are expected to produce small quantities of combustion gases as well as GHGs from equipment used for forest clearing, grading, and pole installation activities, as well as large trucks travelling to and from the Project site. However, Construction will take place over a relatively short period, and Project equipment will adhere to preventative maintenance schedules. Additionally, an idling awareness program will be implemented to lower unnecessary combustion gas emissions from vehicle idling.

Excavation activities and equipment moving along unpaved surfaces are expected to generate dust; however, standard mitigation practices can suppress dust levels to below regulatory objectives. These practices include timely revegetation of areas where the soil has been disturbed, as well as the use of dust suppressants and water on access roads, during dry or windy periods. Topsoil and overburden stockpiles will be seeded and revegetated regularly. Stockpiles will be wetted to reduce amounts of dust generated during the handling and transfer of material.

In consideration of available standard mitigation practices and the duration of Construction, Project-related releases of air contaminants are unlikely to cause exceedances of air quality standards. Similarly, because of the small scope and duration of Construction, Project-related releases of GHGs during Construction will not measurably contribute to provincial and national GHG totals. An estimate was done to calculate GHG emissions from construction based on the quantity and type of equipment required combined with operating hours and the PDA footprint. GHG emissions from the Project are estimated to be approximately 1,000 tCO_2e. Because emissions are less than 10,000 tonnes CO_2e, the project is considered a “low” emitter and no GHG management plan would be required according to CEA Agency assessment guidance.

Use of large equipment and vehicles during Construction will emit sound and vibration. Noise and vibration will be transient and short in duration and will generally occur inside the PDA and adjacent areas. Construction activities will be restricted to daytime hours to lessen the disturbance to nearby residences. In the unlikely event that blasting is required, blasting activities will be carefully controlled by qualified personnel and the extent of blasting activity will be localized and short term. Residents will be notified in advance of any blasting activity. Because of the linear progression of Construction, it is anticipated that any given nearby residence or other sensitive receptor will be exposed to potentially increased noise levels for less than a week at a given time. To reduce overall noise during Construction, equipment will be in good working order, and will undergo preventative maintenance, such as inspection to ensure proper functioning mufflers. Further, because increased rural ambient sound levels likely exist in the PDA

due to proximity of the Houlton International Airport and traffic on Route 95, substantial increase of sound levels is not expected from the Project.

Operation and Maintenance

No substantial air contaminant, GHG, or noise or vibration emissions are expected to occur during Operation and Maintenance of the new transmission line and substation. During normal operation of the transmission line, there will be no equipment on the RoW. Vegetation maintenance activities will be very infrequent, with several years passing between maintenance vegetation maintenance events.

Decommissioning and Abandonment

Air contaminant, GHG, and noise emissions during Decommissioning and Abandonment of the Project are expected to be comparable or less than those that would occur during Construction.

4.3.1.3.2 Mitigation for the Atmospheric Environment

Measures that will be employed to mitigate Project environmental effects on the Atmospheric Environment include:

- Scheduled preventative maintenance for Project equipment to lessen air contaminant, GHG, and noise emissions
- Implementation of an idling awareness program to lower emissions associated with non-essential vehicle idling
- Implementation of standard dust control mitigation practices such as immediate revegetation of exposed soil, as well as the use of dust suppressants (such as water sprays) on unpaved areas under dry or windy conditions
- Construction during daytime hours to reduce disturbances (such as noise) to nearby residents

4.3.1.3.3 Residual Environmental Effects on the Atmospheric Environment

Due to the short construction period, the planned dust control mitigation measures, and the preventative maintenance schedules to be implemented for Project equipment, releases (e.g., air contaminants and/or particulate matter) associated with the Project are unlikely to cause exceedances of air quality objectives. As a result, no significant changes to air quality or climate are anticipated.

GHG emissions from the Project are estimated to be approximately 1,000 tCO_2e, which represents less then 0.01% of provincial GHG emissions. Because emissions are less than 10,000 tonnes CO_2e, the project is considered a “low” emitter and no GHG management plan would be required according to CEA Agency assessment guidance.

Although sound pressure levels could potentially increase near the Project during Construction, noise will mainly be limited to the PDA and adjacent areas, will be restricted to daytime hours, and will be transient and of short duration. Further, the existing ambient sound levels in the PDA are greater than typical ambient sound levels reported for a similar rural setting (35 dBA at night and 45 dBA during the day (AER 2007)) due to the proximity to the Houlton International Airport and Route 95. Therefore, no substantial changes in sound pressure levels or significant environmental effects from increases to sound quality are anticipated.

4.3.1.4 Determination of Significance

With the application of proposed mitigation, the residual environmental effects of the Project on a change in air quality, GHGs, sound quality or EMF as part of the Atmospheric Environment during all phases of the Project are predicted to be not significant. This prediction is made with a high level of confidence in view of the limited nature of the Project and its associated emissions as well as the application of known mitigation to reduce environmental effects.

4.3.2 Water Resources

This section assesses the potential environmental interactions between Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project and the Water Resources VC. Water Resources has been included as a VC due to its potable, recreational, and commercial value, and because of the potential for the Project to interact with groundwater and surface waters.

4.3.2.1 Scope of Assessment

Water Resources consists of water that is available for human use and comes from one of two sources of water: groundwater and surface water. Human use of Water Resources includes consumption, as well as residential, agricultural, commercial, and industrial use. The role of surface water as a component of fish habitat is described further in Section 4.3.3.

4.3.2.1.1 Potential Environmental Effects, Pathways, and Measurable Parameters

There is potential for the Project to interact with Water Resources during the Construction, Operation and Maintenance, and Decommissioning and Abandonment phases. These interactions could result in changes to the quantity or quality of groundwater and/or surface water. The potential effect pathways of these interactions are listed in Table 4.3. Measurable parameters, which will serve to characterize the potential environmental effects of any change to Water Resources, are also provided in Table 4.3.

Table 4.3 Potential Environmental Effects, Environmental Effects Pathways, and Measurable Parameters for Water Resources

Potential Environmental Effect	Environmental Effect Pathways	Measurable Parameter(s) and Units of Measurement
Change in the Quantity and/or Quality of Water Resources	• Change in fracture patterns in bedrock aquifers resulting from blasting or other construction activities. • Increased rates of surface water runoff resulting from vegetation removal in the RoW and substation site.	• Change in the quantity (m^3) of groundwater available for human use. • Change in baseline groundwater quality (units of measure are parameter specific, e.g., mg/L for nitrate) • Changes in the rates of surface water runoff (m^3/s).

4.3.2.1.2 Boundaries

4.3.2.1.2.1 Spatial Boundaries

The assessment of potential environmental effects on Water Resources encompasses two spatial boundaries: the PDA and LAA. These are described below.

Project Development Area (PDA)

The PDA is the immediate area encompassing the Project footprint, and is limited to the expected area of physical disturbance associated with the Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project. The PDA includes the footprint of the 15.7 km-long, 30 m-wide RoW for the new 69 kV transmission line to be constructed and the 0.4 ha footprint of the new substation. The PDA is illustrated in Figure 2.1.

Local Assessment Area (LAA)

The LAA for Water Resources includes the area up to 500 m on both sides of the PDA. Beyond this, the environmental effects of the Project on Water Resources are expected to be minimal. Aquifers within the LAA are expected to follow the general drainage patters of the watershed the LAA is located within. The LAA is illustrated in Figure 4.2.

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Saint John River Basin
Meduxnekeag River

Saint John River Basin
Bulls Creek Composite

Meduxnekeag Valley PNA

Mill Brook PNA

Smith Brook PNA

Jacksonville

Woodstock

Grafton

Richmond Corner

WOODSTOCK

Woodstock Protected Well Field

Route 95 Highway East

Route 95 Highway West

Route 555 Highway

Route 560 Highway

Route 550 Highway

Route 2 Highway East

Route 2 Highway West

Route 103 Highway

Route 585 Highway

Route 105 Highway

Connell Street

Main Street

Houlton Street

Marven Brook

Mill Brook

Bedell Brook

Little Bedell Brook

Meduxnekeag River

Uphams Brook

Bulls Creek

Peabody Brook

Saint John River

Riviere Saint-Jean

Lamb Creek

Gurries Lake

MAINE

N

- Potable Well
- Protected Well Field
- Watershed Boundary
- Local Assessment Area for Watersheds and Water Resources
- Project Development Area
- Proposed Substation
- Contour (10 m)
- Existing Transmission Line
- Watercourse
- Protected Natural Area
- Waterbody

0 0.5 1 1.5 2
kilometres

121812277-006

NAD 1983 CSRS NBDS

Project Location

QC PE ME NH NS MA

Sources: Base data obtained by Service New Brunswick.

Watersheds and Water Resources Assessment Area

Stantec

121812277 - HOLUTON INTERNATIONAL TRANSMISSION LINE

Figure 4.2

4.3.2.1.2.2 Temporal Boundaries

The temporal boundaries for the assessment of Water Resources include the following time periods:

- Construction –anticipated to occur in 2019
- Operation and Maintenance – approximately 50 years or the end of service life
- Decommissioning and Abandonment – anticipated to be three months in duration following the end of service life

4.3.2.1.3 Significance Criteria

A significant adverse residual environmental effect on Water Resources is one that results in:

- A decrease in the quantity or quality of groundwater or surface water such that it becomes inadequate for its current intended use or, if used as drinking water, is no longer suitable for human consumption
- An increase in surface water runoff that results in a greater than 10% change to watershed flow regimes

4.3.2.2 Existing Conditions for Water Resources

The Project is located within the Meduxnekeag River composite watershed. There are no known surface water intakes or Designated Watershed Protected Areas within the LAA.

Municipal water for the town of Woodstock is supplied from groundwater via two wells approximately 45 m in depth. These wells are located on an island in the Saint John River located approximately 2.3 km east of the LAA (Town of Woodstock 2010), and a designated Wellfield Protected Area for these wells is limited to the footprint of the island.

It is anticipated that residents and businesses within the LAA source their domestic drinking water from groundwater wells. Within the LAA, there are 59 properties with buildings present, including several properties that contain multiple buildings. There are 49 residential buildings and 28 non-residential buildings, including eight businesses on these properties. The New Brunswick Online Well Log System (NBOWLS) has record of 27 registered wells within the LAA, 26 of which are domestic drinking water wells and one is a non-drinking water well (NBDELG 2017). The available characteristics of these wells are summarized in Table 4.4.

Table 4.4 Available Water Well Characteristics in the LAA

Parameter	Minimum	Mean	Maximum	Number of Wells
Wells with Records (NBOWLS)	-	-	-	27
Well Depth (m)	16.8	51.9	126.5	26

Table 4.4 Available Water Well Characteristics in the LAA

Parameter	Minimum	Mean	Maximum	Number of Wells
Static Water Level (m)	1.8	4.6	12.2	22
Depth to Bedrock (m)	0.6	2.9	8.5	9
Well Yield (L/s)	5.0	48.4	341.0	26

Notes:

Depths are relative to ground surface

4.3.2.3 Assessment of Potential Environmental Effects on Water Resources

4.3.2.3.1 Project Effect Pathways for Water Resources

During the Construction, phase of the Project, the installation of transmission line poles may interact with Water Resources. The area excavated for the transmission line poles is limited to a small area surrounding each location. These excavations are typically 2.5 to 3 m in depth, and interact with groundwater in areas where the water table is shallow (approximately 3 m from top of ground). It is not possible to predict which excavations have the potential to interact in this way as the depth of the water table varies both locally, and seasonally. Given this, the requirements for temporary dewatering during Construction will be determined based on local water table conditions, and will be evaluated during the pre-construction stage of the Project.

Excavation for the transmission line poles will be completed by auger or an excavator. Mechanical rock breaking activities completed by auger or an excavator are less likely to interact with Water Resources than blasting or rock hammering. However, where soil conditions make these methods inefficient, blasting or rock hammering of consolidated bedrock may be required. This could include areas near outcrops or where the overburden is thin. Blasting has the potential to result in changes to groundwater quantity and/or quality and will be carried out in accordance with best management practices. In rare cases, vibration from blasting in bedrock may alter the fracture geometry, open new fractures, change the aperture of existing fractures, or permanently change the local groundwater flow patterns. The effect on groundwater flow patterns on a nearby receptor well user depends on many factors, including separation distance, seismic properties of the bedrock, strength of the charge and the yield, age and condition of the well. As a result, well yield can increase, or if fractures are closed off, the yield of nearby wells could decrease. Changes in fracture patterns or casing integrity can lead to movement of surface water into a well, which has the potential to change groundwater quality. Rock hammering may also result in vibration to the bedrock, and may result in the same environmental effects as blasting. However, the potential environmental effects from rock hammering will occur at a lesser magnitude and at a more local scale than blasting.

Clearing activities conducted during the Construction phase of the Project also have the potential to interact with surface water. The removal of mature vegetation in the Row will affect runoff coefficients and evapotranspiration amounts, which will likely result in small, temporary increase in runoff volumes discharged to nearby surfaces and streams.

During the Operation and Maintenance Phase of the Project, vegetation management will be required and will be accomplished largely through the use of manual and mechanical means. If herbicides are required, they will be used in accordance with government regulations. This integrated vegetation management program has the potential to interact with surface water.

During the Decommissioning and Abandonment phase of the Project, transmission line poles will likely be cut in place and substation equipment removed. Following Decommissioning and Abandonment activities, the RoW and the substation site will be allowed to revegetate to a natural state. As a result, Decommissioning and Abandonment is not anticipated to interact with Water Resources and is not discussed further.

4.3.2.3.2 Mitigation for Water Resources

NB Power has developed best practices which mitigate the risk of effects to Water Resources. These best practices will be contained within a PSEPP which will be strictly adhered to during all activities and all phases of the Project. With respect to the protection of Water Resources in the LAA, examples of measures to be implemented from the EPP include:

- Using mechanical rock breaking methods where practical
- Where blasting is required, carefully plan and limit load and pattern to only that required to installation of poles and guy wires
- Locating centreline of RoW to make use of topographical features which contribute to terrain stability
- Revegetating the RoW to reduce runoff
- Installing sediment traps and erosion and sediment control techniques in areas where the vegetation mat has been broken and there are exposed soils in order to minimize erosion and run-off of silt-laden water
- Minimize rutting during the Construction and Maintenance of the Project
- Grade exposed faces to a maximum slope of 2:1
- Inspecting vehicles for leaks prior to going into the field

4.3.2.3.3 Residual Environmental Effects on Water Resources

During Construction, any mechanical rock breaking or blasting activities, if required, will be small and localized, and relatively shallow. It is not likely that blasting activities will interact with Water Resources within the LAA and should any interactions occur, they can be readily mitigated.

The Project is linear in nature and the Project footprint is small in comparison to the Meduxnekeag River composite watershed. Any increase in runoff because of clearing activities

during the Construction phase of the Project is considered to be indistinguishable from baseline conditions and will be attenuated by the receiving watersheds. Overall, due to careful Project planning, and construction methods and mitigation to be implemented, the residual environmental effects during the Construction phase of the Project are anticipated to be very small and of short duration, and not expected to result in any measurable change in Water Resources.

The Operation and Maintenance phase of the Project will require vegetation management, which will be conducted in accordance with NB Power's integrated vegetation management program. Control of vegetation will be accomplished largely by mechanical means, especially near residences, agricultural areas, and watercourses. Where herbicides are required, their use will be in accordance with government regulations. As such, the Operation and Maintenance phase of the Project is anticipated to result in no measurable change in Water Resources.

4.3.2.4 Determination of Significance

Given the limited use of blasting anticipated for this Project, the measures taken to avoid buildings along the RoW, and the mitigation and protection measures described in Section 4.3.2.3.2, the residual environmental effects of the Project on a change in the quantity and/or quality of Water Resources during all phases of the Project are rated not significant, with a high level of confidence.

4.3.3 Fish and Fish Habitat

This section assesses the potential interactions between Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project and Fish and Fish Habitat. Fish and Fish Habitat was selected as a VC due to the cultural, recreational, and economic value of fish and fisheries, and because of the potential for the Project to interact with watercourses that will be spanned by the transmission line.

4.3.3.1 Scope of Assessment

Fish and Fish Habitat includes commercial, recreational, and Aboriginal (CRA) fisheries as defined under the *Fisheries Act*, and the habitat that supports these fish populations, including water quality. Fish are defined under the *Fisheries Act* as "any parts of fish…the eggs, sperm, spawn, larvae, spat and juvenile stages of fish" and for the purposes of this assessment include any fish species or life stage of fish within the LAA as described in section 4.3.3.1.1. Fish habitat is defined under the *Fisheries Act* as "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". Fish also include those listed under Schedule 1 of the *Species at Risk Act* (*SARA*) and the New Brunswick *Species at Risk Act* (NB *SARA*) that are afforded additional regulatory protection.

4.3.3.1.1 Potential Environmental Effects, Pathways, and Measurable Parameters

There will be interactions with Fish and Fish Habitat throughout the life of the Project that could potentially result in "serious harm" to fish that are part of or support a CRA fishery. These interactions are assessed herein as potential environmental effects (e.g., changes) to Fish and Fish Habitat that could result in serious harm to a CRA fishery as defined under the *Fisheries Act* (Government of Canada 2015a). The potential environmental effects pathways of these interactions are listed in Table 4.5 along with associated measurable parameters.

Table 4.5 Potential Environmental Effects, Environmental Effect Pathways, and Measurable Parameters for Fish and Fish Habitat

Potential Environmental Effect	Environmental Effect Pathways	Measurable Parameter(s) and Units of Measurement
Change in CRA fisheries productivity and sustainability	• Mortality of fish from a change in water quality • Permanent loss or change to in-stream habitat or riparian areas that results in serious harm or loss of productivity to a CRA fishery that cannot be mitigated or offset	• Change in water quality (baseline versus construction, units of measure vary) • Change in physical habitat measurement (m^2) (quantity, type, and quality) • Fish mortality (number of individuals)

4.3.3.1.2 Boundaries

4.3.3.1.2.1 Spatial Boundaries

The assessment of potential environmental effects on Fish and Fish Habitat encompasses two spatial boundaries, the PDA and LAA. These are described below.

Project Development Area (PDA)

The PDA is the immediate area encompassing the Project footprint, and is limited to the expected area of physical disturbance associated with the Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project. The PDA includes the footprint of the 15.7 km-long, 30 m-wide RoW for the new 69 kV transmission line to be constructed and the 0.4 ha footprint of the new substation. The PDA is illustrated in Figure 2.1.

Local Assessment Area (LAA)

The LAA for Fish and Fish Habitat is inclusive of all areas where a direct or indirect loss of fish habitat may occur, where surface water run-off may occur, and where environmental effects may occur and are measurable to a high degree of confidence. The LAA for Fish and Fish Habitat includes the PDA, as well as sections of watercourses and their 30 m buffers that are crossed by the RoW and occur within 100 m upstream and 100 m downstream of the centreline of the transmission line RoW (Figure 4.3).

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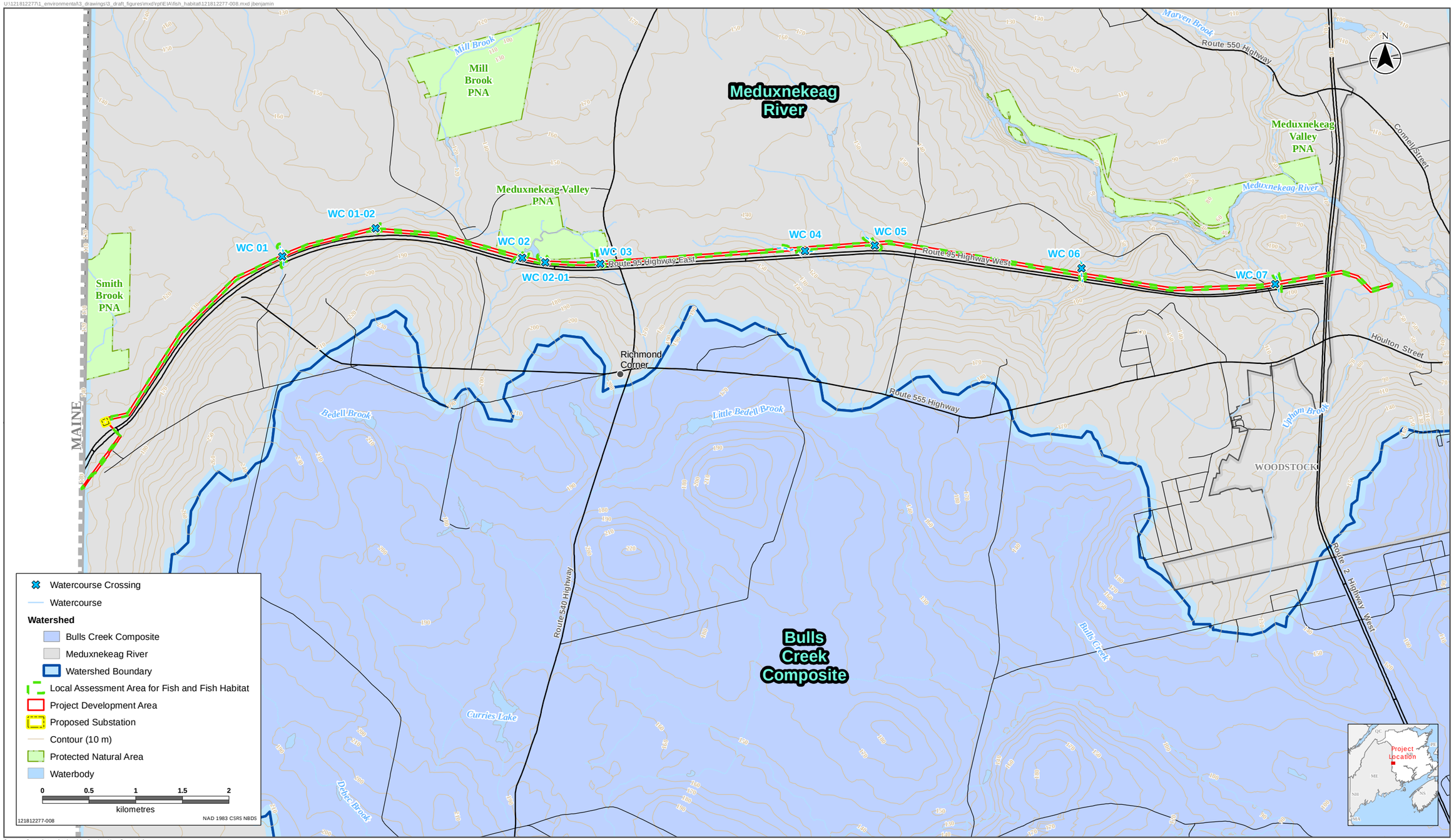

Sources: Base data obtained by Service New Brunswick.

Watersheds and Local Assessment Area for Fish and Fish Habitat

Stantec

121812277 - HOLUTON INTERNATIONAL TRANSMISSION LINE

Figure 4.3

4.3.3.1.2.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on the Fish and Fish Habitat include the following periods.

- Construction – anticipated to occur in 2019
- Operation and Maintenance – approximately 50 years or the end of service life
- Decommissioning and Abandonment – anticipated to be three months in duration following the end of service life

The potential for the Project to interact with Fish and Fish Habitat is considered for all phases of the Project; however, the greatest likelihood for Project-related environmental effects on Fish and Fish Habitat is expected during Construction.

4.3.3.1.3 Significance Criteria

For the Fish and Fish Habitat, a significant adverse environmental effect is one that results in one or more of the following criteria.

- A change in water quality from baseline (e.g., suspended sediments, introduction of deleterious substances) that results in serious harm to a CRA fishery (e.g., death of fish or a permanent alteration to or destruction of fish habitat) due to a loss of productivity that cannot be mitigated or offset through habitat compensation
- A physical change or loss in fish habitat (m2) that supports a CRA fishery that results in serious harm due to a loss of productivity that cannot be mitigated or offset
- The mortality of a SARA-listed or NB SARA-listed species

4.3.3.2 Existing Conditions for Fish and Fish Habitat

The LAA is situated entirely within the Meduxnekeag River Watershed, which is a sub-watershed of the Saint John River (Figure 4.3). The PDA crosses seven mapped watercourses, all which also cross Route 95, and flow through a mix of agriculture and forestry land use areas (Figure 4.3). Historical and existing land uses adjacent to the Meduxnekeag River and Saint John River watershed near Woodstock include timber harvesting, agriculture, and residential development (Kidd et al. 2011; Peabody and Mitchell 2005). Peabody and Mitchell (2005) suggest that anthropogenic activities over the years in the Meduxnekeag River Watershed may have reduced the overall water quality of the aquatic environment. Nevertheless, CRA fish species within the watershed are overall widespread and are abundant (Kidd et al. 2011; Peabody and Mitchell 2005).

Fish habitat field surveys were conducted from August 3 to 5, 2016. The surveys included *in situ* measurements of water temperature, conductivity, and dissolved oxygen (DO). In-stream and riparian habitats, along with any observations of fish, were also recorded electronically to reduce the potential for errors associated with the transfer of information from hand written notes to electronic spreadsheets. These data were uploaded each day to a file server for

storage. Measurements, observations, and site photos were taken at each watercourse transect located near the centre of the proposed RoW, as well as at transects 50 m and 100 m upstream and downstream of each RoW transect. In cases where watercourse transects were situated in culverts beneath Route 95, no measurements were taken.

All watercourses within the PDA were initially assumed to be fish bearing or connect to fish bearing watercourses prior to the field studies. As such, in an effort to reduce stresses to fish from unnecessary electrofishing, no fish sampling was conducted during the field surveys. The decision as part of this EIA to assume that all watercourses that meet the definition of a watercourse (e.g., defined channel and banks) are fish bearing is a conservative approach that affords an equal level of consideration and protection to *all* watercourses in the PDA and *all* species contained within them, regardless of whether or not they are known to support salmonids, American eel (*Anguilla rostrata*), or other fish species.

A total of 11 potential watercourses were identified in the LAA, including seven watercourses that appeared on topographical mapping. Incidental observations of fish were noted as fish were seen in five of 11 watercourse crossings surveyed. Fish species community composition was derived mostly from available literature, professional experience and knowledge, and on professional opinion based on quality of the habitat surveyed.

There is the potential for 28 fish species to occur in the LAA (Table 4.6), two of these species are listed in Schedule A of the NB *SARA List of Species at Risk Regulation*. These include the outer Bay of Fundy Atlantic salmon (*endangered*) and the American eel (*threatened*), both of which occur in the Meduxnekeag River. While these two species are listed on NB *SARA*, they are currently afforded no additional legal protection under the NB *SARA* or federal *SARA*.

Atlantic salmon are viewed as an important commercial, recreational, and Aboriginal fishery elsewhere in New Brunswick, though in recent years, Fisheries and Oceans Canada (DFO) has imposed catch and release restrictions province-wide for Atlantic salmon, given low population counts. However, their low relative abundance and declining numbers in the Meduxnekeag River watershed limits their overall contribution to the CRA fisheries (Peabody and Mitchell 2005). Further, the contribution to the CRA fishery of the watercourses in the LAA crossed by the Project is likely minimal as they consist only of first and second order small watercourses that are typically not the preferred salmon habitat (Stanley and Trail 1995; Maki-Petays et al. 2002). The contribution of the watercourses in the LAA to a CRA fishery would largely be reflected through rearing habitat provided to juveniles of other salmonid species (especially brown trout and brook trout) that eventually move downstream to the larger watercourses where recreational anglers could pursue them. American eels spawn in the Sargasso Sea and move to freshwater habitats to mature and feed (COSEWIC 2012). Any eels present would mature in the watershed and migrate downstream as adults where they could contribute to the commercial eel fishery in the Saint John River. Additionally, many of the smaller species present within this watershed could support recreational and Aboriginal fisheries by providing prey for those species pursued by anglers.

Table 4.6 Fish Species of the Meduxnekeag River Watershed

Common name	Scientific name
Atlantic Salmon	*Salmo salar*
Brook Trout	*Salvelinus fontinalis*
Brown Trout	*Salmo trutta*
Smallmouth Bass	*Micropterus dolomieu*
White Perch	*Morone americana*
Yellow Perch	*Perca flavescens*
Chain Pickerel	*Esox niger*
Brown Bullhead	*Ameiurus nebulosus*
White Sucker	*Catostomus commersoni*
American Eel	*Anguilla rostrata*
American Smelt	*Osmerus mordax*
Pumpkinseed Sunfish	*Lepomis gibbosus*
Alewife	*Alosa pseudoharengus*
Blueback Herring	*Alosa aestivalis*
Fallfish	*Semotilus corporalis*
Creek Chub	*Semotilus atromaculatus*
Lake Chub	*Couesius plumbeus*
Pearl Dace	*Margariscus margarita*
Finescale Dace	*Phoxinus neogaeus*
Blacknose Dace	*Rhinichthys atratulus*
Common Shiner	*Luxilus cornutus*
Golden Shiner	*Notemigons crysoleucas*
Blacknose Shiner	*Notropis heterolepis*
Banded Killifish	*Fundulus diaphanus*
Northern Redbelly Dace	*Chrosomus eos*
Slimy Sculpin	*Cottus cognatus*
Muskellunge	*Esox masquinongy*

Source: Peabody and Mitchell (2005), Jacques-Whitford (2003), www.meduxnekeag.org

The upper reaches of the Meduxnekeag River fall into two broad forms of watercourses: lower order watercourses with higher gradients, higher water velocities and larger substrates (including gravel and rock); and higher order watercourses with lower gradients, lower water velocities, and higher proportions of smaller (fines and organic) substrates (Peabody and Mitchell 2005).

Two of the 11 watercourses surveyed (WC 01-01 and WC 07) had little to no flow or were dry and did not have defined or continuous channels. These two watercourses are therefore not considered fish bearing or fish habitat (Table 4.7). The remaining nine watercourses were surveyed and in-stream habitat and water quality characteristics were measured at the RoW centreline, and at 50 m and 100 m both upstream and downstream of the centreline.

The watercourse survey data collected (Table 4.7) concurs with information presented by Peabody and Mitchell (2005) for in-stream habitat found in watercourses of the upper Meduxnekeag River Watershed. Of the watercourses surveyed, five (WC 02, WC 03, WC 04, WC 05, and WC 06) had observations of fish, including one location (WC 06) where brook trout was identified (Table 4.7). Six watercourses (WC 01, WC 01-02, WC 02, WC 03, WC 04, WC 05) had habitats that could be categorized as being poor habitat for salmonids characterized by predominantly organic substrates, with two of the five watercourses (WC 02, WC 05) having warmer temperatures (> 20°C), and depressed levels of dissolved oxygen (< 6.5 mg/L).

The remaining three watercourses surveyed (WC 01, WC 02, and WC 06) had characteristics that could be categorized as marginal to good habitat for salmonids, with cooler water temperatures (< 19°C) and concentrations of dissolved oxygen above 8 mg/L (Table 4.7). Two of these three watercourses (WC 01, WC 02) had substrate dominated by gravel and one watercourse had substrate dominated by fine sediment. Observations of brook trout during field studies occurred in WC 06, which had gravel and cobble substrates, but marginal water quality at 18.4°C (Table 4.7) at the time of the survey.

Table 4.7 Summary of Key Fish Habitat Characteristics Measured from August 3 to 5, 2016.

Watercourse ID # (see Figure 4.3)	Mean Wetted Width (m)	Mean Channel Width (m)	Mean Depth (m)	Mean Velocity (m/s)	Water Temp. (°C)	Conductivity (µS/cm)	DO (mg/L)	Substrate Type			Survey Status	Observations
								Primary	Secondary	Tertiary		
WC 00 – 01	4.9	6.1	0.02	-	14.3	160	9.8	Large gravel	Small gravel	Fines	Surveyed	Low flow and volume
WC 00 - 02	0.5	1.6	0.03	-	15.8	171	9.4	Large gravel	Cobble/large boulder	Small gravel	Surveyed	Low flow and volume
WC 01	1.6	3.3	0.06	-	19.5	26	6.9	Fines	Small gravel	Cobble	Surveyed	Low flow and volume
WC 01 – 01*	-	-	-	-	-	-	-	-	-	-	Spring – no defined channel	Water flows for 20 m then dissipates into wetland.
WC 01 - 02	0.4	1.1	0.02	-	-	-	-	Cobble	Large gravel	Small gravel	Surveyed	No fish observed, poor fish habitat
WC 02	3.6	4.6	0.45	-	21.3	374	4.2	Fines	Organic	Boulder	Surveyed	Fish observed. No discharge due to low flow and gradient
WC 03	3.2	2.9	0.3	-	19	438	25.0	Organic	Boulder	Cobble/fines	Surveyed	Cyprinids observed in outflow pool
WC 04	2.2	3.2	0.18	-	17.5	306	7.1	Fines	Organic	Cobble	Surveyed	Fish observed, shallow, low flow
WC 05	4.2	5.6	0.25	-	27.1	277	5.9	Organic	fines	Gravel/Cobble/Boulder	Surveyed	Fish observed
WC 06	2.8	6.2	0.17	-	18.4	350	8.6	Gravel	Cobble	Fines/ Boulder	Surveyed	Fish observed (BT)
WC 07*	-	2.1	-	-	-	-	-	Gravel	Fines	Organic	Dry channel/ ephemeral	Large culvert passing under Route 95

Notes:
- Not available
* Not fish habitat
BT = Brook trout
DO – dissolved oxygen

4.3.3.2.1 Assessment of Potential Environmental Effects on Fish and Fish Habitat

There is potential for interaction with Fish and Fish Habitat during the Construction phase of the Project that could result in serious harm as a result of changes to a CRA fishery or changes to habitat that supports a CRA fishery. The pathways by which Project activities may result in serious harm, as well as the practices and techniques that will be applied to mitigate these risks, are described in this section. The potential Project interactions that could result in serious harm to a CRA fishery or habitat that supports a CRA fishery are outlined in Table 4.5 for Fish and Fish Habitat.

4.3.3.2.2 Project Effect Pathways for Fish and Fish Habitat

Serious harm to fish could result from Project activities in the form of a change to the productivity or sustainability of a CRA fishery or the mortality of fish including a *SARA* or NB *SARA* species.

The Construction phase of the Project will involve the use of heavy machinery (e.g., excavators, feller-bunchers, bush hogs) in the RoW to clear vegetation, provide access, and install towers and lines (see Section 2.5.1). The use of machinery in and around watercourses could result in the disruption or destruction of fish habitat through the introduction and mobilization of suspended sediments to the watercourse. Suspended sediments can result from surface water run off as well as through the disturbance of watercourse bed materials.

Clearing of tall, overhanging vegetation within the riparian area of a watercourse also has the potential to interact with Fish and Fish Habitat through the increase in water temperatures due to increased exposure to direct sunlight. Removal of riparian vegetation during the Construction phase could result in an increase in water temperatures of due to exposure of watercourses to direct sunlight. Potential changes in water temperature were assessed in the LAA using the procedures reported by Brown (1970) for individual stream morphometrics and levels of (solar) insolation (GNB 2011a). The potential for an increase in water temperature within the PDA is limited to the peak stream water temperature period of July through August. Given the short (30 m) width of the RoW, the maintenance of 30 m riparian buffers where possible, the allowance of vegetation in the RoW to grow to a height of up to 4.4 m (NB Power 2015), and pre-existing openings in the canopy, the increase in water temperature is anticipated to be negligible.

There are no planned activities during the Operation and Maintenance phase of the Project that involve disturbing riparian soil or removing vegetation beyond that which was done during Construction activities (see Section 2.5.2). Vegetation management will be accomplished largely through the use of manual and mechanical means. If herbicides are required, they will be used in accordance with government regulations. As such, there are no potential adverse environmental effects on Fish and Fish Habitat during Operation and Maintenance.

There are no planned activities during the Decommissioning and Abandonment phase of the Project that involve disturbing riparian soil or removing vegetation (see Section 2.5.3). As such,

there are no potential effects on Fish and Fish Habitat during Decommissioning and Abandonment.

4.3.3.2.3 Mitigation for Fish and Fish Habitat

During Construction, Operation and Maintenance, and Decommissioning and Abandonment, NB Power will adhere to a PSEPP that includes information on the location of watercourses and their buffers, best management practices, and proven mitigation measures to be implemented to reduce the risks to Fish and Fish Habitat. In addition to the mitigation noted below, many of the practices used to mitigate against potential Project interactions with Water Resources (Section 4.3.2.3.2) will also mitigate against potential interactions with Fish and Fish Habitat.

The Project will implement the following measures to mitigate the risks to Fish and Fish Habitat:

- Heavy equipment will not be used for clearing of vegetation for areas within 30 m of the banks of a watercourse. If required, vegetation within 30 m of a watercourse will be managed according to the PSEPP and watercourse and wetland alteration (WAWA) permit conditions. This 30 m buffer will be clearly marked at all watercourses.
- No fording of watercourses will occur; instead temporary bridges will be used (as needed) to provide access for all machinery and equipment to cross watercourses, and all bridges will be installed as per the EPP and any applicable WAWA requirements.
- Installation of sediment and erosion control (i.e., silt fence) downgradient of all areas where soils may be disturbed and the risk of surface water run-off or transport of sediments or woody debris entering a watercourse is increased.
- Maintenance and management of sediment and erosion control measures until the disturbed area is stable from erosion. These features will be managed so that they do not enter a watercourse, and are removed once the RoW has stabilized.
- Adherence to the Project design for a maximum RoW width of 30 m.

Risks to Fish and Fish Habitat will be managed by NB Power through the mitigation outlined above, the measures described in the PSEPP, any applicable Conditions of Approval for the Project, and conditions of the WAWA Permit for the Project to eliminate or minimize the potential for direct and indirect Project environmental effects.

4.3.3.2.4 Residual Environmental Effects on Fish and Fish Habitat

Project planning will incorporate mitigation measures to avoid, mitigate, or offset potential adverse effects to CRA fisheries. With mitigation in place, this Project is not anticipated to result in mortality of any CRA fishes, including any federal or provincially-listed *SARA* species.

During all stages of the Project, potential adverse environmental effects to fish habitat (e.g., increased water temperature, reduced water quality, reduced canopy cover in riparian areas) will be mitigated through best management practices (see 4.3.3.3.2).

With mitigation in place, this Project is not anticipated to have residual adverse environmental effects that would result in serious harm or loss of productivity to a CRA fishery.

4.3.3.3 Determination of Significance

Best management practices will be in place during Project activities to mitigate risks to Fish and Fish Habitat within the LAA. With the mitigation and protection measures for Fish and Fish Habitat implemented as outlined in Section 4.3.3.3.2, the Project is not anticipated to result in mortality of CRA or *SARA* listed fish species, or result in a change in or destruction of fish habitat through direct physical disturbance or the transportation of sediments into the watercourses.

Watercourses within the PDA currently experience varied amounts of direct sunlight because of their proximity to existing infrastructure such as the RoW for Route 95 and secondary roads, as well as natural canopy openings. Potential peak increases in water temperature are well below the significance threshold of 2.8°C reported by Brown (1970), and would be unlikely to reduce dissolved oxygen levels to below the threshold value of 6.5 mg/l (CCME 1999) for watercourses in the PDA. Serious harm to fish is not expected as the Project will not result in a significant adverse change in water quality.

As such, and with planned avoidance through spanning the transmission line over watercourses, the residual adverse environmental effects of the Project on a change in in CRA fisheries productivity and sustainability as part of Fish and Fish Habitat during all phases of the Project are rated not significant, with a high level of confidence.

4.3.4 Terrestrial Environment

The Terrestrial Environment, including vegetation, wetlands, wildlife, and wildlife habitat, is valued by the people of New Brunswick for its environmental and socioeconomic importance. The Terrestrial Environment has been selected as a VC because of the potential for interactions between the Project and wildlife and vegetation species (including Species at Risk (SAR) and Species of Conservation Concern (SOCC)), vegetation communities, and wildlife habitats (including Ecological Communities of Management Concern (ECMC)) and wetlands (including wetland area and function).

4.3.4.1 Scope of Assessment

This section defines and describes the scope of the assessment of potential environmental effects on the Terrestrial Environment. With respect to vegetation and wildlife, this VC focuses on SAR and SOCC. SAR include species which are listed as *extirpated*, *endangered*, *threatened*, or *special concern* by the federal *Species at Risk Act* (*SARA*), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or the New Brunswick *Species at Risk Act* (NB *SARA*). Some of the species defined as SAR in this document are listed under Schedule 1 of the federal *SARA* or the *Prohibitions Regulation* of NB *SARA*, and currently have regulatory protection under those acts. The definition used in this document also includes species on the NB *SARA List of Species at Risk Regulation* and those listed by COSEWIC that currently have no legal protection, but may become protected within the timeframe of this Project.

SOCC are not listed or protected by any legislation, but are considered rare in New Brunswick, or their populations may not be considered sustainable. SOCC are here defined to include species that are not SAR, but are ranked *S1* (critically imperiled), *S2* (imperiled), or *S3* (vulnerable) in New Brunswick by the Atlantic Canada Conservation Data Centre (AC CDC) (AC CDC 2017).

ECMC are those communities that fulfill special management objectives on Crown land in New Brunswick (i.e., conservation forest) or have been identified, through field work or by local conservation organizations, as supporting unique ecological features (e.g., Environmentally Significant Areas (ESA)).

4.3.4.1.1 Potential Environmental Effects, Pathways, and Measurable Parameters

The potential environmental effect of change in the Terrestrial Environment was selected for the assessment of the Terrestrial Environment based on knowledge of the terrestrial conditions within the PDA and surroundings, and the Project and its associated activities. Table 4.8 summarizes the potential environmental effects, environmental effect pathways, and measurable parameters for the Terrestrial Environment VC.

Table 4.8 Potential Environmental Effect, Environmental Effect Pathways, and Measurable Parameters for the Terrestrial Environment

Potential Environmental Effect	Environmental Effect Pathways	Measurable Parameter(s) and Units of Measurement
Change in the Terrestrial Environment	• Vegetation clearing and ground disturbance along the transmission line, for pole placement, at grounding sites, and for line maintenance or at the substation may have an environmental 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. • Collisions with transmission lines are a cause of mortality for many avian species. • Vegetation clearing within the RoW and excavation for pole placement and at grounding sites, and vegetation maintenance during Operation and Maintenance may change wetland area and function.	• 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) • Mortality of wildlife • Loss of wetland area (ha) • Change in wetland function

4.3.4.1.2 Boundaries

4.3.4.1.2.1 Spatial Boundaries

The assessment of potential environmental effects on the Terrestrial Environment encompasses two spatial boundaries, the PDA and LAA.

Project Development Area (PDA)

The PDA is the immediate area encompassing the Project footprint, and is limited to the expected area of physical disturbance associated with the Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project. The PDA includes the footprint of the 15.7 km-long, 30 m-wide RoW for the new 69 kV transmission line to be constructed and the 0.4 ha footprint of the new substation. The PDA is illustrated in Figure 2.1.

Local Assessment Area (LAA)

The LAA for the Terrestrial Environment includes the PDA, and a 500 m buffer on either side of the PDA, that represents the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA is primarily defined by the distance where noise may penetrate wildlife habitats. Edge effects are often thought to extend up to 300 m in forested landscapes for some avian species, but are typically reported to be most pronounced at distances closer to the edge (Batáry and Báldi 2004). The area of potential direct or indirect environmental effects on vegetation and wetlands is expected to be much smaller than that for wildlife and wildlife habitat. The LAA is illustrated in Figure 4.4 as it applies to the Terrestrial Environment.

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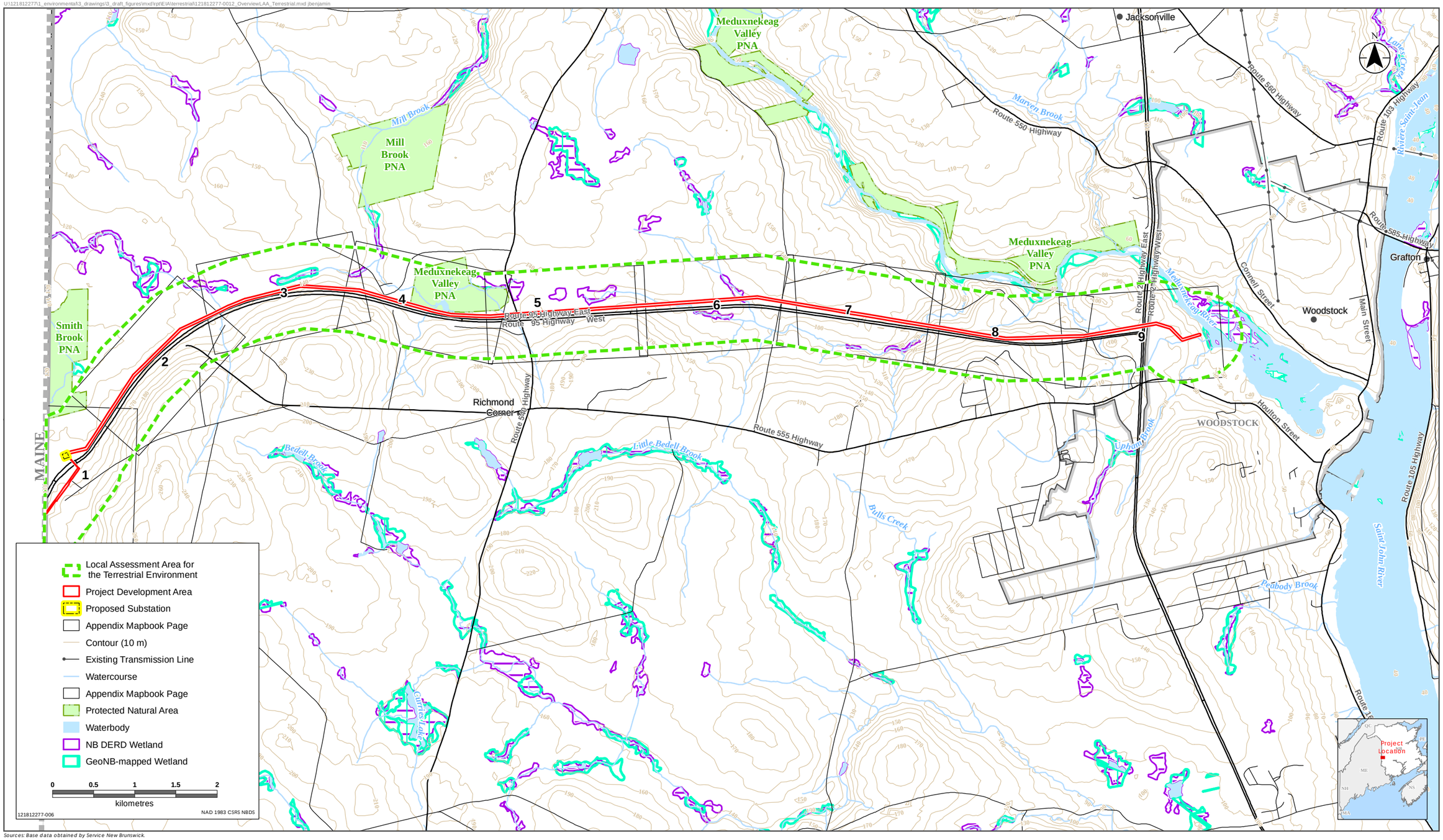

Sources: Base data obtained by Service New Brunswick.

Local Assessment Area for the Terrestrial Environment

Stantec

121812277 - HOLUTON INTERNATIONAL TRANSMISSION LINE

Figure 4.4

4.3.4.1.2.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on the Terrestrial Environment include the following periods:

- Construction – anticipated to occur in 2019
- Operation and Maintenance – approximately 50 years or the end of service life
- Decommissioning and Abandonment – anticipated to be three months in duration following the end of service life

Most potential environmental effects on the Terrestrial Environment will begin and peak during the Construction phase, and diminish during the Operation and Maintenance phase of the Project.

4.3.4.1.3 Significance Criteria

A significant adverse residual environmental effect of a change in the Terrestrial Environment is defined as a Project-related environmental effect that results in one or more of the following:

- Alteration of vegetation communities and wildlife habitat or direct mortality of individuals or communities that results in a decline in the abundance or change in the distribution of a viable population of SAR or SOCC, or a decline in the abundance or change in the distribution of common and secure populations such that the long-term survival of populations will not be sustainable within New Brunswick
- Reduction in wildlife dispersal or migration such that long-term survival of wildlife populations within New Brunswick is substantially reduced as a result
- A non-permitted contravention of any of the prohibitions stated in Sections 32-36 of *SARA* or in in Section 28 of NB *SARA*, or 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
- Affects ECMC such that they experience a change in function, and can no longer support any special populations they contain
- Unauthorized permanent net loss of wetland function, or any loss of wetland function in a Provincially Significant Wetland (PSW), after consideration of planned mitigation or provincially required compensation for unavoidable wetland losses
- Loss of important function (i.e., one that would result in a significant environmental effect on another VC that relies upon wetlands) within New Brunswick, provided by a wetland that cannot be avoided or mitigated

4.3.4.2 Existing Conditions for the Terrestrial Environment

4.3.4.2.1 Information Sources

Vegetation community and wetland data were obtained from various sources, including the New Brunswick Department of Energy, Resources and Development (NBDERD) forestry and non-forest data, GeoNB mapped wetlands and PSW (SNB 2011), and the New Brunswick

Hydrographic Network (NBHN) wetlands, waterbodies, and watercourses. These sources were used to map vegetation communities within the LAA, and to assist in wetland interpretation outside of field-surveyed areas.

Records for vegetation, wildlife, and ECMCs occurring within the LAA and surrounding area were obtained from various sources described below, including the AC CDC, the Maritimes Breeding Bird Atlas (MBBA), the Atlantic Canada Nocturnal Owl Surveys (ACNOS), and the Christmas Bird Count (CBC). A search of the North American Breeding Bird Survey (BBS) database was conducted to obtain records of bird species observed near the LAA (ECCC 2014a), but there were no BBS routes located near the LAA.

4.3.4.2.2 Field Surveys

4.3.4.2.2.1 Vegetation and Wetlands

A vascular plant and wetland survey was completed from July 18 to 21, 2016 within the PDA. Wetlands were also delineated within an additional 30 m buffer around the PDA. During the survey, all vascular plant species encountered were recorded and a GPS location was recorded for each vascular plant SAR or SOCC incidence encountered, along with information such as population size. Any plants for which identification was uncertain were collected and later identified with the assistance of vascular plant flora manuals.

Wetland surveys were conducted within the FSA concurrently with vascular plant surveys. Wetlands encountered within the FSA were delineated and classified per 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 plant communities based on one of eight groups of dominant vegetation. Information on wetland function was also recorded for each wetland within the FSA, and geographic coordinates and field notes were recorded for wetland boundaries. Wetlands outside of the FSA were interpreted using aerial imagery, forest cover data, and LiDAR data.

In spring 2017, portions of the PDA were realigned. Sections of the new route that were not surveyed in 2016 were surveyed for vegetation and wetlands from June 19 to 22, 2017. A follow-up survey of butternut tree health was conducted on July 9, 2017.

4.3.4.2.2.2 Wildlife

Baseline wildlife surveys were conducted in 2016 within the LAA to characterize wildlife use of the area and facilitate an assessment of potential environmental effects of the Project on wildlife and wildlife habitat. The focus of these surveys was on birds and wildlife SAR. Incidental wildlife observations were recorded during vegetation and wetland surveys conducted in July 2016 and June 2017.

Early Breeding Bird Species (Woodpecker and Forest Hawk Survey)

Nineteen roadside surveys targeting early breeding bird species (e.g., woodpeckers and raptors) were conducted on April 18, 2016. Surveys were conducted in good weather conditions (i.e., light winds, and no precipitation), within the PDA. Point counts and playbacks were conducted in and near forested habitats to detect evidence of breeding woodpeckers and raptors. Species, number of individuals, and breeding evidence for all birds encountered were recorded.

Nocturnal Owl Survey

Seven nocturnal owl surveys were completed on the evening of April 17, 2016 to detect breeding owl species within the LAA. Surveys were conducted in accordance with the Guidelines for Nocturnal Owl Monitoring in North America (Takats et al. 2001), and included a two-minute silent listening period followed by a ten-minute period of alternating playbacks and silent listening periods. Surveys began approximately 30 minutes after sunset, and were completed prior to midnight. Survey stations were located no closer than 2 km apart, and were situated at roadside. Information including general noise level, environmental conditions, and the presence of other nocturnal species was recorded.

Crepuscular Bird Survey

Surveys focused on identifying the presence of crepuscular bird species, in particular, common nighthawk (*Chordeiles minor*), were conducted on the evening of June 1, 2016. Survey stations were established near areas with potential to provide breeding opportunities for common nighthawk, including open forest, grasslands, exposed sand and gravel, and other anthropogenic habitats such as farmland and pastures. Roadside surveys were conducted starting approximately 60 minutes before sunset, and continued until up to two hours after sunset. Surveys followed a point count sampling procedure (BC RIC 1998). Data collected included date and time of survey, environmental conditions, and background noise level.

Breeding Bird Survey

Breeding bird surveys were conducted on June 1-2, 2016, to provide an overview of breeding bird species present in the LAA. Survey stations were chosen in various habitat types within 500 m of the PDA, and placed to sample various land cover types present within the LAA, accounting for Project-layout and site accessibility. Survey stations were established with a minimum distance of 200 m between points, and 100 m from edges of other habitat types, where possible.

Breeding bird stations were visited once during the field program, and observers conducted a ten-minute point count at each location, based on a modified fixed-radius point count sampling procedure (Bibby et al. 2000). Surveys began near dawn, and continued until 10:00 am. Data collected included date and time of survey, and environmental conditions.

Incidental Wildlife Observations

Incidental observations of other wildlife species or their sign were made during all field surveys, including vegetation and wetland surveys.

4.3.4.2.3 Overview of Existing Conditions

4.3.4.2.3.1 Vegetation, Wildlife Habitat, and Wetlands

The Project is within the Meductic Ecodistrict of the Valley Lowlands Ecoregion. This ecoregion has the highest diversity of the province, to some extent because it is also the largest ecoregion - stretching from Edmundston south to St. Andrews in Passamaquoddy Bay and including the Upper and parts of the Lower Saint John River Valley - but owing partly to its inland and warmer climate and relatively long growing season (NBDNR 2007).

The Meductic Ecodistrict starts in the north near Dover Hill, and continues south surrounding the Saint John River valley for approximately 130 km to near Prince William. The dominant feature of this ecodistrict is the Saint John River valley, but other notable river systems drain into it, including the Meduxnekeag River, located north of the Project and intersecting with the LAA at its eastern end. The Meductic Ecodistrict supports many tolerant hardwood stands and is underlain by calcareous soils through much of its northern and western area (NBDNR 2007). These factors allow the ecodistrict to support a relatively high number of rare plant species and some rare plant communities.

Appalachian Hardwood Forest (AHF), also known as Saint John River Hardwood Forest (SJRHF), is a hardwood-dominated community composed of species that are not found together outside of this area of the province, including sugar maple, white ash (*Fraxinus americana*), beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), and ironwood (*Ostrya virginiana*). Other species such as white elm (*Ulmus americana*), hemlock (*Tsuga canadensis*), basswood (*Tilia americana*), black cherry (*Prunus serotina*), and butternut (*Juglans cineria*) can also be present (Betts 2000; MacDougall and Loo 1998). AHF stands are associated with many rare understory species, some of which are restricted to this habitat. Some of these species include Canada honewort (*Cryptotaenia canadensis*, *S1*), inflated narrow-leaved sedge (*Carex grisea, S1*), thin-leaved sedge (*Carex cephaloidea, S1*), Canada violet (*Viola canadensis*, *S1S2*), and wild leek (*Allium tricoccum, S2*) (MacDougall and Loo 1998).

Settlement, agriculture, and forest harvesting within the ecodistrict and surrounding area is largely to blame for historical loss of AHF, which is currently highly fragmented and estimated to be well below pre-settlement levels (MacDougall and Loo 1998). Although there is no identified AHF within the PDA, this habitat is an important part of the ecoregion, and there are known stands within approximately 2 km of the LAA.

Approximately 50% of the LAA is forested, dominated by young-immature hardwood (14% of the LAA) (Table 4.9). Young-immature mixedwood, young-immature softwood, mature-overmature

hardwood, and mature-overmature mixedwood are also relatively common, all accounting for more than 5% of the LAA.

Table 4.9 Land Classification within the PDA and LAA

Land classification	PDA		LAA	
	Hectares	%	Hectares	%
Agricultural	0.88	0.18	158.14	9.70
Anthropogenic	14.95	32.32	281.30	17.25
Barren	0.00	0.00	0.11	0.01
Industrial	3.05	6.59	58.16	3.57
Forest Types				
Regeneration-sapling Hardwood	2.96	6.40	68.32	4.19
Regeneration-sapling Mixedwood	2.08	4.50	18.21	1.12
Regeneration-sapling Softwood	0.78	1.69	1.66	0.10
Young-immature Hardwood	2.41	5.21	222.43	13.64
Young-immature Mixedwood	3.66	7.91	137.87	8.46
Young-immature Softwood	4.43	9.58	95.86	5.88
Mature-overmature Hardwood	0.01	0.02	85.97	5.27
Mature-overmature Mixedwood	4.09	8.84	93.24	5.72
Mature-overmature Softwood	0.39	0.84	61.71	3.79
Restricted Freehold	0.05	0.11	18.58	1.14
Forest Total	20.86	45.09	803.85	49.31
Wetlands				
Fen	0.26	0.56	6.67	0.41
Marsh	0.28	0.61	4.17	0.26
Shallow Water Wetland	0.02	0.04	0.02	0.00
Shrub Swamp	1.11	2.40	52.52	3.22
Hardwood Treed Swamp	0.0	0.00	7.81	0.48
Mixedwood Treed Swamp	2.98	6.44	151.90	9.32

Table 4.9 Land Classification within the PDA and LAA

Land classification	PDA		LAA	
	Hectares	%	Hectares	%
Softwood Treed Swamp	1.87	4.04	91.89	5.64
Wetland Total	6.52	14.09	314.98	19.32
Waterbody	0.003	0.01	13.74	0.84
Total	**46.26**	**100.00**	**1,630.28**	**100.00**

Overall, approximately 19% of the LAA is wetland, which is similar to the provincial average of about 18%. The wetlands with the LAA are largely located on the north side of Route 95, where wetland accounts for approximately 29% of land use, versus less than 5% on the south side of Route 95. The south side of Route 95 is steeper and topographically elevated relative to the north side of the highway, which is generally flat beyond an initial slope down from the highway.

Anthropogenic presence/activity represents approximately 17% of the LAA, as the LAA is nearly centred on Route 95 for most of its length. Agriculture accounts for 9.7% of the LAA. The agriculture land use is primarily active crop land, but some fallow pasture also exists. Other land uses, industrial (gravel pits and quarries), barren land, and waterbody, exist within the LAA in relatively small amounts.

The PDA is 46.3 ha in size; much of it is located within the existing right-of-way (RoW) for Route 95. Anthropogenic land use therefore accounts for more than 32% of the PDA and is composed of infrastructure (roads, road right-of-ways, and abandoned railroads) and settled land (both urban and rural).

The remaining area within the PDA is composed of 45% forest, primarily young-immature softwood, mature-overmature mixedwood, and young-immature mixedwood; 14.1% wetland; 6.6% industrial; and less than 1% agricultural.

Mixedwood treed swamp is the most common wetland type within the PDA, accounting for 6.4% of the PDA and 45.7% of wetlands in the PDA (Appendix C). The species composition of this wetland type is typically dominated by a mix of species in the overstory including balsam fir, balsam poplar (*Populus balsamifera*), eastern white cedar, trembling aspen (*Populus tremuloides*), black ash (*Fraxinus nigra*), tamarack (*Larix laricina*), and red maple (*Acer rubrum*), with willows (*Salix* spp.) and speckled alder (*Alnus incana*) occasionally in the shrub layer, and a range of species in the understory, including slender manna grass (*Glyceria melicaria*), fowl manna grass (*G. striata*), cinnamon fern (*Osmunda cinnamomea*), nodding sedge (*Carex gynandra*), tall meadow-rue (*Thalictrum pubescens*), woodland horsetail (*Equisetum sylvaticum*), and purple-stemmed aster (*Symphyotrichum puniceum*).

Softwood treed swamps constitute 4.0% of the PDA and 28.7% of wetlands within the PDA (Appendix C). The westernmost softwood treed swamp (WL-01) is dominated by eastern white cedar, balsam fir, several species of manna grass (*Glyceria* spp.), and sensitive fern. The majority of the area of softwood treed swamps within the PDA are part of a large wetland complex associated with Morrison Lake (WL-06). These wetlands have a high water table, and are dominated by eastern white cedar and black spruce (*Picea mariana*) in the overstory, mountain holly (*Nemopanthus mucronatus*) and common Labrador tea (*Ledum groenlandicum*) in the shrub layer, and because of the high water table, obligate wetland herbaceous species such as broad-leaved cattails, wild calla (*Calla palustris*), harlequin blue flag (*Iris versicolor*), and soft-stemmed bulrush (*Schoenoplectus tabernaemontani*) are scattered throughout the understory, particularly near wetland margins. Two other softwood treed swamps in the PDA (WL-08 and WL-09) are riparian wetlands that have marsh components adjacent to Route 95, and transition to softwood treed swamps further from the highway. These wetlands are associated with past or present beaver activity, and both are dominated by eastern white cedar in the overstory, with speckled alder in and around the watercourse, ferns such as evergreen wood fern (*Dryopteris intermedia*) and eastern marsh fern (*Thelypteris palustris*) near the upland margins, and other herbaceous species in the understory such as nodding sedge, fowl manna grass and broad-leaved cattail. WL-08 contains an SOCC, dotted smartweed (*Polygonum punctatum, S3*).

Several marshes exist within the PDA, which make up 0.6% of the PDA and 4.2% of wetlands in the PDA: a small, seep-fed marsh that has formed in the cleared ditch north of Route 95, a small cleared graminoid meadow west of a tall shrub swamp associated with Morrison Lake and two riparian marshes associated with tributaries to the Meduxnekeag River that cross Route 95, east of the Route 540 interchange (Appendix C). The seep-fed marsh (WL-03) adjacent to Route 95 is dominated by broad-leaved cattail (*Typha latifolia*), narrow-leaved cattail (*Typha angustifolia*), small forget-me-not (*Myosotis laxa*), dwarf scouring rush (*Equisetum scirpoides*), and common spikerush (*Eleocharis palustris*), with some scattered cottony willow (*Salix eriocephala*). A patch of nine Loesel's twayblade (*Liparis loeselii*, S3) orchids were observed within the wetland. The graminoid meadow (WL-06) is dominated by broad-leaved cattail, black-girdled bulrush (*Scirpus atrocinctus*), and scattered willows (*Salix* spp.). One of the riparian marshes (WL-08) is part of a larger wetland complex associated with an unnamed tributary to the Meduxnekeag River. This wetland grades into a softwood treed swamp and has a thick layer of peat that is exposed in places throughout the wetland. The marsh contains species such as fowl manna grass, nodding sedge, reed canary grass (*Phalaris arundinacea*), blue-joint reed grass (*Calamagrostis canadensis*), green-fruited burred (*Sparganium emersum*), and water shield (*Brasenia schreberi*) within the slow-moving watercourse. Some speckled alder shades the watercourse. Two butternut (a SAR) saplings (6 cm diameter at breast height (DBH) and 8 cm DBH) were observed on the upland edge of this wetland, just outside of the PDA. Purple loosestrife (*Lythrum salicaria*), an invasive plant, was observed in a ditch leading to the wetland. The second riparian marsh (WL-09) is associated with another unnamed tributary to the Meduxnekeag River but is largely a slope wetland. This marsh includes some broad-leaved cattail and several sedges (*Carex* spp.), and speckled alder around the watercourse.

Six shrub swamps exist within the PDA, three of which are part of larger wetland complexes (Appendix C). Shrub swamps account for 2.4% of the PDA and 17.0% of wetlands within the PDA. The westernmost shrub swamp (WL-02) has formed between Route 95 and an unnamed, abandoned road north of Route 95. This wetland is dominated by several species of willow (*Salix* spp.), speckled alder, scattered balsam fir, sensitive fern (*Onoclea sensibilis*), and necklace sedge (*Carex projecta*). The next shrub swamp (WL-04) is part of a large wetland complex outside of the PDA, and is associated with an unnamed watercourse that enters the United States northwest of the LAA. This wetland is dominated by speckled alder and young white ash in the shrub layer, and includes understory species such as spotted Joe-pye-weed (*Eupatorium maculatum*), spotted jewelweed (*Impatiens capensis*), white avens (*Geum rivale*), and broad-leaved cattail in the understory. Ostrich fern and purple loosestrife are both present in this wetland. Another shrub swamp within the PDA (WL-05) is a narrow drainageway dominated by willows and sedges, such as nodding sedge and drains down into a large GeoNB-mapped wetland. The fourth shrub swamp (WL-06) is part of a large wetland complex associated with Morrison Lake, and associated with an unnamed tributary to Morrison Lake. This wetland is dominated by willows, some speckled alder, and common winterberry (*Ilex verticillata*). The two remaining shrub swamps are located near the eastern extent of the Project. WL-11 is a flooded beaver pond associated with an unnamed tributary to Meduxnekeag River, located between Route 95 and a quarry on Simcox Road. Within the PDA this wetland is dominated by red osier dogwood (*Cornus sericea*), various willow species (*Salix* spp.), sensitive fern, and northern poison oak (*Toxicodendron rydbergii*), which is also common in the surrounding upland areas. WL-12 is a narrow wetland with standing water that has formed on an abandoned road. It is dominated by eastern white cedar, black ash, blue-joint reed grass, and sensitive fern.

Several marshes exist within the PDA, which make up 0.6% of the PDA and 4.3% of wetlands in the PDA: a small, seep-fed marsh that has formed in the cleared ditch north of Route 95, a small cleared graminoid meadow west of a tall shrub swamp associated with Morrison Lake and two riparian marshes associated with tributaries to the Meduxnekeag River that cross Route 95, east of the Route 540 interchange (Appendix C). The seep-fed marsh (WL-03) adjacent to Route 95 is dominated by broad-leaved cattail (*Typha latifolia*), narrow-leaved cattail (*Typha angustifolia*), small forget-me-not (*Myosotis laxa*), dwarf scouring rush (*Equisetum scirpoides*), and common spikerush (*Eleocharis palustris*), with some scattered cottony willow (*Salix eriocephala*). A patch of nine Loesel's twayblade (*Liparis loeselii*, S3) orchids were observed within the wetland. The graminoid meadow (WL-06) is dominated by broad-leaved cattail, black-girdled bulrush (*Scirpus atrocinctus*), and scattered willows (*Salix* spp.). One of the riparian marshes (WL-08) is part of a larger wetland complex associated with an unnamed tributary to the Meduxnekeag River. This wetland grades into a softwood treed swamp and has a thick layer of peat that is exposed in places throughout the wetland. The marsh contains species such as fowl manna grass, nodding sedge, reed canary grass (*Phalaris arundinacea*), bluejoint reed grass (*Calamagrostis canadensis*), green-fruited burred (*Sparganium emersum*), and water shield (*Brasenia schreberi*) within the slow-moving watercourse. Some speckled alder shades the watercourse. Two butternut (a SAR) saplings (6 cm diameter at breast height (DBH) and 8 cm DBH) were observed on the upland edge of this wetland, just outside of the PDA. Purple loosestrife (*Lythrum salicaria*)

was observed in a ditch leading to the wetland. The second riparian marsh (WL-09) is associated with another unnamed tributary to the Meduxnekeag River but is largely a slope wetland. This marsh includes some broad-leaved cattail and several sedges (*Carex* spp.), and speckled alder around the watercourse.

There is one fen within the PDA, located at Morrison Lake and part of a larger wetland complex (WL-06, Appendix C). This wetland makes up 0.3% of the PDA and 4.0% of wetlands within the PDA. The fen is dominated by shrubs (primarily ericaceous) such as leatherleaf (*Chamaedaphne calyculata*), pale bog laurel (*Kalmia polifolia*), late lowbush blueberry (*Vaccinium angustifolium*), sweet gale (*Myrica gale*), stunted black spruce, white meadowsweet (*Spiraea alba*), and shining willow (*Salix lucida*). Species such as broad-leaved cattail, Canada manna grass (*Glyceria canadensis*), a spikerush (*Eleocharis* sp.), royal fern (*Osmunda regalis*), and water horsetail (*Equisetum fluviatile*) are present in the herbaceous layer.

There is a single shallow water wetland within the PDA (WL-10), located within an inactive gravel pit between Route 95 and Simcox Road (Appendix C). The wetland is dominated by soft-stemmed bulrush, porcupine sedge (*Carex hystericina*), and variegated horsetail (*Equisetum variegatum*).

Although covering a linear distance within the PDA of approximately 1.5 km, wetlands near the western end of the Project that extend outside of the PDA (WL-01, WL-04, and WL-05) are all part of a large wetland complex outside of the PDA. There appears to be a possible divide outside of the PDA within WL-04, with WL-01 and western portions of WL-04 providing stream flow support and draining to the northwest into an unnamed, mapped watercourse (WC 01) that flows into the United States, and eastern parts of WL-04 and WL-05 providing stream flow support and draining to the east into a tributary to Mill Brook (WC 01-02), which ultimately drains into the Meduxnekeag River. These wetlands also function to provide some surface water storage and possibly some waterfowl and waterbird habitat. Herpetile habitat is an important function, as the wetlands are relatively large and connected, and contain a variety of water levels throughout the year. The wetlands are considered to have high function for providing songbird, raptor, mammal, and pollinator habitat.

WL-02 is a tall shrub swamp that formed between Route 95 and an unnamed, abandoned road north of Route 95. There are several culverts within the wetland. Culverts on the southeast of the wetland are inlets which bring water into the wetland from under Route 95, while culverts on the northwest side of the wetland are outlets which release water to the other side of the abandoned road, eventually feeding into WL-01. This wetland provides some hydrological functions, storing and delaying water, and allowing suspended sediments to settle out prior to water entering WL-01. Because the wetland detains water, it also likely retains phosphorus and nitrogen. Although plant and structural diversity does not appear to be very high within the wetland, WL-02 does support a vascular plant SOCC, blunt-leaved bedstraw (*Galium obtusum*). Although function for wildlife habitat is likely generally low, amphibian eggs were observed within ponded water in the wetland, and a garter snake was also observed within the wetland.

WL-03 is a small (0.03 ha) and isolated wetland within a portion of the Route 95 RoW that experiences periodic vegetation management. Water enters the wetland from several seeps and a culvert under Route 95, but there is no clear outlet. Although its functions are limited, a vascular plant SOCC, Loesel's twayblade (*Liparis loeselii*, S3) was observed within this wetland and nowhere else within the PDA or surrounding surveyed areas.

The wetland complex associated with Morrison Lake (WL-06), because of its open water component and multiple wetland types, provides several wetland functions. These include stream flow support and water cooling of Mill Brook (WC 02, WC 02-01, and WC 03), a tributary of Meduxnekeag River. This function is of increased importance as the wetland is in the upper one third of the watershed. Other wetland functions include sediment retention and stabilization; phosphorus and nitrate retention; and the heterogeneity of the wetland increases its function as habitat for wildlife, including aquatic invertebrates, herpetiles, waterbirds and waterfowl, songbirds, raptors, mammals, and pollinators, and native plants. One plant SAR, a large butternut tree, was observed on the upland edge of WL-06, south of the softwood treed swamp component of the wetland.

WL-07, WL-08, and WL-09 are all part of a primarily riparian system that provides stream flow support and water cooling for two unnamed tributaries to the Meduxnekeag River. These wetlands also provide habitat for resident fish populations; fish were observed in both tributaries during aquatic surveys conducted in support of the Project (Section 4.3.3). The wetlands provide habitat for a number of animals, and also provide native plant habitat. One plant SOCC, dotted smartweed, was observed within WL-08 and two butternut saplings, a SAR, were observed on the upland edge of the wetland.

WL-10 is a small (0.02 ha) isolated wetland within an inactive gravel pit. Water enters the wetland from a small seep on the southern end; there are no outlets, a very small catchment area, and no obvious hydrological functions or benefits. The wetland provides some wildlife habitat for amphibians, which can spawn in the open water.

WL-11 is a densely-vegetated shrub swamp that provides hydrological functions such as sediment retention and stabilization, nutrient retention, and water cooling for an unnamed tributary to Meduxnekeag River that passes through the wetland. The wetland also provides native plant habitat, and wildlife habitat, e.g., for beavers and waterbirds.

WL-12 is a small shrub swamp that has formed on an old road or trail. It has limited functions, but likely serves to slow and filter overland flow that enters the wetland from nearby slopes and impervious surfaces associated with Route 95. The wetland has standing water during some parts of the growing season and may provide habitat for amphibians.

4.3.4.2.3.2 Ecological Communities of Management Concern

Wildlife habitat includes Ecological Communities of Management Concern (ECMC). ECMC are typically vegetation communities which fulfil special management concerns in New Brunswick (e.g., deer wintering areas (DWAs), Protected Natural Areas (PNAs), interior forest, ESAs).

White-tailed deer is not a SAR or SOCC; however, it is an important managed species in New Brunswick that requires sheltered areas such as mature softwood stands to overwinter. NBDERD actively manages over 800 DWA on Crown land that total approximately 280,000 ha. There are no DWA within the LAA.

Two PNAs are located within the LAA: Smith Brook PNA and Meduxnekeag Valley PNA. Smith Brook PNA is located on the New Brunswick border with the United States, approximately 250 m northwest of the PDA. No written information is available for this PNA, but the area does include Old Forest Community and Old Forest Wildlife Habitat. Meduxnekeag Valley PNA is one of few PNAs on private land in New Brunswick (GNB 2017). The PNA is also known as the Meduxnekeag Valley Nature Preserve; most of the PNA is located along the Meduxnekeag River and contains a network of walking trails (Meduxnekeag River Association 2012). One isolated area, Morrison Lake Wetland, is located within the LAA, adjacent the PDA for part of its length. Morrison Lake is the primary contributor to Mill Brook, and supports several rare plants (Meduxnekeag River Association 2012).

There are two ESAs located within the LAA: Richmond Corner Woods ESA, and Highway 95 Hardwoods ESA. Both ESAs have botanical objectives. Richmond Corner Woods ESA is a rich, mature tolerant hardwood stand located south of Route 95, approximately 1.5 km east of the Route 540 interchange. This forest stand contains mature butternut trees, and some rare herbaceous species such as American lopseed (*Phryma leptostachya*, *S2*) and large-fruited sanicle (*Sanicula trifoliata*, *S1*) (AC CDC 2016; Tims and Craig 1995). Highway 95 Hardwoods ESA is located south of Vivglenn Road, approximately 400 m from the intersection with Route 555. This area is a rich, immature tolerant hardwood stand that contains butternut and rare herbaceous species such as plantain-leaved sedge (*Carex plantaginea*, *S2*), showy orchis (*Galearis spectabilis*, *S2*), and orange-fruited Tinker's weed (*Triosteum aurantiacum*, *S2*).

Although not an ECMC by definition, there is one managed area, the Kindness Club Wildlife Refuge, within the LAA. Under the *Wildlife Refuges and Wildlife Management Areas Regulation* of the *Fish and Wildlife Act*, no hunting, trapping, or snaring is legally allowed within designated wildlife refuges or wildlife management areas.

Interior forest is defined as patches of mature forest greater than 10 ha in size and a minimum of 100 m from an edge (e.g., waterbodies, clearcuts, anthropogenic areas, and linear features such as roads or transmission lines). Interior forest patches are important to wildlife species that are particularly sensitive to habitat fragmentation. Some examples of interior species include

bay-breasted warbler, black-throated blue warbler, and the SAR eastern wood-pewee, Canada Warbler, and wood thrush.

There are three patches of interior forest contiguous to the LAA (i.e., part of the interior forest patch lies within the LAA). These patches are 15.0 ha, 16.3 ha, and 23.6 ha in size, and none are within 100 m of the PDA (Appendix C).

4.3.4.2.3.3 Vascular Plant SAR and SOCC

During field surveys conducted in support of the Project, 398 vascular plant species were recorded within the PDA and surrounding areas (Appendix D, Table D.1). Of these, one is a SAR and eleven are SOCC (Table 4.10). Those species observed within the PDA are described below.

Table 4.10 Vascular Plant SAR and SOCC Observed within and near the PDA

Scientific Name	Common Name	*SARA* rank	NB *SARA* rank	AC CDC S-Rank[1]	Occurrences within the PDA
Juglans cinerea	butternut	*endangered*	*endangered*	*S1*	27
Polygala senega	seneca snakeroot	-	-	*S2*	0
Triosteum aurantiacum	orange-fruited tinker's weed	-	-	*S2*	4
Crataegus macrosperma	big-fruit hawthorn	-	-	*S2?*	0
Galium obtusum	blunt-leaved bedstraw	-	-	*S2?*	1
Adiantum pedatum	northern maidenhair fern	-	-	*S3*	7
Carex rosea	rosy sedge			S3	2
Carex tenera	tender sedge			S3	1
Dryopteris goldiana	Goldie's woodfern			S3	15
Elatine minima	small waterwort			S3	1
Liparis loeselii	Loesel's twayblade			S3	1
Polygonum punctatum	dotted smartweed	-	-	*S3*	1

[1] *S1* = critically imperiled, *S2* = imperiled, *S3* = vulnerable (AC CDC 2017)

Butternut

Butternut (*S1*) is a medium-sized deciduous tree that typically grows to approximately 25 m in height (Farrar 1995). This species is part of the walnut family and produces large, edible nuts. It

grows best in stands with rich soils, often in riparian zones, but can also grow in gravelly soils in calcareous areas (Farrar 1995; Hinds 2000). Butternut is a SAR, listed as *endangered* under *SARA* and NB *SARA*. Its inclusion as a SAR is the result of the spread of a fungal pathogen known as butternut canker, which causes the crowns of trees to die back, and can eventually cause stem girdling, killing the tree (COSEWIC 2003). Unfortunately, there is currently no treatment or cure for the butternut canker once it has become established in a population. Natural Resources Canada (2016a) recommends the immediate removal of infected trees to limit the spread of the disease. In New Brunswick, the Department of Energy and Resource Development's (NBDERD) has recognized the state of the butternut is so dire, that prohibitions on cutting this species are not warranted. Thus, butternut is not included in the *Prohibitions Regulation* under NB *SARA* despite its *endangered* ranking, and is not protected by the prohibitions listed in NB *SARA*.

Thirty-eight butternut (including two clusters of seedlings) were observed during field surveys conducted in 2016 and 2017 (Appendix C). Of these, 27 are within the current PDA. The size of the butternut trees within the PDA ranges from less than 5 cm DBH to approximately 50 cm DBH. Several of the trees were producing fruit at the time of survey. During a dedicated butternut follow-up survey, it was determined that of the 27 butternut trees observed within the PDA, 23 trees (85.2% of total) had visible signs of canker infection when surveyed in July 2017. The results of the butternut survey are presented in Appendix D, Table D.2.

Orange-fruited Tinker's Weed

Orange-fruited tinker's weed (*Triosteum aurantiacum, S2*), also known as wild coffee, is a plant in the Honeysuckle family with opposite leaves and pink to red flowers in leaf axils that develop to orange-coloured berries (Haines 2011). It is found in rich, mesic woods, and on forest edges (Haines 2011; Hinds 2000). This plant was found in four locations within the PDA and two locations outside of the PDA, all east of the Route 2 and Route 95 interchange (Appendix C). There are also 39 records of this species within 5 km of the Project (AC CDC 2016).

Blunt-leaved Bedstraw

Blunt-leaved bedstraw (*Galium obtusum, S2?*) is a small, delicate plant with whorled leaves that typically grows on shores, swampy thickets, and wet meadows (Hinds 2000; Gleason and Cronquist 1991). It was found in a single location, within the PDA in WL-02 (Appendix C).

Northern Maidenhair Fern

Northern maidenhair fern (*Adiantum pedatum, S3*) is a distinctive-looking fern that is rare in New Brunswick, but locally common in some areas within the Saint John River Valley and several other locations (Hinds 2000). It is typically found in rich, moist hardwood stands (Haines 2011; Hinds 2000). A number of patches of this species were noted near the eastern end of the PDA within sugar maple-dominated hardwood stands, and a single patch of approximately 50 individuals

was observed in a very open area east of Plymouth Road (Appendix C). There are also 97 records of this species within 5 km of the Project (AC CDC 2016).

Rosy Sedge

Rosy sedge (*Carex rosea, S3*) is a sedge with narrow leaves and small, sparse spikelets, and is known to occur in rich woods (Hinds 2000). This species was found within the PDA in two locations: within an old-field, white spruce-dominated forest stand east of Plymouth Road, and within an intolerant hardwood stand east of First Plymouth Road, near the eastern end of the PDA (Appendix C). There are also 67 records of this species within 5 km of the Project (AC CDC 2016).

Tender Sedge

Tender sedge (*Carex tenera, S3*) is a delicate sedge within the Ovales section, typically found in moist, open ground and within forests (Hinds 2000). It was found within a sapling-aged inolerant hardwood stand between Route 95 and an abandoned road, near the western end of the PDA (Appendix C).

Goldie's Woodfern

Goldie's woodfern (*Dryopteris goldiana, S3*) is a large, stout, blueish-green fern that is often restricted to rich, shaded hardwood forest stands (Hinds 2000). A number of patches of this species were found both within and adjacent to the PDA within hardwood stands near the western end of the PDA. It was also found at the edge of the PDA within an eastern white cedar-dominated stand near WL-01, and outside of the PDA near the open edge of a balsam fir and black spruce-dominated forest stand, two habitats that are not typical for this species (Appendix C). There are also 54 records of this species within 5 km of the Project (AC CDC 2016).

Small Waterwort

Small waterwort (*Elatine minima, S3*) is a tiny, inconspicuous plant found in shallow water and along muddy or sandy shores (Hinds 2000). It is likely that its rarity is due in part to its being overlooked. This plant was observed near the edge of the PDA within a mixedwood treed swamp drainageway portion of WL-04 (Appendix C).

Loesel's Twayblade

Loesel's twayblade (*Liparis loeselii, S3*) is a small, fairly inconspicuous orchid found in wet, open soils within thickets, meadows, fens, roadside ditches, and other disturbed areas. Nine individuals were found in a single location within the PDA, within WL-03, a disturbed marsh located adjacent to Route 95 (Appendix C). There is a single record of this species within 5 km of the Project (AC CDC 2016).

Dotted Smartweed

Dotted smartweed (*S3*) is a semi-aquatic plant often observed on muddy or gravelly shores, wet soil, or shallow water (Hinds 2000; Gleason and Cronquist 1991). This plant was observed outside of the PDA within WL-08, within a riparian softwood treed swamp component of the wetland.

4.3.4.2.3.4 Invasive Vascular Plants

The PDA is adjacent to or near Route 95 for the majority of its length, which acts as a vector for the spread of exotic vascular plant species, i.e., vascular plant species that are not native to this area. As a result, a relatively high proportion of the vascular plants that were observed during field surveys (33.1%) are exotic. Most exotic species are unlikely to cause extensive changes to native plant communities; however, invasive species are non-native species that can spread rapidly (sexually, asexually, or both) and can cause harm, either ecological, economic, or to human health (NISC 2006). Ecological harm can include outcompeting native species and reducing biodiversity, and changing ecological function (e.g., reducing wildlife habitat). Economic harm could include damage to crops or timber, and harm to human health includes the effects of poisonous plants (NISC 2006). Four invasive vascular plant species were observed within the PDA during the 2016 and 2017 surveys, described below.

Garlic mustard (*Alliaria petiolata*) is an herbaceous plant in the mustard family that is known to be spreading in forests along the Saint John River valley (NBISC 2012). It is considered one of the worst invasive species in deciduous forests, as it easily colonizes, spreads, and outcompetes other species in undisturbed forests, often the same forests that support rare vascular plants (NCC 2017; NBISC 2012). Garlic mustard was observed in four locations during vascular plant surveys: south of the PDA along the NB Trail at the eastern end of the Project, within the PDA between First Plymouth Road and the NB trail, south of the PDA along an unnamed watercourse east of First Plymouth Road, and within the PDA in a small hardwood stand east of Plymouth Road.

Purple loosestrife is a well-known herbaceous invasive wetland species that is easily identifiable, with pinkish-purple flowers and a tough, square stem. This species can become dominant and reduce biodiversity within wetlands (NCC 2017; NBISC 2012). Purple loosestrife was observed in two locations within the surveyed area: within the PDA on the upland edge of WL-04, and outside of the PDA in a ditch leading to WL-08. Both locations are adjacent to Route 95.

Wild parsnip (*Pastinaca sativa*) is a tall herbaceous plant in the carrot family that is frequently seen in roadside ditches and can also be found in wetlands. It contains compounds that cause extreme photosensitivity when applied to the skin and can result in deep burns and welts (NCC 2017). Wild parsnip was noted in multiple locations both inside and outside of the PDA adjacent to Route 95, approximately 1.8 km west of the Route 2 interchange, and was also noted on the abandoned road on the western end of the Project, south of Route 95.

Japanese knotweed (*Polygonum cuspidatum*) is a large, almost woody plant that grows and spreads very quickly and often forms dense stands. This species can grow in a range of habitats and easily outcompete native vegetation (NBISC 2012). Japanese knotweed was observed north of the PDA in a gravel pit located east of Route 2, approximately 160 m from the end of the Project, and within the PDA near Old Houlton Road on the western end of the Project.

4.3.4.2.3.5 Birds

Information sources including the AC CDC, CBC, MBBA, and field surveys indicate 148 species of birds have been recorded near the LAA (i.e., within 5 km of the PDA, or within the MBBA squares crossed by the Project). A list of all the species reported by various sources near the LAA can be found in Table D.3 Appendix D. Twelve of these species are SAR and 29 are SOCC (Table 4.11).

Atlantic Canada Data Conservation Centre

A list of species and observations with known historical occurrences within a 5 km radius of the PDA was generated by the AC CDC (2016). One-hundred and thirty-two bird species were reported, including 11 SAR.

Maritimes Breeding Bird Atlas

The Project interacts with three MBBA atlas squares (19EM91, 19FM01, and 19EM90). During the 2006-2010 atlas period, 91 species of bird were recorded across these three squares. Thirty-two of these were confirmed as breeding, 20 were probable breeders, and 39 were possible breeders.

Christmas Bird Count

The Project is located within 5 km of a single Christmas Bird Count, for which, at the time of writing, a single year of data was available (2015). Thirty-three species of birds were reported during the 2015 Christmas bird count, including one SAR (bald eagle).

Nocturnal Owl Field Surveys

Roadside surveys involving playbacks were conducted at seven locations during the evening of April 18, 2016. A single barred owl (*Strix varia*) was observed.

Table 4.11 Bird SAR and SOCC Reported or Observed to be Within or Near the LAA

Common Name	Scientific Name	*SARA* Status	COSEWIC Status	NB *SARA* Status	AC CDC S-rank[1]	Data Source
gadwall	*Anas strepera*				*S2B,S3M*	AC CDC
lesser scaup	*Aythya affinis*				*S1B,S4M*	AC CDC
bufflehead	*Bucephala albeola*				*S3M,S2N*	AC CDC
horned grebe	***Podiceps auritus***	**Schedule 1, *special concern***	***special concern***	***special concern***	***S4N,S4M***	**AC CDC**
red-necked grebe	*Podiceps grisegena*		*not at risk*		*S3M,S2N*	AC CDC
black-billed cuckoo	*Coccyzus erythropthalmus*				*S3B,S3M*	AC CDC, MBBA
common nighthawk	***Chordeiles minor***	**Schedule 1, *threatened***	***threatened***	***threatened***	***S3B,S4M***	**AC CDC**
chimney swift	***Chaetura pelagica***	**Schedule 1, *threatened***	***threatened***	***threatened***	***S2S3B,S2M***	**AC CDC**
killdeer	*Charadrius vociferus*				*S3B,S3M*	AC CDC, MBBA, Stantec
solitary sandpiper	*Tringa solitaria*				*S2B,S5M*	AC CDC
black-crowned night heron	Nycticorax nycticorax				*S1S2B,S1S2M*	AC CDC
common tern	*Sterna hirundo*		*not at risk*		*S3B,SUM*	AC CDC
turkey vulture	*Cathartes aura*				*S3B,S3M*	AC CDC, Stantec
bald eagle	***Haliaeetus leucocephalus***		***not at risk***	***endangered***	***S4***	**AC CDC, CBC, MBBA, Stantec**
red-shouldered hawk	*Buteo lineatus*		*not at risk*		*S2B,S2M*	AC CDC
snowy owl	*Bubo scandiacus*		*not at risk*		*S1N,S2S3M*	AC CDC
olive-sided flycatcher	***Contopus cooperi***	**Schedule 1, *threatened***	***threatened***	***threatened***	***S3B,S3M***	**Stantec**
eastern wood-pewee	***Contopus virens***	**No Schedule, no status**	***special concern***	***special concern***	***S4B,S4M***	**AC CDC, MBBA, Stantec**
great crested flycatcher	*Myiarchus crinitus*				*S2S3B,S2S3M*	AC CDC
warbling vireo	*Vireo gilvus*				*S3B,S3M*	AC CDC
purple martin	*Progne subis*				*S1B,S1M*	AC CDC
northern rough-winged swallow	*Stelgidopteryx serripennis*				*S1S2B,S1S2M*	AC CDC
bank swallow	***Riparia riparia***	**No Schedule, no status**	***threatened***		***S2S3B,S2S3M***	**AC CDC, MBBA**
cliff swallow	*Petrochelidon pyrrhonota*				*S2S3B,S2S3M*	AC CDC, MBBA
barn swallow	***Hirundo rustica***	**No Schedule, no status**	***threatened***	***threatened***	***S2B,S2M***	**AC CDC, MBBA**
Carolina wren	*Thryothorus ludovicianus*				*S1B,S1M*	AC CDC
wood thrush	***Hylocichla mustelina***	**No Schedule, no status**	***threatened***	***threatened***	***S1S2B,S1S2M***	**AC CDC, Stantec**
brown thrasher	*Toxostoma rufum*				*S2B,S2M*	AC CDC

Table 4.11 Bird SAR and SOCC Reported or Observed to be Within or Near the LAA

Common Name	Scientific Name	*SARA* Status	COSEWIC Status	NB *SARA* Status	AC CDC S-rank[1]	Data Source
northern mockingbird	*Mimus polyglottos*				*S2B,S2M*	AC CDC
pine grosbeak	*Pinicola enucleator*				*S2B,S4S5N,S4S5M*	AC CDC, MBBA
red crossbill	*Loxia curvirostra*				*S3*	AC CDC
pine siskin	*Spinus pinus*				*S3*	AC CDC, CBC, Stantec
evening grosbeak	*Coccothraustes vespertinus*				*S3B,S3S4N,SUM*	AC CDC, CBC, MBBA, Stantec
Canada warbler	***Cardellina canadensis***	**Schedule 1, *threatened***	***threatened***	***threatened***	***S3B,S3M***	**AC CDC, MBBA, Stantec**
vesper sparrow	*Pooecetes gramineus*				*S2B,S2M*	AC CDC
scarlet tanager	*Piranga olivacea*				*S3B,S3M*	AC CDC, MBBA
indigo bunting	*Passerina cyanea*				*S3B,S3M*	AC CDC, MBBA
bobolink	***Dolichonyx oryzivorus***	**Schedule 1, *threatened***	***threatened***	***threatened***	***S3B,S3M***	**AC CDC, MBBA, Stantec**
rusty blackbird	***Euphagus carolinus***	**Schedule 1, *special concern***	***special concern***	***special concern***	***S3B,S3M***	**AC CDC**
brown-headed cowbird	*Molothrus ater*				*S3B,S3M*	AC CDC
Baltimore oriole	*Icterus galbula*				*S3B,S3M*	AC CDC, MBBA

Note:

Species at Risk (SAR) are presented in **bold text**.

[1] S1 = critically imperiled, S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure, and SNA = not applicable. S#S# = range rank, *i.e.*, the status is uncertain but between two listed ranks (AC CDC 2017)

Early Breeding Bird Field Surveys

Four woodpecker species and two raptor species were observed during the early breeding bird surveys. Table 4.13 summarizes the early breeding species detected during the surveys

Table 4.12 Summary of Early Breeding Bird Species Observed in the LAA

Common Name	Scientific Name	Highest Stantec Breeding Status	Highest MBBA Breeding Status
turkey vulture	*Cathartes aura*	Observed	N/A
bald eagle	*Haliaeetus leucocephalus*	Observed	Confirmed
yellow-bellied sapsucker	*Sphyrapicus varius*	Confirmed	Confirmed
downy woodpecker	*Picoides pubescens*	Possible	Possible
northern flicker	*Colaptes auratus*	Probable	Probable
pileated woodpecker	*Dryocopus pileatus*	Confirmed	Confirmed

Crepuscular Bird Field Surveys

Surveys using playbacks were conducted at five roadside locations with potentially suitable habitat for common nighthawk on the evening of June 1. No nightjars (including common nighthawk) were observed during field surveys conducted in 2016. Additionally, no common nighthawk were reported in the LAA by the AC CDC or MBBA.

Breeding Bird Field Surveys

Breeding bird surveys were conducted in the LAA between June 1 through June 3, 2016. Twenty-six point counts were completed in various habitat types including softwood, mixedwood, and hardwood stands of varying ages, as defined by the NBDNR landbase inventory data. Other habitat types including anthropogenic and wetland habitats were also sampled. Table 4.13 provides statistics on the habitats, including the number of point counts conducted in each.

Seventy species (including species observed incidentally) were identified during the surveys. Excluding incidental observations, the most abundant species observed across all the surveys was oven bird (30 individuals), followed by blue-headed vireo (29 individuals), and American robin (26 individuals).

Table D.2 in Appendix D presents all species recorded within the LAA (including those observed during the point count surveys), and their highest breeding status (available from MBBA or as collected in the field).

The number of species observed within a given habitat type (species richness) was calculated for each of the habitat types sampled within the LAA (Table 4.14). Due to the highly-fragmented nature of the habitat within the LAA, it was not feasible to obtain enough habitat replicate points to calculate species density for each species.

Table 4.13 Habitat Types Sampled During Field Surveys, and Species Richness

Habitat Type	Number of Point Counts Completed	Area of Habitat Type in LAA (ha)	Species Richness*
Agricultural	2	158.14	17
Anthropogenic	4	281.3	27
Barren	0	0.11	0
Industrial	2	58.16	7
Forests			
Regen-sapling Hardwood	3	68.32	16
Regen-sapling Mixedwood	2	18.21	13
Regen-sapling Softwood	0	1.66	3
Young-immature Hardwood	1	222.43	20
Young-immature Mixedwood	2	137.87	16
Young-immature Softwood	2	95.86	17
Mature-overmature Hardwood	2	85.97	9
Mature-overmature Mixedwood	4	93.24	26
Mature-overmature Softwood	1	61.71	14
Restricted Freehold	0	18.58	8
Wetlands			
Fen	0	6.67	11
Marsh	0	4.17	
Shallow Water Wetland	0	0.02	
Shrub Swamp	0	52.52	15
Hardwood Treed Swamp	0	7.81	
Mixedwood Treed Swamp	3	151.90	27
Softwood Treed Swamp	3	91.89	22
Waterbody	0	13.74	8

* Richness values were calculated based upon the habitat in which each individual bird was observed. Due to the fragmented nature of the habitat present in the Study Area, some birds were observed within habitats different than that in which the observer was located during the point count surveys. This resulted in some birds being recorded within habitats in which no point count was centered.

Bird Species at Risk (SAR)

The following 12 SAR have been previously recorded or directly observed by Stantec within or near the LAA (i.e., within 5 km of the PDA, or within the MBBA squares crossed by the Project).

Horned Grebe

Horned grebe (*Podiceps auritus*) is a small, strikingly-colored waterbird. Approximately 92% of the breeding range of this species is within Canada (COSEWIC 2009), where it occurs in British Columbia, Yukon, Northwest Territories, the extreme southern part of Nunavut, all the prairie provinces, northwestern Ontario, and the Magdalen Islands in Quebec (COSEWIC 2009). It is not known to breed in New Brunswick. The BBS (ECCC 2014) reports that this species is in decline at a Canada-wide level. The main factor thought to be responsible for the decline of this species is the permanent loss of wetlands to agriculture development (COSEWIC 2009). In addition, the concentrated nature of the populations of this species when on their breeding grounds makes them vulnerable to threats such as disease and environmental disasters. This species is considered *special concern* under Schedule 1 of *SARA* and NB *SARA*. The AC CDC list this species as *S4N, S4M*, indicating the non-breeding and migratory populations of this species are apparently secure in New Brunswick.

The horned grebe breeds primarily in temperate zones within small semi-permanent ponds, marshes, and shallow bays on lake borders where emergent vegetation is rich. AC CDC records for this species indicate it being observed in “Woodstock general area”; the specific location of the observations is not known (AC CDC 2016). The Morrison Lake area may represent appropriate habitat for this species, but it was not observed during bird surveys conducted in support of the Project. This species is unlikely to be found breeding within the PDA as the habitat at Morrison Lake within the PDA is considered marginal given its proximity to Route 95, but could be found within the LAA, further from Route 95.

Common Nighthawk

The common nighthawk (*Chordeiles minor*) is a medium-sized bird which nests across North America. This species occurs in all Canadian provinces and territories except for Nunavut (COSEWIC 2007a). The common nighthawk is considered *threatened* under Schedule 1 of *SARA* and under NB *SARA*. 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 2007a).

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 2007a). Common nighthawk were reported within 5 km of the PDA by the AC CDC (2016), but not within the LAA. Suitable habitat for common nighthawk exists within the PDA and LAA, including cleared areas and rocky outcrops. Although this species was not observed during common nighthawk surveys conducted in 2016, there is potential for this species to be found within the PDA. It is possible that the 2016 surveys occurred prior to the commencement of nesting.

Chimney Swift

The chimney swift (*Chaetura pelagica*) 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 2007b). This species is considered *threatened* under Schedule 1 of *SARA* and under NB *SARA*. The AC CDC lists this species as *S2S3B, S2M* indicating that the breeding population of this species is considered imperiled to vulnerable, and the migrating population is considered imperiled in New Brunswick.

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 2007b). Chimney swift records within the AC CDC database are within the town of Woodstock. 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 foraging within the PDA and LAA.

The BBS (ECCC 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 declining number of available and suitable breeding and roosting sites including old abandoned buildings and traditional chimneys (COSEWIC 2007b). Pesticide spraying which reduces the availability of aerial insect prey may also be a factor.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is a large, distinctive bird of prey found across Canada, and much of North America. The BBS (ECCC 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 2017). This species is listed as *endangered* under NB *SARA,* and *S4* by the AC CDC, indicating that the population of this species is considered apparently secure in New Brunswick. Bald eagle has no *SARA* rank at this time.

Bald eagle nests are the largest of any species in North America, and this species prefers nesting sites near open water. Suitable nesting habitat, for this species, particularly forested areas near waterbodies, is found within the PDA and LAA. This species was observed outside of the LAA during field surveys in 2016.

Olive-sided Flycatcher

The olive-sided flycatcher (*Contopus cooperi*) is a stout, medium-sized passerine which breeds in scattered locations throughout most of forested Canada (COSEWIC 2007c). The BBS (ECCC 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. This species is listed as *threatened* under Schedule 1 of *SARA* and NB *SARA*. The AC CDC lists the olive-sided flycatcher as *S3B, S3M*, indicating that the breeding and migratory populations of this species are considered vulnerable in New Brunswick.

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. Three olive-sided flycatchers were observed in the LAA during field surveys in 2016 near Morrison Lake and associated wetlands.

Eastern Wood-pewee

The eastern wood-pewee (*Contopus virens*) is a small passerine which breeds across much of Canada from Saskatchewan to the Maritime provinces (COSEWIC 2012a). The BBS (ECCC 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). This species is ranked as *threatened* by COSEWIC and NB *SARA*. The AC CDC ranks this species as *S4B, S4M*, indicating that the breeding and migratory populations of this species are considered apparently secure in New Brunswick.

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 was detected in the LAA south of Route 95 during field surveys in 2016.

Bank Swallow

The bank swallow (*Riparia riparia*) is a small, highly social songbird which feeds primarily on aerial insects (COSEWIC 2013). This species occurs on every continent except Antarctica and Australia.

In North America, this species breeds in every province with the exception of Nunavut (COSEWIC 2013). The BBS (ECCC 2014) reports that this species is in decline in Canada and at the provincial level in New Brunswick. 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 2013). Bank swallow is ranked as *threatened* by COSEWIC, and has no *SARA* status or schedule or NB *SARA* status. The AC CDC ranks bank swallow as *S2S3B, S2S3M*, indicating that the migratory and breeding populations of this species are considered imperiled to vulnerable in New Brunswick.

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 2013). This species has been recorded at the Woodstock Marina and other locations along the Saint John River (AC CDC 2016). Potentially suitable nesting habitat for this species exists within the LAA, and potentially suitable foraging habitat exists with the PDA.

Barn Swallow

The barn swallow (*Hirundo rustica*) 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 2011). The BBS (ECCC 2014) indicates that this species is undergoing a decline in population, although the species is still common and widespread (COSEWIC 2011). 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. The barn swallow is ranked as *threatened* by COSEWIC and NB *SARA,* and *S2B, S2M* by the AC CDC, indicating that the breeding and migratory populations of this species are considered imperiled in New Brunswick. 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 anthropogenic structures. This insectivorous species prefers open habitats for foraging such as pastoral lands, shorelines, and cleared rights-of-way. Foraging and nesting habitat for this species exists within the LAA. It has been reported in Richmond Corner, possibly within the LAA (AC CDC 2016).

Wood Thrush

The wood thrush (*Hylocichla mustelina*) is a medium sized bird which breeds in southeastern Canada from southern Ontario east to Nova Scotia (COSEWIC 2012b). The BBS (ECCC 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). This species is listed as *threatened* by COSEWIC and NB *SARA*, and *S1S2B, S1S2M* by the AC CDC indicating

that the breeding and migratory population of this species are considered critically imperiled to imperiled in New Brunswick. It has no *SARA* designation at this time.

Wood thrush nest predominantly in second-growth and mature forests, both deciduous and mixedwood, with saplings and well-developed understory layers. This species has been observed both north and south of the PDA (AC CDC 2016), and there is suitable habitat for wood thrush within the PDA and LAA. Although this species is unlikely to nest adjacent to Route 95, there is potential for this species to be found within the PDA in sections that are further from the highway, such as east of the Richmond Corner interchange. This species was detected incidentally in the LAA near the western end of the Project, north of Route 95 during vegetation surveys in 2017.

Canada Warbler

Canada warbler (*Cardellina canadensis*) is a small and brightly colored passerine. Approximately 80% of the entire breeding range of this species is located in Canada (COSEWIC 2008), where it can be found breeding in every province and territory except Newfoundland and Labrador and Nunavut. The BBS (ECCC 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.

Canada warbler is ranked as *threatened* on Schedule 1 of *SARA* and under NB *SARA*, and *S3B, S3M* by the AC CDC, indicating that the breeding and migratory populations of this species are considered vulnerable in New Brunswick.

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 2008). 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. This species was observed six times during field surveys conducted in 2016 and four times incidentally in 2017: within the PDA in WL-02, in three locations next to the PDA and in two locations in the LAA in WL-04, within the LAA in WL-06 and WL-07, and in two locations next to the PDA near WL-08.

Bobolink

Bobolink (*Dolichonyx oryzivorus*) is a medium-sized passerine that breeds in the southern part of all Canadian provinces from British Columbia to Newfoundland and Labrador. The BBS (ECCC 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.

Bobolink is ranked as *threatened* by COSEWIC and NB *SARA*, and *S3B, S3M* by the AC CDC, indicating that the breeding and migratory populations of this species are considered vulnerable in New Brunswick. It has no *SARA* rank at this time.

Bobolink originally nested in the tall-grass prairie of the mid-western U.S 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 2010). 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. This species was observed in the LAA in a field north of the PDA during field surveys.

Rusty Blackbird

The rusty blackbird (*Euphagus carolinus*) is a medium-sized passerine most commonly associated with forest wetlands. The BBS (ECCC 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. This species is listed as *special concern* on Schedule 1 of *SARA* and under NB *SARA*. The AC CDC ranks the rusty blackbird as *S3B, S3M*, indicating the breeding and migratory populations of this species are considered vulnerable in New Brunswick.

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. This species has been observed within 5 km of the PDA (AC CDC 2016), and potentially suitable habitat for rusty blackbirds exists within the LAA. There is potential for this species to be found within the PDA, although more likely within the LAA, given the proximity of otherwise suitable nesting sites within the PDA to Route 95.

4.3.4.2.3.6 Other Wildlife

Bats

In late 2014, three bat species native to New Brunswick (little brown myotis (*Myotis lucifugus*), long-eared myotis (*Myotis septentrionalis),* and tri-colored bat (*Perimyotis subflavus*)) were listed as *endangered* under *SARA* and NB *SARA* following precipitous population declines as a result of white nose syndrome (WNS). WNS, which is caused by the introduced fungus *Pseudogymnoagscus destructans*, has resulted in the populations of these species being reduced by over 99% in New Brunswick (CBC 2015).

The AC CDC reports that bat hibernacula are present within 5 km of the PDA, but given the sensitive nature of these species, no precise information is given on the potential number or locations of hibernacula (AC CDC 2016). Although no targeted surveys were conducted, no

bats, or potential maternal colonies were observed within the PDA or LAA during field surveys in 2016.

Wood Turtle

The wood turtle (*Glyptemys insculpta*) is a moderately terrestrial, medium-sized turtle with a distinctive sculptured appearance to its carapace. This species is listed as *threatened* under *SARA*, NB *SARA*, and by COSEWIC, and is ranked *S2S3* by the AC CDC, indicating that this species is imperiled to vulnerable in New Brunswick. This species has a patchy range from Nova Scotia west through New Brunswick, Quebec, and Ontario, with approximately 30% of its global distribution occurring in Canada. The AC CDC (2016) reported the historical presence of wood turtles within 5 km of the PDA. The LAA lies within the natural range for the species (COSEWIC 2007d), and contains potentially suitable habitat.

Monarch Butterfly

The monarch butterfly (*Danaus plexippus*) is a large, orange and black butterfly. This species is listed on Schedule 1 of *SARA* as *special concern*, and is ranked as *endangered* by COSEWIC. NB *SARA* considers the monarch *special concern*. Across Canada, monarchs are found primarily wherever milkweed (*Asclepius* spp.) and wildflowers (such as goldenrod, asters, and purple loosestrife) exist. This includes abandoned farmland, along roadsides, and other open spaces where these plants grow. Milkweed serves as the primary source of food for the larvae of monarchs. The AC CDC (2016) reports the presence of monarchs within 5 km of the PDA, and milkweed was observed at several disturbed locations within the PDA. First instar monarch larvae were observed during field surveys in 2017 within a cleared field (Appendix C).

Common Wildlife

Incidental observations of other wildlife were made by field staff while conducting surveys, including vegetation and wetland surveys.

Excluding birds, 15 wildlife species (or evidence thereof) were observed in the LAA, including:

- Eastern coyote (*Canis latrans*)
- Red fox (*Vulpes vulpes*)
- American black bear (*Ursus americanus*)
- Northern raccoon (*Procyon lotor*)
- Moose (*Alces alces*)
- White-tailed deer (*Odocoileus virginianus*)
- Star-nosed mole (*Condylura cristata*)
- Snowshoe hare (*Lepus americanus*)
- Red squirrel (*Tamiasciurus hudsonicus*)
- American beaver (*Castor canadensis*)
- Common muskrat (*Ondatra zibethicus*)
- Woodland jumping mouse (*Napaeozapus insignis*)

- Wood frog (*Lithobates sylvaticus*)
- Spring peeper (*Pseudacris crucifer*)
- Common gartersnake (*Thamnophis sirtalis*)

Each of these mammal and herpetile species are listed as S5 by the AC CDC which is considered secure, or "common, widespread, and abundant in the province" (ACDC 2017).

4.3.4.3 Assessment of Potential Environmental Effects on the Terrestrial Environment

4.3.4.3.1 Project Effect Pathways for the Terrestrial Environment

4.3.4.3.1.1 Construction

Construction activities have the potential to result in adverse environmental effects resulting in the change and loss of vegetation communities (including wetland and ECMC) and wildlife habitat, the loss of vascular plant and wildlife SAR and SOCC, mortality of wildlife from collision with construction equipment, sensory disturbance to wildlife resulting in habitat avoidance, and edge effects resulting in indirect mortality to wildlife.

Vegetation clearing could result in the direct loss of and change to vegetation communities (including wetlands and ECMC) and wildlife habitat, as well as vascular plant SAR and SOCC. Clearing will remove overstory vegetation such as trees and shrubs from within the PDA, and could damage understory vegetation. If clearing occurs during the normal bird breeding season (i.e., April 1 to August 31 in this area of New Brunswick (ECCC 2016c)), the Project could result in the direct loss of unfledged birds if they are unable to leave their nest. The PDA represents less suitable habitat than adjacent habitat given its proximity to Route 95 and accompanying sensory disturbance. SAR and SOCC appear to be using the PDA. In particular, Canada warbler (a SAR) and killdeer (an SOCC) were observed within the PDA, and also adjacent to both the PDA and Route 95. Although not observed during field surveys conducted in 2016 or 2017, common nighthawk (a SAR) may also use areas within the PDA. Clearing has the potential to remove milkweed (*Asclepias* spp.) plants that are critical for some monarch life stages. Clearing can also reduce interior forest within surrounding areas, if interior forest is within 100 m of the PDA.

No grubbing is planned for the transmission line PDA, however, excavation of one to three holes with a footprint of 1 m x 3 m (i.e., 3m^2) will be required for each of the approximately 85 to 110 poles that are required for the Project, plus an excavation footprint of 1 m x 2 m for each anchor point for guy wires. The number of excavated holes required depends on the type of structures used; it is anticipated that single poles and H-frame poles will be used for the majority of the Project, steel H-frame structures with a longer spanning distance will be used over sensitive areas such as Morrison Lake, and three pole dead end structures will be used where angles are required. Excavation removes soil and the associated seed bank layer and heavy machinery used during construction can cause soil compaction, changing habitat quality. These two factors could potentially change the species that regenerate following construction disturbance.

Excavation for pole placement, where it occurs in wetlands, is expected to result in permanent wetland loss. Where clearing and excavation occur in wetlands, these activities can cause a loss of wetland function. If wetland soils are soft, some infilling immediately around poles may be required for the integrity of the backfill material. The use of heavy machinery will cause soil compaction within the wetland, which can alter wetland hydrology. Removal of vegetation will affect wetland processes such as sediment retention and stabilization, water cooling, supporting fish habitat in riparian wetlands, and depending on the vegetation present, may change the ability of the wetland to provide habitat for wildlife.

There are four ECMC within the LAA, two of which are located on the opposite site of the highway from the Project and one of which is located approximately 250 m from the PDA. These will not be affected by Project activities. Morrison Lake Wetland, part of the Meduxnekeag Valley PNA, is adjacent to the PDA. Although no clearing or direct disturbance to this PNA is expected, the PNA could experience some edge effects where adjacent to forested areas (described below).

Vegetation clearing can have indirect effects on areas adjacent to the PDA (including the Meduxnekeag Valley PNA) through edge effects. Changes in abiotic environmental factors such as light availability, wind penetration, humidity, and temperature because of vegetation removal constitute edge effects, and a change in these factors can influence the success of species that inhabit the area, including SAR and SOCC. Edge effects can also allow the establishment of invasive or exotic species, resulting in a change in community dynamics. Many invasive plant species are strong competitors and can thrive in disturbed (i.e., cleared) habitats. When these species are introduced to an area, their presence can result in native species being outcompeted and lost. Invasive plants that are already found within the existing RoW and PDA can be spread into adjacent areas through edge effects, and new invasive plant species can be introduced into the PDA by equipment that was previously operated in areas with invasive plants.

Edge effects can also increase access for herbivores and predators, resulting in changes to indirect mortality through herbivory or predation, and can also lead to increased nest parasitism. Nest predators and parasites (e.g., brown headed cowbirds) are more abundant near forest edges (Lloyd *et al.* 2005; Rich *et al.* 1994).

There are 27 instances of a vascular plant SAR (butternut), and nine vascular plant SOCC within the PDA. Vegetation clearing and excavation activities could lead to the loss of these individuals within the PDA. Additional butternut trees were observed outside of but near the PDA and may require clearing or partial delimbing to allow for safe construction and operation of the Project.

Vegetation clearing and other construction activities such as excavation will result in sensory disturbance to wildlife resulting from the lights and noise of construction equipment. Sensory disturbance could result in temporary habitat loss for birds through avoidance, and could

influence breeding and rearing success resulting in reduced productivity or nest abandonment. Temporary habitat loss via avoidance may also occur for other wildlife species (Bayne *et al.* 2008). Some small mammals and herpetiles may leave protective cover in response to construction noise and activity, which could increase direct mortality resulting from increased predation rates or collision with equipment.

Mortality of birds resulting from collisions could occur because of the Project. Lighted equipment can attract migrating birds, a phenomenon more pronounced at night and in poor weather conditions (Avery et al. 1976; Longcore and Rich 2004; Ogden 1996; Wiese *et al.* 2001).

Staging (i.e., temporary work spaces) may require additional clearing outside of the PDA. Although the areas where these activities will occur have not yet been identified, these activities could result in minor changes to vegetation communities and wildlife habitats, including wetlands.

4.3.4.3.1.2 Operation and Maintenance

Operation and Maintenance activities have the potential to result in adverse environmental effects resulting in the loss of vascular plant and wildlife SAR or SOCC, a change in vegetation communities and wildlife habitat and wetlands, sensory disturbance resulting in habitat avoidance by wildlife, and mortality of wildlife resulting from collision with project infrastructure.

Periodic vegetation management during Operation and Management could result in adverse environmental effects resulting in further change to previously disturbed vegetation communities and wildlife habitat, including wetlands. The PDA may provide nesting habitat for some bird species, therefore, if vegetation management were to occur during the breeding bird season, the Project may result in the direct loss of unfledged birds if they are unable to leave their nests.

Operation includes the presence of transmission lines, which can pose an increased mortality risk for wildlife, through collisions with the lines. Transmission line collision was recently estimated to be the third leading cause of bird-mortality from human influences (Calvert et al. 2013). Waterfowl and waterbirds are at higher risk of collisions due to their higher wing loading (body weight relative to wing area) and reduced maneuverability in the air (APLIC 2012; Bevanger 1998; Rioux *et al.* 2013). Transmission line design can also influence bird mortality, *e.g.,* transmission lines with inadequate spacing between components such as conductors can lead to electrocutions. This occurs when birds with large wing spans, such as raptors, touch more than one conductor with fleshy body parts (touching with dry feathers will not cause electrocutions).

4.3.4.3.1.3 Decommissioning and Abandonment

While Decommissioning and Abandonment is unlikely to result in significant adverse environmental effects to the Terrestrial Environment, it is possible that some bird species (e.g., osprey) may build nests on Project structures such as transmission line poles. These structures are attractive nesting sites for some birds, as they are typically stable, easily assessable, and the

tallest point in an area. Decommissioning poles may interact with nesting birds if they are present.

Decommissioning and Abandonment may produce sensory disturbance to wildlife, similarly to that produced during Construction. This sensory disturbance could result in temporary habitat loss through avoidance. The breeding and rearing success for some wildlife species could be affected by this sensory disturbance (Bayne *et al.* 2008).

Reclamation activities will result in an increase in native vegetation communities and wildlife habitat relative to the Operation and Maintenance phases.

4.3.4.3.2 Mitigation for the Terrestrial Environment

The following well-established practices to reduce the interaction between the Project and the Terrestrial Environment will be implemented during the various phases of the Project, as applicable:

- Flag and avoid known locations of individuals of SAR and SOCC, when possible, including milkweed, a host plant for monarchs
- Following NBDERD recommendations, any visibly diseased butternut trees removed from within the PDA will be disposed of properly
- Four butternut trees within the PDA that did not show evidence of butternut canker will be tested for the disease, and any mitigation that may be required for these trees will be developed in consultation with NBDELG
- Use the existing NB Power EPP for all phases of the Project
- Avoid clearing activities, in areas of native vegetation during the normal breeding season for migratory birds (April 1 to August 31), where possible
- Will be properly maintained and equipment to reduce potential environmental effects of noise
- Use full cut-off temporary lighting during Construction to reduce attraction to migrating birds
- Restrict clearing activities to the minimum amount required, particularly around wetlands and the Meduxnekeag Valley PNA
- 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 road building in and near wetlands, to reduce the risk of introducing or spreading exotic and/or invasive vascular plant species
- Examine all equipment that arrives at the site to make sure it is 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, and by mechanical means wherever possible

- During the Operation and Maintenance phase, restrict travel through wetlands for inspection or maintenance activities
- Restore temporarily disturbed areas to pre-construction conditions
- Manage invasive species through minimizing Operation and Maintenance activities in wetland areas and clean equipment before entering a wetland
- Limit the use of herbicides, and use mechanical or hand clearing when possible, particularly within 30 m of wetlands
- Comply with the conditions of the integrated vegetation management program and the permit issued by NBDELG
- Avoid Decommissioning and Abandonment activities during the normal breeding season for migratory birds (April 1 to August 31)
- Provide nesting platforms during and following Decommissioning if any bird species are nesting on poles
- Avoid disturbance of all wetlands to the extent possible, and where avoidance is not possible, compensate for the permanent net loss of wetland function (for GeoNB-mapped wetlands only) according to a plan to be developed in coordination with, and approved by, NBDELG

The mitigation described above will limit the reduction of vegetation communities and wildlife habitat, including wetlands, and will also reduce the potential for wildlife mortality potentially resulting from the Project. Some loss of vegetation communities and wildlife habitat is unavoidable if the Project is to proceed, and while not planned, it is possible that some mortality of wildlife could occur; however, the mitigation will reduce potential interactions with the Terrestrial Environment. Vegetation communities and habitat for wildlife species will remain available in the surrounding landscape.

4.3.4.3.3 Residual Environmental Effects on the Terrestrial Environment

Construction will result in a temporary disturbance to approximately 28.3 ha of vegetation communities and wildlife habitat. This includes forest, wetland, and agricultural land, but excludes anthropogenic and industrial land classes. All forested land, treed swamps, and shrub swamps within the PDA will require clearing. With mitigation, most of this disturbance will result in a change, but not a permanent loss of vegetation communities and wildlife habitat. Forested areas will be converted to shrub or regenerating/sapling aged forests following initial construction activities. The conversion of forested habitat represents approximately 2.6% of available forested habitat within the LAA. The forest type that will experience the highest percentage of loss (47.0%) is regeneration-sapling softwood. Of 1.6 ha of this forest type in the LAA, 0.8 ha are within the PDA, and will experience the least amount of functional change, given that the area beneath the transmission line is expected to be maintained in a regeneration-sapling stage. Agricultural areas will likely be maintained in a similar state, with the exception of within the footprint of permanent structures. The substation will result in the permanent loss of approximately 0.4 ha of young-immature softwood forest. As the exact locations of pole structures have yet to be determined, the total loss of various habitats associated with pole structure footprints is not currently known, but is expected to total 330 m² or less. The Project is not expected to lead to additional fragmentation within the LAA, as it follows

Route 95 closely for most of its length and will not result in any reduction of interior forest. The PDA will be cleared outside of the breeding season for migratory birds, and thus interactions with birds, particularly SAR and SOCC, are expected to be limited to a future reduction in available habitat and sensory disturbance associated with construction activities. Due to the availability of habitats in the LAA and surrounding area and the reduced suitability of habitats within the PDA because of their proximity to Route 95 and the associated sensory disturbance, wildlife species that may potentially use the PDA are not expected to be restricted by a lack of suitable habitat within the LAA and surrounding areas.

Of the vegetation communities that will be disturbed as a result of Construction of the Project, approximately 6.5 ha, or 14.1% of the PDA, is wetland. Approximately 3.0 ha of mixedwood treed swamp and 1.9 ha of softwood treed swamp will be cleared, temporarily disturbed, and later likely converted to shrub wetland. Approximately 1.1 ha of shrub wetland will be cleared and temporarily disturbed, but likely will be maintained as shrub wetland throughout the life of the Project. Because of the availability of access to the Project, it is anticipated that disturbance to fen and marsh wetland types will be reduced through mitigation and careful Project planning. These wetland types will likely not require clearing, and are typically small enough that poles need not be placed within them and the Project will not require access through these wetlands.

The PDA is adjacent to Morrison Lake, part of the Meduxnekeag Valley PNA, and clearing could lead to some edge effects within the PNA. However, the extent of these edge effects is expected to be limited, as the area is already adjacent to an existing edge and clearing will be limited to the extent possible in this area.

Vegetation clearing and excavation activities will lead to the loss of 27 butternut trees, ranging in size from less than 5 cm DBH to approximately 50 cm DBH. Some additional butternut trees are located outside of but adjacent to the PDA, and may require limbs to be trimmed to allow for a fully cleared RoW. Although butternut is a SAR and is considered rare in New Brunswick, it is locally abundant in some areas within the province, often in floodplains (COSEWIC 2003). Its status as a SAR is based more on the threat of a fungal canker than on concern over current populations estimates; these estimates ranged from 7,000 to 17,000 individuals in New Brunswick in 2003 (COSEWIC 2003). There are 101 historical records of butternut observations within 5 km of the PDA in the AC CDC database, likely representing more than 150 individual trees (AC CDC 2016). Eight of these records, likely representing over 15 trees, are within the LAA. Approximately 20% of the records within 5 km of the PDA refer to dead or diseased trees, but these records are all over 1.7 km and largely over 2 km from the PDA, concentrated in four areas (AC CDC 2016). As many of the trees observed within the PDA and surrounding areas showed signs of canker, it appears that the disease has likely spread since many of these observations were recorded. Although some of the remaining records are old and likely no longer exist, the AC CDC records do not appear to include the 38 butternut trees observed during field surveys conducted in support of this Project. There are likely additional records within the LAA that have not previously been recorded. The loss of 27 individual butternut trees, 23 of which showed visible signs of

canker, is not expected to have population-level effects on this species in the LAA or surrounding ecodistrict.

The Project may result in the loss of several vascular plant SOCC. Some of these, including orange-fruited tinker's weed and Goldie's woodfern, were observed both inside and outside of the PDA, and have many records within the AC CDC database within 5 km of the PDA (AC CDC 2016). Other species, such as northern maidenhair fern, rosy sedge, and Loesel's twayblade were only observed within the PDA, but have AC CDC records within 5 km (AC CDC 2016). With planned mitigation, including flagging and avoiding direct disturbance, these species will likely not be directly affected by Construction activities. However, the removal of overstory vegetation may change abiotic factors in the area outside of the range of tolerance for these species (e.g., through increasing light availability and decreasing local humidity), which could lead to some decline. However, as these species have also been observed outside of the PDA (either in support of this Project or historically), it is not believed that the loss of individuals within the PDA will have population-level effects on these species in the LAA or surrounding ecodistrict.

Blunt-leaved bedstraw, tender sedge, small waterwort, and dotted smartweed are only known from within the PDA, however, all were found in habitats that are either currently experiencing disturbance, or expected to experience minimal change as a result of the Project. These species can be flagged and avoided during clearing and excavation activities occurring within the PDA, and thus no direct interactions between the Project and these SOCC are expected.

Several instances of common milkweed were observed within the PDA, including a group of plants that was observed to be support first instar monarch larvae in June 2017. Known instances of common milkweed will be flagged and avoided, and as this plant grows in fields and disturbed areas (Hinds 2000), removal of overhead canopy (if present) is not expected to have any interactions with this species.

Due to the reduction in bat populations in New Brunswick, and the proximity of the PDA to Route 95, no interactions between New Brunswick bat populations and the Project are anticipated.

Although the Project is located within 5 km of known wood turtle sites, portions of watercourses within the PDA are typically relatively close to Route 95, are often riprapped, and are generally not considered optimal habitat. However, the EPP for the Project will include direction for contractors, in the event that wood turtles are encountered in the RoW during Construction.

The presence of transmission lines can lead to increases in bird mortality through collisions and electrocutions. The PDA does not lie within a known migration pathway (Bird nature n.d.); however, some migrating birds likely pass through the area. Nocturnal migrants such as passerines are generally high-flyers and are not at risk of suffering collision in flight during migration. Groups including waterfowl, waterbirds, and raptors have more variable flight during migration, and generally move during daylight hours. Although waterfowl and waterbirds are at greater risk for wire collision, there are no known major staging areas near the PDA. Migrating

individuals in these groups are more likely to fly higher than the transmission line wires, limiting their potential for collision. Collisions, if they occur, will likely be limited to local movements of resident birds. In addition, the conductors on the poles to be used for the Project will be spaced at 3.81 m, which provides adequate clearance for large bird species such as raptors to avoid electrocutions (APLIC and USFWS 2005).

4.3.4.4 Determination of Significance

Construction will result in both temporary and permanent disturbance to vegetation communities and wildlife habitat (including wetlands) within the PDA. These changes will occur within vegetation communities and wildlife habitat that is common within the LAA. Some sensory disturbance to wildlife may occur during Construction, but this interaction is considered limited as wildlife using the PDA will likely be somewhat accustomed to sensory disturbance from the adjacent Route 95. Permanent net loss of wetland function of GeoNB-mapped wetlands will be compensated following current provincial policy.

The Operation and Maintenance, 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 of a previously disturbed area.

With mitigation and environmental protection measures, the residual adverse environmental effects of the Project on a change in the Terrestrial Environment during all phases of the Project are rated not significant, with a high level of confidence.

4.3.5 Socioeconomic Environment

This section assesses the potential environmental interactions between Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project and the Socioeconomic Environment VC. The Socioeconomic Environment was selected as a VC due to the potential for this Project to interact with land and resource use, transportation, infrastructure, and services, and employment and the economy.

4.3.5.1 Scope of Assessment

Land and resource use refers to the current and future use of public and private land/resources in the immediate vicinity of the Project. It includes industrial and commercial use, private ownership, and changes in the use of land or resources for any recreational or other purposes. The Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is discussed separately in Section 4.3.7.

Transportation, infrastructure, and services refers to current and future estimated daily traffic, and potential resultant effects on public infrastructure (i.e., change in road surface quality as a result of changes in daily traffic volumes and types, effects on emergency services).

Employment and the economy refers to current and future employment and revenue generating opportunities for the local area and the province.

The scope of assessment is based on applicable regulations and policies, professional judgment and knowledge of the study team, and potential interactions.

4.3.5.1.1 Potential Environmental Effects, Pathways, and Measurable Parameters

The assessment of Project-related effects on the Socioeconomic Environment is focused on the following potential environmental effects:

- Change in land and resource use
- Change in transportation, infrastructure, and services
- Change in employment and economy

The environmental effect pathways and measurable parameters for the assessment of the environmental effects presented above are provided in Table 4.14.

Table 4.14 Potential Environmental Effects, Environmental Effect Pathways, and Measurable Parameters for the Socioeconomic Environment

Potential Environmental Effects	Environmental Effect Pathways	Measurable Parameter(s) and Units of Measurement
• Change in Land and Resource Use	• Nuisance effects to residents in the immediate vicinity of the PDA during Construction, and Decommissioning and Abandonment • Restrictions on resource and/or recreational uses of the PDA during Construction, and Decommissioning and Abandonment • Loss of private land	• Change in sound level (dBA) and air quality (dust) • Area (ha) of land use affected (e.g., access restrictions, recreational land use, loss of private land).
• Change in Transportation Infrastructure, and services	• Changes to the transportation network though increased traffic during Construction due to workforce and heavy equipment moving to and from the site • Modifications to public infrastructure (such as roads, bridges, interchanges) during Construction, and Decommissioning and Abandonment • The workforce increasing the number of people using local services during the construction phase.	• Change in traffic patterns • Availability of accommodations within the LAA (vacancy rates, inventory levels) • Capacity of services (number of emergency response vehicles serving the LAA, availability of local schools, etc.)
• Change in Employment and Economy	• Employment resulting from the Project • Changes in the economy resulting from the Project	• Direct employment (# jobs), and/or Project expenditures on goods and services.

4.3.5.1.2 Boundaries

4.3.5.1.2.1 Spatial Boundaries

The assessment of potential environmental effects on the Socioeconomic Environment encompasses two spatial boundaries: the PDA and LAA. These are described below.

Project Development Area (PDA)

The PDA is the immediate area encompassing the Project footprint, and is limited to the expected area of physical disturbance associated with the Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project. The PDA includes the footprint of the 15.7 km-long, 30 m-wide RoW for the new 69 kV transmission line to be constructed and the 0.4 ha footprint of the new substation. The PDA is illustrated in Figure 2.1.

Local Assessment Area (LAA)

In considering a change in land and resource use, the Local Assessment Area (LAA) encompasses the PDA as well as a 500 m buffer on either side of the PDA, resulting in a 1 km wide perimeter surrounding the overhead transmission line (Figure 4.5).

The LAA for the change in transportation, Infrastructure, and services encompasses the PDA, the land and resource use LAA, as well as the municipal boundaries of the town of Woodstock.

In recognition of the provincial nature of the potential environmental effects of a change in employment and economy, the LAA for the change in employment and the economy encompasses the PDA, the land and resource use LAA, as well as the municipal boundaries of the town of Woodstock, and boundaries of Carleton County and New Brunswick.

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Mill Brook PNA

Meduxnekeag Valley PNA

Mill Brook

Smith Brook PNA

Smith Brook

Route 95 Highway West

Route 95 Highway East

RICHMOND CORNER WOODS ESA

Route 555 Highway

Richmond Corner

Route 540 Highway

MAINE

5745

Bedell Brook

Little Bedell Brook

5472

N

Local Assessment Area for the Socioeconomic Environment

- Environmentally Significant Area
- Building
- Residence
- Project Development Area
- Local Assessment for the Socioeconomic Environment
- Proposed Substation
- NBFSC Trail
- Watercourse
- Crown Land
- Mining Claim
- Property Boundary
- Protected Natural Area
- Restricted Freehold
- Waterbody

Sources: Base Data obtained from Service New Brunswick.

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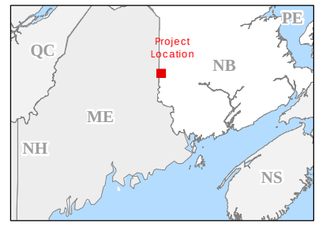
Kilometres

121812277-007

NAD 1983 CSRS NBDS



121812277 - HOULTON INTERNATIONAL TRANSMISSION LINE

Stantec

Fig.4.5 Pg.1

Service Layer Credits:

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Meduxnekeag Valley PNA

Route 560 Highway

Route 550 Highway

Marsh Brook

WOODSTOCK-MEDUXNEKEAG BRIDGE ESA

Meduxnekeag River

Route 2 Highway West

Connell Street

Meduxnekeag Valley PNA

5472

Route 95 Highway West

Route 95 Highway East

Woodstock

HIGHWAY 95 HARDWOODS ESA

Houlton Street

WOODSTOCK

Main Street

Route 555 Highway

Uphill Brook

BEDELL SETTLEMENT WOODS ESA

Little Bedell Brook

Bulls Creek

Saint John River

Route 2 Highway East

Route 165 Highway

Peabody Brook

N

Local Assessment Area for the Socioeconomic Environment

- Environmentally Significant Area
- Building
- Residence
- Project Development Area
- Local Assessment for the Socioeconomic Environment
- Existing Transmission Line
- NBFSC Trail
- Watercourse
- Crown Land
- Mining Claim
- Municipal Area
- Property Boundary
- Protected Natural Area
- Restricted Freehold
- Waterbody

Sources: Base Data obtained from Service New Brunswick.

0 0.25 0.5 0.75 1

Kilometres

NAD 1983 CSRS NBDS

121812277-007

121812277 - HOULTON INTERNATIONAL TRANSMISSION LINE

Stantec

Service Layer Credits:

4.3.5.1.2.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on the Socioeconomic Environment include the following periods.

- Construction – anticipated to occur in 2019
- Operation and Maintenance – approximately 50 years or the end of service life
- Decommissioning and Abandonment – anticipated to be three months in duration following the end of service life

Most of potential environmental effects on the Socioeconomic Environment will occur during the Construction phase of the Project due to peak employment levels and restrictions surrounding physical construction sites. Some socioeconomic environmental effects, such as operation of the power transmission infrastructure and economic benefit by returning revenue to New Brunswick rate payers, will last throughout the life of the Project.

4.3.5.1.3 Significance Criteria

For a change in land and resource use, a significant adverse residual environmental effect is defined as one where proposed Project activities are not compatible with current land and resource use activities as designated through a regulatory process, and/or the Project creates a long-term change or disruption that widely restricts or degrades present uses to a point where the activities cannot continue at current levels.

For a change in transportation, infrastructure, and services, a significant adverse residual environmental effect is defined as one where the Project creates an exceedance of available capacity, a substantial decrease in the quality of a service provided, or availability or degradation of infrastructure on a persistent and ongoing basis, which cannot be mitigated with current or anticipated mitigation measures.

For change in employment and economy, a significant adverse residual environmental effect is defined as a change that is distinguishable from current conditions and trends and cannot be managed or mitigated through adjustments to programs, policies, or plans. While the residual environmental effects assessment considers both positive and adverse environmental effects after mitigation and other best management practices are implemented, a significance determination is made for adverse environmental effects only.

4.3.5.2 Existing Conditions for the Socioeconomic Environment

4.3.5.2.1 Information Sources

A combination of spatial analysis and baseline research was used to characterize the Socioeconomic Environment in the PDA and LAA. Baseline research included a review of online sources for land and resource use information, 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
- Government sources, including
  - Statistics Canada and other agencies and departments of the Government of Canada
  - various departments of the Government of New Brunswick
  - municipal governments
- Community organizations

Past project assessments and technical reports were reviewed for relevant information.

4.3.5.2.2 Overview of Existing Conditions

The proposed transmission line is in Carleton County, New Brunswick, extending 16.2 km from the Town of Woodstock to the Canada/United States border and crossing through both Woodstock Parish and Richmond Parish. According to the 2016 Census, the population of Carleton County was 26,220, which represents 3 % decrease from 2011 (Statistics Canada 2017).

The PDA is predominantly public property (73.6%), as it largely runs along the RoW for New Brunswick Route 95, a provincial highway connecting Interstate 95 in Maine to the TransCanada Highway. The remaining 26.4% of the PDA is divided among 3 private landowners whose land is being used for woodland.

Within the larger LAA, most of the land is classified as anthropogenic (30.9%), industrial (6.6%), agricultural (1.9%), with the remaining LAA (60.6%) classified as a mix of forested, wetland, marsh, swamp and waterbodies (Section 4.3.4.2.3.1).

On the western end of the LAA, the proposed substation intersects a private parcel of land. There are no buildings or structures on this parcel of land.

There are no oil and natural gas licences within or near the LAA (Province of New Brunswick 2005). Two mineral claims have been identified with the LAA, which intersect the PDA (Figure 4.5).

The LAA is intersected by two snowmobile trails: provincial trail 12 in the east and local route 440, at both the eastern and western ends of the LAA. Both trails are actively maintained by the New Brunswick Federation of Snowmobile Clubs, and require a trail permit purchased from Service New Brunswick (NBFSC 2017). The LAA is also intersected in the east by a portion of the TransCanada Trail known as the Woodstock Green Trail (Sentiers NB Trail 2017).

Hunting and fishing are popular recreational activities within the LAA. The LAA is with Wildlife Management Zones (WMZ) 10 and 15. WMZ 10 and 15 are open to big-game hunting, trapping, and snaring.

Recreational angling in New Brunswick generates more than $30 million dollars annually in direct expenditures, and more than $65 million annually in direct and indirect expenditures (DFO 2012). Angling occurs in the streams and lakes within the LAA, although there are currently no known Atlantic salmon fisheries in the LAA.

New Brunswick Route 95 runs along most of the PDA and serves as a connector road from United States Interstate Highway 95 to the TransCanada Highway, known provincially as Route 2. Route 2 is a twinned highway. There are no active rail lines in the area, but a variety of other municipal and rural roads connects the residents and communities in the LAA. Residents within the LAA are accustomed to traffic volumes associated with Route 95.

Emergency services within the LAA are provided in part by the Town of Woodstock Department of Public Safety. Services include those of the Woodstock Fire Department, which, in addition to standard fire-fighting duties, provides technical rescue services, auto extractions and a variety of fire prevention and safety workshops at local schools and within the community. The Woodstock Fire Department consists of four full-time drivers, a full-time fire chief, a deputy chief, two captains, a lieutenant, and twenty-two volunteer firefighters. The Department of Public Safety is also responsible for the Woodstock Police Force, which is comprised of fifteen police officers, augmented by six auxiliary officers and three administrative support workers. (Town of Woodstock 2016).

Health services are provided by Horizon Health and the Upper River Valley Hospital in nearby Hartland. With over 800 employees, 45 physicians and 115 volunteers, the Upper River Valley Hospital provides services to the town of Woodstock, town of Hartland, several villages, and other surrounding communities (Horizon Health 2017).

The Town of Woodstock's Public Works and Water / Sewer Departments consist of fourteen full time employees. This department provides year-round maintenance of approximately 60 km of streets. Also, the public works department is responsible for curbs and sidewalks, storm sewers and the cutting of grass on municipal property throughout Woodstock (Town of Woodstock 2016).

The LAA contains four educational institutions including the Education Support Centre; Meduxnekeag Consolidated School; Townsview School; and Woodstock High School (NBDEECD 2017).

Several temporary accommodation options serve the LAA including two hotels, the Best Western Plus Woodstock Hotel and Conference Center, and Canada's Best Value Inn & Suites – Woodstock; one motel (Knights Inn Woodstock); and two bed and breakfast locations (Bennett House Bed & Breakfast and Brigitte's Bed and Breakfast) (Tourism New Brunswick 2017).

The key economic drivers in Carleton County are agriculture, food processing, forestry, value-added wood products, metal fabrication, construction and contracting, and transportation

(Enterprise Carleton Region 2011). The agricultural sector in this area produces potatoes, soybeans, grains, and other crops. New Brunswick's "potato belt" is in Carleton County (Enterprise Carleton Region 2011); it contributes approximately $1.3 billion to the provincial economy each year (Stantec 2012).

From 2006 to 2011, the number of individuals employed in the province increased by 2.1%, from 344,770 to 351,935 (Statistics Canada 2007a; 2013a). In 2011 (the latest year for which Census data are avaialble), the employment rate in New Brunswick was 56.6%, slightly lower than the national average of 60.9% (Statistics Canada 2007a; 2013a) (Table 4.15).

Table 4.15 Labour Force Statistics: New Brunswick, Carleton County, and Woodstock, 2011

Location	Labour Force	Employed	Participation Rate (%)[1]	Employment Rate (%)[2]	Unemployment Rate (%)[3]
New Brunswick	395,425	351,935	63.5	56.5	11.0
Carleton County	14,015	12,255	63.7	55.7	12.6
Woodstock	2,470	2,235	58.1	52.6	9.5

Notes:
1 Percentage of the working-age population employed or actively looking for employment.
2 Number of employed persons expressed as a percentage of the total population 15 years and older.
3 Number of unemployed persons expressed as a percentage of the labour force.
Note: totals may not add due to rounding.
Source:
Statistics Canada (2013a, 2013b)

In 2011, the experienced labour force in Carleton County totaled 14,015 (Table 4.16), with the most employed workers (15.9%) living in the town of Woodstock (Statistics Canada 2013b). In 2011, Carleton County's labour force participation rate was 63.7%, slightly lower than that in 2006 (65.0%) (Statistics Canada 2007b; 2013a). From 2006 to 2011, the unemployment rate increased from 6.8% to 12.6% (Statistics Canada 2007b).

In 2011, the services-producing sector employed the most workers in Carleton County (9,325, or 66.6% of the labour force), with health care and social assistance, transportation, and retail trade representing 10.7%, 10.3%, and 9.9%, respectively, of the services sector. Within the goods-producing sector, agriculture supports the largest labour force Carleton County (1,450 or 10.3% of the labour force) (Statistics Canada 2013a) (Table 4.16).

Table 4.16 Experienced Labour Force by Industry, Carleton County, 2011

Characteristics	Experienced Labour Force by Industry in Carleton County, 2011 (total)	Experienced Labour Force by Industry in Carleton County, 2011 (%)
Goods-producing Sectors	**4,290**	**30.6**
Agriculture and other resource-based industries	1,450	10.3
Mining, quarrying, oil and gas extraction	30	0.2
Utilities	70	0.5
Construction	805	5.7
Manufacturing	1,935	13.8
Services-producing Sectors	**9,325**	**66.6**
Wholesale Trade	445	3.2
Retail Trade	1,385	9.9
Transportation and Warehousing	1,445	10.3
Information and Cultural Industries	235	1.7
Finance and Insurance	225	1.6
Real Estate and Rental and Leasing	55	0.4
Professional, Scientific and Technical Services	360	2.6
Management of Companies and Enterprises	0	0
Administrative and Support, Waste Management and Remediation Services	460	3.3
Educational Services	810	5.8
Health Care and Social Assistance	1,505	10.7
Arts, Entertainment and Recreation	95	0.7
Accommodation and Food Services	625	4.4
Other Services	705	5.0
Public Administration	975	6.9
Total Experienced Labour Force (all industries)	**14,015**	**100.0**

Note: Totals may not add due to rounding.
Source: Statistics Canada (2013b)

4.3.5.3 Assessment of Potential Environmental Effects on the Socioeconomic Environment

4.3.5.3.1 Project Effect Pathways for the Socioeconomic Environment

4.3.5.3.1.1 Change in Land and Resource Use

Construction and Decommissioning and Abandonment phases of the Project will have an environmental effect on land and resource use due to safety restrictions put in place during these phases of the Project, preventing access to certain locations for land and resource use. The Project will not interact with land and resource use during Operation and Maintenance.

Both forested and agricultural areas within the PDA will experience disturbance from Construction (site preparation, pole installation) and Decommissioning and Abandonment activities (e.g., pole and structure dismantling). These activities will result in temporary access restrictions to woodlot and farm trail segments, as well as the two snowmobile trails (Figure 4.5). The maintenance of access roads associated with the Project will also provide additional access after the transmission line is constructed. Following Decommissioning and Abandonment, it is expected that access established during the life of the Project would continue to be in place.

Access restrictions to the private parcels of land on which the proposed substation is located, will also restrict current access to the woodlot behind this location, where firewood is currently accessed. Mitigation for this loss of property and access, including potential purchase of that property, and/or relocation of the access, are discussed in Section 4.3.5.3.2.1.

Noise, vibration, and dust related to Construction and Decommissioning and Abandonment activities could cause short term nuisance issues with residents in the area and subsequently affect residential and commercial land use for short periods of time.

Recreation land use, such as hunting, could also be affected by loss of wildlife habitat. Approximately 30 ha of combined wildlife habitat will be cleared during Construction and this loss will be long term because of vegetation management throughout Operation and Maintenance. Since the exact locations of pole structures and the dimensions of the substation have yet to be determined, the total loss of various habitats within the footprints is not currently known, but is expected to total approximately 330 m^2, or less.

4.3.5.3.1.2 Change in Transportation, Infrastructure, and Services

Construction and Decommissioning and Abandonment will require an increased workforce that may augment local services in the LAA. The Project will not interact with transportation, infrastructure, and services during Operation and Maintenance.

Construction and Decommissioning and Abandonment will affect the road transportation network. Construction and decommissioning and abandonment activities will temporarily and

intermittently restrict access for vehicular and/or pedestrian traffic, and local traffic patterns in the transportation network leading to and from the PDA and surrounding area, and will result in increased passenger vehicles and heavy trucks transporting workers, materials, and equipment to and from the site.

The operation and maintenance of the Project are not expected to have an environmental effect on transportation, infrastructure, and services. The workforce required for these activities will be minimal and would not stress the capacity of housing and public services within the LAA. Also, due to the limited operational workforce by the existing NB Power team, following Construction, traffic on roads within the LAA is expected to return to pre-Project levels; thus, no environmental effect on transportation is expected during the Operation and Maintenance phase, and are not discussed further.

4.3.5.3.1.3 Change in Employment and Economy

Project hiring of local labour during Construction will affect the LAA labour supply and Project spending will affect LAA businesses and government revenue. Changes in land and resource use can affect the activities of commercial business within the LAA.

Operation and Maintenance activities will be carried out by NB Power, and there are no new job opportunities expected for this phase of the Project; no substantive effects on employment are anticipated during Operation and Maintenance. The purpose of the Project is to export (e.g., sell, transmit, and supply) electricity to the Houlton Water Company in Maine, USA (Section 1.6); therefore, Operation and Maintenance activities are expected to have a positive effect on the economy, by returning revenue from electricity sales to New Brunswick rate payers for the life of the Project.

4.3.5.3.2 Mitigation for the Socioeconomic Environment

4.3.5.3.2.1 Change in Land and Resource Use

The following mitigation for adverse environmental effects to land and resource use will be implemented:

- Siting of Project infrastructure has been undertaken to reduce disruption of land use, where feasible.
- Owners of private land will be consulted and accommodated, as appropriate, prior to Construction; access to those properties will be maintained during the Project.
- NB Power will communicate schedules to affected landowners and stakeholders for all Project activities, particularly those related to clearing activities and related access restrictions.
- Access restrictions will be defined and will be limited in size to reduce the interactions with land and resource users.

- Mitigation described for the Atmospheric Environment (Section 4.3.1) will be used to reduce nuisance effects. These include limiting noise emitting construction activities to daytime hours (i.e., between the hours of 7:00 am and 10:00 pm).
- A public, stakeholder and Aboriginal engagement program has been initiated will be undertaken to identify and address Project concerns.
- Environmental protection and management measures will be used to guide Project planning, design, construction and operation. They include, but are not limited to, the implementation of NB Power's Environmental Protection Plan, which also contains provisions relating to emergency response and contingency planning.

4.3.5.3.2.2 Change in Transportation, Infrastructure, and Services

Project environmental effects on transportation, infrastructure, and services result primarily from movement of construction related vehicles and equipment on, and adjacent to, Route 95; as well as an increased number of people working and living within the LAA during Construction. The following mitigation for adverse Project environmental effects to transportation, infrastructure, and services will be implemented:

- All large-sized vehicles will obtain appropriate weight and size permits. Moving large equipment involving road closures will be conducted at low traffic times.
- The public will be notified about long delays or disruptions to the transportation network.
- Construction traffic will be avoided where feasible during daily peak traffic periods (12:00 pm and 4:30 am).

4.3.5.3.2.3 Change in Employment and Economy

The following initiatives will be used to mitigate potential adverse environmental effects, and enhance potential positive environmental effects, caused to employment and economy by the Project:

- NB Power will follow its existing practice of encouraging local and Aboriginal content and will, where possible and relevant, work toward a hire-local-first practice.
- Workers will be paid wages consistent with the Eastern Canadian labour market.
- NB Power will procure goods and services from local and Aboriginal businesses in accordance with its existing purchasing policies and procedures.

4.3.5.3.3 Residual Environmental Effects on the Socioeconomic Environment

4.3.5.3.3.1 Change in Land and Resource Use

Access restrictions to land use resulting from Construction and Decommissioning and Abandonment activities will result in short term restrictions to portions of the PDA. Communication with users regarding access restrictions will allow users to plan activities in advance and reduce the magnitude of lost opportunities. Where warranted, alternative access will be provided during Construction.

The presence of the transmission line will result in the loss of 20.8 ha (4.2%) of land available for forestry within the PDA. However, this loss will be mitigated through discussion with landowners, negotiation of an easement, or compensation, as appropriate. The residual implications for agricultural land will be minimal, as most of the area within the PDA can continue to be used for agricultural production (0.18% of the PDA) without interference from the Project, except perhaps for a short period during Construction. Merchantable timber will be considered as part of the land easement negotiations.

Siting of the transmission route reduced disruption of land use throughout most of the PDA; however, loss of private land, and disruption to land use, within the substation footprint was unavoidable. This loss of private land, will be mitigated through NB Power's compensation program for purchase of property, which will be negotiated to address the interests, concerns and circumstances of the landowner.

Noise, vibration, and dust related to Construction and Decommissioning and Abandonment activities could cause short term effects on residential and commercial land use for short periods of time. However, as discussed in Section 4.1.3.3, close proximity to the Houlton International Airport and Route 95, results in higher than usual ambient levels of noise for this kind of rural setting. Because of this, along with the transient nature and short duration of Construction activities, substantial increases in sound, vibration and dust levels arising from Project activities are not expected to create a substantive residual adverse environmental effect on land and resource use.

Recreational land use (e.g., hunting, trapping, fishing) will be affected by access restrictions during Construction and Decommissioning and Abandonment. Since access restrictions will be well communicated to residents, and of short duration, with alternate access likely available during that short restriction period, substantive residual adverse environmental effects of Construction and Decommissioning and Abandonment on recreational land use are not anticipated.

Loss of wildlife habitat in the PDA will also affect recreational land and resource use. However, permanent loss will be limited to the areas around the pole locations and the substation (Section 4.3.5.3.1.1); the habitat beneath the line outside of pole locations will be converted from forested into shrub/regen-sapling aged habitat. The regen-sapling aged habitat will be initially cleared during Construction but then will be left to regenerate through Operation and Maintenance, and will continue to support wildlife, with short duration disruptions during maintenance clearing. These environmental effects are reversible and wildlife habitat will return to pre-Project conditions following Decommissioning and Abandonment, over time. The area of habitat loss is small, and land is available in the vicinity of the Project to continue supporting the current level of recreational activity. Residual adverse environmental effects of Operation and Maintenance on recreational land and resource use are therefore not anticipated.

4.3.5.3.3.2 Change in Infrastructure, and Services

Construction will involve NB Power staff as well as a clearing contractor, a general contractor that specializes in transmission line construction, and a limited number of subcontractors, as required. The Project will employ a small labour force of approximately 20 skilled labourers at peak employment over the nine-month Construction phase and three-month Decommissioning and Abandonment phase. While the hiring of local workers is expected to be emphasized, due to the relatively short duration of these Project phases, it is unlikely that many of these workers will relocate or move their families to the area. Skilled laborers employed by the Project during Construction and Decommissioning and Abandonment will therefore not affect local services in the LAA.

Access restrictions to vehicular and pedestrian traffic during Construction activities will result in short term restrictions to portions of the PDA. These will be limited in extent due to the temporary nature of these activities. Communication with users regarding access restrictions will allow users to plan activities in advance and reduce the magnitude of lost opportunities. Limited increases in passenger vehicles and heavy trucks transporting workers, materials and equipment are expected during Construction; however, Project related transportation will be scheduled to avoid night time hours, and times of existing high traffic volume. In consideration of the short duration and transient nature of the Construction and Decommissioning and Abandonment phases, as well as planned mitigation, there will be no noticeable increase in overall traffic volumes or patterns through the LAA, and substantial environmental effects on traffic and the transportation network are not expected.

4.3.5.3.3.3 Change in Employment and Economy

Construction is anticipated to be beneficial to both employment and the economy (though on a limited basis given the limited scale of the Project), because local employment and business opportunities will be created, and income taxes will be paid to municipal and provincial governments. However, these benefits will be relatively short-term (*e.g.,* 12 months). Operation and Maintenance activities are also expected to have a positive effect on the economy by returning revenue to New Brunswick rate payers for the life of the Project with the export (e.g., sell, transmit, and supply) of electricity to the Houlton Water Company.

4.3.5.4 Determination of Significance

Based on the predicted characterization of residual environmental effects and mitigation measures described above (including accommodation for loss of demonstrated public land and access), it is anticipated that Project activities will not cause a directly measurable disruption, wide restriction, or degradation of use to a point for the Socioeconomic Environment where it cannot continue at current levels. Therefore, the residual environmental effects of the Project on the Socioeconomic Environment (including a change in land and resource use, a change in transportation, infrastructure, and services, and a change in employment and economy) during all phases are rated not significant, with a high level of confidence.

4.3.6 Heritage Resources

This section includes an analysis of potential environmental interactions between the Construction, Operation and Maintenance, and Decommissioning and Abandonment phases of the Project and the Heritage Resources VC. Heritage Resources has been selected as a VC in recognition of the interest of: provincial and federal regulatory agencies who are responsible for the effective management of these resources; the general public as a whole; and First Nations that have an interest in the preservation and management of heritage resources related to their history and culture.

4.3.6.1 Scope of Assessment

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 highly tenuous, features of the environment. If heritage resources are present, their integrity is highly susceptible to construction and ground-disturbing activities. For this VC, Heritage Resources includes consideration of historical, archaeological, built heritage, and palaeontological resources. It is further understood that any resources that would be understood to be "historical" are captured under one of these three heritage resource types.

Any Project activity that includes surface or sub-surface ground disturbance has the potential for interaction with Heritage Resources where they are present. Accordingly, Construction represents the Project phase with the greatest potential for interaction with Heritage Resources, as it is during this phase that the majority of the ground breaking and earth moving activities of surface soils will take place to install the Project components.

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 its Archaeological Services Branch.

The review for Heritage Resources has been undertaken through the completion of historical, archaeological, built heritage, and palaeontological research. The Province of New Brunswick does provide some 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).

Consultation and engagement activities have been ongoing as part of the Heritage Resources component of the Project. During the background research for heritage resources, regional experts and regulatory agencies were contacted in order to gather information on potential heritage resources within the PDA.

Table 4.17 lists the experts consulted as part of the engagement activities for Heritage Resources.

Table 4.17 Experts Consulted

Name of Expert	Affiliation
Archaeological Services Staff Members (various)	Archaeological Services – New Brunswick Department of Tourism, Heritage, and Culture
Dr. Randall Miller	Curator Emeritus, Geologist, New Brunswick Museum

NB Power has initiated First Nations consultation for the Project. Should any areas of interest and concern regarding Heritage Resources be identified by First Nations that may be affected by the Project, will be taken into consideration in Project planning and mitigation will be developed as appropriate.

Consultation has occurred with staff at Archaeological Services (AS). This consultation involved requesting and reviewing the provincial archaeological potential maps and map data 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. The provincial archaeological site files were also reviewed for any known archaeological sites within or in proximity of the PDA. Additionally, an Archaeological Field Research Permit (AFRP) application, detailing the methodology to be employed in the Archaeological Impact Assessment for the Project, was submitted to and approved by AS.

Consultation has occurred with Dr. Randall Miller, Curator at the New Brunswick Museum, to discuss any concerns with respect to palaeontological resources. No known palaeontological resource sites were noted by Mr. Miller within the PDA; however, Dr. Miller did note three fossil localities near, but not within, the PDA, and that the study corridor lies within a rock type that presents the possibility of fossil occurrences (Miller 2017).

No other information on Heritage Resources was presented by the individuals who were contacted regarding the assessment of Heritage Resources for the Project.

4.3.6.1.1 Potential Environmental Effects, Pathways, and Measurable Parameters

There is potential for the Project to interact with Heritage Resources during the Construction, Operation and Maintenance, and Decommissioning and Abandonment phases. These interactions could result in changes to the quantity or quality of Heritage Resources. The potential effect pathways of these interactions are listed in Table 4.18. Measurable parameters, which will serve to characterize the potential environmental effects of any change to Heritage Resources are also provided in Table 4.18.

Table 4.18 Potential Environmental Effects, Environmental Effect Pathways, and Measurable Parameters for Heritage Resources

Potential Environmental Effect	Environmental Effect Pathways	Measurable Parameter(s) and Units of Measurement
Change in Heritage Resources	Interactions between the activities and the environment that result in a direct loss of context or change in a heritage resource	• Nature of heritage resource sites in the PDA • Integrity of heritage resource sites in the PDA

4.3.6.1.2 Boundaries

4.3.6.1.2.1 Spatial Boundaries

The assessment of potential environmental effects on Heritage Resources encompasses two spatial boundaries: the PDA and LAA. These are described below.

Project Development Area (PDA)

The PDA is the immediate area encompassing the Project footprint, and is limited to the expected area of physical disturbance associated with the Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project. The PDA includes the footprint of the 15.7 km-long, 30 m-wide RoW for the new 69 kV transmission line to be constructed and the 0.4 ha footprint of the new substation. The PDA is illustrated in Figure 2.1.

Local Assessment Area (LAA)

The Local Assessment Area (LAA) for each VC is the maximum area within which environmental effects from the Project activities and components can be predicted or measured with as reasonable degree of accuracy and confidence. The LAA can be thought of as the "zone of influence" of the Project on a particular VC, and thus can vary from one VC to the next. For considering a potential Change in Heritage Resources as a result of the Project, the LAA for the Heritage Resources VC is limited to the PDA, as it is only Construction and ground-disturbing activities that could interact with Heritage Resources and all activities that may result in ground breaking will be limited to the PDA. Heritage resources located outside of the PDA will not be directly affected by the Project and are not considered further in this assessment.

4.3.6.1.2.2 Temporal Boundaries

Temporal boundaries identify when an environmental effect is evaluated in relation to specific Project phases and activities. The temporal boundaries for the assessment of the potential environmental effects of the Project on the Heritage Resources include the following periods:

- Construction – anticipated to occur in 2019
- Operation and Maintenance – approximately 50 years or the end of service life

- Decommissioning and Abandonment – anticipated to be three months in duration following the end of service life.

Most potential environmental effects on the Heritage Resources will begin and peak during Construction. As there is no ground breaking during the Operation and Maintenance phase of the Project, it is not anticipated that there will be any interaction during this Phase of the Project.

While there is potential for some ground breaking during the Decommissioning and Abandonment phases of the Project, this will be limited to areas previously investigated and disturbed during the Construction phase of the Project. As such, there is not anticipated to be potential to encounter Heritage Resources during these phases of the Project. Thus, the Operation and Maintenance and the Decommissioning and Abandonment Phases of the Project are not considered further in this assessment.

4.3.6.1.3 Significance Criteria

A significant adverse residual environmental effect on Heritage Resources is defined as a Project-related environmental effect that causes an unauthorized loss or alteration to heritage resource sites and contexts. A Change in Heritage Resources is considered significant if the environmental effects of the Project result in unauthorized disturbance to or destruction of *in situ* archaeological, built heritage, or paleontological resources.

4.3.6.2 Existing Conditions for Heritage Resources

4.3.6.2.1 Methods

Baseline conditions were established through background research, regulatory consultation, and a review of available information to determine the location of any known heritage resources within the PDA, to identify likely locations for unknown heritage resources, and to gain an understanding of the general and specific history or the PDA and surrounding area. This was accomplished by reviewing historical records for the PDA, contacting regional heritage experts and/or undertaking field survey to examine the PDA for its potential to contain heritage resources.

Background research was undertaken to determine the nature of the known heritage resources in the PDA and surrounding area. The background research included:

- A review of archaeological potential maps of areas determined by AS (AS 2016) to hold high and medium potential for pre-contact period archaeological resources and possible palaeo-shoreline features
- A review of the provincial archaeological sites database for any known archaeological sites within a 2 km wide area centered on the PDA

- 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
- Meetings and correspondence with representatives from AS and Heritage Branch and other regional experts (e.g., Natural Sciences Branch)
- A review of relevant documents available from the New Brunswick Provincial Archives
- Contacting paleontological experts at the New Brunswick Museum
- A review of other archaeological studies (AIAs) completed for other projects located near the Project
- A review of registered heritage buildings and historical places
- Professional experience and judgment of the Stantec Archaeology Team was applied

The list of archaeological project manuscripts and reports on file at Archaeological Services for projects and research conducted in and around the PDA was provided by representatives at Archaeological Services (T. Brown, pers. comm., 2016). While there have been no formal archaeological assessments previously completed within the PDA, several archaeological and environmental assessments have been undertaken in the surrounding area for other developments such as the TransCanada Highway (Heritage Technologies Inc. 2003; Washburn & Gillis Associates Ltd. 1994), and other NB Power Transmission Projects (Stantec 2016; Washburn & Gillis Associates Ltd. 1991).

In addition to the background research and direct consultation undertaken as part of the heritage resource component for the EIA, a walkover survey was conducted in consideration of the results of the Archaeological Potential Map information (Archaeological Services 2016) following the Archaeological Guidelines (Archaeological Services 2012) in Fall 2016 (Stantec 2017) and Summer 2017.

4.3.6.2.2 Existing Conditions for Heritage Resources

The sections below describe the existing conditions, including geological history, of the three basic groups for Heritage Resources: archaeological resources, built heritage, and palaeontological resources.

The first peoples to inhabit the area defined as New Brunswick likely arrived in the region at the end of the Pleistocene, after the retreating glaciers opened the land for human occupation. Archaeological evidence from Debert, Nova Scotia and Pennfield, New Brunswick indicates that early Indigenous groups had begun occupying the Atlantic provinces as early as 11,000 – 10,000 years before present (McMillan and Yellowhorn 2004; Suttie et. al 2013). Occupation and settlement throughout New Brunswick by ancestral First Nations peoples is believed to have been continuous up to present day. European settlement began in the early 17th Century, with larger portions of the province being settled by the late 18th and early 19th Centuries. The PDA contains areas that may have been occupied by First Nations, their ancestors and later by European settlers. These areas have been a combination of permanent and non-permanent

habitation sites, settlements, and hunting, fishing, and trapping sites, as well as overland and riverine travel routes.

4.3.6.2.2.1 Archaeological Resources

A review of the Archaeological Potential Map for the Project (Archaeological Services 2016) indicated that there are no known archaeological sites located inside of the PDA. According to the Archaeological Services Potential Map, there are no areas within this section of the PDA that cross potential palaeo shorelines; however, there is the potential to encounter post glacial landforms such as eskers, as identified by the surficial geology of the PDA.

The Saint John River, and the rivers that form part of its system, are the traditional home of the Wolastoqiyik (Maliseet) people whose name is synonymous with the Maliseet name of the river, Wolastoq, or, "beautiful river" (Rayburn 1975). The PDA would have been used by these early Indigenous people for hunting, fishing and gathering, and as an overland route between the Saint John River system and the Penobscot system in Maine (Archaeological Services 2016; Bailey 1894; Ganong 1899; NBDNR 2007). Woodstock First Nation is the closest First Nation community to the Project and is located approximately 18 km southeast of the proposed project, between Lower Woodstock and Bulls Creek.

Historically, a major Indigenous village was located near Meductic and was strategically located along the Eel River portage, one of the oldest and most-used portage routes between the Saint John River, Passamaquoddy Bay, and New England. Travelers would hike inland from Meductic, entering the Eel River at Benton, then paddle upriver to First Eel Lake. From there, canoeists would proceed along another portage route to North Lake and on to Grand Lake and the St. Croix River (Ganong 1899; NBDNR 2007). Additionally, another large Indigenous village was located at the mouth of the Meduxnekeag River (Ganong 1899; MacIntosh n.d.a, n.d.b). While neither Ganong nor MacIntosh identify its specific location, the village is believed to have been located on Bulls Island at the mouth of the river, now referred to as Island Park or Connell Park, and along the southern bank of the Meduxnekeag River (Ketchum 2008).

Early European settlers lived almost exclusively along the shores of the Saint John River; however, Loyalists and pre-Loyalists, who were unhappy with the original land grants they were given in the south of the province, moved into the area in the late 1700s. In the early 1800s, a second wave of Scots, Irish, and English settlers arrived in the area. Settlers made a living in logging, agriculture, and mining; Woodstock was the main hub for commercial activity in the area (NBDNR 2007). Based on a review of provincial records, there are no documented Euro-Canadian archaeological sites located within or near the PDA (Archaeological Services 2016).

Based on the Archaeological Guidelines and the archaeological potential maps provided by AS, the shoreline areas of watercourses in the survey area were identified as having elevated archaeological potential. As is standard for all watercourses in New Brunswick, areas 0 m to 50 m from a watercourse bank or 100 m from the confluence of any two watercourses were identified

as exhibiting high archaeological potential, and areas 50 m to 80 m from a watercourse bank were identified as exhibiting medium archaeological potential for the focus of the surveys. Portions of the survey area outside of the 80 m elevated archaeological potential zone were identified as exhibiting low archaeological potential; however, pursuant to the Archaeological Guidelines, they were nonetheless subjected to archaeological survey to confirm their potential to contain heritage resources.

In addition to the background research, a walkover survey of all accessible properties located within the PDA was conducted. This survey was a visual assessment and evaluation of ground surface conditions within the PDA to identify areas of elevated archaeological potential where previously undocumented subsurface heritage resources may be located (Figure 4.6).

U:\121812277\1_environmental\3_drawings\3_draft_figures\mxd\rpt\EIA\archaeology\121812277-0009.mxd acmackay

Project Location

QC
ME
NH
NS
MA

Mill Brook
Route 95 Highway East
Route 95 Highway West
Route 555 Highway
Little Bedell Brook
Daker Brook
Route 103 Highway
Route 565 Highway
Route 105 Highway
Riviere Saint-Jean
Saint John River
Main Street
Houlton St
Route 2
WOODSTOCK
Woodstock
MAINE

WC-01
WC-02
WC-03
WC-04
WC-05
WC 06
WC-07
SNM-WCA-001
TCD-WCA-001
TCD-WCA-002
TCD-WCA-003
TCD-WCA-004
TCD-WCA-005
TCD-WCA-006
KRH-2017-HSF-002
KRH-2017-HSF-003
KRH-2017-HSF-004
MPR-2017-HSF-002
MPR-2017-HSF-003
MPR-2017-HSF-004
KRH-2017-HSF-005
TCD-ARCH-072
SNM-ARCH-054
TCD-ARCH-079

TCD-ARCH-079

KRH-2017-HSF-004
KRH-2017-HSF-003
KRH-2017-HSF-002

KRH-2017-HSF-005
MPR-2017-HSF-004
MPR-2017-HSF-003
MPR-2017-HSF-002

TCD-ARCH-072
SNM-ARCH-054

WOODSTOCK INDIGENOUS COMMUNITY

Historically Significant Feature
Project Development Area
Proposed Substation
Archaeological Services
Confluence Buffer
High Potential Buffer
Medium Potential Buffer
Stantec Shovel Testing Recommendation
High Potential Area
Existing Transmission Line
Watercourse
Indigenous Community
Waterbody

0 0.5 1 1.5 2
kilometres

121812277-009
NAD 1983 CSRS NBDS

Base data: Service New Brunswick/Service Nouveau Brunswick Imagery provided by GeoNB.

Local Assessment Area for Heritage Resources

Stantec

121812277 - HOULTON INTERNATIONAL TRANSMISSION LINE

Figure 4.6

In general, most of the PDA was assessed as exhibiting low potential for archaeological resources. A large portion of the PDA between the US border and the TransCanada Highway Interchange has been heavily disturbed from the construction of Route 95. In addition to this, the PDA between the TransCanada Highway Interchange and the Meduxnekeag River has been altered and disturbed from recent and historic quarrying activities which have resulted in the removal of large volumes of soil inside the PDA.

Three areas of elevated archaeological potential were identified during the walkover survey of the PDA in 2016, of those, only one remains fully within the PDA, and one is partially located in and partially out of the PDA. During the 2017 walkover survey, one additional area of elevated potential was identified. Two of the areas of elevated potential are located on a ridge-terrace feature approximately 120-200 m west of the Meduxnekeag River—one is now located outside of the PDA, and one is located partially within the PDA. This landform feature is located approximately 20-30 m above the floodplain immediately adjacent to the Meduxnekeag River and these areas were determined to have elevated potential as they provide a vantage point both upstream and downstream of the Meduxnekeag River. The third area of elevated potential is located approximately 1.5 km west of the TransCanada Highway Interchange and consists of a small, narrow ridge feature at the toe-of-slope for Route 95. This area provides a good vantage point to the north towards the Meduxnekeag River valley. During the 2017 walkover survey, one area of elevated potential is located on a high, level ridge overlooking a tributary to the Meduxnekeag River. This area was recommended for shovel testing as it would provide a good vantage point to the north toward the Meduxnekeag River valley. Mitigation recommendations for the three areas of elevated potential has been provided in Section 4.3.6.3.2 in the event that these areas cannot be avoided during the Construction phase of the Project.

Since the completion of the 2016 AIA for the Project, a portion of the PDA approximately 3 km in length was realigned near the US border. The realigned PDA is located outside of the areas surveyed during the 2016 AIA, and was subject to an additional AIA to be completed in 2017. During the course of this assessment, two Historic Period Archaeological sites (temporary site nos. 2017NB91-01 and 2017NB91-02) consisting of multiple features were identified and registered with Archaeological Services. Temporary site no. 2017NB91-01 consists of three stone piles, one linear stone feature (LSF), and a scatter of Historic Period stoneware vessel fragments. The stone features and artifacts associated with these archaeological sites include features that are located within and features that are located outside the PDA for this Project.

4.3.6.2.2.2 Built Heritage Resources

A search of the Canadian Register of Historic Places (CRHP 2016) and the New Brunswick Register of Historic Places (NBRHP 2016) indicated that no historic places or heritage sites are located within or near the PDA.

4.3.6.2.2.3 Palaeontological Resources

A palaeontological report, based on known data sources within and near the PDA, was prepared by Dr. Randall Miller of the New Brunswick Museum (Miller 2017). Dr. Miller identified that the geological formations along the PDA are comprised of Ordovician to Silurian Age sedimentary rocks of marine origin. The report states there are no known fossil localities located within the PDA; however, it was noted that the bedrock composition in the PDA has the potential to contain palaeontological resources. In general, the types of fossils typically found in these formations are common for Paleozoic sedimentary rocks and can include brachiopods, trilobites, and graptolites, and microfossils such as condonts. While there are no recorded fossil sites within the PDA, there are three known sites in the vicinity of the PDA, two of which are located approximately 4 km south of the PDA and the third located approximately 3 km east of the PDA (Miller 2017). In the event that fossils are discovered in the PDA, the *Heritage Conservation Act* stipulates a duty to report the discovery of palaeontological resources and requires a permit to collect these resources.

4.3.6.3 Assessment of Potential Environmental Effects on Heritage Resources

4.3.6.3.1 Project Effect Pathways for Heritage Resources

4.3.6.3.1.1 Construction

During the Construction phase, the Project has the potential to cause adverse environmental effects resulting in a change in heritage resource sites. Activities that could result in a potential interaction with Heritage Resources include: Vegetation Clearing, Access and Staging, and Excavation, Structure Assembly and Anchoring. Though the RoW will be cleared for the Project, ground breaking and earth moving activities will be limited to the areas where excavations are carried out to place the transmission line poles and build the new substation. 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 Construction, specifically as excavations are carried out for transmission line poles. Any potentially adverse environmental effects on Heritage Resources due to Construction activities will be permanent, as no archaeological site can be returned to the ground in its original state. Vegetation clearing for the Project will largely be carried out by mechanical means and has the potential to interact with Heritage Resources as these activities may result in some ground disturbance, though grubbing of the RoW is not expected. Where Access and Staging occurs, there is the potential for the use of heavy equipment which may cause rutting resulting in ground disturbance and potential interaction with subsurface Heritage Resources. Excavation, Structure Assembly and Anchoring involve mechanical augering, excavation, or blasting, all of which have the potential to interact with Heritage Resources.

Activities listed under Construction that are not anticipated to interact with Heritage Resources include: Conductor Stringing, Inspection and Energization, and Clean Up/Revegetation. Clean Up and Revegetation may involve back blading, but will occur within the existing previously

disturbed Construction footprint and thus, no new ground disturbing activities will occur. Conductor Stringing, and Inspection and Energization of the transmission lines will not involve ground breaking activities; therefore, no environmental effects with Heritage Resources will occur from these activities.

4.3.6.3.1.2 Operation and Maintenance

During Operation and Maintenance, it is anticipated that there will be no interaction between Heritage Resources and any equipment brought onto the RoW during Vegetation Management. In the unlikely event that a heritage resource is discovered during this activity, NB Power would implement the Archaeological and Heritage Resources Contingency Plan in the PSEPP and contact the appropriate regulating agency to assess the discovery and develop appropriate mitigation.

Maintenance of Project infrastructure via ground and air line inspections will not result in ground disturbance and, therefore, will not interact with Heritage Resources.

4.3.6.3.1.3 Decommissioning and Abandonment

Decommissioning and Abandonment activities will not occur until the end of life of the Project, which is expected to be at least 50 years from the start of the Operation and Maintenance phase. While there is potential for some ground breaking during the Decommissioning and Abandonment phases of the Project, this will be limited to areas previously investigated and disturbed during the Construction phase of the Project. As such, there is not anticipated to be potential to encounter heritage resources during these phases of the Project. Thus the Operation and Maintenance and the Decommissioning and Abandonment Phases of the Project are not considered further in this assessment.

4.3.6.3.2 Mitigation for Heritage Resources

The following mitigation measures, through careful design and planning, will be implemented to avoid or reduce the environmental effects on Heritage Resources:

- An additional AIA will be completed for the portion of realigned PDA near the US border, any additional mitigation recommended as a result of that survey will be completed prior to the initiation of ground breaking construction activities.
- If the location of the proposed Project is altered from that reviewed during the AIA and paleontological assessment, NB Power will undertake additional impact assessments of the new locations, and implement any recommended mitigation prior to the initiation of ground breaking construction activities.
- Planned avoidance (e.g., transmission tower placement) of areas of elevated potential for archaeological resources identified during the walkover survey.
- Planned avoidance (e.g., transmission tower placement) of areas within 100 m of identified heritage resources and archaeological sites identified during the walkover survey.

- If avoidance is not possible, where elevated archaeological potential is confirmed, a shovel testing program will be developed based on the results of the archaeological survey and in consultation with AS. The proposed shovel testing program would be submitted to AS for review before it is implemented.
- If avoidance is not possible, where heritage resources or archaeological sites are located, mitigation (e.g., shovel testing, mapping, photography, excavation) will be developed in consultation with AS.
- If a shovel testing program is required, it will be supervised and completed under the direction of a provincially permitted archaeologist(s), and undertaken before construction and completed as required under the Archaeological Guidelines, and undertaken in consultation and participation of Indigenous communities and persons, should the Maliseet communities so desire.
- If archaeological or heritage resources are identified during a shovel testing program, the findings will be immediately reported to NB Power and the Province of New Brunswick, and the First Nation community as applicable. Further mitigation (e.g., systematic archaeological excavation or realignment of project components) would be implemented in consultation with NB Power, AS, First Nations, and completed according to the Archaeological Guidelines (AS 2012).
- The development of an environmental protection plan for the Project that includes an archaeological response protocol that includes a protocol for the unanticipated discovery of heritage resources during construction, up to and including the temporary stoppage of construction activities in proximity to the discovery until the discovery is investigated and any applicable mitigation is implemented

4.3.6.3.3 Residual Environmental Effects on Heritage Resources

During the background research for the Project, no heritage resource sites were identified within the PDA. However, during the field assessment, two Historic Period archaeological sites—composed of nine unique features and/or artifact scatters—were identified and four areas of elevated potential for heritage resources were identified within the PDA, only three of which remain inside the PDA. Efforts will be made to avoid placement of poles within 100 m of any features associated with registered archaeological sites, and these areas of elevated archaeological potential. If avoidance is not feasible, mitigation will be developed for the archaeological sites and shovel testing will be conducted in areas of elevated archaeological potential in accordance with the Guidelines. Any subsequent mitigation, if required, will be based on the results of the shovel testing and carried out in consultation with Archaeological Services.

With mitigation, including the implementation of an archaeological response protocol for the Project, this Project is not anticipated to have any residual adverse environmental effects to Heritage Resources.

4.3.6.4 Determination of Significance

In consideration of the above, and considering the nature of the interactions between the Project and Heritage Resources as well as the planned implementation of known and proven mitigation as well as adherence to applicable Acts, Regulations, and Guidelines, the residual environmental effects of the Project on a change in Heritage Resources during all phases are predicted to be not significant. This conclusion has been determined with a high level of confidence based on a good understanding of the general effects of construction activities on Heritage Resources and the effectiveness of mitigation measures discussed in Section 4.3.6.3.2.

4.3.7 Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

This section assesses the potential environmental interactions between Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project and the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons (Current Use) VC. Current Use was chosen as a VC in recognition of the potential importance of the lands and resources within the Project Development area of current use by Aboriginal persons, as well as the constitutionally protected rights of Aboriginal persons to carry out those activities.

4.3.7.1 Scope of Assessment

In this chapter, "current" refers to use of the land and resources for traditional purposes in the area of the proposed Woodstock to Houlton, Maine transmission Line (the Project), for the last 200 years (i.e., the last seven generations) and which would include the period prior to the construction of the present-day alignment of Route 95 to the United States border and Houlton, Maine in the 1970s, and the existing transmission facility (# 0038), built in 1957. "Use" refers to traditional activities such as hunting, fishing and gathering conducted by Aboriginal persons for traditional purposes, and considers subsistence, social and ceremonial uses, and for which the right to engage in those activities is afforded constitutional protection.

The assessment of environmental effects in this VC has been made based on data and documentary information available at the time of writing. NB Power will work with Aboriginal leadership to develop a traditional land and resource use (TLRU) study for this Project, to supplement the assessment of this VC and to determine if there is more specific information on traditional activities that may be occurring in the PDA and region. Once the TLRU study is completed, NB Power will consider the information presented in it in the overall planning and design of the new transmission line and substation.

For the assessment of potential environmental effects of the Project on the use of the PDA by Aboriginal persons prior to 200 years ago, the reader is referred to the Heritage Resources VC (Section 4.3.6), where such use would result in archaeological sites that may have be created during earlier timeframes.

The PDA is located within the traditional territory of the Wolastoqiyik (Maliseet), an area that would have been used in the past for hunting, fishing, gathering, and travel within and outside of Wolastoqiyik territory. While there are no current First Nations communities located within the PDA, Woodstock First Nation is located approximately 5 km south of the PDA; Tobique First Nation (*Negootuk* or *Neqotkuk*) is approximately 68 km north of the PDA.

The Project crosses through both private land and provincial Crown land, with the majority (73.6 %) of the land being public land. This percentage is somewhat skewed, however, as the Project is mostly located within the RoW for Route 95, which is a Crown asset on Crown land. The lands immediately outside of the Route 95 RoW are all privately held. Most of the transmission line installation is planned for the ditch area adjacent to Route 95 that is owned by the NBDTI. Crown land includes the easement for Route 95, from the eastern terminus of the Project, on a gravel trail west of the Meduxnekeag River, west to the border with the United States, as well as watercourse crossings, as all watercourses to the high watermark are also considered Crown land.

As described in the *Guide to Environmental Impact Assessment in New Brunswick*, pursuant to Section 5(2) of the New Brunswick *Environmental Impact Assessment Regulation* 87-83, proponents are required to describe all cultural activities, hunting, fishing, gathering and traditional uses by First Nations, take these uses into consideration in terms of their interactions with the Project, and describe the mitigation to address any adverse interactions.

Further, as described in the National Energy Board Filing Manual (2016), Section 4A, Table A-3, there is a requirement to describe how lands and resources in the study area are currently used by Aboriginal persons or groups for traditional persons and to describe reasonable alternatives to avoid and mitigate impacts on Current Use activities.

4.3.7.1.1 Potential Environmental Effects, Pathways, and Measurable Parameters

Activities and components of the Project have the potential to interact with potential Current Use within the PDA as well as result in adverse environmental effects on populations of species and/or habitats of importance for traditional activities. In consideration of these potential interactions, the assessment of Project-related environmental effects on current use by Aboriginal Persons is therefore focused on the following potential environmental effect:

- Change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Table 4.16 summarizes the potential environmental effects, environmental effect pathways, and measurable parameters for the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons VC.

Table 4.19 Potential Environmental Effects, Environmental Effect Pathways, and Measurable Parameters for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Potential Environmental Effect	Environmental Effect Pathways	Measurable Parameter(s) and Units of Measurement
Change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons	Construction activities and operation of the Project facilities may alter or limit access to, and availability of, areas and/or species or habitats or resources of importance to traditional activities	• Loss of access to land/species/habitats/resources in the terrestrial, riparian or aquatic environment that are important for current use • Loss of availability of land/species/habitats/resources in the terrestrial, riparian or aquatic environment

The interactions as described include the potential for loss of access to and availability of species/habitats/resources/location, which is assessed for the Construction phase only.

4.3.7.1.2 Boundaries

4.3.7.1.2.1 Spatial Boundaries

The assessment of potential environmental effects on Current Use encompasses two spatial boundaries: the PDA and LAA. These are described below.

Project Development Area (PDA)

The PDA is the immediate area encompassing the Project footprint, and is limited to the expected area of physical disturbance associated with the Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project. The PDA includes the footprint of the 15.7 km-long, 30 m-wide RoW for the new 69 kV transmission line to be constructed and the 0.4 ha footprint of the new substation. The PDA is illustrated in Figure 2.1.

Local Assessment Area (LAA)

The LAA for Current Use includes the PDA, and a 100 m buffer on either side of the PDA, and represents the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. It also represents the likely zone of Project influence. The LAA is illustrated in Figure 4.7 as it applies to Current Use.

U:\121812277\1_environmental\3_drawings\3_draft_figures\mxd\rpt\EIA\current_use\121812277-0010.mxd jbenjamin

MAINE

Route 95 Highway East

Route 95 Highway West

Mill Brook

Smith Brook

Bedell Brook

Little Bedell Brook

Richmond Corner

Route 555 Highway

Butts Creek

Route 540 Highway

Curries Lake

Route 550 Highway

Meduxnekeag River

Upham Brook

Connell Street

Houlton Street

Main Street

Woodstock

Connell House

WOODSTOCK

Peabody Brook

Route 105 Highway

Riviere Saint-Jean

Saint John River

Route 165 Highway

Route 2 Highway East

Route 2 Highway West

WOODSTOCK INDIGENOUS COMMUNITY

N

Field Observed Species at Risk and Species of Special Concern

- Vascular Plant (Species of Conservation Concern)
- Vascular Plant (Species at Risk)
- Historic Site
- Local Assessment Area for Current Use
- Project Development Area
- Proposed Substation
- Existing Transmission Line
- Watercourse
- Indigenous Community
- Waterbody

0 0.5 1 1.5 2

kilometres

121812277-0010

NAD 1983 CSRS NBDS

QC PE ME NH NS MA Project Location

Base data: Imagery provided by GeoNB.

Local Assessment Area for the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Stantec

121812277 - HOULTON INTERNATIONAL TRANSMISSION LINE

Figure 4.7

4.3.7.1.2.2 Temporal Boundaries

Temporal boundaries identify when an environmental effect is evaluated in relation to specific project phases and activities. The temporal boundaries for the assessment of the potential environmental effects of the Project on Current Use include the following periods:

- Construction – anticipated to occur in 2019
- Operation and Maintenance – approximately 50 years or the end of service life
- Decommissioning and Abandonment – anticipated to be three months in duration following the end of service life

Most potential environmental effects on Current Use will begin and peak during Construction, and diminish during the Operation and Maintenance phase of the Project. Decommissioning and Abandonment will occur following the useful service life of the facilities, and will be carried out at in accordance with regulations in place at that time. Additionally, potential interactions between Decommissioning and Abandonment and Current Use will be similar to those for Construction. Thus, Decommissioning and Abandonment will not be carried further in this assessment.

4.3.7.1.3 Significance Criteria

For the purposes of this environmental effects assessment, a significant environmental effect on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is defined as a Project-related environmental effect that:

- Causes a change in Current Use within the proposed RoW such that continued use of land and resources is altered in a way that they cannot continue at or near current levels and where accommodation or mitigation is not possible. This change would result in a loss of plant or animal (terrestrial or aquatic) populations, either from alteration of the terrestrial or aquatic habitat or direct mortality of communities of SAR/SOCC important to traditional activities. This change could cause a decline in the distribution or abundance of a viable population of SAR/SOCC important to traditional activities such that long-term survival is substantially reduced within the LAA, and for which accommodation or mitigation is not possible.

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

While virtually every part of the lands within Wolastoqiyik territory may have seen some level of use over the millennia, there are anticipated to be specific locations which have additional historical and cultural significance to Aboriginal people. These include locations where Aboriginal people have and continue to pursue traditional activities that are an element of a practice, custom, or tradition integral to the distinctive culture of Wolastoqiyik. Given the nature and location of the Project, being located within or near the toe-of-slope/ditchline for an

existing highway, it is not anticipated with that significant land use activities are currently taking place within the PDA. Further, while the timeframe for Current Use extends beyond the original development of Route 95, the nature of the terrain and small size of the watercourses crossed by the proposed transmission line RoW suggest that there is no readily identifiable unique aspect of the land and resources within the LAA as it relates to Current Use. NB Power is currently engaging the First Nation communities in proximity to the Project and should any information regarding Current Use be identified during the engagement and/or regulatory approval process for the Project, this information will be considered by NB Power as Project planning advances for the Project. If any additional mitigation is warranted based on information gathered, the information and mitigation will be provided to NBDELG for consideration in the approval of the Project. The following sections present the general environmental setting for the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.

4.3.7.2.1 Methods

Key information for determining existing Current Use within the LAA included reviewing various sources of publicly available information and literature pertaining to past and present Aboriginal use of lands within the LAA and data collected for other disciplines for this Project. These data and sources included:

- Traditional ecological knowledge or traditional land use studies for other projects
- Published documents, publicly available documents, and online documents pertaining to past and present Wolastoqiyik (Maliseet) lifeways and oral and written histories
- Data collected for other field disciplines (e.g., vegetation and wetlands, wildlife, and heritage resources)

As described above, this section does not presume or replace information that may become available through further engagement of Aboriginal communities. A TLRU study is currently planned for this Project and NB Power will consider the information from that study regarding the Project as planned, once that study becomes available.

4.3.7.2.2 Overview of Existing Conditions

This Project takes place in the heart of the Wabanaki homeland, a cultural geographic area called the Maritime Peninsula, which includes the Canadian Maritime provinces of New Brunswick, Nova Scotia, and Prince Edward Island, the Bas St. Laurent and Gaspésie regions of Québec, and the State of Maine, east of the Kennebec River. The Wabanaki people include the Penobscot in Maine, the Peskotomukhatiyik (Passamaquoddy) in Maine and New Brunswick, the Wolastoqiyik (Maliseet) along the *Wolastoq* (Saint John River) and its environs, and the Mi'kmaq in eastern New Brunswick, Prince Edward Island, and Nova Scotia.

The proposed Project transects an area traditionally home to the Wolastoqiyik, and since the retreat of the glaciers from this area approximately 12,000 years ago, and into the recent past, the Saint John River provided subsistence and economy for the Wolastoqiyik and the river was

the main corridor of transportation and conveyance between Wolastoqiyik communities from Québec and Maine when water routes were one of the main means of travel. More recently with the establishment of the First Nation Reserve system in Canada under the *Indian Act*, six Maliseet communities were created in New Brunswick: Madawaska Maliseet, Tobique (*Negootuk* or *Neqotkuk)*, Woodstock, Kingsclear (*Pilick*), St. Mary's (*Sitansisk*), and Oromocto (*Welmooktuk*).

The PDA would have been used by early Aboriginal people for hunting, fishing, gathering and as an overland route between the Saint John River system and the Penobscot River system in Maine (Archaeological Services 2015; Bailey 1894; Ganong 1899; NBDNR 2007). The Project parallels an ancient travel route that facilitated trade and social interaction between Wolastoqiyik and Penobscot, and that extended from the pre-European period through to the early 20th Century.

Traditional land and resource use territory for the Wolastoqiyik, as shown in Goddard (1996), includes a broad swath of hunting, gathering and fishing territory anchored around the Saint John River. Although ethnohistoric maps (e.g., Ganong's (1899) "Map No. 12") sharply delimits Wolastoqiyik, Mi'kmaq and Passamaquoddy traditional territories in New Brunswick, these boundaries may be a post-Contact construct, or, at the very least, more fluid than shown.

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

The assessment of potential environmental effects on Current Use was conducted using a combination of field-collected data from other disciplines (e.g., Terrestrial Environment, Fish and Fish Habitat, and Heritage Resources) and publicly-available literature and desktop sources of information.

Engagement and consultation activities with Aboriginal communities have been initiated by NB Power and are ongoing. Once the TLRU study is complete, NB Power will consider the results of that study in the planning of the Project.

4.3.7.3.1 Project Effect Pathways for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

During the Construction phase of the Project, it is anticipated that the use of heavy equipment for vegetation clearing and ground-disturbing activities, as well as the installation of transmission structures, will limit access to the land-based, riparian, and aquatic portions of the PDA. These restrictions will be temporary, primarily for safety reasons, as following the installation of transmission facilities, the PDA will be fully accessible. Clearing activities could lead to the loss of currently-available Species at Risk (SAR) and Species of Conservation Concern (SOCC) (e.g., butternut, big-fruit hawthorn, and dotted smartweed) that may be of importance for traditional activities, and additional butternut trees located outside and adjacent to the PDA may require clearing or partial delimbing for construction and operation of the Project. Further, clearing activities may cause some small mammals and herpetiles to leave protective cover due to noise

and activity, potentially resulting in increased direct mortality. Use of machinery during construction may result in the disruption or destruction of fish habitat through sedimentation and construction activities will also temporarily restrict access to watercourse and riparian areas in proximity to construction activities. These restrictions will be limited to the transmission line RoW only and areas outside of the RoW will remain available as they currently are.

Further to this, it is not anticipated that there are significant Current Use activities within land proposed for the RoW. The RoW is proposed to be located immediately adjacent to Route 95 that has been in place for ten years, in an area that is the ditch and/or toe of slope for that highway. All watercourses crossed by the RoW are first order and not traversable by watercraft, nor do they contain large specimens of fish species of the kind that would typically be sought by those using such resources. Outside the proposed RoW location, the land is privately held and has been for some time, hence Current Use of these lands is unlikely.

During all stages of the Project, potential adverse environmental effects to fish habitat will be mitigated through best management practices and changes to access to fish and fish habitat will be restricted to the portion of the watercourse within the RoW and it in not anticipated to be a direct affect to fish that may be exploited for Current Use.

During Operation and Maintenance, the RoW lands, riparian areas and aquatic environment will be accessible for current use activities. Vegetation management of the RoW lands is not anticipated to influence SAR or SOCC populations as that effect (i.e., removal) will occur during Construction, if at all. There are no planned activities that will interact or have adverse environmental effects on Current Use during Operation and Maintenance, and therefore Operation and Maintenance are not considered further in this assessment.

4.3.7.3.2 Mitigation for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

NB Power is committed to continuous improvement and will continue to evaluate opportunities to reduce interactions with Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons throughout the construction phase of the Project. NB Power will reduce interactions with Current Use from Project activities by implementing the following mitigation measures:

- Continue engagement activities with Aboriginal communities to determine if there is any Current Use within the proposed Project RoW.
- Conduct a TLRU study for the RoW.
- If any use is identified, provide Aboriginal communities or individuals who currently use the PDA the opportunity to harvest/gather any species of importance to traditional activities that might be affected by Project activities prior to the initiation of any construction activities. It is further recommended that the opportunity to conduct these harvesting/gathering activities be timed appropriately for the seasonality of the species of interest.

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

Construction is expected to create a temporary change in access to land and resources within the PDA, particularly during clearing of the RoW, and transmission tower installation. However, given the nature of the Project, it is not anticipated that this change in access will be for the long term. Further, as described in Section 4.3.7.3.1, Construction is expected to result in the loss of vegetation communities, and, as a result, the loss of SAR and SOCC present. Among those SAR and SOCC identified within the PDA as being important to traditional activities are 27 mature and immature butternut trees. The loss of these individuals is not anticipated to have population-level effects within the LAA or surrounding ecodistrict and this species is also available elsewhere within 5 km of the PDA (AC CDC 2016). Therefore, with the implementation of appropriate mitigation in regard to providing access to these trees prior to any clearing activities, the construction of the Project is expected to result in low adverse changes to access within the RoW and low adverse changes to SAR/SOCC of importance for traditional activities. These changes are expected to be short-term (access to the RoW) and long-term (lost of SAR/SOCC), and are expected to occur in a single event. Changes to the access to the RoW are considered reversible; however, changes to SAR/SOCC are not expected to be reversible, and occur in a unique ecological and socioeconomic context.

Decommissioning includes pole and conductor removal procedures which may result in temporary access restrictions to the RoW; however, any access restrictions will be short-term, and the land will again be available for current use once Decommissioning is completed.

Changes to access to the RoW within the PDA are considered reversible.

4.3.7.4 Determination of Significance

With the application of proposed mitigation, the residual environmental effects of a change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons during all phases of the Project are predicted to be not significant. Subject to confirmation through the TLRU study that will be carried out for the Project to verify these environmental effects predictions, this conclusion has been determined with a moderate level of confidence. This determination is based on the current understanding of the general effects of construction activities on access restrictions to the RoW and on SAR/SOCC of importance to traditional activities and the effectiveness of mitigation measures discussed in Section 4.3.7.3.2. NB Power will carefully review and consider the findings of the TLRU study, and adapt its approaches based on those findings as appropriate, as part of adaptive management measures for the Project.

4.3.8 Effects of the Environment on the Project

Effects of the Environment on the Project are assessed in this EIA Registration because of the potential for natural hazards and environmental conditions to interact with the Project.

Interactions between the environment and the Project may include naturally-occurring events associated with climate (including weather), climate change, seismic activity, and forest fires.

The effects of natural hazards and environmental conditions, if unanticipated or unmanaged, can result in adverse changes to Project components, schedule, and costs. Typically, these potential effects are addressed through project design (including site and materials selection), scheduling, and operational procedures implemented in consideration of expected normal and extreme environmental conditions.

NB Power adheres to generally accepted engineering practices, designs, and design standards to consistently manage the potential effects of the natural environment on transmission infrastructure, including extreme conditions. Such engineering design incorporates a considerable margin of safety that fosters the safe and reliable operation of a facility throughout its lifetime. NB Power will monitor any observed Effects of the Environment on the Project, and take action as required to maintain, repair, and upgrade Project infrastructure and modify operations to facilitate its continued safe operation.

Some effects, such as damage to infrastructure, could also result in consequential effects on the environment; these environmental effects are addressed as Accidents, Malfunctions, and Unplanned Events in Section 2.8.

4.3.8.1 Scope of Assessment

This section assesses the potential interactions between the environment and the Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project, with consideration of the following environmental conditions:

- Climate (including weather and weather variables such as air temperature, precipitation, winds, and extreme weather events)
- Climate change
- Seismic activity
- Forest fires (from causes other than the Project)

4.3.8.1.1 Potential Environmental Effects, Pathways, and Measurable Parameters

Interactions will occur between the environment and the Project that could result in damage to Project infrastructure, or equipment, or result in adverse changes to Project schedule. The potential effects that the environment could have on the Project are characterized through potential effects pathways and measurable parameters, as listed in Table 4.20.

Table 4.20 Potential Effects, Effect Pathways, and Measurable Parameters for Effects of the Environment on the Project

Potential Effect	Effect Pathways	Measurable Parameter(s) and Units of Measurement
Adverse Changes to Project Schedule or Operation and/or Damage to Project Infrastructure or Equipment	• Reduced visibility, or result in the inability of workers to access the site or manoeuver construction and operation equipment. • Damage to infrastructure and/or equipment, resulting in adverse environmental effects, an increase risk to health and safety, loss of electrical transmission, or repairs that could not be implemented.	• Changes to Project schedule or Operation (e.g., construction delays or long-term interruption of service) (increased Project cost). • Damage to Project infrastructure and/or equipment (increased Project cost).

4.3.8.1.2 Boundaries

4.3.8.1.2.1 Spatial Boundaries

The assessment of potential Effects of the Environment on the Project encompasses only one spatial boundary: the PDA, as described below.

Project Development Area (PDA)

The PDA is the immediate area encompassing the Project footprint, and is limited to the expected area of physical disturbance associated with the Construction, Operation and Maintenance, and Decommissioning and Abandonment of the Project. The PDA includes the footprint of the 15.7 km-long, 30 m-wide RoW for the new 69 kV transmission line to be constructed and the 0.4 ha footprint of the new substation. The PDA is illustrated in Figure 2.1.

Because this section is assessing the potential environmental effects on the Project, spatial boundary for Effects of the Environment on the Project is only concerned with those areas having Project-related infrastructure within them. By definition, this is limited to the PDA (Figure 2.1). There is no local assessment area associated with Effects of the Environment on the Project.

4.3.8.1.2.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential effects of the environment on the Project include the following periods:

- Construction – anticipated to occur in 2019
- Operation and Maintenance – approximately 50 years or the end of service life
- Decommissioning and Abandonment – anticipated to be three months in duration following the end of service life

4.3.8.1.3 Significance Criteria

A significant adverse residual effect of the environment on the Project is one that would result in one or more of the following:

- A substantial change to the Project schedule (*e.g.*, a delay resulting in the Construction period being extended by one season)
- Damage to Project infrastructure, resulting in a substantial increase to health and safety risk
- Damage to Project infrastructure, resulting in repairs that could not be technically or economically implemented
- A long-term interruption in service (*e.g.*, interruption in power transmission activities causing electricity demands not to be met for a period longer than 24 hours)

4.3.8.2 Existing Conditions for Effects of the Environment on the Project

4.3.8.2.1 Climate

Climate is the long-term trend in meteorological conditions experienced in an area or region, and is characterized by the statistical average (mean and variability) of meteorological/weather conditions of a region over a substantial period of time (typically 30 years). Climate includes, but is not limited to, elements such as temperature, precipitation, sunshine, cloudiness, wind, and fog (ECCC 2016a).

The current climate conditions are generally described by the most recent 30-year period (1981 to 2010; Government of Canada 2017) for which the Government of Canada has developed statistical summaries, referred to as climate normals. The closest ECCC weather station with available historical data is located in Woodstock, NB. Wind and fog (visibility) data are unavailable at this weather station; therefore, data from the weather station) in Fredericton, NB, (located approximately 75 km southeast of Woodstock) are reviewed for approximate wind speed and fog in the region.

4.3.8.2.2 Air Temperature and Precipitation

Annual climate readings at the Woodstock weather station indicate that January is typically the coldest month of the year, with a daily average temperature of -11.5°C. July is typically the warmest month of the year, with a daily average temperature of 19°C.

The average annual precipitation in Woodstock is 1,131 mm, with August being the month with the most rain (101 mm on average) and January being the month with the most snow (77 cm on average) (Government of Canada 2017).

4.3.8.2.3 Wind

The winds measured at the Fredericton weather station are generally out of the west in November to January, out of the northwest from February to April, out of the south from May to

August, and out of the southwest in September and October. April has the highest wind speeds (14 km/h), and August has the lowest wind speeds (9.6 km/h) (Government of Canada 2017). The average annual wind speed is 12 km/h.

4.3.8.2.4 Fog

Fog is defined as ground-level cloud and consists of tiny water droplets suspended in the air. Fog can reduce visibility to a distance of less than 1 km (ECCC 2016a). The Fredericton weather station recorded, on average, 108 hours, or 4.5 days, of fog per year). Visibility is lowest during the months of December and January and is reduced to a distance of less than 1 km for approximately 12 hours per month (Government of Canada 2017).

4.3.8.2.5 Extreme Weather Events

The Government of Canada lists severe storms, storm surges, hurricanes, floods, earthquakes, and tornadoes amongst New Brunswick's regional environmental hazards in the federal "Get Prepared" campaign (Government of Canada 2015b). Earthquakes (seismic activity) are discussed in Section 4.3.8 Although tornadoes are rare, they do occasionally occur in New Brunswick (Cheng et al. 2013).

Extreme storms and precipitation in New Brunswick tend to be more common and severe during the winter months. Winter storms can consist of high winds and a mixture of snow, rain and ice. New Brunswick has experienced recent power outages related to excessive ice build-up on distribution lines that resulted in poles In general, distribution power lines are more susceptible to damage during storm events than transmission power lines due to distribution power lines requiring a relatively narrow cleared RoW through vegetation (trees, overhanging branches, etc.). As such, distribution power lines are more susceptible to storm events forcing vegetation into the cleared RoW and onto distribution powerlines, and to breaking under the increased structural load. A low-pressure system brought torrential rain to New Brunswick in December 2010, and was focused over the southwestern and mid-western regions. Damages from flooding and heavy rainfall threatened public safety and transportation systems, and cost the province over $15 million (NBDELG 2010). In February 2015, extreme snowfall events exceeded the recorded provincial average winter snowfall total (CBC News 2015).

4.3.8.2.6 Climate Change

Climate change is defined by the Intergovernmental Panel on Climate Change (IPCC 2014) as:

> "*a change in the state of climate that can be* identified (e.g., *using statistical tests) by changes in the mean and/or variability of its properties and that persists for an extended period, typically decades or longer*."

Climate change can be due to natural forces and/or human activities that cause changes to the composition of the atmosphere, or changes to land use (IPCC 2014). The United Nations

Framework Convention on Climate Change distinguishes 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).

Predictions of future climate change are limited by the inherent uncertainty of climate change models. While climate change models can provide useful information for predicting and preparing for climate change, their ability to forecast regional changes is quite limited compared to larger-scale predictions (*e.g.*, continental climate change) (Randall et al. 2007; Flato et al. 2013). However, like all modelling projections, the results obtained from climate change models can be used as a guide for the planning process, and can facilitate Project design and adaptation.

Future climate change, such as increases in temperature, frequency and magnitude of precipitation, and increased incidences and intensity of storm events, could affect the long-term integrity and reliability of the Project. Despite differences in climate change model outputs, there is an overall consensus among the climatological community in that, over the next century, Atlantic Canada will likely experience warmer temperatures, more frequent storm events, increased storm intensity, and increased flooding (Lemmen et al. 2008; Lines et al. 2005, 2008). This average temperature change is expected to be gradual and is likely to affect precipitation types and patterns including later freeze up, wetter, heavier snow, more liquid precipitation occurring later into the fall, and possibly more freezing precipitation during both seasons (*Lines et al. 2008).*

4.3.8.2.7 Seismic Activity

Seismic activity is defined by the local geography of an area and the movement and/or fracture of rocks within the Earth (*e.g.*, movement of tectonic plates). These movements release seismic waves that cause vibration of the ground known as earthquakes (Natural Resources Canada 2016b).

The Project is located within the Northern Appalachians seismic zone which includes New Brunswick and extends towards New England. Historically, seismic activity in this area has been low. Earthquakes with a magnitude of 3 (on the Richter scale) have occurred in the general area of the Project, however it is unlikely that an earthquake with a magnitude of less than 5 would cause damage (Natural Resources Canada 2016b).

4.3.8.2.8 Forest Fires

The Canadian Wildland Fire Information System is a computer-based fire management information system that monitors the risk of forest fires in Canada on a short-term (daily and seasonally) and long-term basis (Natural Resources Canada 2015a). The average Fire Weather Index, a component of the Canadian Wildland Fire Information System, 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 2015a).

The Fire Weather Index ranks the potential risk for forest fires in Canada by province and month, on a scale that runs from 0 (low risk) to more than 30 (high risk). New Brunswick, for the years 1981 to 2010, is rated from 0 – 10 for August, which is the month which has the highest risk of forest fires in the province. This ranking places New Brunswick at the lower range of the fire index scale, which correlates to a low risk of forest fires in the province (Natural Resources Canada 2015b).

4.3.8.3 Assessment of Potential Effects of the Environment on the Project

This section describes how the environment could interact with planned Project activities to result in change to Project schedule and/or damage to the Project. The techniques and practices that will be applied to mitigate the potential negative effects of these environmental interactions are also presented.

4.3.8.3.1 Project Pathways for Effects of the Environment on the Project

The Project pathways for the Effects of the Environment on the Project (including environmental attributes such as climate, climate change, seismic activity, and forest fires) include the following:

- reduced visibility, or inability of workers to access the site or manoeuver construction and operation equipment
- damage to infrastructure and/or equipment, resulting in environmental effects, an increase to health and safety risk, loss of electrical transmission, or repairs that could not be implemented

Typically, Effects of the Environment on the Project are addressed with engineering design, best practices, and codes and standards that aim to prevent damage to the Project from environmental forces and natural hazards. These are discussed further in Section 4.3.8.3.2.

4.3.8.3.1.1 Climate

Extreme low temperatures during Construction of the Project have the ability to reduce the ductility of construction materials and increase susceptibility to brittle fracture. All aspects of Project design, including selection of materials and equipment to be used, planning, and maintenance, will include consideration of normal and extreme climate/weather conditions that may be encountered throughout the life of the Project.

Heavy snow and excessive ice build-up could potentially increase loadings on Project infrastructure and have the potential to exceed the tensile strength of the conductors, causing them to break (NB Power 2016). Extreme winter precipitation could also affect winter

construction activities by causing a delay in the receipt of materials, and result in additional effort for snow clearing and removal. Wind also has the potential to increase structural loadings on infrastructure and could result in damage to Project infrastructure and/or equipment. Extreme precipitation, storms and hurricanes could result in the inability for workers to access the site, cause damage to infrastructure/equipment, and/or cause an interruption of Operation (electrical power services) for extended periods of time.

Fog (reduced visibility) could cause difficulties with manoeuvering equipment and other Project-related activities, as could high winds (due to blowing snow or dust and debris).

During electrical storms, fault currents (electric currents that flow from one conductor to ground, or to another conductor because of an abnormal connection between the two (IESO 2015)) may occur during a lightning strike. This could result in danger to workers and/or damage to Project infrastructure/ equipment. Lightning strikes during electrical storms can also ignite a fire (see Section 2.8 for a discussion of fire as an accidental event).

4.3.8.3.1.2 Climate Change

All aspects of Project design will consider predictions for climate change and measures for adaptation. Several publications and engineering protocol guidance documents are available to guide design engineers in this regard, including those available from the Public Infrastructure Engineering Vulnerability Committee (PIEVC 2016). NB Power will also implement a maintenance and safety management program, as well as contingency plans, including emergency back-up power for necessary operations and dispatch of crews for emergency repairs of storm damage.

Precipitation

The New Brunswick (NB) Climate Change Projections are derived from the application of existing weather station data in New Brunswick to the guidance provided in the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). The data are extrapolated to predict climate change scenarios across several regions of NB (Figure 4.8). The nearest ECCC weather station to the Houlton Project is in Woodstock, NB and is considered representative of climate at the project location.

The climate change variables that are available and applicable from the NB AR5 data for an assessment of potential effects on Project infrastructure (e.g. transmission poles and lines) are limited to those related to precipitation, since moderate changes in temperature will not directly affect the integrity of Project infrastructure.

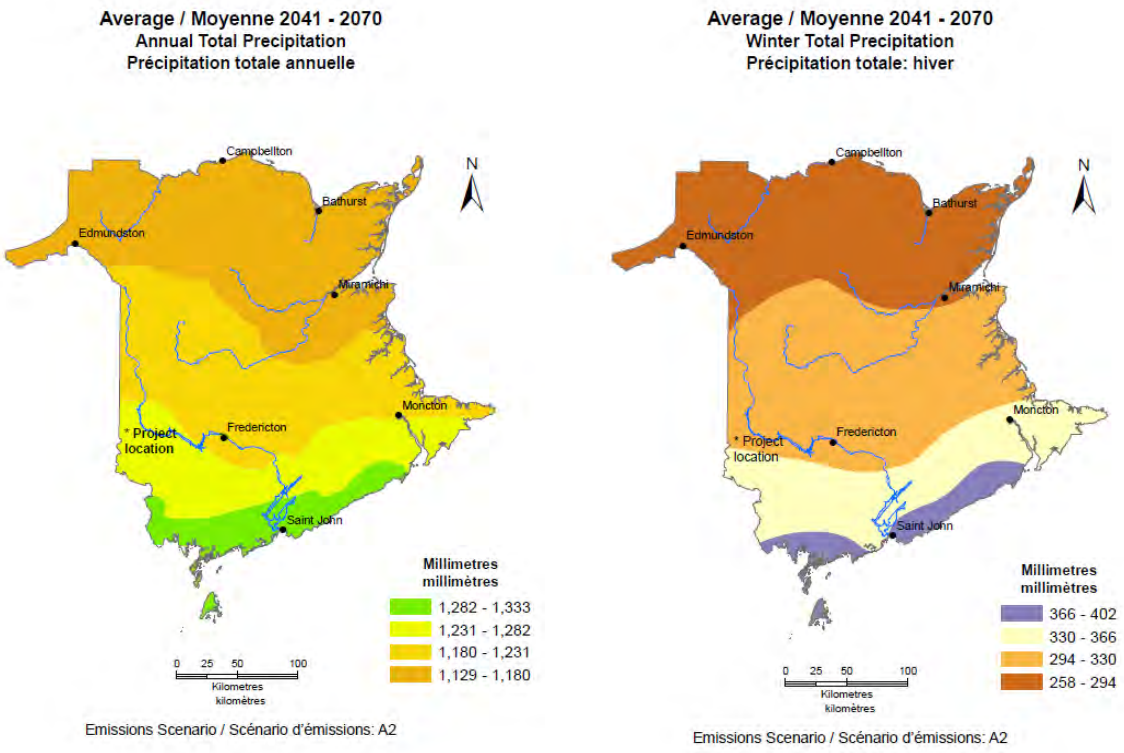


Figure 4.8. New Brunswick Future Climate Projections 2041 - 2070: A. Annual Precipitation (left) and B. Winter Precipitation (right). (Source: GNB 2016a)

For precipitation, ECCC Climate Normals for 1981 to 2010 for the Woodstock station indicate total average annual precipitation of 1,130.6 mm (ECCC 2016d). Figure 4.8 depicts the New Brunswick Future Climate Projections for the Woodstock region for 2041 to 2070 as being between 1,231 and 1,282 mm per year (GNB 2016). However, the long-term projection for the Woodstock region is still less than the total precipitation historically experienced elsewhere in New Brunswick, such as at the Saint John station (1,295.5 mm). As transmission infrastructure in Saint John has not been adversely affected by total precipitation exceeding that projected for Woodstock, climate change related effects are not expected to cause adverse effects on the Project infrastructure.

Cornell University also uses weather stations to predict extreme precipitation in northeastern North America, including Atlantic Canada. The nearest weather station to the Project that is used by Cornell University to predict future extreme precipitation events is the Beechwood station located near Bath, New Brunswick, 40 km north of the Project (Cornell University 2016). The 50-year, 24-hour extreme precipitation estimate for Beechwood, NB has a maximum depth of 128.1 mm, which is greater than the maximum precipitation depth of 116 mm recorded at the nearby Woodstock weather station in August 1990 (ECCC 2016d). This represents an increase of

up to 10.4% when compared with the largest extreme precipitation event recorded for the project area.

Heavy rains can also exacerbate the effects of freezing or high winds on project infrastructure, by allowing water to enter stress fractures in the insulators resulting in a power failure (NB Power 2016). The potential effects of extreme winter precipitation will be taken into consideration in the Project design.

Winter Precipitation

Winter precipitation could be considered a surrogate for snowfall and/or freezing rain, both of which could affect the integrity of the infrastructure through load bearing on lines and poles, or trees falling across the lines, from snow/ice load. Winter precipitation for the Woodstock station has averaged 266.8 mm per year from 1981 to 2010 (ECCC 2016d). New Brunswick Future Climate Projections for the Woodstock region for the years 2041 to 2070 range from 294 – 330 mm (GNB 2016a). The long-term upper level projection for the Woodstock region is only forecasted to be 6.9% greater than the total winter precipitation historically experienced in Moncton (308.6 mm), where New Brunswick has successfully maintained transmission infrastructure. Climate change related effects due to winter precipitation are therefore not expected to cause adverse effects on the Project infrastructure. The existing design specifications for Project infrastructure are suitable for the predicted extreme weather events over the lifespan of the project.

Rainfall Intensity and Duration

Rainfall Intensity-Duration Frequency (IDF) curves are commonly used in Canada as a key design parameter in design of water infrastructure. The IDF Climate Change Tool (UWO 2016) is used to derive rainfall IDF curves for future climate scenarios to account for climate change on infrastructure design, and may also be used for watershed-related activities such as water supplies, water quality management, flood control, or access structures. In this case, Project infrastructure is not being placed in wetlands or adjacent to watercourses where washout could occur. The Project does not involve the installation of culverts, bridges, pipelines, or drainage structures. The use of temporary bridges to cross watercourses, if needed, can be removed quickly if severe precipitation is forecast. Project infrastructure will not affect water supply, either directly through usage, or indirectly through runoff or the introduction of contaminants, and will not affect flood control measures because the RoW for the new 69/34.5 kV transmission line will remain vegetated (though trees will be cut, above the ground surface, with no grubbing or removal of stumps), with the possible exception of stumps located where pole structures are planned.

Since climate change predictions for the Project area are consistent with precipitation levels currently experienced elsewhere in New Brunswick, and the structural design of the transmission poles and conductors have already incorporated factors related to wind frequencies and

storms, climate change-related effects regarding precipitation are not expected to adversely affect the integrity of Project infrastructure.

Flooding and Erosion

Extreme precipitation has potential to result in flooding, erosion, and other events (such as access roads being washed out). These events could lead to the release of total suspended solids in runoff, and the related environmental effects of such an occurrence. The Project will not result in an increase in runoff or flooding compared to runoff or flooding in the project area currently, and therefore Project infrastructure is not at risk of flooding, erosion, or other readily available indices related to climate change.

Extreme precipitation in excess of 50 mm in a 24-hour period has occurred recently in the Woodstock area (ECCC 2016d). The GNB Flood History Database noted three flood events caused by heavy rainfall in central and southwestern New Brunswick on December 13, 2010, July 5, 2014, and December 9, 2014. However, while storm-related flooding was reported across vast areas of the province, there were no reports of flooding or flood-related damage in the proposed Project area (GNB 2016b).

The Project, by design, avoids low lying areas such as wetlands, waterbodies, watercourses, and their 30 m buffers, using pole placement to span such areas. In the unlikely event that that the Project cannot avoid such an area, the infrastructure is installed in a fashion that accounts for a permanent or periodically wet environment, including inundation from flooding.

Though the RoW will intersect nine watercourse crossings, Project infrastructure such as transmission poles and anchors will be placed to span watercourses, and wetlands including, 30 m buffers. As the Project design has placed infrastructure on surrounding topography at elevations that are above the watercourse shoulders, and at distances beyond the 30 m buffers, it is not at risk of being affected by flood waters.

The Project does not alter land use or drainage boundaries, nor does it increase the imperviousness of the ground such that runoff would increase. The proposed RoW will not be grubbed during Construction, and will continue to be vegetated with grasses, shrubs, and bushes and runoff will not be increased. The Project is therefore not expected to contribute to flooding.

Existing Infrastructure

There are no potable water wells within the PDA. Additionally, the wellfield for Woodstock is outside of the PDA and is not at risk of inundation or contamination from Project-related activities or infrastructure. There are no storm water basins associated with this Project, nor are there any within the PDA that could be affected by Project-related activities or infrastructure. There are no residential or non-residential buildings within the PDA. The Project will not result in increased rates of surface water runoff as the new RoW will be vegetated. The Project, by

design, will not result in the inundation of stormwater into any habitable space or municipal wastewater infrastructure that could result in ground saturation or septic backup. The Project will not have any effect on water levels within or beyond the PDA. The Project will not affect plumbing or electrical systems as a result of Project-related activities or infrastructure.

4.3.8.3.1.3 Seismic Activity

The level of seismic activity in the province and near the PDA is low, and the earthquakes that have been recorded in the general area of the Project have generally been low on the Richter scale (see Section 4.3.8.2.7). Therefore, the likelihood of a major seismic event occurring in the vicinity of the Project that would cause substantive damage to the Project or interruption to any Project-related activities or phases is low. Project structures will be built in accordance with industry standards to withstand minor seismic events.

4.3.8.3.1.4 Forest Fires

The average incidence of forest fires in the province is relatively low (see Section 4.3.8.2.8), and the likelihood of a major forest fire event occurring in the vicinity of the Project that would cause substantive damage to the Project or interruption to any Project-related activities or phases is low.

4.3.8.3.2 Mitigation for Effects of the Environment on the Project

The potential effects of climate, climate change, seismic activity, and forest fires will be addressed during the planning and design of the Project to maintain the long-term viability and integrity of the system. 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 (CSA 2015). These standards and codes provide factors of safety regarding environmental loading and Project specific activities and events. The Canadian Electricity Association (CEA) also reported that modern transmission infrastructure is better suited to withstand current climate predictions than is aging infrastructure that was designed under older climate change scenarios (CEA 2016).

Measures to mitigate the potential effects of climate on the Project will include the following:

- All components and physical activities associated with the project will follow the PSEPP.
- Infrastructure will be designed and maintained to the standards of the Canadian Electrical Code (CSA 2015).
- Implementation of a maintenance and safety management program.
- Implementation of contingency plans, including emergency back-up power for necessary operations and dispatch of crews for emergency repairs of storm damage.
- Emergency measures will be in place, in conjunction with existing NB Power, community, and provincial plans to provide rapid detection and response to any fire threat, and quickly control and extinguish the flames prior to contact with any flammable structures (e.g., wood). Mitigation for Project-caused fires is discussed in Section 2.8.2.

- There will be a cleared operational buffer zone established around Project components (e.g. RoW) to decrease the likelihood of a fire causing substantive damage to the Project, and to reduce the risk of fallen trees or other debris damaging Project infrastructure.
- All aspects of Project design, including selection of materials and equipment to be used, planning, and maintenance, will consider normal and extreme climate/weather conditions that may 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, safety and industry codes and standards for wind, snowfall, ice, extreme precipitation, and other weather variables associated with climate. These standards and codes, as described in in the Canadian Electrical Code: Overhead Systems. CAN/CSA-C22.3 No. 1-15 (CSA 2015), provide factors of safety regarding environmental loading on Project infrastructure.
- All aspects of Project design will consider predictions for climate change and measures for adaptation. Several publications are available to guide design engineers in this regard, such as the Public Infrastructure Engineering Vulnerability Committee's "Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate" (2011).
- Route selection to minimize the number of crossings or interactions with watercourses, waterbodies, wetlands, and their 30 m buffers. Avoiding these areas increases the distance that surface waters from the RoW must travel before reaching low-lying areas.
- Incorporation of a maximum slope grade of 2H:1V for graded surfaces within the PDA, to improve erosion protection and slope stability where grading must occur.
- Weather forecasts will be monitored to predict poor weather conditions (i.e., extreme precipitation, wind, fog), and allowance for them will be included in the Construction schedule.
- Ground vegetation and low shrubs will be left to grow within the proposed right-of-way (RoW)and will filter and absorb runoff, slowing down the movement of runoff and providing protection against surface erosion and runoff channeling.

As this Project is located in its entirety next to Route 95, there is immediate access available to conduct maintenance or repairs, if necessary. Any interrupton in transmission due to an Effect of the Environment on Project infrastructure would therefore likely be of short duration (i.e., less than 24 hours).

4.3.8.3.3 Residual Effects of the Environment on the Project

Environmental factors including extreme weather conditions and climate predictions are accounted for in Project Construction techniques, and best practices for facility and equipment design codes. Therefore, the potential for environmental conditions to affect Project infrastructure or operations resulting in a change to Project schedule and/or damage to the Project is considered low over the life of the Project. If such damage or interruption of service was to occur, NB Power will rely on standard contingency and response plans to repair damaged equipment and reduce service interruptions.

The potential effects of climate and climate change will be considered and incorporated into the planning and design of the Project, which would reduce the potential for damage to infrastructure and changes to the Operation of the Project. Inspection and maintenance

programs will prevent the deterioration of Project infrastructure and will help the Project to comply with applicable design criteria, best-practices/standards/codes, and will maintain the reliability of the transmission system and normal course of operation of the Project. Therefore, adverse residual effects from climate and climate change on the Project are anticipated to be generally low and infrequent.

Seismic activity is not considered to have the potential to substantively damage the Project, due to a history of low seismic activity in the area, and the application of comprehensive engineering design and compliance with codes and standards. Therefore, no adverse residual effects from seismic activity are anticipated.

While there is the potential for natural forest fires to occur near the Project, they are not likely to have a substantive residual effect on the Project. If a fire was to occur, emergency response plans would be implemented to control and extinguish the flames. There will be a cleared safety buffer zone established around Project components to further decrease the likelihood of a forest or a brush fire causing substantive damage to the Project.

4.3.8.4 Determination of Significance

The Project will be designed and operated to maintain safety, integrity, and reliability in consideration of the Effects of the Environment. Therefore, the Effects of the Environment, at any time during Project activities, are not anticipated to result in:

- A substantial change to the Project schedule (*e.g.*, delay resulting in the Construction period being extended by one season)
- A Long-term (> 24-hour) interruption in service (*e.g.*, interruption in power transmission activities causing electricity demands not to be met)
- Damage to Project infrastructure, resulting in a substantial increase to health and safety risk
- Damage to Project infrastructure, resulting in repairs that could not be technically or economically implemented

The Proponent will use an adaptive management approach throughout the life of the Project to monitor any observed Effects of the Environment, and will maintain the Project infrastructure and operations in accordance with up-to-date standards as described by the CSA in the Canadian Electrical Code. With the mitigation measures described in Section 4.3.8.3.2, adverse residual Effects of the Environment on the Project are rated not significant.

4.4 CUMULATIVE ENVIRONMENTAL EFFECTS

4.4.1 Scope of Assessment

The residual environmental effects of the Project that may interact cumulatively with the residual environmental effects of other projects or physical activities that have been or will be carried out are identified in this section, and the resulting cumulative environmental effects are assessed.

An assessment of cumulative environmental effects is warranted if:

- The Project is assessed as having residual environmental effects on one or more VCs, whether those residual environmental effects are significant or not; and
- The residual environmental effects of the Project on the VCs could act cumulatively with the residual environmental effects of other past, present, or reasonably foreseeable future projects or activities.

The environmental effects of past and present projects or activities on VCs have been generally considered in the description of existing conditions as applicable for each VC. For example, air contaminant emissions produced by existing facilities, such as from operation of the adjacent Route 95, have been considered in the baseline air quality as existing conditions that encompass the contributions of those other existing facilities to baseline air quality.

4.4.1.1 Boundaries

For the purpose of the cumulative environmental effects assessment, a regional assessment area (RAA) has been defined as land (in Canada) within a 25 km radius of the PDA (Figure 4.9). The RAA is the area within which potential cumulative environmental effects—defined as the residual environmental effects of the Project in combination with those of past, present or reasonably foreseeable projects—are assessed. This RAA has been selected because it encompasses the PDA and LAAs of all VCs assessed for the Project, and because it encompasses most of the Meduxnekeag River watershed (in Canada) and a portion of the Meductic Ecodistrict of the Valley Lowlands Ecoregion, both of which are used by some VCs to put the VC assessment into context (e.g., terrestrial environment). The RAA includes stretches of the Saint John River valley both north and south of Woodstock, and includes several nearby municipalities (e.g., Woodstock, Hartland, and the Village of Meductic).

Temporal boundaries for the assessment of cumulative environmental effects are the same as for each VC as identified in Section 4.3 of this EIA Registration. These temporal boundaries encompass periods of Construction (i.e., 2019), Operation and Maintenance (i.e., approximately 50 years), and Decommissioning and Abandonment (i.e., three months following the end of service life) of the Project.

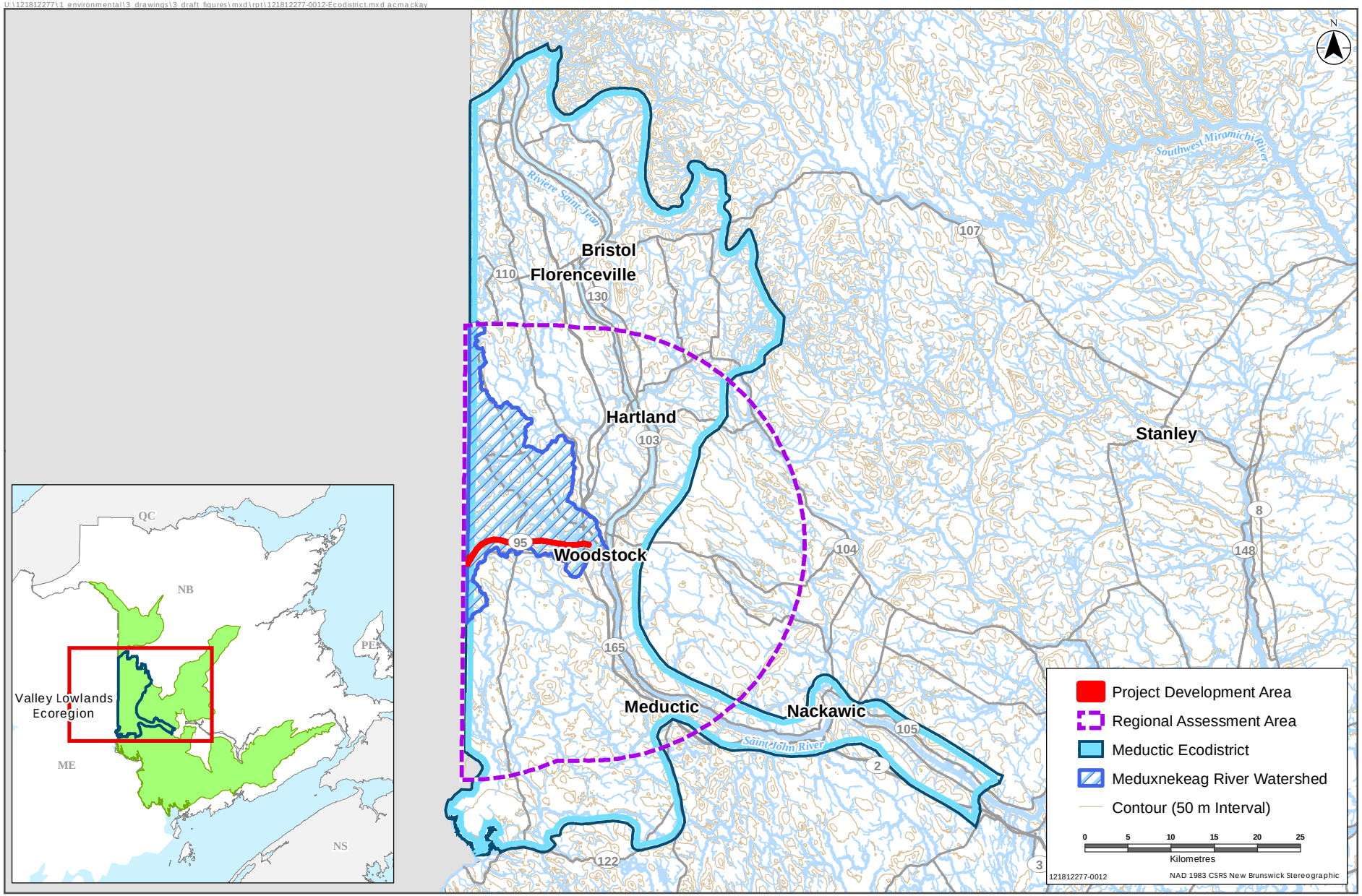
4.4.1.2 Significance Criteria

Thresholds of significance for the assessment of cumulative environmental effects are the same as for each VC, as identified in Section 4.3 of this EIA Registration.

4.4.1.3 Description of Other Projects or Activities

Future projects or activities were considered if the study team considered them to be reasonably foreseeable, as follows:

1. They have been publicly announced with defined project execution period and with sufficient project details available publicly that allow for a meaningful environmental effects assessment;
2. They are currently undergoing an environmental assessment, either federally or provincially, and information on those environmental assessments is available publicly; or
3. They are currently in a known permitting process.



Sources: Base data provided by Service New Brunswick.

Regional Assessment Area

Stantec

A review of the websites of the New Brunswick Department of the Environment and Local Government (NBDELG; http://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/environmental_impactassessment/registrations.html)) and the Canadian Environmental Assessment Agency (CEA Agency; http://www.ceaa-acee.gc.ca/050/index-eng.cfm) conducted on July 9, 2017 revealed no specific projects within the Meductic Ecodistrict (which is predominantly within Carleton County but also part of York County) that might result in residual environmental effects that might overlap those of the Project to cause cumulative environmental effects.

In the absence of known specific future projects or activities that may occur within the RAA, the study team identified four broad categories of past, present or reasonably foreseeable future activities with which the residual environmental effects of the Project will be assessed. These broad categories of activities have been selected based on the nature of the residual environmental effects of the Project that may overlap those of other projects or activities, as well as the study team's knowledge of current activities taking place in the RAA (e.g., agriculture and forestry activities are major economic drivers in the region). The four broad categories of past, present, or reasonably foreseeable future physical activities that have been identified as having the potential to result in residual environmental effects that may act cumulatively with those of the Project are:

- Industrial Development;
- Infrastructure Development;
- Forestry and Agriculture; and
- Commercial and Residential Development.

Further details on these broad categories of past, present, or future projects or activities are provided below.

4.4.1.3.1 Industrial Development

There are no large industrial facilities near the Project, nor within the RAA. There are various pits and quarries in the region, with the nearest gravel pit to the Project near the intersection with the TransCanada Highway, and another south of Route 95 near the border. Intermittent activity could occur on a sporadic basis.

According to the NBDELG's database of EIA registrations and the CEAA Registry, no new planned industrial developments have been identified based on a review of projects that have been registered under the EIA Regulation (as of July 9, 2017).

Due to the limited potential for interaction between the Project and industrial development in the RAA, due to negligible emissions from the Project, and given the distance to other existing large industrial emitters, Industrial Development is not carried forward in the assessment.

4.4.1.3.2 Infrastructure Development

The Project is located in and near Woodstock, which has various existing public and private infrastructure. The most notable existing infrastructure near the Project is Route 95 between the TransCanada Highway and Houlton, which would be paralleled for most of its length by the Project. Other existing public infrastructure includes water and sewage works, other electrical transmission lines, border crossing and customs infrastructure, and a local road network within and surrounding the town of Woodstock and in surrounding communities (see Section 3.3.3). Project construction traffic is likely to use Route 95 and arterial highways.

According to the NBDELG's database of EIA registrations and the CEAA Registry, no new planned infrastructure developments have been identified (as of July 9, 2017). There are no planned major road or infrastructure work managed by NBDTI or Brun-Way that may overlap with the Project Construction, based on consultation by NB Power. However, given the proximity of the Project to other infrastructure, and the potential for the environmental effects of the Project to overlap with those of infrastructure, Infrastructure Development is carried forward in the cumulative environmental effects assessment.

4.4.1.3.3 Forestry and Agriculture

Given the proximity of the Project to Route 95, and considering the majority of the PDA (85%) consists of public property within the RoW of Route 95, there is limited forestry activity immediately near the Project. However, generally speaking, forestry activities are a major economic driver in the Woodstock area and more broadly in Carleton and York counties. While there is forest habitat north and south of Route 95 and the PDA, there is little, if any, active forest harvesting within the PDA, but this activity does occur in adjacent properties and within the RAA, with forest covering 65% of the Meductic Ecodistrict.

Agricultural activity is present in the surrounding landscape, making up less than 1% of the PDA, and 9.5% of the LAA (within 500 m of the PDA). Agriculture is quite prevalent in the larger landscape and is a major economic driver in Carleton and York counties, especially to the south, and makes up a large portion of the land use in the landscape (e.g., 25% of the Meductic Ecodistrict).

Given the importance of forestry and agriculture activities as major economic drivers in the RAA, and the potential for the environmental effects of the Project to overlap with those of forestry and agriculture activities, Forestry and Agriculture is carried forward in the cumulative environmental effects assessment.

4.4.1.3.4 Commercial and Residential Development

Most of the commercial development in the area is within the town of Woodstock and near the TransCanada Highway.

There are various residential areas near the PDA, namely along Route 555 especially near Richmond Corner and Bedell, both south of Route 95. As the Carleton County population is shrinking (see Section 4.3.5.2.2), large scale residential developments in the short-term are unlikely. There are currently 11 listings in residential areas just south of Route 95, largely along Route 555 and adjacent subdivisions (realtor.ca; accessed July 9, 2017).

Given the prevalence of commercial and residential activity in the town of Woodstock and surrounding areas, and the potential for the environmental effects of the Project to overlap with those of commercial and residential developments, Commercial and Residential Development is carried forward in the cumulative environmental effects assessment.

4.4.2 Identification of Potential Cumulative Environmental Effects Interactions

Based on the assessments presented in Section 4.3, the following four VCs are anticipated to have residual environmental effects that might overlap those of other projects or activities that have been or will be carried out, and for which a cumulative environmental effects assessment was therefore undertaken:

- Atmospheric Environment;
- Terrestrial Environment;
- Socioeconomic Environment; and
- Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.

Table 4.21 highlights the potential for interactions between the residual environmental effects of the Project and the broad categories of past, present, or reasonably foreseeable future projects or activities identified.

Table 4.4.21 Potential Cumulative Environmental Effects Interactions Among Valued Components and Past, Present, or Future Projects or Activities

Past, Present, or Future Project or Activity	Valued Components			
	Atmospheric Environment	Terrestrial Environment	Socioeconomic Environment	Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons
Infrastructure Development	✓	✓	✓	✓
Forestry and Agriculture	✓	✓	✓	✓
Commercial and Residential Development	✓	✓	✓	

NOTES:

✓ indicates that the residual environmental effects of the Project on the VC might overlap spatially or temporally with the residual environmental effects of other projects or activities, and therefore a cumulative environmental effects assessment is required.

The Project is not expected to have overlapping residual environmental effects on other VCs (i.e., water resources, fish and fish habitat, heritage resources, and effects of the environment on the Project). The rationale for not carrying these VCs further is provided below.

As discussed in Section 4.3.2, the Project is not expected to result in residual environmental effects to Water Resources (i.e., surface water or groundwater) during Construction. During Construction, any mechanical rock breaking or blasting activities, if required, will be limited to pole and anchor locations and therefore be small, localized, and relatively shallow. It is not likely that blasting activities will interact with groundwater within the LAA and should any interactions occur they can be readily mitigated. Any increase in surface water runoff because of clearing activities during Construction is considered to be indistinguishable from baseline conditions and will be attenuated by the receiving watersheds. The residual environmental effects during the Construction phase of the Project are anticipated to be very small and of short duration, and not expected to result in any measurable change in Water Resources. There are no known interactions between the Project and Water Resources during Operation and Maintenance or Decommissioning and Abandonment, and thus no overlapping environmental effects to assess

with other projects or activities. An assessment of cumulative environmental effects on Water Resources is therefore not warranted.

The residual environmental effects of the Project on Fish and Fish Habitat are limited to those resulting from Construction, and include some potential for increases in water temperature. There are no features of the Project that would result in environmental effects to Fish and Fish Habitat during Operation and Maintenance or Decommissioning and Abandonment. Given the short (30 m) width of the RoW, the maintenance of 30 m riparian buffers where possible, the allowance of vegetation in the RoW to grow to a height of up to 4.4 m, and pre-existing openings in the canopy (including rip rap at culverts along Route 95), the increase in water temperature that might arise as a result of the Project is anticipated to be negligible. With mitigation, there is a low likelihood for the introduction of sediments to watercourses during Construction, as no fording of streams (no instream work) is planned. Instead, temporary bridges will be used (as needed) to provide access for all machinery and equipment to cross watercourses. With mitigation, no residual environmental effects on Fish or Fish Habitat are anticipated, and therefore, an assessment of cumulative environmental effects on Fish and Fish Habitat is not warranted.

Interactions between the Project and Heritage Resources are not anticipated to result in residual environmental effects. There are no known heritage resources within 100 m of the PDA, and the zone of influence of the Project on Heritage Resources is limited to the PDA. In light of the mitigation that will be implemented for the Project regarding potential Heritage Resources and since there will be no other projects or activities in the PDA other than the Project, there is no potential for overlapping cumulative environmental effects to occur with other projects or activities. An assessment of cumulative environmental effects on Heritage Resources is therefore not warranted.

Cumulative environmental effects interactions involving commercial and residential developments and Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, are unlikely as these are most likely to involve private lands near urban or suburban areas, which are unlikely to involve Current Use activities.

Finally, the assessment of Effects of the Environment on the Project in combination with the Project is presented in Section 4.3.8. Therefore, there is no need to carry out a further cumulative environmental effects assessment with respect to Effects of the Environment on the Project beyond that assessment presented in Section 4.3.8.

4.4.3 Assessment of Cumulative Environmental Effects

Past or present projects or activities that have been or are being carried out have influenced the baseline conditions for the assessment of Project environmental effects, as documented in the existing conditions section of each preceding VC section. Included in this is the Route 95 Highway and other collector and local roads, connecting electrical transmission lines, as well as

forestry and agriculture activities. Since the environmental effects of past or present projects or activities are largely encompassed within existing conditions for each VC, the environmental effects of other projects or activities that have been or are being carried out (i.e., past and present environmental effects) in combination with the environmental effects of the Project are considered in the assessment of the residual environmental effects of the Project.

4.4.3.1 Assessment of Cumulative Environmental Effects on the Atmospheric Environment

As detailed in Section 4.3.1, the residual environmental effects of the Project on the Atmospheric Environment during Construction include the release of criteria air contaminants (CACs), greenhouse gases, and noise above existing conditions. The residual environmental effects of the Project on the Atmospheric Environment during Operation and Maintenance or Decommissioning and Abandonment are negligible and are not discussed further.

In consideration of available standard mitigation practices and the relatively limited duration of Construction, Project-related releases of air contaminants are unlikely to cause exceedances of air quality standards, and are unlikely to act cumulatively with other projects and activities. Similarly, because of the small scale and duration of Construction, Project-related releases of GHGs during Construction will not measurably contribute to provincial and national GHG totals.

Use of large equipment and vehicles during Construction will emit sound and vibration. Noise and vibration will be transient and short in duration and will generally occur inside the PDA and immediately adjacent areas. Construction activities will be restricted to daytime hours to lessen the disturbance (such as noise) to nearby residences. Because of the linear progression of power line Construction, it is anticipated that any given nearby residence or other sensitive receptor will be exposed to potentially increased noise levels for less than a week at a given time. Given the likely infrequent use of local pits and quarries, such activity is unlikely to overlap with Construction of the Project. Potential cumulative environmental effects of noise are unlikely to extend beyond the LAA (within 500 m).

Highway operation, and forestry and agriculture activities in the area are expected to be ongoing and similar to past and present activities in terms of contribution to noise and air quality, and those environmental effects are encompassed in existing conditions for the atmospheric environment.

Other future projects or activities would be subject to approvals and permits which would determine the acceptability of their environmental effects and prescribe any required mitigation. Cumulative environmental effects of the Project in combination with other past, present or future activities (including Infrastructure Development, Forestry and Agriculture, and Residential and Commercial Development) on the Atmospheric Environment during all phases of the Project are therefore not expected to be substantive.

4.4.3.2 Assessment of Cumulative Environmental Effects on the Terrestrial Environment

The residual environmental effects of the Project on the Terrestrial Environment during Construction of the Project include a temporary and permanent disturbance to vegetation, wetland and wildlife habitat in the PDA, and a minor residual environmental effect on SAR and SOCC and wetlands in the LAA. There are no substantive residual environmental effects of the Project on the Terrestrial Environment during Operation and Maintenance that were not initially introduced during Construction, with the potential exception of the risk of transmission lines to the mortality of birds.

Construction will result in a temporary disturbance to approximately 30.0 ha of vegetation communities and wildlife habitat. This includes forest, wetland, and agricultural land, but excludes anthropogenic and industrial land classes. These environmental effects will persist through Operation and Maintenance, but may be partially restored following Decommissioning and Abandonment through active rehabilitation and/or natural revegetation over time. With mitigation, most of this disturbance will result in a change, but not a permanent loss of vegetation communities and wildlife habitat. Forested areas will be converted to shrub or regenerating/sapling aged forests following initial construction activities. The PDA will be cleared outside of the normal breeding season for migratory birds (April 1 to August 31), where possible; thus interactions with birds, particularly SAR and SOCC, are expected to be limited to a future reduction in available habitat and sensory disturbance associated with Construction activities. Due to the availability of habitats elsewhere in the RAA and surrounding area and the reduced suitability of habitats within the PDA because of their proximity to Route 95 and the associated sensory disturbance, wildlife species that may potentially use the PDA are not expected to be restricted by a lack of suitable habitat.

Vegetation clearing will lead to the loss of 27 butternut trees. There are 101 records of butternut within 5 km of the PDA in the AC CDC database, likely representing more than 150 individual trees (AC CDC 2016). However, the loss of 27 individual butternut trees is not expected to have population-level effects on this species in the LAA or RAA, as most, if not all, are infected with the butternut canker.

During Operation and Maintenance, the presence of transmission lines can lead to increases in bird mortality through collisions and electrocutions. The PDA does not lie within a known migration pathway (Bird nature n.d.); however, some migrating birds likely pass through the area. Nocturnal migrants such as passerines are generally high-flyers and are typically not at risk of suffering collision in flight during migration. Groups including waterfowl, waterbirds, and raptors have more variable flight during migration. Although waterfowl and waterbirds are at greater risk for wire collision, there are no known major staging areas near the PDA. Migrating individuals in these groups are more likely to fly higher than the transmission line wires, limiting their potential for collision. Collisions, if they occur, will likely be limited to local movements of resident birds. In addition, the conductors on the poles to be used for the Project will be spaced

at 3.81 m, which provides adequate clearance for large bird species such as raptors to avoid electrocutions (APLIC and USFWS 2005).

Future Infrastructure Development activities are likely to result in similar environmental effects to the Terrestrial Environment as with Project environmental effects. However, the Project is in a fragmented landscape and the footprint of disturbance of the Project is relatively small and is likely to be small for any future infrastructure developments. While no other electrical transmission line projects are known to be currently planned in the RAA or that would overlap the Project, there currently exists various electrical transmission lines from 69 to 345 kV, within the RAA. The additional 16 km of 69kV transmission line is not expected to result in a substantive increase in the potential for bird mortality in the RAA. The PDA does not lie within a known migration pathway, and there are no known major staging areas near the PDA.

Forest harvesting activities have the potential to result in the direct removal of terrestrial habitat and plant communities, wetland disturbance, and loss of plant biomass from the forest ecosystem, and increase wildlife mortality risk through a number of mechanisms including the removal of nests, dens, burrows and hibernacula; vehicle collisions; and increased access by hunters. Construction of access roads for forestry operations often results in the loss and fragmentation of terrestrial habitat and the crossing of watercourses, which may lead to sedimentation and alteration of physical habitat units. In the context of the Project and LAA for the Terrestrial Environment, limited overlap with forestry activity is anticipated, given the generally disturbed nature of the area, and land ownership. Given the relatively small footprint of disturbance of the Project, and location adjacent a largely disturbed and fragmented landscape, the residual environmental effects of the Project are unlikely to act cumulatively with forestry activities to adversely affect the sustainability of populations and habitats within the RAA. The habitat types within the PDA are abundant within both the LAA and RAA.

Agriculture can have indirect environmental effects on vegetation communities and wetlands in adjacent land, where there may be excessive fertilizing and watering that can result in runoff into wetlands. However given the nature of Construction, these potential residual environmental effects of the Project are unlikely. Agriculture can result in the disturbance to and mortality of breeding birds. Mitigation to avoid the breeding periods of birds during clearing activities, where possible, will avoid residual environmental effects on birds, and the transient nature of construction means disturbance will be of short duration in any one location along the PDA.

Future commercial and residential development activities are likely to result in similar environmental effects on the Terrestrial Environment, though the extent of spatial or temporal overlap with those of the Project would determine whether cumulative environmental effects might occur. However, these potential developments are unlikely to result in substantive environmental effects on the Terrestrial Environment in such a manner as to cause a measurable change from existing conditions that would be above regulatory thresholds or that would affect the ongoing viability of populations and habitats in the RAA.

In consideration of the residual environmental effects of the Project on the Terrestrial Environment, the ecological context of the Project along an existing highway corridor, and the very limited number of other likely projects and activities in the LAA, the potential cumulative environmental effects of the Project in combination with other past, present or future activities (including Infrastructure Development, Forestry and Agriculture, and Residential and Commercial Development) on the Terrestrial Environment during all phases of the Project are not expected to be substantive.

4.4.3.3 Assessment of Cumulative Environmental Effects on the Socioeconomic Environment

The Project will affect the Socioeconomic Environment during Construction, resulting in short-term access restrictions to portions of the PDA, affecting land use, including recreational land use. However, there is unlikely to be any overlap with any potential environmental effects of other projects or activities on land use. There are no substantive residual environmental effects of the Project on the Socioeconomic Environment during Operation and Maintenance or Decommissioning and Abandonment that were not initially introduced during the Construction phase.

The Construction of the Project will also result in the loss of approximately 20.8 ha of forest land available to forestry; however, this loss will be mitigated through discussion with landowners, negotiation of an easement, or compensation, as appropriate. Similarly, other identified or potential projects and activities that may also result in spatial loss of land would be mitigated in the same manner.

The Project is expected to result in a minor increase in demand in the local labour force and accommodations, and minimal residual environmental effects on transportation during Construction. The Project labour requirements are modest, such that competition for labour or a decline in the availability of local accommodations and public services are unlikely to cause a significant environmental effect on the Socioeconomic Environment, even in combination with other projects or activities.

Limited increases in passenger vehicles and heavy trucks transporting workers, materials and equipment are expected during Construction; however, traffic volumes are not such that additional traffic from Construction activities is unlikely to be of concern. Therefore, in consideration of the short duration and transient nature of the Construction, as well as planned mitigation, there will be no noticeable increase in overall traffic volumes or patterns through the LAA, and substantial environmental effects on traffic and the transportation network are not expected. As no other projects in the RAA are anticipated to result in traffic increases on Route 95 at the time of Construction of the Project, no cumulative effects on transportation are anticipated.

In summary, while there may be occasional short-term overlapping environmental effects of the Project with those of other projects or activities that have been or will be carried out, given the nature of the Project and the RAA, it is unlikely that those overlapping environmental effects would cause a significant cumulative environmental effect. Therefore, cumulative environmental effects of the Project in combination with other past, present or future activities (including Infrastructure Development, Forestry and Agriculture, and Residential and Commercial Development) on the Socioeconomic Environment during all phases of the Project are not expected to be substantive.

4.4.3.4 Assessment of Cumulative Environmental Effects on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

As noted in Table 4.21 above, the only projects or activities that have the potential to cause overlapping cumulative environmental effects with those of the Project on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons ("Current Use", for brevity) are from Infrastructure Development and Forestry and Agriculture.

As discussed in Section 4.3.7, the PDA would have been used by early Aboriginal peoples for hunting, fishing, gathering and as an overland route between the Saint John River system and the Penobscot River system in Maine. The Project parallels an ancient travel route that facilitated trade and social interaction between Wolastoqiyik and Penobscot, and that extended from the pre-European period through to the early 20th Century.

Traditional land and resource use territory for the Wolastoqiyik, as shown in Goddard (1996), includes a broad swath of hunting, gathering and fishing territory anchored around the Saint John River. Past traditional land and resource use studies in the area have indicated that current use in the vicinity of the Project is generally at the low end of the scale (particularly in light of the nature of the Project on a largely disturbed corridor adjacent to Route 95), with "more use" to the north and south of the PDA.

Given its location largely along an existing RoW, it is not anticipated that there are significant Current Use activities within land proposed for the Project RoW. The RoW is proposed to be located immediately adjacent to Route 95 that has been in place for ten years, in an area that is the ditch and/or toe of slope for that highway. All watercourses crossed by the RoW are first order and not traversable by watercraft, nor do they contain large specimens of fish species of the kind that would typically be sought by those using such resources. Outside the proposed RoW location, the land is privately held and has been for some time, hence Current Use of these lands is unlikely.

The residual environmental effects of the Project on Current Use are expected to be negligible to moderate given the size, nature and location of the PDA, and the fact that few resources currently in the PDA are not likely subject to much if any harvesting or use currently. While there is no doubt that modern development in general and past and present activities in the ecoregion

have or are affecting the current use of land and resources for traditional purposes by Aboriginal persons, given the relatively small footprint of the Project, and its location within the RoW of an existing highway, it is not anticipated that the environmental effects of the Project are sufficient to be measurable in the context of cumulative environmental effects with other projects or activities. It is anticipated that any other future projects or activities that might be proposed in the future will be subject to environmental review and their environmental effects on the natural resources will be taken into account, similar to this Project. Therefore, cumulative environmental effects of the Project in combination with other past, present or future projects (including infrastructure development) and activities (including Forestry and Agriculture) on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons during all phases of the Project are not anticipated to be substantive.

4.4.4 Summary and Determination of Significance

Overall, the PDA for the Project is relatively small and parallels the existing Route 95 highway for 85% of its alignment, which will reduce residual Project and cumulative environmental effects. While the existing Route 95, as well as other past infrastructure, commercial and residential development, and past forestry and agriculture activities have affected the existing landscape, those alterations were considered in, and encompassed within, the baseline conditions used to assess the residual environmental effects of the Project.

The Project will result in some environmental effects on VCs that may potentially overlap with similar environmental effects on those VCs from other past, present, or reasonably foreseeable projects or activities in the area. However, in all cases, these cumulative environmental effects are similar to the residual Project environmental effects presented in the EIA Registration, though having limited temporal and spatial overlap. Residual environmental effects from Project activities are predicted to be not significant. It is understood that other projects or activities defined as undertakings in the EIA Regulation will also be required to reduce potential environmental effects through compliance with government standards and permit stipulations, further reducing the potential for cumulative environmental effects; no currently-registered projects will overlap with the Project. No additional mitigation is recommended.

Therefore, given the relatively small footprint and limited residual environmental effects of the Project and with the application of planned Project mitigation, cumulative environmental effects of the Project in combination with other projects or activities that have been or will be carried out (including Infrastructure Development, Forestry and Agriculture, and Residential and Commercial Development) during all phases of the Project on all affected VCs are rated not significant. There is a high level of confidence in this prediction.