# BARRACHOIS WIND FARM

## ENVIRONMENTAL ASSESSMENT – MAY 2014

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# Executive Summary

This Environmental Assessment has been prepared for the proposed Barrachois Wind Farm by Natural Forces Wind Inc. in accordance with the Nova Scotia Department of Environment guidelines entitled *A Proponents Guide to Environmental Assessment* (NSE, 2009) and the Nova Scotia Department of Environment guidelines entitled *Proponents Guide to Wind Power Projects: Guide for preparing an Environmental Assessment Registration Document* (NSE, 2012)

Work completed as part of this Environmental Assessment includes desktop and field studies to gather background information and to identify biophysical, physical and socio-economic valued environmental components; consultation with federal, provincial, municipal, local stakeholders and Mi'kmaq right–holders also took place as part of the assessment. The significance of residual effect due to project activities was studied for the Valued Environmental Components identified in the background studies based on potential impacts after employing the proposed mitigative measures. Finally, appropriate follow up measures were proposed based on the Valued Environmental Component analysis.

It has been determined from this Environmental Assessment that there are no significant residual environmental effects expected for the proposed Barrachois Wind Farm on the Valued Environmental Components. This project promotes responsible renewable energy development in Nova Scotia and will help Nova Scotia meet the provincial requirement of 25% renewable energy by 2015 and the further target of 40% renewable energy by 2020 set by the Department of Energy.

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*Please note that within the appendices Natural Forces Wind Inc. may be referred to as Wind Prospect Inc. or Natural Forces Technologies.

# List of Acronyms

| | |
|---|---|
| **ACCDC** | Atlantic Canada Conservation Data Center |
| **AMEC** | AMEC Environmental & Infrastructure |
| **BWF** | Barrachois Wind Farm |
| **CBRM** | Cape Breton Regional Municipality |
| **CBC** | Christmas Bird Count |
| **CEDC** | Community Economic Development Corporation |
| **CEDIF** | Community Economic Development Investment Fund |
| **CLC** | Community Liaison Committee |
| **COMFIT** | Community Feed In Tariff |
| **COSEWIC** | Committee of the Status of Endangered Wildlife in Canada |
| **CWS** | Canadian Wildlife Study |
| **dB(A)** | Decibel A-weighting |
| **DFO** | Fisheries and Oceans Canada |
| **EA** | Environmental Assessment |
| **EMP** | Environmental Management Plan |
| **IBA** | Important Bird Area |
| **km** | Kilometer |
| **MEKS** | Mi'kmaq Ecological Knowledge Study |
| **MBBA** | Maritime Breeding Bird Atlas |
| **MW** | Megawatt |
| **NSDNR** | Nova Scotia's Department of Natural Resources |
| **NSESA** | Nova Scotia Endangered Species Act |
| **NSPI** | Nova Scotia Power Inc. |
| **PPA** | Power Purchase Agreement |
| **Project** | Barrachois Wind Farm |
| **Proponent** | Natural Forces Wind Inc. |
| **SARA** | Species at Risk Act |
| **SCADA** | Supervisory Control and Data Acquisition |
| **SOCI** | Species of Conservation Concern |
| **SODAR** | Sonic Detection and Ranging |
| **Strum** | Strum Environmental |
| **SPL** | Sound Pressure Level |
| **VEC** | Valued Environmental Component |
| **W4All** | Wind4All Communities Inc. |
| **WAM** | Wet Area Mapping |
| **WTG** | Wind Turbine Generator |

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# 1.0 Introduction

## 1.1 Overview

The Barrachois Wind Farm (Project or BWF) as proposed is a 4.0 megawatt (MW) two wind turbine generator (WTG) project. The Project is located in the Cape Breton Regional Municipality (CBRM), near the community of Barrachois adjacent to Bras d'Or Lake.

Natural Forces Wind Inc. (Proponent) is proposing to develop the Project near the community of Barrachois under the Nova Scotia Department of Energy Community Feed in Tariff (COMFIT) program. The proposed WTG location is situated on existing privately owned land located approximately 17 km west of Sydney and 13 km south west of North Sydney. Currently, construction activities are expected to begin in the Fall of 2014, and Project completion is expected in Spring 2015. The Project will have an operational phase of 20 years.

The CBRM has been a leader in embracing the green energy revolution, and has lead the province in welcoming wind farm development throughout the municipality. The recently published CBRM mayoral proposition paper, titled *Shaping Our Future in the Cape Breton Regional Municipality – A Reorganization Plan for Positive Change*, not only supports green energy development, but strongly advocates for community economic development initiatives (Clark, 2012). Many other local agencies throughout the CBRM have been known to support responsibly developed green energy projects, including the Cape Breton County Economic Development Authority, the Cape Breton Partnership, the Atlantic Coastal Action Program and Cape Breton University.

The Nova Scotia *Renewable Electricity Plan* sets out clear legal requirements in regards to the source of electricity supplied; that is, 25 percent must be from renewable sources by 2015 and a further target of 40 percent renewable by 2020. The Project will help meet the provincially mandated targets outlined in the Renewable Electricity Plan, while at the same time enabling local ownership and community economic development; both of the initiatives are supported by the Province of Nova Scotia.

The COMFIT program is part of the Nova Scotia 2010 *Renewable Electricity* Plan and is designed to introduce locally-based renewable electricity projects that are majority owned by residents from communities throughout the province. The Proponent will use a Community Economic Development Investment Fund (CEDIF) to enable local investment and ownership in the Project.

The COMFIT program is integral to Nova Scotia's 2010 *Renewable Electricity Plan* and is designed to promote locally-based renewable electricity projects that are majority owned by one of six qualifying eligible entities. The following entities are eligible to participate in the COMFIT program:

- Community Economic Development Investment Funds;
- Co-operatives;
- Mi'kmaq band councils;

- Municipalities or their wholly-owned subsidiaries;
- Not-for-Profit Organizations; and
- Universities.

COMFIT approval for the proposed BWF was awarded to the Community Economic Development Corporation Wind4All Communities Inc. (W4All) in the spring of 2012. W4All was created and sponsored by the Proponent. The Proponent will not be using any source of public funding for the purpose of this project.

It typically takes approximately three years to develop and construct a wind farm. Although, the proposed BWF is still in the development phase, public consultation began in late 2011 with a public open house and meetings with community members, the municipalities and stakeholders.

## 1.2 Proponent

Natural Forces Wind Inc. is a company that was established in 2001 based in Halifax, Nova Scotia and entirely Maritime owned. Composed of a small team, the Proponent has over 30 years of international (Canada, USA, Europe and Australia) experience in the wind industry. The Proponent is a wind farm developer, constructor, operator and asset owner.

The Proponent has two operational wind farms in the Maritime Provinces; Kent Hills Wind Farm and Fairmont Wind Farm. Kent Hills Wind Farm is a 150 MW wind farm in New Brunswick constructed in 2008. The Fairmont Wind Farm is a 4.6 MW wind farm near Antigonish, Nova Scotia, which became energized at the end of 2012.

The Proponent is currently working on developing projects in Nova Scotia and British Columbia.

In the next few years, the Proponent aims to develop five projects in Nova Scotia with a total approximate capacity of 21 MW. The five proposed wind projects are detailed in Table 1-1.

**Table 1-1: Proposed wind energy projects.**

| Project Name | Number of WTGs | Rated Capacity |
|---|---|---|
| Hillside Boularderie Wind Farm | 2 | 4 MW |
| Gaetz Brook Wind Farm | 1 | 2.3 MW |
| **Barrachois Wind Farm** | **2** | **4 MW** |
| Aulds Mountain Wind Farm | 2 | 4.6 MW |
| Amherst Wind Farm | 3 | 6 MW |

## 1.3 Regulatory Framework

### 1.3.1 Federal

Federal environmental approvals are not required for the proposed project. The Project is not expected to require permitting through harmful alteration, disruption or destruction of fish habitat or have an impact to navigable waters.

Consultation with Federal authorities has been ongoing with Navigation Canada, Transport Canada, the Department of National Defence, and the Canadian Wildlife Service (CWS).

### 1.3.2 Provincial

The Environmental Assessment process, as required under the provincial *Environmental Assessment Act* is a Proponent-driven, self-assessment process. The Proponent is responsible for determining if the Environmental Assessment (EA) process applies to the Project, what category the Project belongs to and when the EA process should be initiated.

Under Section 49 of *the Environmental Assessment Act*, new electricity Projects or 'Undertakings' can be classified under one of two categories, Class 1 undertakings or Class 2 undertakings (EAR, 1995). Wind farms with a rated capacity of 2 MW or greater are considered Class 1 undertakings. It is anticipated that the rated capacity for the BWF is 4.0 MW and therefore is a Class 1 undertaking.

Three guidance documents were used in the preparation of this EA for the BWF Project, they are:

1. *A Proponent's Guide to Environmental Assessment*, published by the Environment Assessment Branch of the Nova Scotia Department of Environment (NSE, 2009);
2. *Proponent's Guide to Wind Power Projects: Guide for preparing an Environmental Assessment Registration Document*, also published by the Environment Assessment Branch of the Nova Scotia Department of Environment (NSE, 2012); and
3. *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document,* published by the Environment Assessment Branch of the Nova Scotia Department of Environment (NSE, 2005).

### 1.3.3 Permitting

At the provincial level, a number of permits are required to progress the various stages of development and construction of a wind farm. A list of the required provincial permits is shown in Table 1-2, although additional permits may be required following continued stakeholder consultation.

**Table 1-2: Federal and Provincial permitting requirements.**

| Permit Required | Permitting Authority | Status |
|---|---|---|
| Heritage Research Permit | NS Department of Tourism, Culture and Heritage | Issued |

| Permit Required | Permitting Authority | Status |
|---|---|---|
| Special Move Permit | NS Transportation and Infrastructure Renewal | Not issued |
| Transportation Plan | NS Transportation and Infrastructure Renewal | Not issued |
| Environmental Assessment Approval | NS Environmental Assessment Branch | Under review |
| Work Within Highway Right-of-Way Permit | NS Transportation and Infrastructure Renewal | Issued |

Additional municipal permits and authorizations are required. Table 1-3 lists the municipal permits and authorizations required. Again, additional permits may be required following further consultation with municipal stakeholders.

**Table 1-3: Municipal permitting requirements.**

| Permit Required | Permitting Authority | Status |
|---|---|---|
| Development Permit | Cape Breton Regional Municipality | Issued |

## 1.4 Development and Structure of Document

This EA was prepared by Natural Forces Wind Inc. based on high level advice from Verterra Group Environmental Strategies Ltd. as our consultant. Verterra Group's knowledge of scoping and EA structure development supported the expertise of BWF's Project Manager and Vice President of Developments – Andy MacCallum, and Development Officer – Chris Veinot, who compiled primary and secondary data sources to draft this EA document. The EA document will follow the structure as represented in Figure 1-1.

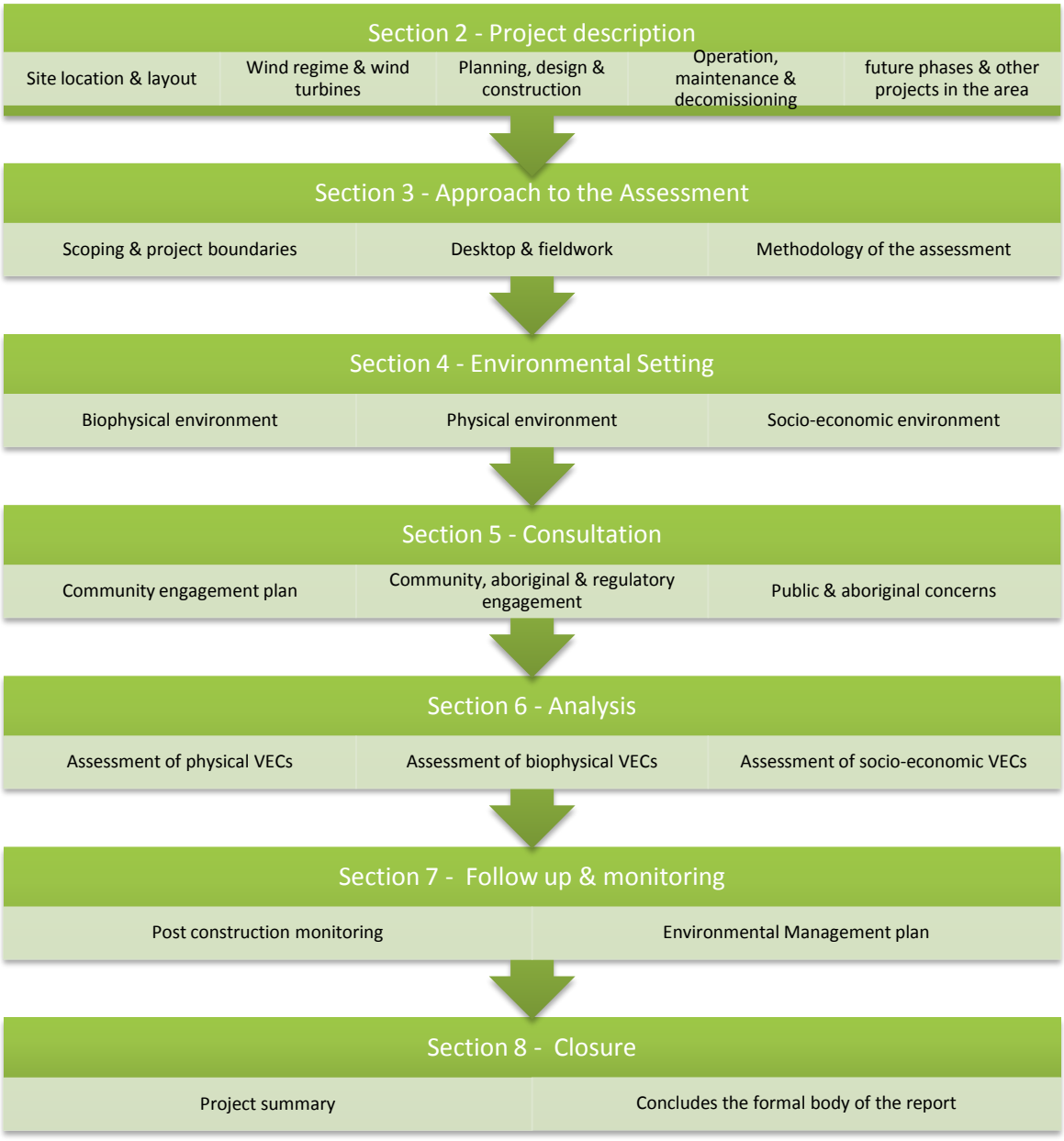


**Figure 1-1: Structure of document.**

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# 2.0 Project Description

## 2.1 Site Location and Layout

The BWF is located on privately owned land in the Cape Breton Regional Municipality near the community of Barrachois, located approximately 15 km west of Sydney. The Proponent plans to construct and operate a 2 WTG, 4.0 MW wind farm; the proposed locations for the WTG 1 and 2 can be seen in Figure 2-1 and Figure 2-2 respectively. Figure 2-3 shows a general overview of the project location. The WTG coordinates are shown below in Table 2-1.

**Table 2-1: Turbine coordinates in UTM Zone 20.**

| | Easting | Northing |
|---|---|---|
| **Wind Turbine 1** | 700,489 m | 5,114,871 m |
| **Wind Turbine 2** | 700,565 m | 5,114,388 m |

**Figure 2-1: Proposed location for WTG 1 (Photo courtesy Davis MacIntyre & Associates Ltd.).**

**Figure 2-2: Proposed location for WTG 2 (Photo courtesy Davis MacIntyre & Associates Ltd.).**

Setback distances from residential dwellings to the WTGs are approximately 1000 m.

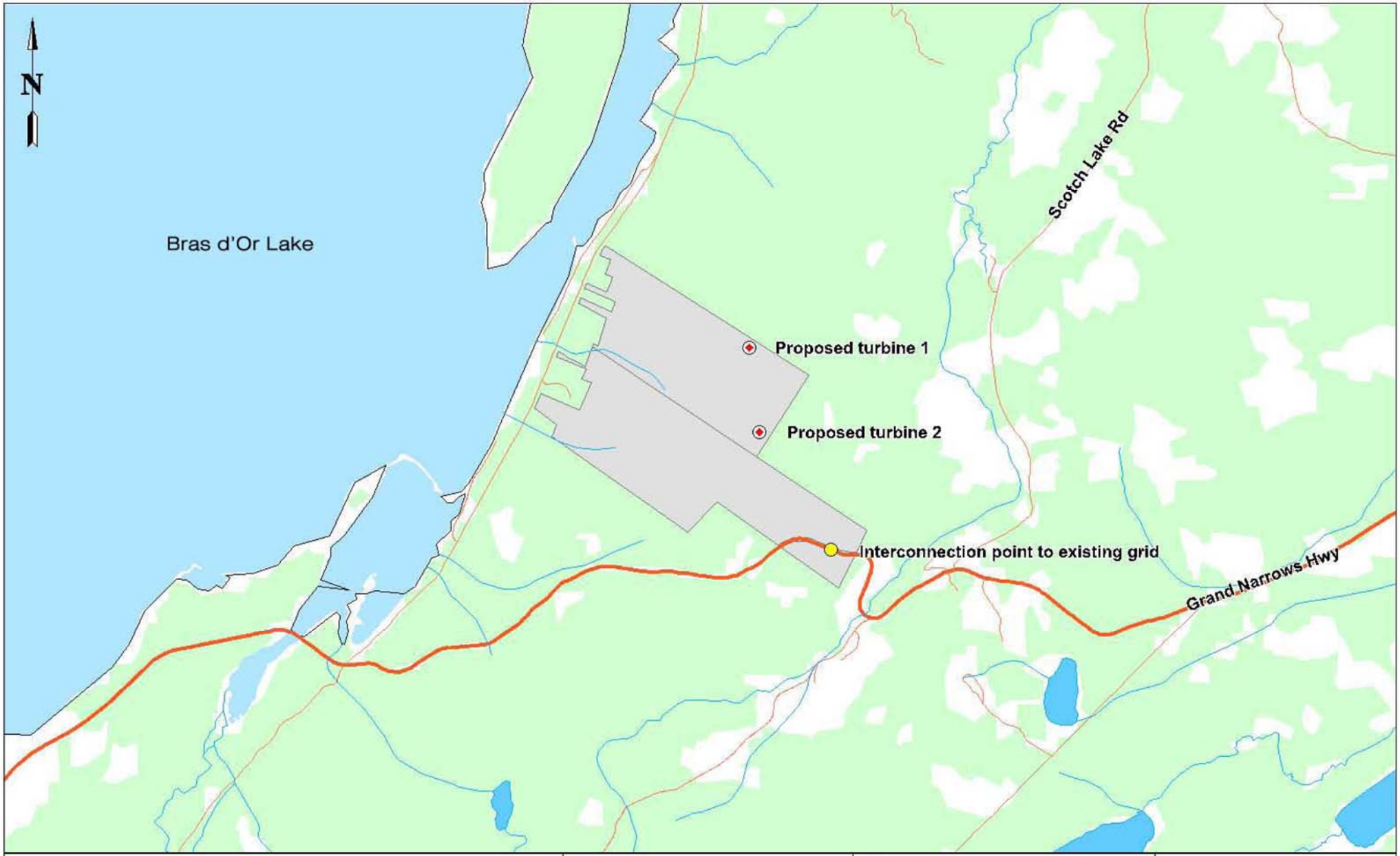
The BWF will connect to the Nova Scotia Power Inc's (NSPI) distribution grid via 3-phase distribution line located on the Grand Narrows Highway which originates from the Keltic Drive substation (11S) located approximately 15 km east of the Project site.

The lands under option consist of two privately owned land parcels, covering a total of 370 acres; both WTGs will be located on the northern most land parcel with site access utilizing the southern parcel. The overall project footprint will be approximately 2.3 hectares but will only require 1.8 hectares of clearing by making use of an existing road on the Project site.

The Project land is located in Rural CBRM Zone in which the CBRM permits the development of utility scale wind turbines when compliant with the municipal setback by-laws (CBRM, 2004).

The access road will be constructed by entering the Project site from Grand Narrows Highway. The proposed access road will make use of an existing road that will be upgraded to accommodate the wind farm equipment; by using existing roads, the Proponent aims to minimize the overall environmental impact of the project.

The Proponent has extensive knowledge in site finding and development of community based wind farms. There are three main factors to consider during the site finding phase of the development of a wind farm. These factors include wind regime, local power grid infrastructure and environmental/ socio-economic concerns. Detailed assessment of these three factors have led the Proponent to determine that the location of the BWF presents the best opportunity to capture the wind regime in an effort provide efficient wind energy to the local community given the environmental, socio-economic, regulatory and technical factors.




**LEGEND**

- Project land
- Proposed turbines
- Proposed interconnection point to existing NSPI grid
- Highway
- Arterial & minor road
- Watercourse

Source: Nova Scotia Department of Natural Resources



**SCALE**

0 0.5 1
kilometres

1:30,000

**KEY MAP**


**PROJECT** Barrachois Wind Farm

**TITLE** General Project Overview

**FIGURE** Figure 2.3

**DATE** May 16, 2014

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## 2.2 Wind Turbine Generator

Two Enercon E92 WTGs will be used on site for the duration of the Project. The Enercon E92 has a total rated capacity of 2.0 MW, a turbine tower height range of 78 – 98 m and rotor blade diameter of approximately 92 m. From base to blade tip the WTG will have a maximum height of 144 m.

All Enercon WTGs are designed and certified according to the latest international standards. Currently the basis for design is the International Electrotechnical Commission (IEC) standards of the IEC-61400 series.

This IEC standard utilizes assumptions and conditions that are used to define the load cases that the WTGs have to endure. The safety system of the Enercon WTG features various control sensors that protect the turbine and its components from damage. This includes, among other things, high and low temperatures, vibrations, oscillations and strain. In the case that one or more of these sensors detect conditions outside the design limits, the main control of the WTGs will take the appropriate measures, which range from small power limitations to complete stop of the turbine (Enercon, 2012).

Ice may form on the rotor blades of the WTGs in specific weather conditions. The ice build-up poses the risk of ice fragments detaching, creating safety hazards to the surrounding area. The Enercon WTGs will be equipped with a reliable ice detection system. Once ice has been detected, the Enercon blade de-icing system will activate and effectively melt the ice on the WTG blade to reduce the risk of ice throw.

Additional WTG specifications are presented in Table 2-2 as well as in Appendix A.

**Table 2-2: Enercon E92 specifications (Enercon, 2012).**

| Characteristic | Value |
|---|---|
| Rotor diameter | 92 m |
| Swept area | 6648 $m^2$ |
| Rotations per minute | 5 – 16 $min^{-1}$ |
| Cut out wind speed | 28 – 49 m/s (Enercon storm control) |
| Hub height | 85 – 138 m |
| Max sound pressure level | 105 dB(A) |

## 2.3 Wind Regime

The Nova Scotia wind atlas was used in preliminary site finding and indicates an approximate wind speed of 7.5 – 8.5 m/s at 80 m (NS Wind Atlas, 2013).

A detailed wind resource assessment at the BWF site was initiated in January 2012 with the installation of a 60 m meteorological mast (met mast) containing anemometers at 40 m, 50 m and 60 m above ground level. The wind resource assessment studies wind direction, wind speed, temperature, relative humidity and atmospheric pressure. A collective assessment of these parameters will be used to determine the feasibility of harnessing the wind regime; and to determine optimized WTG micro-siting.

A long-term wind resource assessment is currently being conducted with the data collected from the meteorological mast and Triton.

Based on Natural Forces' independent Wind Resource Assessment a wind rose found in Figure 4-1 indicates the prevailing wind at the Project site location. The Nova Scotia Wind Atlas indicates an average wind speed of 7.5 – 8.0 meters per second at a height of 80 m.

## 2.4 Planning and Design

The planning and design phases are crucial steps of the Project that can set the stage for following project activities and help avoid issues that may be encountered in future project phases. Specifically, the BWF site is an attractive site due to the wind resource, distance from dwellings, capacity of the distribution grid and minimal ecological concerns.

A variety of criteria has been considered in the site selection of the BWF. The criteria include technical, environmental and land use consideration. The following is a list of the criteria considered:

- Technical Considerations;
    - Sufficient wind resource;
    - Proximity to electrical distribution network; and
    - Capacity of the local electrical distribution network.
- Environmental Considerations;
    - Proximity to known wetlands;
    - Sufficient setback distance from known bat hibernacula
    - Sensitivity of flora & fauna; and
    - Proximity to provincial or national parks and nature reserves.
- Land use considerations;
    - Available access to the land and suitable ground conditions; and
    - Proximity to residential properties, communities and towns.
- Planning Considerations.
    - County or Municipal zoning by-law regulations.

**Technical Considerations**

The BWF is located adjacent to the Bras d'Or Lake, which is a significant body of water. During the summer, a sea-breeze is observed from the Bras d'Or Lakes where the land heats up quicker than the water and provides a prevailing northwest wind. The Project site is approximately 160 m above sea level on top of a gradual hill. Typically at exposed elevations, similar to the Project site, uninterrupted laminar wind flow can provide an optimal wind resource.

A Distribution System Impact Study conducted by Nova Scotia Power Inc. (NSPI) on behalf of the proponent indicates the Project can be connected to the nearby local electrical distribution system. Through an agreement with NSPI, the Project will be connected to the 11S-301 circuit of the Keltic Dirve

substation, which provides electricity to Barrachois, Sydney and surrounding communities. The proximity of the BWF to a high electrical load center such as Sydney is a key determinate in securing a feasible grid connection to the existing NSPI distribution system. Projects located further from load centers and substations tend to be less feasible in terms of securing a successful grid connection.

There are two existing communication towers located directly west of the Project site, approximately 650 m from WTG 1 and 1,100 m from WTG 2.

**Environmental Considerations**

The landscape of the BWF site lies on a mixture of upland forest and regenerating forest, which have been clear cut in the past.

The Project site is located adjacent to Bras d'Or Lake with an elevation range of 30 – 180 m above sea level. The proposed turbine locations are approximately 155 m and 175 m above sea level.

**Land Use Considerations**

The closest local communities are Ironville, Leitches Creek, Scotch Lake, and Barrachois in which the Project is located. These communities consist of sparsely spaced rural dwellings. The proposed turbine location has a minimum setback of approximately 1000 m from the closest dwelling. The Project site is bound by Grand Narrows Highway to the south, Harbour Cove Road to the northwest and various privately owned land parcels to the north and east.

The landowner has made the land available for the installation a two WTGs and ancillary infrastructure on their land. An existing access road will be upgraded and extended to gain access to the proposed WTG location.

## 2.5 Construction

Construction of the BWF is proposed to take approximately six months and will include the following main construction activities:

- Clearing and grubbing of Project area;
- Construction of access road, lay down area and crane pads;
- Construction of turbine foundation;
- Construction of power pole, power lines and underground electrical;
- Turbine installation;
- Commissioning of the WTG; and
- Removal of all temporary works and restoration of the site.

The proposed schedule for these construction activities is presented in Table 2-3.

**Table 2-3: Schedule of construction activities.**

| Construction Activity | Typical Distribution (months) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Surveying and siting activities | ■ | | | | | |
| Construction of access road and crane pad | | ■ | ■ | | | |
| Construction of crane pad & turbine foundation | | | ■ | ■ | | |
| Construction of electrical works | | | | ■ | ■ | |
| Wind turbine assembly and installation | | | | ■ | ■ | |
| Removal of temporary works and site restoration | | | | | | ■ |

### 2.5.1 Surveying, Siting and Logistic Activities

Prior to the commencement of access road, foundation construction and turbine installation, a number of enabling works need to be undertaken. These will include:

- Engineering site visits to evaluate the Project land and soils conditions;
- Boring of holes and/or excavation pits for geotechnical investigations;
- Improvement of land drainage as required to facilitate construction; and
- Widening and improvement of the site entrance for safe vehicle access.

The Proponent and the turbine manufacturer will coordinate transportation of the turbine components that will require overweight special move permits. Service Nova Scotia and Municipal Relations officers will be consulted to ensure any other potential permits (ie. over-dimensional and overweight vehicle permits) are obtained and transportation regulations are followed. Although the WTG transportation route has yet to be planned, the Proponent is aware of certain road weight restrictions. Roads used for the construction phase of the Project will comply with intermediate and maximum weight road restriction lists (Road designation, 2012).

### 2.5.2 Access Road

Access roads required for the development are typically 5 – 6 m wide with a maximum width of 12 m in certain areas to facilitate moving a fully assembled crane. The access road will be used to move workers and equipment about the site during construction, operation and decommissioning phases.

The upgrade and extension of the access road will involve the removal of soil to a depth of between 0.25 – 1.0 m (depending on the ground conditions encountered during the geotechnical investigations) and placing layers of crushed stone. The stone would be compacted, with a finished construction depth between 0.25 – 0.5 m, again dependent on the strength of the underlying road formation. The internal site road would be maintained in good condition during construction and throughout the lifetime of the Project.

The removed topsoil would be stored in accordance with best practice guidance, and later used for site restoration. Soils needed for backfill would be stored temporarily in bunds adjacent to the excavations until needed. Any remaining excavated material would be shaped into fill slopes in the road bed, or removed from site to an approved landfill. The proposed access road designs can be seen in Figure 2-4. This figure demonstrates where existing road will be used to help reduce the footprint of the project that will require clearing. The road shown in black is the existing road and therefore should not require further clearing. The road that is indicated by blue has not been cleared or constructed. By making use of the existing road the total footprint of the project requiring clearing is reduced from 2.3 hectares to 1.8 hectares.

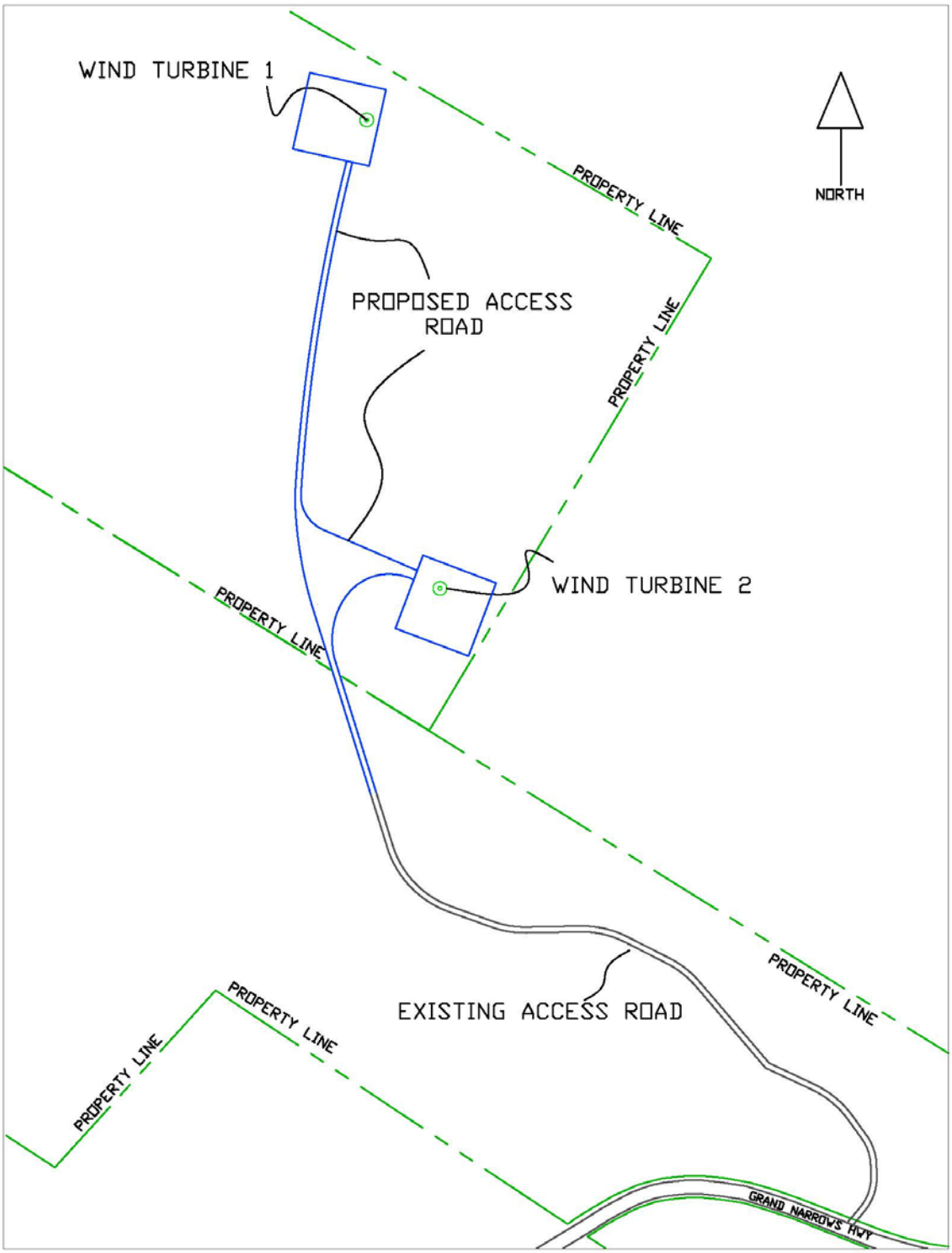


**Figure 2-4: Proposed Access Road Design.**

### 2.5.3 Crane Pad & Turbine Foundation

**Crane Pad**

The installation of the Enercon E92s will both require a crane pad that will be approximately 50 m by 25 m. Its purpose is to safely accommodate the weight of the large crane necessary for turbine installation and maintenance. The exact arrangement of the crane pads would be designed to suit the specific requirement of the turbines and the surrounding topography of the Project site.

Construction of the main crane pads would involve the removal of soil to a depth of between 0.25 – 0.5 m, depending on the ground condition encountered during the geotechnical investigation. The subsoil would be covered by layers of graded crushed stone. Total construction depth is between 0.25 – 0.5 m, again dependent on the characteristics of the underlying soil formations.

The crane pads may be retained throughout the operation life of the wind farm to allow for periodic WTG maintenance, and to accommodate any crane necessary for the replacement of large components should they require replacement during the operation phase of the Project.

**Turbine Foundations**

A concrete foundation approximately 20 m in diameter will be required for the WTGs. A detailed geotechnical investigation will be undertaken to establish the nature of the soil at each identified WTG location. A registered Civil Engineer will design the foundations to match the soil conditions. Foundations will most likely be a gravity (inverted “T”) design, designed by Enercon.

The construction of the reinforced concrete foundation will include excavation to a depth of several meters, the placement of concrete forms and steel reinforcement, and the pouring of concrete within the forms. The upper surface of the base will lie approximately 1 m below ground level. Rock chipping may be required to facilitate excavation. The central support pedestal would extend 0.20 m above existing ground level to receive the bolted bottom tower section. Suitable excavated material would be compacted in layers on top of the concrete foundation to terminate in line with the existing ground level, leaving room to allow sufficient topsoil reinstatement for vegetation growth.

The soils removed would be stored in accordance with provincial regulations and best practice guidelines, and replaced during the restoration phase in consultation with the landowner. Soil material needed for backfill would be stored temporarily in a designated area adjacent to the excavations until needed. Any remaining excavated material will be recycled to another site needing clean fill material or removed from site and sent to an approved landfill.

### 2.5.4 Civil and Electrical Works

The electricity produced from the WTGs will be transformed to 12.5 kV by a transformer located in the base of each of the WTGs. The electricity will then be conducted via insulated electrical cables through cable ducts cast into the WTG foundation routed out to new power poles on site, and then to the new point of connection to the existing NSPI distribution system.

A bare copper earthing (grounding) cable will be laid alongside the WTG foundation for lightning protection of the WTG; grounding will also be installed at other areas as determined by the electrical design.

The electrical, communications and grounding cable will leave the WTG foundations below grade via cable ducts cast into the WTG foundations. Where the cables are to cross the site roads and crane base, they may be located in cable ducts surrounded by 0.15 m of concrete to ensure the integrity of the cable is maintained independent of the vehicle site crossings above. The overhead cabling configuration will be similar to the standard 12 m wooden utility poles found throughout the surrounding area. Any buried electrical cable will likely be marked with permanent safety signs to warn of potential hazards from excavation. The size, type and location of the marker signs will be determined in consultation with the landowner and be in accordance with applicable safety standards.

### 2.5.5 Interconnection to Grid

The connection point to the NSPI electrical distribution system will be located on the Project site. The BWF will connect to the NSPI's distribution grid via 3-phase distribution line originating from the Keltic Drive substation (11S) located approximately 15 km east of the Project site. This connection will connect to an existing 3-phase distribution, which is part of circuit 11S-301. Figure 2-3 presents the proposed location of the interconnection to the NSPI grid.

### 2.5.6 WTG assembly and installation

The main WTG components include the tower sections, nacelle, hub and blades. Towers are normally delivered in four sections. The overall erection process for the WTG will take approximately one to four days, depending on the wind conditions, and would not start until suitable wind conditions prevail.

Once delivered, the tower sections will be erected in sequence on the WTG foundations using a 150 tonne tailing crane and a large 800 – 1000 tonne main lift crane. The smaller crane will erect the base and lower-midsection of the towers and then assist the main crane with the erection of the upper-midsection, the tower top section, the nacelle and the rotor. The main erection crane also lifts heavy internal components such as the generators.

For the nacelle and blades, the assembly will involve the use of a small 135 tonne rough-terrain crane for vehicle off-loading, a 150 tonne tailing crane for preliminary assembly, and a main erection crane of approximately 800-1000 tonnes for the main lift.

The blades are attached to the hub on the ground. The hub and blades are then lifted as one unit, called the rotor. The tailing crane helps to control the orientation of the rotor during this lift, while the main crane lifts the weight.

### 2.5.7 Site Restoration

After construction, erection and commissioning are completed and the Project is in the operation phase, all temporary works will be removed and the land re-graded. The stored topsoil will be replaced and fine graded, and the site will be dressed to restore maximum tillable area and a pleasing appearance.

### 2.5.8 Other

Entry to the Project site will be adjacent to the Grand Narrows Highway. This will be the entry point for all workers, construction equipment and WTG components for the duration of the construction phase. Minor, temporary road widening may be required along specific portions of the road.

During construction of the access road and the WTG foundations, there will be an increase in truck traffic on the roads leading to and from the Project site. Increased dust is possible, although water trucks will dampen the roads and excavation area when necessary to control fugitive dust.

During delivery of the WTG components, delivery of oversized loads may slow traffic flow. Every effort will be made to ensure that oversized loads are delivered during times of lowest area traffic. Pilot vehicles and licensed flaggers will be provided to coordinate traffic flow and ensure public safety.

Delivery of materials and equipment will be phased throughout the construction period depending upon the specific construction activity. The vehicles likely to be involved include:

- Large trucks with trailers for delivery of materials, earth-moving equipment and cargo containers for storage of tools and parts;
- Dump trucks to deliver and/or move stone for constructing internal site roads;
- Concrete trucks for constructing WTG foundation;
- One 800-1000 tonne main lift crane;
- One 150 tonne tailing crane;
- One 135 tonne rough-terrain crane for assembling WTG;
- WTG component delivery vehicles; and
- Miscellaneous light vehicles including cars and pickup trucks.

Of these predicted vehicle movements, approximately 25 will be oversized loads associated with the delivery of WTGs component parts (towers, blades, and nacelles) and the cranes required for erection. These deliveries are anticipated within months 4 through 6 and subject to movement orders as agreed upon with governing authorities.

## 2.6 Operation and Maintenance

### 2.6.1 Site Access and Traffic

Once the wind farm is operational, minimal vehicle activity will be required. The internal site roads will be used for periodic maintenance and safety checks. A comprehensive Supervisory Control and Data Acquisition (SCADA) system will be installed within the turbine for remote monitoring and control of the

wind turbine, which will minimize the need for on-site personnel. The SCADA system ensures safe efficient operation of the turbine and of the overall Project site.

### 2.6.2 Project Safety Signs

A Project sign will be located at the entrance to the site. This sign will provide essential safety information such as emergency contacts and telephone numbers. As well, the sign will provide information about the wind farm and the companies involved in the Project. Safety signs and information will also be installed throughout the Project Site. These signs will be maintained throughout the operational life of the wind farm.

### 2.6.3 Maintenance Plans

Scheduled maintenance work will be carried out several times each year throughout the operational phase. Unscheduled maintenance is minimal, as the SCADA system provides 24-hour monitoring of the turbines. Maintenances procedures may require the use of small or large cranes for brief periods of time, for replacement of blades or other turbine components.

### 2.6.4 VEC Monitoring

Birds and bats will likely be monitored for a period of time during the first few years of the operational phase.

## 2.7 Decommissioning

The Barrachois Wind Farm project will be in operation for approximately 20 years. The lifetime is based on the duration of the Power Purchase Agreement (PPA) signed between Nova Scotia Power and the Proponent. This is also consistent with the length of the land lease that will be signed by participating land owners.

Decommissioning will commence within six months after the license has been terminated. The decommissioning phase will be completed within six months after its commencement.

The WTGs components will be dismantled and removed from the site. Similar traffic movements to those experienced during the delivery of the turbine components are anticipated. The decommissioning phase will require considerably lower vehicular support than during the construction phase. The following four steps are anticipated in the decommissioning phase:

1. The WTGs will be dismantled and removed from the site for scrap or resale. The bases will be removed to below plough depth, and the top soil will be reinstated so that the land may be returned to its former use.
2. The internal site roads and site entrance, if not required may be removed. After removal, the land will be reinstated to its former use.
3. The underground cables will be below plough depth and contain no harmful substances. They may be recovered if economically attractive or left in the ground. Terminal connections will be cut back below plough depth.

4. All other equipment will be dismantled and removed, and the land will be returned to its former use.

## 2.8 Future Phases of the Project

There are no future phases planned for the BWF Project. There are three contributing factors that have been considered in determining the 20 year project duration.

1. The current land lease agreement details that the duration of the lease once the Project has been commissioned will be 20 years.
2. The Proponent has agreed upon a 20 year fixed rate power purchase agreement with NSPI.
3. The WTGs have a life expectancy of 22 years.

Based on these three factors, at this time the has no further plans to develop this Project after the proposed 20 year Project life has elapsed.

## 2.9 Other Projects in Area

There is only one other proposed project in the surrounding area. This project is the Hillside Boularderie Wind Farm, proposed by the Proponent and is located approximately 11 km northeast of the BWF. Since the Hillside Boularderie Wind Farm is located outside a 10 km radius of the BWF, it will not be considered for cumulative effects in the VEC assessment of this EA. Construction for the Hillside Boularderie Wind Farm was started in the fall of 2013.

There are no other proposed or under construction wind farms within a 10 km radius of the BWF.

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# 3.0 Approach to the Assessment

## 3.1 Scoping and Bounding

The scoping process identifies the physical, biophysical and socio-economic VECs that may be subject to impact given the works proposed as described previously in Section 2. The proposed work is composed of the construction, operation and maintenance phases of the Project conducted by the Proponent including any accidents and malfunctions that may occur. The decommissioning of the BWF is also included as part of the assessment. The identification of the VECs is based on the potential interaction of the Project within the environmental and socio-economic settings described in Section 4. Additionally, any concerns from stakeholders and the general public as identified through the consultation process described in Section 5 are taken into great consideration when identifying the VECs to be assessed.

The scope of the assessment is formed by the potential interaction of the project activities with the VECs. The scoping was completed at a preliminary level to define the appropriate desktop and field studies that would be relevant to the Project. The scoping is continually refined as the Project progresses, the environmental setting is studied and consultations are held. While it is difficult to assess all of the potential effects of a project, properly defining a scope reduces the risk of overlooking an important project impact.

The Proponent has identified the physical, biophysical and socio-economic aspects that will be subject to assessment based on its knowledge and experience, review of the regulatory requirements, as well as feedback from the community, First Nations, regulatory authorities and other stakeholders. This process has identified the physical, biophysical and socio-economic VECs to be evaluated for the Project; these VECs are listed in Table 3-1.

**Table 3-1: Identified Valued Environmental Components.**

| Physical | Biophysical | Socio-economic |
|---|---|---|
| Ambient Air | Wetlands / Watercourses | Land Use |
| Ground & Surface Water | Fish and Fish Habitat | Aboriginal Resources / Uses |
| Ambient Noise | Migratory and Breeding Birds | Archaeological Resources |
| Ambient Light | Flora | Vehicular Traffic |
| | Fauna | Telecommunications |
| | | Landscape Aesthetics |
| | | Health and Safety |
| | | Local Economy |

Spatial and temporal boundaries must be determined in the assessment process to properly evaluate the Projects impacts on the aforementioned VECs. Spatial boundary is the physical bounds in which the Project facilities and activities are located as well as zones affected by project activities, i.e. discharge

and emissions. Temporal boundary is the time frame in which the activities within the spatial boundary overlap with the presence of identified VECs.

Based on the *Proponent's Guide to Wind Power Projects'* it has been determined that the Project site sensitivity is classed as very high, which classifies the BWF as a category 4 on the level of concern category matrix due to a known bat hibernacula within 25km of the Project site. Projects in this category present a high level of risk to wild species and/or their habitat, and require comprehensive surveys, spread over a one year period, to obtain quantitative information on wild species and habitats on the site (NSE, 2012). The proponent has engaged the services of external consultants to provide these surveys, and will be discussed throughout this EA.

The study area includes a spatial boundary that encompasses the footprint of all activities associated with the construction, operation and decommissioning of the proposed Project. Further, the study area also includes all areas that interactions between the project and environment could be reasonably expected to occur. The spatial boundary will be defined for each separate VEC assessment since it is not reasonably possible to define a single spatial boundary to encompass all project activities and VECs.

The temporal boundaries include, but are not limited to the timeline for short term construction activities, as a long term temporal boundary includes the 20 year operation of the project as well as its decommissioning. The temporal and spatial boundaries are identified in the VEC analysis in Section 6.

## 3.2 Desktop and Field Work Completed

### 3.2.1 Wetland and Watercourse

The Proponent has engaged the services of Strum Consulting (Sturm) to evaluate the presence of wetlands and watercourses at the Project site. The evaluation consisted of an initial desktop review followed by a field assessment. The objective of the assessment was to identify and characterize areas of wetland habitat and watercourses on the Project site in the areas around the proposed locations of WTG infrastructure and along the associated proposed access road, then relocate any infrastructure away from the known wetland habitat.

**Desktop Survey**

The first step in wetland delineation involves a review of available local databases and maps. The following resources were consulted as part of this assessment.

- Nova Scotia Department of Natural Resources (NSDNR) Significant Species and Habitat Database;
- NSDNR Wet Areas Mapping (WAM); and
- Topographic Mapping.

A review of the NSDNR Significant Species and Habitat database identified one treed swamp located in the western portion of the site associated with a mapped indefinite stream discharging to the St.

Andrews Channel. In addition, a treed bog or fen is situated along the south – south eastern property boundary, immediately south of Highway 223 (Drawing 3 - Appendix H). WAM results indicate the potential for wetland habitat in both areas, in addition to a wet area extending from the southern property boundary into the central portion of the site (NSDNR, 2012b).

**Field Assessment**

The wetland assessment was carried out in July 2013 by Strum wetland delineator, John Murray. The assessment area was walked to assess for potential wetlands and the presence of watercourses. Strategic investigation transects were routed to identify the outer extent of the habitat. Where wetland boundaries were observed in the field, individual waypoints to identify the outer edges of the wetland habitat were recorded. Where wetland habitat extended beyond transect routes, approximate wetland boundaries were identified based on field observations and desktop information. Wetland boundaries within the assessment area were defined based on the criteria set out in the US Corps of Engineers Wetland Delineation Manual (1987). The field data was combined with information collected for the NSDNR Significant Species and Habitat database and the WAM database to identify preliminary wetland boundaries.

A second wetland assessment was conducted in order to optimize the turbine locations away from delineated wetlands. The second assessment consisted of a more extensive survey, identifying and surveying the boundaries of all wetlands within the study area as shown in Drawing 4 of Appendix G.

### 3.2.2 Avian Survey

The Proponent has engaged the services of AMEC Environment & Infrastructure (AMEC) to provide an assessment of potential effects of the proposed Project on local and migratory populations. To provide a complete assessment, AMEC has conducted a desktop data review for bird species in the region and has implemented a survey plan for pre-construction baseline avian surveys.

The objectives of this study were to determine:

1. What species make use of the habitat at the proposed project site at different times of year;
2. What species may be most susceptible to collision with turbines based on flight height and behavior;
3. What are the peak spring and fall migration periods based on bird abundance and species diversity; and
4. Whether any species at risk or species of conservation concern make use of the proposed site for migration or for breeding.

**Desktop Review**

Prior to conducting field surveys, aerial photographs of the site were reviewed to determine appropriate survey sites that would ensure all representative habitat types within the proposed project footprint were surveyed. The Important Bird Area (IBA) database was consulted to determine whether known

areas with significant attributes for birds exist near the Project site. As well, a list of bird species known or suspected to be breeding in the area was obtained through the Maritimes Breeding Bird Atlas (MBBA), and the Christmas Bird Count (CBC) database was consulted to obtain records of winter bird species in the region.

**Spring Migration Surveys**

Spring migration surveys were conducted by establishing a 1 km transect route along the access road, which was selected to be representative of the habitat on site. The migration surveys took place during the morning or early afternoon and were conducted by traversing the route on foot with frequent listening stops while recording all birds seen or heard. Weather conditions, bird species and numbers, and behavior (in particular, the height of birds in flight around the proposed WTG locations) were noted. During the spring migration surveys, a night time survey for nocturnal species including owls and nighthawks was conducted; this survey employed playback of target species to increase the probability of detection.

**Breeding Bird Surveys**

A point count methodology was used for the breeding bird survey, which consisted of ten minutes of silent listening at the proposed WTG locations, as well as one "control" location more than 500 m from the WTG locations along the site access road. The point count surveys were conducted on two occasions during the breeding season, once on June 20, 2013 and the second on July 5, 2013. All visual and auditory (songs and calls) observations of birds within 100 m of the observer were recorded, along with the number of individuals and breeding evidence using Bird Studies Canada and MBBA criteria. Surveys were also conducted in the early morning, and during suitable weather conditions (not during sustained precipitation or windy days) to maximize probability of observation.

**Fall Migration Surveys**

Fall migration surveys were conducted by establishing a 1 km transect route along the access road, which was selected to be representative of the habitat on site. The migration surveys took place during the morning or early afternoon and were conducted by traversing the route on foot with frequent listening stops while recording all birds seen or heard. Weather conditions, bird species and numbers, and behavior (in particular, the height of birds in flight around the proposed WTG locations) were noted.

In the fall of 2012, preliminary fall migration surveys were conducted at the property boundary approximately 300 m west of the proposed WTG 1 location, in a cleared area around a cellular tower.

**Winter Resident Surveys**

Spring migration surveys were conducted by establishing a 1 km transect route along the access road, which was selected to be representative of the habitat on site. The migration surveys took place during the morning or early afternoon and were conducted by traversing the route on foot with frequent

listening stops while recording all birds seen or heard. Weather conditions, bird species and numbers, and behavior (in particular, the height of birds in flight around the proposed WTG locations) were noted. The winter resident surveys incorporated a particular focus on raptor species.

### 3.2.3 Flora

The proponent has engaged the services of Strum to conduct a study on the plant species at the Project site. Study methodology includes a desktop review of available information on the plant species within 100 km of the Project site and a field survey.

**Desktop Study**

The Atlantic Canada Conservation Data Center (ACCDC) database was reviewed to compile a list of recorded observations of flora species within 100 km of the Project site. This preliminary list was then used to develop as short list of plant species of conservation interest (SOCI) that may be present at the Project site (Table 1 – Appendix G). For the purpose of this assessment, plant SOCI include:

- Species listed as "Red" or "Yellow" under the Nova Scotia Department of Natural Resources General Status Ranks of Wild Species in Nova Scotia;
- Species assessed as endangered, threatened, or of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC);
- Species ranked as endangered, threatened or of special concern under the Species at Risk Act (SARA); and/or
- Species protected under the Nova Scotia Endangered Species Act (NSESA).

The results of the desktop review were then used by botanists to develop a field assessment strategy based on site habitat.

**Field Survey**

A vascular plant survey was completed in July 2013 within the designated survey area by expert botanist Jim Jotcham. The survey was designed to focus on those areas of the Project site associated with the proposed WTG location and access road (Drawing 2 – Appendix G). A list of plant species identified at the site was compiled and is provided in Appendix G – Table 2.

### 3.2.4 Fauna

Other than bat species, the proponent has not conducted dedicated field surveys for fauna. Instead it has relied on meetings and discussions with Wildlife, Furbearers & Upland Game biologists at Nova Scotia Department of Natural Resources in order to evaluate the potential impacts the Project may have on their respective populations and habitat.

Particular focus was given to bats, and both the endangered American Marten and Canada Lynx. In addition to the discussions with wildlife biologists, the proponent utilized the published Recovery

Plans and Special Management Practices documents for both these species to aid in the assessment process.

**Bats**

The Proponent has engaged the services of AMEC to conduct a study of the bat community and to provide an assessment of potential effects of the proposed Project on endangered bat species. Study methodology includes a desktop review of available information on the ecology of bat species in Nova Scotia and the general Project area, as well as 2012 and 2013 field surveys. The full Bat Impact Assessment can be found in Appendix C.

**Review of Available Data**

The baseline bat monitoring survey began with a detailed desktop review of existing data. As NSE regards wind farm sites within 25 km of a known bat hibernaculum as having 'very high' site sensitivity, it is imperative to determine whether bat hibernacula are known to occur within this radius.

A review of geological mapping of the area was conducted to determine the likelihood of possible bat hibernacula, in the form of natural caves. NSDNR's Abandoned Mine Openings database was also consulted to determine if there are abandoned mines in the area, which could also serve as hibernacula. As many parts of Nova Scotia have historically supported various types' of mining activities, a review of the geology and mining history of the site can be beneficial in determining the likely presence of natural caves and/ or abandoned mines.

Bat species occurring in the general Sydney area were discussed with NSDNR's regional Biologist for Cape Breton. Local naturalists were also consulted.

**2012 Deployment**

In 2012 an Anabat SD2 acoustic bat detector was deployed at the Barrachois site from September 6 to October 12 as shown in Appendix C – Figure 3.1. The detector was deployed, along with its power supply, on the ground in a waterproof housing fitted with a microphone tube, which allowed sampling of a section of the sky approximately 45 degree from horizontal. The detector was programmed to record all ultrasonic sounds between 7 pm and 7 am. This setup was placed within 5 m of the tree line on the site, with the microphone tube pointing parallel to the tree line (northeast) to allow sampling of the forest edge (Appendix C – Photo 3.3). The waterproof housing was covered in brush to minimize visibility and potential vandalism.

**2013 Deployment**

In 2013 an Anabat SD2 acoustic bat detector was re-deployed at the Barrachois site from July 29 to September 30. Deployment was identical to the 2012 deployment, except that the unit was placed at the base of the aerial tower.

### 3.2.5 Archaeological Resource Impact Assessment

An archaeological resource impact assessment was conducted by Davis MacIntyre & Associates Limited in April 2013. The purpose of the assessment was to determine the potential for archaeological resources within the impact zone and to provide the recommendations for further mitigation if deemed necessary. This assessment included consultation of the Maritime Archaeological Resource Inventory in the Department of Communities, Culture and Heritage as well as historic maps, manuscripts and published resources. A preliminary reconnaissance of the development area was also conducted. A preliminary reconnaissance of the Project site was also conducted. Findings and results of the archaeological resource impact assessment are presented in Section 4.2.2.

### 3.2.6 Mi'kmaq Ecological Knowledge Study

The proponent has engaged the services of AMEC to provide a Mi'kmaq Ecological Knowledge Study (MEKS). The purpose of the MEKS is to understand the relationship between the Mi'kmaq and the region in which the Project is located. The BWF MEKS methodology consisted of two main exercises:

1. A desktop review of existed data was performed to gather site specific information, while consultations with local First Nations groups and individuals enabled the collection of local site specific knowledge of historical and current Mi'kmaq use of natural resources.
2. Field surveys were then conducted to confirm and update the existing available knowledge.

**Review of Available Data**

In many regions, indigenous organizations and researchers have adopted a process for traditional ecological knowledge data collection that moves away from individual informant interview and brings small groups of community members together in a workshop format. This system enables researchers to observe and collect information from a variety Mi'kmaq knowledge holders (such as youth, elders, women, hunters, community leaders, etc.) during community level workshops that build upon active social engagement strategies.

Information on the general area encompassing the site was requested from the Treaty and Aboriginal Rights Research Center. In addition, the Gorsebrook Research Center at St. Mary's University and the Treaty and Aboriginal Rights Research Center has collaborated on a Mi'kmaq place names research project. This research has demonstrated the significant cultural and environmental history that is tied to the Mi'kmaq names of places through their traditional territory. AMEC communicated with researchers to seek information on place names in and near the Project site.

AMEC conducted roundtable discussions in Membertou on October 25, 2012, November 28 and 29, 2012 and March 20, 2013. Meetings were also held in Eskasoni on October 24, 2012 and April 8, 2013. Follow-up phone conversations with some participants were undertaken in August, 2013 to verify notes. Roundtable discussions were held to discuss Mi'kmaq knowledge and interest (current and historical use) of the Project area.

**Field Surveys**

A site visit was undertaken to identify and locate potential medicinal plants and other related resources that may be of importance today. Vegetation surveys were conducted on October 12, 2012 by AMEC's Biologist and Mi'kmaq Specialist within the study area depicted in Figure 3 of Appendix E. Prior to conducting field surveys, the various habitats located within the study area were assessed and classified using information gathered during a desktop study (e.g. aerial photography and Nova Scotia Forest inventory database, etc.). Habitat modeling was conducted to identify the potential presence of plant species of significance to Mi'kmaq based on available habitat. Vegetation Surveys focused on plant species identified during the desktop review and consisted of optically controlled meanders through habitat polygons identified to potentially contain plants of Mi'kmaq significance. General locations of significant plants identified in the field were recorded using a GPS and photographs of the habitat were recorded with a digital camera.

While surveys specifically targeting wildlife species were beyond the scope of this study, a review of the historical use of wildlife and fish resources by Mi'kmaq, combined with known wildlife habitat preferences and the results of the habitat surveys, allowed a determination of wildlife species potentially using the Project site. The results of the desktop reviews, field surveys and the public consultation exercise were compiled and a habitat modeling exercise was conducted. This exercise consisted of comparing habitat preferences of Nova Scotia wildlife species with the habitats known to occur at the Project site, in order to determine the likelihood of each species' present at the Barrachois site.

## 3.3 Methodology of Assessment

The assessment focuses on the evaluation of potential interactions between the VECs and socio-economic aspects with the various Project activities as described in Section 2.

As defined in the Nova Scotia Environment Act:

*"Environment" means the components of the earth and includes*

*(i) air, land and water;*
*(ii) the layers of the atmosphere; organic and inorganic matter and living organisms;*
*(iii) the interacting systems that include components referred to in sub clause (i) to (iii); and*
*(iv) for the purpose of Part IV, the socio-economic, environmental health, cultural and other items referred to in the definition of environmental effect.*

"*Environmental Effect" means in respect of an undertaking*

*(i) any change, whether positive or negative, that the undertaking may cause in the environment, including any effect on socio-economic conditions, environmental*

*health, physical and cultural heritage or on any structure, site or thing including those of historical, archaeological, paleontological or architectural significance, and;*

*(ii) any change to the undertaking that may be cause by the environment, whether that change occurs inside or outside the Province.*

The assessment is designed to focus on the evaluation of the potential interactions between the VECs and the various Project activities that have been previously outlined in Section 2. The residual environmental effects are those that remain after mitigation and control measures have been applied. The prediction of residual environmental effects follows three general steps.

- Determining whether an environmental effect is adverse;
- Determining whether an adverse environmental effect is significant; and
- Determining whether a significant adverse environmental effect is likely to occur.

The analysis evaluates the interactions between the Project activities and the VECs, and determines the significance of any residual adverse environmental effects, i.e., effects that may persist after all mitigation strategies have been implemented. To determine and appreciate the relevance of residual effects following mitigation, the following definitions of impact have been adhered to:

- *Significant:* Potential impact could threaten sustainability of the resource in the study area and should be considered a management concern;
- *Minor:* Potential impact may result in a small decline of the quality of the resource in the study area during the life of the Project – research, monitoring and/ or recovery initiatives should be considered;
- *Negligible:* Potential impact may result in a very slight decline of the quality of the resource in the study area during the life of the Project – research; monitoring and/ or recovery initiatives would not normally be required;
- *No impact:* the consequences of the Project activity have no effect on the specific VEC; and
- *Beneficial impact:* the consequence of a Project activity enhances the specific VEC.

Further, a review of the effect of the environment on the Project is included in the assessment. This includes climate impact and extreme events.

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# 4.0 Environmental Setting

## 4.1 Biophysical

### 4.1.1 Geophysical

The proposed BWF is located in the Boisdale Hills sub-unit of the North Bras d'Or Uplands (Natural Theme Region #313c) represented in Figure 2.0-2 of Appendix D. This region is characterized by a series of elongated fault blocks oriented northeast-southwest and were once islands in the Carboniferous Sea. The soil is predominately a well-drained, stony, sandy loam; however Mira soils (poorer draining sandy loam) have developed where relieve has impeded drainage. Soil depths are typically shallow, particularly on ridges and steep slopes. Further details on the geophysical environment can be found in the archaeology report in Appendix D.

### 4.1.2 Atmospheric

Historic climate data was taken from an Environment Canada weather station located near Sydney, approximately 16 km west of the Project site. The data collected from Environment Canada representing climate averages and extremes are shown in Table 4-1.

**Table 4-1: Sydney, Nova Scotia Atmospheric Conditions (Environment Canada, 2012).**

| Parameter | Time Period | Data Source | Value |
|---|---|---|---|
| Average Daily Temperature (°C) | Yearly Average (1971-2000) | Environment Canada | 5.5 |
| Extreme Maximum Temperature (°C) | August 10, 2001 | Environment Canada | 35.5 |
| Extreme Minimum Temperature (°C) | February 8, 1994 | Environment Canada | -27.3 |
| Average Total Rainfall (mm) | Yearly Average (1971-2000) | Environment Canada | 1212.9 |
| Maximum Daily Rainfall (mm) | August 17, 1981 | Environment Canada | 128.8 |
| Average Total Snowfall (cm) | Yearly Average (1971-2000) | Environment Canada | 298.3 |
| Maximum Snow Depth (cm) | February 9, 1992 | Environment Canada | 123 |
| Prevailing Wind Direction | Yearly Average (1971-2000) | Environment Canada | South |
| Average Wind Speed (km/h) | Yearly Average (1971-2000) | Environment Canada | 18.6 |
| Maximum Gust Speed (km/h) | December 1, 1964 | Environment Canada | 161 |

**Visibility & Fog**

The presence and frequency of fog events at a wind farm site can have a detrimental effect on migratory birds due to collisions during adverse weather conditions. Artificial lighting, particularly work lights inadvertently left on by turbine maintenance crews are also known to have an adverse effect on

migratory birds (Kearney, 2012) During adverse weather events, sporadic artificial lighting during dawn and dusk at a wind farms may attract migrating birds, signaling a potential safe area of refuse.

The Project setting is considered rural, with little to no presence of artificial lighting. Light pollution from North Sydney, Sydney Mines and Sydney can be considered the only significant sources of artificial light.

According to the internationally-accepted definition of fog, it consists of suspended water droplets or ice crystals near the Earth's surface that lead to a reduction of horizontal visibility to below 1 km (NOAA, 1995). Environment Canada's database of Canadian Climate Normals 1971-2000 was consulted to provide baseline fog data relevant to the Project site. A weather station in Sydney, Nova Scotia was selected, which is 16 km south-east of the Project site (Environment Canada, 2012). Based on this data presented in Table 4-2, fog can be expected to occur 4.24% of the time throughout the duration of an average year.

This data will provide background site information for the assessment of the significance of adverse affect on the environment in the VEC analysis section.

**Table 4-2: Sydney, Nova Scotia fog data average from 1971 – 2000 (Environment Canada, 2012).**

| Month | Hours with visibility less than 1 km | % of foggy weather* |
|---|---|---|
| January | 29.8 | 4.01 |
| February | 26.2 | 3.90 |
| March | 46.8 | 6.29 |
| April | 61.1 | 8.49 |
| May | 60.2 | 8.09 |
| June | 38.9 | 5.40 |
| July | 28.9 | 3.88 |
| August | 17.5 | 2.35 |
| September | 8.0 | 1.11 |
| October | 11.8 | 1.59 |
| November | 17.4 | 2.34 |
| December | 24.7 | 3.32 |
| Annual | 371.4 | 4.24 |

* Based on days/month x 24 hr/day.

**Wind Regime**

Based on Natural Forces' independent Wind Resource Assessment a wind rose found in Figure 4-1 indicates the prevailing wind at the Project site location. The Nova Scotia Wind Atlas indicates an average wind speed of 7.5 - 8.0 meters per second at a height of 80m at the project site.

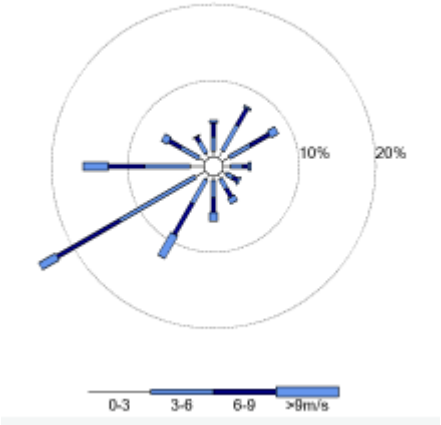


**Figure 4-1: Meteorological mast wind rose.**

### 4.1.3 Wetlands and Watercourses

A detailed wetlands assessment was undertaken as part of this EA to identify areas of wetland habitat coinciding with Project infrastructure. Multiple areas of wetland habitat, primarily treed swamps, were identified during the initial field assessment and are shown in Appendix F – Drawing 4.

Consultation with NSDNR it has led the proponent to apply a 30 m minimum buffer from the tip of WTGs blade to the nearest wetland during the wind turbine micrositing process. Figure 4-2 shows the proposed WTG locations along with a 76 m radius buffer (blade length + 30 m) with no impedance on the delineated wetlands. The WTG locations have been optimized such that they comply with the NSDNR recommendations to maintain a minimum 30 m buffer from the WTG blade tip, and therefore reducing the potential impacts to species living within and adjacent to wetland ecosystems.

The proposed access road layout has been designed to minimize disturbance to existing conditions, primarily by making use of an existing road. No wetland alteration is expected to be required for road construction under the Nova Scotia Wetland Conservation Policy. The proposed access road can be seen in both Figure 4-2 and Figure 4-3. Additional mitigation measures, including conducting all clearing/construction activities during the water, and outside of peak breeding season for birds, will also be employed.

The Proponent is aware of the Nova Scotia Wetland Alteration Approval process and that it defines the following four activities as wetland alteration:

(1) Filling;
(2) Draining;
(3) Flooding; and

(4) Excavating.

In the event that a watercourse alteration is required, the Proponent will follow the provincial permitting requirements and will acquire the necessary permits in advance.

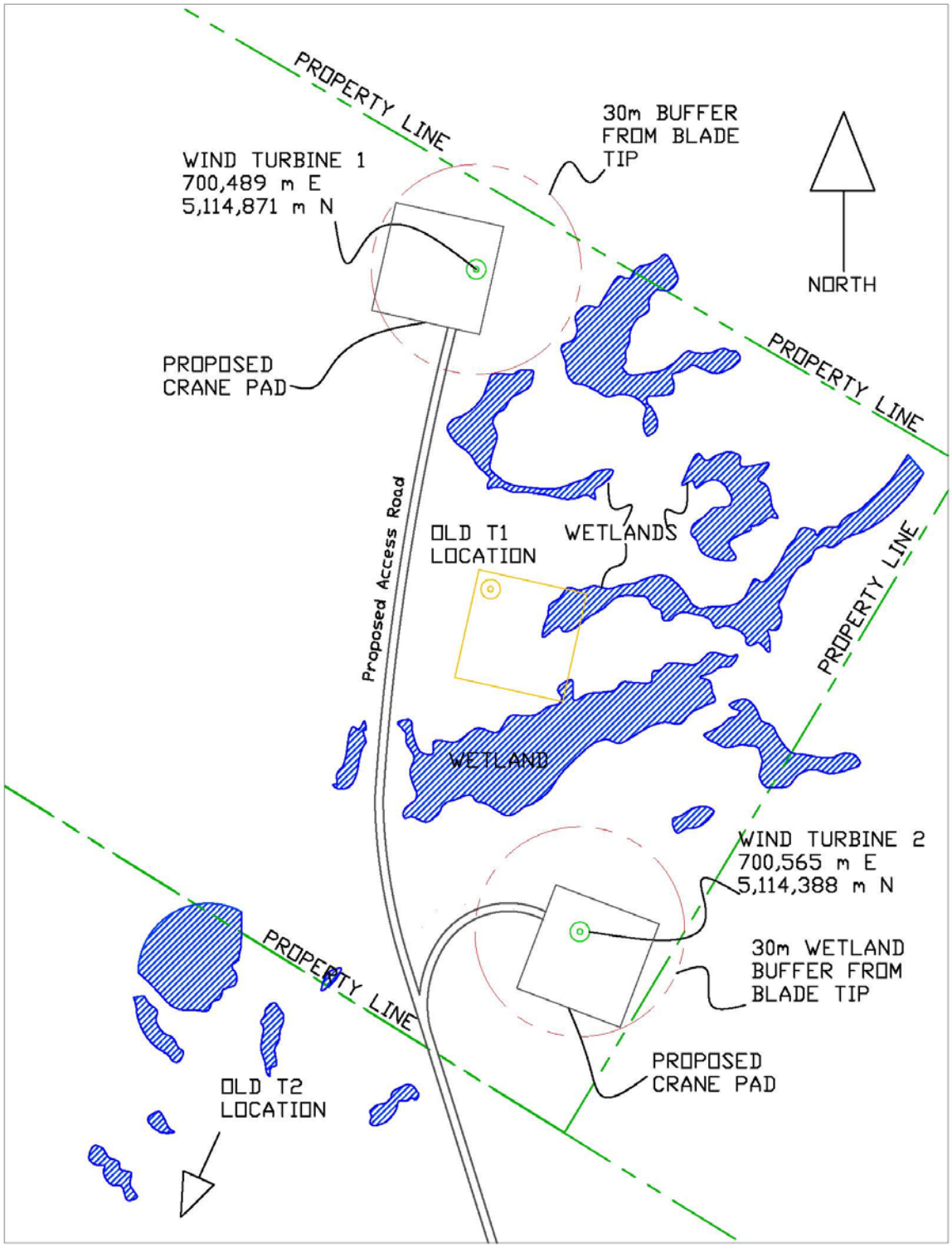


**Figure 4-2: WTG locations showing 30 m plus blade length setback from wetlands and proposed access road design, as well as old Turbine locations.**

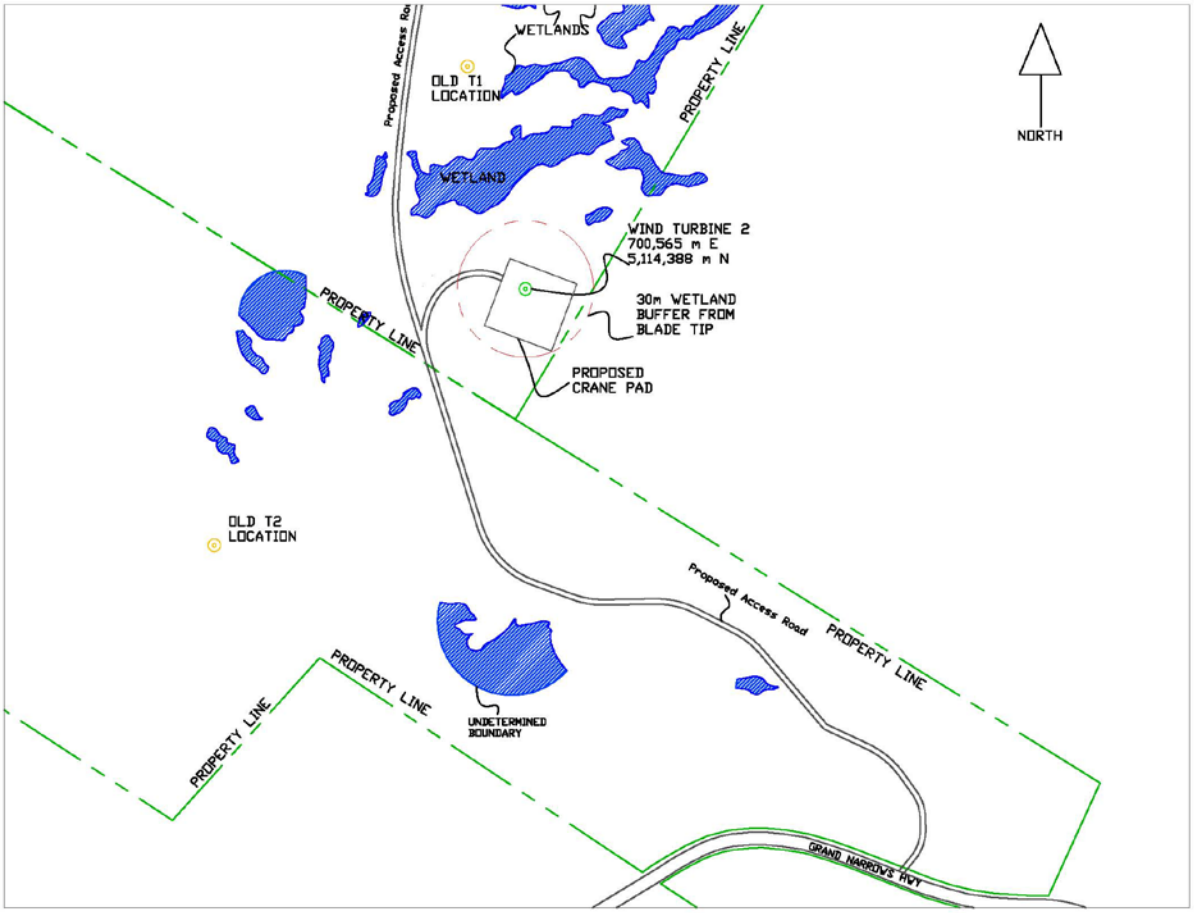


**Figure 4-3: Lower Project site showing delineated wetlands and proposed access road design.**

### 4.1.4 Fish and Fish Habitat

Based on the wetland and watercourse assessment conducted by Strum all of the wetlands have been identified as a marsh or swamp. These swamps and marshes do not provide an adequate environment for fish to use as habitat. Other than the wetlands and watercourses identified by Strum there are no other water bodies on the Project site. No impact to fish and fish habitat is expected.

The closest fish habitat to the Project site is Bras d`Or Lake, approximately 1,300 m from any proposed project infrastructure. The Project is not expected to have any impact on this fish habitat.

### 4.1.5 Avian Survey

**Desktop Review**

A search of the IBA database revealed that the nearest IBA, Central Cape Breton Highlands (NS061) is situated approximately 12 km northwest of the Project site (IBA, 2013). This IBA is home to a globally

significant number of Bicknell's Thrush. The Bincknell's Thrush favours dense coniferous forest, and so is unlikely to occur on the Project site, which is dominated by mixed forest.

Results of the second MBBA were accessed to provide information on breeding birds in the general project area. Results were obtained for a 10 km by 10 km atlas square in which the Project site is located; because the site is located near the western edge of this square, results were also obtained for the adjacent square. A total of 88 species were recorded for the MBBA database (Appendix B – Table A.1). Of these species, 22 were confirmed to be breeding in one or both squares based on observed breeding evidence, and a further 43 were considered probable breeders.

Count results were obtained for all 28 CBCs conducted between 1966 and 2012 in the Sydney's count area, a 24 km diameter circle that is centered near North Sydney and encompasses the Project location (CBC, 2013). Over the 28 CBCs, a total of 135 species have been observed wintering in the Sydney's count area (Appendix B – Table A.2).

**Summer Breeding Season Survey**

Breeding bird surveys were conducted on June 20, 2013 and July 5, 2013. Over the course of the two surveys, breeding evidence was recorded for 28 species (Appendix B – Table A.5), including 8 probable breeders, 18 possible breeders and two confirmed breeders according to the categories used by the MBBA. One additional species, the Northern Goshawk was considered as a probable breeder near the site. An adult bird was observed near the edge of the meteorological tower clearing, and at least one juvenile could be heard in the forest nearby. Significant effort was spent searching for Goshawk nests both by the proponent and filed biologists although none were found. One Olive-sided Flycatcher was also observed during the summer breeding survey.

The most commonly observed species during the breeding bird surveys at the Project site were Black-capped Chickadee, Hermit Thrush and Ovenbird. Red-eyed Vireo, Black-and-white Warbler and Black-throated Green Warbler were also frequently observed.

The priority species observed during the breeding season surveys are listed in Table 4-3.

**Fall Migration Survey**

Fall 2013 migration surveys were conducted on August 24$^{th}$, September 5$^{th}$, September 21$^{st}$, September 24$^{th}$ and October 1$^{st}$. A total of 42 bird observations were recorded, with 13 species detected (Appendix B Table A.6). Blue Jay, Black-capped Chickadee and Golden-crowned Kinglet were the most commonly observed species at the site in the fall.

Just 16 individuals representing 11 species were detected during the preliminary fall migration surveys conducted in 2012 at the property edge (Appendix B Table A.7). Species abundance and diversity were quite low at the site, and all of the species observed are known to breed in the region, with no northern

migrant species detected. Therefore, it is unlikely that the area serves as a significant migration stopover.

**Winter Survey**

The winter survey consisted of 7 area search surveys, at seven different locations. There were 10 species, consisting of 68 individual birds, recorded during winter surveys. On average, 10 birds were detected per survey, with an average of 4 species detected per survey.

Species observed during the fall migration survey were screened against the criteria outlined in the document "A Guide to Addressing Wildlife Species and Habitats in an EA Registration Document" (NSE, 2009) to develop a list of priority species. The priority species observed during the winter surveys are listed in Table 4-3.

**Spring Migration Survey**

Spring migration surveys were conducted on May 16 and 31, 2013 and June 8, 2013. A total of 156 bird observations were recorded, with 30 species detected. Black-throated Green Warbler, Ovenbird, Black-and-White Warbler, American Robin and Hermit Thrush were the most commonly observed species that the Project site. Overall, species abundance and diversity was not particularly high, and all of the species observed are known to breed in the region, with no northern migrant species detected; therefore, is unlikely that the Project area serves as a significant spring migration stopover. The priority species observed during the spring migration surveys are listed in Table 4-3.

**Observed Height of Birds**

Most of the birds observed during the surveys were detected by sound or were seen perched in vegetation on the site. For birds that were seen in flight, the approximate height at which birds were observed was recorded. Of the recorded observations of birds in flight, all but one were 20 m or lower; a pair of Great Cormorants were observed at approximately 100 m above the ground surface in October 2012.

**Species of Conservation Concern**

**Table 4-3: Species of conservation concern observed during avian surveys.**

| Common Name | SARA | NSESA | ACCDC |
|---|---|---|---|
| Olive-sided Flycatcher | Threatened | Threatened | Uncommon |
| Gray Jay | Not Listed | Not Listed | Uncommon/Usually widespread |
| Great Cormorant | Not Listed | Not Listed | Uncommon |
| Northern Goshawk | Not Listed | Not Listed | Uncommon/Usually widespread |
| Yellow-bellied Flycatcher | Not Listed | Not Listed | Uncommon/Usually widespread |

| Common Name | SARA | NSESA | ACCDC |
|---|---|---|---|
| Boreal Chickadee | Not Listed | Not Listed | Uncommon |

A number of additional species at risk and species of conservation concern may occur in the Project area, based on information from the MBBA and CBC. Of those, the following are considered to have potential to occur on the site based on the available habitat:

- Common Nighthawk (*SARA* and *NSESA*: Threatened; ACCDC: S3B)
- Eastern Wood-pewee (*NSESA*: Vulnerable; ACCDC: S3S4B)
- Wilson's Snipe (ACCDC: S3S4B)
- Pine Grosbeak (ACCDC: S3?B,S5N)
- Pine Siskin (ACCDC: S3S4B,S5N)

Certain species, including raptors and the previously mentioned Wilson's Snipe, are considered to be at potentially greater risk of negative interactions with wind turbines due to aerial behavior such as hunting and mating displays. Because of this concern, presence of raptors is of particular interest. The following raptor species have been observed at various times of year during the field surveys:

- Northern Goshawk, observed during the summer breeding season. Breeding near site, as one agitated adult bird and at least one immature were observed near the edge of the met tower clearing.
- Red-tailed Hawk, a single individual observed during summer and fall surveys.

In addition to the above species, Bald Eagle, Sharp-shinned Hawk, Broad-winged Hawk, American Kestrel and Merlin were all observed during the breeding season within approximately 10 km of the site based on findings from the MBBA during the desktop review.

**Discussion**

A total of 48 species were observed during the surveys, of which 29 are confirmed or believed to be breeding on or near the project site. All of the species observed during the migration surveys are known to breed in the region; it is not evident that the area serves as a significant migration stopover.

Breeding status was inferred based on observed behavior the June and July breeding bird surveys and incidental observations. Three species were confirmed to be breeding in the area based on presence of fledged young or on observations of adults carrying food, and a further 8 species are considered "probable" breeders based on territorial behaviour (observed in suitable habitat on two or more occasions over the breeding season), agitated behaviour of adults, and/or presence of a breeding pair in suitable habitat. Another 18 species were considered "possible" breeders, heard or observed only once in a particular location in suitable breeding habitat. One federally listed species at risk, the Olive-sided Flycatcher, was observed during the summer breeding surveys. Additionally, six regionally rare species

according to ACCDC were observed: Gray Jay, Great Cormorant, Northern Goshawk, Yellow-bellied Flycatcher, Boreal Chickadee and Olive-sided Flycatcher.

The potential negative effects of wind farms on birds can be classified into four main categories: collision, displacement due to disturbance, barrier effects and habitat loss; these will be addressed by proposing mitigative measures in Section 6.2.

**Northern Goshawk Reconnaissance**

A field survey conducted in the summer of 2013 indentified a Northern Goshawk at the Project site. Since this observation, the site has been visited numerous times by Natural Forces field staff and AMEC biologists to determine if there is a nest at the Project site. Most recently a field reconnaissance was conducted on May 1, 2014 by an AMEC biologist in an effort to locate the Northern Goshawk and to assess the likelihood of nesting near the proposed WTG locations based on the available habitat.

A Goshawk was heard near the edge of a clearing near the meteorological mast in a similar location to where it was heard during the summer breeding season survey in 2013. The area was approached where the bird was heard however the Goshawk was not seen and a nest was not found.

The habitat around WTG 2 is primarily young, mixed forest with predominately closed understory. It was determined that the area around WTG 2 does not provide suitable habitat for the Northern Goshawk as the species prefers mature hardwood forests with an open understory.

The habitat surrounding WTG 1 was slightly more suitable with an open understory and a few large conifers among younger mixed wood. There was no evidence of a nest, nor were there any piles of debris that might suggest that a nest had fallen during the winter.

### 4.1.6 Flora

Results of the flora desktop review indicated that 249 vascular flora species have been identified within 100 km of the Project site. Of the 249 vascular plant species identified by ACCDC, 180 vascular flora SOCI were identified within 100 km of the Project site (Appendix G – Table 1). No floral species of conservation interest were found during the field survey.

The vascular plant survey encompassed three habitat types: upland forests, regenerating forests and wetlands. A complete list of vascular plant species identified during the survey is provided in Table 2 of Appendix G.

**Upland Forest**

Upland forest habitats were dominated by hardwood and mixed wood stands. The south eastern extent of the assessment area was dominated by mixed wood habitat, with hardwood stands accounting for portions of the northern extent of the assessment area, and intermittent smaller stands adjacent to the existing road.

Deciduous tree species observed included red maple (*Acer rubrum*), white birch (*Betula papyrifera*), sugar maple (*Acer saccharum*), speckled alder (*Alnus incana*), yellow birch (*Betula alleghaniensis*), and stripped maple (*Acer pensylvanicum*).

Coniferous species consisted of balsam fir (*Abies balsamea*), white spruce (*Picea glauca*), eastern hemlock (*Tsuga canadensis*) and eastern white pine (*Pinus strobus*). A diverse mix of plant, herb and shrub species included:

- Wild sarsaparilla (*Aralia nudicaulis*);
- Bunchberry (*Cornus Canadensis*);
- Star flower (*Borago officinalis*);
- Clintonia lily (*Clintonia borealis*);
- Golden rod (*Solidago Canadensis*);
- Beech fern (*Phegopteris connectilis*);
- Interrupted fern (*Osmunda claytoniana*);
- Cinnamon fern (*Osmunda cinnamomea*);
- New York fern (*Thelypteris noveboracensis*);
- Hay-scented fern (*Dennstaedtia punctilobula*);
- St. John's wort (*Hypericum perforatum*);
- Bittersweet nightshade (*Solanum dulcamara*);
- Colts foot (*Tussilago farfara*);
- Oxeye daisy (*Leucanthemum vulgare*);
- Fowl mana grass (*Gluceria striata*);
- Bone set (*Eupatorium perfoliatum*);
- Hawkweed (*Hieracium pilosella*);
- Bladder sedge (*Carex intumescens*);
- Twinflower (*Linnaea borealis*);
- Wood fern (*Dryopteris intermedia*);
- Sensitive fern (*Onoclea sensibilis*);
- Bracken fern (*Pteridium aquilinim*);
- Rock polypody (*Polypodium virginianum*);
- Brown breakrush (*Rhynchospora fusca*);
- Three-seed sedge (*Carex trisperma*);
- Raspberry (*Rubus idaeus*);
- Red elderberry (*Sambucus racemosa*); and
- Canada holly (*ilex verticillata*).

**Regenerating Forests**

Portions of the landscape have been clear cut and regrowth is dominated by immature/regenerated sapling mixed wood and softwood stands. Eastern hemlock, white ash (*Fraxinus Americana*), American beech (*Fagus grandifolia*) and wood fern (*Dyropteris intermedia*) were commonly observed.

**Wetlands**

Wetland habitat is relatively interspersed throughout the assessment area and predominantly consists of treed swamps. Woody cover was generally immature/mature black spruce, balsam fir, red maple, specled alder, white birch, yellow birch, eastern hemlock and red maple. Common herbs include cinnamon fern, grasses and sedge. Other wetland common species included silvery spleenwort (*Deparia acrostichoides*), brown breakrush (*Rhynchospora fusca*) and Canada holly.

### 4.1.7 Fauna

**Moose**

In conversation with NSDNR's species at risk biologist *Alces alces americana* is identified as a species at risk on the mainland of Nova Scotia but not in Cape Breton (*Alces andersonii*). As a result, no moose surveys were conducted for the purpose of the Project.

**Canada Lynx**

The proponent has met with and/or held discussions with several Nova Scotia Department of Natural Resources Biologists. Terry Power and Peter Austin-Smith were consulted in order to gather knowledge and background data on how to assess the potential impact the Project may have on the Canada Lynx. The proponent also relied on the Canada Lynx Recovery Plan document and the Canada Lynx Special Management Practices document for additional guidance.

Canada Lynx (*Lynx canadensis*) has been listed as an endangered species under the *Nova Scotia Endangered Species Act* since 2002. The lynx has been essentially absent from mainland Nova Scotia for over 40 years and is primarily found in the highlands of Cape Breton Island. An increase occurrence in adjacent lowland areas of Cape Breton has been noticed during a recent peak in local snowshoe hare populations (NSDNR, 2012c). This was further confirmed in conversation with NSDRN biologists in late 2013 along with winter snow tracks recorded near Eskasoni approximately 20km south east of the project site in the winter of 2013/2014. As shown in Figure 4-5, the Project site is located near the northern tip of an expected lynx habitat range; as a result likelihood for lynx within the Project region will be assessed and mitigation measures are proposed in Section 6.2.

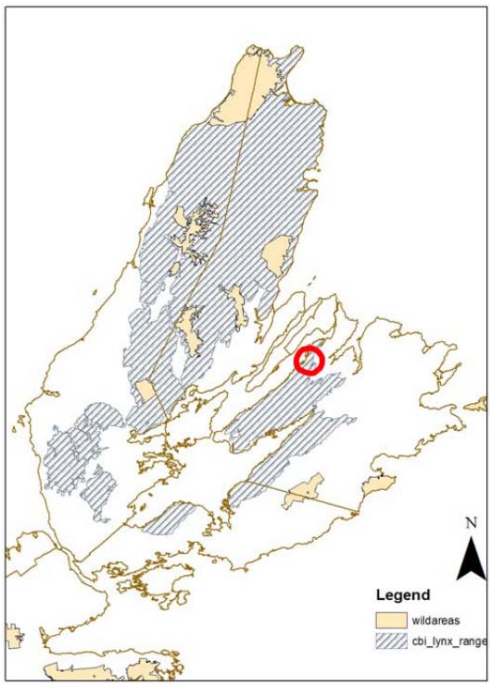


**Figure 4-4: Predicted Canada lynx habitat in Cape Breton – Project site circled in red. (NDSNR, 2012c)**

Canada lynx is a carnivore that primarily consumes snowshoe hare (*Lepus americanus*) but also relies on prey like red squirrels (*Tamiasciurus hudsonicus*) and occasionally white-tailed deer (*Odocoileus virginianus*) (NSDNR, 2007). Lynx populations are subject to fluctuations in response to changes in populations of their primary prey species; this is exhibited by corresponding cyclical population patterns between the snowshoe hare and lynx. A decline in lynx population is typically observed following a trough in the snowshoe hare population cycle (NSDNR, 2012c). During these times the dependence on alternative prey such as red squirrels becomes essential to survival and lynx will migrate to habitat suitable to red squirrels.

There is limited population data for lynx in Cape Breton aside from general habitat prediction maps such as Figure 4-5. By identifying preferred habitat characteristics of prey and comparing to the characteristics of the Project site it is possible to form predictions of the likelihood that lynx make use of the area.

The Project site has been assessed by Strum as described in Section 4.1.6 and three main habitats were identified. Upland forest habitats were dominated by hardwood and mixed wood stands. Deciduous trees observed included red maple, white birch, sugar maple, speckle alder, yellow birch and stripped maple. Coniferous species consisted of balsam fir, white spruce, eastern hemlock and eastern white pine with a diverse mix of plant, herb and shrub species. Portions of the landscape have been clear cut and re-growth is dominated by immature/regenerated sapling mixed wood and softwood stands. Eastern hemlock, white ash, American beech and wood fern were commonly observed. The Project site does contain suitable lynx habitat based on the preferred habitat of the lynx prey and the similarity to

the habitat identified in the Strum habitat survey. While ideal habitat would consist of conifer thickets and swamps the Project site has a mixture of softwood, hardwood and wetlands.

Potential impacts that may occur to lynx habitat include habitat fragmentation, habitat loss and disturbance. This would be the result of clearing for access road construction and WTG and ancillary infrastructure construction. The proposed mitigation measures are presented in Section 6.2 under Fauna.

**American Marten**

Much the same with the above Canada Lynx, the proponent has met with and/or held discussions with Nova Scotia Department of Natural Resources Biologists Terry Power and Peter Austin-Smith in order to gather knowledge and background data on how to assess the potential impact the Project may have on the American Marten. The proponent also relied on the American Marten Recovery Strategy document and the American Marten Special Management Practices document for additional guidance.

The American Marten (*Martes americana*) has been listed as an endangered species under the *Nova Scotia Endangered Species Act* since 2001 due to their small population size and limited localized occurrence. Historically, marten were abundant throughout mainland Nova Scotia but due to trapping activities from the 1700's to 1900's their population has been reduced to low numbers and reduced to a small population in southwestern Nova Scotia as well as on Cape Breton Island (NSDNR, 2012d). In consultation with NSDNR's biologists a brief desktop review of available marten literature was conducted in order to assess the potential impact to marten and their habitat at the Project site and to identify suitable mitigation measures.

The Cape Breton Island population of marten is highly fragmented with two main subpopulations; one on the northwest side of the Highlands and the other on the southeastern side of the Highlands. The species is generally associated with late-successional conifer-dominated forests and their optimal habitat appears to be in older forests where coarse woody debris (downed logs, exposed roots and stumps) play an important role for marten in hunting and thermo-regulation (NSDNR, 2012d). Primary critical marten habitat has been identified in Victoria County (shown in Figure 4-6) and within the 190,000 ha Victoria County, less than 1% can be considered good or optimal habitat.

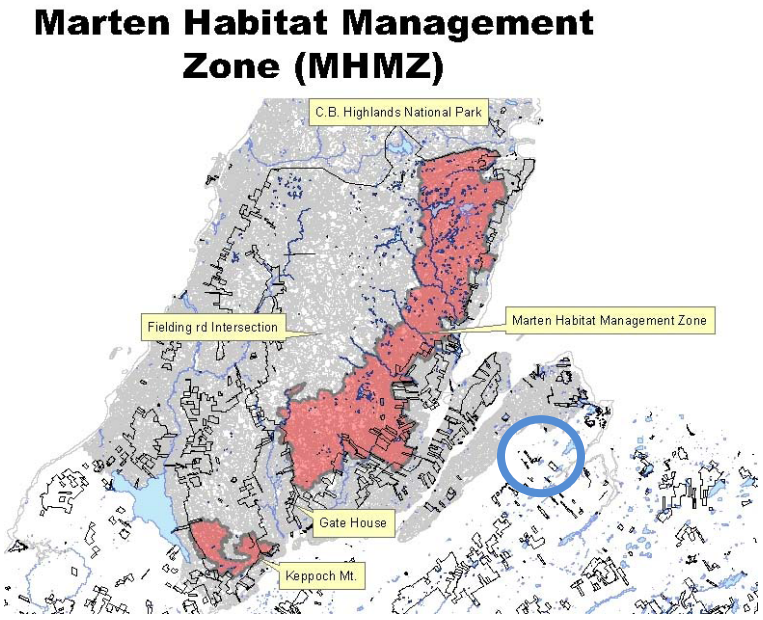


**Figure 4-5: American Marten critical habitat in red, Project location circled in blue. (NSDNR, 2012d)**

The marten habitat management zone as shown in Figure 4-6 does not interact with the Project site indicated in blue. Although marten are not known to frequent the region in which the proposed BWF is located, at the recommendation of the NSDNR regional biologist the proponent assumes the American Marten may be utilizing the surrounding wind farm site area.

The marten is further addressed in the VEC assessment in Section 6.2 under fauna.

**Bats - Review of Available Data**

In 2013, three resident bat species of Nova Scotia were listed as endangered under the Nova Scotia Endangered Species Act; these species are the Little Brown Myotis, Northern Myotis and Tri-colored Bat. The Little Brown Bat and Northern Myotis became endangered because of a disease known as White-nose-Syndrom (WNS), which is caused by the fungus, Geomyces destructants. WNS has killed nearly 7 million bats in eastern North America in the past 8 years and estimates of a 90% decline in Nova Scotia have taken place in just 3 years since the disease was first recorded (NSDNR, 2013c). The Tri-colored Bat population in Nova Scotia is through to be geographically isolated from others in eastern North America. Although WNS has not been confirmed in this species in Nova Scotia, evidence in the north east US indicates the species has been seriously impacted (NSDNR, 2013c).

Within 25 km of the Project site there are almost 500 known mine openings according to the Nova Scotia Abandoned Mine Openings (AMO) database (NSDNR, 2013). None of these mine openings correspond to caves known to support bats in Nova Scotia. Total measured depths of most of the mine openings are not provided; however, two of the openings have a measured depth of ten meters or

more. The original depths of some of these openings were much greater, but according to the records, the majority have been filled or sealed for public safety (NSDNR, 2013).

Discussions with Dr. Hugh Broders and NSDNR Regional Biologist Terry Power indicate that there are no known bat hibernacula in the immediate area of Barrachois. According to Terry Power, there is a small hibernaculum in an abandoned mine located approximately 8 km south of the Project site; in a winter 2012 survey, fewer than 20 *Myotis* individuals were counted. Dr. Broders states that observations of significant swarming activity suggests a possible hibernaculum near Donkin, approximately 35 km east of the Project site, and there have been reports of at least two other minor hibernacula (10 – 100 bats) in Cape Breton: the one in Coxheath, and another near Louisbourg, more than 40 km southeast of the Project site.

**Bats – Anabat Aerial System**

The 2012 tree-mounted system, which was deployed from September 6 to October 11, recorded bat activity during 17 of the 19 deployment nights. The average was 11.05 calls per night (minimum 2, maximum 57). The majority of the bat calls were *Myotis* species, though a few were questionable. While it is difficult to confidently assign *Myotis* echolocation sequences to a particular species, the calls recorded show characteristics of both *M. Lucifugus* and *M. Septentrionalis*, and it is assumed that both species are present on the site.

The 2013 aerial system, which was deployed from July 30 to September 30, recorded bats on 44 of the 54 nights on which the unit appeared to be functioning properly. During the period between September 7 and September 16 no data was recorded, possibly due to an unexpected compact flash card formatting error, however for four days prior to and after this event, the units each set up folders to record data, indicating they were functioning properly but did not record any data.

Figure 4-7 presents the number of bat echolocation sequences recorded by the aerial Anabat unit in 2013 as well as temperature and precipitation data for the Sydney Airport.

All units recorded a significant number of bat calls. All appear to belong to *Myotis* species. The aerial system in particular recorded a maximum of 828 bat echolocation calls on one night, August 8, 2013. It is of note that the majority of the aerial data recorded at Barrachois in 2013 is very “clean”, i.e., there are virtually no noise files recorded. In addition, the vast majority of the aerial files appear to be simple echolocation calls, with no evidence of “feeding buzzes”, indicating that bats recorded by the aerial system are not feeding. The specific nature and reasons for this event are subject to various interpretations: migration, movement from local hibernaculum due to disturbance, etc. However, the reason for the increased numbers does not diminish the important observation that the bats have been detected in the area.

**Bats – Anabat Ground System**

The 2012 ground system, which was deployed from September 6 to October 11, recorded bat activity during 20 of the 36 deployment nights. The average was 13.35 calls per night (minimum 1, maximum 62). The majority of the bat calls appear to be *Myotis* species. While it is difficult to confidently assign *Myotis* echolocation sequences to a particular species, the calls recorded show characteristics of both *M. Lucifugus* and *M. Septentrionalis*, and it is assumed that both species are present on the site.

The 2013 ground system, which was deployed from July 29 to September 30, recorded bats on 44 of the 46 nights on which the detector was functioning properly. An unexpected compact flash card formatting issue led to the unit not recording data from September 7 to September 16. The data recorded by the ground system shows a very high percentage of feeding buzzes, indicating the bats are foraging in the area, but below 10 m height.

Figure 4-7 depicts the number of bat echolocation sequences recorded by the ground-based Anabat unit in 2013, as well as the temperature and precipitation data for the Sydney Airport (the closest weather station with sufficient data).

**Bats - Discussion**

The proponent recognizes that there exists a significant lack of data on bats and the locations of their hibernacula's, in addition there exists a considerable difficulty in quantifying potential impact to a species that has undergone significant decline in recent years.

The decrease in bat echolocation sequences as the fall season progresses in both 2012 and 2013 matches the seasonal behaviour of *Myotis* species in Nova Scotia. Occasional nights earlier in the season during which few bat calls were recorded may be due to inclement weather conditions, such as heavy rain, discouraging foraging by bats. This is likely the case for the night of September 9, 2012, during which the units recorded numerous noise files but only a single recognizable bat sequence, while there were high numbers of bat calls recorded on the previous and subsequent nights.

The resurgence in bat activity on September 21 and 22, 2013 appears to correspond to a rise in night time temperature after two cold (maximum 2 degrees Celsius nights) suggesting that bats were perhaps making up for lost foraging and/or transit time. It is also possible that the resurgence on bat activity levels from September 20-23 could be due to different *Myotis* species behaviours or behaviours of bat populations from different hibernacula.

Overall, the review of the data from the 2012 and 2013 monitoring program suggests a significant level of bat activity at the Project site. Based on the high levels of bat activity detected by the aerial system (828 sequences in one night), it appears there may be a significant number of bats present in or transiting through this area on a seasonal basis.

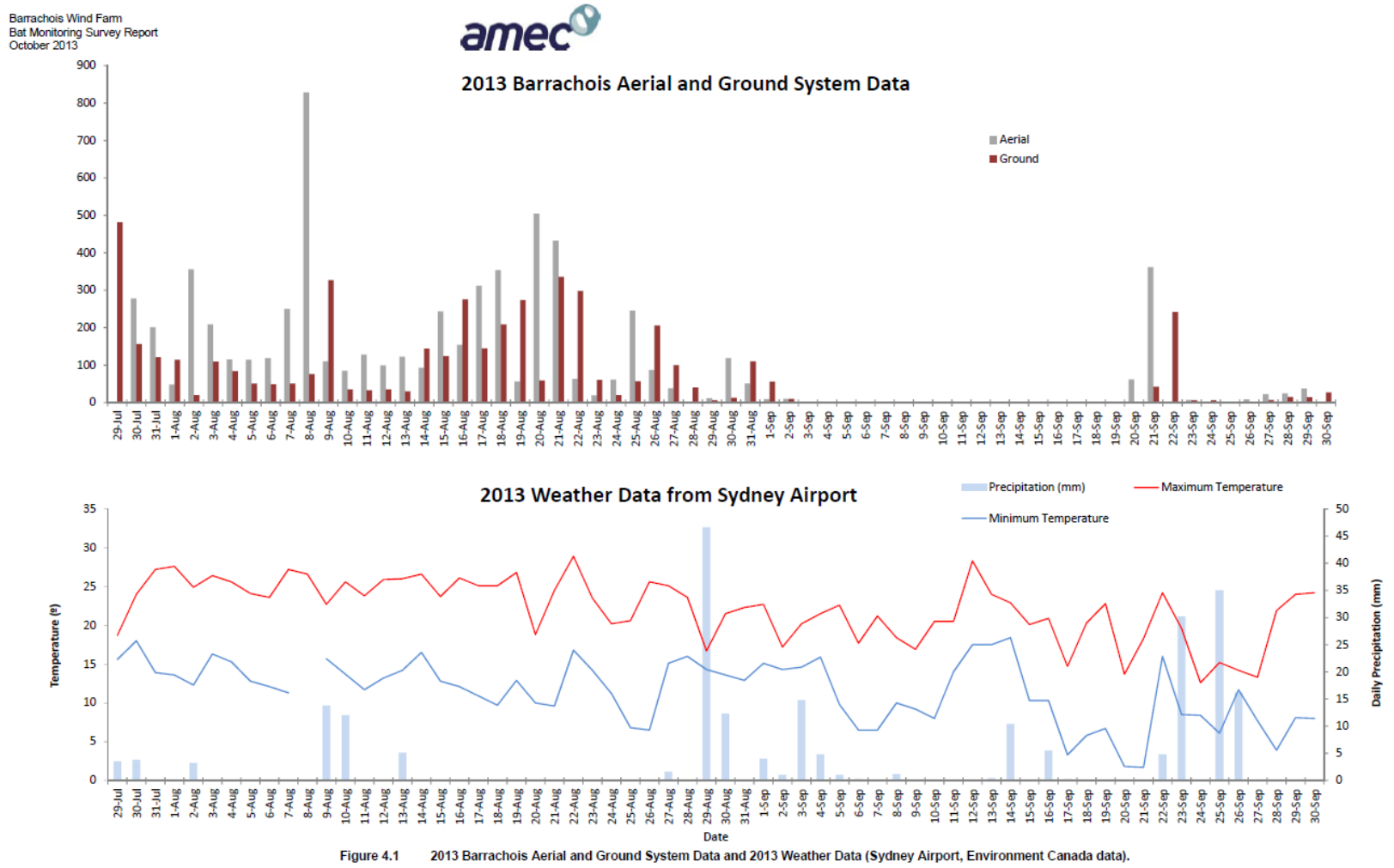


Figure 4.1 2013 Barrachois Aerial and Ground System Data and 2013 Weather Data (Sydney Airport, Environment Canada data).

**Figure 4-6: Results from the 2012 and 2013 bat survey (AMEC, 2013).**

**Bats – Relating pre-construction bat activity and post-construction bat fatality**

Arnette et al. synthesised data from 94 pre-construction bat activity and 75 post-construction bat fatality studies at wind energy facilities in 4 regions of North America to establish whether pre-construction bat activity relates to post-construction fatality. Of these studies, only 12 included both pre and post-construction comparative data, which would be used to determine whether bat acoustic data gathered prior to construction can be used to predict fatality. The analysis suggests a weak relationship between pre-construction bat activity and post construction bat fatality. It is likely that the sample size (n=12) was insufficient to properly assess whether or not a relationship exists. Although understanding population level is important in evaluating the biological impacts, measures to mitigate existing and future impacts should proceed in the absence of population data (Arnett et al. 2013a).

Nova Scotia is faced with the same lack of data issue that was encountered with the Arnette synthesis. Provincial Environmental Assessments in Nova Scotia require pre-construction acoustic studies that assess the bat activity at the proposed wind farm location and also require post-construction fatality studies. There have been many pre and post-construction studies conducted in Nova Scotia for operational wind farms; however much of the data is not currently available to the public. The results of the data that is available indicates a very low number of *Myotis* and other bat species are being killed by wind turbines. As recommended in the discussion of the Arnette synthesis, in the absence of population data, implementation of operational mitigation for minimizing bat fatalities is recommended for high bat activity sites especially until better population data and understanding of impacts is possible. Increasing the cut-in wind speed at which the WTG starts to operate has proven to be an ecologically sound and economically feasible strategy for reducing bat fatalities (Arnette et al. 2013b).

A review of fatality data from three wind farms in North America suggests bat fatalities are dominated by migratory tree bats such as the hoary bat and eastern red bat (Arnette et al. 2013b). Table 4-4 presents the findings of three post-construction bat fatality studies, very few of which are *Myotis* species. This may suggest that resident bats experience a much lower fatality rate because they forage below the swept area of the WTG. With a hub height of 98 m and rotor length of 46 m the minimum swept height of the proposed Barrachois wind farm will be 52 m.

**Table 4-4: Bat species found as fatalities (Arnette et al. 2013b).**

| Wind Farm | Min swept height | Myotis species fatalities | Other species fatalities |
|---|---|---|---|
| Vermont 2012 | 33.5 m | 0% | 55% hoary bats<br>28% eastern red bats<br>17% silver-haired bats |
| Ontario 2011 | 33.5 m | 0%-1.9% | 50% hoary bats<br>17.3% eastern red bat<br>15.4% silver-haired bat<br>15.4% big brown bat |

| Wind Farm | Min swept height | Myotis species fatalities | Other species fatalities |
|---|---|---|---|
| Maryland 2013 | 33.5 m | 0%-1.2% | 53.7% eastern red bat<br>32.9% hoary bat<br>7.3 % silver haired bat<br>3.7% big brown bat<br>1.2% tri-colored bat<br>1.2% unidentified bat |

**Additional Monitoring & Mitigation**

The proponent is committing to additional Fall 2014 pre-construction bat monitoring. The acoustic monitoring equipment will be setup in the same location and format as the 2012 and 2013 surveys.

Additionally, the proponent is committing to active turbine mitigation (increasing rotor cut-in speed) during the operational phase of the project should the post-construction carcass search surveys reveal higher than normal bat fatalities on site.

Both the additional acoustic monitoring and the post construction mitigation plan are outlined in further detail in Section 7, Follow Up and Monitoring.

## 4.2 Socio-economic

### 4.2.1 Community

The community of Barrachois is located along the northeastern tip of Bras d'Or Lake and borders the communities of Ironville, Upper Leitches Creek, Scotch Lake and Long Island. Barrachois is approximately 7 km west of North Sydney and 15 km northwest of Sydney. Land in Barrachois is mainly used as residential property for year round and seasonal. There is a quarry located directly to the south of the Project lands.

The community remains rural and residences are located along the roadways such as Grand Narrows Highway, Scotch Lake Road and Long Island Road. There are 64 dwellings within 2,000 m of the WTGs and 36 are located within 1,500 m of the closest WTG.

Community meetings were held at the Boisedale Fire Hall and the Membertou Convention Center. Details from the community consultation are presented in Section 5.0.

### 4.2.2 Archaeological Resource Impact Assessment

A historic background study was conducted by Davis MacIntyre & Associates in May 2013. Historical maps, manuscripts, and published literature were consulted at Nova Scotia Archives and Records Management. The Maritime Archeological Resource Inventory, held at the Nova Scotia Museum's Heritage Division, was searched to understand prior archaeological research and known archeological resources neighbouring the Project site. A field reconnaissance was conducted in May 2013.

The historical background study indicates Cape Breton was occupied and used by the Mi'kmaq and their ancestors prior to European contact. The lands may have been used for hunting and gathering but the potential is low for finding any archaeological evidence of this activity at the study area. The study area appears to offer little in terms of long-term settlement and subsistence such as navigable waterways and fishing sites.

The historical background study also indicates that two properties and two houses were located within the study area circa 1886. These properties belong to J. Nicholson and J. McNeil and appear to be located at the northwest end of the study area, well outside the impact zones of the WTGs and access road. Aside from these two houses, no other buildings or infrastructure appears to have been located within the study area.

The Maritime Archaeological Resource Inventory indicated that no archaeological sites have been reported within a 5 km radius of the study area. However, two archaeological sites are known within a 15 km radius. Approximately 14 km south of the study area, stone flakes relating to First Nations occupation were noted on the beach of the Bras d'Or Lake in 1975. The second site is the remains of two houses representing nineteenth century Scottish occupation on the "Little" Peter MacIntyre property in Rear Boisdale; located approximately 11 km south west of the study area.

Fields reconnaissance was completed in May 2013, which consisted of an archaeological evaluation of the proposed turbine locations and the approximate access road route. The only evidence of historical activity found from the field reconnaissance was logging activity in the form of stumps and young tree growth. This was observed at the proposed location for WTG 1.

Research and field reconnaissance in the study area has revealed the presence of no areas of elevated archaeological potential or archaeological features.

### 4.2.3 Mi'kmaq Ecological Knowledge Study

**Review of Available Data**

Discussions were held with researchers from the Gorsebrook Institute and the Treaty and Aboriginal Rights Center. It was noted that research is still ongoing and as a result, information is not available for public release through a MEKS at this time.

Sessions in Eskasoni and Membertou were consistent in findings for all informants. Respondents were familiar with the area, but participants at the roundtable were not aware of any direct interaction with the area in many years. The most commonly cited reasons were:

- The area was used by non-aboriginal population so people would not feel comfortable hunting in the area;
- Better hunting areas in the Highlands (moose is a priority target for hunting);
- Too close to Sydney for good hunting; and
- Fewer hunters today compared to years ago (it was noted that only 60 persons were of the age of 65 in the community).

One respondent indicated that elders would use the area for picnicking in the past but was unable to assign any specific details as to the location. It was known that one elder had considerable experience in trapping fur-bearing animals in the general vicinity.

The participants in the Membertou discussions were also familiar with some activities in the Project area. The indicated to following uses in the area on or near the BWF project site:

- The water's edge has been used by Band members for swimming (possibly the same location implied by Eskasoni residents as to picnicking areas);
- Gathering (fruit);
- Deer hunting along Leitches Creek (near Barrachois);
- Fishing in Roach lake (in the general area of the Project site);
- Lobster fishing in the Bras d'Or Lake in the waters near the property.

It was stated by one Band member that while people do not extensively hunt in this area because better hunting in the Highlands and in areas closer to the reserve, it is possible that people may want to hunt in

the area in the future as game abundance changes in existing hunting areas frequented by Band members.

**Field Surveys**

A total of 24 plant species of edible, medical or other significance to the Mi'kmaq were recorded during the survey of the study area. An additional two species considered useful for other purposes were also recorded. Table 4-5 provides a list of all 24 culturally significant plant species encountered in the study area along with their tradition use category.

**Table 4-5: Culturally significant plant species recorded in the study area.**

| Mi'kmaq Name | Common Name | Scientific Name | Category |
|---|---|---|---|
| Tupsi | Alder | Alnus sp. | Useful species, Medicinal |
| | American Beech | Fagus grandifolia | Food |
| Stoqn | Balsam Fir | Abies balsamea | Useful species, Medicinal, Food |
| | Black Spruce | Picea mariana | Useful species, Medicinal, Food |
| | Common Blackberry | Rubus alleghanienses | Medicinal, Food |
| Wso'qmanaqsi'l | Bunchberry/ Dwarf Dogwood | Cornus canadensis | Medicinal |
| | Buttercup | Raninculus sp. | Medicinal |
| | Wild cherries | Prunus sp. | Food, Medicinal |
| | Large-fruited Cranberry | Vaccinum macrocarpon | Food, Medicinal |
| | Eastern Hemlock | Tsuga canadensis | Useful species, Medicinal, Food |
| | Everlasting | Antennaria sp. Or Anaphalis sp. | Medicinal |
| Wisawtaqji'jkl | Goldthread | Coptis trifolia | Medicinal |
| | Labrador Tea | Rhododendron groenlandicum | Medicinal, Food |
| | Sheep Laurel/ lambkill | Kalmia angustifolia | Medicinal |
| | Maple | Acer sp. | Food |
| | Mountain Ash | Sorbus Americana | Food |
| | Partridge Berry | Mitchella repens | Food, Medicinal |
| | Pussy Willow | Salix discolor | Medicinal |
| Klitawmanaqsi'k | Red Raspberry | Rubus idaeus | Food, Medicinal |
| Atuomkminaqsi | Virginia Strawberry | Fragaria virginiana | Food, Medicinal |
| | White Pine | Pinus strobus | Useful species, Medicinal, Food |
| | White Spruce (Cat Spruce) | Picea glauca | Food |
| Wopapa'kjukal | Wild Sarsaparilla | Aralia nudicaulis | Food |
| Nomnoqn | Yellow Birch | Betula alleghaniensis | Food, Medicinal |

A review of the historical use of wildlife and fish resources by Mi'kmaq, combined with known wildlife habitat preferences and the results of the habitat surveys, allowed a determination of wildlife species potentially using the Project site, which are:

- Black Bear
- Bobcat
- Eastern Coyote
- Red Squirrel
- Red Fox
- Raccoon
- Short-tailed Weasel
- White-tailed Deer
- Ruffed Grouse
- Great Horned Owl
- Barred Owl

### 4.2.4 Noise

Sound pressure level (SPL) is defined as the force of sound on a surface area. This is measured in dB(A); dB or decibels is a logarithmic unit that is used to measure SPL and (A) is the weighting applied to denote, as perceived by humans. Nova Scotia does not currently have any regulations pertaining to maximum sound pressure levels (SPL) required at receptor locations near wind farms; further, the CBRM Land Use By-Laws do not specify any restrictions pertaining to SPLs relating to WTG activities. As a best practice effort, the Proponent has followed the *Ontario Noise Guidelines for Wind Farms* as a guideline regarding acceptable noise emission from the BWF. The Ontario guidelines present a 40 dB(A) SPL as the maximum exposure level for a noise receptor (Ministry of the Environment, 2008).

A noise assessment was completed for the BWF using WindPRO software; the software uses ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors standards. By assuming conservative estimates of factors contributing the SPLs of the WTGs, the model yields results that represent a worst case scenario. A WTG hub height of 98 m was used with a SPL of 105 dB(A) being produced from the turbine nacelle, located at the hub height.

A total of 64 receptor points were used to represent 64 dwellings within a 2,000 m range of the proposed turbine locations. The model was run using two turbines with no added vegetation layer and continuous downwind propagation for conservative results. The closest receptor is located 994 m from a turbine, this receptor was subjected to a maximum SPL of 35.7 dB(A). Table 4-6 presents a summary of the receptors and the maximum SPL that may be experienced under a worst case scenario and their compliance with the Ontario guidelines. The full noise impact assessment can be found in Appendix H.

**Table 4-6: SPL from WTG at receptor locations**

| Point of Reception ID letter | Distance from Receptor to nearest wind turbine (m) | Max Sound Level from wind farm for all wind speeds dB(A) | Compliance with Ontario Guidelines (Yes/No) | Compliance with 40 dB(A) Noise Level (Yes/No) |
|---|---|---|---|---|
| A | 1111 | 35.3 | Yes | Yes |
| B | 1219 | 33.4 | Yes | Yes |
| C | 2344 | 26.9 | Yes | Yes |
| D | 997 | 35.6 | Yes | Yes |
| E | 1700 | 30.8 | Yes | Yes |
| F | 1006 | 35.5 | Yes | Yes |
| G | 1236 | 33.2 | Yes | Yes |
| H | 2024 | 28.6 | Yes | Yes |
| I | 1799 | 30 | Yes | Yes |
| J | 1622 | 31.4 | Yes | Yes |
| K | 1740 | 30 | Yes | Yes |
| L | 1136 | 34.1 | Yes | Yes |
| M | 1823 | 29.9 | Yes | Yes |
| N | 1348 | 33.6 | Yes | Yes |
| O | 1642 | 31.2 | Yes | Yes |
| P | 1166 | 35 | Yes | Yes |
| Q | 1783 | 30.2 | Yes | Yes |
| R | 1139 | 34.2 | Yes | Yes |
| S | 1126 | 34.2 | Yes | Yes |
| T | 1059 | 35.6 | Yes | Yes |
| U | 1664 | 30.5 | Yes | Yes |
| V | 1520 | 32.1 | Yes | Yes |
| W | 2413 | 26.5 | Yes | Yes |
| X | 994 | 35.7 | Yes | Yes |
| Y | 1193 | 33.6 | Yes | Yes |
| Z | 1217 | 34.2 | Yes | Yes |
| AA | 2419 | 26.5 | Yes | Yes |
| AB | 1303 | 32.9 | Yes | Yes |
| AC | 1941 | 29.1 | Yes | Yes |
| AD | 1251 | 34.2 | Yes | Yes |
| AE | 1382 | 33.3 | Yes | Yes |
| AF | 2298 | 27.1 | Yes | Yes |
| AG | 1135 | 34.1 | Yes | Yes |
| AH | 1132 | 35.2 | Yes | Yes |
| AI | 1757 | 30 | Yes | Yes |
| AJ | 1500 | 31.2 | Yes | Yes |
| AK | 1763 | 30.3 | Yes | Yes |
| AL | 1923 | 29.3 | Yes | Yes |
| AM | 1289 | 34.2 | Yes | Yes |
| AN | 1330 | 33.8 | Yes | Yes |

| Point of Reception ID letter | Distance from Receptor to nearest wind turbine (m) | Max Sound Level from wind farm for all wind speeds dB(A) | Compliance with Ontario Guidelines (Yes/No) | Compliance with 40 dB(A) Noise Level (Yes/No) |
|---|---|---|---|---|
| AO | 1179 | 34.4 | Yes | Yes |
| AP | 1008 | 35.8 | Yes | Yes |
| AQ | 1765 | 30.3 | Yes | Yes |
| AR | 2440 | 26.4 | Yes | Yes |
| AS | 1162 | 34.7 | Yes | Yes |
| AT | 1300 | 32.7 | Yes | Yes |
| AU | 2445 | 26.4 | Yes | Yes |
| AV | 1036 | 35.7 | Yes | Yes |
| AW | 1145 | 34 | Yes | Yes |
| AX | 1421 | 32.9 | Yes | Yes |
| AY | 2372 | 26.8 | Yes | Yes |
| AZ | 1871 | 29.6 | Yes | Yes |
| BA | 1392 | 32.3 | Yes | Yes |
| BB | 1640 | 31.3 | Yes | Yes |
| BC | 1791 | 29.7 | Yes | Yes |
| BD | 1186 | 33.6 | Yes | Yes |
| BE | 1435 | 31.7 | Yes | Yes |
| BF | 1164 | 33.8 | Yes | Yes |
| BG | 1150 | 34 | Yes | Yes |
| BH | 1365 | 32.2 | Yes | Yes |
| BI | 1221 | 34.6 | Yes | Yes |
| BJ | 1049 | 36.2 | Yes | Yes |
| BK | 1688 | 31 | Yes | Yes |
| BL | 1698 | 30.8 | Yes | Yes |

### 4.2.5 Visual

ReSoft Ltd WindFarm software was used to create a photomontage of the BWF. One location was chosen to present a predicted view of the wind farm using a 98 m hub height; Figure 4-8 shows the photomontage taken from Grand Narrows Highway looking north at the Project site.

**Figure 4-7: Predicted view looking north from Grand Narrows Highway approximately 3 km from the proposed WTG location.**

### 4.2.6 Shadow Flicker

The Proponent has undertaken a shadow flicker impact assessment for the BWF to assess the potential impact of shadow flicker on the surrounding dwellings within a 2,000 m radius. Shadow flicker is the change in light received by a receptor due to a WTG blade impeding the light path between the sun and the receptor. As there are few federal, provincial or municipal guidelines or policies for governing or quantifying what is an acceptable amount of shadow flicker, the German standards, *Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergianlagen* have been adopted for the purpose of this study and are generally used within the wind energy industry as standard guidelines. These guidelines, based on astronomic worst case scenario suggest that acceptable levels at each shadow receptors are:

- No more than 30 hours per year of astronomical maximum shadow (worst case); and
- No more than 30 minutes on the worst day of astronomical maximum shadow (worst case).

The guidelines also specify two factors that limit the shadow flicker effect, due to optic conditions in the atmosphere:

1. The angle of the sun over the horizon, which must be at least 3 degrees; and
2. The blades of the WTG must cover at least 20 % of the sun.

Receptors exposed to less than 30 minutes per day on the worst affected day or a total of 30 hours per year from all WTGs are considered unlikely to require technical mitigation.

Receptors used in the shadow flicker assessment are at the same locations used for the noise assessment; this being a total of 64 receptors representing 64 dwellings. The model was run with WindPRO software to predict astronomical worst case shadow flicker at each receptor in terms of total

hours per year, days per year, and maximum minutes per day. Table 4-7 presents a summary of the results for the shadow flicker assessment. Some receptors may not experience any shadow flicker at all as the model uses conservative assumptions, which is described in detail in the full shadow flicker impact assessment in Appendix I.

**Table 4-7: Predicted maximum worst case shadow flicker results summary.**

| Point of Reception ID letter | Shadow flicker | | |
|---|---|---|---|
| | Shadow hours per year (hr/year) | Shadow days per year (days/year) | Shadow hours per day (hours/day) |
| A | 7:38 | 30 | 0:20 |
| B | 0:00 | 0 | 0:00 |
| C | 0:00 | 0 | 0:00 |
| D | 0:00 | 0 | 0:00 |
| E | 0:00 | 0 | 0:00 |
| F | 0:00 | 0 | 0:00 |
| G | 0:00 | 0 | 0:00 |
| H | 0:00 | 0 | 0:00 |
| I | 0:00 | 0 | 0:00 |
| J | 0:00 | 0 | 0:00 |
| K | 0:00 | 0 | 0:00 |
| L | 0:00 | 0 | 0:00 |
| M | 0:00 | 0 | 0:00 |
| N | 6:39 | 31 | 0:17 |
| O | 0:00 | 0 | 0:00 |
| P | 7:42 | 31 | 0:19 |
| Q | 0:00 | 0 | 0:00 |
| R | 0:00 | 0 | 0:00 |
| S | 0:00 | 0 | 0:00 |
| T | 12:48 | 51 | 0:21 |
| U | 0:00 | 0 | 0:00 |
| V | 0:00 | 0 | 0:00 |
| W | 0:00 | 0 | 0:00 |
| X | 0:00 | 0 | 0:00 |
| Y | 0:00 | 0 | 0:00 |
| Z | 9:44 | 44 | 0:18 |
| AA | 0:00 | 0 | 0:00 |
| AB | 0:00 | 0 | 0:00 |
| AC | 0:00 | 0 | 0:00 |
| AD | 6:13 | 27 | 0:18 |
| AE | 13:51 | 63 | 0:17 |
| AF | 0:00 | 0 | 0:00 |
| AG | 0:00 | 0 | 0:00 |
| AH | 7:37 | 30 | 0:20 |

| Point of Reception ID letter | Shadow flicker | | |
|---|---|---|---|
| | Shadow hours per year (hr/year) | Shadow days per year (days/year) | Shadow hours per day (hours/day) |
| AI | 0:00 | 0 | 0:00 |
| AJ | 0:00 | 0 | 0:00 |
| AK | 0:00 | 0 | 0:00 |
| AL | 0:00 | 0 | 0:00 |
| AM | 9:45 | 44 | 0:18 |
| AN | 10:03 | 46 | 0:17 |
| AO | 9:59 | 45 | 0:18 |
| AP | 7:15 | 26 | 0:21 |
| AQ | 0:00 | 0 | 0:00 |
| AR | 0:00 | 0 | 0:00 |
| AS | 6:17 | 26 | 0:19 |
| AT | 0:00 | 0 | 0:00 |
| AU | 0:00 | 0 | 0:00 |
| AV | 12:47 | 50 | 0:21 |
| AW | 0:00 | 0 | 0:00 |
| AX | 0:00 | 0 | 0:00 |
| AY | 0:00 | 0 | 0:00 |
| AZ | 0:00 | 0 | 0:00 |
| BA | 0:00 | 0 | 0:00 |
| BB | 0:00 | 0 | 0:00 |
| BC | 0:00 | 0 | 0:00 |
| BD | 0:00 | 0 | 0:00 |
| BE | 0:00 | 0 | 0:00 |
| BF | 0:00 | 0 | 0:00 |
| BG | 0:00 | 0 | 0:00 |
| BH | 0:00 | 0 | 0:00 |
| BI | 7:30 | 32 | 0:18 |
| BJ | 0:00 | 0 | 0:00 |
| BK | 0:00 | 0 | 0:00 |
| BL | 0:00 | 0 | 0:00 |

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# 5.0 Consultation

## 5.1 Community Engagement

Open, transparent and comprehensive community engagement is crucial to the success of any development. Community engagement forms an integral part of the proposed BWF development and consists of various engagement activities the Proponent will undertake throughout the development, construction, and operation of the wind farm. The Proponent is committed to addressing, to the best of their abilities, all concerns pertaining to this proposed development raised by local residents and community members.

The numerous engagement activities described in the following section will provide an opportunity to facilitate meaningful dialogue between various stakeholders and the Project Proponent; as well as provide true and accurate information pertaining to the Project in an open and transparent fashion. A comprehensive stakeholder engagement list has been formed, and will be kept up to date as further stakeholders express their interest in the Project.

## 5.2 Community

**First Public Meeting**

An open house was held on November 3, 2011 at the Membertou Convention Center from 5:00 pm – 8:30pm. The meeting was advertised via Canada Post Admail, a service offered that facilitates the distribution of invitations/ flyers to a defined geographic location. The open house was attended by 65 community members and the meeting lasted three hours and a half hours.

The Proponent handed out questionnaires to attendees at the first public meeting. The questionnaire was designed to gather contact information so interested persons could be provided with up to date information, to learn about the public's interest in having a wind farm in their community and provide an opportunity for the public to express any concerns they had regarding the BWF Project. The open house format was held as an open discussion where Project information posters were displayed presenting Project information with Proponent representatives were present to answer questions the public had.

Following the meeting, the proponent addressed any questions/concerns that were submitted via the questionnaires by writing personal letters addressing the specific concern of the stakeholder.

**Second Public Meeting**

A second public open house was held on September 16, 2013 at the Boisedale Fire Hall from 5:00pm – 8:00pm. The open house was advertised via Canada Post Admail as described above approximately 630 invitations were sent out. An advertisement was published in The Cape Breton Post advertising details regarding the open house. Stakeholders who expressed interest in the project were personally

contacted and invited to attend the second open house. Finally, personal invitations were sent to Government stakeholders and First Nations right-holders inviting them to participate in the open house.

Again, the proponent handed out questionnaires as described above in an effort to collect valuable public feedback. The open house was held as an open discussion with Proponent representatives engaging in conversation with the attendees to address any issues or concern.

**Website**

The Proponent has set up a Project website for the BWF. The website: www.barrachoiscommunitywindfarm.ca will be updated periodically and used to inform the general public right-holders and stakeholders about all aspects of the proposed development. Website content and updates will include some or all of the following items:

- Notices for public information sessions;
- Photos of the Project location and turbine types;
- Progress reports on the Environmental Assessment;
- Environmental Assessment;
- Construction activity notifications;
- Online questionnaire and comment form (Have Your Say); and
- Media and PR related material

**Newsletters**

Previous wind farms developed by the Proponent included newsletters as a key engagement tool to update and inform the local community on recent Project activities. The Proponent may circulate newsletters via email, website and Canada Post to the community throughout the 2013 and 2014 calendar years.

**Issues Resolution**

The Proponent has drafted a Complaint Resolution Plan, which covers what community members should do and whom to contact should there be negative impacts affecting the community members or the environment caused by the BWF development. The Complaint Resolution Plan can be found in Appendix K.

## 5.3 Aboriginal Peoples

The aboriginal population has been contacted through right-holder update letters throughout the development process. Most recent efforts include letters mailed to First Nation Chief's in the region providing an update of the Project status, as well as providing the Proponents contact info in an effort to engage First Nations.

The Office of Aboriginal Affairs, Membertou, Eskasoni and Wagmatcook First Nations have been contacted via telephone to engage the First Nations community. This effort was to provide information regarding the public meetings that would be taking place and to extend a personal invite to the Chief of Indian Brook First Nation. Table 5-1 presents a log of communications activities between the Proponent and various Aboriginal groups relative to the BWF.

**Table 5-1: Communication activities with First Nations.**

| Date | Person Contacted | Band/Organization | Method of Communication | Content |
|---|---|---|---|---|
| September 15, 2011 | Twila Gaudet, Consultation Liaison Officer | Kwilmu'kw Maw-Klusuaqn Negotiation Office | Letter | Initial engagement efforts with Mi'kmaq communities |
| November 1, 2011 | Twila Gaudet, Consultation Liaison Officer | Kwilmu'kw Maw-Klusuaqn Negotiation Office | Letter | Invitation to first public meeting |
| November 1, 2011 | Norman Francis Bernard, Chief | Wagmatcook First Nation | Letter | Invitation to first public meeting |
| November 1, 2011 | Terry Paul, Chief | Membertou First Nation | Letter | Invitation to first public meeting |
| November 1, 2011 | Leyroy Denny, Chief | Eskasoni First Nation | Letter | Invitation to first public meeting |
| August 20, 2013 | Norman Francis Bernard, Chief | Wagmatcook First Nation | Letter | Project Update |
| August 20, 2013 | Terry Paul, Chief | Membertou First Nation | Letter | Project Update |
| August 20, 2013 | Leyroy Denny, Chief | Eskasoni First Nation | Letter | Project Update |
| September 6, 2013 | Norman Francis Bernard, Chief | Wagmatcook First Nation | Letter | Invitation to second public meeting |
| September 6, 2013 | Terry Paul, Chief | Membertou First Nation | Letter | Invitation to second public meeting |
| September 6, 2013 | Leyroy Denny, Chief | Eskasoni First Nation | Letter | Invitation to second public meeting |

## 5.4 Regulatory

The Proponent has engaged in consultation with Municipal, Provincial and Federal Government bodies regarding the proposed BWF Project.

**Municipal Consultation**

The Proponent has engaged members of the CBRM planning department to discuss the planning regime such as permitting requirements on numerous occasions. Consultation provided the Proponent with detail regarding regional by-laws, land use and other policies within the CBRM that would relate to the proposed development of the BWF.

Appendix L presents a log of communication between the Proponent and members of the CBRM and council member throughout the duration of the Project thus far.

As a continuous effort, the Proponent will be in constant consultation with the municipality and council members throughout the duration of the Project.

**Provincial Consultation**

The Proponent has met with various provincial organizations regarding the development of the BWF.

The scoping of this Environmental Assessment document was discussed with the Nova Scotia Department of Environment – Environmental Assessment branch (EA branch) and the NSDNR. The consultation provided valuable information regarding the EA process, document formatting and relevant Health Canada studies to review.

Consultation topics with the EA Branch and NSDNR included:

- Surveys and studies to conduct as part of the BWF Environmental Assessment;
- Ideal dates to conduct effective bat monitoring surveys (last week of August to second week of September);
- Potential for bat hibernacula in the region;
- Background for further investigating the potential impact the WTGs may have on bird and bat species. Particular focus on regional weather, mainly fog and the potential impact WTG will have on species at risk during fog events was discussed and determined to be further investigated in the EA;
- Provide insight on proper course of action to take in effectively avoiding wetlands, mitigating impacts on wetlands and compensation that is required when direct wetland alteration is required;
- Local Marten and Lynx DNR wildlife inventory reports from the regional biologist
- Species at risk in general, and approach to assessment in EA.

As a continuous effort, the Proponent will be in constant consultation with the appropriate provincial departments throughout the duration of the Project.

**Federal Consultation**

The Proponent has consulted with various Federal Government entities regarding the construction of the BWF. Environment Canada, NAV Canada, Transport Canada and the Department of National Defence were all contacted regarding the development of the BWF. Like their provincial counterparts, they have assisted in the preparation of this EA, Project planning and design.

The Proponent will continue to engage Federal regulators when required throughout the development, construction and operation of the BWF as appropriate.

## 5.5 Public and Aboriginal Concern

Based on the public meeting questionnaires, individual discussion and aboriginal consultation, local residents and aboriginal people have raised concerns relating to the Project and project activities. These concerns have been addressed in this EA. All issues raised have been identified in Table 5-2; included in this table is the section(s) in which the public and aboriginal issues have been addressed. As previously mentioned in Section 5.1 the Proponent is committed to addressing, to the best of their abilities, all concerns pertaining to this proposed development raised by local residents and community members.

**Table 5-2: Summary of issues raised.**

| Issues Raised | Section(s) |
|---|---|
| Noise generated by WTG | 4.2.4, 6.3, Appendix H |
| Shadow Flicker Effect | 4.2.6, 6.3, Appendix I |
| Impact on birds | 6.2, Appendix B |
| Impact on bats | 4.1.7, 6.2, Appendix C |
| Health & Safety | 6.3 |
| Impact on property values | 6.3 |

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# 6.0 Analysis

The construction, operation and decommissioning phases of the BWF Project have the potential to affect physical, biophysical, and socio-economic environment. Identifying the VECs is an important part of the EA process. Following the presentation of the Project's activities in Section 2, the Environmental Setting in Section 4 and the review of issues identified from consultation in Section 5, the interaction of the Project activities with the VECs can be completed.

An interaction matrix in Table 6-1 presents the potential interactions between Project activities and each identified VEC. These VECs are presented in the following sub-sections in terms of potential environmental effects of Project activities including accidents and malfunctions, as well as proposed mitigation strategy, cumulative effects and finally, the level of significance of the residual effects. This VEC assessment is completed as outlined in the methodology as presented in Section 3.

**Table 6-1: Potential Linkages of Project and the Environment.**

| | Site Preparation and Construction | | | | | | | | Operation and Maintenance | | | Decommissioning | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Clearing and Grubbing | Access Road and Laydown Area | Turbine Foundation | Power Pole and Line & U/G Electrical | Crane Pad Construction | Turbine Installation | Commissioning | Accidents and Malfunctions | Turbine Operation | Inspection and Maintenance | Accidents and Malfunctions | Infrastructure Demolition | Site Reclamation | Accidents and Malfunctions |
| Physical VECs | | | | | | | | | | | | | | |
| Ambient air | • | | | | | | | • | | | | • | | • |
| Ground and Surface Water | • | • | • | • | | | | • | | | • | • | • | • |
| Ambient noise | • | • | • | • | • | | • | | • | | | • | • | |
| Ambient light | | | | | | • | | | • | | | | | |
| Biophysical VECs | | | | | | | | | | | | | | |
| Wetlands / watercourses | • | • | | | • | | | • | | | | | | |
| Fish and Fish Habitat | • | • | | | | | | • | | | • | | | • |
| Migratory and breeding birds | • | • | | | • | | | | • | | | | • | |

| | Site Preparation and Construction | | | | | | | | Operation and Maintenance | | | Decommissioning | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Clearing and Grubbing | Access Road and Laydown Area | Turbine Foundation | Power Pole and Line & U/G Electrical | Crane Pad Construction | Turbine Installation | Commissioning | Accidents and Malfunctions | Turbine Operation | Inspection and Maintenance | Accidents and Malfunctions | Infrastructure Demolition | Site Reclamation | Accidents and Malfunctions |
| Flora | • | • | | | • | | | | | | | | • | |
| Fauna | • | • | | | • | | | | • | | • | | • | |
| Socio-economic VECs | | | | | | | | | | | | | | |
| Land use | • | | | | | | | | • | | | | | |
| Aboriginal resources / uses | • | • | • | • | | | | | | | | | | |
| Archaeological | • | • | • | • | | | | | | | | | • | |
| Vehicular traffic | | | • | • | • | • | | | | | | | | |
| Telecommunications & Radar Communications | | | | | | | | | • | | | | | |
| Landscape aesthetics | | | | | | | | | • | | | | | |
| Health and safety | | | | | | | | • | | | • | | | • |
| Local economy | • | • | • | • | • | • | • | | • | • | | • | • | |

## 6.1 Assessment of Physical VECs

**Ambient Air**

Control and monitoring of ambient air quality is important in maintaining a healthy work, recreation and living environment. Based on the nature of activities that will take place at the Project site, ambient air quality has been identified as a VEC.

A significant environmental effect would result if a significant increase in contaminant concentration was determined a result of Project activities.

*Boundaries* – Spatial boundaries include the Project site for over all vehicular emissions but also focusing on gravel access roads up to the WTGs for fugitive dust. The temporal boundary focuses on the Project

construction and decommissioning phases during high vehicular traffic activities from machinery and trucks.

**Table 6-2: Potential impacts and proposed mitigative measures for ambient air.**

| Potential Impacts on Ambient Air | Proposed Mitigative Measures |
|---|---|
| **Local air quality may be affected through fugitive dust from access roads during construction and decommissioning** | • Fugitive dust during dry weather conditions may be controlled with the application of water. |
| **Local air quality may be affected through tailpipe emissions from construction vehicles and machinery** | • All vehicles and machinery will comply with current emission standards and will be used efficiently, minimizing distances travelled whenever possible. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – A decrease in ambient air quality is determined to be negligible; fugitive dust will be eliminated through mitigative measures and vehicle emissions will comply with current emission standards. Therefore, the significance of residual effects on ambient air is to be considered negligible.

**Ground and Surface Water**

Management of ground and surface water quality is important as they are an integral aspect of a diverse ecosystem and functional ecology. Dwellings in this area rely on well water; therefore ground and surface water are also directly related to human health for this Project. Several wetlands and watercourses have been identified at the Project site and are assessed in detail in Section 6.2 under wetlands and watercourses. As a result, ground and surface water quality and quantity have been identified as a VEC.

A significant environmental effect would result if a considerable change to ground or surface water quantity or quality could be identified as a result of project activities.

*Boundaries* – Spatial boundaries include the ground and surface water at the Project site as well as any water bodies and watercourses that are supplied by the ground and surface water. Temporal boundaries are focused on the construction and decommissioning phases but include all phases of the Project in the unlikely event of an unplanned release.

**Table 6-3: Potential impacts and proposed mitigative measures for ground and surface water.**

| Potential Impacts on Ground and Surface Water | Proposed Mitigative Measures |
|---|---|
| **Vegetation clearing, grubbing, ground stripping, excavation and machinery traffic during the construction of the WTG pads and access road might induce a change in hydrology or sediment input into ground and surface water.** | • Efforts will be made to design the access road such that it does not interfere with a watercourse, water body or drainage channel;<br>• Where possible, clearing shall take place in the winter months on frozen ground;<br>• Erosion control strategies (ie. Straw bales and geo-textiles) will be outlined in the Erosion and Sedimentation Control Plan hopes to maintain baseline water quality conditions in the watercourses and wetlands at the site; and<br>• Where water must be pumped out of excavation pits, there will not be a discharge into a wetland, watercourse or defined channel. If pumped water contains total suspended solids (TSS) the water will be pumped to vegetated land with gentle slope to allow sediment to filter, or filtered before release with a filter bag. |
| **Exposure or accidental spillage of hazardous materials such as fuel, oils and hydraulic fluids has potential to contaminate ground water supplies during construction, operation and decommissioning phases.** | • Equipment shall be in good working order and maintained so as to reduce risk of spill/leaks and avoid water contamination;<br>• Spill response kits will be provided on site to ensure immediate response to a potential waste release; and<br>• Routine maintenance, refuelling and inspection of machinery will be performed off-site whenever possible. |

| Potential Impacts on Ground and Surface Water | Proposed Mitigative Measures |
|---|---|
| **Vehicular traffic during decommissioning might induce a change in hydrology or sediment input into ground and surface water.** | • Efforts will be made such that the access road does not interfere with a watercourse, water body or drainage channel;<br>• Erosion control strategies (ie. Straw bales and geo-textiles) will be outlined in the Erosion and Sedimentation Control Plan hopes to maintain baseline water quality conditions in the watercourses and wetlands at the site; and<br>• Used oil filters, grease cartridge containers and other products associated with equipment maintenance shall be collected and disposed of in accordance with regulatory guidelines. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – After employing the proposed mitigative strategy, should any sedimentation and/or erosion occur it will be temporary, of small magnitude and contained. While any direct release into ground or surface water will be a negative effect, it will be of small magnitude, of short duration and local. The significance of residual effects on ground and surface water is to be considered negligible.

**Ambient Noise**

Noise is defined as a sound, especially one that is loud, unpleasant or that causes disturbance. The Project poses two issues with noise pollution, which could affect local residents. Noise from the construction and decommissioning phase, as well as noise from the WTG operation is to be expected. As a result, ambient noise has been identified as a VEC.

A significant environmental effect would result if a considerable change in the ambient noise was found to be the result of project activities.

*Boundaries* – The spatial boundary is the area in which the noise impact study was conducted; this being a 2,000 m radius from the WTG location. The temporal boundary includes all Project activities from site preparation, construction, and operation to decommissioning.

**Table 6-4: Potential impacts and proposed mitigative measures for ambient noise.**

| Potential Impacts on Ambient Noise | Proposed Mitigative Measures |
|---|---|
| **During construction and decommissioning phases the ambient noise sound pressure levels will be affected as a result of the use of equipment and machinery such as excavators, dump trucks and bulldozers. Elevated noise levels can disturb fauna and local residents.** | • Noise impact will be limited by restricting construction and decommissioning activities to daytime hours when appropriate;<br>• Health Canada recommends the long-term average day-night sound level (Ldn) be below 57 db(A) at the closest residence. An Ldn of 57 db(A) is expected to be within the threshold for widespread complaints for construction noise. (USEPA, 1974). |
| **Elevated sound pressure levels will be observed during operation from the nacelle, which is 98 m above ground level.** | • A noise impact assessment has been conducted to predict a 'worst case scenario' sound pressure level that can be expected at the surrounding dwellings; and<br>• By minimizing grubbing and clearing, flora on the Project site will aid in attenuation of noise produced from the WTG as perceived by local receptors. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – Elevated SPLs caused by construction and decommissioning phases will be temporary, during the day and short term. Noise production from the WTG during operation has been mitigated by setback distances and confirmed by a noise impact assessment. The Project is not anticipated to have any significant residual environmental effect on the ambient noise levels. While any effect on ambient noise will be negative, the significance of residual effects on ambient noise is to be considered minor.

**Ambient Light**

There are three attributes associated with the Project that have potential to cause an impact on ambient lighting; lighting during night time construction activities, WTG lighting, and shadow flicker are expected to contribute to ambient lighting. By employing the proposed mitigation strategy, the effect of the Project on ambient lighting can be considered negligible.

A significant environmental effect would result if a considerable change in the ambient light was found to be the result of project activities.

*Boundaries* – The spatial boundary is the area in which the noise impact study was conducted; this being a 2.0 km radius from the WTG location. The temporal boundary is focused on the operation phase of the WTG but also includes the turbine installation phase of construction.

**Table 6-5: Potential impacts and proposed mitigative measures for ambient light.**

| Potential Impacts on Ambient Light | Proposed Mitigative Measures |
|---|---|
| **During the night time, lighting will be seen atop some of the WTG, depending on the WTG layout.** | • LED lighting will be used to minimize light throw;<br>• Only the minimum amount of pilot warning and obstruction avoidance lighting will be used;<br>• Only lights with short flash durations and the ability to emit no light during the 'off phase' of the flash (i.e. as allowed by strobes and modern LED lights) will be installed on tall structures; and<br>• Lights will operate at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada. |
| **Shadow flicker may occur during certain weather conditions and times of the year.** | • The potential negative effect of shadow flicker has been mitigated at the design stage through responsible turbine siting; and<br>• Compliance with industry standard guidelines on shadow flicker. All dwellings will, in a worst case scenario experience less than 30 hours of shadow flicker per year and 30 minutes of shadow flicker on the worst day. |
| **Lighting during night time construction activities such as turbine installation.** | • Construction activities will be limited to the day time when possible. The turbine may be erected during the evening as the activity must be completed when the wind is less than 4 m/s. These conditions are commonly seen in the early evening. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – Annoyance during project construction from work lighting, if necessary, will be temporary and of short duration. Lighting concerns from residents during operations such as shadow flicker and WTG lighting is expected to be limited, as mitigation measures were employed

during site design. Therefore, while any effect on ambient light will be negative, the significance of residual effects on ambient light is predicted to be negligible.

## 6.2 Assessment of Biophysical VECs

**Wetlands / Watercourses**

Management of wetlands and watercourses is an important and integral aspect of maintaining a diverse ecosystem. The Projects impact on ground and surface water quality and quantity as assessed in Section 6.1 was predicted to be negligible in terms of significance of environmental effect. While the quality and quantity of ground and surface water is important in terms of ecological functionality of wetlands and watercourses the Project may also interact with wetlands and watercourses in terms of direct alteration.

As discussed in Section 4.1.3, the WTGs have been re-located a minimum of 30 m plus blade length (76 m total) from the identified wetlands and watercourse. As a result of the wetland and watercourse surveys identifying numerous water features at the Project site, wetlands and watercourses have been identified as a VEC. The mitigation sequence of avoidance, minimization of impact and compensation as detailed by NSE's Wetland Conservation Policy will be followed (NSE, 2011).

A significant environmental effect would result if a considerable change to wetlands and watercourses was the result of project activities.

*Boundaries* – Spatial boundaries are limited to works associated with the Project focusing on the access road and WTG locations. The temporal boundary focuses on Project construction but also includes operation and decommissioning for the unlikely event of an accident or malfunction.

**Table 6-6: Potential impacts and proposed mitigative measures for wetlands / watercourses.**

| Potential Impacts on Wetlands / Watercourses | Proposed Mitigative Measures |
|---|---|
| **During the construction phase, possible impacts to wetlands may arise from clearing, grubbing, infilling and excavation of the soil needed for constructing the access road. Such activities might induce silt run-off, alter flow into the wetlands or see them become repositories of significantly increased water flow, nutrients or sediments.** | • Avoidance of all wetlands and locating turbines at least 76m from delineated wetlands;<br>• Two wetland and watercourse field surveys have been completed to date to ensure wetlands have not been missed;<br>• In wetlands associated with sensitive water crossings, grubbing shall be minimized by the placement of geo-textile;<br>• Construction of the access road will attempt to create a buffer surrounding the wetland;<br>• NSE will be continually consulted throughout the wetland and watercourse alteration process; and<br>• The Environmental Management Plan will include all Provincial and Municipal regulations as well as all conditions determined by the Nova Scotia Wetland Alteration approval. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – The Project will be continually optimized around the access road design constraints to avoid direct alteration of wetlands and watercourses. The WTGs have been located such that a minimum 76 m buffer (blade length + 30 m) exists between each WTG and any wetland. NSE will be provided with additional detail and all work will be completed as per Provincial requirements. Any direct alteration is expected to be small in magnitude and may fall under the Wetland Conservation Policy exemption. Compensation will be completed as required under the Nova Scotia Wetland Conservation Policy. The significance of residual effects on wetlands and watercourse is predicted to be minor.

**Fish and Fish Habitat**

Alteration of freshwater environments such as the potential watercourse alteration proposed for the proposed access road may be required; however it is not expected to impede any fish habitat on the Project site. The wetlands and watercourse survey identified all wetlands on the Project site as swamps or marshes, therefore not providing a suitable environment for fish habitat. The Proponent has identified Bras d'Or Lake as the closest water body likely to support fish and fish habitat. The Proponent

does not expect any impact to this water body and as a result of the Project, and expects the significance of residual effects on fish and fish habitat to be negligible.

**Migratory and Breeding Birds**

Throughout the construction operation and decommissioning of a wind farm the potential negative impacts can be classified into four categories: collision, displacement due to disturbance, barrier effects, and habitat loss. As a result, migratory and breeding birds have been identified as a VEC. The Proponent will comply with the *Migratory Bird Convention Act* at all times and for all project related activities.

A significant environmental effect would result if a considerable change to migratory and breeding birds was the result of project activities.

*Boundaries* – The spatial boundaries include the area in that the WTG will be located, also including pathways and locations that are frequented by birds. The temporal boundary is all phases of the Project.

**Table 6-7: Potential impacts and proposed mitigative measures for migratory and breeding birds.**

| Potential Impacts on Migratory and Breeding Birds | Proposed Mitigative Measures |
|---|---|
| **During construction (clearing/grubbing) some vegetation might be cleared that may be habitat to some migratory birds.** | • The Proponent will avoid site clearing activities near areas where both the Olive-sided flycatcher and nesting Goshawk was observed, along with other identified avian species at risk;<br>• In particular, a 200 m minimum clearance buffer will be observed from the approximate Northern Goshawk nesting location;<br>• Should clearing activities occur during breeding season, a 350 m clearance buffer will be observed around the approximate nesting Goshawk location; and<br>• The Proponent will endeavor to conduct construction activities such as clearing and grubbing during a time period that does not coincide with the time period in which migratory birds would possibly be in the area. |

| Potential Impacts on Migratory and Breeding Birds | Proposed Mitigative Measures |
|---|---|
| **During operation there is a possibility that migrating birds could collide with the WTG.** | • A desktop and field study has been conducted to identify and assess the presence of migratory and breeding birds. The studies determined the Project site does not support a large number of migrating birds; and<br>• A follow up avian mortality survey will be conducted after the WTG commissioning and appropriate actions will be taken in consultation with NSDNR and CWS should there be a significant negative impact to migration flyways. |
| **Birds may alter their migration flyways and/or local flight paths to avoid WTG.** | • A follow up avian mortality survey will be conducted after the WTG commissioning and appropriate actions will be taken in consultation with NSDNR and CWS should there be a significant negative impact to migration flyways. |
| **Fog events can impair avian visibility, increasing the likelihood of mortality from collision with WTG.** | • Environment Canada climate database has been consulted to predict the rate of fog occurrence;<br>• An annual average of 4 % fog is observed at a weather station in close proximity to Project site; and<br>• Instructions will be given to wind farm maintenance staff to ensure all work lights are turned off upon leaving the site particularly during foul weather events. |
| **The WTG footprint will cause a loss of habitat for breeding and migratory birds.** | • The Proponent will avoid site clearing activities near areas where both the Olive-sided flycatcher and nesting Goshawk was observed, along with other identified avian species at risk; and<br>• Desktop and field studies conducted suggest that no more than 1.8 hectares will be considered a loss of habitat. This is considered to have no negative impact on migratory and breeding birds. |

| Potential Impacts on Migratory and Breeding Birds | Proposed Mitigative Measures |
|---|---|
| **Lighting on turbines can result in adverse impacts on birds. The Proponent recognizes that nocturnal migrant and night-flying seabirds are the birds most at risk of attraction to lights.** | • Only the minimum amount of pilot warning and obstruction avoidance lighting will be used;<br>• Only lights with short flash durations and the ability to emit no light during the 'off phase' of the flash (i.e. as allowed by strobes and modern LED lights) will be installed on tall structures;<br>• Lights will operate at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada;<br>• Instruction will be given to wind farm maintenance staff to ensure all work lights are turned off upon leaving the site particularly during foul weather events; and<br>• A follow up avian mortality survey will be conducted after the wind farm commissioning, and appropriate actions will be taken in consultation with NSDNR and CWS should there be a significant negative impact to night migrants. |
| **There will be an increase in habitat when the Project site is reclaimed at the end of the 20 year project lifetime.** | • N/A – no mitigation measures necessary for a positive potential impact. |
| **When the WTG are removed there will no longer be the potential barrier effect impeding flyways or local flight paths.** | • N/A – no mitigation measures necessary for a positive potential impact. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – Disturbance of bird habitat during construction will be unlikely to occur by employing the proposed mitigation measures. It is expected that the mortality rate of birds from collision or habitat loss during Project operation, if at all, will be low. Monitoring for bird mortality during operation will verify the effect the Project has on migratory and breeding birds. While not all phases of the Project are negative, construction and operation phases pose potential for negative impact. With the proposed mitigation measures employed, the significance of residual effects on migratory and breeding birds is predicted to be minor.

**Flora**

Information collected during a desktop review and a field survey to ensure that all habitat types were surveyed. The field survey revealed three major habitat types: regenerating forests, upland forests and wetlands. In an effort to preserve local flora species and to ensure flora species of conservation interest remain unharmed, flora has been identified as a VEC.

A significant environmental effect would result if a considerable change to flora was the result of Project activities.

*Boundaries* – The spatial boundary is the entire Project site. The temporal boundary includes the construction phase focusing on clearing, grubbing and building the access road, WTG crane pads and foundations, as well as the decommissioning phase focusing on site reclamation.

**Table 6-8: Potential impacts and proposed mitigative measures for flora.**

| Potential Impacts on Flora and Fauna | Proposed Mitigative Measures |
|---|---|
| **Clearing and grubbing will result in the disturbance of flora.** | • There will be an approximate land/habitat loss of no more than 1.8 Hectares attributable to the construction phase as determined by desktop and field studies. This is considered to have a negligible impact on flora and fauna; and<br>• The access road will be optimized to make use of existing roads at the Project site to reduce the amount of flora to be cleared; and<br>• Location of the access road will be optimized to reduce footprint and to avoid sensitive areas. |
| **There is a risk of introducing invasive species through plant matter attached to construction equipment** | • Construction equipment will be cleaned prior to transportation and use to ensure that no plant matter is attached to the machinery. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – The Project will decrease the flora footprint by no more than 1.8 hectares. While the construction phase presents potential for negative impact, once the decommissioning phase has started, land reclamation will restore the Project site to its previous state. With the proposed mitigation measures employed, the significance of residual effects on flora is predicted to be minor.

**Fauna**

Through consultation with NSDNR specific fauna was identified to frequent the Project site. Canada Lynx, American Marten and bats have been identified as species of conservation interest in for the purpose of this EA. As a result fauna has been identified as a VEC, focusing on Canada Lynx, American Marten and bats

A significant environmental effect would result if a considerable change to fauna was the result of Project activities.

*Boundaries* – The Project boundary is the entire Project site. The temporal boundary includes the construction and operation phases.

**Table 6-9: Potential impacts and proposed mitigative measures for fauna.**

| Potential Impacts on Fauna | Proposed Mitigative Measures |
|---|---|
| **Canada Lynx habitat loss, fragmentation and disturbance maybe occur as a result of the Project.** | • Minimizing the total project footprint by utilizing existing access roads ;<br>• Apply Special Management Practices when relevant to site activities as outlined in NSDNR Lynx SMP publication;<br>• Avoidance of areas of high quality and important habitat; and<br>• Continue consultation with NSDNR in an effort to reduce overall impact to Canada Lynx. |
| **American Marten habitat loss, fragmentation and disturbance maybe occur as a result of the Project.** | • Minimize the total project footprint by utilizing existing access roads ;<br>• Apply Special Management Practices when relevant to the site activities as outlined in NSDNR Marten SMP publication; and<br>• Continue consultation with NSDNR in an effort to reduce overall impact to the American Marten. |

| Potential Impacts on Fauna | Proposed Mitigative Measures |
|---|---|
| **Bats are at risk for collision with WTGs** | • Commitment to active turbine mitigation should post construction carcass searches reveal higher than normal bat deaths.<br>• Research and use best lighting equipment, placement and regime to minimize impacts to bats;<br>• Although not specifically a mitigation measure, the Proponent is committing to two years of post construction bat monitoring to augment the existing 2012, 2013 and upcoming 2014 datasets; and<br>• Consult with CWS to design turbine lighting to minimize avian attraction to lights that may put bats in danger of collision. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – Thorough desktop and field studies have been conducted to identify fauna that may be present at the Project site. Presence of fauna on the Project site is low; combined with the detailed mitigative measures, the significance of residual effects on fauna is predicted to be minor.

## 6.3 Assessment of Socio-economic VECs

**Land Use**

The proposed BWF makes use of two land parcels totalling 340 acres in the Cape Breton community of Barrachois. The lands are privately owned and have been leased to the Proponent for the purpose of developing the proposed BWF. Lands surrounding the Project land parcels are rural residential properties that consist of year round and seasonal homes. There are 66 dwellings within 2,000 m of the Project. As a result land use has been identified as a VEC

A significant environmental effect would result if a considerable change to land use was the result of project activities.

*Boundaries* – The spatial boundaries proposed WTG locations. The temporal boundary includes all phases of the Project including construction, operation and decommissioning.

**Table 6-10: Potential impacts and proposed mitigative measures for land use.**

| Potential Impacts on Land Use | Proposed Mitigative Measures |
|---|---|
| **Public concern that property value may decrease as a result of the Project** | • Recent real estate value studies have consistently determined no correlation between proximity to wind farms and property devaluation (Canning et. al., 2010); and<br>• Education through public consultation can be effective in providing factual, relevant information to alleviate the concerns of local residents. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – The significance of residual effects on land use is expected to be negligible.

**Aboriginal Resources / Uses**

Desktop and field studies have been completed as part of a Mi'kmaq Ecological Knowledge Study to promote a strong relationship between the Proponent and the Mi'kmaq population. Focusing on vegetation, the study identified any species that has significant importance for use of traditional medicine, food, clothing or other living necessities.

A significant environmental effect would result if a considerable change to Aboriginal resources / uses was the result of Project activities.

*Boundaries* – The spatial boundary includes all areas of the Project site. The temporal boundary focuses on the early construction phases of the Project when clearing and grubbing, access road construction and turbine pad construction will take place.

**Table 6-11: Potential impacts and proposed mitigative measures for aboriginal resources / uses.**

| Potential Impacts Aboriginal Resources / Uses | Proposed Mitigative Measures |
|---|---|
| **Potential impact on culturally significant plant species and general habitats.** | • Mi'kmaq ecological knowledge study was conducted to identify potential for valued aboriginal resources;<br>• Through roundtable discussions with Mi'kmaq right holders it was determined that the Projects impact on culturally significant flora and fauna species is negligible;<br>• The Proponent will maintain communications with the local Mi'kmaq communities; and<br>• Location of the access roads may be optimized to reduce footprint and to avoid areas of cultural significance. |
| **Direct impact to Mi'kmaq artifacts during construction activities, such as blasting and excavation.** | • If an artifact or object of potential Aboriginal significance is thought to have significance is discovered during project activities the KMK will be contacted immediately along with other appropriate individuals and organizations to determine a suitable method of mitigation. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – The significance of residual effects on land use is expected to be negligible. In the unlikely case that an artifact with potential interest/value to Mi'kmaq heritage is discovered appropriate individuals/ organizations will be contacted immediately.

**Archaeological Resources**

The results of the archaeological resource impact assessment indicated that the lack of navigable waterways and a landscape unsuitable to agriculture and settlement significantly diminish the likelihood of archaeological resources at the Project site. As a result, it is not expected that a significant adverse environmental effect is to occur.

A significant environmental effect would result if a considerable change to archaeological resources was the result of project activities.

*Boundaries* – The spatial boundary for this VEC is the entire Project site. The temporal boundary is the construction phase where ground disturbance is likely to occur.

**Table 6-12: Potential impacts and proposed mitigative measures for archaeological resources.**

| Potential Impacts on Archaeological Resources | Proposed Mitigative Measures |
|---|---|
| **Direct impact to cultural resources during construction activities, such as blasting and excavation.** | • The Archaeological resource impact study concludes the Project site is of low potential for significant archaeological resources for First Nations and Euro-Canadians;<br>• Avoidance is the preferred method of mitigation in all instances where archaeological resources are present; and<br>• Should archeological resources be encountered, all activities are to stop and the Coordinator of Special Places will be contacted immediately to determine a suitable method of mitigation. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – The significance of residual effects on archaeological resources is expected to be negligible.

**Vehicular Traffic**

The Project will be accessed via Grand Narrows Highway. During construction of the access road and WTG foundations, there will be an increase in truck traffic on the roads leading to and from the Project site. During delivery of the WTG components, delivery of oversized loads may slow traffic flow.

Of these predicted vehicle movements, approximately 24 will be oversized loads associated with the delivery of WTG component parts (towers, blades, and nacelles) and the cranes required for erection. These deliveries are anticipated within months 4 through 6 of the project construction schedule and subject to movement orders as agreed upon with governing authorities.

*Boundaries* – The spatial boundaries are all roads that will be used through the construction phase of the Project and the Project site. The temporal boundaries are those associated with the construction phase of the Project.

**Table 6-13: Potential impacts and proposed mitigative measures for vehicular traffic.**

| Potential Impacts on Vehicular Traffic | Proposed Mitigative Measures |
|---|---|
| **Vehicular traffic may increase as a result of construction activities and transportation of WTG components to the Project site.** | • Every effort will be made to ensure that oversized loads are delivered during times of lowest traffic to mitigate traffic jams. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – The time frame in which an impact to traffic may occur will be temporary, and combined with the proposed mitigative measure of avoiding high traffic times; the significance of residual effects on vehicular traffic is expected to be negligible.

**Telecommunication and Radar Communications**

With the installation of WTGs there is the possibility that the turbine rotor may interfere with the transmission and receiving of telecommunication signals. The proponent has consulted with the Department of National Defence and the Transport Canada to mitigate potential negative impacts on telecommunications and radar communications. As a result, telecommunication and radar communication has been identified as a VEC.

A significant environmental effect would result if a considerable change to telecommunication and radar communications was the result of project activities.

*Boundaries* – The spatial boundary consists of the local area including the proposed WTG and neighbouring communication infrastructure. Temporal boundaries include the operation phase of the Project.

**Table 6-14: Potential impacts and proposed mitigative measures for telecommunications and radar communications.**

| Potential Impacts on Telecommunications | Proposed Mitigative Measures |
|---|---|
| **WTG operation may interfere with telecommunication and/or radar communication infrastructure** | • Consultation was completed as recommended by CanWEA and Radio Advisory Board of Canada's guidance document – *Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines, on Radio Communications, Radar and Seismoacoustic Systems*;<br>• A desktop EMI assessment was conducted by the proponent in line with the Radio Avisory Board of Canada guidelines. The results of the assessment showed that the turbine will not interfere with the telecommunication links of nearby towers;<br>• Application process with NAV Canada's Land Use Proposal Submission Form to ensure that the Project does not pose any hazard to the navigational systems of NAV Canada; and<br>• Department of National Defence and Transport Canada have also been consulted. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – Based on consultation with the appropriate authorities, no impedance on communication infrastructure is to be expected. As a result, the significance of residual effects on telecommunication and radar communication is expected to be negligible.

**Landscape Aesthetics**

The proposed WTG is located in the rural community of Barrachois on a hill with a WTG pad elevations of approximately 175 m and 185 m above sea level. A visual impact assessment was completed by collecting photographs from high-traffic areas around the Project site. Photomontages were created at two high traffic areas using WindFarm software. These photomontages produce a realistic projection of what the WTG will look like superimposed on the Project landscape. Since the Project site is a rural, scenic area landscape aesthetics has been identified as a VEC.

A significant environmental effect would result if a considerable change to landscape aesthetics was the result of project activities.

*Boundaries* – The spatial boundary is defined as the areas surrounding the Project site in which the WTGs are visible. The temporal boundary is the Project operation phase.

**Table 6-15: Potential impacts and proposed mitigative measures for landscape aesthetics.**

| Potential Impacts on Landscape Aesthetics | Proposed Mitigative Measures |
|---|---|
| **Community members may have a negative reaction towards the aesthetics of the WTGs.** | • The Proponent considered landscape aesthetics when deciding on specific siting of the WTGs;<br>• The paint on the WTGs will be selected so that they do not contrast sharply with the environment; and<br>• By-Laws regarding responsible siting of WTG were followed to minimize the potential impact on the landscape aesthetics during WTG siting; |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – The perception of landscape aesthetics is a subjective matter. The Proponent recognizes that development of the proposed WTGs may have a negative effect in the perception of the community. It is possible that the negative reaction may be a result of a change in the landscape and may diminish over time. While landscape aesthetics will be altered with the development of the BWF, the significance of residual effects on landscape aesthetics is expected to be negligible.

**Health and Safety**

Public health and safety are of the greatest concern in the development of a Project such as the BWF. During the construction, operation and decommissioning phase the protection of workers and the public's health and safety is protected under the provincial Occupational, Health and Safety Act (OHS). It is best practice to consider a 'worst case scenario' when developing a health and safety policy / plan, as a result, health and safety has been identified as a VEC.

A significant environmental effect would result if a considerable change to health and safety was the result of project activities.

*Boundaries* – The spatial boundary includes the Project site and for the sake of ambient noise and ambient light, a 2.0 km radius from the WTG. The temporal boundaries include all phases of the Project.

**Table 6-16: Potential impacts and proposed mitigative measures for health and safety.**

| Potential Impacts on Health and Safety | Proposed Mitigative Measures |
|---|---|
| **During extreme cold weather events there is the potential for ice to build up and throw ice from the WTG blades.** | • WTGs are equipped with ice-detection systems on each blade;<br>• WTGs are designed to shut down in the case of ice-buildup; and<br>• When ice is detected the blade has a heating element that will effectively melt the ice to mitigate ice-throw; and<br>• Personal Protection Equipment (ie. hard-hats) will be worn when near the WTGs. |
| **During extreme weather events, there is the potential for electrical fires within the turbine nacelle through lightning strikes.** | • WTGs are equipped with lightning protection that, in the unlikely event of a lightning strike, will dissipate the lightning current to the ground. |
| **Potential aviation hazard to low flying aircraft.** | • Application process with NAV Canada's Land Use Proposal Submission Form to ensure that the Project does not pose any hazard to the navigational systems of NAV Canada. |
| **Increase in vehicular traffic may have the potential to affect public safety.** | • Every effort will be made to ensure that oversized loads are delivered during times of lowest traffic to mitigate road traffic. |
| **Shadow flicker may affect human health.** | • This potential impact has been addressed in the Ambient Light Section 6.1. |
| **Noise impact may affect human health.** | • This potential impact has been addressed in the Ambient Noise Section 6.1. |
| **Potential for accidents and malfunctions pose a risk to workers and the public's health and safety;** | • The OHS Act will be followed. |

*Cumulative Effects* – As described in Section 2.9 there are no other proposed or operational wind farms within 10 km of the BWF that would contribute to cumulative effects.

*Significance of Residual Effects* – Based on Project planning and design, the top priority has been health and safety. This is to make every reasonably possible effort to eliminate any negative potential impacts the Project may have on the public's health and safety. By following the proposed mitigative measures as well as regulatory guidelines pertaining to health and safety, the significance of residual effects on health and safety is expected to be negligible.

**Local Economy**

During the Project phases, there will be a significant amount of money spent within the CBRM, Cape Breton Island and Nova Scotia. During the development, the need for contractors and trades will be required and the Proponent will make every effort to utilize local companies to promote the local economy.

The COMFIT program will guarantee a "feed-in-tariff" that is a rate per kilowatt hour that the community owned Project is guaranteed for the 20 year power purchase agreement.

A significant effect would result if a considerable change to local economy was the result of project activities.

*Boundaries* – The spatial boundary is any area, business and individual that may observe a financial impact from the Project. The temporal boundary includes all phases of the Project.

*Potential Impacts and Proposed Mitigative Measures* – Potential positive impacts during the development phase of the Project include:

- Hiring local consultants; and
- Use of local services such as accommodations, restaurant and fuel.

Potential positive impacts during the construction and decommissioning phase of the Project include:

- Contracting construction work to local businesses;
- Use of local services such as accommodations, restaurant and fuel; and
- Municipal taxes being paid to the CBRM.

Potential positive impacts during the operation phase of the Project include:

- Use of local services such as accommodations, restaurant and fuel;
- Involvement of Nova Scotia residents in the CEDIF to invest in the Project;
- Municipal taxes being paid to the CBRM; and
- Long term contracts may be used in the operation and maintenance of the Project.

*Cumulative Effects* – The Proponent has another 4.0 MW project located in the CBRM. Together both of these projects will help stimulate the local economy.

*Significance of Residual Effects* – The Proponent will, when appropriate make every effort to utilize local services and products, this promotes local economy, which is in line with the Proponents ideology of community based projects. The predicted effects of this Project on the local economy are positive and as a result of the municipal taxes, CEDIF and economic spinoff, the significance of residual effects on local economy is expected to be beneficial.

### 6.3.1 Effect of Environment on Project

**Extreme Weather**

Severe weather events could potentially damage WTG due to conditions exceeding the operational design of the WTGs. High winds, extreme temperatures and icing on blades all have the potential to shut down the WTGs. Extreme weather events that could occur within the CBRM, Nova Scotia region are listed in Table 6-17.

**Table 6-17: Extreme events, associated effects and mitigation.**

| Weather Event | Effect | Mitigation |
|---|---|---|
| **Extreme wind** | Damage to blades | Automated control system would initiate shut down |
| **Hail** | Damage to blades | Appropriate WTG maintenance |
| **Heavy rain and flooding** | None anticipated | None |
| **Heavy snow** | Damage to WTG components | Automated control system would initiate shut down |
| **Ice storms** | Icing on blades resulting in potential ice throw | Automated control system would initiate shut down and heating system |
| **Lightning** | Potential for fires within nacelle of WTGs | Lightning protection system would conduct electrical surge away from nacelle |
| **Seismic activity** | None anticipated | None |
| **Severe drought** | None anticipated | None |

**Turbine Icing**

Ice accumulation on WTG blades can occur during the winter months when the appropriate conditions of temperature and humidity exist, or during certain extreme weather conditions, such as freezing rain (Seifert et al., 2003). In the event that ice builds up on the WTG blades, there are two types of risks possible: the first is ice throw from an operating WTG, and the second is ice fall from a WTG that is not in operation.

When a WTG is in operation, it is assumed that ice may collect on the leading edge of the rotor blade and detaches regularly due to aerodynamic and centrifugal forces (Seifert et al., 2003). The distance that the ice will be thrown from the moving WTG blade will vary depending on the wind speed, the rotor azimuth and speed, the position of the ice in relation to the tip of the blade, as well as characteristics of the ice fragment.

In a Canadian study titled *Recommendations for Risk Assessments of Ice Throw and Rotor Blade Failure in Ontario* (LeBlanc et al., 2007) ice throw was investigated to determine the individual risk probability

for an individual to be struck by ice thrown from an operating WTG. The following parameters and assumptions were used:

- Rotor diameter of 80 m;
- Hub height of 80 m;
- Fixed rotor speed of 15 RPM;
- Ice fragment is equally likely to detach at any blade azimuth angle and 3 times more likely from the blade tip than the rotor;
- Ice fragments have a mass of 1 kg and frontal area 0.01 square ms;
- All wind directions are equally likely; and
- Ever-present individual between 50 m and 300 m (dounut shaped buffer around WTG), individual equally likely in any given 1 square m within that area.

The statistical analysis found that individual risk probability for an individual is 0.000000007 strikes per year or, 1 strike in 137,500,000 years. For an individual to be ever-present in the defined area, this assumes that the individual would be outside during the unpleasant weather necessary for icing conditions. This analysis does not take into account the presence of trees that could provide shelter from potential ice throw (Seifert, H. Et al., 2003). The Enercon E92 has slightly different specifications than used in this example; however this should be used as general example to understand the risk probability of an individual being struck by ice throw.

As with trees, power lines masts and buildings, ice can accumulate on a stationary WTG, and will be eventually be released and fall to the ground. Depending on the rotor position of the stationary rotor, different fall distances along the current prevailing wind will occur (Seifert, H. Et al., 2003).

**Potential Surface Water Impacts**

Activities associated with the Project that can impact surface water resources include the development of gravel pits, road construction, stream crossings, concrete use and disposal, and petroleum products from WTGs and heavy ground moving. To mitigate such impacts, a Spill Contingency Plan will be enforced, as well as the Environmental Management Plan.

### 6.3.2 Summary of Impacts

Based on the completed VEC analysis, it has been determined that the Project activities are only expected to have minor negative effects on wetlands/watercourses, ambient noise, bats and migratory and breeding birds, while the local economy will see a beneficial impact. All other VECs are predicted to observe a negligible residual effect from the Project. Where a minor effect is predicted, monitoring and follow up initiatives should be considered. A summary of the VEC assessment is presented in Table 6-18, in terms of the following assessment criteria:

- Nature – positive (+), negative (-), or No impact where no impact is predicted;
- Magnitude – order of magnitude of the potential impact: small, moderate, large;

- Reversibility – reversible (REV) or irreversible (IRR);
- Timing – duration of impact, short for construction or decommissioning and long for Project operation or longer;
- Extent – spatial extent of the impact, local, municipal, provincial etc.; and
- Residual Effect – negligible, minor, significant, and beneficial or no impact as described in Section 3.3.

**Table 6-18: Summary of identified VECs.**

| | Nature | Magnitude | Reversibility | Timing | Extent | Residual Effect |
|---|---|---|---|---|---|---|
| Ambient Air | - | small | REV | Short | Local | Negligible |
| Ground and Surface Water | - | small | REV | Short | Local | Negligible |
| Ambient Noise | - | small | REV | Long | Local | Minor |
| Ambient Light | - | small | REV | Long | Local | Negligible |
| Wetlands/ Watercourses | - | small | REV | short | Local | Minor |
| Fish and Fish Habitat | - | small | REV | short | Local | No Impact |
| Migratory and Breeding Birds | - | small | REV | Long | Local | Minor |
| Flora | - | small | REV | Short | Local | Minor |
| Fauna | - | small | IRR | Long | Local | Minor |
| Land Use | - | small | REV | Long | Local | Negligible |
| Aboriginal Resources / uses | - | small | IRR | Long | Local | Negligible |
| Archaeological Resource | - | small | IRR | Short | Local | Negligible |
| Vehicular Traffic | - | small | REV | Short | Local | Negligible |
| Telecommunications | - | small | REV | Short | Local | Negligible |
| Landscape Aesthetics | - | small | REV | Long | Local | Negligible |
| Health and Safety | - | small | IRR | Long | Local | Negligible |

| | Nature | Magnitude | Reversibility | Timing | Extent | Residual Effect |
|---|---|---|---|---|---|---|
| Local Economy | + | moderate | REV | Long | Provincial | Beneficial |

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# 7.0 Follow Up and Monitoring

The purpose of this section is to describe the potential follow-up programs and management plans required during the construction, operation and decommissioning phases of the Project.

## 7.1 Post-Construction Monitoring

### 7.1.1 Avian

Referring to the VEC assessment in Section 6.2 the Project was assessed as having a minor significance of residual effects on migratory and breeding birds. As a result, a post-construction monitoring plan will be implemented for a period of time. This monitoring program will be developed in consultation with the appropriate authorities.

### 7.1.1 Bats

Referring to the VEC assessment in Section 6.2 the Project was assessed as having a minor significance of residual effects on bats.

**2014 Fall Acoustic Monitoring**

As previously stated in Section 4.1.7, the Proponent is committing to additional pre-construction acoustic bat surveys to be completed in the Fall of 2014. The equipment set-up and monitoring location will be the same as what was used during both the 2012 and 2013 field surveys. The proponent sees value in conducting this third annual survey to evaluate whether there are site specific annual variations in bat activity. This baseline data may also be useful should a mitigation program be adopted during the operational phase described in further detail below. The proponent will provide the survey's results to NSDNR or other interested parties for review and discussion.

**Mitigation**

Discussion in Section 4.1.7 described how active turbine mitigation at wind farms can lead to a significant decrease in bat fatalities. The mitigation involves increasing the turbine rotor 'cut-in' speed, essentially preventing the rotor from spinning at low wind speeds when bats are most active.

Based on a review of effective mitigation scenario's at wind farms in other jurisdictions across North America, the proponent has designed a draft mitigation scenario. This draft scenario involves increasing the rotor cut-in speed from 2 m/s to 5 m/s on both turbines, from July 24$^{th}$ to October 1$^{st,}$ from half hour before sunset to half hour after sunrise. Should mitigation be adopted, these metrics would be re-assessed in order to closely reflect baseline *Myotis* activity on site.

The Proponent is only committing to active mitigation should the post construction carcass searches reveal higher than normal mortality levels on site. Currently, it is industry standard to conduct post construction carcass searches for at least two years at wind farms operating within the Province, and to

forward on the results of those surveys to NSDNR and the Department of Environment. This practice is also most often mandated through conditions associated with Environmental Assessment approvals.

As there is already a mechanism in place to conduct post construction carcass monitoring, the Proponent will use this mechanism to review and assess the results of the post construction surveys. Should it be determined, in consultation with NSDNR that in fact the wind farm is producing higher than normal bat fatalities, the Proponent, in collaboration with NSDNR and NSE will be open to adopt an active mitigation program, the ultimate aim of which is to reduce bat fatalities on site.

### 7.1.2 Ambient Noise

Referring to the VEC assessment in Section 6.2 the Project was assessed as having a minor significance of residual effects on ambient noise. As a result, a public input mechanism will be established to resolve issues pertaining to ambient noise levels.

## 7.2 Management Plan

Throughout the life of the Project, various management and contingency plans, as listed below, may be required to aid in the responsible development of the Project. These plans will be developed and implemented prior to construction of the BWF and will explicitly outline the steps taken for different Project concerns.

It is anticipated that some or all of the following management plans will be required as the Project development matures.

**Management Plan Requirements**

- Environmental Management Plan;
- Erosion and Sedimentation Control Plan;
- Spill Contingency Plan;
- Decommissioning and Site Reclamation Plan; and
- Public Complaint Procedure.

A number of permits will be required during pre-construction, all of which are listed in Section 1.3.

# 8.0 Closure

Natural Forces Wind Inc. wishes to develop the proposed Barrachois Wind Farm with the intent of helping Nova Scotia meet its renewable energy regulations and targets.

This EA has been prepared in accordance with the guidelines set out by the Environmental Assessment and Approval Branch of the Nova Scotia Department of Environment. The scope of the EA was discussed in advance with Nova Scotia Department of Environment Environmental Assessment branch. Consequently, it is anticipated that this EA meets all criteria outlined by the Nova Scotia Environmental Assessment Act.

A thorough analysis of the Project components and activities has been carried out for the construction, operation and decommissioning phases of the Project. Baseline environmental characteristics of the region have been documented and Valued Environmental Components have been identified. Consultation has been undertaken with a wide variety of local stakeholders, right-holders, and government stakeholders to gauge the full range of impacts and concerns with regards to the Project. The impact of the Project on the local environment has been evaluated based on all of these criteria. Mitigative measures have been presented and adopted in an effort to reduce the significance of residual impact as a result of the Project's activities. Cumulative effects of the Project on the environment due to other regional Projects and activities have also been identified and assessed.

The following benefits would result due to the BWF and are considered as advantages of the Project, these include:

- Increased revenue for the CBRM through payment of annual property taxes by the Project Proponent;
- Increased revenue for local businesses due to activities surrounding the construction, operation and decommissioning phases of the Project;
- Creation of supplementary income and income diversity for local landowner;
- Creation of additional employment in the region during the entire Project life;
- Production of emission-free energy, which will displace energy produced from fossil fuels in Nova Scotia; and
- Help Nova Scotia meet its renewable energy regulations and targets for 2015 and 2020.

In conclusion, it is anticipated that through proposed mitigative measures the Barrachois Wind Farm will have no significant residual effects on the physical, biophysical and socio-economic environment.

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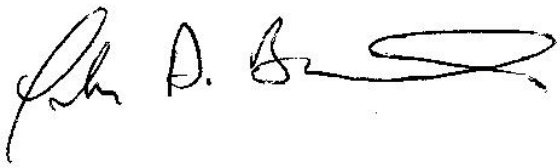
# 9.0 Company Signature

Table 9-1 below defines the concluding signature of this Environmental Assessment for Natural Forces Wind Inc.

**Table 9-1: Signature Declaration**

| | |
|---|---|
| EA CONDUCTED BY: | Chris Veinot, Natural Forces Wind Inc. |
| PROPONENT: | Natural Forces Wind Inc. |
| PROPONENT SIGNATURE: |  <br>John Brereton, President |
| DATE: | May 16, 2014 |

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