3.0 PROJECT SCOPE AND METHODOLOGY

3.1 Assessment Scope

EA is a planning tool used to predict the environmental effects of a proposed project, identify measures to mitigate adverse environmental effects, and to predict whether there will be significant adverse environmental effects after mitigation is implemented. EAs are typically organized and focused according to the selected VECs, which are those biophysical and socio-economic elements that may potentially be affected, either negatively or positively, by the proposed project. Activities associated with the project that may interact with identified VECs are also determined.

3.1.1 Activities Scope

The scope of this EA comprises all phases of the Project and associated activities, as described in Section 2.4.

The potential effects of accidents and malfunctions are also considered within this EA, as are the potential cumulative effects of this Project in relation to other projects/activities in the regional area. The potential effects of the environment on the Project are also addressed.

3.1.2 VEC Scoping and Selection

The process by which VECs are identified is a stepwise approach that begins with a high-level examination of the Project site using various data sources and consulting with stakeholders.

Regulatory Guidance and Consultation

As a Class 1 EA, this registration document and supporting studies have been developed to meet all requirements under Section 9(1A) of the *NSEA*.

In addition, the registration document has been prepared using the following provincial guidelines:

- "A Proponent's Guide to Wind Power Projects: Guide for preparing an Environmental Assessment" (NSE 2012); and
- "A Proponent's Guide to Environmental Assessment", published by the Environmental Assessment Branch of NSE and revised in 2009 (NSE 2009a).

The following regulatory bodies have been contacted by the Project team to provide input into the Project planning process and advice regarding the EA scope and VEC selection:

- CWS;
- Nova Scotia Department of Communities, Culture and Heritage;
- NSE; and
- NSDNR.

During the EA review process, additional consultation may be required with these and other agencies.

Literature Review

For this Project, existing information was collected from a number of sources to identify potential VECs and features of interest. Sources include, but are not limited to:

- Municipal documentation from the Municipality of the District of Chester;
- 1:20,000 aerial photos;
- 1:10,000 Nova Scotia base mapping;
- NSDNR wetland inventory mapping;
- Atlantic Canada Conservation Data Centre (ACCDC);
- Nova Scotia Well Log Database;
- Reports, books, and other materials on the area's natural history and geology;
- Reports, books, and other materials relative to wind turbine developments and environmental effects; and
- Information available at selected websites (e.g., Statistics Canada, *Species at Risk Act* (*SARA*) registry).

Field Studies

Field studies are initiated to characterize the existing natural and social-economic environment within the vicinity of and including the Project site boundaries. Field studies for this Project included:

- Seasonal avian monitoring (November 2011-June 2012);
- Vegetation survey (June 2012);
- Wetland survey (June 2012);
- Fauna surveys (November 2011-June 2012);
- Site visits to support the visual impact assessment (June 2012); and
- Site visits for characterization of socio-economic environment (Winter/Spring 2012).

Professional Judgement

Project personnel involved in the completion of this EA are trained, professional biologists, scientists, planners, and/or EA practitioners. Professional judgement was exercised through the selection of VECs and in the evaluation of environmental effects in this report. The use of professional judgement in EA practice is widely accepted and compliments the aforementioned scoping techniques.

VEC Selection

Based on preliminary investigations, provincial guidance, and the collective knowledge and expertise of the Project team, the following list of potential VECs was used for analysis of potential Project impacts and mitigation:

- Air quality;
- Surficial geology (soil);
- Bedrock geology;
- Groundwater;
- Freshwater habitats;
- Terrestrial habitat;

- Wetlands;
- Plants;
- Terrestrial fauna
- Birds;
- Bats;
- Local communities;
- Land use/recreation;
- Human health;
- Radar/radio interference;
- Transportation;
- Culture and heritage resources;
- Visual aesthetics; and
- Acoustics.

Following the determination of mitigation measures that may reduce or eliminate potential negative effects, those VECs that remain significant are further assessed (refer to Section 8 for detailed methodology and results of this assessment). Potential residual effects are also evaluated and appropriate follow-up measures were developed to monitor such effects.

3.2 Spatial and Temporal Boundaries of the Assessment

For this Project, the assessment of effects was undertaken for the area identified as the Project site (Drawing 2.3), unless otherwise identified. Reference to the Project footprint refers to the actual footprint of the Project (i.e. the turbine pad and road footprint). For the purpose of the wetland and vegetation field surveys, an assessment area was defined, covering a radius of 100 m from the turbine location. Distances measured to or from the Project site are referenced from the proposed turbine location.

For the purpose of data collection and the socio-economic environment, the Municipality of the District of Chester was also considered. In addition, residences located within a 2 km buffer of the Project site were assessed as potential receptors for the purposes of evaluation impacts of sound and shadow flicker.

The temporal scope of this assessment covers the construction, operations and maintenance, and decommissioning phases of the Project, which are expected to extend over the next 20 years.

3.3 Site Sensitivity

Potential wind farms are assigned a category level, according to a matrix provided in the "Proponent's Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment Registration Document" (NSE 2012). This matrix considers the overall Project size (Table 3.1) and the sensitivity of the Project site (Table 3.2), to determine a category level (Tables 3.3). The category level provides guidance to the level of complexity of component studies that will need to be completed to evaluate any residual effects, to determine any potential additional studies, and to identify post-construction monitoring requirements.

Table 3.1: Project Size

Size	Definition
Very Large	Total local area projected to contain more than 100 turbines
Large	Total local area projected to contain 41-100 turbines
Medium	Total local area projected to contain 11-40 turbines
Small	Total local area projected to contain 1-10 turbines

Table 3.2: Site Sensitivity Table

Potential Sensitivity	Determining Factor
Very High	Species identified are: • listed as "at risk" federally or provincially (NS *Endangered Species Act*, *SARA*, Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or NS General Status of Wild Species as "Red" occurring within, or being negatively affected by the development. Site identified as: • habitat for a large or important bird colony, such as herons, gulls, terns, common eider, and seabirds • a known bat hibernacula (25 km radius) • a significant migration staging or wintering area for bats, waterfowl, or shorebirds • an area recognized as internationally, nationally, or provincially important for bird (e.g., by being located in or adjacent to a provincial Wildlife Management Area or Wildlife Sanctuary, National Wildlife Area, Migratory Bird Sanctuary, Important Bird Area (IBA), National Park, Western Hemisphere Shorebird Reserve Network (WHSRN) and/or Ramsar sites, or similar area specifically designated to protect birds) • providing habitat for large concentrations of raptors (e.g., wintering, migration) • a known, or reasonably inferred migration corridor • having potential to reduce functional quality/quantity of habitat and/or cause significant land fragmentation with loss of connectivity
High	Site identified as: • having landform factors that concentrate species (e.g., shoreline, ridge, peninsula, or other landform that may funnel bird movement) or significantly increase the relative height of the turbines • a coastal island, or less than 5 km inland from coastal waters • an area of large local bird movements (between habitats) or is close to significant migration staging or wintering area for waterfowl or shorebirds • an area recognized as provincially or nationally significant for habitat conservation and/or protection • having increased bird activity from the presence of an area recognized as nationally and/or provincially important habitat for birds (e.g., a National Wildlife Area, Migratory Bird Sanctuary, IBA,

Potential Sensitivity	Determining Factor
	National Park, or similar area protected provincially or territorially because of its importance to birds) • containing species of high conservation concern (e.g., Species listed as "Yellow" under NS General Status of Wild Species)
Medium	• Site is recognized as regionally or locally important to birds, or contains provincially significant habitat types
Low	• Site does not contain any of the elements listed above

Since this Project involves one turbine, it is considered a small project. However, based on the known existence of several bird species with a provincial ranking of "endangered" (red), several birds ranked as "yellow" and "red", by Nova Scotia Department of Natural Resources (NSDNR), the Project is classified as having a "Very High" potential site sensitivity. As such, the Project is determined to be a Category 4, according to the following matrix (Table 3.3).

Table 3.3: Project Category

Facility Size	Site Sensitivity			
	Very High	High	Medium	Low
Very Large	Category 4	Category 4	Category 3	Category 2
Large	Category 4	Category 3	Category 2	Category 2
Medium	Category 4	Category 3	Category 2	Category 1
Small	Category 4	Category 2	Category 1	Category 1

3.4 Site Optimization and Constraints Analysis

A detailed desktop constraints analysis was conducted to ensure that the Project would result in the smallest possible impact to potential VECs.

The following process outlines the steps taken to finalize the turbine placement and minimize impacts on potential VECs:

- Mapping of the wind regime within the Project site was completed using the meteorological data in combination with the Nova Scotia Wind Atlas (NSDE 2007). The map product was an input to the turbine layout modeling by which optimal wind resource areas were identified (Drawing 3.1).
- Desktop assessment results were used to develop associated GIS datasets to produce constraints mapping to identify areas where the turbine could be located to avoid and minimize potential impacts to VECs. The following constraints were mapped using the preliminary turbine location:
    - watercourses, as identified in provincial 1:50,000 provincial mapping;
    - lakes, or other visible open water bodies as identified in 1:50,000 provincial mapping;
    - wetlands identified from desktop assessments;
    - known protected areas, wildlife sites, provincial parks, or reserves;
    - occupied dwellings and other buildings;
    - property boundaries;

- existing and proposed access roads and other infrastructure; and
- public roads.

Once the above parameters were mapped, the following setback distances and buffers were applied:

- 30 m from all wet areas including wetlands, watercourses, and water bodies;
- 1,100 m from industrial buildings (Kaizer Meadow Environmental Management Centre) and a minimum of 2,300 m from residential buildings;
- 200 m setback from public roads; and
- 165 m setback from property lines.

The mapping produced (Drawing 3.2), once setbacks were applied, was used to determine the best location for the Project. As field studies were completed, results were incorporated into the Project layout to avoid and minimize potential impacts.

N

Dam Bay

Highway 14

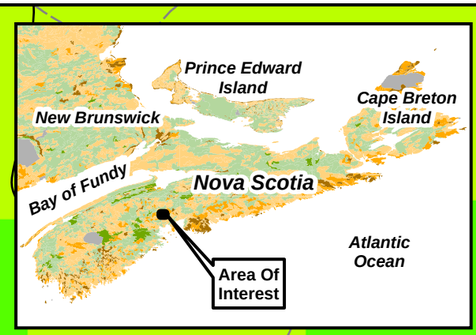
Card Lake

Anderson Lake

Kaizer Meadow Road

Landfill

Highway 14



0 150 300 600 900 1,200 Metres

Notes:

1. Reference: Digital Topographic Mapping And Nova Scotia Wind Atlas By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine
- Proposed Road
- Project Site Boundary
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Water Bodies

Wind Velocity At 80m Height

- 0.0 - 4.5
- 4.5 - 5.0
- 5.0 - 5.5
- 5.5 - 6.0
- 6.0 - 6.5
- 6.5 - 7.0
- 7.0 - 7.5
- 7.5 - 8.0
- 8.0 - 8.5
- 8.5 - 9.0
- 9.0 - 9.5
- 9.5 - 10.0

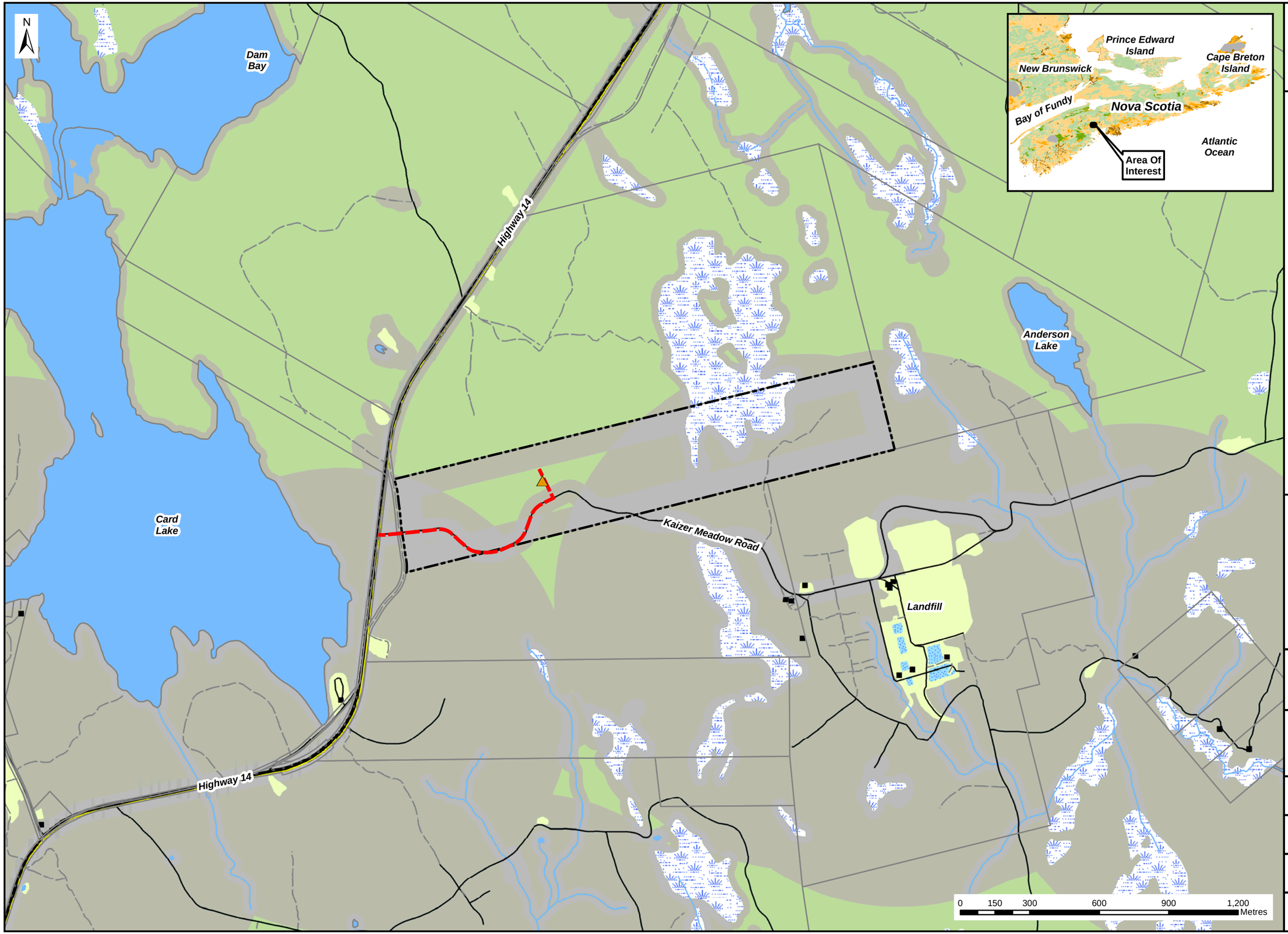
Wind Resources

MUNICIPALITY OF THE DISTRICT OF CHESTER

MINAS BASIN

Strum ENVIRONMENTAL

Date:	Project #:
June 2012	12-4360
Scale: 1:15,000	**Sheet:** 3.1
Drawn By: H. Serhan	
Checked By: A. Walter	



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine
- Proposed Road
- Project Site Boundary
- Adjacent Properties
- Building
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Sewage Settling Pond
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Constraints

- 30 m Waterbody Buffer
- 30 m Wetland Buffer
- 30 m Watercourse Buffer
- 1000 m Building Buffer
- 100 m Internal Lot Buffer
- 50 m Public Road Buffer

Environmental and Social Constraints

MUNICIPALITY OF THE DISTRICT OF CHESTER

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Checked By: A. Walter	

4.0 BIOPHYSICAL ENVIRONMENT AND EFFECTS MANAGEMENT

4.1 Atmospheric Environment

4.1.1 Weather and Climate

Nova Scotia's climate is quite varied and is largely governed by coastal influences and elevation (Davis and Browne 1996). The Project site (centered at 44°43'39.78" N, 64°15'16.08 W) lies within the Western Ecoregion of Nova Scotia, which extends from Yarmouth to Windsor (Neily et al. 2003). This region is characterized by mild winters and warm summers, although significant variations in temperature occur due to the proximity to the Bay of Fundy (Neily et al. 2003). Mean annual temperature for the area is 6.5°C, with summer and winter temperatures averaging 17.2°C and -4.3°C, respectively (Webb and Marshall 1999). The typical growing season in the area of the Project site is 203 days (Webb and Marshall 1999).

Local temperature data were obtained from the Windsor Martock meteorological station (44°56'00.00N, 64°10'00.00W) located approximately 24 km to the northeast of the Project site. For the period from 1971-2000, the mean annual temperature was 7.4°C, with a mean daily high of 12.3°C and a mean daily low of 2.4°C (EC 2011a). January and February were the coldest months (-5.2°C and -4.4°C, respectively), while the warmest months were July and August (19.8°C and 19.3°C, respectively) (EC 2011a).

Local precipitation data were obtained from the Avon meteorological station (44°53'00.00N, 64°13'00.00W) located approximately 18 km north of the Project site. This station was used for the precipitation analysis because it is situated closer to the Project site than the Windsor Martock station, although it did not record temperature data. From 1971-2000, mean annual snowfall was 216.1 cm and rainfall was 1,211.6 mm (EC 2011b). Most snowfall is received in December and January (46.5 cm and 52.6 cm, respectively), while the rainiest months are September, October, and November (114.7 mm, 123.6 mm, and 138.3 mm, respectively) (EC 2011b). Information provided from the Greenwood meteorological station which is located approximately 60 km northwest of the Project site, indicates that on average, over the last 30 years, fog, freezing fog, or ice fog can be expected for 34 days per year (Weather Network 2012).

An obvious consideration with regards to local climate, particularly in the context of wind power development, is wind speed and direction under typical and extreme conditions. Environment Canada (EC) measures wind conditions in Nova Scotia at those meteorological stations that are under long term observation. The closest such station to the Project site is in Greenwood. The Canadian Climate Normals (1971-2000) for this station indicate an annual mean wind speed of 15.3 km/h, most commonly out of the southwest (EC 2011c). The maximum hourly wind speed for this station was 113 km/h, recorded on January 10, 1964, with the highest single wind gust measured at 188 km/h on February 2, 1976 (EC 2011c). This station has an average of 35.6 days per year with wind speeds in excess 52 km/h (EC 2011c).

4.1.2 Air Quality

Currently in Nova Scotia, 42% of total greenhouse gas (GHG) emissions come from electricity use and 89% of electricity comes from fossil fuels (NSDE 2011). Because of this heavy reliance on coal and other fossil fuels for electricity, every megawatt (MW) of wind power installed reduces GHG emissions by as much as 2,500 tonnes per year (Government of Nova Scotia 2009). By reducing Nova Scotia's reliance on fossil fuels, wind energy will therefore contribute to improving local air quality (Government of Nova Scotia 2009).

Nova Scotia monitors air quality at six stations throughout the province. Measured parameters include ground-level ozone (O_3), particulate matter (PM2.5), and nitrogen dioxide (NO_2), and these values are used to calculate a score on the Air Quality Health Index (AQHI) (EC 2011d). The AQHI is a scale from 1-10+, in which scores represent the following health risk categories: Low (1-3), Moderate (4-6), High (7-10), and Very High (10+).

The AQHI monitoring station closest to the Project site is located in Kentville, approximately 45 km northwest of the Project site. The AQHI at this site is usually low at all times of the year (EC 2011e).

4.1.3 Effects and Mitigation

The potential effects to the atmospheric environment from wind turbines apply mainly to local air temperatures, soil moisture loss, and emissions, primarily during the construction phase.

Evidence provided by researchers at Duke and Princeton Universities suggests that localized air temperatures can be affected by the rotors of wind turbines. The blades of the turbines are thought to create air turbulence, mixing the air, and creating a warming and drying affect. It has been predicted that this could lead to as much as a $2^{o}C$ localized temperature rise in early dawn hours when natural wind conditions are usually calm. In addition, rotors are thought to redirect wind to the ground and increase evaporation of soil moisture (ScienceDaily, 2005). No other potential effects have been identified in relation to the development of a wind farm and weather and climatic conditions.

Wind turbines are a source of green energy production whereby the process does not involve combustion of fuels. However, albeit minimal, some emissions are expected during both the construction and operational phases of the Project from construction vehicles. In addition, the blasting/chipping of bedrock for the installation of the turbine foundation will produce dust emissions during the construction phase. Potential effects to the atmospheric environment, during the different phases of the Project, are identified in Table 4.1.

Table 4.1: Potential Effects on the Atmospheric Environment

Potential Effect	Source of Effect	Project Phase*		
		C	O/M	D
Soil moisture loss	Redirection of wind to the ground.		✔	
Increased airborne particulates and dust	Ground work (i.e. excavation, grading and exposed surfaces).	✔		✔
	Transportation of materials (i.e. mud on truck loads and collection of mud on wheels).	✔		✔
	Blasting activities (if required).	✔		
	Stockpiled material.	✔		✔
Increased vehicle emissions	Release of CO_2, nitrous, and sulphur oxides from trucks, on-site machinery, service vehicles, and maintenance equipment.	✔	✔	✔
Localized air temperature rise	Turbulence created by turbine blades.		✔	

**C – Construction Phase O/M – Operations/Maintenance Phase D – Decommissioning Phase*

The following mitigative measures will be implemented to minimize or eliminate impacts to the atmospheric environment:

- Development and implementation of an Environmental Protection Plan (EPP), which will include provisions for erosion and sediment control, emission controls, and dust control. The EPP will be approved by NSE prior to the start of construction.
- Contractor requirements that address all applicable air quality criteria during construction.
- Monitoring of complaints and implementation of appropriate actions, as required.
- Following construction, in areas where soil remains exposed (outside the turbine graded pad), re-vegetation with native species will occur to decrease the potential effects of soil moisture loss.

Mitigation measures described above are considered to be standard best practices, and are expected to address potential impacts. Therefore, atmospheric environment is not assessed further.

4.2 Geophysical Environment

4.2.1 Physiography and Topography

The Project site is located within two physiographic subdivisions; the Atlantic Uplands and the Hants-Colchester Lowlands (Goldthwait 1924). Topography is characterized by a rolling till plain situated within the drumlin fields of the New Ross area. Elevation of the region ranges from 110 m to upwards of 250 m above sea level. Overall, the topography undulates but generally slopes downward from west to east.

4.2.2 Surficial Geology

Based on geological mapping of the Project site, the surficial geology can be characterized into two different units: silty till plain and organic deposits (Drawing 4.1) (Stea and Brown 1992). The majority of the site is overlain by a silty till plain (ground moraine), which creates a flat to rolling topography with a thicker till masking bedrock undulations. An area located in the eastern half of the Project site is classified as an organic deposit composed of sphagnum moss, peat, and clay. These organic deposits can range in depth from 1 m at the edge to 5 m in the centre. A geotechnical investigation of the Project site was conducted in May 2012 by Exp Services Inc. on behalf of Strum Environmental (Strum 2012). A total of six boreholes were completed to verify subsurface conditions. Surficial geology was confirmed to consist of sand and gravel with silt, traces of organics, wood, and occasional cobbles ranging in depths from 0.6 m to 2.4 m.

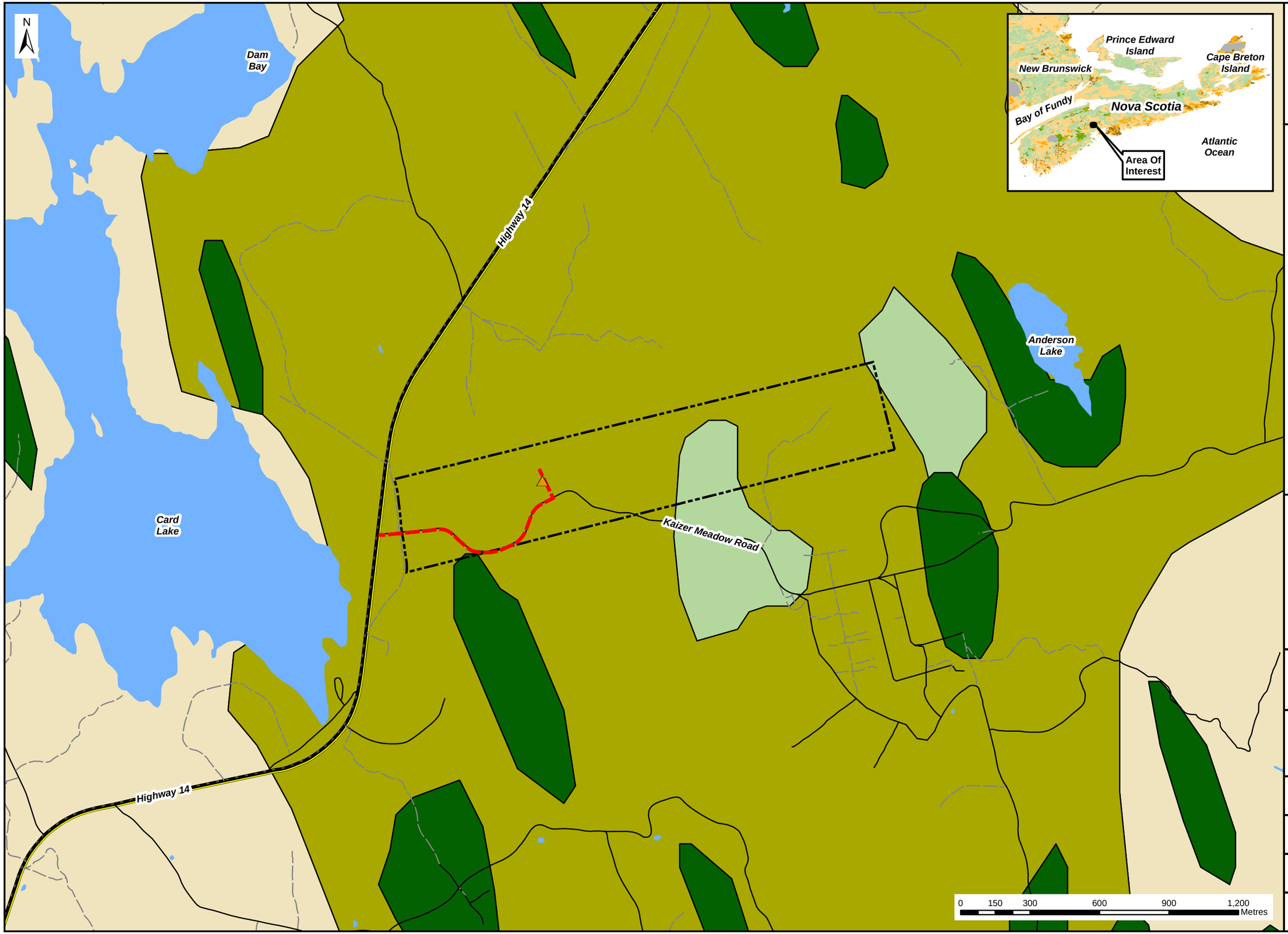
Elevated concentrations of radon soil gas have been confirmed in the Millet Brook area, approximately 14 km north of the Project site, which are associated with highly evolved Middle-Lake Devonian leucomonzogranite on the eastern margin of the South Mountain Batholith (Goodwin et al. 2008).

4.2.3 Bedrock Geology

Geological mapping across the Project site indicates bedrock consists of Middle to Late Devonian aged leucomonzogranite (New Ross Leucomonzogranite) of the South Mountain Batholith (Keppie 2000) (Drawing 4.2). Coring of boreholes was completed as part of the geotechnical investigation, confirming bedrock conditions as moderately weathered leucomonzogranite.

Granites have low matrix permeability and fracture systems contribute the only significant permeability in these rocks. Trescott (1969) reported that permeability in granite is found almost entirely in joints except near the surface where the release of confining pressure by erosion of the overlying rock has allowed fractures to open and where weathering has increased the aperture of many fractures. A large hydrothermal deposit (U-Ag) occurs approximately 14 km north of the Project site at Millet Brook (Chatterjee and Strong 1984).

Within a 1.5 km radius of the Project site, three drilled wells were identified in the NSE Well Log Database (NSE 2010), at depths of 77.65 m, 28.93 m, and 77.65 m. All three wells were drilled through varying surficial materials including clay and silt; silt; clay and bounders; and sand, clay and boulders ranging from 1.2 to 2.4 m in thickness, followed by bedrock. One of the wells was logged as being drilled through granite bedrock, where in the other two wells, bedrock type was not specified.



Notes:

1. Reference: Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, 1:500 000, by R. R. Stea, H. Conley and Y. Brown, 1992. Digital product compiled by R. R. Stea and B. E. Fisher.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine
- Proposed Road
- Project Site Boundary
- Public Roads
- Access Roads and Trails
- Major Roads and Highways
- Water Bodies

Surficial Geology Units

- Organic Deposits
- Silty Drumlin
- Silty Till Plain (Ground Moraine)
- Stony Till Plain

Surficial Geology

MUNICIPALITY OF THE DISTRICT OF CHESTER

MINAS BASIN

Strum ENVIRONMENTAL

Date:	*Project #:*
June 2012	12-4360
Scale: 1:15,000	*Sheet:* **4.1**
Drawn By: H. Serhan	
Checked By: A. Walter	

N

Dam Bay

M-LDmbmg

Highway 14

M-LDlmg

Anderson Lake

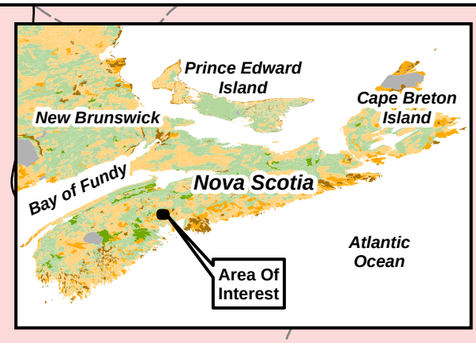
Card Lake

Kaizer Meadow Road

M-LDmbmg

M-LDmbmg

Highway 14



0 150 300 600 900 1,200 Metres

Notes:

1. Reference: Nova Scotia Department of Natural Resources, Minerals and Energy Branch, Map ME 2000-1, Geological Map of the Province of Nova Scotia, 1:500 000, Compiled by J. D. Keppie.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine
- Proposed Road
- Project Site Boundary
- Public Roads
- Access Roads and Trails
- Major Roads and Highways
- Water Bodies

Bedrock Geology By Formation

- Middle - Late Devonian Muscovite Biotite Monzogranite
- Middle - Late Devonian Leucomonzogranite

Bedrock Geology

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Strum ENVIRONMENTAL

Date: June 2012	***Project #:*** 12-4360
Scale: 1:15,000	***Sheet:*** **4.2**
Drawn By: H. Serhan	
Checked By: A. Walter	

4.2.4 Hydrogeology and Groundwater

Groundwater Quantity
Water supplies near the Project site are generally derived from individually drilled wells. A summary of the pertinent well properties for wells located within 1 km of the Project site is presented in Table 4.2.

Table 4.2: Summary of Drilled Well Records Within Approximately 1 km of the Project Site

Well ID	Drilled Date (yr)	Well Depth (m)	Casing Length (m)	Estimated Yield (Lpm)	Water Level (m)	Overburden Thickness (m)	Water Bearing Fractures (m)
1282	2000	77.65	7.61	7.94	1.22	1.22	n/a
12507	2001	28.93	7	181.6	2.44	2.44	9.1, 15.2, 21.3
51513	2005	77.65	12.18	15.89	n/a	2.44	n/a

Source: NSE 2010

Based on short term driller's estimates for the three drilled wells identified in the NSE Well Log Database, the average yield is approximately 68.5 Lpm (18.1 gpm) and average well depth is approximately 61.4 m (201.4 ft). These yields represent very short term yields estimated by the driller at the completion of well construction. Groundwater flow in granite bedrock is highly fracture dependant. One of the three drilled wells contains three water bearing fractures, whereas there were none observed in the remaining two wells. Fracture depths in the one drilled well was recorded at 9.1 m (30 ft), 15.2 m (50 ft), and 21.3 m (70 ft). The closest drilled well to the Project site is located approximately 360 m southeast of the Project site boundaries, south of Kaizer Meadow Road.

The NSE Pump Test Database (NSE 2009b) provides longer term yields for select wells throughout the province. One regional well drilled through granite bedrock and located at Card Lake Provincial Park (approximately 1 km west of the Project site) indicates long term safe yields (Q_{20}) of 50 Lpm (13.2 gpm) and apparent transmissivity (T) values of 3.7 m^2/d.

An observation well (No. 079) is situated at the Jerry Lawrence Provincial Park, approximately 33 km southeast of the Project site that forms part of the NSE Nova Scotia Groundwater Observation Well Network (NSE 2011). This observation well was drilled through granite bedrock and a 3 hour pump test was completed on the well in 2008. Results of the pump testing indicated the well had a T value of 1.53 m^2/d and a safe yield rate of 39.8 Lpm (8.8 gpm).

Groundwater Quality
Water quality from dug wells in the vicinity of the Project site is very limited. Analytical data from one dug well within 10 km of the Project site was available for review, in addition to several dug wells within Lunenburg County, retrieved from the NSDNR Groundwater Mapping database (NSDNR 2009). Some average values and ranges from various literature sources were also reviewed. Water quality from dug wells is normally acceptable when in

compliance with the Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2010a). Hardness, iron, manganese, colour, turbidity, and low pH are the most common chemical parameters noted in the area that may pose aesthetic issues to the user and may require point-of-entry treatment.

Groundwater in contact with granite bedrock will tend to have higher alkalinity, hardness, and total dissolved solids (TDS). Potential health-related concerns associated with groundwater supplies in granite bedrock aquifers include elevated concentrations of arsenic (related to sulphide and base metal mineralization), as well as radionuclides such as radium, uranium, fluoride, radon, and lead-210 (Fracflow 2004). Mineralized zones near the contacts of granite bedrock and the Meguma Group (Goldenville Formation) bedrock (approximately 13 km northwest) can result in elevated concentrations of arsenic, iron, and manganese. Water quality data from four wells drilled in granite bedrock located within 10 km of the Project site indicated exceedences of iron, fluoride, arsenic, and uranium guideline values. All other parameters were found to typically meet the Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2010a).

4.2.5 Effects and Mitigation

Potential geophysical effects from Project activities include localized disturbances of surface soil and shallow bedrock from ground stripping, excavation, and heavy machinery during construction. Mobilization of soils by wind or water may be transported to nearby surface water bodies.

Only three domestic wells were located within 1 km of the Project site. While large scale blasting is not anticipated to occur, the potential for short term, localized blasting may arise for the construction of the turbine pad.

Potential effects to the geophysical environment during the different phases of the Project are identified in Table 4.3

Table 4.3: Potential Effects on the Geophysical Environment

Potential Effect	Source of Effect	Project Phase*		
		C	O/M	D
Soil mobilization	Ground stripping, excavation, and heavy machinery use.	✔		✔
	Blasting (if required).	✔		
Interference with domestic wells	Blasting (if required).	✔		

**C – Construction Phase O/M – Operations/Maintenance Phase D – Decommissioning Phase*

The following mitigative measures will be implemented to minimize or eliminate impacts to the geophysical environment:

- Development and implementation of an EPP for all phases of construction that will include specific sediment and erosion controls as well as provisions for the inspection

and monitoring of erosion and sedimentation controls, handling of petroleum products and environmental protection measures. EPP will be approved by NSE prior to the start of construction.
- Once the location of any required blasting is confirmed, an inventory of wells in the vicinity of the blasting will be completed and the need to complete a pre-blast survey and monitor during blasting will be evaluated.
- The extent of blasting activities will be minimized to the extent possible.
- Areas of exposed bedrock or previously undisturbed soils will be minimized during construction.
- Following any blasting or disturbance of soils or bedrock, exposed soils or bedrock will be covered with soil and re-vegetated as required to minimize any exposure.

Mitigation measures described above are considered to be standard best practices, and are expected to address potential impacts. Therefore, the geophysical environment is not further assessed.

4.3 Freshwater Environment

4.3.1 Freshwater Habitats

The Project site lies within the South Mountain Ecodistrict (Neily et al. 2003). Drainage is poor, and sluggish, and rivers and streams meander from one shallow lake to another or among wetlands (Webb and Marshall 1999).

The Project site lies within two primary watersheds, referred to as the Avon River (1DE) and Ingram River (1EH) Watersheds. The western third of the Project site lies within the Avon River Watershed. The Avon River flows northerly, eventually becoming tidal, and creating an estuary in the area of Hantsport. Prominent water bodies in the Avon River Watershed include Card Lake, Panuke Lake, Falls Lake, Big St. Margaret's Bay Lake, and Mockingee Lake.

The Ingram River Watershed occupies the remaining portion of the Project site. Anderson Lake, located in northern portions of the watershed, is the closest major waterbody to the Project site and is drained by Melvin Meadow Brook which flows south to Connaught Lake located in central portions of the watershed. Mill Lake and Houghton Lake exist to the south of the Project site, and drain water east, also into Connaught Lake. Another prominent waterbody within the Ingram River Watershed is Timber Lake, which borders the eastern watershed boundary and drains to the southeast via Timber Lake Brook.

There are no mapped surface waterbodies within the boundaries of the Project site. In addition, field assessments confirmed that there are no watercourses within the Project footprint. The nearest lakes are Anderson Lake, located approximately 676 m to the northeast of the Project site boundary, and Card Lake located approximately 322 m to the west of the Project site boundary.

Water quality data was obtained from the Lake Inventory Program (NSE 2012b) for lakes located within 20 km of the Project site. Water quality data results for 31 lakes in the area

were relatively consistent with few apparent observations. Dissolved oxygen (DO) levels higher than 2 mg/L are considered optimal for aquatic life and this concentration was observed in all cases except some bottom samples. Conductivity levels were highly variable and water clarity, ranged from 1.1 m to 3.45 m. All lakes surveyed reported acceptable pH levels (guideline 5.0 – 9.0) and surface DO levels (>5.0) mg/L) based on water quality guidelines for the protection of aquatic life (CCME 2009) and recreational use guidelines (Health Canada 2009).

4.3.2 Effects and Mitigation

As there are no lakes and or watercourses within the Project footprint, and no adverse effects on freshwater habitats are anticipated as a result of the Project. In addition, standard construction best practices will be employed throughout the duration of the Project to manage drainage and control erosion. Therefore, the freshwater environment is not further assessed.

4.4 Terrestrial Habitats

4.4.1 General Habitats

Vegetation composition within the Ecodistrict is defined as mixed wood forest, made up of intermediate to tall stands of red spruce (*Picea rubra*), Eastern hemlock (*Tsuga canadensis*), and white pine (*Pinus strobus*). American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and red oak *(Quercus rubra)* are found on exposed slopes and hilltops, particularly around lakes. Fire stands of red oak, red maple (*Acer rubrum*), and white birch (*Betula papyrifera)*, often mixed with white pine and black spruce (*Picea mariana*), are abundant. Balsam fir (*Abies balsamea*) and black spruce occupy the poorly drained sites (Webb and Marshall 1999).

Ground vegetation typical of this type of mixed wood forest includes bracken fern (*Pteridium aquilinium Kuhn*), bunchberry (*Cornus canadensis*), sheep-laurel (*Kalmia angustifolia*) and blueberry (*Vaccinium angustifolium).*

Habitat types present within the Project site are provided in Drawing 4.3. Habitat types and percent cover for the site are provided in Table 4.4.

Table 4.4: Site Habitat Type and Cover

Habitat Type	Cover (%)
Unclassified Forest	41
Softwood	22
Mixed Wood	21
Treed Bog	9
Hardwood	7

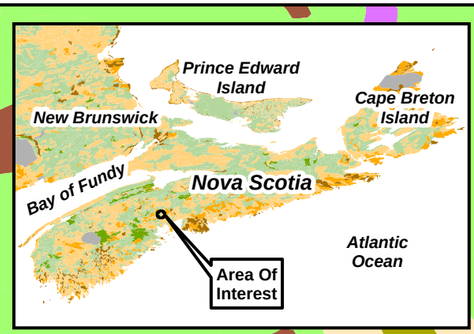
Source: NSDNR 2012a

N

Highway 14

Kaizer Meadow Road

Card Lake



0 125 250 500 750 1,000 Metres

Notes:

1. Reference: Forestry Inventory By Nova Scotia Department Of Natural Resources (NS DNR).
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine
- Proposed Road
- Project Site Boundary
- Major Roads and Highways
- Water Bodies
- Softwood
- Mixed Wood
- Hardwood
- Unclassified Forest
- Plantation
- Brush
- Clear Cut
- Partial Cut-over
- Treed Bog
- Inland Water
- Urban
- Other
- Gravel Pit
- Road Corridor

Habitat Cover

MUNICIPALITY OF THE DISTRICT OF CHESTER

MINAS BASIN

Strum ENVIRONMENTAL

Date:	Project #:
June 2012	12-4360
Scale: 1:7500	**Sheet:** 4.3
Drawn By: H. Serhan	
Checked By: A. Walter	

The majority of the Project site is forested. The only non-forested land is identified as a treed bog located near the northeastern extent of the Project site. Softwood stands at the Project site are dominated by red spruce and black spruce with a balsam fir and red maple component. Mixed wood stands account for 21% of the cover type on the Project site and are of the red maple-balsam fir association, while red maple dominates the hardwood stands with minor red oak and balsam fir components.

The footprint of the proposed Project has been previously clear cut; therefore, shrubby successional species consisting of grey birch *(Betula populifolia)* and red maple saplings and shrubs; and bristly blackberry *(Rubus setosus Bigel),* braken fern*,* huckleberry *(Gaylussacia baccata)* and low bush blueberry herbs dominate the landscape. Beyond the Project footprint , mixed wood forest dominated by red maple, red spruce, black spruce and balsam fir trees and shrubs; and goldthread *(Coptis trifolia)*, sheep laurel, cinnamon fern *(Osmunda cinnamomea)* and braken fern herbs extends throughout the remainder of the Project site.

4.4.2 Wetlands

A desktop identification of the location and extent of potential wetlands at the Project site was completed by reviewing the following information sources:

- aerial photography;
- Nova Scotia Wet Areas Mapping database (WAM);
- NS Significant Species and Habitats database; and
- topographical maps.

A review of the NSDNR Significant Species and Habitats database and NS Geomatics Centre reveals one mapped wetland (9.2 ha) in the northeastern portion of the Project site (Drawing 4.4). The NS Significant Species and Habitats database classifies the wetland as a bog or fen, whereas the NS Geomatics Centre classifies it as a swamp. This wetland extends further north, beyond the Project site boundary, and appears to be connected to a larger, 17.0 ha wetland. No additional mapped wetlands appear on the Project site (NSDNR 2012a).

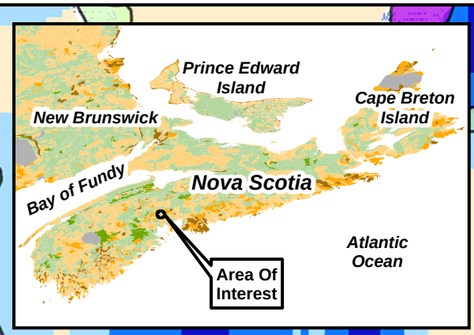
WAM reveals several potential wet areas across the Project site (Drawing 4.4). The eastern extent of the Project site appears to have high potential for wetland habitat to exist, as nearly half of this portion of the Project site has a modelled depth to water table within 2.0 m of the surface. In addition, potential wet areas are located near the western extent of the Project site. The shape and orientation of these wet areas within close proximity to Card Lake appear to resemble streams or watercourses (NSDNR 2011a).

Site visits were conducted in September 2011 and June 2012 to determine the presence of wetlands within 100 m of the turbine location (i.e. the “assessment area”), as shown on Drawing 4.5).

N

Highway 14

Kaizer Meadow Road



Legend:

- Proposed Turbine
- Proposed Road
- Project Site Boundary
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Water Bodies
- Mapped Wet Area

NS DNR Wetland Inventory

Wetland Type

- Bog or Fen
- Fen
- Marsh
- Salt Marsh
- Swamp
- Water

Depth to Water Table

Depth (metres)

- 0 - 0.10 m
- 0.11 - 0.50 m
- 0.51 - 2 m
- 2.01 - 10 m
- > 10 m

0 75 150 300 450 600 Metres

Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre. Wetland Inventory and Wet Areas Mapping By Nova Scotia Department Of Natural Resources (NS DNR).
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Wetland Assessment: Desktop Review

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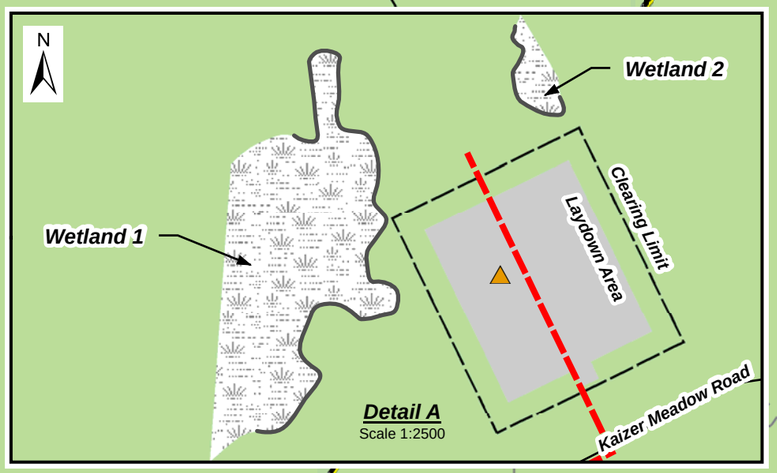
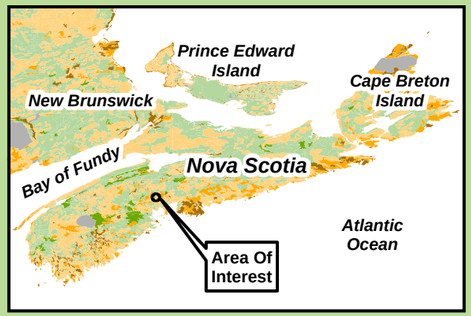
MINAS BASIN

Strum ENVIRONMENTAL

Date: June 2012	***Project #:*** 12-4360
Scale: 1:7500	***Sheet:*** **4.4**
Drawn By: H. Serhan	
Checked By: A. Walter	





See Detail A

Wetland 2

Wetland 1

Highway 14

Kaizer Meadow Road

Card Lake

0 75 150 300 450 600 Metres

Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine
- Proposed Road
- Project Site Boundary
- Wetland Boundary
- Major Roads and Highways
- Water Bodies

Wetland and Plant Assessment: Field Results

MUNICIPALITY OF THE DISTRICT OF CHESTER

MINAS BASIN

Strum ENVIRONMENTAL

Date: June 2012	**Project #:** 12-4360
Scale: 1:7000	**Sheet:** 4.5
Drawn By: H. Serhan	
Checked By: A. Walter	

Wetland boundaries within the assessment area were delineated based on the methodology set out by the US Corps of Engineers Wetland Delineation Manual (1987). Wetland boundaries in close proximity to the proposed Project footprint were walked and flagged using pink flagging tape marked "wetland delineation". The boundaries of wetlands which extend away from the Project footprint were not fully delineated. The boundaries were documented by recording the position of each flag using the track function on a GPS receiver capable of sub-5m accuracy. Detailed data point analysis (two wetland points and one upland point), were completed within the assessment area to confirm wetland boundaries (Table 4.5).

Table 4.5: Wetland Data Point Analysis Results

Data Point	Hydric Soil Indicator	Indicators of Wetland Hydrology	Hydrophytic Vegetation Present / %	Positive Test for Wetland Habitat
Wetland Point 1	S5 – Sandy Redox	High water table (20 cm), saturated at surface	Yes / 100%	Yes
Wetland Point 2	A2 – Histic Epipedon, S5-Sandy Redox	Saturated at surface	Yes / 100%	Yes
Upland Point 2	None	None	Yes / 100%	No

Two areas of treed swamp wetland habitat were observed within the assessment area. Wetland 1 is located to the northwest of the Project footprint and extends to the southwest, down a very gentle gradient. It is likely that this wetland functions as an outflow feature and drains water to a narrow wet area and/or watercourse which the WAM database indicates drains to Card Lake. Wetland boundaries are undefined and water appears to be sourced from run-off and groundwater discharge from surrounding upland habitat north of the Project footprint. Additional characterization details are provided in Table 4.6.

Table 4.6: Wetland 1 - Characterization

Wetland Type		Treed Swamp
Landscape Position		Terrene (inferred)
Landform		Slope
Water Flow		Outflow
Soil Type		Organic over depleted mineral (with redox concentrations)
Surface/Hydrological Conditions		Saturated surfaces, groundwater within 20 cm
Dominant Vegetation	Herbs	cinnamon fern, goldthread, huckleberry, velvet-leaf blueberry
	Shrubs	balsam fir, black spruce, red maple, mountain holly
	Trees	balsam fir, red maple, black spruce, white birch

Wetland 2 is located north of the Project footprint and drains water from south to north, exiting via the north, northeastern wetland boundary as drainage (surface and subsurface).

Wetland habitat was observed to extend to the north, northeast and is likely sourced by surface run-off and groundwater discharge from surrounding upland habitat. Wetland boundaries are typified by a very gentle rise in topography, and ground conditions are saturated, although small pockets of drier surface conditions exist. Although the north, northeastern extent of the wetland has not been defined, site observations indicate that Wetland 2 is likely narrow and exists as an isolated feature. Additional characterization details are provided in Table 4.7.

Table 4.7: Wetland 2 - Characterization

Wetland Type		Treed Swamp
Landscape Position		Isolated Terrene
Landform		Slope
Water Flow		Outflow
Soil Type		Organic over depleted mineral
Surface/Hydrological Conditions		Saturated surfaces, groundwater within 20 cm
Dominant Vegetation	Herbs	cinnamon fern, velvet leaf blueberry, huckleberry
	Shrubs	balsam fir, black spruce, red maple
	Trees	black spruce

4.4.3 Effects and Mitigation

The potential effects on terrestrial habitats are mostly related to the construction phase of the Project, though some effects may also occur during maintenance and decommissioning activities. General habitats are susceptible to sedimentation and erosion and exposure of surface soils. Where the Project footprint has already been cleared and supports an existing road, there will be minimal habitat fragmentation associated with construction activities. Potential for colonization of invasive species exists in areas cleared of native vegetation.

There are no direct impacts to wetland habitat expected within the Project footprint (including the access road). Indirect effects such as the on-going use of machinery and vehicles adjacent to wetland habitat could potentially result in sediment and erosion and/or contamination via accidental spills and leaks during all phases of the Project.

Potential effects to terrestrial habitats, including wetlands, during the different phases of the Project, are identified in Table 4.8.

Table 4.8: Potential Effects on Terrestrial Habitats

Potential Effect	Source of the Effect	Project Phase*		
		C	O/M	D
General Habitats				
Sediment and erosion	Clearing, excavating, grubbing, and machine use.	✔		✔
Introduction of invasive species	Colonization of invasive species in areas of cleared vegetation.	✔	✔	
Habitat fragmentation	Clearing, grubbing, excavation.	✔		
Wetland Habitats				
Contamination	Fuel leaks and accidental spills from vehicles and machinery.	✔	✔	✔
Sediment and erosion	Clearing, excavating, grubbing, and machine use.	✔		✔

**C – Construction Phase O/M – Operations/Maintenance Phase D – Decommissioning Phase*

The following mitigative measures will be implemented to minimize or eliminate impacts to terrestrial habitats:

- Development and implementation of a site specific EPP that will include best practices for erosion and sediment control, protection of vegetation, spill prevention, and site drainage.
- Use of existing road networks.
- Machinery will be cleaned before and after use on-site to prevent the spread of invasive species.
- Site restoration will be implemented for temporary works, following construction.

Mitigation measures described above are considered to be standard best practices, and are expected to address potential impacts. Therefore, terrestrial habitats are not further assessed.

4.5 Terrestrial Vegetation

4.5.1 Desktop Review

Prior to undertaking field assessments in 2012, the ACCDC database was reviewed to compile a list of recorded observations of flora species within 100 km of the Project site. Records indicate that 313 vascular and 5 nonvascular flora species have been identified within 100 km of the Project site. In addition, 27 species of lichen have been recorded within this range. Of the 345 species identified by ACCDC, 193 vascular flora, 4 non-vascular flora, and 23 lichen Species at Risk (SAR) were identified within 100 km of the Project site.

A short list of plant SAR (Appendix A) that may be present at the Project site was then developed and habitat requirements for each species were reviewed. For the purposes of this assessment, SAR included:

- Species listed by COSEWIC (COSEWIC 2012a) or under *SARA* (SARA 2011) as endangered, threatened, or of special concern;
- Species protected under the *Nova Scotia Endangered Species Act* (NSESA 2007); and,
- Species listed in the NSDNR General Status Ranks of Wild Species in Nova Scotia as "Red" or "Yellow".

The results of the desktop review were used by botanists to develop the field assessment strategy in 2012.

4.5.2 Plant Surveys

A plant survey was completed on June 18, 2012 within the assessment area of the Project site by an experienced botanist. The survey encompassed three habitat types: woodland, a wetland, and a cut-over area. A complete list of plant species identified during the survey is provided in Appendix A.

Woodland

The woodland is dominated by red maple, and balsam fir. Also present but in lesser amounts are black spruce, red spruce and white spruce (*Picea glauca*), white pine, white birch, grey birch and northern mountain-ash (*Sorbus decora*). The amount of herbaceous ground cover present varies from sparse to abundant depending on the degree of shade present. The greater the shade the fewer the herbaceous plants present. Common herbaceous species in the woodland habitat include: bunchberry, starflower (*Trientalis borealis*), cinnamon fern, hay-scented fern (*Dennstaedtia punctilobula*), goldthread, wild lily-of-the-valley (*Maianthemum canadense*), wild sarsaparilla (*Aralia nudicaulis*). Common shrubs found in the woodland include: blueberries, sheep laurel, mountain holly (*Nemopanthus mucronata*), and wild raisin (*Viburnum nudum* var. *cassinoides*). Less common plant species present include painted trillium (*Trillium undulatum*), pink lady's-slipper (*Cypripedium acaule*), several clubmosses (*Lycopodium annotinum, L. obscurum*) and Indian cucumber-root (*Medeola virginiana*).

Wetland

The wetland present in the study area is dominated by a mix of tree species (red maple, black spruce, balsam fir, and white birch), both high and low shrubs [wild raisin, huckleberry, mountain holly, and Labrador-tea *(Ledum groenlandicum)*], and several ferns (cinnamon fern and New York fern). The substrate is primarily sphagnum moss (Sphagnum spp.).

Southern twayblade (*Listera australis*), a Red-listed species typically found in red maple swamps and high shrub sphagnous wetlands in Nova Scotia, was not observed in this wetland.

Cut-over Area

The wetland and woodland habitats described above are both peripheral to a central cut-over habitat within the assessment area. Common to abundant species present in this area include red maple, wire birch, sheep laurel, bracken fern, cinnamon fern, a number of sedges

(*Carex* spp.), several bulrushes (*Scirpus* spp.), common blackberry (*Rubus allegheniensis*), blueberries, huckleberry, and wild raisin.

The two non-native species observed during this survey - wild raspberry (*Rubus idaeus* var. *strigosus*) and hawkweed (*Hieracium piloselloides*) both occurred in this disturbed habitat.

4.5.3 Rare Plant Species

No vascular plant species of conservation concern were observed during this survey. This includes federal *SARA*-listed species, species listed under the *Nova Scotia Endangered Species Act,* and Red- and Yellow-listed species under the NSDNR General Status Ranks of Wild Species in Nova Scotia.

There were a small number of species that could not be identified to species level due to immaturity of the plants. It is considered unlikely, however, that any of these are species of conservation concern.

4.5.4 Effects and Mitigation

As the Project site will make use of an existing road and a cut-over area for the turbine location, potential effects of the Project on plant species is minimal. However construction, operations and maintenance, and decommissioning activities, and associated activities, will result in the removal and loss of some plants. Improper disposal and management of fluids can also affect plant health. Potential effects to plants during the different phases of the Project are identified in Table 4.9.

Table 4.9: Potential Effects on Plants

Effect	**Source of Effect**	***Phase applicable to**		
		C	**O/M**	**D**
Loss and physical damage	Clearing, grubbing, infilling, and heavy machinery.	✔		✔
	Vegetation management.		✔	
Introduction of invasive species	Clearing, grubbing, infilling, and heavy machinery.	✔		✔
Contamination	Release of hazardous materials chemicals, fuels, lubricants, or hydraulic fluids.	✔	✔	✔

**C – Construction Phase O/M – Operations/Maintenance Phase D – Decommissioning Phase*

The following mitigation measures will be implemented to minimize or eliminate impacts to plants:

- Development and implementation of an EPP for the Project, which will include provisions for erosion and sediment control, protection of plants, spill prevention, and post-construction monitoring (as necessary). The EPP will be approved by NSE prior to the start of construction.

- Minimization of the footprint of physical disturbance by:
    - locating the turbine within previously disturbed land; and
    - minimization of routine vegetation clearing.

The mitigation measures described above are considered to be standard best practices, and are expected to address potential impacts. Therefore, terrestrial vegetation is not further assessed.

4.6 Terrestrial Fauna

4.6.1 Mammals

The landscape of Nova Scotia features a variety of habitats for mammalian fauna, including forests, fields, mountains, wetlands, and shorelines (Davis and Browne, 1996). These environments provide habitat for 57 species of terrestrial and semi-aquatic species, ranging from small rodents such as the Deer mouse (*Perymyscus maniculatis*) and Red-backed vole (*Clethrionomys gapperi*) to large ungulates such as Moose (*Alces alces*) (Davis and Browne, 1996).

The distribution of mammals in the province is driven by species specific cover and food requirements, and is influenced by other factors such as local climate, introductions and extirpations, and natural barriers to dispersal/migration (Davis and Browne, 1996). Some species, such as the American red squirrel (*Tamiasciursus hudsonicus*), are common and abundant throughout the province, while others, such as the American marten (*Martes americana*), occupy restricted ranges and exist in disjunct populations (Davis and Browne, 1996; MTRI, 2008).

Information regarding the mammalian community in the vicinity of the Project site, including SAR, was obtained through a combination of desktop review and field studies. The desktop component included a review of the Nova Scotia Significant Species and Habitat Database and ACCDC data on species recorded within a 100 km radius of the Project site, and the comparison of habitat mapping data (Section 4.4) to known habitat requirements for species expected to occur within the area and for all SAR.

The Significant Species and Habitats database (NSDNR 2012a) indicates that multiple features related to mammal species are present within a 100 km radius of the Project site. Records for mammals/mammal habitat within a 25 km radius of the Project site are provided in Table 4.10.

Table 4.10: Mammals/Mammal Habitat within 25 km of the Project site

Site #	Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
LU55	American beaver	*Castor canadensis*	Green	Not Listed	Not Listed	Not Listed
LU93	Fisher	*Martes pennanti*	Yellow	Not Listed	Not Listed	Not Listed
HN37/HN32	White-tailed deer	*Odocoileus virginianus*	Green	Not Listed	Not Listed	Not Listed

Source: NSDNR 2012a

The fisher is the only mammalian priority species with records within 25 km, according to the Significant Species and Habitats database. Fisher habitat is present approximately 17.3 km to the southwest of the Project site, and includes part of the Holden Lake Operational Non-designated Park. White-tailed deer wintering grounds are located approximately 5 km to the north of the Project site in a softwood dominated stand in Upper Vaughan, as well as 22 km to the northwest of the Project site. Beaver habitat is present in Harris Lake, approximately 16.75 km to the northwest of the Project site.

ACCDC data indicate that 12 mammal species have been recorded within a 100 km radius of the Project site (Table 4.11).

Table 4.11: Mammal Species Recorded within a 100 km radius of the Project Site

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
American marten	*Martes americana*	Red	Not Listed	Not Listed	Endangered
Canada lynx	*Lynx canadensis*	Red	Not at Risk	Not Listed	Endangered
Eastern cougar	*Puma concolor*	Undetermined	Data Deficient	Not Listed	Not Listed
Fisher	*Martes pennanti*	Yellow	Not Listed	Not Listed	Not Listed
Long-tailed shrew	*Sorex dispar*	Yellow	Not Listed	Not Listed	Not Listed
Maritime shrew	*Sorex maritimensis*	Green	Not Listed	Not Listed	Not Listed
Moose	*Alces americanus*	Red	Not Listed	Not Listed	Endangered
Southern flying squirrel	*Glaucomys volans*	Yellow	Not at Risk	Special Concern	Not Listed

Source: ACCDC 2012

[1] NSDNR 2010; [2] COSEWIC 2012a; [3] SARA 2011; [4] NSESA 2007

Of note is that sightings of many of the most common species are unreported to ACCDC, and are therefore under-represented or absent from the database. Consequently, a review of the ACCDC data reveals predominantly rare or noteworthy species despite the fact that these species represent a small fraction of the existing mammal community in an area.

Field studies of mammalian fauna at the Project site consisted of direct observation of individuals, as well as the indirect identification of species by sound and/or sign (i.e. scat, tracks, scent, dens, lodges, etc.). Mammal surveys were conducted between September 2011 and July 2012. Table 4.12 lists the mammal species observed/identified at or near the Project site during field studies.

Table 4.12: Mammal Species Observed at the Project Site

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
American black bear	*Ursus americanus*	Green	Not at Risk	Not Listed	Not Listed
American red squirrel	*Tamiasciursus hudsonicus*	Green	Not Listed	Not Listed	Not Listed
Coyote	*Canis latrans*	Green	Not Listed	Not Listed	Not Listed
Raccoon	*Procyon lotor*	Green	Not Listed	Not Listed	Not Listed
Red fox	*Vulpes vulpes*	Green	Not Listed	Not Listed	Not Listed
Short Tailed Shrew	*Sorex maritimensis*	Green	Not Listed	Not Listed	Not Listed
American mink	*Mustela erminea*	Green	Not Listed	Not Listed	Not Listed
White-tailed deer	*Odocoileus virginianus*	Green	Not Listed	Not listed	Not Listed

[1] NSDNR 2010; [2] COSEWIC 2012a; [3] SARA 2011; [4] NSESA 2007

Species at Risk Analysis

Mammal species identified during field studies or that have been recorded within a 100 km radius of the Project site were screened against the criteria outlined in the "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE, 2005) to develop a list of priority species. These priority species include:

- American marten – "Red" (NSDNR 2010), "Endangered" (NSESA 2007);
- Canada lynx – "Red" (NSDNR 2010), "Endangered" (NSESA 2007);
- Fisher – "Yellow" (NSDNR 2010);
- Long-tailed shrew – "Yellow" (NSDNR 2010);
- Moose – ""Red" (NSDNR 2010), "Endangered" (NSESA 2007);
- Southern flying squirrel – "Yellow" (NSDNR 2010), "Special Concern" (SARA 2011).

The American marten prefers mature coniferous forests, and has been more recently observed in mixed forests and cutovers (MTRI 2008). Although these types of habitat are prominent at the Project site, the current known distribution of the American marten in Nova

Scotia is limited to Cape Breton and the southwestern part of the province. Therefore, it is unlikely that Project activities will interact with and/or impact American marten populations.

The distribution of Canada lynx is limited to the availability of extensive coniferous forests and snowshoe hare (main prey item), and in Nova Scotia the Lynx is limited to the Cape Breton Highlands (MTRI 2008). Although lynx may travel great distances in times of food scarcity, potentially passing through the Project site, the possibility of this occurring during the construction phase of the Project is highly unlikely. The Project, therefore, will not have any impact on lynx.

This Fisher is listed as "Yellow" by NSDNR (2010), meaning that the species is sensitive to human activities or natural events. Fishers generally require dense mixed wood forests with continuous overhead cover (as cited in Allen 1983). The small Project footprint, combined with the regular disturbance associated with the adjacent waste management facility (heavy truck traffic, presence of facility staff, etc.), likely make the Project site unattractive for fisher. The Project is therefore not expected to have any impact on Fisher populations.

The Long-tailed shrew in Nova Scotia was thought to be found only in the Cobequid Mountains, but recent research has identified an additional population 60 km to the southwest, near Wolfville (Shafer and Stewart 2006). The species appears to favor rocky areas and sites adjacent to cool, mountain streams, and the presence of rocks is considered a principal habitat component (Kirkland 1981). The Project site lacks watercourses and rocky barrens, and falls outside of the known range of this species in Nova Scotia. It is therefore unlikely that Project activities will impact Long-tailed shrew populations.

Concentrations of Moose in mainland Nova Scotia occur in the Tobeatic Wilderness and the Cobequid Mountains areas, although the current range of the species extends across much of the province (MTRI 2008). Although a small area of wetland habitat (treed swamp) exists on the Project site, it fails to provide aquatic and emergent plant species, and the hydrological conditions suitable for moose cows and calves to utilize in the summer months (Parker 2003). In addition, although a small area of cutover at the proposed turbine location exists, large areas of successional growth which offer quality foraging habitat for moose are absent at the Project site. According to the ACCDC database, the closest recorded sighting of moose is 22±10 km from the Project site. Although no indication of Moose was observed during field studies, and there is no evidence to suggest that a viable population exists in the area, Project activities will incorporate the potential for Moose to occur at the Project site.

The Project site occurs within the known range of Southern flying squirrel in Nova Scotia, which includes the New Ross area in northeast Lunenburg County (COSEWIC 2006). The species requires mast bearing trees for forage and tree cavities for nesting and in the Atlantic Region, southern flying squirrels select older forest stands (COSEWIC 2006). Small areas of the Project site feature large hardwood trees, particularly red maples and intolerant hardwoods, which may provide habitat for this species. It is therefore possible that Southern flying squirrels occur at or near the Project site, however Project activities have been planned to minimize disturbance to existing forest habitat by locating all Project related

activities within an area of previously cutover forest. It is therefore unlikely that that Southern flying squirrel habitat will be impacted as a result of the Project.

4.6.2 Herpetofauna

Nova Scotia's reptile and amphibian community consists of 25 species, a relatively low level of diversity when compared to mainland areas of the continent (Davis and Browne 1996). However, the same factors that have limited post-glacial species colonization in the province, namely climatic changes, have caused amphibian and reptile populations to become isolated, leading to a higher degree of morphologic variation than seen in continental populations (Davis and Browne 1996).

Information regarding the herpetofaunal community in the vicinity of the Project site, including any SAR, was obtained through a combination of desktop review and field studies. The desktop component included a review of the Nova Scotia Significant Species and Habitat Database and ACCDC data on species recorded within a 100 km radius of the Project site, and the comparison of habitat mapping data (Section 4.4) to known habitat requirements for species expected to occur within the area and for all SAR.

The Significant Species and Habitats database (NSDNR 2012a) indicates that multiple features related to herpetofaunal species are present within a 100 km radius of the Project site. However, there are no habitat or species records for herpetofauna within a 25 km radius of the Project site.
Table 4.13 lists the reptile and amphibian species recorded by ACCDC within a 100 km radius of the Project site.

Table 4.13: Reptile and Amphibian Species Recorded within a 100 km radius of the Project Site

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Snapping turtle	*Chelydra serpentina*	Green	Special Concern	Special Concern	Not Listed
Wood turtle	*Glyptemys insculpta*	Yellow	Threatened	Threatened	Vulnerable
Blanding's turtle	*Emydoidea blandingii*	Red	Endangered	Endangered	Endangered
Eastern ribbonsnake	*Thamnophis sauritus*	Red	Threatened	Threatened	Threatened

Source: ACCDC 2012

[1] NSDNR 2010; [2] COSEWIC 2012a; [3] SARA 2011; [4] NSESA 2007

The same data limitations and interpretations noted for the mammalian fauna (Section 4.6.1) are also applicable to the reptile and amphibian data.

Field studies of amphibian and reptile species were conducted in conjunction with other field surveys completed between September 2011 and July 2012. Species were either identified directly through visual observation, or indirectly using other evidence (i.e. calls, egg masses, tadpoles, etc.). Table 4.14 lists the amphibian and reptile species identified at or near the Project site during field studies.