Contents

Appendices

List of Figures

List of Tables

Acronyms

ACCDC	Atlantic Canada Conservation Data Centre
AWPC	Atlantic Wind Power Corporation (2005) Ltd.
CCG	Canadian Coast Guard
CDC	Conservation Data Centres
CEPA	*Canadian Environmental Protection Plan*
CEAA	*Canadian Environmental Assessment Act*
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWP	Cobequid Wind Power Inc.
DFO	Fisheries and Oceans Canada
DND	Department of National Defence
EC	Environment Canada
EMF	Electrical Magnetic Field
EMP	Environmental Management Plan
EPP	Environmental Protection Plan
FA	Federal Authority
FEAC	Federal Environmental Assessment Coordinator
ha	hectare
HADD	Harmful Alternation, Disruption and Destruction
IC	Industry Canada
km	kilometre
MEK	Mi'kmaq Ecological Knowledge
MW	Mega Watts
NRCan	Natural Resources Canada
NSDE	Nova Scotia Department of Environment
NSDNR	Nova Scotia Department of Natural Resources
NSIMRS	Nova Scotia Integrated Mobile Radio System
NSPI	Nova Scotia Power Inc.
NSTPW	Nova Scotia Department of Transportation and Public Works
NWPA	*Navigable Waters Protection Act*
PPA	Power Purchase Agreement
PID	Property Identification
RA	Responsible Authority
RCMP	Royal Canadian Mounted Police
SARA	*Species at Risk Act*
TC	Transport Canada
The Agency	Canadian Environmental Assessment Agency
VEC	Valued Ecosystem Component
WTG	Wind Turbine Generator

Chapter 1 **Introduction**

1.1 Proponent Information

The following individuals may be contacted to provide additional information on the Project or with respect to this Project Description:

Project Name:	Nuttby Mountain Wind Farm
Project Location:	Cobequid Mountain Region of Colchester County, Nova Scotia to the west of Route 311 and approximately 3 to 4 kilometers (km) to the north of the village of Nuttby.
Size of the Project:	Up to 45 Megawatts (MW)
Proponent Information:	3217284 Nova Scotia Limited ("321 NS Ltd.") (a subsidiary of EarthFirst Canada Inc.) c/o EarthFirst Canada Inc. Attention: Erich Ossowski 805 - 10th Ave SW, Suite 300 Calgary, Alberta T2R 0B4
Proponent Contact Person:	Charles Demond Atlantic Wind Power Corporation (2005) Ltd. ("AWPC") Phone: (902) 835-3340 Fax: (902) 484-7075 Email: cdemond@awpc.com (note – AWPC is a service provider to EarthFirst Canada Inc.) - or - Erich Ossowski, Vice President Phone: (403) 513-0764 Email: eossowski@earthfirstcanada.com
Applicant:	CBCL Limited 1489 Hollis Street Halifax, Nova Scotia B3J 2R7
Applicant Contact Person:	Ann Wilkie, VP Environment CBCL Limited Phone: (902) 492-6764 Fax: (902) 423-3938 Email: annw@cbcl.ca

The following documentation was prepared as required by the *Canadian Environmental Assessment Act (CEAA)* and the *Nova Scotia Environment Act* and associated regulations.

Proponent's Signature
Date: June 9, 2008

Ann G. Wilkie
Applicant's Signature
Date: 16th June 2008.

321 NS Ltd. and AWPC are both Nova Scotian registered companies. EarthFirst Canada Inc. is a company incorporated under the Canada Business Corporations Act. EarthFirst, through its wholly owned subsidiary, 321 NS Ltd., owns the Nuttby Mountain Wind Farm Project. AWPC, an experienced Nova Scotia based wind farm developer, has entered into a services agreement with EarthFirst wherein AWPC will provide services to assist with the permitting, development, construction and commissioning of the Nuttby Wind Farm project (the Project). Once constructed, EarthFirst will direct operations of the wind farm with service assistance from the wind turbine supplier. It is anticipated that there will be local involvement in the post-construction operation of the wind farm.

1.2 Project Overview

The Nuttby Mountain Wind Farm is expected to consist of between 15 and 18[1] wind turbines with a total capacity to generate a maximum of 45 MW of electricity. All of the electricity generated at the wind farm will be sold to Nova Scotia Power Inc. (NSPI) under a power purchase agreement to increase the supply of renewable energy available to Nova Scotians.

As depicted in Figure 1.1, the Nuttby Mountain Wind Farm is located on approximately 11 km^2 of land in the Cobequid Mountain region of Nova Scotia in Colchester County. The site is situated on four land parcels to the west of Route 311 approximately 3 to 4 km to the north of the village of Nuttby and 6 km to the west of Earltown. The proponent has entered into lease agreements with the owners of the land parcels involved, i.e., PID 20015178, PID 20015293, PID 20015251 and 20015244. The distribution of the proposed turbines are also depicted on Figure 1.2. Geographical coordinates of the turbine locations are provided in Table 1.1.

Table 1-1: Geographical Coordinates of Turbines

Turbine	*UTM*		*Turbine*	*UTM*	
	Easting	*Northing*		*Easting*	*Northing*
1	481240	5045940	11	481218	5044797
2	480747	5046067	12	483887	5045002
3	484151	5045960	13	482377	5044864
4	483028	5046216	14	482970	5044737
5	483579	5046190	15	482491	5045761
6	480868	5045551	16	484126	5044736
7	483236	5045632	17	482925	5044185
8	481803	5045658	18	482193	5044286
9	484347	5045169	19	482418	5045283
10	481869	5045043			

Access to the site will be attained from Old Nuttby Road and to each of the turbine locations from the access roads depicted on Figure 1.2. About 7 km of these roads are existing woods roads that have been used to access and work the wooded areas on site; the balance, or about 7 km, will involve new construction.

[1] 19 turbine locations are shown on the figures, but it is anticipated that one location within the interior of the site will be dropped accordingly; depending on the choice of WTG, a maximum of 18 will be installed.

1.3 Spatial and Temporal Boundaries

The study area for this environmental assessment includes the footprint of all works associated with the construction and operation of the proposed wind turbines and those areas within which project-environment interactions could reasonably be expected to occur. It is not possible to establish a single study area boundary that accurately accommodates the spatial characteristics of all potential project-environmental interactions. For example, the study boundary for the archaeological field programs is very much determined by the siting of the turbines, associated access roads and lay down areas, i.e., areas that will be disturbed by the construction of the proposed facility. The study area for flora is larger and takes into account the nature of all habitats in proximity to areas that may be disturbed. The study area for the ornithological work is greater still and that referenced for the socio-economic analysis is geographically the most extensive in order to take into account the consequences of the project for local residents and communities.

Temporal project boundaries include the timeline for the short term construction activities as well as the long term operation of the facility and its eventual decommissioning.

1.4 Regulatory Context

1.4.1 Requirement for Provincial Environmental Assessment

As a result of changes to the Nova Scotia Environmental Assessment Regulations that came into force in February of 2003, the proposed wind farm at Nuttby Mountain will be subject to a Class I environmental assessment as defined in those regulations. This necessitates the registration of the Project with the Nova Scotia Department of Environment (NSDE). The department has prepared the "*Proponent's Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document*". The following factors must be addressed and shall be considered by the Minister in formulating a decision:

(a) the location of the proposed undertaking and the nature and sensitivity of the surrounding area;
(b) the size and scope of the proposed undertaking;
(c) concerns expressed by the public about the adverse effects or the environmental effects of the proposed undertaking;
(d) steps taken by the proponent to address environmental concerns expressed by the public;
(e) potential and known adverse effects or environmental effects of the technology to be used in the proposed undertaking;
(f) project schedules;
(g) planned or existing land use in the area of the undertaking;
(h) other undertakings in the area; and
(i) such other information as the Minister may require.

Each of the above factors has been addressed in the documentation that follows.
No later than 25 days following the date of registration, the NSDE shall advise the proponent in writing of the Minister's decision. At this stage the Minister may require additional information prior to making a decision, may make a decision to enable the project to proceed with or without conditions, or may require the proponent to comply with a more extensive assessment process. Many of the matters that the Minister may wish to consider are the same, or similar to those to be addressed by the federal regulators.

Therefore it is prudent to facilitate the exchange of information between the regulating parties and to the extent possible minimize duplication of effort by both the Proponent and the various agencies and departments with interests to be addressed.

1.4.2 Requirement for Federal Environmental Assessment

To enable the project to be carried out, the proponent has sought financial assistance in the form of an incentive under the ecoENERGY for Renewable Power Program administered by Natural Resources Canada (NRCan). As such, the installation of a wind energy farm at Nuttby Mountain as proposed by AWPC will trigger an environmental assessment under the *CEAA*. The *CEAA* is the legal basis by which the federal government outlines the responsibilities, requirements and procedures required for the environmental assessment of proposed projects. More specifically, federal departments and agencies must complete an environmental assessment whenever one or more of the following *CEAA* triggers apply:

- the federal department or agency carries out a project;
- the federal department or agency provides financial assistance to enable a project to be carried out;
- the federal department or agency sells, leases or otherwise transfers control or administration of land to enable a project to be undertaken; or
- the federal department or agency issues an authorization to enable a project to go forward.

Since federal financial assistance and, possibly, other federal approvals are required to enable the development of the wind farm at Nuttby Mountain to proceed, the *CEAA* will be triggered.

Under the *CEAA*, the type of assessment required varies depending on the complexity, size, and the significance of the possible environmental effects of the project. Most inland wind farms are required to complete a screening style assessment. "A screening systematically documents the anticipated environmental effects of a proposed project and determines the need to modify the project plan or recommend further assessment to eliminate or minimize these effects" (*CEAA*, 2003). *CEAA* Section 16 (1), stipulates that the environmental screening must provide the following information:

- The project's environmental effects, including the environmental impact of malfunctions or accidents that may occur in relation to the project, and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- The significance of the effects listed in the previous statement;
- Comments from the public received in accordance with the *CEAA* and its regulations;
- Measures that are technically and economically feasible which would mitigate any significant environmental effects of the project; and
- Any other matters relevant to the screening, such as the need for the project and alternatives to the project.

NRCan has developed "*Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms under the Canadian Environment Assessment Act*". These guidelines serve as a guide for the environmental screening required for the proposed project. Although the Responsible Authority (RA) will ultimately decide the necessary scope of the assessment, a typical screening document addresses the following:

- Construction, including reference to any pre-construction survey, site preparation, excavation, transportation of material, turbine erection, power connection, site remediation and demobilization of construction work;
- Operation and maintenance requirements; and
- Decommissioning of the wind turbine and site remediation.

These phases in the life of the wind farm are addressed in the analysis presented in Section 5.0.

The construction and subsequent operation of the proposed works is likely to involve the following federal regulatory authorities:

- NRCan who is responsible for the ecoENERGY program under which the proponent has applied for financial support;
- Transport Canada (TC) in connection with the marking and/or lighting of the proposed turbines to address the requirements of the *Aviation Regulations* pursuant to the *Aeronautics Act*;
- Fisheries and Oceans Canada (DFO) to potentially provide authorization under the *Fisheries Act* for the Harmful Alteration, Disruption and Destruction (HADD) of fish habitat should an existing access road need to be upgraded at a watercourse crossing in a manner that may impact upon fish habitat;
- Health Canada who will take into account in their review of the documentation noise and other matters that may have a bearing on the health of those residents in closest proximity to the Project site;
- Environment Canada (EC) as an expert authority under the *Canadian Environmental Protection Act* (*CEPA*), the *Species at Risk Act* (*SARA*) and the *Migratory Birds Convention Act*; and
- Canadian Environmental Assessment Agency (the Agency) providing coordination for the federal environmental assessment process under *CEAA*.

1.4.3 Municipal Authorizations

The Municipality of the County of Colchester has been contacted regarding any setback or easement requirements for wind farms. Staff stated that the municipality does not have any by-laws relating to wind farms at this time.

1.5 Approach and Expertise Involved

The approach to the preparation of this environmental assessment has been to address regulatory requirements and to focus on the issues raised by the study team, the public and others involved in the process. In addition to the research and the consultation program undertaken, a range of field programs were executed at different times in 2007 and 2008. The programs executed are described fully in Chapter 3. Table 1.2 identifies the team leads responsible for the research and field work undertaken.

Table 1-2: Team Leads

Name	*Topic*
Clinton Pinks, CBCL Limited	Determination of habitats including wetlands
Ian Bryson, CBCL Limited	Characterization of forest stands and Species at Risk
Leanda Delaney, CBCL Limted	Characterization of fish habitat
Bob Rutherford	Determination of whether fish habitat will be disturbed
Brian Dalzell, Atlantic Bird Surveys	Execution of avian field programs
Sean Blaney, ACCDC	Execution of plant inventory
Ross Hall	Execution of large mammal survey
Hugh Broders, St. Mary's University	Execution of bat field program
Steffen Käubler, CBCL Limited	Visibility analysis and land use investigations
Stephen Davis, David Archaeological Consultants Limited	Execution of archaeological field programs
Jason Googoo, Membertou Geomatics Consultants	Mi'kmaq Ecological Knowledge (MEK) Study
Oldham Engineers Inc.	Communication tower links
Garrad Hassan Canada Inc.	Noise

1.6 Structure of the Document

This report documents the environmental assessment of the environmental effects of the proposed construction, operation and decommissioning of the Nuttby Mountain Wind Farm. This report consists of the following sections:

- Section 1.0 provides an introduction to the proponent and the proposed Project, an overview of the environmental assessment process and an account of the approach to the environmental assessment;
- Section 2.0 provides information on the site's wind resources, justification for the Project and a review of Project alternatives. This section also identifies the principal Project components, activities, scheduling, anticipated emissions and discharges, as well as outlining the Project's health, safety and environmental management plan and how malfunctions and accidents will be addressed;
- Section 3.0 describes the environmental work program that has been undertaken;
- Section 4.0 provides the environmental baseline, i.e., data on the existing biophysical and socio-economic environment;
- Section 5.0 describes the consultation undertaken by the proponent;
- Section 6.0 describes the approach taken to the environmental evaluation, identifies the Valued Ecosystem Components (VECs), the socio-economic issues, the evaluation criteria and references how cumulative effects and effects of the environment on the project are addressed;
- Section 7.0 details the analysis of anticipated environmental effects, identifies mitigation measures, discusses cumulative effects, provides a summary of the residual environmental effects, references the proposed environmental management system and describes follow-up commitments and monitoring initiatives; and
- Section 8.0 summarizes the assessment results.

This environmental assessment report includes mapping and the following appendices:

A Tabulated Results of Plant Inventory

B Archaeological Research Permits

C Mi'kmaq Ecological Knowledge Study

D Photographs of the Radio Towers Adjacent the Project Site

E Open House Materials

F Predicted Noise Contours

Chapter 2 Project Description

2.1 Project Background

2.1.1 Project History

AWPC, with the assistance of its local partner Cobequid Wind Power Inc. (CWP), commenced development of the Nuttby Mountain wind farm project in 2006. In August of 2007, AWPC, through its subsidiary 321 NS Ltd., submitted a proposal to NSPI in response to its public call for wind energy supplies. In support of this bid the proponent had tested the wind regime at the site, initiated the ecological field programs required by the environmental assessment process and embarked on the micro-siting studies and associated engineering works necessary to define the optimum locations for the turbines and to ensure effective access for construction and subsequent maintenance. At the same time steps were taken to engage the local residents and to disseminate information about the Project.

321 NS Ltd. was successful in its submission to NSPI and, as a result, entered into a long term power purchase agreement (PPA) with NSPI in January, 2008. The PPA requires that all energy from the Nuttby Mountain wind farm be delivered and sold to NSPI at a fixed price over a fixed term.

In March of 2008, 321 NS Ltd. was sold to EarthFirst Canada Inc. This was done, with the full consent of NSPI, to facilitate the efficient financing of the project. AWPC continues to be involved in the project as it provides a wide range of services pursuant to an agreement with EarthFirst made the same date as the project ownership transfer. As a result, AWPC will be active in the finalization of development, construction and commissioning of the project. The principals of AWPC have worked with many of the key personnel within EarthFirst in connection with an existing Nova Scotia project, the Pubnico Point Wind Farm.

2.1.2 Political and Economic Context

Canadians are amoung the highest per-capita producers of carbon dioxide (CO_2) in the world due to their heavy reliance on fossil based energy; in Atlantic Canada, over 40% of greenhouse gas emissions come from the generation of electricity. To reduce such emissions under the Kyoto Protocol, both the federal and provincial governments are supportive of the development of alternative energy sources. Their aim, if not to replace power generated from hydrocarbons, is to augment such sources and to halt the growth in and reliance upon such sources. The proposed wind farm at Nuttby Mountain will provide green renewable energy to the Nova Scotia grid.

More specifically, the federal and provincial governments have introduced strategies to facilitate the development of alternative energy sources to reduce the emission of “green house gases”. The Province of Nova Scotia, for example, has enacted the *Environmental Goals and Sustainable Prosperity Act*, which identifies the long-term objectives of the province to be:

- To lower greenhouse gas emissions by 2020 by at least 10% below the 1990 emitted levels; and
- To obtain 18.5% of the total electricity needs of the province from renewable energy sources by 2013.

The conversion of wind power into electricity is an acknowledged means of meeting these objectives. Further, NSPI has established competitive bidding mechanisms by which they will buy from selected producers, including the proponent, "clean energy", i.e., wind power, in an effort to meet its emission targets.

The federal government also plays a leading role whereby it recognizes the need to financially encourage a change from existing sources of energy production to the use of more renewables, which, like wind, are often initially capital intensive. Accordingly, it administers an incentive program called "EcoENERGY for Renewable Power". This program provides one cent per kilowatt hour to qualified renewable power producers in respect to their electricity generation at newly constructed wind farms for the first 10 years of production. The program is administered by NRCan. To qualify, a wind farm must meet several criteria including having undergone a federal environmental assessment. The proponent is a registered applicant in the EcoEnergy program and anticipates the receipt of funding.

2.1.3 Project Justification and Purpose

The purpose of the proposed works, i.e., the construction of up to 18 wind turbines on Nuttby Mountain, is to use natural wind energy to generate electricity for sale to NSPI. The proposed turbines will add to the clean energy generated in Nova Scotia, and its successful generation will contribute to NSPI's initiatives to reduce its greenhouse gas emission targets. It is a project that has been designed to address the province's political goals of reducing green house emissions and of moving NSPI closer to meeting its mandate of accommodating increasing amounts of renewable energy on the grid.

2.1.4 Alternatives

There are a limited number of areas that can be used for the production of wind energy. For any site to be considered commercially for a wind farm, it must have at least the following attributes:

- located at a financially viable wind resource;
- in proximity to the end user or the off-taker, i.e., NSPI's electrical grid, at a physical location where the planned capacity of the wind farm can technically be accommodated in the grid and preferably in an area where additional load is welcomed or needed;
- access to the necessary lands at an economical cost; and
- general accessibility.

2.1.5 Location and Land Ownership

As stated in Section 1.2, and depicted on Figure 1.2, the Nuttby Wind Farm is located on four land parcels to the west of route 311 approximately 3 to 4 km to the north of the village of Nuttby and 6 km to the west of Earltown. All lands involved are privately owned, and lease agreements have been entered into with the land owners involved.

2.2 Principal Project Components

Although the Project will be located in an area of approximately 11 km^2, its footprint will use approximately 4% of that land area, allowing forestry, blueberry production and most other uses, e.g., snowmobiling and hunting, to continue throughout much of the area. The Proponent, however, will work with the landowners to restrict hunting in proximity to the WTGs to protect their functional integrity and to ensure the safety of service personnel.

The principle project components associated with the proposed works are the wind turbine generators (consisting of towers, nacelles and blades), the concrete foundations and lay down areas, access roads, a largely overhead cable collection system interconnecting the turbines, an electrical substation and physical connection to the grid. An ancillary work and storage building may also be situated on site.

2.2.1 The Wind Turbine Generators (WTGs)

A final decision regarding the actual wind turbines to be used in the project has not been made at the time of writing. The choice, however, has been narrowed to two suppliers and two specific models. As a result, the proponent will install either a 2 MW wind turbine generator on a 78 m tower, or a 3 MW unit on an 80 m tower. In the case of the 2 MW unit, the blade diameter would be 82 m and for the 3MW would be 90 m. The footprint of a single wind turbine is relatively small, i.e., an area of approximately 60 m x 60 m, an area that is sufficient to accommodate the turbine and a crane pad.

Although there will likely be small modifications as the detailed engineering is executed, the final layout and configuration of the proposed wind farm, based on the results of the studies undertaken to date and including the preliminary engineering of the access roads, is depicted on Figure 2.1. This configuration will involve the location of up to 18 WTGs on Nuttby Mountain and generate more than 100,000,000 kW/hr of electricity annually which would be fed into the NSPI transmission grid.

The output of each WTG will be 400V, 600V, or 690V, 3-phase, 60 Hz, depending on the WTG manufacturer chosen. Each unit will have its own main breaker which will provide both protection and isolation to the unit. Connection to the main breaker at each unit will be by 1000V cables installed underground in ducts which will run to a padmounted unit transformer located approximately 5 m from the base of each wind turbine generator tower. Connected to each of the unit transformers will be a cable collection system. To ensure that the cable system will be consistent with typical distribution practices and to keep the cables to a reasonable and economical size, both a 25 kV and a 34.5 kV collection system are under consideration. The cables on site are expected to be mostly or all overhead lines; some may be installed underground.

The proposed generators will generate sufficient clean, renewable energy to supply between 12 and 17,000 average Canadian homes displacing up to 120,000 tonnes of CO_2 (carbon dioxide) each year. This is the equivalent of not driving 14,000 – 21,000 cars for a year, or of planting up to 1,000,000 trees to absorb CO_2 for 60 years.

2.2.2 Concrete Foundations and Lay Down Areas

Each wind turbine is situated on and affixed to a concrete foundation. The foundation types being considered are spread footing, rock anchored or a cylindrical type commonly referred to as the Patrick and Henderson design; the latter will likely only be the choice if the 3MW WTG is selected. The final decision on the foundation type will be made following the examination of results from the balance of the geotechnical work that will be done after the final WTG choice has been made. Based on observations of the geological records for the area and the on-site selective drilling and the geotechnical analysis that has been done by an independent engineering firm for the proponent, the entire site is expected to consist of bedrock near the surface and will readily accommodate any one of the various foundation choices. Although the spread footing and, perhaps to a lesser extent, the rock anchor foundations requires a greater number of loads of concrete, the extent of the excavation required could be less.

The lay down areas, located on Figure 2.1, are leveled, gravel covered areas around each wind turbine and are used as a place for the temporary storage of the wind turbine components, i.e., tower sections, blades, etc. In addition, each lay down area will accommodate the cranes used to erect and assemble each wind turbine as well as for subsequent maintenance, component replacements, possible refit work and ultimate decommissioning. Each lay down area has been designed to use the least amount of space and generally will involve a graveled area of about 60 x 60 m; some additional area may be cleared of vegetation to enable the placement and assembly of blades and other components. This larger area may be up to 90 x 90 m in area.

2.2.3 Access Roads and Transportation of WTG Components

In addition to the facilities referenced above, access is required to the wind farm site and to each of the turbine locations. Access will be attained from Route 311 and the Old Nuttby Mountain Road to the site. Given the size and weight of some of the flatbed trucks that will be used, the Proponent and their engineers will work closely with the road authorities to ensure that the roads, particularly the Old Nuttby Mountain Road, have the capacity to accommodate the loads. The intent is to select a cost effective and efficient means of transportation and to work will all authorities to ensure safety for all involved including road users. Access on site will be accommodated to the extent possible on existing logging roads and, where necessary, through the construction of new roads. As indicated in Section 1.2, approximately 7 km of the required roads are existing; the balance, i.e., another 7 km, will involve new construction. Figure 2.1 depicts the proposed turbine locations, the existing network of logging roads in the area and the proposed new roads. Figure 2.2 depicts a typical cross section of an access road.

2.2.4 Connection to the Grid

The wind farm will be electrically connected to the Nova Scotia transmission grid. The grid has various transmission lines at voltages ranging from 69 kV to 345 kV. The Nuttby Mountain wind farm will be connected to a 69 kV radial transmission line which runs from Onslow to Tatamagouche. Connection to the grid will be via a 69 kV – 25 kV substation or a 69 kV – 34.5 kV substation, to be located to the near east of the wind farm as shown on Figure 2.1. This substation will be an outdoor, completely fenced-in facility typical of many substations throughout the province. The primarily function of the substation is to transform the voltage of the electrical energy generated at the wind farm from the cable collection voltage, i.e., being 25 kV or 34.5 kV, to transmission voltage at 69 kV using one or two transformers. In addition, the substation will contain various electrical protection devices and NSPI accessible communication equipment to monitor and protect both the wind farm and the grid side of the interconnection. It is expected that less than 1 km of newly constructed 69 kV transmission line will be necessary to physically connect the substation to the grid.

The entire interconnection engineering and construction will follow the requirements laid out by NSPI pursuant to a system impact study, a facilities interconnection study and the governing generator interconnection agreement. These studies and agreement are required and defined by the generator interconnection procedures which form part of the Open Access Transmission Tariff regime as approved by the Nova Scotia Utility and Review Board and administered by NSPI.

2.2.5 Ancillary Components

A servicing building and lighting are necessary to the construction and/or operation of the proposed wind farm. These components are in addition to the principle structural elements described above.

2.2.5.1 Servicing Building

During construction, facilities will be provided on site to provide for the needs both of the construction crews and for the storage of equipment. Some portion of these facilities will be temporary and will be removed once the farm is in operation. Consideration is also being given to the development of a small, but permanent, administrative building that would be used throughout the operating life of the wind park. The sitting and scale of such a structure has not yet been determined.

2.2.5.2 Lighting of WTGs

The wind turbines will be marked in accordance with TC's Obstruction Marking and Lighting Standards (CAR 621.19). These guidelines have specific directions for marking wind turbines. In short, they require WTGs to be marked at least every 900 m around the perimeter of the wind farm with synchronized red flashing beacons atop the nacelles. The intensity and direction of the lighting is also governed by these standards. The proponent recognizes that when satisfying the lighting requirements as imposed by the TC standards it must also be mindful of the EC (through CWS) preference to have a flash with a distinct off period. Accordingly, the proponent is considering the use of a LED based technology pointed within the TC acceptable range with all lighting synchronized.

2.3 Project Activities

2.3.1 Construction

In determining the scope of the Project for environmental assessment, AWPC has given consideration to the following:

- What is involved in the construction of the principal structural elements necessary to the Project including the towers, the installation of the cabling and the substation; and
- Other ancillary physical works that are necessary to accommodate the construction of the principal elements.

Construction will involve a number of actives including, but not necessarily limited to, the following:

- The completion of geotechnical surveying (sample drilling and analysis has been done);
- The preparation of the site for construction, including access roads to each of the turbine locations, which will involve the clearing of some vegetation;
- the mobilization of construction equipment;
- Excavation to accommodate the concrete foundations for each of the tower bases and the necessary disposal of the excavated materials in accordance with provincial regulatory requirements;
- The preparation of the building forms for the foundation, the pouring of the reinforced concrete foundation and the attachment of the mounting ring for the tower;

- The transportation of the wind turbine components, including the towers, and other equipment such as the substation's main transformer(s) to the site by the supplier on flatbed trucks;
- The lifting by crane of the tower sections which will be sequentially bolted into place;
- The lifting and placing of the nacelle, which contains the gear box, generating and yaw mechanism, on the top of the tower;
- The rotor, i.e., the blades of the turbine, will be assembled, or partially assembled, on the ground and then lifted to the nacelle and bolted into place;
- Depending on final wind turbine choice, an external pad-mounted transformer for each turbine, which will be approximately 1.5 cubic meters in size, will be sited within or proximal to the tower base;
- To the extent that underground cabling is used, the trenches for the power cables will be dug using heavy equipment, and, after the placement of the cables, the trenches will be backfilled;
- Assembly and installation of all equipment, switches, devices and infrastructure for the outdoor substation including delivery and installation of the main transformer(s);
- Physical interconnection to the grid; and
- Demobilized and removal of cranes, construction equipment and tools and clean-up of the facility.

2.3.1.1 Water Crossings

Preparation of Typical Crane Pat and Lay Down Area at Pubnico Point Wind Farm

The proposed road layout for the wind farm, as depicted on Figures 2.1 and 2.3, will use a combination of upgraded existing logging roads and new access roads for the construction, operation and continued maintenance of the turbines throughout the duration of the project. This road layout is influenced, on the one hand, by the accessibility requirements of the large crane necessary to erect the turbines and, on the other hand, by minimizing potential impact to the environment. The intent is to avoid all wetlands and to minimize the number of stream crossings necessary to construct the project, even if it requires constructing longer access roads.

Figure 2.3 illustrates both the locations of existing cross-drainage culverts and the locations for proposed new cross drainage culverts. Most of the existing culverts (blue on Figure 2.3) have been installed to maintain surface runoff and are either constructed of corrugated metal pipe or black polypropylene pipe, 500 mm in diameter or less. The proposed new cross drainage culverts (red on Figure 2.3) have been sited based on field reconnaissance to maintain or ensure continued surface runoff; they have been located in depressions, or low-lying areas, even where there was no presence of surface runoff at the time of the field visit. Both the existing and proposed culverts have been geo-referenced. In those situations where cross drainage culverts need to be extended, or installed, corrugated PVC pipe, similar to that already on site will be used to maintain drainage. All crossings will be refurbished and appropriate sedimentation and siltation measures implemented to prevent impacts to downstream habitats in accordance with the Nova Scotia Environmental Practices for Culvert Specifications (1991).

The proposed turbines are located along and across the drainage divide created by Nuttby Mountain. Based on available mapping of the existing culvert locations, the watercourse crossings within the project site were assessed by Mr. B. Rutherford, Fish Habitat Biologist, in April 2008 for their potential to support fish habitat. Preliminary fish habitat assessments in the general area indicate that while most of the streams represent first order streams with ill-refined stream channels, and intermittent flow, there are two streams crossings, i.e., Culvert A and Culvert B on Figure 2.3, that have the potential to support fish habitat, especially for brook trout (*Salvelinus fontinalis*). Section 4.3.4.2 provides for a more detailed description on the habitat characteristics of these tributaries.

Culvert A is an open-bottom, corrugated metal box culvert crossing a second order tributary of the Waugh River. The culvert is 1,500 mm (5 ft) in diameter and approximately 7,900 mm (26 ft) in length.

The existing open-bottom allows for potential fish habitat

Existing CMP box culvert (Culvert A) over a tributary of the Waugh River to be extended

Culvert B is located on the main access road to the project site and is a PVC pipe, 500mm in diameter. It is located along a headwater stream of Fergusson Brook (Figure 2.3). This tributary is also considered to be potential trout habitat. (Rutherford pers. com, 2008).

Headwater Stream of Fergusson Brook and location of Culvert B, viewing downstream.

It is proposed that both culverts will be temporarily lengthened to increase site accessibility for the transportation of heavy equipment through the site. The length of the culverts will be extended to allow the large crane to place one track on the existing road bed and one track on top of the culvert extension. This proposed extension includes the placement of a 3,000 mm wide x 1,200 mm high, precast concrete, open bottom, box culvert over the stream. The box will be set back 1.5 m away from the center of the stream and will be placed on a clear stone base, which shall be constructed outside of the tributary channel and banks. Sediment control fencing will be erected at both the up-stream and down-stream ends of the culvert. Sediment control berms will be placed on either side of the tributary banks to prevent any sediment, or gravel materials from entering into the watercourses. The extension to Culvert A will be placed downstream of the existing structure while for Culvert B, the extension will be upstream (see details on Figure 2.4). By using an open bottom culvert design, no instream work will be required, and it is intended that these temporary culvert extensions will be removed once the turbines have been erected.

2.3.2 Operation and Maintenance

Operation and maintenance can be divided into two distinct categories. Operations is the day-to-day observation, guidance and control of the facility. This involves ensuring the facility and the operation thereof complies with various contracts and obligations to which the proponent is bound, including any environmental assessment release decision and the attached conditions. The proponent intends to have at least one full-time designated individual on site (based in Truro or closer) to assist in the guidance of these activities together with the proponent's larger off-site wind energy team. This 'front-line' individual will be accessible to the community and to other relevant interested parties.

Maintenance of the wind farm will be done by trained technicians staffed by the wind turbine supplier at least for the duration of the warranty and service contract between the proponent and the supplier. This may involve two or three full time positions based on or near the site as well as involvement from regionally based personnel. The maintenance role keeps the wind turbines fully serviced and attends to any warranty matter, i.e., the replacement of defective parts if necessary. The proponent's operations team essentially oversees this work as the owner of the wind farm.

The wind turbines will be operational on a continual basis except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities. Each turbine will be subject to periodic maintenance and inspection. Regular maintenance will involve oil changes, and any waste products, e.g., the waste oil, will be disposed of in accordance with municipal and provincial waste management regulations.

Finally, the operations team will engage other suppliers under the guidance of its engineering team, to maintain and service what are commonly referred to as the 'balance of plant' components. These include the cable collection system, substation, interconnection, etc. The servicing requirements are not as frequent for these more static components and accordingly the specialized appropriate servie personnel will be called in as needed.

2.3.3 Reclamation and Decommissioning

The design life of a wind farm is typically 20 or more years and capital improvement and replacement programs may extend safe and efficient operations well beyond 40 years. Decommissioning and/or repowering of both the turbines and the site, when it is necessary or desirable, will be undertaken in accordance with the regulatory regime in place at the time.

At the end of its useful life, the wind farm will be, if not repowered, decommissioned, and the wind turbines will be dismantled and disposed of in a manner that meets all applicable regulatory requirements. Such activities would likely involve the preparation of the site, e.g., the establishment of access for construction equipment and the mobilization of that equipment including cranes, etc. The nacelle, blades and sections of the towers would be taken apart and would be reused, recycled or disposed of in accordance with regulatory requirements. It is not the proponent's intent to excavate and remove the portion of each wind turbine foundation that is below grade.

2.4 Construction Schedule

AWPC plans to construct and install the wind farm essentially in one distinct phase (see Figure 2.5). Land clearing and road construction, however, will commence as soon as possible in 2008 and carry into 2009. An early start to the civil work is very important to achieve timely completion of the access roads, turbine pads and foundations in preparation for the delivery and installation of the major components starting as early as mid June, 2009. In this regard, the schedule accounts for the inherent limitations imposed by typical winter conditions at Nuttby Mountain which are expected to preclude major construction activities during December through February or March. In addition, the impact of the Department of Highway's spring thaw road access restrictions for heavy vehicles must be taken into consideration when scheduling construction activity.

Civil work, including the foundations, should be completed by June, 2009. The Proponent then expects to install up to 18 wind turbines by or near the end of August, 2009. This will allow lifting work to be completing prior to the commencement of the typically windier months. Installation of the cable collection system, terminations to the turbines, completion of the substation and interconnection to the grid will progress concurrent with the turbine installations and be completed in early fall, 2009.

The wind farm is scheduled to be fully commissioned, interconnected and operational before December 31, 2009 to meet contractual obligations of the Proponent pursuant to its PPA with NSPI.

2.5 Anticipated Emissions and Waste Streams

During Project operation the proposed wind farm will not generate air emissions, and anticipated discharges are limited to the waste oils that will be handled during the course of regular maintenance. These wastes will be managed and disposed of in accordance with all applicable regulations.

2.5.1 Site Runoff

During the construction phase of the Project, the control of silt-laden run-off will be an important issue. Erosion and sediment control measures will be detailed in an Environmental Management Plan (EMP) and stringently applied during construction and will be maintained until soil cover has been re-established. Construction debris will be managed on site or at offsite disposal locations in an approved manner. Solid wastes will be recovered for reuse or recycling as required by provincial legislation.

2.5.2 Hazardous Wastes

A limited number of hazardous materials will be required for the construction and operation of the proposed turbines. As referenced above, prior to commercial operation, an EMP will be developed and implemented to ensure that all staff working at the wind farm are appropriately trained to handle, store and dispose of these materials which may include one or more of the following:

- Corrosion and fouling inhibitors;
- Paints;
- Industrial cleaners; and
- Lubricating oils and fuels.

The EMP will be updated to address the specific needs of Project Operation. All hazardous materials will be stored and handled according to relevant federal and provincial regulations. Staff will receive the training specified by law.

2.5.3 Other Emissions

Electrical magnetic fields (EMFs) are created when electrical charges flow within any object that conducts electricity. For a transmission line, these fields are created by current in a conductor. When a voltage is applied to a conductor, a magnetic field is created in the space around the conductor, but field intensity decreases rapidly with distance. There has been some public concern expressed with respect to a perception that exposure to magnetic fields is associated with health. The available EMF research does not establish this linkage. Indeed, the National Research Council has concluded that "…. the current body of evidence does not show that exposures to (magnetic) fields present a human-health hazard" (National Research Council, 1996). This subject is addressed further in Section 7.4.8.

2.6 Environmental Management

The objective of environmental management is to implement safe, environmentally responsible, and sound engineering, construction, operation, and training practices. AWPC is committed to articulate and adhere to systems, procedures, practices and materials that will ensure the development and operation of the wind farm at Nuttby Mountain is executed in a manner that protects the environment and facilitates the safety of all who work or visit the site. To the extent practical AWPC will seek to eliminate sources of pollution at source. The principle components of an environmental management system include the preparation of the following:

- Environmental Protection Plan (EPP); and
- Contingency and Safety Plan.

The intent of the environmental management system is to:

- define environmental, health and safety responsibilities and accountabilities for personnel;
- ensure compliance with regulations, goals and objectives;
- establish minimum standards for a contractor safety and the implementation of environmental protocols in the field;
- establish safe work practices and procedures documentation that ensure basic precautions for preventing accidents, injuries or illnesses in the performance of work;

- define environmental practices and procedures that establish minimum standards for all operations that have a potential to cause environmental problems;
- define minimum safety training standards to ensure that all personnel are aware of potential hazards and know safe work practices and emergency procedures; and
- establish an accident/incident reporting system that standardizes prompt reporting of all injuries and environmental incidents.

2.6.1 Environmental Protection Plan (EPP)

The EPP will be developed in consultation with relevant federal and provincial agencies including EC, DFO Habitat Management Division and NSDE, will be completed prior to construction and will outline specific environmental and engineering measures that must be employed during construction, e.g., the deployment of techniques to control erosion and sedimentation and measures to prevent spills of hazardous materials. The EPP will expand upon measures identified in this environmental assessment report and will accommodate recommendations from the regulatory authorities. These requirements will be brought to the attention of all personnel working on the site, including contractors.

2.6.2 Contingency and Safety Plan

The goal of the Contingency and Safety Plan is to reduce the frequency, extent and duration of accidental events and to reduce the risk to the environment and public safety from such events. A contingency and safety plan will be developed in consultation with relevant federal and provincial agencies for both the construction and operation of the Project. The plan will designate personnel responsible for specific actions, and ensure that an effective communications and reporting system is in place.

These plans can only be finalized once the project design is finalized.

2.7 Malfunctions and Accidents

AWPC is cognisant that malfunctions and accidents that pose a risk to human health and safety and to the environment can occur and are committed to ensuring that all requisite protocols are established to:

i) To minimize the risk to human health and safety during both construction and operation; and
ii) To minimize the risk to the environment during both construction and operation.

These protocols will include the formulation of a site specific EPP to ensure the application of environmental protection measures and good engineering practices throughout construction; and the preparation of an emergency response plan to address responses in the event of an accident during either construction or operation.

The construction and operation of a wind farm, though handling structural elements that are not yet common to this region, employs techniques and technologies that are familiar to the construction industry. The likelihood of serious malfunctions or accidents associated with a wind farm that would pose a risk to human health and safety or the environment are substantially less than those associated with many alternative forms of power generation.

The likelihood of serious malfunctions or accidents associated with the operation of a wind farm that would pose a risk to human health and safety or the environment are substantially less than those associated with many alternative forms of power generation. Icing is perhaps the predominant safety concern and this can be addressed through technical safeguards incorporated in the equipment, staff training and the use of warning signs. Fire is a second potential concern. Again the likelihood of this occurrence can be mitigated by training and the establishment of response protocols. The operating staff will be trained to respond appropriately in the event of different scenarios including, but not limited to, technical failure, icing, fire and a lighting strike.

3.1 Overview and Approach

The environmental assessment methodology has been developed to meet the requirements of the assessment regulations of both the Nova Scotia *Environment Act* and the *CEAA*. The approach also reflects the technical and professional competency of the study team and their ability to address specific issues in a rigorous and pragmatic manner. In general, the approach has been designed to produce an environmental assessment document that:

- focuses on issues of greatest concern whether these have been identified by the study team, by the public or by the regulators;
- clearly addresses regulatory requirements; and
- integrates engineering design and mitigative measures into a framework that will enable, as the engineering proceeds, the preparation of a comprehensive EMP for the Project.

Figure 3.1 depicts the key steps in the assessment process.

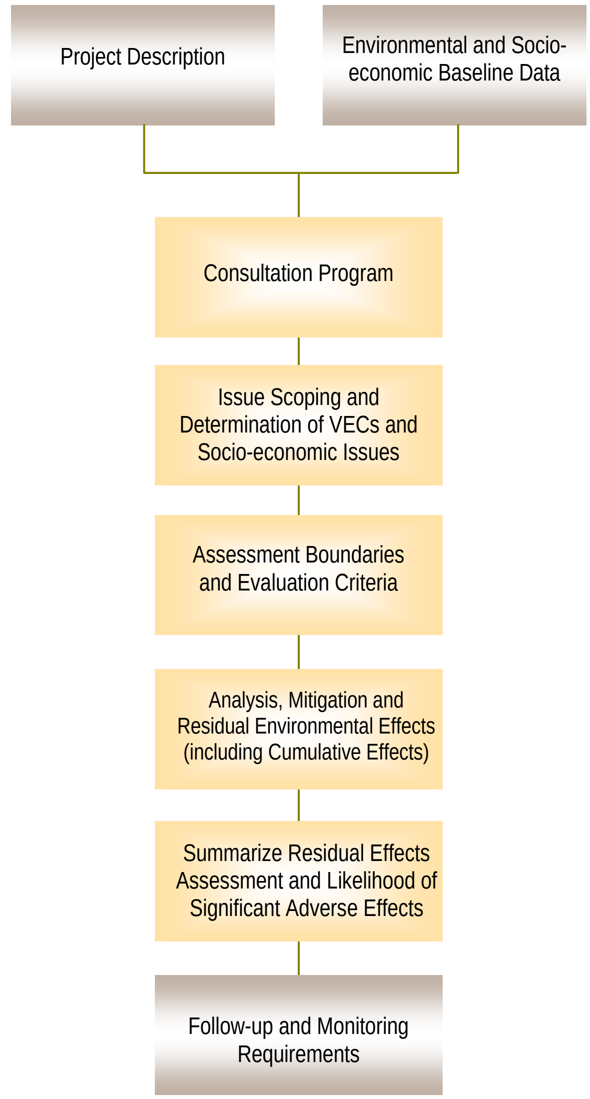

Figure 3.1: Environmental Assessment Process

The preparation of the Project description and the environmental and socio- economic baseline are the two fundamental building blocks necessary for the environmental analysis. The former is derived from the work undertaken by the Proponent and their engineering team. The latter is derived from the review and compilation of pertinent secondary data sources and the execution of selected field programs. The integrity of these building blocks is critical to the credibility of the subsequent analysis; the preparation of the two, however, is often iterative. This allows the environmental assessment to be used as a planning tool and to influence Project design.

To compile the environmental and socio-economic baseline, the study team drew on its collective knowledge and experience and considered input and opinions expressed by the community, the relevant regulations and guidelines and pertinent research including the field work undertaken. Reference has also been made to environmental work executed by the Proponent in other areas, but particularly with respect to the lessons learnt from the development and operation of the wind farm at Pubnico Point in southwest Nova Scotia. This work has generated a substantial data base and enabled the identification of those matters that warrant evaluation. The assessment examines the potential effects of each Project phase, i.e., construction, operation and decommissioning, as well as malfunctions and accidents, with regard to each

VEC or socio-economic issue. VECs represent “key” or “indicator” species, communities, species groups or ecosystems, as well as specific media, e.g., water or air, that may transport environmental effects. Social, cultural or economic factors, or issues, may also be affected by the proposed works and are identified as such.

The final selection of VECs and socio-economic issues that provide the focus of this assessment reflect an informed understanding of the consequences of the proposed works in the physical, ecological and socio-economic context of the receiving environment. These were determined through reference to pertinent literature, through consultation, as a result of work done on other like projects and through the execution of the field programs. The local consultation undertaken has been extensive; there have also been meetings with environmental regulatory staff at the provincial and federal levels. Chapter 5 provides an account of the consultation undertaken.

3.2 Research and Field Work Undertaken

Environmental assessment is a process that is executed early in Project planning to enable environmental factors to influence decisions and detailed engineering. It is in part a planning tool, the underlying intent of which is to ensure that all works associated with the Project's construction, operation and decommissioning are executed in a manner that causes minimal harm to the physical, ecological and socio-economic environments.

In addition to the research and the consultation program executed, environmental field programs were undertaken in 2007 and in 2008 to facilitate both the compilation of the environmental and socio-economic baseline and the determination of the VECs and socio-economic issues. Both biophysical and ecological field programs were conducted; these included, but were not limited to investigations and/or surveys to identify:

- ecological habitats and vegetation patterns to determine locations that were subsequently subject to further field examination as habitat for rare or endangered plants, or other species;
- stream crossings and wetlands that would be subject to further investigation;
- breeding and migrating birds;
- the presence of bats;
- locations of archaeological value; and
- a MEK study.

The above and other programs undertaken are described below.

3.2.1 Secondary Data Research

The initial step in the environmental assessment process for this Project was to compile, review and evaluate secondary data essential to the definition of the field programs and to the scoping of the environmental assessment. In broad terms, this phase of the work included the following:

- acquisition of data sets from various government sources including Nova Scotia Department of Natural Resources (NSDNR);
- the acquisition and examination of aerial photographs;
- review of key texts, e.g., the Natural History of Nova Scotia (Davis and Browne, 1996);

- consideration of the *SARA*, the *Endangered Species Act* and examination of the listings compiled by the Committee on the Status of Endangered Wildlife in Canada (“COSEWIC”), the Atlantic Canada Conservation Data Centre (“ACCDC”) and NSDNR; and
- compilation of demographic and related data from Statistics Canada to facilitate the preparation of the socio-economic profile.

The Agency has amended the definition of “environmental effect” in subsection 2(1) of the *CEAA* to clarify that under the *SARA*, an environmental assessment must always consider project impacts on listed wildlife species, their critical habitat or the residences of individuals of that species. Since *SARA* is legislation of general application, the requirements of that Act must be addressed in any assessment. In addition, the provincial environmental assessment process requires a “Species at Risk” review. *SARA*, in conjunction with the provincial *Endangered Species Act*, provides the regulatory framework pertinent to the protection of valued rare and endangered species.

In Nova Scotia, species of concern are tracked and designated at four levels. *SARA* and the *Endangered Species Act* provide legislative designations while the NSDNR - General Status Ranks and the ACCDC provide technical tracking lists.

The NSDNR-General Status Ranks are, by design, high level in nature. The results of the General Status Assessment provide more in-depth scientific assessment approaches and a "first-step tool" to help identify priorities, i.e., establish a list of priority species, for more detailed status evaluations, inventory, research and management. The ACCDC is a member of NatureServe, an international non-profit organization that provides science and technical support to various Conservation Data Centres (“CDC”). The ACCDC provides objective data and expertise about species and ecological conservation concerns in Atlantic Canada.

A list of the potential species of concern that may reside in, or migrate through, Nuttby Mountain was compiled from the legislated designated lists, the ACCDC and the NSDNR General Status Ranks.

The methodology followed to determine potential species of concern was the protocol developed by NSDNR, *Standards and Processes Applied to Provincial Environmental Impact Assessment, Wild Species Priorities Inventory and Mitigation Standards for Reporting*. The protocol provides a framework through which listed species can be ruled in or out of an environmental assessment based, in the first instance, on geographical occurrence, and secondly, on the presence or absence of appropriate habitat within the Project area. The observed distance of each species from the study area (as noted in the ACCDC guidance list) was also taken into consideration. Additional sources used to determine the regional distribution and habitat preferences for birds included the *Atlas of Breeding Birds of the Maritime Provinces* (Erskine, 1992) and *Eastern Birds* (Peterson, 1980). For plants, a key reference was *Roland’s Flora of Nova Scotia* (Zinck, 1998).

A list of sightings of rare and endangered species within 100 km of Nuttby Mountain was acquired from the ACCDC. Within this list, there were 197 Yellow and Red listed species under NSDNR’s General Status List. By defining the habitat present on site, this list was refined to 29 species which have a habitat requirement consistent with those identified on site (see Table 4.5). This list of species was divided by taxon, i.e., birds, plants, etc.; this provided both guidance for the development of field methodologies and as a reference for the assessment.

Those species identified by COSEWIC, or by the NS *Endangered Species Act* as “Endangered”, “Threatened” or of “Special Concern”, and/or by NS DNR General Status as “Red” or “Yellow” and/or by ACCDC as “S1: or “S2” were identified. Table 3.1 provides a summary of definitions of rarity ranks associated with the referenced lists.

Table 3-1: Definitions of Rarity Rankings

Atlantic CDC Ranks Definitions	
S1	Extremely rare throughout its range in the province (typically five or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.
S2	Rare throughout its range in the province (six to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.
S3	Uncommon throughout its range in the province, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences).
S4	Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the species is of long-term concern, e.g., watch list (100+ occurrences).
SU	Unrankable: Possibly in peril throughout its range in the province, but status uncertain: need more information. Used for new species not previously identified.
SX	Extinct/Extirpated: Believed to be extirpated within the province.
S#S#	Numeric range rank: A range between two consecutive numeric ranks. Denotes uncertainty about the exact rarity of the species, e.g., S1S2.
?	Inexact or uncertain: For numeric ranks, denotes uncertainty, e.g., SE? Denotes uncertainty of exotic status.
NSDNR General Status Ranks	
Undetermined	Species for which insufficient data, information or knowledge is available or reliably evaluate their status.
Red	Known to be or is thought to be at risk.
Yellow	Sensitive. Species that are not believed to be at risk of immediate extirpation or extinction but which may require special attention or protection to prevent them from becoming at risk.
Green	Secure. Species that are not believed to be at risk or sensitive. This category includes some species that have declined in numbers but remain relatively widespread or abundant.
NS Endangered Species Act	
Endangered	A species that faces imminent extinction or extirpation and it listed as an endangered species pursuant to Section 12
Threatened	A species that is likely to become endangered if the factors affecting its vulnerability are not reversed and is listed as a threatened species pursuant to section 12
Vulnerable	A species of special concern due to characteristics that make it particularly sensitive to human activities or natural events and that is listed as a vulnerable species pursuant to

	section 12
COSEWIC Ranks	
Endangered	A species facing imminent extirpation or extinction
Threatened	A species likely to become endangered if limited factors are not reversed
Special Concern	A species of concern because of characteristics that make it particularly sensitive to human activities or natural events**.**

The execution of this analysis provided a framework of relevance to the definition of selected field programs, to the identification of VECs and to their evaluation.

Based on the review of the secondary databases and the initial mapping generated from the NSDNR forest GIS database, as well as the interpretation of recent aerial photography, representative forest cover types were identified. Although large areas have been logged, and continue to be logged, Nuttby Mountain is forested; the dominant habitat cover types are:

- Roadside Vegetation;
- Tolerant Hardwood Forest;
- Mixed Forest;
- Coniferous Plantation; and
- Clearcut.

The habitats are further described in Section 4.2.1. The database and mapping compiled provided the reference material for the initial field reconnaissance and facilitated the design of the field programs.

3.2.2 Field Programs Executed

To augment the work referenced above, a number of specific field programs were undertaken. These are identified in Table 3.2 and outlined in the following sections.

Table 3-2: Field Programs Undertaken

Field Program	*Program Description*	*Lead Researcher*
General ecological field investigations	Ecological reconnaissance, including the identification of wetlands, habitat description and stream/stream crossing assessments	Clinton Pinks, CBCL Limited and Bob Rutherford
Bird breeding and migratory programs	Field work to identify breeding and migratory bird populations	Brian Dalzell, Atlantic Bird Surveys
Botanical survey	Field investigations for priority plant species.	Sean Blaney, ACCDC
Large mammals	Field investigation to determine relevance of the site to large mammals, primarily mainland moose.	Ross Hall
Bat monitoring program	Field investigation to determine the importance of the site for bats	Hugh Broders, Saint Mary's University
Archaeological program	An archeological desktop study and an archeological field program of the turbine sites	Davis Archaeological Consultants Limited

Field Program	Program Description	Lead Researcher
	and the access roads.	
MEK study	A review of First Nations traditional and current land use patterns.	Membertou Geomatics
Communication tower links	Field work and associated analysis undertaken of adjacent radio towers.	Oldham Engineers Inc.
Land use investigations	Documentation of land use in and near the project site including the compilation of data for the visibility analysis.	Steffen Käubler, CBCL Limited
Noise	Determination of noise from the turbines under consideration using the GH Wind Farmer model.	Erich Ossowski, Garrad Hossan Canada Inc.

3.2.2.1 General Ecological Field Investigations

There were a number of reconnaissance visits to the site. These are referenced below.

Confirmation of Habitat Types

Initial mapping based on the secondary databases was ground truthed by CBCL Limited to confirm the habitat delineations identified. Where necessary, the mapped classifications were updated to reflect the on-the-ground conditions.

Wetlands and Surface Water

A desktop GIS survey was conducted using the NSDNR Wetlands Inventory database to determine whether wetlands or waterbodies were located within the study area. The Nuttby Mountain site is well drained, and does not contain a large number of wetlands. The wetlands on the mountain, however, were mapped, and the sites ground truthed by CBCL Limited during the initial field reconnaissance. No additional wetlands were identified during this field program. Subsequent to the proponent's analysis of the wind regime and the determination of optimal siting for the turbines, the environmental team worked with the proponent and with the engineers, including an intensive field inspection, to confirm the location of each turbine, the access roads and lay down areas and to ensure that wetlands on the site were avoided by the necessary works.

Fish Bearing Streams and Stream Crossings

A fish habitat assessment was conducted at the existing or proposed access roads that crossed, or would cross, streams on the site (Figure 2.3). Photographs were taken, GPS coordinates of each crossing recorded and brief descriptions prepared of each crossing. This description included the percentage of vegetative cover along the banks and instream, the substrate composition, flow characteristics, the absence or presence of fish and fish spawning habitat, i.e., redds and water clarity; the condition of the existing culverts and the pH and temperature of the water were also measured. Those streams considered as having potential habitat for fish are described further in Section 4.3.4.

Land Use

Information on land use in and adjacent to the area was determined from observations in the field, through conversations with people at the open house and from consultations with those who own and use the properties involved. The observations made in the field were also used to identify viewpoints that could be used in the visual assessment (see Section 3.2.2.9).

3.2.2.2 Avian Field Programs

Following consultation with Environment Canada biologist, Dan Busby, on May 1, 2007, it was decided that the best approach to assessing both the breeding and migrating birdlife of the Nuttby Mountain area would involve:

- Breeding Bird Point Counts;
- Standardized Area Search;
- Morning Fall Stopover Counts; and
- Fall Raptor Watch.

These surveys were executed by Brian Dalzell (Atlantic Bird Surveys). A primary reference in the design of the work programs was Environment Canada's text entitled "Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds". Figure 3.2 indicates the survey locations and the following subsections provide further detail on the surveys undertaken.

Breeding Bird Point Counts

Eighteen survey points were identified, each point located in proximity to each of the proposed 18 turbine sites at the time the study was undertaken, i.e., June, 2007. These point counts as situated within the identified habitats are summarized in Table 3.3.

Table 3-3: Breeding Bird Point Counts by Habitat Type

Habitat Type	***# of Point Counts***	***Site #***
Mature Hardwood Forest	8	1, 2, 3, 5, 14, 15, 17 & 18
Young Regenerating Clear-Cut	2	13 & 16[1]
Young Predominantly Hardwood Regeneration	4	4, 6, 11 & 12
Young Predominantly Softwood Plantation	4	7, 8, 9 & 10

1 The reason only two point counts were located in this habitat was due to the very similar (monotypic) nature of the entire clear-cut area.

Surveys at each of these points were conducted twice during the peak of the breeding season, i.e., once in early June and again 10 to 14 days later. Each count was 10 minutes in duration; during this period all birds heard and seen within a 100 m radius were recorded and their position geo-referenced.

Standardized Area Search

Standardized ground searches were conducted using the old tote roads to more completely assess the breeding habitats in the project area and to identify species not sampled by the point counts. These searches were generally undertaken over a couple of hours on the same day as the point counts. A total of some 30 hours were dedicated to this task between late May and early September, 2007. The methods employed were similar to those used in the preparation of the first Maritimes Breeding Bird Atlas (Erskine, 1992).

Morning Fall Stopover

Because most land birds migrate at night, their identification is nearly impossible. To assess the magnitude and timing of any nocturnal migration, therefore, and the possible existence of migration corridors in the Nuttby Mountain area, a transect was defined that passed within 250 m of the proposed turbine sites. The length of this transect was 3.8 km. The start was at the summit of Nuttby Mountain (elevation 354 m); proceeded west along a tote road through PID 20015293 for 1,800 m, until it intersected the Old Nuttby Road, then north for 800 m until it intersected a second tote road, and finally 1,200 m eastward to the endpoint (elevation 306 m) in PID 20015178. The four habitats identified in Table 3.3 were equally sampled along the length of the transect; the latter also passed within 250 m of 11 of the 18 turbine sites.

This transect was driven 12 times between 2nd August and 6th November, 2007. These surveys were generally conducted between the hours of 7:00 to 11:00 a.m. Three-minute stops were made every 200 m along the transect, and all birds observed were identified and counted. The sequence of sampling along the transect was alternated on every second coverage; that is, beginning at the 0 m mark on the first survey and at the 3,800 m mark on the second. Detailed notes on each observation, location, behaviour and weather were recorded (see Table 3.4) and multi-species foraging groups were recorded.

Table 3-4: Weather Observations at Start of Morning Stopover Counts

Date	***Temperature and Visibility***	***Relative Wind Speed and Direction***
August 2, 2007	+14C @ 0655. Partly cloudy	Calm winds.
August 11, 2007	+12C @ 0700. Sunny with high cloud	Light breeze from SSE.
August 21, 2007	+10C @ 0715. Clear and sunny	Very light winds.
August 30, 2007	+12C @ 0600. Fog until 1100	Winds very calm from SSW.
September 8, 2007	+14C @ 0630. Fog until 1045	Winds ~20kph from SSW.
September 19, 2007	+4C @ 0655. Sunny and clear	Wind <10kph from SW.
September, 20, 2007	+13C @ 0815. Overcast, ceiling 150 m	Strong SW wind >30kph.
September 21, 2007	+3C@ 0610. Clear and sunny	Calm winds.
October 5, 2007	+4C @ 0655. Clear and sunny	Calm winds.
October 18, 2007	0C @ 0730. Clear and sunny	Calm winds.
October 19, 2007	-1C @ 0830. Clear and sunny	Light NW breeze (10-15kph).
November 6, 2007	+2C @ 0930. Mostly sunny	Calm winds.

Taken from Summit of Nuttby Mountain. Late Summer and early Fall, 2007

The surveys were used to document the presence, species composition, and abundance of nocturnal migrants using the project area for stopover habitat. There were more birds found at the higher end of the transect, probably due to the higher habitat diversity near the summit of Nuttby Mountain. Only one significant stopover event took place, on September 8th at stop # 3 (0815-0830). A fairly large (by local standards) mixed flock of foraging warblers, thrushes and sparrows was encountered moving very low in a roughly south-north direction through young, thick hardwoods about 250 m from the summit. Approximately 100 birds of 21 species were detected in this flocks and it appears some (~50%) were genuine Boreal Forest migrants, such as Blackpoll and Tennessee Warblers.

Vireos and warblers were largely present along the survey transect until late September, after which finches and sparrows became more abundant. This is to be expected, as most wood-warblers and vireos are neo-tropical migrants. These long-distance migrants are primarily insectivores and, therefore, leave their nesting territories early in the migration period due to the reduction in prey and the need to travel more miles to wintering areas. The sparrows, on the other hand, are primarily near-migrants, spending the winter in the continental United States. They are omnivores and utilize seeds and plant fruits that are available later into the fall, and their short-distance migrations do not require as much time to travel.

Interestingly, during the fall of 2005, during similar stopover surveys at Mars Hill, Maine (Woodlot Alternative, March 2006), it was found that nights with high migrant passage rates (as shown on radar) did not necessarily translate into increased morning stopover activity. Variation in the number of birds observed along the Nuttby Mountain fall stopover survey transect was probably due to weather, individual habitat preference, site selection, and level of effort. Patterns in the seasonal abundance of species was as would be expected, with most long-distance migrants present through the middle of the survey season, and short-distance migrants and potential wintering species present late into the survey season.

Fall Raptor Watch

Because Nuttby Mountain is the highest point in mainland Nova Scotia (1,150 ft) and in the Cobequid Mountains, it was thought prudent to investigate for the possibility of any significant fall raptor migration. Migrant raptor watch counts were conducted on 12 dates between 2nd August and 6th November, 2007, for a total of 72 hours of observation time. Each count was of six-hour duration and centered on the NSDNR Fire Tower on the summit of Nuttby Mountain (45 33’ 11.33” N, 63 13’ 25.18” W elevation of 361 m. Counts started no earlier than 10:00 a.m. and concluded no later than 4:00 p.m. on the following dates: 2nd, 11th, 21st, and 30th August; 8th, 19th, 20th, 21st September; 5th, 18th, 19th October; and 6th November. The weather conditions were recorded at the start and conclusion of each survey; the results of the field program are presented in Section 4.3.1.2.

3.2.2.3 Bats

Anabat II detection systems were used to sample the echolocation calls of bats in the study area at the locations identified in Table 3.5 and indicated on Figure 3.3. Each system was deployed at ground level and consisted of an ultrasonic Anabat II detector interfaced to a CF Storage ZCAIM (Titley Electronics Ltd., NSW Australia). The seasonal timing of the sampling period corresponded to fall migration activity by migratory species and movement by resident species to local hibernacula.

Table 3-5: Bat Monitoring Locations

Location	*UTM Easting*	*UTM Northing*
1	481208	5044753
2	481928	5045493
3	481667	5044824

Datum: NAD83, UTM Zone 20

The detectors were placed along forest edges, i.e., along roads or in clearings, to maximize the recordings of bats commuting or foraging in the area. Monitoring began on the evening of 24th August, 2007 to the morning of 29th August, 2007 at location 1 and from the evening of 31st August, 2007, to the morning of 7th September, 2007 at locations 2 and 3.

The identification of many bat species is possible because of the distinctive nature of their echolocation calls (Fenton & Bell 1981; O'Farrell et al. 1999). Species were qualitatively identified from echolocation sequences by comparison with known echolocation sequences recorded in this and other geographic regions. In the case of species in the genus *Myotis* (northern long-eared and little brown bat), no sequences were identified to the species level, as their calls are too similar to be separated. Identifications were accomplished using frequency-time graphs in ANALOOK software (C. Corben, www.hoarybat.com). An anabat echolocation file that approximates a call sequence, defined as a continuous series of greater than two calls (Johnson et al. 2004), was used as the unit of activity. The results of the work undertaken are provided in Section 4.3.3.2.

3.2.2.4 Large Mammals

Historically the Nuttby Mountain portion of the Cobequid Hills was occupied by moose, with both moose and moose sign being frequently encountered during the 1970s. A pellet group survey was chosen to measure the present status of moose near the Nuttby Mountain area. This study was undertaken by Ross Hall in May, 2007.

The method employed entailed a springtime search of the forest floor and, using a transect sampling system, counting the number of moose fecal pellet groups deposited on fall leaf litter. The time interval over which fecal pellets are being deposited, and subsequently sampled during the course of the survey, is generally early November to May. The number used in this survey and calculations is that over a 200 day winter interval one moose will deposit 3,400 pellet groups. This number, if not totally accurate, at least allows comparisons to other surveys.

Fifteen transects, each 1 km long, were established in expected good moose habitat surrounding the Nuttby Mountain site and ranging up to 7 km from the site (see Figure 3.3). A compass bearing was followed in a straight line for 1 km through the forest, while laying a line of string from a hip-chain box. After establishing the 1 km long transect, it was walked in reverse, following the string, and the pellet groups were counted. Moose pellet groups within 2 m of the string were counted, and deer pellet groups within 1 m of the string were counted. As a result of the 15 plots, a total 6 hectare of forest floor was searched for moose pellet groups. The dispersed plot locations and long layout of plots allowed a sampling of different habitats and increased the likelihood of encountering moose sign if moose occupied habitats in a clumped fashion.

The results of the work undertaken are provided in Section 4.3.3.2.

3.2.2.5 Plants

Botanical surveys were executed by Sean Blaney on June 8th and 9th, 2007. A pedestrian survey of 20.7 km was undertaken. The locations of the proposed turbine sites were loaded into a GPS unit and each turbine site was visited. At each turbine site, plant communities were photographed, species composition noted, stand age for forested sites was assessed and any obvious disturbance history was noted. Search efforts were concentrated on the footprint of the proposed development, but occasional sampling outside the linear corridors was conducted where noteworthy habitats were observed.

A full vascular plant list was compiled for the area as a whole and the species relative abundance estimated. For plant species tracked by the Atlantic Canada Conservation Data Centre, i.e., those ranked S1, S2, S3 or S3S4 in Nova Scotia, GPS locations along with habitat descriptions and more precise estimates of local abundance were recorded. The results are discussed in Section 4.3.2.2 and the detailed listings provided in Appendix A.

3.2.2.6 Archaeological Program

In May 2006, Davis Archaeological Consultants Limited conducted a desktop archaeological resource impact assessment of the study area. The purpose was to determine the potential for archaeological resources within the development zone and to provide recommendations, as warranted, for mitigation. The assessment included consultation of the Maritime Archaeological Resource Inventory at the Nova Scotia Heritage Division as well as historic maps, manuscripts and aerial photographs of the study area. Published literature was accessed at the Public Archives of Nova Scotia and at the Department of Natural Resources Library in Halifax. A predictive modelling exercise was conducted to determine the potential for First Nations resources within the study area. This model was based on the visual analysis of National Topographic Series maps at a scale of 1:10,000. The model took into consideration historic documentation, topography, floral and faunal ecology, stream order, climate, and available transportation routes.

In early May 2008, field surveys were undertaken at Nuttby Mountain under a Category C Heritage Research Permit issued by the Nova Scotia Heritage Division (Appendix B). The locations of the WTGs were uploaded to a handheld GPS unit. All locations were surveyed with up to 50 m additional buffer around each WTG site. The access roads were also walked and surveyed. Digital photographs were taken of the WTG locations and surrounding terrain, and notes were made in a field notebook to document the reconnaissance activity. The results of the work undertaken are reported in Section 4.4.5.

3.2.2.7 Mi'kmaq Ecological Knowledge

The Mi'kmaq Ecological Knowledge Study was undertaken by Membertou Geomatics Consultants to identify land and resource use which is of particular importance to the Mi'kmaq people in the vicinity of the Project location. The area subject to consideration included the location of the wind farm at Nuttby Mountain and a surrounding 10 km buffer zone. This larger area was used to ensure the capture of Mi'kmaq traditional use activities. The key components of this study included:

- Historical Review – a review of the historical documentation as it relates to the Mi'kmaq and the Project area;

- Traditional Use Data – a review of existing documentation as it pertains to Mi'kmaq traditional land and resource use of the study area to provide information on historical Mi'kmaq use and occupation related to the location of the proposed wind farm;
- Present Day Use – to document information from the surrounding Mi'kmaq communities as a means of identifying current use of lands and waters in the Project area. This phase of the work program was executed by contacting the Mi'Kmaw communities, particularly the Millbrook First Nation and the Pictou Landing First Nation, and interviewing individuals who were familiar of Mi'kmaq use and knowledge of the area. Those interviewed were provided with maps of the area and were asked to identify where they undertake traditional activities; and
- Mi'kmaq Significant Species Survey – As Mi'kmaq land and resource use often involves plant and animal species which play a key role in the Mi'kmaq community be it for medicinal, food or spiritual purposes, a significant species survey was executed by Mi'kmaq individuals who are custodians of knowledge regarding such species.

The results of this work are referenced in Section 4.4.6 and the report is provided in its entirety in Appendix C.

3.2.2.8 Communication Tower Links

Oldham Engineers Inc. was contracted to examine the impact the proposed wind turbines would have on the performance of the existing communication towers that are located in close proximity to the Project site. The approach to the analysis involved the following steps:

- the identification of the proposed wind turbines;
- obtaining data for all licensed radio systems within 40 km of the wind farm from the radio spectrum licensing authority, i.e., Industry Canada (IC);
- reviewing the IC data records and producing a "short list" of the existing radio systems that cross the property proposed for the wind farm;
- visiting the site to verify the location of the applicable radio towers and the existence of the antennas identified on the "short list". Antennas at the Nuttby Mountain radio site that had not been identified on the IC database and point in the direction of the wind farm were also identified;
- preparing a verified inventory of, and mapped, systems that were of concern; and
- conducting the analysis.

Further detail of the work undertaken and the results are provided in Sections 4.4.3.

3.2.2.9 Visual Assessment Methodology

Aesthetics are often a fundamental question for those who have concerns about wind-energy projects. The question is not whether wind turbines are beautiful or not, but rather to what degree they may affect important visual resources in the surrounding area. Therefore the evaluation needs to focus on the relationship of the project to the scenic features of the surrounding landscape. In understanding visual impacts it is useful to understand the broader context of the view. Furthermore, it is essential to create technically accurate simulations of the wind farm. The methodology used to assess the visual impact of the proposed Nuttby Wind Farm Project is outlined in Figure 3.4.

View Shed Analysis

A computer generated map based on a digital terrain model of the area was prepared that illustrates where the proposed wind farm could potentially be visible within the study area (Figure 3.5). This map, however, based on a digital terrain model, does not take into account surface elements like vegetation or buildings that might block views. Field analysis is therefore essential to verify actual visibility.

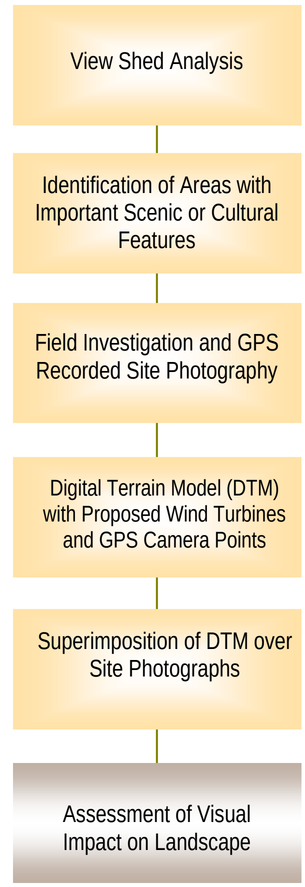

Figure 3.4: Visual Assessment Methodology

The identification of areas with important scenic or cultural features typically focuses on areas of public use. These include public roads, recreation areas, trails, wilderness or natural areas, historic sites, village centres and other important scenic or cultural features identified in planning documents, or by the public themselves. No definitive or highly valued vistas were identified in the vicinity of the Project site. Nevertheless, to facilitate the visual assessment, high resolution photographs were taken from two locally important viewpoints with a 50 mm focal length lens (this most closely matches the human eye). The first of these viewpoints was looking west from Earltown; the second was looking north towards the site from Nuttby. Each of the viewing points was recorded by GPS (see Figure 3.5).

Digital Terrain Model

Using the GIS data of the study area, a digital terrain model was created and the exact turbine locations and heights inserted into the model. Accurate digital images of the terrain were then created from the field points recorded. The views created resembled the same field of view, i.e., focal length, as used for the site photography. The images of the digital terrain model were then merged with the site photographs, and photographic images of the wind turbines are placed in the locations indicated by the digital terrain model. The results of this analysis are presented in Section 7.3.9.

4.1 Geophysical Environment

4.1.1 Climatology and Meterology

At the regional scale, Atlantic Canada lies within a zone of prevailing westerly winds that carry air from the interior of the North American continent. This zone experiences the passage of high and low pressure systems which are in turn influenced by ocean currents and continental topography. The low pressure systems moving through this area typically track across the continent, or up the seaboard, resulting in the onset of wind from an easterly direction, thickening cloud and a gradual drop in pressure. The frequent movement of such systems through Atlantic Canada brings significant precipitation. Winters are usually cold with frequent snowfall and freezing precipitation. Spring is typically late (some time in May), cool and cloudy. Summers are short in duration, warm and are characterized by less precipitation than in other seasons.

In recent years, extreme weather events have been occurring more frequently. The Province has been subjected to both drought and intense storms, including the landfall of Hurricane Juan in September 2003. Tropic weather events are expected to be both more intense and frequent as the effects of climate change influence ocean warming and coastal currents. Climate models predict an increase in extreme local events throughout this century.

This section provides a general description of the region's climate, i.e., climate norms, over a 30-year period and the meteorological conditions at the Nuttby site. The site is situated at the eastern end of the Cobequid Hills within a cool, temperate climatic zone. Climate norms, i.e., 30-year averages, for the 1971 to 2000 period from the weather station located at the Truro are tabulated in the sections that follow. Extreme weather data are also provided for the period of record.

4.1.1.1 PRECIPITATION

Precipitation data recorded is summarized in Table 4.1. The total annual precipitation (1,202.9 mm) is defined as the total rainfall plus water equivalent of snowfall and other forms of frozen precipitation. Rainfall is generally higher in the fall with snow and freezing precipitation frequent between October and March. Monthly precipitation ranges from 84.5 mm (April) to 125.5 mm (December).

Table 4-1: Precipitation Normals and Extremes

Month	***Mean Rainfall (mm)***	***Mean Snowfall (cm)***	***Total Precipitation (mm)***	***Extreme Daily Rainfall (mm)***	***Extreme Daily Snowfall (cm)***	***Extreme Daily Precipitation (mm)***
JAN	69.8	51.9	117.4	77.3	39	85.8
FEB	46.9	49.2	91.7	48.2	42.2	56.2
MAR	66.1	45	107	48.6	34	51.5
APR	66	19.8	84.5	62.4	22.9	62.4
MAY	91.6	2.2	93.7	58.4	20	58.4

Month	Mean Rainfall (mm)	Mean Snowfall (cm)	Total Precipitation (mm)	Extreme Daily Rainfall (mm)	Extreme Daily Snowfall (cm)	Extreme Daily Precipitation (mm)
JUN	85.1	0	85.1	60.5	0	60.5
JUL	89.8	0	89.8	69.4	0	69.4
AUG	85.4	0	85.4	100.8	0	100.8
SEP	101.3	0	101.3	52.8	0	52.8
OCT	104.6	1.5	105.9	96	17.5	96
NOV	101.1	14.2	114.7	64	22	64
DEC	83.7	45.2	125.5	71.1	38.1	71.1
YEAR	991.4	229.1	1202.1	100.8	42.2	100.8

Source: Environment Canada Climate Normals: 1971-2000.

4.1.1.2 Temperature

The Atlantic Provinces tend to experience a large annual temperature variation. Daily mean temperatures range from -6.9°C in January to 18.4°C in July. The annual daily mean is 5.8°C. Daily maximums, minimums and extreme temperatures at the Truro weather station are reported in Table 4.2.

Table 4-2: Temperature Norms and Extremes: Truro Weather Station

Month	Daily Maximum (°C)	Daily Minimum (°C)	Daily Mean (°C)	Extreme Maximum (°C)	Extreme Minimum (°C)
JAN	-1.5	-12.3	-6.9	16	-32
FEB	-1.2	-11.8	-6.5	17	-34.4
MAR	3.1	-6.7	-1.8	20	-27.9
APR	8.8	-0.9	3.9	23	-15.6
MAY	15.6	3.8	9.8	30	-6.4
JUN	20.7	8.7	14.7	33	-2.8
JUL	24.1	12.7	18.4	33.5	2.8
AUG	23.5	12.1	17.8	33	0
SEP	19.2	7.7	13.4	30.5	-3.3
OCT	12.9	2.5	7.7	26.5	-10
NOV	7	-1.4	2.8	21.7	-16
DEC	1.3	-8.3	-3.5	16.7	-32
YEAR	11.1	0.5	5.8	33.5	-34.4

Source: Environment Canada Climate Normals: 1971-2000.

4.1.1.3 Wind

Table 4.3 provides a summary of wind data at the Truro weather station. The average annual wind speed is 13.78 km/hr for all directions. Maximum hourly speeds of 93 km/hr were measured in January. Extreme gusts of 134 km/hr were recorded in February. Table 4.4 presents a frequency distribution of wind directions for the 1960 to 2000 period of record.

Table 4-3: 30-Year Normals Wind Data: Truro Weather Station

Wind	*Average Per Month*												
	J	***F***	***M***	***A***	***M***	***J***	***J***	***A***	***S***	***O***	***N***	***D***	***Year***
Speed (km/h)	13.7	14	14.8								13.1	13.3	14.8
Prevailing Direction	W	W	W								W	W	--
Extreme hourly Speed (km/h)	93	71	64	61	61	48	48	58	51	64	68	69	93
Extreme Gust Speed (km/h)	115	134	94	84	89	81	122	76	81	107	108	108	134
Direction	SE	SW	SE	E	SE	S	E	SW	SW	SE	W	W	S

Source: Environment Canada Climate Normals: 1960-1986.

Table 4-4: Summary of Wind Direction Frequency: Truro Weather Station

Wind Direction	*Percent Frequency*
N	0
NE	0
E	16.6
SE	33.3
S	8.3
SW	25
W	16.6
NW	0

Source: Environment Canada Climate Normals: 1971-2000.

4.1.1.4 Air Quality

Because of the location of the Project site and the fact that the Project will not emit emissions to the atmosphere, no laboratory testing to determine air quality has been undertaken. It is expected that the area's air quality is comparable to that across much of northern Nova Scotia.

4.1.2 Topography and Physical Setting

As was indicated on Figure 1.1, the project site is sited on approximately 11 km^2 of land near Nuttby Mountain in Colchester County. This area is located in the Cobequid Hills, Theme Region 311, according to the *Natural History of Nova Scotia* (Davis, and Browne, 1996). The area in general is characterized by deeply incised valleys and fast flowing streams, Nuttby Mountain, at an elevation of 361 m is the highest point on mainland Nova Scotia and provides the head waters of several streams. Indeed, numerous small streams run away from the area of the proposed wind farm, the most important of which include Vamey Brook, Ferguson Brook and the Middle Branch of the North River. While the Cobequid Hills create a drainage divide across the northern portion of the Province, Nuttby Mountain is the local drainage divide. Figure 4.1 depicts the hydrology of the area and indicates both the distinct watersheds that radiate from the area and the very limited wetland in the area.

4.1.3 Geology

The geology of the area is dominated by sediments, granites and volcanic deposits that have been metamorphosed into schists and gneisses. Some of the oldest rocks in the Province can be found between Economy River and Nuttby Mountain. The resultant soils are stony, usually shallow and are comprised of acidic, gravely sandy loams. These well drained loams provide an excellent forest soil, providing a porous, but solid rooting medium.

The proposed turbine locations on the higher elevations are in an area comprised largely of exposed bedrock, where the thickness of the surface soils is generally less than 1 m. The bedrock is primarily granite of the Wyvern Pluton (late Devonian) era and is composed of quartz, feldspar and mica.

4.2 Ecological Context

4.2.1 Terrestrial Habitats and Site Vegetation

The Cobequid Plateau supports a forest of Sugar Maple (*Acer saccharum*), Yellow Birch (*Betula alleghaniensis*) and American Beech (*Fagus grandifolia*) interlaced on the shallow soils with Balsam Fir (*Abies balsamea*) and Red and Black Spruce. The poorly drained depressions support Balsam Fir and Black Spruce. Eastern Hemlock (*Tsuga canadensisis*) is common in the ravines. White Spruce (*Picea glauca*), Red Spruce and Balsam Fir form mixed woods with Sugar Maple, Yellow Birch (*Betula alleghaniensis*) and Red Maple (*Acer rubrum*) growing on the upper slopes. Davis and Browne (1996) describe these associations as shifting toward softwood forests of Black Spruce, White Spruce and White Pine lower down in the valleys. Exposure to wind affects some portion of the forest; Red Spruce and Yellow Birch in particular are susceptible and may be stunted.

Field work undertaken in late June 2007 identified five main habitats: Old Nuttby Road, tolerant hardwood forest, mixed forest, clear-cut (or cut-over) and coniferous plantation. Several primary and secondary streams and wet areas were also observed and mapped. Given the current distribution and siting of the proposed turbines and the alignment of the access roads, no wetlands will be impacted by the proposed development. A description of the general habitats, and associated plant communities, is provided below; these provide the context that the various ecological field programmes build upon.

4.2.1.1 TOLERANT HARDWOOD FOREST

The main forest type in the Nuttby area is that of Sugar Maple, Yellow Birch and American Beech. Amongst the dominant hardwood matrix are scattered individuals of coniferous species such as White and Red Spruce, and Balsam Fir. This hardwood habitat has a high canopy with a woody understorey consisting of Hobblebush (*Viburnum alnifolium*), Beaked Hazelnut (*Corylus cornuta*), Mountain maple (*Acer spicatum*) and Striped Maple (*Acer pensylvanicum*). The typical herbaceous layer includes species such as Sarsaparilla (*Aralia nudicaulis*), White Violet (*Viola blanda*), Rosy Twisted-Stalk (*Streptopus*

Sugar Maple Birch and Beech dominate the tree canopy in the hardwood forest *lanceolatus*), Bunchberry (*Cornus Canadensis*), Wood Sorrel (*Oxalis montana*), Wild Lily-of-the-valley (*Maianthemum canadense*) and Blue-bead lily (*Clintonia bore*alis). The herbaceous layer also contained various ferns, the most common of which were Hayscented fern (*Dennstaedtia punctilobula*), Mountain wood fern (*Dryopteris campyloptera)*, Lady fern (*Athyrium filix-femina*) with Cinnamon fern (*Osumda cinnamonmea*) and Sensitive fern (*Onoclea sensibilis)* common in moist locations.

4.2.1.2 Mixed Forest

Much of the mixed forest habitat is made up of a similar species composition as the tolerant hardwood habitat, except that it has a greater complement of coniferous species. As the forest canopy transitions from hardwood to mixed forest, the forest understorey also changes. In the mixed forest, the spruce and fir typically lower the canopy closer to the forest floor, impacting available sunlight, moisture and the composition of the plant communities. The presence of Bunchberry, Wild Lily-of-the-valley, wood sorrel and Twinflower (*Linnaea borealis*) are all more prominent in the mixed forest; Hobblebush, Striped Maple and hayscented fern become less dominant. Cinnamon fern is present in areas where the forest is damp.

Ferns and wild sarsaparilla cover the forest floor under the hardwoods

4.2.1.3 Clear-cut

As depicted on Figure 4.2, much of the area in the vicinity of the proposed turbines has been clear cut for industrial forestry purposes. At least eight of the proposed turbines, i.e., WTG #3, 4, 7, 9, 12, 13, 15 and 17, are situated within this habitat type. The clear cut was conducted in such a manner as to leave vegetated buffers around the nearby tributaries and wetlands. The wetlands are actually low-lying areas where Black Spruce, Balsam Fir and Red Maple may be present. Islands of trees have been retained, as a method for the natural reseeding of the area. The islands consistently comprise hardwood species with some understorey of spruce and fir where sunlight can reach the forest floor.

Islands of mature hardwoods are left behind in the cleared areas

The size and the composition of the vegetation growing in the cutovers would suggest that the trees were cleared about five years ago. Brush and a thick vegetative mat make crossing this habitat difficult, even though the vegetation is only about a metre high. Most of the plants are considered primary species; these include Red-berried Elderberry (*Sambucus racemosa*), Red Raspberry (*Rubus idaeus*), Blackberry (*Rubus allegheniensis*), Balsam Fir, goldenrods and asters. Much of the tree regeneration in the cutover is comprised of coppiced Red Maple, with occasional Yellow Birch, Balsam Fir and Spruce.

Red Maple and Balsam Fir are two species recolonizing the clearcut

4.2.1.4 Coniferous Plantation

Many areas that have been harvested for forestry purposes have been replanted with coniferous species such as White Spruce and Red Spruce, species which at maturity can be harvested for fiber and timber. This type of habitat is generally characterized by low overall biodiversity, since it tends to be actively managed in favor of the crop tree species. In the more mature plantation sites, there is typically a minimal understory due to the dense (2 - 2.5 m) stocking, and little variation in canopy tree species. The typical understory in the more mature plantation may include Bunchberry, Wild Lily-of-the-valley and mosses such as Schreber's moss (*Pleurozium schreberi*). Younger conifer plantations that have been planted on former hardwood sites may still retain some of the vegetation characteristic of tolerant hardwood forest, with the exception of those species which are sensitive to disturbance, or are intolerant to the increased levels of sunlight.

A typical young coniferous plantation

4.2.1.5 Old Nuttby Road

The Old Nuttby Road is a narrow gravel road, of a type common to the area and is lined with typical roadside species. The road provides excellent access to the two main forest habitats as it passes through the study area. Woody species typical of roadside disturbance include alders, willows, raspberries and blackberries. Common herbaceous roadside species include smooth and rough stemmed goldenrods (*Solidago spp.*), Queen Ann's Lace (*Daucus carota*), strawberry (*Fragraria virginiana*) and late-flowering asters (*Aster spp*.). Beyond the road, the transition from the hardwood to the mixed forest plant communities can be clearly seen.

The Old Nuttby Road passing through the hardwood forest

The roadside-forest ecotone contains attributes of both vegetative communities, generally with early successional tree species of lesser stature, interspersed with weedy roadside vegetation. The dominant tree species in this ecotone includes American Beech, Yellow Birch, White Spruce, Balsam Fir and Red Maple. The main understorey species include wild sarsaparilla, Blue-bead lily and Hayscented Fern.

4.2.2 Aquatic Environment

4.2.2.1 Riverine Habitats

The Cobequid Hills contain the headwaters of the many watercourses that drain to the south into the Bay of Fundy and to the north into the Northumberland Strait; these include the Waugh and North rivers, respectively. The streams rise in the lakes and bogs on the till

blanketed crest of the hills and then plunge down the scarp slopes in waterfalls and cascades. The hills form a drainage divide across this northern part of Nova Scotia. The tributaries that have their headwaters within the study area either drain north into the Waugh River via Ferguson Brook or south into the North River via Middle Branch North River.

The small headwater lakes, bogs and swamps located along the Cobequid Hills in general and more specifically and within the project site are relatively infertile. Conductivity ranges between 16 and 62 µm/cm and the pH averages 6.8. A preliminary assessment of the streams draining from the project site was conducted. The habitat characteristics of each stream were consistent with those of first and second order streams. The streams were shallow with low, but turbulent flows; the substrate consisted of boulder cobble, gravel and sand with little to no silt or clay deposits. These streams would not likely be considered navigable by TC.

4.3 Species of Concern

As indicated in Section 3.2.1, Section 2(1) of the *CEAA* has amended the definition of "environmental effect" to clarify that under *SARA*, an environmental assessment must always consider project impacts on listed wildlife species, their critical habitat or the residences of individuals of that species. Environmental effect is defined as any effect on species of concern and their habitat resulting from project activities. Figure 4.3 shows areas of sensitive habitat, i.e., the river systems to the north and northeast of Nuttby Mountain, a number of small wetlands and the locations of dwarf ginseng (*Panax trifolius*) and Braun's Holly Fern (*Polysticham braunii*). The potential for effects resulting from the construction and operation of the proposed Nuttby Mountain wind farm on these areas, on listed wildlife species, their critical habitat, or the residences of individuals of that species, provides the focus of this environmental assessment.

The screening of the ACCDC list acquired for areas within 100 km of Nuttby Mountain yielded a number of species that warranted further investigation during the various field programs executed; these are identified on Table 4.5.

Table 4-5: Conservation Status of Potential Species at Risk at Nuttby Mountain

Common Name	***Scientific Name***	***COSEWIC***	***NESEA***	***NSDNR***	***ACCDC***
BIRDS					
American Peregrine Falcon	*Falco peregrinus anatum*	Threatened	Threatened	Red	S1B
Bobolink	*Dolichonyx oryzivorus*	-	-	YELLOW	S3B
Eastern Bluebird	*Sialia sialis*	-	-	YELLOW	S2S3B
Northern Goshawk	*Accipiter gentilis*	NAR	-	YELLOW	S3B
Rusty Blackbird	*Euphagus carolinus*	Species of concern	-	YELLOW	S3B
Short-eared Owl	*Asio flammeus*	Species of Concern	-	YELLOW	S1S2B
Vesper Sparrow	*Pooecetes gramineus*	Endangered	-	YELLOW	S2S3B

Common Name	*Scientific Name*	*COSEWIC*	*NESEA*	*NSDNR*	*ACCDC*
Boreal Chickadee	*Parus hudsonicus*	-	-	YELLOW	S3S4
PLANTS					
Blue Cohosh	*Caulophyllum thalictroides*	-	-	Red	S2
Canada Lily	*Lilium canadense*	-	-	Yellow	S2S3
Climbing False-Buckwheat	*Polygonum scandens*	-	-	Yellow	S2
Crowded Sedge	*Carex adusta*	-	-	Yellow	S2S3
Field Milkwort	*Polygala sanguinea*	-	-	Yellow	S2S3
Fragrant Fern	*Dryopteris fragrans*	-	-	Yellow	S2
Heart-Leaved Foam Flower	*Tiarella cordifolia*	-	-	Yellow	S2
Lance-Leaf Grape-Fern	*Botrychium lanceolatum*	-	-	Yellow	S2
Large Round-Leaved Orchid	*Platanthera orbiculata*	-	-	Yellow	S2
Northern Bog Violet	*Viola nephrophylla*	-	-	Yellow	S2
MAMMALS					
Eastern Pipistrelle	*Pipistrellus subflavus*	-	-	Yellow	S1?
Moose	*Alces alces*	-	Endangered	Red	S1
FISH					
Atlantic Salmon (Anadromous pops.)	*Salmo salar*	Endangered	Endangered	Red	S2
American Eel	*Anguilla rostrata*	Special Concern	-	-	-
Brook Trout	*Salvelinus fontinalis*	-	-	Yellow	-
Striped Bass	*Morone saxatalis*	Threatened	-	Red	-
Gaspereau or Alewife	*Alosa spp*	-	-	Yellow	-
REPTILES					
Wood Turtle	*Clemmys insculpta*	Species of concern	Vulnerable	Yellow	S3
FRESHWATER MUSSELS					
Eastern Lamp Mussel	*Lampsilis radiata*	-	-	Yellow	S2
INVERTEBRATES					
Arctic Fritillary	*Boloria chariclea*	-	-	Yellow	S2

Common Name	Scientific Name	COSEWIC	NESEA	NSDNR	ACCDC
Monarch	*Danaus plexippus*	Species of concern	-	Yellow	S2B

4.3.1 Birds

Based on the ACCDC screening, eight bird species were identified as having some potential for residing in or passing through the project area. By understanding the critical habitat for individual species, and through the execution of field programs, the likelihood of project impacts on the bird species at risk were examined. Section 4.3.1.1 provides information on the avian species of risk identified in Table 4.5. Section 4.3.1.2 provides information from the field programs executed by Brian Dalzell (Atlantic Bird Surveys).

4.3.1.1 Bird Species at Risk

American Peregrine Falcon (*Falco peregrinus anatum*)

Although reported that American Peregrine Falcon numbers have increased since the 1980s, this species is listed as “Red” by NSDNR and as threatened by COSEWIC. It is a migratory species, with breeding areas in Nova Scotia restricted to exposed cliffs, most notably around the Bay of Fundy and the Minas Basin in Cumberland, Colchester, Hants, Kings and Victoria counties and in Inverness County. The likelihood of finding this species within the project area was considered low.

Bobolink (*Dolichonyx oryzivorus*)

This species is listed as a ‘Yellow’ species by NSDNR. Bobolink habitat includes hayfields, moist meadows and other areas that are dominated by a mixture of tall grasses. The numbers of this species have declined sharply both in Nova Scotia and throughout its eastern range in part because of more intensive agricultural haying practices. At the Nuttby Mountain site, there are no agricultural areas; the only marginal habitat that might be potentially suitable is the roadside areas. This species is much more likely to be encountered in the lowland areas surrounding Nuttby Mountain, where agriculture predominates. The likelihood of finding this species within the project area was considered low.

Eastern Bluebird (*Sialia sialis*)

Listed as a “Yellow” species by NSDNR, the eastern bluebird prefers habitat that consists primarily of a combination of interspersed deciduous forest and grassland. While the former habitat component is plentiful on site, the latter is not. The likelihood of finding this species within the project area was considered low.

Northern Goshawk (*Accipiter gentilis*)

The NSDNR Yellow listed Northern Goshawk tolerates a wide range of habitats including mature deciduous, coniferous and mixed forest, particularly those with open understoreys. This species is primarily an interior forest hunter and generally avoids habitats with considerable amounts of edge, or those areas which are frequented by humans and traffic. Breeding sites for Northern Goshawk are typically located in isolated locales, generally in one of the largest trees in an area. While the greater Nuttby Mountain area appears moderately suitable as Goshawk habitat, as it is relatively secluded and has a high proportion of mature forest, the immediate project area seems to offer more marginal habitat.

Forest management has rendered most of the project footprint as immature forest with a high level of edge effect. The likelihood of occurrence of this species within the project was considered low.

Rusty Blackbird (*Euphagus carolinus*)
Listed as a "Yellow" species by NSDNR and listed by COSEWIC as a Species of Concern, the Rusty Blackbird's favoured habitat is among wetlands, such as bogs, fens, meadows and swamps and along watercourses; it particularly favours a boreal forest setting. It is also known to feed extensively on aquatic invertebrates within the riparian zones of shallow, slow moving rivers. There are relatively few wetlands of any type on Nuttby Mountain, and there is nothing in the way of boreal forest type habitat in the vicinity. The likelihood of finding this species within the project area was considered low.

Short-eared Owl (*Asio flammeus*)
Listed as a "Yellow" species by NSDNR and listed by COSEWIC as a Species of Concern, the primary habitat of the short-eared owl is grasslands, estuaries and marshes, habitat types which are not found at Nuttby Mountain. Open areas provide important rodent hunting grounds for the species, but only marginal open areas are found with the project area in cutovers and along the roads. The likelihood of finding this species within the project area was considered low.

Vesper Sparrow (*Pooecetes gramineus*)
Listed as a "Yellow" species by NSDNR and listed by COSEWIC as Endangered, Vesper sparrows are characteristically found in areas with short grass or low shrubs, such as pastures, blueberry fields and clearings; scattered trees and taller shrubs are often used as sing posts. The species has been listed by NSDNR as yellow because over the last 50 years, changes in land use and increased farming intensity has had deleterious effects on the species' habitat and therefore populations. Because of the nature of the habitat on Nuttby Mountain, the likelihood of finding this species within the project area was considered low.

Boreal Chickadee *(Parus hudsonicus)*
The Boreal Chickadee is listed as a yellow species by NSDNR. This species prefers habitat categorized as young (20-50 years) coniferous forest at a high elevation. Given the presence of a considerable area of White Spruce plantation on site, it was not unexpected that numbers of this species were seen.

4.3.1.2 Results of the Avian Field Program
As outlined in Section 3.2.2.2, the approach to assessing both the breeding and migratory birdlife in the Nuttby Mountain area included breeding bird point counts, a standardized area search, morning fall stopover counts and a fall raptor watch. The results are detailed below.

Breeding Bird Point Counts
The early-season point counts took place between June 7 and June 10, 2007; this resulted in the recording of 39 species of breeding birds. The 11 most common species were: White-throated Sparrow (*Zonotrichia albicolis*), Red-eyed Vireo (*Vireo olivaceous*), Black-throated Green Warbler (*Dendroica virens*), American Robin (*Turdus migratorius*), Magnolia Warbler (*Dendroica magnolia*), Ovenbird (*Seiurus aurocapillis)*, Dark-eyed Junco (*Junco hyemalis*), Boreal Chickadee (*Poecile hudsonica*),

Swainson's Thrush (*Catharus ustulatus*), Hermit Thrush (*Catharus guttatus*) and Ruby-crowned Kinglet (*Regulus calendula*).

The late-season point counts were completed between June 23 and June 27, 2007, using the same points surveyed earlier in the month. In this period, a total of 28 species of breeding birds were recorded, of which only one, the Mourning Dove, was new, i.e., a total of 40 species of breeding birds were recorded as a result of the point counts. The 10 most common songbird species were more-or-less the same as found during the early-season counts: White-throated Sparrow (*Zonotrichia albicolis*), Red-eyed Vireo (*Vireo olivaceous*), American Robin (*Turdus migratorius*), Hermit Thrush (*Catharus guttatus*), Dark-eyed Junco (*Junco hyemalis*), Song Sparrow (*Melospiza melodia*), Ovenbird (*Seiurus aurucapillis*), Hermit Thrush (*Catharus guttatus*), Black-throated Green Warbler (*Dendroica virens*) and American Redstart (*Setphaga ruticilla*).

Results of Standardized Area Search

A standardized area search using the old tote roads in the project area was undertaken, generally a couple of hours per day, and usually on the same day as the point counts. This approach proved effective, adding an additional nine species not detected during the point counts. The new species were: Barred Owl, Eastern Wood-Pewee, American Crow, Common Raven, Black-capped Chickadee, White-breasted Nuthatch, Golden-crowned Kinglet, Nashville Warbler and Black-and-white Warbler. This resulted in a total of 49 species of breeding birds being detected in the area of which 34 were confirmed as breeding, 10 as probably breeding and five as possibly breeding.

Only one species of special concern, as listed by the ACCDC and the NSDNR was detected in the immediate project area. This was the Boreal Chickadee (*Parus hudsonicus*), of which several individuals were found in a young softwood plantation where WTGs 1, 2, 5, 6, 10, 11 and 13 will be located. Boreal Chickadee is listed in the "Yellow" category by NSDNR, meaning species "Sensitive to human activities or natural events".

The ACCDC ranks Boreal Chickadee as S3S4 in Colchester County. S3 denotes the species is "Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences)." S4 denotes "usually widespread, fairly common, and apparently secure with many occurrences, but of longer term concern, e.g., watch list, 100+ occurrences." In the vicinity of Nuttby Mountain and within the Colchester County, given the number of boreal chickadees observed, the researcher would place this species within the S4 category in the vicinity of Nuttby Mountain.

Boreal Chickadee is likely as common in suitable habitat in the vicinity of Nuttby Mountain as it is anywhere in mainland Nova Scotia. This is likely due to its affinity for higher elevations coupled with the presence of contiguous tracts of young to medium-aged (20 to 50 years) predominantly coniferous forests. The habitat in which they were found was an almost pure Cat Spruce (*Picea glauca*) plantation of approximately 100 acres, planted sometime around 1988.

A complete listing of all the species detected in both counts plus the standardized area search is provided in Table 4.6.

Table 4-6: Breeding Bird Species Observed During Point Counts and Area Searches in Vicinity of Nuttby Mountain, NS, June 2007

Highest Status	***Species Code***	***Common Name***	***Latin Name***	***Estimated Number of Pairs***
Possible	RTHA	Red-tailed Hawk	*Buteo jamaicensis*	<1
Confirmed	MODO	Mourning Dove	*Zenaida macroura*	2
Probable	GHOW	Great Horned Owl	*Bubo virginiensis*	1
Possible	BDOW	Barred Owl	*Strix varia*	1-2
Probable	RTHU	Ruby-throated Hummingbird	*Archilochus colubris*	2
Confirmed	YBSA	Yellow-bellied Sapsucker	*Sphyrapicus varius*	5
Confirmed	DOWO	Downy Woodpecker	*Picoides pubescens*	2
Confirmed	HAWO	Hairy Woodpecker	*Picoides villosus*	3
Confirmed	NOFL	Northern Flicker	*Colaptes auratus*	3
Confirmed	EAWP	Eastern Wood-Peewee	*Conoptes virens*	2
Confirmed	YBFL	Yellow-bellied Flycatcher	*Empidonax flaviventris*	10
Confirmed	ALFL	Alder Flycatcher	*Empidonax alnor*um	5
Confirmed	LEFL	Least Flycatcher	*Empidonax minimus*	10
Confirmed	BHVI	Blue-head Vireo	*Vireo solitarus*	5
Confirmed	REVI	Red-eyed Vireo	*Vireo olivaceous*	35
Probable	BLJA	Blue Jay	*Cyanocitta cristata*	1
Possible	AMCR	American Crow	*Corvus brachyrhynchos*	1
Confirmed	CORA	Common Raven	*Corvus corax*	1
Confirmed	BCCH	Black-capped Chickadee	*Parus atricapilla*	10
Confirmed	BOCH	Boreal Chickadee	*Parus hudsonicus*	5
Confirmed	RBNU	Red-breasted Nuthatch	*Sitta canadensis*	2
Possible	WBNU	White-breasted Nuthatch	*Sitta carolinensis*	1
Probable	WIWR	Winter Wren	*Troglodytes troglodytes*	1
Probable	GCKI	Golden-crowned Kinglet	*Regulus satrapa*	5
Confirmed	RCKI	Ruby-crowned Kinglet	*Regulus calendula*	10
Confirmed	SWTH	Swainson’s Thrush	*Catharus ustulatus*	20
Confirmed	HETH	Hermit Thrush	*Catharus guttatus*	15
Confirmed	AMRO	American Robin	*Turdus migratorius*	25
Confirmed	CEDW	Cedar Waxwing	*Bombycilla cedrorum*	2
Probable	NAWA	Nashville Warbler	*Vermivora ruficapilla*	2
Probable	NOPA	Northern Parula	*Parula americana*	2
Confirmed	CSWA	Chestnut-sided Warbler	*Dendroica pensylvanica*	15
Confirmed	MAWA	Magnolia Warbler	*Dendroica magnolia*	20
Confirmed	YRWA	Yellow-rumped Warbler	*Dendroica coronata*	15
Confirmed	BTGW	Black-throated Green Warbler	*Dendroica virens*	25
Possible	BLBW	Blackburnian Warbler	*Dendroica fusca*	2
Probable	BBWA	Bay-breasted Warbler	*Dendroica castanea*	5
Probable	BAWW	Black-and-white Warbler	*Mniotilta varia*	2

Highest Status	*Species Code*	*Common Name*	*Latin Name*	*Estimated Number of Pairs*
Confirmed	AMRE	American Redstart	*Setophaga ruticilla*	15
Confirmed	OVEN	Ovenbird	*Seiurus aurocapillus*	30
Confirmed	MOWA	Mourning Warbler	*Opornis philadelphia*	10
Confirmed	COYE	Common Yellowthroat	*Geothlypis trichas*	10
Confirmed	CHSP	Chipping Sparrow	*Spizella passerina*	1
Confirmed	SOSP	Song Sparrow	*Melospiza melodia*	10
Probable	LISP	Lincoln's Sparrow	*Melospiza lincolnii*	10
Confirmed	WTSP	White-throated Sparrow	*Zonotrichia albicollis*	25
Confirmed	DEJU	Dark-eyed Junco	*Junco hyemalis*	15
Confirmed	PUFI	Purple Finch	*Carpodacus purpureus*	5
Confirmed	AMGO	American Goldfinch	*Carduelis tristis*	2
		Total Species: 49	**Total estimated pairs:**	**413**

Morning Fall Stopover Counts

As indicated in Section 3.2.2.2, most land birds migrate at night. Their identification in these circumstances is nearly impossible. For this reason morning stopover surveys were conducted at Nuttby Mountain in the fall of 2007. A total of 545 individual birds comprising 50 species were documented during the 12 morning bird stopover surveys (Table 4.7). Dark-eyed Junco (*Junco hyemalis*) and Yellow-rumped Warbler (*Dendroica coronate*) were the most common migrants, likely made up of a combination of locally-raised and migrating birds. In third place was the Black-throated Green Warbler (*Dendroica virens*), again a common local breeder and migrant. Fourth was the Black-capped Chickadee (*Poecile atricapillus*) and fifth was the Blue Jay (*Cyanocitta cristata*). Though both species breed locally, the Blue Jays were definite diurnal migrants; they were seen moving north at treetop level during October.

Table 4-7: Bird Species Observed During Morning Stopover Counts in the Vicinity of Nuttby Mountain, NS. Late Summer and Early Fall, 2007

Bird Group	*Alpha Code*	*Common Name*	*Latin Name*	*Total*
Waterfowl	CAGO	Canada Goose	*Branta canadensis*	28
Gamebirds	RUGR	Ruffed Grouse	*Bonasa umbellus*	5
Raptors	SSHA	Sharp-shinned Hawk	*Accipiter striatus*	3
Raptors	RTHA	Red-tailed Hawk	*Buteo jamaicensis*	3
Raptors	AMKE	American Kestrel	*Falco sparverius*	1
Shorebirds	AMWO	American Woodcock	*Scolopax minor*	1
Owls	BDOW	Barred Owl	*Strix varia*	1
Landbirds	YBSA	Yellow-bellied Sapsucker	*Sphyrapicus varius*	3

Bird Group	*Alpha Code*	*Common Name*	*Latin Name*	*Total*
Landbirds	HAWO	Hairy Woodpecker	*Picoides villosus*	4
Landbirds	NOFL	Northern Flicker	*Colaptes auratus*	1
Landbirds	PIWO	Pileated Woodpecker	*Drycopus pileatus*	1
Landbirds	EAWP	Eastern Wood-Pewee	*Conoptrus virens*	1
Landbirds	ALFL	Alder Flycatcher	*Empidonax alnorum*	1
Landbirds	LEFL	Least Flycatcher	*Empidonax minimus*	3
Landbirds	BHVI	Blue-headed Vireo	*Vireo solitarus*	3
Landbirds	REVI	Red-eyed Vireo	*Vireo olivaceous*	23
Landbirds	BLJA	Blue Jay	*Cyanocitta cristata*	30
Landbirds	AMCR	American Crow	*Corvus brachyrhynchos*	4
Landbirds	CORA	Common Raven	*Corvus corvax*	17
Landbirds	TRES	Tree Swallow	*Tachycineta bicolor*	6
Landbirds	BCCH	Black-capped Chickadee	*Parus atricapilla*	35
Landbirds	BOCH	Boreal Chickadee	*Parus hudsonica*	10
Landbirds	RBNU	Red-breasted Nuthatch	*Sitta Canadensis*	6
Landbirds	RTHU	Ruby-throated Hummingbird	*Archilochus colubris*	5
Landbirds	GCKI	Golden-crowned Kinglet	*Regulus satrapa*	8
Landbirds	RCKI	Ruby-crowned Kinglet	*Regulus calundula*	10
Landbirds	SWTH	Swainson’s Thrush	*Catharus ustulatus*	6
Landbirds	HETH	Hermit Thrush	*Catharus guttatus*	8
Landbirds	AMRO	American Robin	*Turdus migratorius*	25
Landbirds	CEDW	Cedar Waxwing	*Bombycilla cedrorum*	6
Landbirds	TEWA	Tennessee Warbler	*Vermivora peregrina*	3
Landbirds	NAWA	Nashville Warbler	*Vermivora ruficapilla*	2
Landbirds	CSWA	Chestnut-sided Warbler	*Dendroica pensyl*vanica	2
Landbirds	MAWA	Magnolia Warbler	*Dendroica magnolia*	10
Landbirds	BTBW	Black-throated Blue Warbler	*Dendroica caerulescens*	3

Bird Group	***Alpha Code***	***Common Name***	***Latin Name***	***Total***
Landbirds	YRWA	Yellow-rumped Warbler	*Dendroica coronata*	55
Landbirds	BTGW	Black-throated Green Warbler	*Dendroica virens*	44
Landbirds	BLBW	Blackburnian Warbler	*Dendroica fusca*	3
Landbirds	BLPW	Blackpoll Warbler	*Dendroica striata*	15
Landbirds	BAWW	Black-and-white Warbler	*Dendroica varia*	5
Landbirds	AMRE	American Redstart	*Setophaga ruticilla*	12
Landbirds	OVEN	Ovenbird	*Seiurus aurocapillus*	3
Landbirds	MOWA	Mourning Warbler	*Oporornis philadelphia*	3
Landbirds	COYE	Common Yellowthroat	*Geothlypis trichas*	5
Landbirds	SOSP	Song Sparrow	*Melospiza melodia*	8
Landbirds	WTSP	White-throated Sparrow	*Zonotrichia albicolis*	10
Landbirds	DEJU	Dark-eyed Junco	*Junco hyemalis*	85
Landbirds	PIGR	Pine Grosbeak	*Pinicola enucleator*	2
Landbirds	PUFI	Purple Finch	*Carpodacus purpureus*	5
Landbirds	AMGO	American Goldfinch	*Carduelis tristes*	12
			Grand Total	**545**

The Canada Goose (*Branta canadensis*), American Robin (*Turdus migratorius*), Red-eyed Vireo (*Vireo olivaceous*), Common Raven (*Corvus corvax*) and Blackpoll Warbler (*Dendroica striata*) rounded out the top 10. The Canada Geese were sighted coming from the south, along the Middle Branch of North River, then along the valley towards the site of planned turbines, i.e., WTG 18, 19 and 14. The date of this observation was October 18, 2007 at 9:30 a.m. The birds were observed flying fairly low, i.e., no more than 120 m above the surface of the valley.

Completing the list of species with more than 10 individuals found were the American Redstart (*Setophaga ruticilla*), the American Goldfinch (*Carduelis tristis*), the Magnolia Warbler (*Dendroica magnolia)*, the White-throated Sparrow (*Zonotrichia albicolis*), the Boreal Chickadee (*Parus hudsonicus*) and the Ruby-crowned Kinglet (*Regulus calendula)*. Only the Black-capped and Boreal Chickadees, and Common Ravens were from resident populations; the Blue Jays were not. Only five species in the top 17 were neo-tropical migrants; the remainder were temperate species.

The surveys were used to document the presence, species composition, and abundance of nocturnal migrants using the project area for stopover habitat. There were more birds found at the higher end of the transect, probably due to the higher habitat diversity near the summit of Nuttby Mountain. Only one significant stopover event took place, on September 8th at stop # 3 (0815-0830). A fairly large (by local standards) mixed flock of foraging warblers, thrushes and sparrows was encountered moving very low in a roughly south-north direction through young, thick hardwoods about 250 m from the summit. Approximately 100 birds of 21 species were detected in this flocks, and it appears some (~50%) were genuine Boreal Forest migrants, such as Blackpoll and Tennessee Warblers.

Vireos and warblers were largely present along the survey transect until late September, after which finches and sparrows became more abundant. This is to be expected, as most wood-warblers and vireos are neo-tropical migrants. These long-distance migrants are primarily insectivores and, therefore, leave their nesting territories early in the migration period due to the reduction in prey and the need to travel more miles to wintering areas. The sparrows, on the other hand, are primarily near-migrants, spending the winter in the continental United States. They are omnivores and utilize seeds and plant fruits that are available later into the fall, and their short-distance migrations do not require as much time to travel.

Interestingly, during the fall of 2005, during similar stopover surveys at Mars Hill, Maine (Woodlot Alternative, March 2006), it was found that nights with high migrant passage rates (as shown on radar) did not necessarily translate into increased morning stopover activity. Variation in the number of birds observed along the Nuttby Mountain fall stopover survey transect was probably due to weather, individual habitat preference, site selection, and level of effort. Patterns in the seasonal abundance of species was as would be expected, with most long-distance migrants present through the middle of the survey season, and short-distance migrants and potential wintering species present late into the survey season.

Raptor Watch

At 361 m Nuttby Mountain is the highest point of land in mainland Nova Scotia. The purpose of the migrant Raptor Watch was to test the hypothesis that a significant fall raptor migration of unknown proportions took place annually over the top of the Cobequid Mountains and more particularly in the vicinity of Nuttby Mountain in an east-west direction. This theory was proven to be unfounded; extremely low numbers of raptors were seen, i.e., only 12 raptors in 72+ hours of observation (see Table 4.8), during what should have been the prime time for fall raptor migration.

Table 4-8: Individual Raptor Events, Summit of Nuttby Mountain, NS, Fall of 2007

Date	***Raptor Species***	***Flight Direction and Height***
August 11, 2007	Broad-winged Hawk (1250)	South at Tree Level*
August 21, 2007	Red-tailed Hawk (1030)	Hovering, Well Above Tree Level*
August 21, 2007	Adult Bald Eagle (1055)	Circling High*, 1.5 km to south
September 8, 2007	Red-tailed Hawk (1147)	Hovering, Well Above Tree Level*
September 20, 2007	Red-tailed Hawk (1100)	Hovering, Well Above Tree Level*
October 5, 2007	American Kestrel (0830)	Hovering, Well Above Tree Level*
October 18, 2007	Red-tailed Hawk (0910)	Perched, Tree Level*

Date	*Raptor Species*	*Flight Direction and Height*
October 18, 2007	Sharp-shinned Hawk (1345)	Southward at Tree Level*
October 19, 2007	Juvenile Bald Eagle (1045)	High* to the northeast
October 19, 2007	Sharp-shinned Hawk (1130)	Southward at Tree Level*
October 19, 2007	Sharp-shinned Hawk (1550)	Southward at Tree Level*
November 6, 2007	Red-tailed Hawk (1220)	Circling High* to the north
***Tree Level (1-10m), Above Tree Level (10-40 m), Well Above Tree Level (40-100 m), High (>100 m).**		

The observations presented simply as "events" due to the fact that foraging residents cannot be readily separated from foraging migrants.

The five species recorded, i.e., Sharp-shinned Hawk, Broad-winged Hawk, Bald Eagle, Red-tailed Hawk and the American Kestrel, were as expected. The Red-tailed Hawk were observed (over five events) the most, while the Broad-winger Hawk and American Kestrel (one event) were observed the least. Three Sharp-shinned Hawk (*Accipiter striatus*) events were recorded in October. All were believed to be passage migrants, foraging from north-south at tree-top (10 m) level. The single flyby of an immature Broad-winged Hawk (*Buteo platypterus)* at eye-level, also in a north-south direction, in an area where suitable breeding habitat is absent, strongly suggests a genuine migrant. A pair of Red-tailed Hawks (*Buteo jamaicensis*) were sighted circling and hover-hunting more than 100 m above the summit of Nuttby Mountain. They were not thought to be migrants, but one pair of two known to nest approximately 2 km north of Nuttby Mountain.

The only two sightings of Bald Eagles made during the more than 100 hours of observation were made during the Raptor Watch. Very few raptors were seen in the study area in the period between late May and early September of 2007. The most commonly encountered raptor was the Red-tailed Hawk (*Buteo jamaicensis*), of which at least one individual was seen several times hunting in the large clear-cut to the north of Nuttby Mountain. The pair likely nested somewhere south of the study property, in the mature hardwood forest. No breeding Northern Goshawks (*Accipiter gentilus*), Sharp-shinned Hawks (*Accipiter striatus*), Merlins (*Falco columbarius*), or American Kestrels (*Falco sparverius*) were noted, despite the presence of what appeared to be suitable breeding habitat for all four. A general dearth of breeding birds in the vicinity may have been responsible for a similar lack of predatory hawks.

No Bald Eagle nests were found in or near the study property, nor are there any active nests located within 15 km of the nearest proposed turbine site. There are three recorded nests all associated with river systems that fall within an approximate range of 15 to 20 km of the Nuttby area. The closest would be a nest on Waughs River at around 15 km, followed by French River at around 16 km and the Salmon River at around 18 km (Kimberley A. George, NSDNR).

4.3.2 Plants

As indicated on Table 4.5, 10 species of plants, based on the ACCDC screening, were identified as possibly existing in the Project area, based on geographic proximity and overall habitat conditions. The list was further refined based on the actual habitats within the project footprint. While each of the 10 species have been observed within 100 km of Nuttby Mountain, many are limited in their range, and many obligate to much richer and wetter sites, i.e., intervale or floodplain forests, than are found on Nuttby Mountain. Typically, the rich intervale forests that provide habitat for many of the identified species are located in the lower reaches of the watersheds, where the rivers are wider, slower moving and more nutrient laden than the headwater streams that feed into them. These forests also tend to have a wider and flatter riparian zone than those associated with upland streams. The seasonally flooded intervales, where the combination of year round moisture and high nutrient soils lead to a higher overall biodiversity and incidence of rare taxa, are not found.

None of the 10 identified species were encountered during the botanical survey, and a closer examination of their specific habitat requirements shed light as to why this is the case. While the theoretical habitat requirement for any given species is often satisfied, this is not a guarantee that that species exists in that habitat. Section 4.4.2.1 provides information on the plant species at risk identified in Table 4.5. Section 4.4.2.2 provides information on the field programs executed by Sean Blaney (ACCDC).

4.3.2.1 Plant Species at Risk

Blue Cohosh (*Caulophyllum thalictroides)*
This species is rare throughout the province and is most commonly found in rich deciduous and intervale forests. While the former habitat is present on site, there are no true intervale forests. The likelihood of encountering this species was considered unlikely.

Canada Lily (*Lilium canadense*)
This species has similar habitat requirements to Blue Cohosh, but is more obligate to floodplain forest. It prefers fertile, undisturbed sites. The likelihood of encountering this species was considered unlikely.

Climbing False-Buckwheat (*Polygonum scandens*)
Climbing False-buckwheat is a trailing vine which favors moist woods, thickets and riparian areas with rich loamy soils. This species generally thrives in disturbed areas. The type of river system which generates the habitat required to sustain Climbing False-buckwheat is not present on Nuttby Mountain. The likelihood of encountering this species was considered unlikely.

Crowded Sedge (*Carex adusta*)
The Crowded Sedge favors acidic, sandy soils associated with open woods and clearings. Overall the moisture regime on Nuttby Mountain is relatively fresh; the notable exceptions being associated with the roadsides and some cutover areas. The likelihood of encountering this species was considered unlikely.

Field Milkwort (*Polygala sanguinea*)
The Field Milwort is found in moist fields and meadows, damp slopes and open woods. Although this type of habitat is not consistent with the overall habitat on Nuttby Mountain, there are some lower lying areas which may be more conducive to the species. Nevertheless, the likelihood of encountering this species was considered unlikely.

Fragrant Fern (*Dryopteris fragrans*)
The Fragrant Fern is generally found clinging to cliff overhangs, along cliffs and near waterfalls. No such habitat exists within the Project area. The likelihood of encountering this species was considered unlikely.

Heart-Leaved Foam Flower (*Tiarella cordifolia*)
This species can be found in a variety of habitats, some of which are present within the Project area; these include areas of deciduous forest and roadsides habitats. Intervale forests are also potential habitat, but these are not found in the immediate area. Given the habitat characteristics of Nuttby Mountain, the likelihood of encountering this species was considered unlikely.

Lance-Leaf Grape-Fern (*Botrychium lanceolatum*)
This species is generally found on rich wooded hillsides, a habitat type that may be found on and in proximity to the proposed turbine locations. Although suitable habitat may exist in the vicinity, most of the project associated works are situated on the relatively flat and sparsely vegetated plateau areas. The likelihood of encountering of this species in areas to be disturbed was considered unlikely.

Large Round-Leaved Orchid (*Platanthera orbiculata*)
This species is typically found in damp, shaded woods, typical of much of the deciduous forest cover found on the site. Although there is suitable habitat in the area, indicating potential for its presence, much of the area is severely disturbed. In the circumstances, the likelihood of encountering this species was considered unlikely.

Northern Bog Violet (*Viola nephrophylla*)
This species is found primarily in bogs, riparian areas and damp woods, all of which are present on Nuttby Mountain though not in abundance. The likelihood of encountering this species was considered unlikely.

4.3.2.2 Results of the Plant Field Program

Plant Communities
Table 4.9 provides descriptions of the plant communities at the turbine locations as surveyed in 2007. The natural plant communities observed both at the sites and elsewhere on Nuttby Mountain were not rare in a provincial context. Although scattered old trees (probably 150+ years) were present, no exceptionally old forest was identified. The oldest forest stances in the vicinity of the turbine sites were about 80 years of age, i.e., at locations A2, B7 and B12. Location A2 is no longer a proposed turbine site; B7 is the location of WTG 15 and B12 is the location of WTG14. Supplementary field work will be undertaken in 2008 to check the plant communities associated with the final layout for the WTGs.

Two areas of especially rich and fairly mature deciduous forest (of the type that would be called “cove forest” by community ecologists in New England), were noted in or near the development footprint: a) on the north-facing slope north and east of the clearcut in which WTGs 4 and 5 are located, and b) on the east-facing slope between the proposed substation and the existing powerline on the east edge of the development area. Tree cover in these sites was strongly sugar maple-dominated as with most forest on site, but the herbaceous flora was distinctly different from other areas within the site, being heavily dominated by Silvery Glade-Fern (*Deparia acrostichoides*) and supporting numerous other plant species uncommon or rare elsewhere on the site and indicative of richer soils and groundwater seepage, including the marginally rare Braun's Holly Fern (*Polystichum braunii*) near WTG 5. These were good examples of an uncommon, though not provincially rare, community. Making minor turbine site adjustments and restricting construction impacts to the already clearcut area around WTGs 4 and 5 would probably prevent any significant impacts to the rich forest there. If powerline construction east of the proposed substation could be adjusted to areas with limited groundwater seepage, impacts would also be lessened.

As noted in Table 4.9, turbines B11 and A6 were proposed immediately adjacent to small streams; these locations are no longer being used.

Overall, the natural heritage (species and natural community) values of the site do not present a high level of concern relative to the proposed development. A substantial portion of the total development footprint as depicted on Figure 4.1 is within areas already significantly altered by people, i.e., recent clearcuts, young conifer plantations in areas which were previously deciduous forest, logging roads and a small quarry used for road construction material. The most significant impact of the development footprint as outlined is where natural forest is being removed.

Vascular Plants
Table 1 in Appendix A provides a list of 223 vascular plant taxa (199 native or potentially native and 24 exotic) identified during field work, with estimates of their abundance within the site and their provincial status. Under both the S-rank system used continent-wide by all conservation data centres and the National General Status ranks, which have been developed by each provincial and territory.

Table 4-9: Plant Communities Proposed Turbine Sites

Common names for species listed here are given in the site plant list in Table 1 in Appendix A. Also included in Appendix A is a map showing 2007 turbine locations referenced. Species names in round brackets () are minor constituents.

Potential Turbine Locations 2007	***Tree Species (~order of abundance)***	***Forest Age (approx.)***	***Dominant tall shrub / sapling spp.***	***Herbaceous & Low Shrub Dominants***	***General Description & Notes***
A1	sugar maple 7, beech3 [80% cover]	65-75	beech, yellow birch, *Acer spicatum, Acer pensylvanicum*; [10-15% cover]	*Dryopteris campyloptera, Erythronium americanum, Maianthemum canadense, Clintonia borealis, Oxalis montana, Streptopus lanceolatus, Claytonia caroliniana*; [80% cover]	Moderately mature sugar maple upland forest.
A2	sugar maple 8, beech1, yellow birch1 [80% cover]	2 ages - 20 & 70	beech; [10-20% cover]	*Dryopteris campyloptera, Erythronium americanum, Clintonia borealis, Maianthemum canadense, Rubus pubescens, Streptopus lanceolatus, Oxalis montana, Claytonia caroliniana;* [85% cover]	Two ages: moderately mature deciduous forest, and young deciduous forest about 20 years old.
A3	sugar maple7, yellow birch2, beech1 [60-80% cover]	65	*Rubus canadensis,* beech, yellow birch, sugar maple, *Acer spicatum*; [45% cover]	*Dryopteris campyloptera, Rubus pubescens, Viola blanda, Erythronium americanum, Clintonia borealis, Maianthemum canadense, Aralia nudicaulis, Carex leptonervia, Streptopus lanceolatus;* [85% cover]	Intermediate- mature deciduous forest, selectively cut for firewood in last 5-10 years
A4	yellow birch [<5% cover]	10 to 15	yellow birch, sugar maple, *Acer spicatum;* [0% in rock quarry, 85% outside]	very limited vascular plant cover in quarry site	Turbine site is in small rock quarry within 10-15 year old deciduous forest clearcut with a dense sapling layer
A5	yellow birch6, sugar maple2, beech2 [15-20% cover]	10 & 1-2 (site at border of recent cut)	yellow birch, beech, balsam fir, *Acer spicatum, (Rubus idaeus* ssp. *strigosus);* [20% cover in recent cut, 100% cover in 10 year old cut]	*Erythronium americanum, Maianthemum canadense, Dryopteris campyloptera, (Cinna latifolia, Carex leptonervia, Clintonia borealis, Carex novae-angliae, Carex arctata, Panax trifolius, Streptopus lanceolatus, Rubus pubescens);* [65% cover]	Cut-over, mesic deciduous forest with some canopy cover remaining. Site is at border of a recent cut (1-2 years old) and a cut of approximately 10 years ago.

Potential Turbine Locations 2007	***Tree Species (~order of abundance)***	***Forest Age (approx.)***	***Dominant tall shrub / sapling spp.***	***Herbaceous & Low Shrub Dominants***	***General Description & Notes***
A6	sugar maple5, red spruce3, yellow birch2 [80-90% cover]	two age classes - 40 & 80 years old	yellow birch, balsam fir, sugar maple, *Lonicera canadensis, Viburnum lantanoides, Acer spicatum;* [30-50% cover]	*Dryopteris campyloptera, Maianthemum canadense, Clintonia borealis, Cornus canadensis, Phegopteris connectilis, Oxalis montana;* [80% cover]	Bouldery small ravine with small stream 10m away. Nearby clearcut would provide a better site for a turbine from a natural heritage perspective.
A7	sugar maple, yellow birch, beech [75-85% cover]	60-80, scattered older yellow birch perhaps 150+	sugar maple, yellow birch, beech, *Acer spicatum, (Acer pensylvanicum, Cornus alternifolia, Rubus canadensis, Lonicera canadensis);* [35% cover]	*Dryopteris campyloptera, Erythronium americanum, Maianthemum canadense, Rubus pubescens, Oxalis montana, Streptopus lanceolatus, Aralia nudicaulis;* [65% cover]	Intermediate aged, mesic deciduous forest
B1	white spruce10, (balsam fir, yellow birch) [75% cover]	30	yellow birch, balsam fir, *Sambucus racemosa, Corylus cornuta*; [5-10% cover]	*Maianthemum canadense, Erythronium americanum, Rubus pubescens, Dryopteris campyloptera, Oclemena acuminata, Phegopteris connectilis;* [% cover varies from 5% or less to 70% depending on light levels]	Young-intermediate aged white spruce plantation in area formerly occupied by deciduous forest
B2	sugar maple8, beech1, yellow birch1; [85% cover]	85 in area of turbine, but younger in surrounding area	sugar maple, yellow birch, beech; [5-10% cover]	*Dryopteris campyloptera, Rubus pubescens, Oclemena acuminata, Aralia nudicaulis, Erythronium americanum, Viola blanda, Cinna latifolia, Streptopus lanceolatus, Huperzia lucidula, Claytonia caroliniana*; [80-90% cover]	Mature to intermediate-aged deciduous forest
B3	white spruce9, (balsam fir, yellow birch)1 [60% cover]	20-30	yellow birch, balsam fir; [<5% cover]	*Maianthemum canadense, Erythronium americanum, Dryopteris campyloptera, Athyrium filix-femina, Solidago rugosa, Doellingeria umbellata*; [30% cover]	Young-intermediate aged white spruce plantation in area formerly occupied by deciduous forest. Tree cover varies from ~50 to 95%.

Potential Turbine Locations 2007	***Tree Species (~order of abundance)***	***Forest Age (approx.)***	***Dominant tall shrub / sapling spp.***	***Herbaceous & Low Shrub Dominants***	***General Description & Notes***
B4	white spruce10 (balsam fir) [75-80% cover]	30	balsam fir, *(Salix bebbiana, Sambucus racemosa)*; [5-10% cover]	*Maianthemum canadense, Viola blanda, Erythronium americanum, Rubus pubescens, Oclemena acuminata, Aralia nudicaulis*; [20% cover]	Young-intermediate aged white spruce plantation in area formerly occupied by deciduous forest
B5	white spruce10 (balsam fir, yellow birch) [75-80% cover]	30	yellow birch, balsam fir; [<5% cover]	*Maianthemum canadense, Clintonia borealis, Erythronium americanum, Dryopteris intermedia, Dennstaedtia punctilobula, Athyrium filix-femina, Streptopus lanceolatus, Panax trifolius, Trientalis borealis*; [30% cover]	Young-intermediate aged white spruce plantation in area formerly occupied by deciduous forest
B6	yellow birch4, sugar maple3, beech3 [95% cover]	15-20	balsam fir, *Lonicera canadensis*; [<5% cover]	*Dryopteris campyloptera, Maianthemum canadense, Erythronium americanum, (Carex arctata, Carex novae-angliae, Aralia nudicaulis, Panax trifolius, Oclemena acuminata, Cinna latifolia, Streptopus lanceolatus, Clintonia borealis, Oxalis montana);* [50% cover]	Very uniform-aged, young, mesic deciduous forest regenerating from clearcut about 15-20 years ago.
B7	minimal [~0% cover]	<5	yellow birch, sugar maple, *Rubus canadensis, Rubus idaeus* ssp. *strigosus, (Sambucus racemosa, Acer pensylvanicum, Viburnum lantanoides, Acer spicatum, Lonicera canadensis,* red spruce); [60% cover]	*Erythronium americanum, (Streptopus lanceolatus, Polygonatum pubescens, Dennstaedtia punctilobula, Rubus pubescens, Scirpus cyperinus, Chamerion angustifolium, Maianthemum canadense, Maianthemum racemosum, Dryopteris campyloptera, Viola blanda, Carex leptonervia);* [65% cover]	Approximately 5 year old deciduous forest clearcut

Potential Turbine Locations 2007	***Tree Species (~order of abundance)***	***Forest Age (approx.)***	***Dominant tall shrub / sapling spp.***	***Herbaceous & Low Shrub Dominants***	***General Description & Notes***
B8	minimal [~0% cover]	3	sugar maple, yellow birch, *Acer spicatum, Sambucus racemosa, Picea* sp. (just planted); [40% cover]	*Maianthemum canadense, Carex communis, Erythronium americanum, Polygonum cilinode, Streptopus lanceolatus, Carex leptonervia, Dryopteris campyloptera, Aralia nudicaulis, Scirpus cyperinus*; [60% cover]	Deciduous forest, recently clearcut and just planted with spruce. Site is near edge of an especially rich deciduous forest slope and it would be best to avoid impacts on existing forest here.
B9	sugar maple10 [90% cover]	60-70	sugar maple, *Acer spicatum, Rubus idaeus ssp. strigosus* [10% cover]	*Deparia acrostichoides, Erythronium americanum, Dryopteris campyloptera, Cinna latifolia, Carex leptonervia, Oclemena acuminata, (Polygonum cilinode, Dicentra cucullaria, Rubus pubescens, Galium triflorum, Viola sp., Streptopus lanceolatus, Trillium cernuum, Lactuca biennis);* [90% cover]	Site is directly on edge of clearcut, with description describing the uncut portion - an unusually rich deciduous forest stand. Turbine would be better placed higher on hill to the southwest so that no existing forest is affected.
B10	sugar maple [5% cover - only in nearby "habitat island" left in clearcut]	<3, but ~90 in tiny habitat island	*Rubus canadensis, Rubus idaeus ssp. strigosus*, yellow birch, sugar maple, *(Sambucus racemosa);* 50-60% cover	*Erythronium americanum, Carex leptonervia, Maianthemum canadense, (Rubus pubescens, Streptopus lanceolatus, Polygonatum pubescens, Chamerion angustifolium, Lactuca biennis);* [40% cover]	Massive recent deciduous forest clearcut within 20m of very small "habitat island" left standing
B11	sugar maple10 [15% cover, but only in stream buffer along ravine]	~4 in clearcut and 80 in narrow stream buffer	sugar maple, yellow birch, planted Japanese? Larch, balsam fir, *Rubus canadensis*, (*Acer pensylvanicum, Viburnum lantanoides, Cornus alternifolia*); [75% cover]	*Streptopus lanceolatus, Maianthemum canadense, Erythronium americanum, Rubus pubescens, Aralia nudicaulis, (Cinna latifolia, Carex communis, Polygonatum pubescens, Carex brunnescens var. sphaerostachya);* [45% cover]	The point given was at the bottom of a small stream ravine and may be slightly inaccurate. Description is from the adjacent crest of the ravine.

Potential Turbine Locations 2007	***Tree Species (~order of abundance)***	***Forest Age (approx.)***	***Dominant tall shrub / sapling spp.***	***Herbaceous & Low Shrub Dominants***	***General Description & Notes***
B12	beech8, sugar maple2 [85%cover]	60-80	*Acer spicatum*, beech, *(Rubus canadensis);* [30% cover]	*Dryopteris campyloptera, Erythronium americanum, (Maianthemum canadense, Aralia nudicaulis, Cinna latifolia, Rubus pubescens, Oclemena acuminata, Carex leptonervia, Carex arctata, Phegopteris connectilis, Viola blanda);* [80% cover]	Intermediate aged, mesic deciduous forest at crest of high hill. Forest canopy very low for age of trees, with trees perhaps stunted by wind.

Based on records of all rare species found within 100 km of the site, along with the distance of each record from a central point in the proposed development area, the researcher evaluated and summarized the findings by species, listing the number of records per species and the closest known record to the Nuttby Mountain site. He then evaluated the habitat requirements of each species, excluding 179 species on the basis of habitat and developing a list of 81 rare species with some potential for occurrences on the site. Tables 2 and 3 in Appendix A list all of the 260 rare vascular plant species noted within 100 km of the site, along with whether or not they were estimated to have some likelihood of occurrences.

Rare Plants Observed in the Field

Only two species considered rare by the ACCDC were found on the site. The first, Dwarf Ginseng (*Panax trifolius*, ranked S3), was present in large numbers in many sites within the proposed development area, primarily in the more mature deciduous forests, but also in the conifer plantations that were formerly deciduous forests and in recently cut deciduous forests. This species is ranked *Secure* in Nova Scotia under the National General Status of Wildlife process and is thus of limited concern to NS DNR. Recent 2007 fieldwork by Sean Blaney and the ACCDC in Cobequid Mountain sites between Portapique and Marshy Hope has found this species to be widespread and locally abundant in deciduous forests. If this level of abundance (which is not known in any other region of the Maritimes) is general across the eastern part of the Cobequid Mountains, this species' S-rank should be revised to S4. Dwarf Ginseng occurrences observed on site are mapped in Figure 4.3, but these undoubtedly under-represent the total distribution of the species in the study area. It appears to be present in almost all deciduous forest on-site. Occurrences observed in less-disturbed forest types (not conifer plantations or recent cuts) would be of higher priority for conservation than those in disturbed habitats. In general, avoiding impacts on more mature and less-disturbed forest habitats, where possible, is probably more valuable for conserving the natural heritage value of the site than is concern over particular Dwarf Ginseng populations, because of its widespread occurrence within the development area. The locations where Dwarf Ginseng is most abundant do, however, tend to correlate with the highest quality deciduous forest habitats on site.

The second rare plant species was Braun's Holly Fern (*Polystichum braunii*, ranked S3S4 and Secure). This species is only marginally rare in Nova Scotia, being locally common in Cape Breton and in the Blomidon area and being widespread, but uncommon, in cool ravines and steep slopes throughout the northern mainland of Nova Scotia. About 25 plants were found in especially rich deciduous slope forest to the north of turbine site 9 and northeast of turbine site 8. These locations are mapped in Figure 4.3. If construction activities are restricted to the flatter ground at the top of the slope within the clearcut in this area, impacts on Braun's Holly Fern should be limited or non-existent.

4.3.3 Mammals

Nova Scotia provides habitat to 57 species of mammals (Davis and Brown, 1996), and most are relatively widespread in their distribution across the province. The Whitetail deer (*Odolcoileus Virginianus*), the coyote (*Canislatrans*), the American black bear (*Ursus americanus*), the racoon (*Procyon lotor*) and the porcupine (*Erethizon dorsatum*) are amoung the mammals likely to frequent the lands in and around the Project area. Based on the ACCDC screening, two listed species of mammals, the mainland moose (*Alces alces*) and the Eastern Pipistrelle (*Pipistrellus subflavus*) had been reported within a 100 km of the Project site. Section 4.3.3.1 provides information on the listed mammal species; Section 4.3.3.2 provides information derived from the field programs conducted by Ross Hall and Hugh Broders.

4.3.3.1 Mammal Species at Risk

Mainland moose (*Alces alces americana*)
The mainland moose is a 'Red' listed species under the NSDNR General Status List and is legislated as Endangered under the *Nova Scotia Endangered Species Act*. The latter designation was introduced in 2003.

Eastern Pipistrelle (*Pipistrellus subflavus*)
The Eastern Pipestrelle is a 'Yellow' listed species under the NSDNR General Status List. Its preferred habit varies, but it is reliant on the presence of suitable hibernacula, such as caves, mine openings, rock crevices or buildings.

4.3.3.2 Results of Research and Field Work

Large Mammals
Several large mammalian species are known to reside along the Cobequid Hills; these include deer, black bear, fox, bobcats, coyotes and the endangered mainland moose. Though black bears, in particular, are attracted to blueberry fields that exist in the vicinity of the study area (pers. comm.., Kim George, DNR), none of these mammals are restricted to the lands in the vicinity of the proposed turbines. They can and do roam freely across an extensive area. In winter, for example, the accumulation of snow and the open nature of the deciduous forest, force the deer to migrate off the Cobequid Hills to the south-facing slopes; they return in May to the mature hardwood habitats to feed on the spring flowers.

The study area has in the past supported a moose population; they used the softwood forest on the poorly drained soils for winter cover. Historically, the Nuttby Mountain area, partly because of its remoteness, provided habitat for a good population of moose, but increased access, the development of the radio towers and extensive logging has diminished both habitat and the area's remoteness. It has also been suggested any enhanced access to the forest has increased opportunities for illegal hunting thereby suppressing the recovery of the moose population in this area.

Mark Elderkin, NSDNR Species at Risk biologist, has expressed special concern for the mainland moose. Several proponents of wind power, in addition to AWPC, have expressed interest in developing farms elevated locations along the Cobequid Hills, an area which, over the past 40 years, has provided the better moose habitat in northern Nova Scotia. While the impact of one wind power development might have only a small effect, there is the potential of cumulative degradation of moose habitat following several developments.

White-tailed deer are carriers of a parasitic brainworm (*Parelaphostrongylus tenuis*) which remains clinically silent in deer, but infection of moose by the same parasite is often fatal. Both moose and deer become infected after ingesting gastropods, an intermediate host. Changes in forest practices and increased road access have perhaps encouraged more deer onto the Cobequid Hills thus increasing a likelihood of moose infection. Certainly the remoteness of moose habitat has been eroded.

As described in Section 3.2.2.4, a total 6 hectare of forest floor was searched for moose pellet groups. The dispersed plot locations and the long layout of plots allowed a sampling of different habitats and increased the likelihood of encountering moose sign if moose occupied habitats in a clumped fashion. During this assessment, no moose pellet groups were observed. In fact no moose signs were observed. On the softer shoulders of wood roads and softer ground, either while on plot or preparing to begin plots, no moose tracks were observed. For quantitative purposes the plots were 4 m wide for moose, but at many locations the observer's eye could see beyond the 4 m and at times plots would lead through small openings in advanced regeneration where moose would tend to walk or bed, but no moose sign was seen. Forest conditions in the author's opinion were excellent and would have provided both great feeding opportunities and cover.

Deer population is calculated at 1.86 deer per square kilometer. Two scats from a large black bear were observed on plots 11 and 12. In May both the bear and the deer were frequenting the open hardwood forests to feed on ephemeral plants. No moose, however, presently occupy the lands of Nuttby Mountain, the site of the proposed wind farm. Their absence, however, does not preclude the occasional moose traveling through the area.

Bats

In comparison to avian fatalities, the documentation and analysis of bat fatalities at wind facilities is relatively recent, but is gaining considerable attention. Species composition of collision fatalities is typically comprised of hoary bats (*Lasiurus cinereus*), silver-haired bats (*Lasionycteris noctivagans*), eastern red bats (*Lasiurus borealis*), and big brown bats (*Eptesicus fuscus*), with smaller numbers of eastern pipistrelles (*Perimyotis subflavus*), northern long-eared (*Myotis septentrionalis*) and little brown bats (*Myotis lucifugus*). Nova Scotia is close to the northern periphery of the current known range for each of these species, with the exceptions of the northern long-eared and the little brown bat (van Zyll de Jong, 1985). These two species, as well as the eastern pipistrelle, are the only bat species with significant populations in Nova Scotia (Broders et al., 2003a; Farrow, 2007).

The northern long-eared bat is a species of the forest interior (Broders et al., 2003a; Henderson, 2007; Jung et al., 2004), while the little brown bat is more of a generalist species, associated with forests, as well as human-dominated environments (Barclay, 1982; Jung et al., 1999). Both of these species are year-round residents in the province with over-wintering documented at a number of hibernacula located throughout central Nova Scotia (Garroway, 2004; Moseley, 2007; Tutty, 2006).

The field program undertaken is detailed in Section 3.2.2.3. A total of 243 bat echolocation call sequences were recorded over 19 detector nights at the three sample locations. All of the recorded echolocation sequences at the proposed Nuttby Mountain wind development site were calls of the two Myotis species known to occur in Nova Scotia, i.e., the little brown bat and the northern long-eared bat. This was expected as these two species are the most common species in the province and are two of only three species of bats

Nuttby: Small Residence, United Baptist Church and Nuttby Mountain in Background with significant populations in Nova Scotia (Broders et al., 2003b). There were no call sequences of any of the migratory species, the eastern pipistrelle, over the 19 day sampling period[2]. This latter species is likely only locally abundant in southwest Nova Scotia (Broders et al. 2003a; Farrow 2007), and therefore, it was expected that it would not be well represented in this area.

Migratory species of bats have received the greatest attention because they make up the large majority of fatalities at existing wind turbine developments. Past evidence (Broders et al. 2003b), as well as the results of this survey, suggest that there is likely no significant movements of migratory bats species (hoary, red, silver-haired and big brown bats) through the region.

4.3.4 Fish

Throughout the Cobequid Hills watershed, on both sides of the divide, there is known habitat for several species including Atlantic salmon (Salmo Salar), brook trout (*Salvelinus fontinalis*), striped bass (*Morone saxatalis***)**, gaspereau (*Alosa* spp.), brown bullhead (*Ameiurus nebulosus*), Rainbow Smelt (*Osmerus mordax*), American eel (*Anguilla rostrata*) and brown trout (*Salmo trutta)*. As indicated in Table 4.5 the Atlantic Salmon, brook trout, the striped bass, gaspereau, and the American Eel are recognized as being of concern. They are discussed below.

4.3.4.1 Fish Species at Risk

Atlantic Salmon (*Salmo salar*)

The entire Cobequid watershed is considered significant habitat for Atlantic salmon populations, including the endangered Bay of Fundy population within the North River watershed. In 2001, this species was designated an endangered species by COSEWIC. As a result, all Inner Bay of Fundy rivers have been closed to recreational and commercial fishing. In 2003, fewer than 100 adults were estimated to have returned to the 32 rivers that were known to have historically contained the species, including the North River and its tributaries. The reasons for their decline in the region are unknown, but the lead causes of Atlantic salmon decline in freshwater habitats have been attributed to habitat loss and interbreeding with cultured species (COSEWIC, 2006).

Atlantic salmon are anadromous, spending part of their life feeding and growing during long migrations in the sea, and then returning to reproduce in their natal streams. Spawning grounds and nursery areas for Atlantic salmon are quite extensive on the upper reaches of Waugh River and its tributaries that drain through the site. Salmon angling is very limited because of the lateness of the salmon run. Atlantic salmon that are ready to spawn begin moving up river from spring through fall. Spawning occurs from October to November usually in gravel beds or redds near the head of riffles or tail of a pool. Young salmon (smolt) usually live in shallow riffle areas 25 to 26 cm deep that have gravel, rubble, rock or boulder bottoms. Adult salmon that have spawned immediately return to sea before winter, or remain in

[2] 180 of the sequences were recorded at one location, 39 at the second and 24 at the third. The average number of sequences per night at the Nuttby Mountain Wind development area (all locations) was 20 (SD=16) during the sampling period. For context, in 129 nights of monitoring along 5 forested edges from June-August 1999 in the greater Fundy National Park Ecosystem, the average number of sequences per night was 27 (SD=44) [Broders unpublished data]. The level of activity at this site was less than the average nightly activity found during the summer in southern New Brunswick.

the stream until spring (NSb, 2005). The preferred freshwater habitats for each life stage of Atlantic salmon are riffles and pools with high percentage pebble and gravel substrate. An optimal temperature for growth for the Atlantic salmon is 16^{o}C (Scott and Scott, 1988).

Striped Bass (*Morone saxatalis*)
There is a small run of striped bass that is supported by North River. Little information, however, is available about striped bass in this system. Striped bass are anadromous and spawn during May and June when temperatures are 15^{o}C. They prefer to spawn in tidal bores, or areas of the river that are still tidally influenced. The Bay of Fundy population has been federally legislated as ‘Threatened’ by COSEWIC, due to repeat spawning failure that has led to the disappearance of the Annapolis and Saint John River populations. The lead cause in population decline for the striped bass has been attributed to habitat change and changes in flow regime and poor water quality. This species will not be found in the head water streams of Nuttby Mountain.

American Eel (*Anguilla rostrata*)
The American eel was federally legislated by COSEWIC as a species of Special Concern in April 2006. Since the 1970s, American eel abundance has declined significantly in the Upper St. Lawrence River and in Lake Ontario. Possible causes of the observed decline have been related to habitat alteration, dams, fishery harvest, oscillations in ocean conditions, acid rain and contaminants (COSEWICb, 2006). There have been no signs of significant American eel decline within the Maritime region.

The American eel is catadromous, spending most of its life in freshwater and returning to salt water to spawn between August and December; peak migration occurs in the September to October period. Eels may remain in freshwater, such as in the Cobequid Hills watershed, from five to 20 years. Eels also undertake long oceanic migrations to the Sargasso Sea to spawn. The buoyant eggs float to the surface, hatch and develop into larvae which drift with ocean currents to the coastal areas of North America. Glass eels (juveniles) are attracted to freshwater and actively migrate into brackish estuaries and freshwater (NSh, 2005). Glass eels and elvers reach the Maritime coast in April and May. They may remain in the estuaries for some time moving up and down with the tides as they adapt to living in freshwater. The upstream migration can take several years, but not all eels migrate upstream; some elvers tend to remain in the estuaries. The preferred water temperature for eels is 16.7^{o}C (MACSIS, 1996).

Gaspereau or alewife (*Alosa* spp.)
Gaspereau has been listed by the Nova Scotia Department of Natural Resources (NSDNR) as a species of concern (Yellow) as little biological information is available on the species that inhabit many of the rivers within Nova Scotia. Gaspereau comprise two closely related species: alewife (*Alosa pseudolarengus*) and the blueback herring (*A. aestivalis*). They are ubiquitous to the watercourses, entering the majority of streams in Nova Scotia including the Waugh and North Rivers. Gaspereau are anadromous and enter the Waugh and North Rivers from early May to early June. From August to October the young-of-the-year migrate downstream in large schools to live in estuaries and surrounding coastal areas. Adults over-winter at sea. In the Maritimes, gaspereau spend most of their life growing in salt water (NSf, 2006).

Gaspereau that spawn upriver tend to spawn in May and June when water temperatures are greater than 10°C. Spawning can last only a few days, optimally when temperatures are between 15 to 22°C. Gaspereau are repeat spawners, spawning three to five times and sometimes up to six times (Rutherford, 2007).

Brook (speckled) trout (*Salvelinus fontinalis*)

Brook trout in Nova Scotia have been listed as a species of concern by NSDNR pursuant to the General Status Rank of Wild Species in Nova Scotia. Brook trout spawn during October and November in shallow, gravelly areas of streams with clean bottoms and good water flows. Some populations of speckled trout migrate to sea for short periods. They move downstream and upstream in the spring or early summer and remain in estuaries and ocean areas where food is plentiful. After about two months during the fall, they return to freshwater. Brook trout probably migrate to sea in response to crowded conditions, low food supplies, or unfavourable temperatures in their home waters. Some over-winter in estuaries and some move up and down the coastline. Not all fish in a population migrate, nor do they necessarily migrate every year (Gilhen, 1971). Brown and brook trout prefer small streams with cooler temperatures for spawning, and can be found throughout the Waugh and North River watersheds and habitat located near the project site.

4.3.4.2 Results of Research and Field Work

As previously referenced, the proposed turbines are located along and across the drainage divide created by Nuttby Mountain. Based on the desktop research undertaken and the field work conducted by Mr. B. Rutherford, a Fish Habitat Biologist, the streams draining from the project site could potentially support fish populations, particularly brook trout (*Salvelinus fontinalis*) and Atlantic salmon (Northumberland Strait populations). Tributaries of Ferguson Brook and Vamey Brook flowing north and tributaries of the North River, flowing south through the site were, in particular, identified as consistent habitat for fish. It is, however, considered unlikely that Atlantic salmon populations would reside in higher elevation headwater streams flow through the project site.

Temperature and pH were taken at each of the stream crossings, proposed and existing, and favorable conditions were met for fish, at two particular stream crossings (Rutherford pers. com, 2008). Culvert A (see Figure 2.3) is a metal open-bottom culvert (1,200 mm in diameter) that has been properly embedded into the stream bed and appears to provide adequate habitat for fish passage and for spawning. At the time of the assessment, the substrate characteristics of the stream were comprised of gravel, sand and cobble and some larger size boulders, inside the culvert and around it. There was no instream vegetation within the vicinity of the culvert; the stream, however, was almost completely covered by overhanging vegetation.


Culvert A-Looking upstream

Culvert B Headwater stream draining through project site

Culvert B is located on the headwaters of the Fergusson Brook. It flows through the site, north into the Waugh River and eventually to the Gulf. This stream has been impacted by clear cutting activities. At the time of the site assessment there was a high volume of woody debris within the upper reaches of the stream.

Downstream of Culvert B (see Figure 2.3), there was still a large percentage of woody debris and allocthanous material, but the stream channel was more defined. At the downstream end of Culvert B, the substrate consisted of sand, cobble, gravel and some large boulders around the culvert. Small pools in close proximity to the culverts, created by the debris were evident. This would indicate good spawning habitat for trout.

4.3.5 Herpetiles

There are 22 species of terrestrial and freshwater herpetile species in the province. Based on the ACCDC screening the only listed species reported within 100 km of the Project site is the wood turtle (*Clemmys inscultpa*). Section 4.4.5.1 provides information on this species, and Section 4.4.5.2 records the research findings.

4.3.5.1 Herpetile Species at Risk

Wood Turtle (*Clemmys inscultpa*)

The wood turtle (*Clemmys insculpta*) has been federally legislated as a species of concern and provincially as a vulnerable species, due to loss of habitat from increasing land development. Their preferred habitat can be defined as slow moving rivers and streams, intervales and their adjacent riparian zones. Streams with gravel banks with southern exposure are especially important as potential nesting and basking areas (Gilhen, Pers Comm, 2008). The wood turtle typically congregates in small populations of up to 100 individuals near riparian habitat characterized by high depositional sandy banks that are scoured by winter and spring floods.

4.3.5.2 RESEARCH FINDINGS

The streams encountered at Nuttby mountain are, for the most part, narrow, fast moving and cross steep topographic gradients. These are generally unsuitable as Wood Turtle habitat; no occurrences of this species were recorded.

4.3.6 Freshwater Mussels

4.3.6.1 SPECIES AT RISK

Eastern Lamp Mussel (*Lampsilis radiata*)

As indicated on Table 4.5, the Eastern Lamp Mussel is listed as a "Yellow" species by NSDNR. Freshwater mussels are most often encountered within relatively undisturbed riverine sites, typically those which contain developed riffle-pool-run sequences. The survival and reproduction of this species is also dependent upon the passage of a significant number of fish through the river system. Fish serve as a dispersal mechanism for the juvenile mussels (*glochidia*), which attach themselves to the gills of the fish, which in turn transport the *glochidia* from downstream to upstream locations. Mussels become sedentary after dropping off the fish at the upstream location.

4.3.6.2 RESULTS OF RESEARCH

While a number of potential fish-bearing streams have been identified, which would indicate potential for mussel migration, the physical characteristics of these streams is limiting. Most of the tributaries are first order streams, which experience significant drawdown and intermittent flow during the summer months. These streams are of insufficient size to provide the buffer against drawdown and littoral zone desiccation required for mussel survival. Furthermore, the nutrient load of these streams would be insufficient to support the filter feeding requirements of this species. Downstream locations, such as the main branches of the Waugh and North Rivers, have a more stable flow regime and physical structures more suitable for sustaining Eastern Lamp Mussel populations. The likelihood that any of the small tributaries on site at Nuttby Mountain will support this, or other species of freshwater mussels is negligible.

4.3.7 Invertebrates

4.3.7.1 INVERTEBRATES AT RISK

Arctic Fritillary (*Boloria chariclea*)

Habitat for this NSDNR 'Yellow' listed species is primarily meadows, streamsides and bogs, provided that their life-stage specific, i.e., caterpillar vs. adult, dietary preferences are met. Caterpillars' diet consists of various species of Violets (*Viola spp.*), Willows (*Salix spp.*) and Blueberries (*Vacinnium spp.*). These species are most often associated with wetlands and heathlands; these are not common in the vicinity of the proposed project site.

Adults are known to feed on the nectar of various species of Goldenrod (*Solidago spp.*) and Aster (*Aster spp.*). While the latter are common roadside species found throughout the Nuttby Mountain area, the potential for good caterpillar habitat is limiting. There is a low likelihood of encountering Arctic Fritillary on site, but its presence cannot be entirely discounted due to its mobility.

Monarch butterfly (*Danaus plexippus*)
The Monarch butterfly is listed as a COSEWIC 'Species of Concern' as well as a NSDNR 'Yellow' species. Its preferred habitat consists of open habitats such as fields, meadows, marshes and roadsides. Similar to the Arctic Fritillary, its range is limited by the availability of its preferred food, which is Milkweed (*Asclepias spp.*). There are two species of milkweed present in Nova Scotia, Swamp Milkweed (*Asclepias incaranata)* and Common Milkweed (*Asclepias syriaca*). During the course of the botanical surveys, neither of these species was encountered on site.

4.3.7.2 RESULTS OF RESEARCH AND FIELD WORK
Based on a review of the literature detailing the habitat requirements for the Arctic Fritillary and the Monarch butterfly and the results of the field programs, particularly the botanical surveys, it appeared unlikely that the project area provided habitat for these species. No adult individuals were encountered on site.

4.4 Socio-Economic Environment
The general area has been accessed and used by Europeans at least since the mid nineteenth century. As previously referenced, the Project site is located in the Municipality of the County of Colchester to the west of Route 311 which runs from Nuttby through Earltown and West Earltown to Tatamagouch. The site is approximately 6 km from Earltown, the nearest community; the population of the County in 2006 was 50,023; the principle towns are Truro (population 11,765) and Stewiacke (population 1,421). Earltown and the other communities along Route 311 are small, providing little in the way of services to the local population. Most in the area will travel to Truro on a regular basis to shop, to access medical and other services.

4.4.1 Key Settlements and Local Population Trends
The key settlements surrounding the proposed wind farm are Nuttby, Earltown and West Earltown, all of which are located on Route 311 that circles Nuttby Mountain. Nuttby is a small community of roughly three dozen residences, some farms and a Baptist Church at the foot of Nuttby Mountain. The only evidence of commercial activity is an auto repair shop across from the Nuttby United Baptist Church. The closest wind turbine on the proposed wind farm will be located 2.5 km from what appears to be the heart of Nuttby.

Earltown is a picturesque community nestled along a west-sloping hill at the junction of Route 311 and Route 326. European settlement dates here back to 1813 as an extension of the Highland Scott settlements in Western Pictou County. At its height in the late 1800s, the Earltown area boasted a population of 2,000 with most residents employed in farming and forestry. Remnants of this time are stately Victorian homes, some of which appear to be in various states of disrepair. The core of Earltown features a community centre in the former Earltown

Earltown Gas Bar

School, a charming traditional gas bar/convenience store and a church. Currently, the area has a population of approximately 250 residents. The closest wind turbine on the proposed wind farm will be located 5.5 km from the community.

West Earltown is a small community of dispersed residences and farms to the North of Nuttby Mountain. The majority of houses are located along Route 311 with some residential dwellings huddled up against the foot of Nuttby Mountain itself. The closest wind turbine on the proposed wind farm will be located approximately 3 km from West Earltown.

West Earltown Looking East

For the purpose of analysing local population trends, the boundaries of the community of Earltown were derived from the Nova Scotia Community Counts[3]. Place names included are: Balfron, Balmoral Mills, Berichan, Clydesdale, Earltown, East Earltown, MacBains Corner, North Earltown, Nuttby, The Falls, and West Earltown. In 2006, the population of this area was 737. Contrary to the trend in most rural areas in Nova Scotia, the area saw an increase in population of 3.2 percent between 1996 and 2006. The population increase, however, are most prevalent in the plus 45 year age cohorts, which can be credited to the aging of the provincial population. Nevertheless, the 3.2 percent population increase also suggests that people retiring or planning for retirement, have chosen the Earltown area as a location in which to settle. In contrast, the outflow of younger people has been dramatic with a 22 percent decrease in the population aged between 0 to 39.

The traditional industries still provide most of the employment for Earltown's male labour force, with 25.9 percent employed in construction, 20.1 percent in agriculture, forestry, fishing and hunting, and 17.2 percent in manufacturing. Earltown's female labour force is predominantly employed in the services and health care sector – 14.8 percent in health care and social assistance, 14.2 percent in retail trade and 13.1 percent in accommodation and food services.

4.4.2 Existing Land Use and Economic Activity

The predominant businesses in the area involve forestry and logging. The principal forestry companies operating in the area include Bonnyman and Byers Ltd., Neenah (Formerly Kimberly-Clark) and Atlantic Star Forestry Ltd.; all have large land holdings in the area (pers. comm. MacIntosh, Pam, 2007). There is some blueberry production on the slopes of Nuttby Mountain, and there are both farms and residential single family units located along Route 311; many of these residents presumably travel to work and shop in Truro.

[3] Community Counts is a statistical infrastructure system developed by the Province of Nova Scotia.

As is apparent from Figure 4.2, the prevalent land use in the area is forestry though a significant portion of the Project site has been clear cut. The areas around Nuttby Mountain and McRae Lake are also very popular destinations for recreational hunting, trapping and fishing. The roads and trails that access the fire tower, the RCMP tower and the utility towers are all used by recreational hunters, trappers and fishers, and there are a number of camps and hides on the mountain. Hunted game includes deer, moose, bear and rabbits though hunters predominantly hunt deer (pers. comm. Adrian Samson, NSDNR).

Modern clearcutting activity at Turbine #15 site, looking southeast. *Archaeologist is facing south.*

The nearest structure to a proposed turbine is a hunting cabin that is located approximately 150 m from turbine location WTG17 (see Figure 2.2); it is situated on one of the properties leased by the proponent and is not occupied year round. The North Shore Snowmobile Club has a building that is located approximately 300 m from the nearest turbine location and there is a seasonal camp located on Old Nuttby Road approximately 600 m south of turbine WTG11. The nearest all year-round occupied residences are over 1 km distant from any WTG.

On lands immediately adjacent to the site of the proposed wind farm, there are several communication towers, some of which are operating and some of which are not. The proponent engaged a specialized engineering firm to determine the exact nature and operating parameters of these communication towers and also to determine whether the proposed wind farm was likely to cause any significant adverse affects with respect to their operation.

A local landmark is a family business that has been operating in the area for over 30 years: Sugar Moon Farm Maple Products and the Pancake House. This business produces maple syrup products and operates a year round dining room. The operator also offers hiking, skiing, snowshoeing and sleigh rides to tourists and visitors.

4.4.3 Communications Towers and Related Systems

4.4.3.1 Local Radio Communications

IC's database indicates that there are existing licensed point to point microwave links at the Nuttby radio site adjacent the proposed wind farm. A field visit to the area found that there are numerous antennas on the structures on the site adjacent the wind farm that are no longer in service. The following paragraphs summarize the status of the antennas adjacent the wind farm site. Figures 4.1 and 4.4 depict the radio site in relation to the wind farm and the location of the towers relative to each other. Appendix D provides photographs of the 10 radio towers. The following sections briefly describe the function of the antennas on each of the 10 towers based on the field appraisal and evaluation conducted by Oldham Engineers Inc.

Tower 1 – Nova Scotia Integrated Mobile Radio System (NSIMRS)

There are numerous parabolic antennas on this tower (to McLellans Mountain and to Shubenacadie), but the location of the wind turbines is not expected to infringe on the primary beam, i.e., multiple Fresnel zones, of these PTP paths. All other antennas on this tower operate at tower frequencies, i.e., 150 MHz, 450 MHz and 900 MHz, and have wide beam widths, e.g., omni-directional whip antennas, omni-offset multi-dipole antennas, corner reflectors and yagis.

Towers 2, 3, 4, 5 and 6

The antennas on these towers operate at lower frequencies, i.e., 150 MHz, 450 MHz and 900 MHz and have wide beam widths, e.g., omni-direction whip antennas, omni-offset multi-dipole antennas, corner reflectors and yagis.

Tower 7 (Wireless INet)

This tower supports antennas used to provide wireless Inet access service. There is a single PTP directional antenna (to Penny Mountain) on the tower, but the location of the wind turbines is not expected to infringe on the main beam, i.e., multiple Fresnel zones, of this PTP path. There are also two sectoral antennas (2.4 GHz/120 degree beam width) located at the top of the tower. According to Netbundle, the primary service area for this system is Truro.

Aliant Towers (Towers 8 and 9)

Aliant has confirmed that it owns these two large towers on the site, but there are no records in the IC database related to the parabolic antennas that exist on these towers. Aliant has, however, confirmed that with the exception of a small parabolic on Tower 9 that is a non-licensed link to an Aliant site in Truro, i.e., opposite direction of the proposed wind farm, the remaining parabolic antennas on these towers are no longer in service. The other antennas on these two towers operate at lower frequencies (150 MHz, 450 MHz and 900 MHz) and have wide beam widths, e.g., omni-direction whip antennas, omni-offset multi-dipole antennas, corner reflectors and yagis.

Tower 10 (Astral Media)

There are two large multi-bay FM broadcast antennas on this tower and a single grid parabolic antenna that points towards Truro. The multi-by broadcast antennas operate at lower frequencies (99.5 MHz Cat Country and 100.9 MHz Big Dog) and likely have a slightly offset radiation pattern. The grid parabolic antenna (studio link) points towards Truro and therefore does not cross the proposed property of the wind farm.

4.4.3.2 Other Radar and Related Communication Systems

Environment Canada Weather Radar System

The closest EC weather radar system is located in Gore, Nova Scotia, about 65 km SW of Nuttby Mountain. CanWEA recommends coordination with weather radars within 80 km of weather radar systems, and EC has been made aware of the proposed Project.

Siesmoacoustic Systems

The closest seismoacoustic monitoring station is at Caledonia Mountain, New Brunswick, about 55 km from Nuttby Mountain and located outside the 50 km consultation zone.

Department of National Defence (DND) Air Defence and Air Traffic Control Radar Systems
DND has confirmed that the proposed wind farm is not expected to significantly impact the performance of their Air Defence radar systems or Air Traffic Control radar systems.

Nav Canada Air Traffic Control Radar
Airports that fall within the suggested 60 km radius consultation zone are located at Debert (25 km distant) and at Trenton (45 km distant). Neither airport is within line of sight of the proposed WTGs. The performance of air traffic control radar systems (if in existence) at these locations is not expected to be significantly impacted.

Canadian Coast Guard (CCG) Vessel Traffic Radar System
The proposed wind farm is not expected to significantly impact the operations of the CCG Marine Communication and Traffic Services radio network or other vessel traffic control communications.

4.4.4 Transportation Routes and Traffic Patterns
The study area and the Old Nuttby Mountain Road are accessed from Route 311. Route 311 which runs from Truro north to Tatamagouch, circumvents the study area and runs through the adjacent communities of Nuttby, Earltown and West Earltown. In Earltown, Route 326 branches off to the north to connect the area with Route 6 which runs along the Northumberland Strait. Travel distances from Earltown to the surrounding key communities are: 30 km to Truro; 22 km to Tatamagouch; 44 km to Pictou; and 43 km to Wentworth.

A large portion of Route 311 was upgraded three years ago, work that included resurfacing and shoulder upgrades, but the road still has many sharp turns, and drivers tend to exceed the speed limit (pers. comm., MacIntosh, Pam, 2007). From Nuttby, the Old Nuttby Mountain Road leads towards and will provide access to the proposed Project.

There is within the Project area an extensive network of logging roads that provide access for logging and forestry management. These roads are unsurfaced, but will facilitate access to build the turbines. Culverts have already been installed at low-lying areas and at water course crossings. Wherever economically and environmentally viable, the existing logging roads will be used to access the turbine sites. Some of these roads may need to be widened and/or upgraded, and a number of the existing culverts may need to be extended or replaced.

There is also an extensive system of trails that are used by those who access the area for recreational purposes, i.e., the hunters, trappers, fishers, hikers, skiers and snowshoers; more trails are proposed (pers. comm. Norris Wishton, Cobequid Eco-trail Society). One trail that is proposed by the Cobequid Eco-trail Society would see the protected area around Gully Lake connected to Nuttby Mountain. Another proposed trail might be a part of the proposed Cape to Cape Trail.

4.4.5 Archaeological Findings
One archaeological site was discovered as a result of the field work undertaken. This find comprises three structural features, namely a house and two likely barns; there were also several piles of field clearance. The site, as depicted on Figure 4.5, is located roughly 100 m west of the intersection of the

Old Nuttby Mountain Road and Nuttby Tower Lane. This site is likely a late historic or early modern farming homestead dating to the 19th or early 20th century. The location appears on a 1902 Geological Survey of Canada map sheet as a linear arrangement of four buildings along Old Nuttby Mountain Road. The features appear to correspond to an area labelled on Church's 1874 map as the homestead of L (or I) MacRae.

No First Nations archaeological resources were identified in the development area.

Barn 1 footing, identifiable by linear rock arrangement and concentration of leaf litter

One of several field clearance features at archaeological site recorded during current survey

4.4.6 Mi'kmaq Ecological Knowledge

The Mi'kmaq use activities determined to occur within the study area as defined in Section 3.2.2.7 include fishing, hunting and the collection of plants. A site at the Upper North River is used on occasions an overnight camping location. Map A in Appendix C provides an overview of the spatial extent of Mi'kmaq use in the area.

4.4.6.1 Fishing

Fishing is a traditional Mi'Kmaw activity and is one that continues to be pursued. The Mi'kmaq fish the many brooks, streams and lakes in the area for food. The most important species harvested is trout, but salmon and smelt are also fished. Key areas include Earltown Lake, the Falls area of Waughs River, the North Branch River, the Upper North River and the Central North River. Nearer to the wind farm, MacRaes Lake is fished for trout.

Salmon are also harvested. Key areas for this species include the Falls on the Waughs River, the Middle Branch North River, the Sugarloaf Mountain Area, the Central New Annan Area and the Tatamagouche Mountain Area.

Smelts are fished at the Falls on the Waughs River and from the North River.

4.4.6.2 Hunting

Mi'kmaq hunt within the study area primarily for deer, rabbit and partridge. Moose and porcupine area also harvested, but to a lesser extent. Deer are harvested in the following areas: Earltown, Central New

Annan, Sugarloaf Mountain, Silica Mountain and the West Branch area. Rabbit is hunted primarily in the Nuttby/Middle Branch North River Area.

4.4.6.3 Collecting of Plants

The Mi'kmaq collect plants for food and for medicinal purposes. Of the former the two primary plants harvested are blueberries and apples; these are harvested primarily in the Sugarloaf Mountain area, but also in Central New Annan and in the vicinity of Silica Lake, Earltown, Clydesdale, South Branch North River and Upper Kemptown.

The following medicinal plants are harvested:

- Sweetgrasse – Switte (*Hierochloe odorata L*);
- Goldenthread – Wisswtagji'jkl; and
- Flagroot – Ki'kwesu'sk.

The above have all been harvested to the west of the Earltown Lake area. Fir and various types of hardwood and princess pine are also harvested from the Nuttby Mountain area and the Silica Mountain area.

4.5 Environmental Factors Susceptible to Impact

Based on the expertise and experience of the Project team and the work undertaken to compile this environmental baseline, the following physical, ecological and socio-economic factors should be evaluated further:

- Surface Water Quality: because the Project area is the location of the headwaters of several streams, care must be taken throughout construction and all subsequent activities to prevent the degradation of these waters;
- Species of Concern: a legislative requirement;
- Forest Cover: although the forest cover across the Project site is already fragmented as a result of logging operations, some additional cover will be removed to facilitate the siting of the turbines;
- Migratory and Breeding Birds: given the nature of the Project, birds are susceptible to collision with the rotating blades of the turbines;
- Bats: given the nature of the Project, bats are susceptible to collision with the rotating blades of the turbines; and
- Recreational Use: hunters, trappers and others access the project area for a range of recreational purposes

Chapter 5 Consultation

5.1 Community Consultation

Consultation is both an important part of the environmental assessment process and is also necessary to convey accurate, relevant and complete information to the local community. The study team have had numerous meetings with local residents and property owners who may in one way or another be affected by the construction and operation of the Project. They have also met with and kept the municipal elected officials fully informed about the Project and the various studies that have been undertaken. In addition to the informal meetings and communications that have taken place, a public open house was held and a ratepayers meeting with local property owners convened by the municipal representative. Further details on these are provided below.

5.2 Public Open House

To ensure that all interests in the local area had the opportunity to meet with the proponent and the environmental study team a public open house was held on August 20th 2007 in the North River Fire Hall. This event was advertized in the Truro Daily News and the Amherst Daily News; on local radio, i.e., CKTO and CKTY, and posters were distributed in the local area. In addition, approximately 110 landowners within 3 km of the Project site were individually notified by mailed letter. The objectives of this event were:

- to provide information on the siting and development of up to 22 wind turbines on Nuttby Mountain;
- to provide interested individuals an opportunity to meet with the developers and the project team;
- to provide information on the environmental assessment process;
- to demonstrate an understanding of the area;
- to listen to concerns and provide information to mitigate those concerns; and
- to provide some indication of the timelines, constraints and requirements associated with the development of the Project.

Information about the Project was made available through a brief fact sheet that was distributed to attendees, through a series of 16 storey boards and through one to one discussions. In addition, the Proponent had made available for viewing a series of photographs of the development of the Pubnico Point Wind Farm and multimedia presentation on continuous loop showing the construction of a Vestas turbine in Germany. These were invaluable tools in describing the sequence of events that were likely to occur on site and provided informative information of the size of the components that are associated with a turbine.

Questionnaires (Appendix E) were distributed. A number were returned at the Open House; others were returned by mail. In total, 12 were received. Overall people wanted to know more about the turbines, wanted to know where they were likely to be sited relative to their property and sought answers to a range of pragmatic questions including details of the construction schedule, noise, etc. The following topics were raised at the Open House and/or in response to the questions posed in the questionnaire:

- turbine noise
- property value
- visual/landscape impact
- large mammals: deer/bear

- interference with television and telephone reception
- construction traffic
- jobs and local economic benefits
- trail use
- blueberry production

The following observations are illustrative of those received from the questionnaires:

- we have to depend on satellite for TV located on Nuttby Mountain. Will these wind turbines effect our reception?
- traffic on the old Nuttby Road and the maintenance of said road and associated safety, noise, dust, etc.; and
- interference with snowmobile trails.

Overall, the feedback from those in attendance was supportive. One resident from the Old Nuttby Road wrote:

> *"I have no concerns about the development. I would far sooner put up with a little noise if it is a concern rather than not be able to breath because of fossil fuel pollution"*.

5.2.1 Ratepayers Meeting and Other Consultation Processess

As a follow-up to the open house, Councilor Ron Cavanaugh organized a ratepayers meeting to ensure that all community members had had an opportunity to ask additional questions following reflection on the materials presented at the open house. This also provided an opportunity, outside of the summer months, for those who were unable to attend the open house to learn more of the Project. The meeting was held at the North River Fire Hall on September 29, 2007. Approximately 40 people attended at which Councilor Cavanaugh moderated a panel consisting of representatives form the proponent group. A large format map showing a layout of the wind turbines was posted for viewing.

The meeting started with a brief overview of the project by the proponent team, following which the floor was opened to questions. Approximately 10 people asked questions. Questions raised included:

- the potential for noise including audible and infra sound;
- set-back distances and whether there would be a controlling bylaw;
- the timing of construction and the extent of vehicular and equipment movement on Old Nuttby Road area;
- municipal taxes; and
- the possibility for local energy cost savings as a result of the wind farm.

All of the questions were answered by the panel members to the extent possible given the known project parameters. In cases where the proponent promised to follow-up with specific additional information, this has since been done.

After the open forum concluded, the proponent team stayed and had several informal dialogues. This provided the opportunity for some of the questions that had been posed to be more thoroughly understood and answered one-on-one. A number of positive dispositions towards the wind farm project were heard from the attendees.

The proponent believes that all of the matters raised at the ratepayers meeting are addressed in this Environmental Assessment.

As a result of suggestions at the ratepayers meeting, an informal community liaison committee has been established under the direction of the area Councillor so that the proponent and the community have a means of keeping each other informed as the project unfolds. The proponent has communicated with the Councillor on a number of occasions since the ratepayers meeting.

In addition to the public meeting described above, the proponent has met on a number of occasions with members of the Cobequid trail group whose mandate is to establish a hiking trail extending throughout the region. Although the proponent does not own land on which the proposed trail is sought to be placed, the wind farm is in proximity to one particular segment of the proposed trail. The proponent has and will continue to keep the community committee and the trail group informed of its plans.

5.3 Regulatory Consultation

An integral and important part of the environmental assessment is to meet and/or communicate with the many regulatory departments that have expertise and guidance to contribute to the successful execution of the various field programs and studies. This has been done at various levels. After the submission of the Project Description to the Canadian Environmental Assessment Agency in August, 2007, the proponent and the environmental assessment manager met with representatives of the key regulatory agencies; this meeting took place on October 12th, 2007 at the offices of the Canadian Environmental Assessment Agency.

The study team presented the Project as then envisaged and described the work that was underway. This in turn lead to a discussion of various topics including the following:

- potential interference to telephone and television reception;
- the need for those conducting the field programs to have sufficient and substantive consultation with key leads in the Canadian Wildlife Service and NSDNR;
- the need to address EMF in the environmental assessment;
- the need to identify and categorize the forest types on the site; and
- the need to provide specific information on turbine lighting including the number and nature of the lights proposed.

Table 5.1 summarizes the role of the regulatory agencies participating in the meeting.

Table 5-1: Involved Federal and Provincial Departments

Agency/Organization	***Role***	***Observations***
Canadian Environmental Assessment Agency	Federal Environmental Assessment Coordinator (FEAC)	
Health Canada	Federal Authority (FA)	➢ human health concerns related to noise ➢ exposure to electric and magnetic fields (EMFs)
DFO	Had yet to be determined whether DFO would be a RA	➢ clarification of impact on stream crossings and fish habitat provided in Chapter 4
Environment Canada	Expert Authority with mandates under several federal statutes	➢ recommended liaison with CWS with respect to the scope of avian baseline studies ➢ recommended lighting with short flash durations and the ability to emit no light during the “off phase” of the flash, e.g., strobes and modern LED lights ➢ detail/categorization of habitats ➢ proximity to weather radar
Natural Resources Canada	RA	➢ NPA approved under the ecoENERGY program
Transport Canada	Not a RA	➢ No navigable waters within the Project site

The above matters were discussed at some length and have been taken into account in the execution of the work programs described in Chapter 3 and in the determination and assessment of project impacts in Chapter 7.

In addition, to the specific meeting referenced above, the team at different times and for different purposes has been in contact with representatives of the following:

- ➢ Canadian Environmental Assessment Agency
- ➢ NRCan
- ➢ Transport Canada
- ➢ Environment Canada – Canada Wildlife Service
- ➢ Industry Canada
- ➢ NS Department of Environment
- ➢ NS Department of Transportation
- ➢ NS Department of Natural Resources
- ➢ Department of Fisheries and Oceans

5.4 First Nations Notification

A letter providing information on the Proponent, the nature of the proposed Project, the consultant conducting the environmental assessment and the name of the company, i.e., Membertou Geomatics, that conducted the Mi’kmaq Ecological Knowledge (MEK) study was sent to each of the following:

- ➢ Assembly of Nova Scotia Mi’kmaq Chiefs (the “Assembly”);

- Union of Nova Scotia Indians;
- Confederacy of Mainland Mi'kmaq;
- Kwilmu'kw–klusuagn;
- the Native Council of Nova Scotia; and
- Nova Scotia Department of Aboriginal Affairs.

The results of the MEK Study form an integral part of the database for this environmental assessment; a copy of the study in its entirety is provided in Appendix C.

Chapter 6 Scope of the Assessment

6.1 Approach

The overall approach to this assessment and the fieldwork is detailed in Chapter 3. Figure 3.1 depicts the steps in the environmental assessment process. The following sections provide a further explanation of how the environmental evaluation was undertaken.

6.2 Scoping: VECs and Socio-Economic Issues

It is impractical, if not impossible, for an assessment to address all of the potential environmental effects that might be directly or indirectly associated with a proposed undertaking. An important part of the assessment process, therefore, is to identify those matters upon which the assessment may be focused to ensure a meaningful and effective evaluation. This process is often referred to as scoping, i.e., an activity designed to identify those components of the biophysical and socio-economic environment which may be impacted by the Project and for which there is public and professional concern (Sadar, 1994). This section references the steps that were taken to focus this assessment and to identify the VECs and socio-economic issues.

As detailed in Chapters 3 and 4, there was both extensive documentary research and the execution of a range of field programs. The resultant database, in conjunction with the consultation undertaken, including consultation with pertinent provincial and federal departments, and the study team's professional expertise and experience, has enabled the definition of the VECs and socio-economic issues. This process has involved internal team discussions to ensure that the requisite interdisciplinary rigor brought focus to the assessment. These discussions have included the participation of the specialists contracted to execute specific field programs and the engineers involved in the prefeasibility studies associated with the siting of the turbines and the access roads. The informed professional judgement of this team, particularly those who have executed the various field programs, and the local knowledge that the proponent team brought to the process, were important inputs to the determination of the VECs and socio-economic issues identified in Section 6.3. It is these factors that are subject to evaluation in Chapter 7.

6.3 Potential Pathway and the Definition of VECs and Socio-Economic

Once the scope of the Project was determined and the phases of the Project defined, it is possible to identify those facets that may cause consequences for the receiving environment. This is accomplished by identifying the linkages, or pathways, between the Project and the receiving environment. That is, those components and activities that will be carried out on the site during Project construction, operation and eventual decommissioning that may have the potential to interact with the physical, ecological and/or socio-economic environment. Such pathways will include, but will not be limited to, the generation of sedimentation and emissions, including noise and dust.

The study team has determined the VECs and socio-economic issues that will be subject to assessment based upon its collective knowledge and experience; input received from the Proponent; review of the regulatory requirements and feedback from the regulatory authorities, and others as part of the consultation program and selected field programs. The VECs and socio-economic issues that will be evaluated are identified in Table 6.1.

Table 6-1: Potential VECs and Socio-economic Issues

Physical Components	***Ecological Components***	***Socio-economic Issues***
Ground and surface water quality	Wetlands	Land use
Communication towers	Fish habitat	Employment and the economy
Rural ambiance	Forest cover	Property values
	Species of Concern	Aboriginal use of lands
	Migratory and breeding birds	Archaeological resources
	Bats	Visual impacts
		Traffic
		Interference with television and telephone service
		Health and safety

6.4 Analysis and Evaluation Criteria

The definition of "environment" in the *NS Environment Act* is as follows:

"Environment" means the components of the earth and includes

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

In the provincial legislation *"environmental effect"* means in respect of an undertaking

- *a) 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*
- *b) any change to the undertaking that may be caused by the environment, whether that change occurs inside or outside the Province.*

This assessment focuses on the evaluation of potential interactions between the VECs and socio-economic issues and the various Project activities outlined in the Project description, i.e., in Chapter 2. A standard evaluation system has been developed to ensure that potential effects are clearly and completely evaluated. Residual environmental effects are those that remain after mitigation and control measures are 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.

Many, if not all potential adverse effects, can be avoided through the application of good engineering and construction practices, the careful timing of activities, and the adherence to appropriate environmental management techniques.

The effects evaluation for each VEC and socio-economic issue is conducted by Project phase, i.e., construction, operation, and decommissioning, as well as malfunctions and accidents. For each phase, the study team selects those Project activities that may result in a positive or negative effect on the VEC or socio-economic issue. To determine if there are adverse effects, the study team took the following factors into account:

- negative effects on the health of the biota;
- loss of rare and endangered species;
- loss of critical and/or productive habitat;
- fragmentation of habitat;
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;
- reductions in the capacity of renewable resources to meet the needs of present and future generations, including those lands and resources used by aboriginal peoples; and
- interference with the use and enjoyment of property.

The analysis evaluates the interactions between Project activities and the VEC or socio-economic issue 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 - research, monitoring and/or recovery initiatives should be considered; and
- *Negligible*: Potential impact may result in a slight decline of the resource in the study area during the life of the project - research, monitoring and/or recovery initiatives would not normally be required.

As not all consequences of Project development and operation on the identified VECs and socio-economic issues are adverse, the above table has been supplemented by the following two definitions:

- no impact, i.e., where the consequences of the Project have no effects on the specific VEC or socio-economic issue; and
- beneficial impact, i.e., where the consequences of that phase of the Project enhance the specific VEC or socio-economic issue.

6.5 Cumulative Effects

A consideration in any environmental assessment process is how the proposed Project may interact with past, present or likely, i.e., approved, future projects or activities within the defined spatial and temporal timeframes identified. It is, in fact, a way of setting the Project into its broader ecological and regional development context, and it is the Project's interface with this context that is discussed further in the evaluation.

6.6 Effects of the Environment on the Project

Several naturally occurring environmental factors, including fire, extreme weather events and climate change, could to varying degrees have consequences for the development and operation of the Project. These are referenced as appropriate in the evaluation of specific VECs and socio-economic issues in Section 7.5.

7.1 VECs and Socio-Economic Issues

The VECS and socio-economic issues that form the basis for this environmental analysis were identified in Table 6.1. For an impact to occur, however, there has to be a link between the Project and the VEC or socio-economic issue, i.e., a pathway. Table 7.1 depicts where there is a potential pathway or linkage between the identified VEC or socio-economic issue through site preparation and construction, the operation and maintenance of the turbines and their decommissioning. This table graphically depicts potential interactions where there is a possibility for impact. Where there is no pathway, or linkage, there can be no impact on that VEC or socio-economic issue; a justification of this outcome is provided in the text.

Table 7-1: Potential Interactions Between Project Activities and VECs/Socio-Economic Issues

	Site Preparation and Construction						Operation and Maintenance				Reclamation & Decommissioning			
	Site preparation	Transportation of WTGs	Assembly of WTGs	Release of hazardous materials	Noise	Accidents and malfunctions	Movement of WTG blades	Release of hazardous materials	Noise	Accidents and malfunctions	Dismantling of WTGs	Transportation of WTGs	Noise	Accidents and malfunctions
Physical														
Ground and surface water quality	✓	✓	✓	✓		✓		✓		✓	✓	✓		✓
Communication towers							✓							
Rural Ambience	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓
Biophysical														
Wetlands	✓	✓	✓	✓		✓		✓		✓	✓	✓		✓
Fish habitat	✓	✓	✓	✓		✓		✓		✓	✓	✓		✓
Forest cover	✓					✓				✓	✓			✓
Species of Concern	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Migratory and breeding birds	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bats	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Socio-economic														
Land use	✓						✓				✓			
Employment and the economy	✓	✓	✓								✓	✓		

	Site Preparation and Construction						Operation and Maintenance				Reclamation & Decommissioning			
	Site preparation	Transportation of WTGs	Assembly of WTGs	Release of hazardous materials	Noise	Accidents and malfunctions	Movement of WTG blades	Release of hazardous materials	Noise	Accidents and malfunctions	Dismantling of WTGs	Transportation of WTGs	Noise	Accidents and malfunctions
Property values														
Aboriginal use of lands	✓			✓										
Archaeological resources	✓													
Visual impacts							✓							
Traffic	✓		✓									✓		
Interference with television							✓							
Health and safety	✓	✓	✓	✓		✓		✓		✓	✓	✓		✓

The following sections present the environmental evaluation and identify the residual effects of the proposed Project on the above identified physical and biophysical VECs and socio-economic issues. Recommendations for mitigation are identified where applicable. The analysis also takes into account the consequence of the proposed Project interacting cumulatively with other activities including recreational activities in the area, logging and the operation of blueberry fields.

7.2 Physical VECs

7.2.1 Ground and Surface Water Quality

The maintenance of the quality of the ground and surface waters on site is important to the maintenance of habitat quality particularly that associated with:

- the wetlands that are located on Nuttby Mountain; and
- the headwaters of the several streams that drain both northwards to the Northumberland Strait and southwards into the Bay of Fundy, the most important of which include Vamey Brook, Ferguson Brook and the Middle Branch of the North River.

Ground and surface water quality has therefore been identified as a VEC.

A significant environmental effect on ground and surface water quality would result if a substantive change attributable to the Project could be identified in ground and surface water quality on Nuttby Mountain, or in the headwaters of the streams that drain from the site.

7.2.1.1 Boundaries

The physical boundaries encompass those wetlands and streams in proximity to those areas which will be subject in the first instance to the construction or upgrading of the access roads, laydown areas and WTG foundations. This work will involve during construction the use of heavy equipment and some excavation of the bedrock; during Project operation the focus will be upon maintenance activities while the eventual decommissioning of the WTGs will again involve the use of heavy equipment. The temporal boundaries are primarily those associated with site preparation and Project construction, but the effects, if mitigative measures are not applied, could be more reaching both spatially and over time. In the broader sense the temporal boundaries relate to the anticipated life of the Project, i.e., perhaps 40 years or more.

7.2.1.2 Pathway Analysis

The pathways that may adversely affect ground and surface water quality include:

- the disturbance of sediments during the construction of the WTGs and the associated access roads;
- dust; and
- the accidental release of hazardous materials such as fuels, oils and lubricants.

7.2.1.3 Mitigative Measures

Construction activity will involve clearing and grubbing in addition to excavation, activities that have the potential to cause erosion and the transportation of sediment to adjacent areas, including existing ditches, wetlands and streams. The severity of erosion and sediment transport depends on several factors including precipitation, soil type, slope, vegetation cover and distance. Given the greater part of the topography where construction will occur and the fact that the vegetation surrounding the wind turbine pad locations will remain largely untouched, sedimentation is not anticipated in most areas to be an issue. This will be reinforced through the use of proven methods to control run-off, erosion, and dust including:

- defined procedures for the storage and handling of excavated materials;
- timely re-vegetation, if necessary, of disturbed areas after construction; and
- the installation of temporary erosion control measures, e.g., drainage barriers, sediment fences, plastic sheeting, straw or mulches, etc., as necessary; and
- watering of exposed areas to control dust as required.

As depicted on Figure 2.3 and discussed in Sections 2.3.1.1 and 4.3.4.2, there are two locations where the existing culverts will be extended over streams to enable the passage of the crane necessary for the construction of the WTGs. These extensions will be designed and implemented in a manner that all works will take place out side of the waters, and the necessary protective measures will be installed to ensure that there is no impact from the disturbance of sediments on those waters.

Figure 7.1 illustrates the construction sequence and mitigative measures that will be taken to protect the waters and habitat at Culverts A and B. More specifically the following mitigative are proposed for the construction, operation and decommissioning phases.

Site Preparation and Construction

- Installation of erosion and sedimentation control measures and surface water control features, e.g., silt fencing, where appropriate, before land clearing and earth handling;
- Excavation for turbine footings and the storage, handling and disposal of excess materials in an environmentally appropriate manner;
- No equipment to enter the streams;
- Installation of required culvert sections to specified grades and inspections to ensure tight joints;
- Placement of geotextile between existing slope and new culvert to prevent backfill material from falling into the stream bed;
- Placement of backfill at 300 to 450 mm layers and compacted to 95% standard proctor;
- Placement of road gravels;
- Covering exposed surfaces where applicable with straw mulch;
- Removal of all temporary culverts upon completion of site works;
- Pull back road bed;
- Re-establishment of take-off ditches; and
- Removal of sediment control fences.

Operation and Maintenance

During the operation and maintenance of the site, storm drainage structures will be monitored and maintained to the extent applicable to prevent sedimentation migrating into the streams and wetlands from any runoff from the turbine pads.

Reclamation and Decommissioning

The mitigative actions during reclamation and decommissioning will be comparable to those executed during the construction phase, including the installation of site specific erosion and sedimentation control measures and the management of storm drainage from disturbed areas. Work will involve:

- Removal of any temporary culverts upon completion of the site works, pulling back of the road bed and the re-establishment of the take-off ditches; and
- Removal of the sediment control structures.

Accidental releases of hazardous materials could occur during any phase of the Project and might include petroleum products and possibly solvents and paints. Accidental releases of other chemicals could occur from storage facilities or vehicles. The severity of an accidental event would depend on the chemical characteristics and volume of the release and its proximity to a watercourse. Relatively small amounts of fuel and hydraulic fluid spilled during the operation of construction equipment, or the servicing of the turbines, are the most likely types of accidental releases. Standard practices for the handling, storage and use of potentially hazardous materials will be enforced through all phases of the Project. The following mitigative measures will also be applied:

- all hazardous materials to be used at the site will be labeled according to WHMIS regulations;
- vehicle maintenance and refueling will be prohibited within 30 m of all water courses and wetlands;
- frequent inspection and maintenance of all equipment used on the site will be undertaken to identify and repair fuel leaks;
- used oil, filters and other products associated with equipment maintenance shall be collected and disposed of in accordance with regulatory requirements; and
- all spills shall be immediately reported to the Environmental Emergency # 1-800-565-5733.

Given the use of proven sedimentation control measures, including those advocated in the “Erosion and Sedimentation Control Handbook for Construction Sites”, the distances from the WTG sites to streams in the area and the further development of standard practices for the handling, storage and use of potentially hazardous materials as part of a comprehensive EMP program, it is highly unlikely that sedimentation will pose a hazard to ground and surface waters. In summary, through the use of standard and accepted industry procedures and mitigative measures, adherence to applicable regulations and guidelines, and waste management planning, the construction of the proposed Project will be undertaken in an environmentally responsible manner and is unlikely to result in a significant adverse effect on surface and ground water quality.

Project interactions with surface and ground water during Project operation are anticipated to be minimal. The most likely interface is an accidental release of a hazardous material during turbine maintenance or when machinery is necessary to facilitate repairs. In summary, by adhering to applicable regulations and guidelines, implementing mitigation measures and applying good management practices as referenced above, the operation of the proposed Project is unlikely to result in a significant adverse effect on surface and ground water quality.

The decommissioning of the Project would involve the dismantling and removal of the WTGs and the reasonable rehabilitation of the Project site. There would be no excavation of bedrock involved, and, as referenced in Section 2.3.3, the concrete pads at the site would remain in place. In summary, the reclamation and decommissioning of the site is unlikely to result in a significant adverse impact on surface and groundwater quality.

Beyond the accidental release of a hazardous material, malfunctions could perhaps involve a need to replace components of one or more WTGs, or other components of the wind farm. The measures adopted to minimize erosion or sedimentation during construction would be likewise adopted to address the consequences of any earth works required to resolve malfunctions in equipment.

7.2.1.4 Cumulative Effects

There are no known development activities that will take place in or in the vicinity of the site that might act cumulatively with the proposed Project to cause a significant adverse effect on the surface or ground water quality. It is likely, however, that the property owners will continue to harvest the forest cover and to do so will use heavy equipment. This ongoing activity together with the ATV and snowmobile traffic that accesses the mountain will continual to cause some level of ground disturbance and generation of silt to surface and ground water in the area.

7.2.1.5 Residual Effects

The Project is not anticipated to have a significant residual environmental effect on the surface and ground waters of the area, i.e., on either the wetlands or the headwater streams. The impact is predicted to be negligible.

7.2.2 Communication Links on Towers Near Site

As detailed in section 4.4.3 and illustrated in Appendix D, there are existing radio communications systems on lands adjacent the proposed Project. They have been identified as a physical VEC.

A significant environmental effect on microwave radio links would result if there was a substantive disruption to the operation of the microwave radio tower adjacent the wind farm.

7.2.2.1 Boundaries

The pertinent spatial boundaries are the areas served by the communication towers; these have been identified by Oldham Engineers Ltd. and are referenced in section 4.4.3. Assuming these towers and their function will be maintained, the temporal boundary is the duration of the wind farm's operation, i.e., perhaps 40 years or more.

7.2.2.2 Pathway Analysis

As indicated in section 3.2.2.8, Oldham Engineers Inc. obtained data on all licensed radio systems operating within 40 km of the proposed Project from the radio spectrum licensing authority, i.e., I.C.; this included available information on the radio towers on Nuttby Mountain. A site visit was conducted and a tabulated and a verified inventory compiled of systems that could be of concern.

Based on the data compiled (reported in section 4.4.3), Table 7.2 summarizes the findings of the analysis undertaken with respect to the radio communications towers adjacent to the Project site. As referenced in Section 4.4.3.2, there are other radar and related communications systems within 100 km of the Project site. No impact on these systems is anticipated.

Table 7-2: Evaluation of Microwave Radio Towers

Tower(s)	Results
#1 NSIMRS	The performance of the radio systems utilizing low frequency/non-parabolic antennas on this tower are not expected to be significantly impacted by the introduction of the proposed wind farm.
# 2, 3, 4, 5 and 6	The performance of the radio systems employing low frequency/non-parabolic antennas on these towers are not expected to be significantly impacted by the introduction of the proposed wind farm.
#7 Wireless INet	Due to the wide beam width of the antennas on this tower, the introduction of the proposed wind farm is not expected to significantly impact the performance of the system.
#8 & 9 Aliant Towers	The performance of the radio systems employing the antennas on these towers is not expected to be significantly impacted by the introduction of the proposed wind farm.
#10 Astral Media	The performance of the broadcast systems and the radio link to Truro on this tower are not expected to be significantly impacted by the introduction of the proposed wind farm.

7.2.2.3 Mitigative Measures

There are no specific mitigative measures required or proposed.

7.2.2.4 CUMULATIVE EFFECTS

There are no other known works proposed in the area of Nuttby Mountain that would act cumulatively with this Project to impact the functioning of the communication towers; no cumulative effects are anticipated.

7.2.2.5 RESIDUAL EFFECTS

Based on the work undertaken and the resultant analysis, the proposed Project is not expected to impact the performance of the communication towers; no impact is predicted.

7.2.3 Rural Ambience of the Area

The proposed site on Nuttby Mountain is rural and at some distance from the nearest communities, i.e., Nuttby and Earltown which are 2.5 and 6 km distant respectively. The rural ambience of the area has been identified as a physical VEC. The possible impact of lighting and noise need to be taken into account when considering this ambiance.

As indicated in section 2.2.5.2, the wind turbines do have to be marked in accordance with TC's Obstruction Marking and Lighting Standards (CAR 621.19). To meet these requirements and in recognition of CWS's preference to have a flash with a distinct off period, the proponent is considering the use of a LED based technology pointed within the TC acceptable range with all lighting synchronized. The purpose of the lighting is to provide an effective means of indicating the presence of objects that could present a hazard to aviation safety.

Noise produced by wind turbines is a recognized concern often identified by people when learning of the possible development of a wind farm in their community. It was a question raised at the public Open House. Noise from a WTG is caused in part from the conversion of wind energy into sound when interacting with the blades and in part from other mechanical sources. Sound is measured in decibels (dBs). The audible range is from 0dB, the threshold of hearing, to 140dB, the threshold of pain. Noise impacts on people falls into three general categories:

i) annoyance or nuisance – a subjective effect;
ii) interference with sleep, speech and learning; and
iii) physical effects such and hearing loss or anxiety.

The impact of noise depends on a range of factors that influence sound propagation including, but not limited to, the following:

- distance from the source, i.e., the bulldozer or WTG etc;
- height of the source;
- atmospheric conditions, including humidity;
- intervening topography or structures;
- vegetation; and
- background wind noise levels.

The proposed wind farm is located in a rural area. As detailed in Section 4.4.2, the nearest dwellings that are occupied year round are located over 1 km distant from the nearest turbine on the Old Nuttby

Mountain Road. The communities of Nuttby and Earltown are 2.5 and 6 km respectively from the wind farm. The sole sources of anthropogenic noise in the area are residential and commercial vehicles, and since traffic volumes are low, the background noise levels, i.e., wind, vegetation moved by wind, traffic and animal sounds, e.g., birds and frogs, are generally low.

A significant environmental effect on the rural ambience of the study area would result if a substantive increase in light and noise levels attributable to the Project was demonstrated to disrupt if the way of life of local residents.

7.2.3.4 Boundaries

The geographical area of interest with respect to both the lighting that will be installed on the turbines and the noise that they will generate is twofold:

i) the area within which wildlife, including birds, may be impacted; and
ii) the nearest communities, i.e., Nuttby and Earltown.

The temporal boundaries for both ambient light and noise is the anticipated life of the Project, i.e., perhaps 40 years or more.

7.2.3.5 Pathway Analysis

Lighting

The intent of the lighting that will be installed is to ensure aviation safety. As such, the flashing light will be angled in accordance with TC requirements. The lighting of necessity will be visible for some considerable distance including from the communities of Nuttby and Earltown. The lighting will be red, synchronized and intermittent. It should not pose discomfort to those living in proximity to it, nor to the residents of the communities of Nuttby and Earltown. The Proponent is also seeking the most effective means to meet both the requirements of TC and to minimize the impact of the required lighting on wildlife, including birds.

Noise

All phases of the proposed project will generate noise, i.e., construction, project operation and decommissioning. During the construction and decommissioning phases, the anticipated noise will be that generated by typical construction activity including the transportation of materials, site works including the building of access roads, turbine pads, etc. The noise will be caused by the operation of heavy equipment such as back hoes, bulldozers, flatbed trailers, cranes, dump trucks, ready mix trucks and smaller vehicles used to transport workers to and from the site.

Typical dBA levels in a rural environment are 38 – 46 dBA, in a suburban environment 48 – 52 dBA and in an urban residential area 58 – 62 dBA. The nearest occupied residence is approximately 600 m distant from a turbine site. Construction noise will be heard at this distance and may be heard at 1 km, but is unlikely at this distance to be an ongoing nuisance. Such noise may, however, temporarily disrupt the activities of fauna and birds at or in the vicinity of the construction activates on the Project site.

As indicated above, noise in a typical rural area can be expected to be in the vicinity of 38 – 46 dBA. It has been found to be easier in practise to calculate the potential sound emissions from wind farms than to measure them, because to attain an accurate measurement the sound level has to be some 10dBA above the background noise. With typical ambient background levels frequently greater than 30 dBA, this can be difficult. Reliance is therefore placed on calculation. Garrad Hassan Canada Inc. have predicted noise contour plots for the two turbine models being considered by the Proponent, i.e., the Vestas V90 and the Enercon E82 and three different turbine layouts for the site; these plots are presented in Appendix F. An examination of this data would suggest a worst case scenario of approximately 33 dBA at the nearest residence, i.e., likely lower than the ambient rural noise most of the time, and background noise from natural and anthropogenic sources would likely drown out the sounds associated with the WTGs. Indeed, it is anticipated that the maximum incremental sound levels at the nearest residence will be well below the NSDEL Noise Guidelines, i.e., 55 -65 dBA, most, if not all, of the time.

7.2.3.6 Mitigative Measures

The lighting of the wind farm is a legislative requirement. Beyond obtaining the best technology to address the requirements while simultaneously striving to minimize the impact to wildlife, there are no mitigative measures proposed.

To mitigate the impact of noise from construction activities, construction and decommissioning should be limited to daytime working hours whenever reasonably possible and all machinery should be fully serviced.

The wind farm has been located as some considerable distance from the nearest residences and this set back distance, i.e., over 1 km from the nearest year round occupied residence, will absorb the incremental noise to the level of the typical rural environment most of the time. In addition, the turbines will automatically switch off at high wind speeds, thus eliminating higher noise levels during the less frequent, but very high wind speeds.

7.2.3.7 Cumulative Effects

There are no known development activities that will take place in or in the vicinity of the Project site that might act cumulatively with the proposed Project to aggravate ambient lighting in the area or to increase noise levels thereby causing a significant adverse impact on the quiet enjoyment of the rural characteristics and ambience of the area; no cumulative effects are anticipated.

7.2.3.8 Residual Effects

The lighting required to ensure the safe operation of the Project and the noise that will be generated by the Project are not predicted to have a significant residual effect on the wildlife or the residents' ability to enjoy the rural characteristics and attributes of the area. The impact is predicted to be negligible.

7.3 Biophysical VECs

7.3.1 Wetlands

Wetlands provide distinctive habitat and serve as an important link between freshwater and terrestrial ecosystems. AWPC acknowledges the importance of the "Federal Program Wetland Conservation" and its objective to "promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future." As detailed in Sections 3.2.2.1 and 4.1.2 and depicted on Figure 4.1, there is a limited number of small wetlands scattered across the lands associated with the Project. As a result of the field truthing and associated investigations carried out as detailed in Section 3.2.2.1, the proponent has succeeded in siting both the WTGs and the access roads that service them to avoid direct impact on any wetland. The intent of the proposed layout is to ensure the retention of the existing wetlands and to ensure their protection.

A significant environmental effect on wetlands would result if there was a substantive change to the wetlands on Nuttby Mountain that could be attributed to the Project.

7.3.1.1 Boundaries

The spatial boundaries are limited to the physical extent of the wetlands themselves and the physical relationships between these areas and the WTGs and access roads. The temporal boundaries are primarily those associated with Project construction.

7.3.1.2 Pathway Analysis

The pathways that could have an adverse impact on the wetlands include the grubbing and clearing of land for the WTGs and the access roads, the construction process itself and the associated disturbance of sediments and dust that may be associated with such activities. Other pathways include the accidental spilling of fuels, lubricants, or hydraulic fluids and pedestrian and vehicular access into the wetlands.

Construction activity can affect a wetland in several ways. The movement of heavy machinery, for example, can result in the physical disturbance of plant communities and substrates. Other activities such as clearing and grubbing, trenching and backfilling, if inappropriately undertaken, could result in the sedimentation of inundated portions of a wetland. Trenching could alter the hydrologic regime by changing groundwater flows. In dry weather, excessive dust could be blown into wetland areas. In turn, this could result in increased or decreased water levels depending on whether groundwater is directed into the wetland or drained from it. Wetland flora and wildlife species could also be affected by accidental spills of fuels, lubricants or hydraulic fluids.

7.3.1.3 Mitigative Measures

As referenced above, effective planning for the proposed wind farm has enabled the siting of both the WTGs and the access roads to be undertaken to avoid direct impact on any wetland. Indirect impacts in the absence of effective mitigation could be associated with the consequences of construction on ground or surface waters. The latter are addressed in Section 7.2.1 above.

Since there will be no direct impact on any wetland from the construction of the WTGs or the access roads associated with the development of the proposed wind farm, it is not anticipated that the operation and maintenance of the proposed facilities will have any effect on the wetlands on Nuttby Mountain. The most likely pathway for impact is an accidental release of a hazardous material during turbine maintenance or when machinery is necessary on site to facilitate repairs. ATVs will likely continue to access the lands in this area and will continue to travel through and around the wetland areas. Through the application of good management practices, the operation of the proposed Project is unlikely to result in a significant adverse effect on the wetlands on Nuttby Mountain.

The decommissioning of the Project would involve the dismantling and removal of the WTGs and the reasonable rehabilitation of the Project site. There would be no excavation involved and, as referenced in Section 2.3.3, the foundations of the WTGs would be left in situ. In summary, the decommissioning of the site, though involving the transportation in heavy equipment of large structural components, would be less invasive than the construction program and would be conducted in accordance with all applicable regulatory requirements in an environmentally responsible manner.

Beyond the accidental release of a hazardous material, malfunctions could involve the need to replace components on one or more WTGs, or other components of the wind farm. The measures advocated to address spills and minimize sedimentation would be applied as appropriate.

Malfunctions and accidents are not predicted to have a significant adverse effect on the wetlands.

7.3.1.4 Cumulative Effects

There are no known works that are proposed in the vicinity of the proposed wind farm on Nuttby Mountain that would interact cumulatively with the construction and operation of the wind farm to have an adverse impact on the wetlands in the area. It is likely, however, that the ATV use in the area will continue and that there may continue to be some degradation to the site. The proposed Project will not act cumulatively with this ATV use to cause a significant adverse impact on the wetlands; no cumulative effects are anticipated.

7.3.1.5 Residual Effects

The Project is not anticipated to have a significant residual environmental effect on the wetland, i.e., the impact will be negligible.

7.3.2 Fish Habitat

As stated in Section 4.1.2, the headwaters of several streams are located on Nuttby Mountain. Of particular importance, as indicated in Section 4.3.4.2, are tributaries of Ferguson Brook and Vamey Brook flowing northwards and tributaries of the North River, flowing south through the site; these headwaters were identified as consistent habitat for fish, particularly brook trout *(Salvelinus fontinalis)* and Atlantic Salmon (Northumberland Strait populations). The streams provide the feed waters to a number of very important fish habitats. The protection of these waters is therefore important as adverse impacts to the waters on the mountain could adversely impact valued fish populations and habitat downstream. This habitat has therefore been identified as a VEC.

A significant environmental effect on fish habitat could result if a substantive change attributable to the Project was identified in the headwaters of the streams that drain from Nuttby Mountain.

7.3.2.1 Boundaries

The spatial boundaries are limited to the headwaters of those streams in proximity to the sites of the proposed WTGs and the associated access roads. The temporal boundaries are primarily those associated with Project construction.

7.3.2.2 Pathway Analysis

The pathways that could have an adverse impact on fish populations and fish habitat are those activities that could adversely impact water quality in the headwaters that originate on Nuttby Mountain, i.e., those discussed in Section 7.2.1 above. As detailed, the headwater streams on the Project site are small, and measures have been advocated, i.e., the extension of two culverts as depicted on Figure 7.1, to protect the waters and therefore the fish habitat of two specific streams that could be susceptible to impact during the construction and decommissioning phases of the Project.

7.3.2.3 Mitigative Measures

The mitigative measures identified in Section 7.2.1 to protect the water quality of the headwater streams on Nuttby Mountain will also serve to protect the fish habitat that exists both on site and downstream.

7.3.2.4 Cumulative Effects

As indicated in Section 7.2.1.4, there are no known development activities that will take place at or in the vicinity of the site that might act cumulatively with the proposed Project to cause a significant adverse effect on the water quality and therefore on the quality of the fish habitat. It is, however, pointed out that the property owners will continue to harvest the forest cover and to do so will use heavy equipment on the properties. This ongoing activity together with ATV and snowmobile traffic that accesses the mountain will continue to cause some level of ground disturbance and generation of silt to the surface waters in the area.

7.3.2.5 Residual Effects

If the mitigative measures identified above to protect the quality of the surface and ground waters on Nuttby Mountain are undertaken, the Project is not anticipated to have a significant residual effect on the fish or fish habitat, i.e., the impact will be negligible.

7.3.3 Forest Cover

As detailed in Section 4.2.1 and depicted on Figure 4.2, Nuttby Mountain site is an integral part of the Cobequid Plateau and as such the natural cover of the area is forest. Such forest cover provides valued habitat for a range of wildlife including birds and has therefore been recognized as a VEC. The forest cover on the Project site, however, is fragmented and much disturbed as a consequence of logging and reforestation programs; active logging and woodlot regeneration in the area is likely to continue. Field work undertaken in June 2007 identified the following habitats:

- tolerant hardwood forest;
- mixed forest;
- clear cut;
- coniferous plantation; and
- Old Nuttby Road.

A significant environmental effect on forest cover could result if a change attributable to the Project resulted in a substantive loss of this cover.

7.3.3.1 Boundaries

The areas of concern with respect to forest cover include:

- those areas that will have to be cleared to accommodate the WTGs that will not be located in areas of clear cut; and
- those areas that will have to be cleared to accommodate the new access roads.

These areas are all an integral part of the footprint of the Project. The temporal boundary is in the first instance the period associated with the construction of the Project when there will be clearing to enable the works to proceed. In the longer term the forest cover will regenerate and will continue to be modified through ongoing practices in the area.

Fire is the most likely accidental event to pose a threat to the forest cover.

7.3.3.2 Pathway Analysis

To enable the development of the Project will require that trees and associated vegetation be cleared. Although such clearing will occur in an area that is logged for commercial purposes, the clearing will further aggravate the fragmentation of the forest cover and degrade the habitat conditions for both mammals and birds.

The dominant cover type over most of the area, under an undisturbed scenario, would be of tolerant hardwood forest. Currently, this tolerant hardwood matrix is interspersed with both new clear cuts and planted stands of conifer trees in older clear cuts. The turbine sites and roads will be new areas of permanent non-forest and will contribute to the fragmentation of the forest cover. In addition to the activities associated with the development and operation of the Project, the area is a ‘working forest’ and will be subject to ongoing management during all phases of the Project.

Connectivity of forest cover at Nuttby Mountain is already considerably compromised. There is, for example, an extensive existing network of logging roads, which provide access to vehicular traffic. Additionally, there are a number of large recent clear cuts in the vicinity of the project area; this area totals approximately 80 hectares.

7.3.3.3 Mitigative Measures

During project construction, the fragmentation of the remaining forested areas will be mitigated by clearing only the minimum required area for the construction of the required roads, turbine pads and laydown areas.

Staff will be trained to respond appropriately to accidental events, including the occurrence of fire. The Contingency and Safety Plan will detail appropriate response measures (see section 7.7).

7.3.3.4 Cumulative Effects

As stated above, this site is actively logged. The clearing required to accommodate approximately 50% of the WTGs and 7 km of new access road will interact cumulatively to further fragment the forest cover on Nuttby Mountain. The nature of the remaining cover will continue to evolve as this Project and the forestry practices in the area interact.

7.3.3.5 Residual Effects

Overall, fragmentation will be offset over time by the eventual regeneration (whether natural or artificial) of the existing clear-cut areas, aside from those cleared for the construction of the Project. The forest productivity at Nuttby Mountain is relatively high, so the potential for regeneration of all areas through natural or artificial means is high. It is likely that the level of fragmentation resulting from the Project will be minimal in comparison to the past and ongoing fragmentation due to forestry.

7.3.4 Species at Risk

Under federal and provincial legislation, an environmental assessment must consider impacts of the proposed Project on listed flora and wildlife species, as well as their critical or core habitat, and residences of individuals of that species. A list of the potential species of concern that may reside on, or migrate through, the Nuttby Mountain site was compiled from the legislated designated lists, i.e., the Atlantic CDC and the NSDNR General Status Ranks. This list is presented and discussed in Section 4.4.6.

As protection of Species at Risk is ecologically and socially important, as well as being required by legislation, Species at Risk have been identified as a VEC.

A significant environmental effect on Species at Risk would result if an identified species or their habitat was irreversibly harmed by works attributable to the Project.

7.3.4.1 Boundaries

The spatial boundaries of this analysis include the lands necessary to the Project's development on Nuttby Mountain and adjacent lands that may provide habitat for Species at Risk. The temporal boundary is the duration of the wind farm's operation, i.e., perhaps 40 years or more.

7.3.4.2 Pathway Analysis

The possible pathways associated with the Project that my have adverse effects on listed species include the physical disturbance to the habitat necessary to their life cycle and those activities that may impact other VECs including water quality. The following sections identify potential interactions with listed species that have been identified in the study area.

Birds

Of the eight bird species that were identified as having some potential for residing in or passing through the Project area, only the Boreal Chickadee (*Parus hudsonicus*), listed as a yellow species by NSDNR, was found in the area. As detailed in Section 4.3.1.2 several individuals of this species were noted in a young softwood plantation in the vicinity of the locations of WTGs 1, 2, 5, 6, 10, 11 and 13. The ACCDC ranks this species as S3S4 in Colchester County; S3 denotes the species is "Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences)". S4 denotes "usually widespread, fairly common, and apparently secure with many occurrences, but of longer term concern, e.g., watch list, 100 plus occurrences.

The Boreal Chickadee is likely as common in suitable habitat in the vicinity of Nuttby Mountain as it is anywhere in mainland Nova Scotia. The researcher suggests that given the number of the species that it should be categorized as S4 in this area. This is likely due to its affinity for higher elevations coupled with the presence of contiguous tracts of young to medium age (20 to 50 years) predominantly coniferous forests.

Plants

As indicated in Section 4.3.2, none of the 10 species of plants, based on the ACCDC screening, were encountered during the botanical field program.

Only two species considered rare by the ACCDC were found within the study area. Dwarf Ginseng (*Panax trifolius*, ranked S3), was present in large numbers in many locations, primarily in the more mature deciduous forests, but also in conifer plantations that were formerly deciduous forests and in recently cut deciduous forests. This species is ranked secure in Nova Scotia under the National General Status Wildlife process[4]. Occurrences of Dwarf Ginseng are shown on Figure 4.3, but these undoubtedly under-represent the total distribution of the species in the area. The species appears to be present in almost all deciduous forest on site.

The second rare plant species encountered was Braun's Holly Fern (*Polystichum braunii*, ranked S3S4 and secure). This species is only marginally rare in Nova Scotia, being locally common in Cape Breton and in the Blomidon area, and being widespread throughout the northern mainland of Nova Scotia. About 25 plants were found on the especially rich deciduous slope forest to the north of the WTG sites 4 and 5 (see Figure 4.3). Because construction activities are expected to be restricted to the flatter ground at the top of the slope within the clear cut, impacts on Braun's Holly Fern should be limited or non-existent.

Bats

The Eastern Pipistrelle, categorized as yellow by NSDNR, was identified as having some potential for residing or passing through the Project area. No call sequences of this species were recorded during the field program. The Project's impact on other bat species is discussed in Section 7.3.6 below.

Moose

The mainland moose is a "Red" listed species under the NSDNR General Status List and is legislated as endangered under the *Nova Scotia Endangered Species Act*. The study area has in the past supported a moose population, but a 6 hectare search of the forest floor found no evidence of their presence (see Section 4.3.3.2).

Fish

Of the five fish species at risk that might inhabit the water that originate on Nuttby Mountain, only the brook trout is likely to reside in the higher elevation headwater streams that flow from the site. The Project's possible impacts on fish habitat are discussed more fully in Section 7.3.2 above.

[4] 2007 fieldwork by Sean Blaney and ACCDC in Cobequid Mountain sites between Portapique and Marshy hope found this species to be widespread and locally abundant in deciduous forests. If this level of abundance, which is not known in any other region of the Maritimes, is general across the eastern part of the Cobequid Mountains, this species S-rank should be revised to S4.

7.3.4.3 MITIGATIVE MEASURES

The minimization of the Project footprint, including the minimization of further clear cutting and the avoidance of both wetlands and streams together with the commitment to a rigorous EMP will serve to protect the diverse habitat in the area and the species that depend upon it.

7.3.4.4 CUMULATIVE EFFECTS

There are no known development activities that will take place in or in the vicinity of the study area that might act cumulatively with the proposed project to cause a significant adverse effect on Species at Risk. As indicated in Section 7.2.1.4, it is likely that property owners will continue to harvest the forest cover and therefore to impact habitat and the species that rely upon it.

7.3.4.5 RESIDUAL EFFECTS

The Project is not anticipated to have a significant residual environmental effect on Species at Risk. The impact is predicted to be negligible.

7.3.5 Migratory and Breeding Birds

As indicted in section 4.3.1, many birds breed, visit and fly over Nuttby Mountain; migratory and breeding birds have therefore been identified as a VEC. As detailed in Section 4.3.1.2, work undertaken in the field included bird breeding counts, a standardized area search, morning fall stopover counts and a fall raptor watch. This resulted in the identification of 49 species of breeding birds during the point counts and area searches (see Table 4.6), 50 species during the morning fall stop over counts (see Table 4.7), but only 12 raptors in 72+ hours of observation (see Table 4.8) during what should have been the prime time for fall raptor migration.

A significant environmental effect on migratory and breeding birds would result if a substantive change in their numbers and habits could be attributed to the Project.

The vast majority of North American land birds migrate at night. This may be to take advantage of more stable atmospheric conditions for flapping flight (Kerlinger, 1995), or night migration may provide a more efficient medium to regulate body temperature during active, flapping flight and could reduce the potential for predation while in flight (Alerstam 1990, Kerlinger 1995). Conversely, species using soaring flight, such as raptors, migrate during the day to take advantage of warm air rising in thermals and laminar flow of air over the landscape, which can create updrafts along hillsides and ridge tops.

Collision with unseen obstacles is a potential hazard to night-migrating birds, and some lighted structures may actually attract birds to them under certain weather conditions; this can be associated with collision or exhaustion of birds, both of which often result in mortality (Ogden 1996). Birds have, for example, been documented colliding with tall lighted structures, such as buildings and communication towers, particularly when weather conditions reduce visibility (Crawford 1981; Avery *et al.* 1976, 1977). Wind turbines can therefore pose a potential threat to migrating birds as they are relatively tall structures, have moving parts and may be lit. Factors that could affect potential collision risk of nocturnally migrating birds by wind turbines include weather, magnitude of migration, height of flight, and movement patterns in the vicinity of a wind project, along with the height of turbines and other site-specific characteristics associated with a wind farm.

The altitude at which nocturnal migrants fly has been one of the least understood aspects of bird migration. In 1971, Belrose flew a small plane at night along altitudinal transects to visually document the occurrence and altitude of migrating songbirds. He found the majority of birds were observed between 150 m and 450 m above ground level, but on some nights the majority of birds were from 450 m to 762 m above the ground. Radar studies have largely confirmed these visual observations, with the majority of nocturnal bird migration appearing to occur less than 500 m to 700 m above the ground (Able, 1970, Alerstam 1990, Gauthreaux 1991, Cooper and Ritchie 1995).

Recent studies at proposed wind facilities in the Northeastern U.S. and Mid-Atlantic states are also consistent with this finding. Mabee *et al.* (2005) documented a mean nighttime flight height of 356 m in west-central New York, with an average of nine percent of targets flying less than 125 m above the ground. In far western New York, Cooper *et al.* (2004a) documented a mean flight altitude of 532 m, with a small percentage (4%) of targets flying less than 125 m above the ground. Cooper *et al.* (2004b) documented mean nightly flight altitudes at Mount Storm, West Virginia, between 214 m and 769 m, with a seasonal mean of 410 m, and an average of 16 percent flying below 125 m.

Results from radar studies at Mars Hill, Maine (Woodlot Alternatives, March 2006) in the fall of 2005 are similar to other surveys, with a mean nightly flight altitude of 424 m, and there is no reason to believe that the mean flight altitude of nocturnal migrants at Nuttby Mountain (only 400 km southeast of Mars Hill) varies significantly. The percentage of targets flying less than 120 m above the ground was low (8%), similar to that found by Cooper *et al.* (2004a).

The high mean flight altitude of targets documented at Mars Hill in 2005 further supports the presumption that topographic features do not affect migration patterns, particularly flight direction. The mean flight altitude being so high above the radar indicates that most birds are flying high enough that their flight is unimpeded by topographic features, such as Mars Hill (and by extension, the rolling hills of the Cobequid Mountains of Nova Scotia).

The risk to night-migrating birds, however, does exist, as mortality from collisions with turbines has been documented at operating facilities including the Pubnico Point Wind Farm. The risk of collision may be greater during periods of inclement weather that can force birds to fly at lower heights and decrease night-time visibility. Lower flight altitudes were observed during cloudy, foggy, and rainy night in the Mars Hill project area. Those nights, however, were typically associated with low to very low nightly passage rates. Despite this fact, while increased risk potential could develop due to inclement weather at Nuttby Mountain, the predictions of those events cannot be reliably made because night-to-night variation in flight characteristics occur, even on nights with similarly unsuitable migration weather.

Considering the amount of time invested in the fall stopover surveys, and the length of route covered (3.8 km), it is surprising that so few migrants were detected (an average of only ~ 45 per survey). It would appear that despite its comparatively high elevation, nocturnal migrants are not impeded by Nuttby Mountain as they make their way south during the fall migration. Only one minor fall out on September 8th, but nonetheless significant, was detected, and quite a few (~ 50%) of the birds in that flock could conceivably have bred in the immediate vicinity. It is therefore the opinion of the Project ornithologist that the Project as sited should not negatively impact nocturnal passerine migrants as Nuttby Mountain does not appear to be a significant fallout destination for migrants in the event of weather inducted groundings.

Further it is unlikely that migrating, or resident, raptors will be adversely affected by the proposed Project. The few migrating raptors seen appeared to be trending in a north-south direction, rather than east west. In summary, large hawks and eagles were recorded well above the communications towers (100+ m), while Broad-winged Hawk, American Kestral and Sharp-shinned Hawk generally crossed the summit at tree-top level.

7.3.5.1 Boundaries

The boundaries associated with the determination of breeding and migrating birds encompassed the entirety of the Project site on Nuttby Mountain and the immediately adjacent lands. Details of the field programs undertaken are provided in Section 3.2.2.2. The pertinent temporal boundary for the assessment of Project impacts on avian species is the duration of the Project, i.e., perhaps 40 years or more.

7.3.5.2 Pathway Analysis

The two primary pathways that may cause detrimental impacts to birds are:

- the destruction of valued habitat during Project construction; and
- the operation of the WTGs throughout the operating life of the Project.

Clearly there will be a footprint where the WTGs are located and access roads are constructed. This will result in some minimum habitat loss to locally breeding species. As referenced above 49 species of breeding birds were identified at the Project site. As indicated in Section 4.3.1.2, only one species of special concern, as listed by the ACCDC and the NSDNR was detected in the immediate Project area, i.e., the Boreal Chickadee *(Paus hudsonicus).* This species has been discussed above in Section 7.3.4. Construction activity will disturb lands on the mountain for a limited period of time, i.e., weeks during the winter and early spring of 2008 to 2009 and through one breeding season. Beyond the access roads, the sites of the WTGs and the laydown areas, the balance of the area, i.e., the greater portion of the area will not be disturbed. In the circumstances, Project construction is unlikely to severely impact the numbers or the diversity of bird species breeding in the Project area.

In addition to the small portion of habitat lost to the WTGs and access roads, the effects of the rotating turbine blades and the question regarding whether or not birds are attracted to WTG marking lights should be considered. As indicated above, the Project site appears to be located such that it should not have a significant impact on migrant and resident bird populations. With respect to lighting, as indicated in Section 7.2.3, the proponent is seeking to strike a balance between the demands of aviation safety and the CWS preference for intermittent lighting with a distinct off period. Finally it is widely thought that birds that are resident in the vicinity of wind farms quickly become acclimated to them (Kingsley and Whittam, 2001).

7.3.5.3 Mitigative Measures

Initial siting and WTG choice could be viewed as the primary mitigative measures. The Nuttby Mountain Wind Farm has been responsibly sited to avoid known locations of valued bird habitat, a fact that has been confirmed through field investigations. The WTGs are in the range of 120 to 125 m to tip of extended blade, and are therefore of a height less likely to interfere with bird passage. Finally the towers which are to support the turbines are not of a latticework design; birds will not be attracted to them for perching.

Although it is known that wind turbines will from time to time kill birds, it is also important to put such kills into perspective. The following paragraph may help to address this issue:

> "One American study estimated that an average of 2.19 birds are killed annually at each wind turbine in the United States. Outside of California, the estimated fatality rate drops to 1.83 (there is no published study of the impacts of wind turbines on birds in Canada). Therefore, based on 15,000 American wind turbines in operation, approximately 33,0000 birds are killed each year by wind turbines in the US. 26,600 in California alone. Although 33,000 is a lot of dead birds, the overall impact is small when compared with the millions of birds that travel over wind farms each year; not to mention the millions to hundreds of millions of birds that die due to collision with transmission lines, vehicles, buildings, and communications towers each year. Even if there were a million turbines in North America, they would likely not contribute to more than a few per cent of all bird collision deaths attributed to human structures" (Whittam and Hingsley, 2003).

7.3.5.4 Cumulative Effects

There are no known development activities that will take place in or in the vicinity of the site that may act cumulatively with the proposed Project to cause a significant adverse effect on migrating and breeding birds.

7.3.5.5 Residual Effects

In summary, although there will likely be some minimum impact on birds, the construction, operation and decommissioning of the wind farm is unlikely to result in a significant adverse impact on this VEC. The impact will be negligible.

7.3.6 Bats

To date very little is known about the real implications of wind developments on populations of small, non-migratory bat species and there were no echolocation call sequences recorded for any of the three migratory species or the big brown bat. Location records for these species in Nova Scotia are patchy with offshore accounts for migratory species suggesting only occasional migratory movements through the province (Broders et al. 2003b; van Zyll de Jong. 1985). Although bat levels at the site appeared to be relatively low, bats have been identified as a VEC.

It is likely that many design and site level differences determine bat fatality events as well as various aspects of bat behaviour and movements during the fall swarming and migration period although information on these phenomena are poorly understood (Holland 2007). For example, it is not known if bats actively echolocate when migrating (either locally or long distance) and the role of landmarks (natural or artificial) as visual cues for swarming and/or migration are also not understood (Cryan & Brown.2007). It is also not known if certain bat species routinely and predictably migrate at certain heights and routes (specific to a region or site), nor is it known if there is a large variation in the number of migrants passing through an area from year to year (stemming from yearly differences in local bat populations – Barclay et al. 2007; Johnson et al. 2003a). Stochastic weather factors that vary spatially (regionally from topography) and temporally (in frequency) may also contribute to bat fatality events in an unpredictable manner. In particular, low barometric pressure, low relative humidity and low wind velocities (conditions associated with the passing of storm fronts in an area) have been shown to be associated with high bat mortality events (Erickson et al. 2003; Kerns et al. 2005). Preconstruction surveys, therefore, may be limited in their ability to detect and predict migrating bats moving through an area and thus unexpected mortalities may be found once turbines have been installed and are on line.

A significant effect on bats, specifically those species identified at the site, could result if a substantive change in their numbers or habits could be attributed to the operation of the Project.

7.3.6.1 Boundaries

The pertinent spatial boundary is that of the WTGs; the pertinent temporal boundary is the duration of the wind farm's operation, i.e., perhaps 40 years or more.

7.3.6.2 Pathway Analysis

Bats can be impacted by the proposed works through the disturbance of habitat and through the motion of the turbine blades, i.e., as the result of collision.

Migratory species of bats have received the greatest attention because they make up the large majority of fatalities at existing wind turbine developments. Past evidence (Broders et al. 2003b), as well as the field work undertaken at Nutty Mountain in 2007, suggest that there is likely no significant movements of migratory bat species (hoary, red, silver-haired or big brown bats) through the region. As a result, the proposed WTGs likely will not have a major impact on migratory species populations in the region, given their sporadic and patchy distribution.

Bat activity recorded at the proposed site was dominated by Myotis species (little brown bat and northern long eared), which typically forage at heights below the level of the turbine blades. Because the proposed wind farm at Nuttby Mountain is located in a forested area and bat mortalities have recently been noted at other forested wind developments in eastern North America, there may be a risk of the mortality of Myotis bats at this site. Nevertheless, there was no evidence to suggest that significant numbers of bats were moving through the study area during the migratory period, i.e., no evidence that Nuttby Mountain was an integral part of a migratory corridor; in fact, bat activity levels were low.

7.3.6.3 Mitigative Measures

No specific mitigation measures are recommended.

7.3.6.4 Cumulative Effects

There are no known development activities that will take place in or in the vicinity of the Project site that may act cumulatively with the proposed Project to cause a significant adverse effect on bats.

7.3.6.5 Residual Effects

Although there are many unknowns associated with the movements of bats, based on the field work done and the research undertaken, the construction, operation and decommissioning of the wind farm will not result in a significant adverse impact on this VEC. The impact, if any, is anticipated to be negligible.

7.4 Social Economic Issues

7.4.1 Land Use

Land use in the immediate vicinity of the turbines is restricted to logging, forestry management, the harvesting of small areas of blueberries and some hunting. Since the Project will introduce a new use into the mix of uses on Nuttby Mountain, land use has been identified as a socio-economic issue to be evaluated.

A significant effect on land use would result if current land uses in the area were irreversibly changed as a consequence of the development, operation and decommissioning of the Project.

7.4.1.1 Boundaries

The spatial area of greatest relevance includes those lands within 500 m of the WTGs; the temporal boundary would extent over the life of the Project, i.e., perhaps 40 years ore more.

7.4.1.2 Pathway Analysis

As has been stated the primary land use activity in the immediate vicinity of the proposed wind farm is logging and the associated commercial management of private woodlots. This activity will continue as will the harvesting of areas of blueberries to the extent that such occurs in the vicinity of the proposed WTGs. Other activates that use the lands in the vicinity of the turbines include hunting and the use of various trails for snowmobiling and ATV use. Apart from working with the landowners to ensure both the safety of all who use the lands in the area including those who access and service the turbines, and also the integrity of the WTGs, permission to access the lands for hunting and other purposes resides with the land owners.

7.4.1.3 Mitigative Measures

Apart from minimizing the footprint of the proposed works, no specific mitigative measures are proposed to protect existing land use in the area.

7.4.1.4 Cumulative Effects

There are no other known works that would act cumulatively with the proposed Project to impact land use in the area; no cumulative impacts are anticipated.

7.4.1.5 Residual Effects

Based on the above analysis, the Project is not anticipated to have a significant residual effect on land use on Nuttby Mountain; the impact is predicted to be negligible.

7.4.2 Employment and the Economy

The Project area is remote and unless they travel into Truro, most in the area find employment in farming and/or forestry. There are few other sources of local work. The creation of jobs and the opportunity to find work, be it of a short term nature or longer, in the local area may be of interest. Employment and the economy has therefore been identified as a socio-economic factor to be evaluated.

A significant effect on employment and the economy would result if a substantive change in either employment or the economy could be attributed to the Project.

7.4.2.1 Boundaries

The spatial area of interest is the acceptable commuting distance to the Project site and the municipality to which taxes will be paid, i.e., Colchester County. The temporal boundary is the life of the Project, i.e., perhaps 40 years or more.

7.4.2.2 Pathway Analysis

The development of the proposed Project will generate employment. Labour will be required both to clear the required new access roads, the WTG sites and laydown areas and also to build the wind farm. Although contractors have not yet been selected for this work, based on experience of comparable sites, including the Pubnico Point Wind Farm, it is estimated that up to 100 people could be employed during the peak times of the construction phase. Some of this labour will be drawn from the regional area.

After the WTGs are up and operational, there will be a need for two to three skilled persons with applicable training to maintain the WTGs and to assist with the management of the site.

Throughout construction, those working on the Project will seek services and supplies from gas, accommodations and sandwiches to more sophisticated equipment and services both in the immediate and regional areas. These expenditures, large and small, will bring benefit to a wide range of suppliers.

Another important benefit is the tax benefit that will accrue to the Municipality of the County of Colchester. Legislation has been enacted as to how this amount is determined. As a result over the life of the Project, the Municipality will be a substantial beneficiary of the Project.

7.4.2.3 Mitigative Measures

No mitigative measures are required.

7.4.2.4 Cumulative Effects

There are no known works in the vicinity of Nuttby Mountain and surrounding communities that would act cumulatively with the Project to impact employment and the economy.

7.4.2.5 Residual Effects

Based on the evaluation undertaken the execution of the Project as detailed will create possible employment opportunities in the short term and will create an enduring tax base for the Municipality. The impact will be beneficial.

7.4.3 Property Values

Whenever a new use, particularly an industrial or commercial use, is introduced into an area, there is sometimes concern that such a use will cause a decrease in property values. It is a difficult subject, because there are many variables that affect property value. Thus empirically isolating the impacts of one variable, in this instance a wind farm, is difficult if not impossible. It is possible to theorize about variables such as landscape aesthetics in a scenic area, and whether or not a change in such a landscape would lower property value, but it would remain only one of the variables involved. Property values have been identified as a socio-economic issue to be considered in the evaluation.

The proposed wind farm is located in a remote, largely forested rural setting. As detailed in Section 4.4.2, the nearest dwelling to a proposed turbine is a hunting cabin that is located some 150 m distant from WTG 17; it is situated on one of the properties leased by the proponent and is not occupied year round. The North Shore Snowmobile Club has a building that is located some 330 m distant from a turbine. Apart from these properties, the nearest dwellings are located on Old Nuttby Mountain Road approximately 600 m away and just off the Old Nuttby Mountain Road some 900 m distant. The community of Earltown is approximately 6 km from the site of the wind farm.

Property values fluctuate for a variety of reasons including, but not limited to the demand for property in an area, and the nature and age of the property involved. Values can both increase and decrease over time. Whether or not the development and operation of a wind farm might influence such trends is difficult to determine and there are only a few studies that explore this issue. The findings of a study undertaken by Sterzinger et al in 2003 in the US suggested that the development of a windfarm had no adverse impacts on property values within a radius of 5 km of such a development. For their study, Steringer et al compiled data on US wind farms commissioned between 1998 and 2001 that had a capacity of 10 MW or greater. Property sales records for an area within 8 km of the wind farm site were compiled for three years prior to commissioning and for three years subsequent to commissioning to determine change. For comparison, sales records were also compiled for the same period from communities comparable to that for each wind farm. A total of 10 wind farms were examined. Overall, property values increased at the same rate in the wind farm communities as they did in those communities without wind farms. Nine of the ten projects showed a greater increase in property values after commissioning compared to the period prior to commissioning. Indeed, communities near a wind farm actually experienced greater increases to property values than those without a nearby wind farm. These findings suggest that there is no support for the notion that the development of wind farms decreases property values.

The British Wind Energy Association posted a news article in March 2007 that concluded that the effect of wind farms on property values is neutral or positive. This conclusion was based on an independent study conducted by the Royal Institute of Chartered Surveyors and Oxford Brookes University which found that there was no clear relationship between the location of a wind farm and property values in the surrounding area.

A significant impact on property values would result if a substantive decline in property values, greater than any comparable shift in property value in the area, could be attributed to the development and operation of the proposed wind farm.

7.4.2.1 Boundaries

The spatial boundaries are difficult to define, but may be assumed to include properties within the view shed of the wind farm. Property value beyond that boundary would be unlikely to be affected by the presence of the Project. Sterzinger et al, for example, adopted the premise that wind developments could have a visual impact within 8 km of the turbines; they suggested that although WTGs may be visible beyond that distance, they do not tend to be highly noticeable, and at that distance they have relatively little influence on the landscape’s overall character and quality.

7.4.2.2 Pathway Analysis
Most people in the local area are some 2 to 6 km distant from the proposed Project. Although there may be some disturbance or nuisance caused to such properties through the period of construction, it is the longer timeframe associated with the operation of the wind farm that would have an effect, if any, on property value. As stated above, it is difficult to determine whether the development and operation of a wind farm within a certain distance of a property would be the key variable influencing a change in the value of a specific property. If, as is the case with the proposed wind farm on Nuttby Mountain, the WTGs are at a substantive distance from residential properties, it would appear unlikely that the development would have a detrimental impact on property value.

7.4.2.3 Mitigative Measures
There are no specific mitigative measures through site preparation and construction that would influence whether or not there would be a detrimental impact on property values. The period of construction is time limited and the impact, if any, would be negligible.

As stated above, the nearest year round occupied dwellings to a WTG at the proposed site on Nuttby Mountain are over 1 km distant. The village of Earltown is 6 km distant. No measures are proposed or are conceivable that would influence property values.

The decommissioning and transportation of equipment may cause some temporary nuisance effects for properties adjacent the works and access roads, but no specific mitigative measures are warranted or possible that would influence property values.

7.4.2.4 Cumulative Effects
There are no other known works proposed in the area of Nuttby Mountain that would act cumulatively with this Project to impact property values; no cumulative effects are anticipated.

7.4.2.5 Residual Effects
Based on the above analysis and the negligible residual effects predicted for either the biophysical VECs or other social and economic issues, the Project is not anticipated to have an effect on property values; no impact is predicted.

7.4.3 Aboriginal Use of Land
In the execution of the MEK study, consideration of the availability and importance of the key resources of value to First Nations were taken into account. More specifically the following definitions were applied:
- rare- may only be found in a minimum of areas and may be a species at risk or endangered;
- common – known to be available in a number of areas; and
- abundant – easily found throughout the study area or in other areas in the vicinity.

The MEK study identified numerous species both within and adjacent the study area, including the 10 km buffer zone, that are used by the Mi’kmaq people. As a result, the aboriginal use of land was identified as a socio-economic issue to be evaluated. Table 7.3 summarizes the number of sites identified by the Mi’kmaq as having value.

Table 7-3: Number of Sites of Value Identified by the MEK Study

Type of Use	*Number of Areas/Sites*	*Number of Species*
Food/Sustenance	251	30
Medicinal/Ceremonial	25	8
Tools/Art	33	13

The majority of the plant species documented as a result of the work undertaken for the MEK study can be classified as common. The species are commonly found throughout Nova Scotia, and the harvesting of these resources by the Mi'kmaq in the study area is undertaken to a lesser degree than elsewhere. None of the species identified in the MEK study are legislated species at risk.

With respect to species fished or hunted for food, the principle species were trout, smelt, deer, rabbit and partridge. Salmon is no longer fished and the moose is no longer hunted in this area.

A significant effect on the aboriginal use of land would result if their access to land or resources was substantially inhibited or the resources themselves adversely impacted.

7.4.3.1 Boundaries

The boundaries of Project impacts on aboriginal use of land and resources reflect the area considered in the MEK Study together with those areas considered with respect to the evaluation of habitats and ecological features. The Mi'kmaq have indicated that they do fish and collect plants on and in the vicinity of Nuttby Mountain. The temporal boundary is the life of the Project, i.e., perhaps 40 years or more.

7.4.3.2 Pathway Analysis

The potential pathways to link the Project to the aboriginal use of land and resources parallel those identified for the evaluation of habitats and ecological features.

7.4.3.3 Mitigative Measures

The mitigative measures proposed for the different phases of the Project including the preparation of a comprehensive EMP and those identified to protect specific VECs will serve to protect the resources of value to First Nations peoples. The plants, for example, that are identified as important resources in the context of traditional Mi'kmaq use are widely available throughout the Province. Fish populations will be protected by the proposed mitigative measures that will be undertaken to ensure the maintenance of water quality.

7.4.3.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with the Project to impact the aboriginal use of land and resources; no cumulative effects are anticipated.

7.4.3.5 Residual Effects

Based on the implementation of the recommended mitigative measures, the negligible residual effects on physical and biophysical VECs, the proposed Project is anticipated to have a negligible residual effect on the aboriginal use of land and resources.

7.4.4 Archaeological Resources

Archaeological resources are protected by legislation and have therefore been identified as a socio-economic factor to be evaluated. As detailed in Section 4.4.5, one archaeological site was discovered as a result of the field work undertaken. This find comprises three structural features, namely a house and two likely barns; there were also several piles of filed clearance. The site, as located on Figure 4.5, is located roughly 100 m to the west of the intersection of the Old Nuttby Mountain Road and Nuttby Tower Lane. It will not be impacted by the works associated by the proposed Project.

A significant effect on archaeological resources is defined as a loss or the destruction of a cultural resource either of European or pre-contact association.

7.4.4.1 Boundaries

The spatial boundaries of the analysis on archaeological resources relate to the lands that will be directly impacted by the proposed works. The temporal boundaries relate to the anticipated life of the Projects, i.e., perhaps 40 years or more.

7.4.4.2 Pathway Analysis

The possible pathways associated with the Project that may cause adverse effects on archaeological resources include disturbance of the one resource found and identified on Figure 4.5. As indicated above, this resource is located to the west of the intersection between the Old Nuttby Mountain Road and Nuttby Tower Lane. It will not be impacted by the works associated with the development or operation of the proposed Project.

7.4.4.3 Mitigative Measures

The mitigative measures relate solely to site preparation and construction activities and include the avoidance of the one site that has been identified through field work.

7.4.4.4 Cumulative Effects

There are no other known works proposed to be undertaken within the boundary of the proposed assessment that would act cumulatively with the Project to impact archaeological resources; no cumulative effects are anticipated.

7.4.4.5 Residual Effects

Based on the avoidance of the one site of archaeological relevance, the proposed Project would have no residual effect on archaeological resources in the area; no impact is predicted.

7.4.5 Visual Impact

Wind turbines are highly visible in most landscapes due to their size, and they can, therefore, be intrusive. As such, visual impact has been identified as a socio-economic factor to be evaluated. Adverse visual impacts can be defined as “unwelcome visual intrusion, or the creation of visual contrasts, that affect the quality of the landscape’ (BLM, 2004). There are views in Nova Scotia and elsewhere that are highly valued as reflective of the locality and that attract visitors to an area, i.e., views can have an intrinsic economic value. In such circumstances, steps can be taken through bylaws to protect such scenic resources from unnecessary adverse effects. There are no such views in the vicinity of the proposed Project.

A significant visual impact would involve substantive intrusion into a view of provincial or national significance and having a recognized economic value in the local economy.

7.4.5.1 Boundaries

The visual impact of the proposed Project extends some distance from the site itself. Two factors come into play: distance itself and topography, vegetation and man made structures that may block the line of sight to one or more of the turbines. Figure 3.5 presents the viewshed analysis for an area of several kilometres around the proposed wind farm. The further away from the proposed turbines, the smaller they will appear and the less intrusive they will be on the line of sight, i.e., spatial boundaries encompass the area from which the turbines are visible. The temporal boundaries relate to the time period the turbines are in place, i.e., the operating life of the proposed Project.

7.4.5.2 Pathway Analysis

As the two nearest communities to the proposed wind farm are Nuttby and Earltown, viewpoints as depicted on Figure 3.5 were selected for detailed analysis.

View from Nuttby

Nuttby, the nearest community to the wind farm, is small and is situated on Route 311 directly to the south of the proposed Project. For travellers heading north on Route 311, views of the proposed wind farm begin after the road ascends from the North River Valley and turns sharply to the east. From this point, panoramic views of Nuttby Mountain and portions of the wind farm will be visible for the next 2 km along Route 311. The view point for the image simulation of the proposed wind farm (depicted on Figure 7.2) is located 2.7 km from the closest wind turbine. The view focuses on a sequence of treed mountains in the background. The middle ground is dominated by undulating fields. In the foreground a barn, a residence and a utility pole slightly interfere with the view of the proposed farm. A total of 11 wind turbines would be visible: five on the ridge would be totally visible and six would be partly visible due to their location behind the ridge. The wind farm from this viewpoint would populate about 50% of the view.

View from Earltown

Earltown is a small community nestled along a west-sloping hill at the junction of Route 311 and 326. For travellers heading north on Route 311 and travellers coming south on Route 326, broad views of Nuttby Mountain and the surrounding peaks open up. A comparable panoramic view can be experienced from most points along the 5 km of road along Route 311 between Earltown and West Earltown. The view point for the image simulation of the proposed wind farm (depicted on Figure 7.3) is located 5.3 km from the closest wind turbine. The background of the panoramic view is dominated by the two 300 m peaks which are at the centre of the view. The middle ground features vast lands of mixed forest. The foreground is characterized by a meadow and immature spruce tree growth. It can be assumed that the further maturing of the trees in the foreground will partially obscure the view of the proposed wind farm. A total of 14 wind turbines would be visible from this position: four on the ridge would be totally visible and 10 would be partly visible due to their location behind the ridge. The wind farm from this perspective would populate about 20% of the view.

7.4.5.3 Mitigative Measures

The visual impact of the Project cannot be totally avoided. A number of mitigative measures, however, have been considered by the turbine manufacturers in the design of their product and by the proponent in the consideration of the layout of the wind farm. These include:

- tubular towers presenting an aesthetic design balance;
- off-white, or essentially very light grey colour, non reflective, i.e. not shiny;
- all WTGs are anticipated to be the same model;
- minimizing the lighting on the turbines to what is required for air safety;
- minimizing the project footprint and implementing erosion control measures;
- maintaining the turbines on a regular basis; and
- removing all construction debris and associated litter thereby maintaining a tidy and clean site.

7.4.5.4 Cumulative Effects

The presence of the radio towers on the adjacent site to the proposed wind farm will interact cumulatively on the visual frame with the wind farm. No further cumulative effects are anticipated.

7.4.5.5 Residual Effects

Based on the above analysis, the implementation of the recommended mitigative measures including the maintenance of a tidy and clean site, the proposed Project is anticipated to have a negligible visible impact. Indeed, given the subjective nature of the topic, there may be many in the community that perceive the sight of the proposed turbines in the distance as attractive and as contributing positively to the environment and to the local and provincial economies.

7.4.6 Traffic

As indicated in Section 4.4.4, access to the Project site will be via Route 311 and the Old Nuttby Mountain Road. Although surfaced these roads will have to be carefully evaluated as to their capacity, and some select upgrading may be necessary to facilitate the movement of the construction vehicles and those vehicles transporting the component parts of the WTGs. Traffic was identified at the public Open House as an issue of local concern and has therefore been recognized as a socio-economic factor to be evaluated.

7.4.6.1 Boundaries

The spatial boundaries are those public and logging roads that will be used through the construction and decommissioning phases of the Project. The temporal boundaries are primarily those associated with Project construction.

7.4.6.2 Pathway Analysis

During both construction and decommissioning Route 311 and the Old Nuttby Mountain Road will be accommodating both increased volumes of traffic on a daily basis and heavier loads. The transportation of the major WTG components will involve the use of numbers of very large flatbed trucks. Their movement on these narrow roads will be slow, and there will be inconvenience caused to the travelling public for defined, but limited periods of time.

7.4.6.3 Mitigative Measures
The proponent will work closely with the provincial authorities, the Municipality and the community to evaluate what works, if any, need to be done to the roads to ensure the integrity of the road structures, the safety of the travelling public and to minimise inconvenience to local road users. On the recommendations of the authorities, including the RCMP, the roads will be posted and flagged during key transportation events.

7.4.6.4 Cumulative Effects
There are no other known works proposed in the area of Nuttby Mountain that would act cumulatively with this Project to acerbate construction traffic; no cumulative effects are anticipated.

7.4.6.5 Residual Effects
Based on the above analysis, the construction traffic necessary to facilitate the development of the wind farm will cause inconvenience and some congestion on the local roads, but this will be for a limited period of time. There will be no impact on traffic patterns during the day to day operations of the Project.

7.4.7 Interference with Televison Services
During the public Open House questions were raised as to whether the development and operation of the proposed Project would cause interference with local television reception. As a concern it has been identified as a socio-economic factor to be evaluated.

A significant effect on television service would be the loss of such service for a material period of time, or on a regular basis, that could be attributed directly to the operation of the wind farm.

7.4.7.1 Boundaries
The spatial boundaries of the analysis with respect to interference with television reception are local, i.e., the reception received by the communities of Nuttby and Earltown, i.e., within a 2 – 8 km radius of the wind farm. The temporal boundaries relate to the anticipated life of the Project, i.e., perhaps 40 years or more.

7.4.7.2 Pathway Analysis
The Project is not expected to have any adverse impact on the reception that area residents receive from their satellite sourced television input signal. This is because the turbines are not anticipated to be in the path between any applicable antenna or receiver and the transmitting satellites given the anticipated angle for such a path and the known proximity of residents to the wind farm. For example, given the positioning of satellites, the proponent believes that a resident would have to be situated to the north of the wind farm and very near a wind turbine for the potential of an issue to arise.

7.4.7.3 Mitigative Measures
No mitigation is presently planned to address an issue which is considered very unlikely. Nonetheless, the Proponent is committed to responding promptly and to investigating fully the magnitude and extent of any reception problem if there is evidence of such.

7.4.7.4 Cumulative Effects

There are no known works proposed in the area of Nuttby Mountain that would act cumulatively with the proposed Project to impact television reception in the area; no cumulative effects are anticipated.

7.4.7.5 Residual Effects

Based on the above analysis, the Project is not anticipated to pose significant effects on television reception; no impact is anticipated.

7.4.8 Health and Safety

Regard for public health and safety and the occupational safety of workers is very important to the Proponent and to all associated with the development and operation of the proposed Project. Considerations discussed in this section include ice throw, EMFs, shadow flicker and occupational and site safety. Health and safety has been identified as a socio-economic issue to be addressed as it was raised both by Health Canada and by attendees at the Open House.

A significant effect on health and safety would result if the health or safety of those involved in the construction and operation of the wind farm, those who use the lands on Nuttby Mountain or those who reside in proximity to the wind farm was appreciably compromised.

Ice Fall or Throw

Under certain atmospheric conditions, it is possible for ice to form on the wind turbine blades. Generally, icing occurs at temperatures below 0°C when there is humidity in the air. The type, amount and density of ice depend on both meteorological conditions and the dimensions and type of structure (moving/static). To the extent such icing may occur, it can break free in a warming of temperatures or by movement of the blades and fall or be thrown to the ground. The aerodynamic blades, however, are sensitive to even minor changes in the blade profile, and braking systems, pitch controls and/or related speed controls respond to changes and automatically shut down operation of the turbine if an imbalanced blade movement is detected. Ice accumulation is an event that could cause such an imbalance and therefore be indirectly detected by the wind turbine operational systems.

Given the meteorological conditions in the area 15 - 25 freezing rain events may not be uncommon in an average year. However, for the reasons noted above, it is not necessarily the case that ice accumulation on wind turbine blades will occur at this frequency. If ice does form on the blades on occasion or occasions throughout the winter period, the risks of any safety concern are then a function of proximity of the wind turbine to residences and persons in the area and any mitigation measures undertaken by the proponent. It is noteworthy to consider the work done by Garrad Hassan Canada as described in the report entitled *Recommendations for Risk Assessment of Ice Throw and Blade Failure in Ontario*. In this work, it was found (in the Ontario context) that the risk of a fixed dwelling situated 250 m from a turbine being struck by ice fragments is equivalent to 1 in 300 years and the risk to an individual being struck in the vicinity of the dwelling is equivalent to 1 in 500,000 years.

Electric and Magnetic Fields

Power frequency electric and magnetic fields (EMFs) are present everywhere electricity flows. All electric wires and the lighting, appliances and other electrical devices they supply are sources of electric and magnetic fields. Although they are often referenced together as EMFs, electric fields and magnetic fields are actually distinct components of electricity. Most of the public interest regarding possible health effects is related to magnetic fields. So usually, when the term EMF level is used, it is the magnetic field strength that is being referred to. Both electric and magnetic fields, whether it is a power line or an appliance such as a hair dryer, dishwasher or microwave oven, are strongest at their sources; these fields, including those associated with the WTGs and the proposed substation, decrease rapidly as you move away from the sources and become indistinguishable from background levels.

Shadow Flicker

Shadow flicker is the visual impact that results when the blade of a wind turbine passes between the sun and a particular point of observation, i.e., the receptor, and interrupts the sun's rays causing a flicker effect. Whether such flicker occurs at all and to what extent it does is dependent on many factors including weather conditions, i.e., whether the sun is shining or not, geographical position, topography and time of day. The duration and severity of shadow flicker effects also varies depending on the time of the year and wind conditions. Finally the distance of the WTG from a receptor will also influence the impact, since light perception diminishes with distance. The primary impact of shadow flicker is annoyance. As detailed in Model Wind Turbines By-Laws and Best Practices, "shadow flicker from wind turbines usually has a frequency range of between 0.5 Hz to 1.25 Hz which is well below the level of concern for this health issue (Noble Environmental Power, Department of Business Enterprise and Regulatory Reform, UK)." The same British government ministry has indicated that at a distance of 10 rotor diameters, i.e., 800 – 900 m, a person should not experience shadow flicker.

Occupational and Site Safety

Occupational safety issues are primarily associated with the construction and decommissioning activities associated with the handling and operation of large machinery and WTG components. Nevertheless, safety issues must also be considered as they pertain to the operational phase and the potential use of the area by local people.

7.4.8.1 Boundaries

The spatial area associated with the above safety issues is primarily an area in proximity to the WTGs and their immediate surroundings; the exception is the larger area that should be taken into account when dealing with shadow flicker, i.e., an area up to 900 m from a WTG. The temporal boundary involves the construction, operational and decommissioning phases of the proposed Project.

7.4.8.2 Pathway Analysis

Ice Throw

Ice may accumulate on wind turbine blades under conditions of freezing rain, or melting snow, but the number of occasions that this is likely to occur in any year are small. Safety issues, however, can arise if anyone is in the vicinity of a turbine when ice slides, or is thrown off the blades.

Electric and Magnetic Fields

As referenced above, both electric and magnetic fields decrease rapidly as you move away from the source and become indistinguishable from background levels. The term "extremely low frequency" is used to describe any frequency below 300 Hz, and power frequency EMF (such as that from components of the Nuttby Mountain Wind Farm) has a frequency of 60 Hz, placing it in the extremely low frequency category. It is at the lower end of the spectrum near DC electricity and well below the microwave, or RF (radio frequency) radiation emitted by cellular phones and radio broadcast transmitters. Epidemiological studies have failed to establish a cause and effect relationship between electromagnetic energy and health concerns. As a consequence, there are no Canadian government guidelines for exposure to EMFs at extremely low frequencies. Health Canada does not consider guidelines necessary because the scientific evidence is not strong enough to conclude that typical exposures cause health problems. Based on the evidence there is no obvious pathway between the proposed Project and the articulated public concern with respect to EMFs.

Shadow Flicker
As referenced above shadow flicker can be an issue of concern within narrowly defined parameters. As the nearest residence to a WTG is over 1 km. There is unlikely to be a potential pathway. This is because the topography, the distance and the vegetated nature of the lands and the fact that light perception diminishes with distance, mitigate against the possibility of a shadow flicker effect.

Occupational and Site Safety
The assembly and maintenance of WTGs pose the range of occupational health and safety issues associated with any major construction project that involves the use of heavy equipment and the assembly of large structures. Ensuring the safety of all parties on site is a priority of EarthFirst Canada Inc. and all associated with the proposed Project and, as will be referenced below, the Proponent will take steps to ensure site safety for all concerned.

7.4.8.3 Mitigative Measures

The mitigative measures proposed for the different phases of the Project in conjunction with the preparation of a comprehensive EMP will also ensure that the health and safety of the workforce, those accessing the lands at Nuttby Mountain and those residing in proximity to the site are protected. More specifically the following mitigative measures are proposed:

- training including training on the hazards associated with ice forming on tall structures;
- a flag placement protocol which will necessitate the posting of a falling ice warning if, and when, ice is identified as an issue. This necessitates that operational staff are trained to be aware of the conditions likely to lead to ice accumulation on the WTGs and the risk of ice falling;
- establishment of a comprehensive EMP which will include a Contingency and Safety Plan; the latter will detail the training and the protective equipment required for all who access the site; and
- access to the site will be restricted to authorized personnel throughout the period of construction.

No specific mitigative measures are required or proposed with respect to either EMFs or shadow flicker, because neither is considered to pose a concern for health or safety.

7.4.8.4 Cumulative Effects

There are no other known works that will take place within the vicinity of Nuttby Mountain that would act cumulatively with the proposed Project to impact upon health and safety; no cumulative effects are anticipated.

7.4.8.5 Residual Effects

Based on the analysis undertaken and the implementation of the recommended mitigative measures, the proposed project is unlikely to have a significant adverse effect on health and safety; the anticipated effect is considered to be negligible.

7.5 Effects of the Environment on the Project

Several environmental factors, e.g., fire, extreme weather, including climate change, could have an adverse effect on the Project. These factors have all influenced the design criteria for the turbines and the layout of the proposed wind farm.

7.5.1 Boundaries

The spatial boundaries for these effects are restricted to the area of the wind farm. Temporal boundaries include all Project phases: construction, operation and decommissioning. Fire and extreme weather events could adversely impact the Project schedule, but such events are likely to be of short duration. Fire in the area could be instigated by both natural events, e.g., a lightening strike, or by humans.

Extreme weather events, including such events as might be aggravated by global warming, including ice formation, high winds, hail or lightening strikes, could damage the turbines.

7.5.2 Pathway Analysis

Fire and extreme weather could conceivably damage the installed facilities, reduce productivity and/or cause the turbines to be shut down.

7.5.3 Mitigative Measures

The design and operation of the WTGs, however, include measures to address the consequences of extreme weather events. For example, the turbines and transformers are equipped with temperature related alarms. In addition, there are fire watches maintained during the most sensitive dry summer months in the region. It is therefore likely that any fire would be quickly detected and a prompt emergency response instigated. The turbine towers are also sufficiently high that damage to the nacelle in the event of a fire is unlikely. Any damage to power transmission in such circumstances would be quickly repaired.

During high wind events, or ice formation, the design of the WTGs is such that the wind turbines will cut out. These factors have been taken into consideration in the operational and commercial planning of the Project. The turbine towers will be equipped with lightening protection, and damage to WTGs from such an event is considered very rare.

In conclusion, extreme weather events are unlikely to pose a significant adverse effect on project construction, operation or decommissioning.

7.5.4 Cumulative Effects

There are no known other works taking place in the area, or in the vicinity, that might act cumulatively with severe weather events to increase the likelihood of an adverse environmental effect on the Project.

7.5.5 Residual Effects

Extreme environmental events are not anticipated to have a significant residual environmental effect on the Project, i.e., the impact is predicted to be negligible.

7.6 Summary of Potential Environmental Impacts

Residual environmental effects are those predicted to remain after the proposed mitigative measures have been implemented. Table 7.4 summarizes those effects for the proposed Project for each VEC or socio-economic issue. The effect is presented in terms of nature of effect, magnitude, reversibility, duration, timing and aerial extent. These are defined as:

- nature of effect, i.e., positive (+) or negative (-);
- magnitude of effect on background levels, i.e., small, moderate or large;
- reversibility of the effect, i.e., reversible or irreversible;
- timing of the effect during construction or operation, i.e., long or short term; and
- aerial extent of the effect, e.g., immediate area of construction is considered local.

Table 7-4: Residual Effects Assessment

VEC or Issue	*Nature*	*Magnitude*	*Reversibility*	*Timing*	*Extent*
Ground and Surface Water Quality	-	Small	Reversible	Short	Local
Communication Towers	NI	N/A	N/A	N/A	
Rural Ambience	-	Small	N/A	Long	Local
Wetlands	-	Small	Reversible	Short	Local
Fish Habitat	-	Small	Reversible	Short	Local
Forest Cover	-	Small	Reversible	Long	Local
Species of Concern	-	Small	Reversible	Long	Local
Migratory and Breeding Birds	-	Small	Reversible	Long	Local
Bats	-	Small	Reversible	Long	Local
Land Use	-	Small	Reversible	Long	Local
Employment and the Economy	+	Moderate/small	N/A	Short/long	Regional
Property Values	NI	N/A	N/A	N/A	N/A
Aboriginal Use of Lands	-	Small	Reversible	Long	Local
Archaeological Resources	NI	N/A	N/A	N/A	N/A
Visual Impacts	-	Small	Reversible	Long	Local
Traffic	-	Small	Reversible	Short	Local
Interference with Television	NI	N/A	N/A	N/A	N/A
Health and Safety	-	Small	Reversible	Long	Local

NI = No Impact
N/A = Not Applicable

This is an important Project. Given the nature of such an investment, numerous studies have been executed and detailed engineering and associate work is ongoing to ensure that all necessary issues are addressed and that both corporate and regulatory decision makers have the information that they require to make decisions in a timely manner. It is a progressive and iterative process. Environmental work continues to be executed and will be an integral work stream throughout detailed engineering, construction.

Because the adverse residual effects are primarily small to moderate in magnitude, reversible and local, it is concluded that the undertaking can be executed with negligible residual effects on VECs and socio-economic issues with the application of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines, and proactive environmental protection planning, including implementation of the mitigative measures as identified.

7.7 Environmental Management and Monitoring

While it is anticipated that the residual environmental effects of the proposed works will be negligible based on the work that has been conducted, the Proponent will prepare an EMP to address potential issues and concerns and to ensure that the necessary work through Project construction and decommissioning is undertaken with due regard to environmental considerations and safety. The proponent also undertakes to honour all commitments made in this environmental assessment and to comply with all applicable laws and regulations. As indicted in Table 7.5, most, if not all, potential adverse effects, can be avoided through the application of good engineering and construction practices, the careful timing of activities and the adherence to appropriate environmental management techniques. All work in and around the site will be undertaken in accordance with the standards and protocols set out in the *Erosion and Sedimentation Handbook for Construction Sites.*

The Environmental Protection Plan (EPP) is a key component of the EMP and will be developed for both the construction and operations phases of the Project. The underlying objective of the construction EPP is to reduce environmental impacts during this period and consists of routine activities including:

- contingency procedures in the event of an erosion control failure;
- procedures to address fuel and hazardous material spills;
- procedures to address fire; and
- procedures to address archaeological finds.

The EPP for construction will detail inspection and reporting requirements, include detail of the applicable permits, approvals and authorizations and incorporate a key contact list. The EPP for the operation of the wind farm will articulate guidelines for equipment maintenance activities, the storage, handling and disposal of petroleum, oils and lubricants and the safe storage and handling of hazardous materials.

A second component of the EMP is the Contingency and Safety Plan. This provides detail of the response system that will be implemented to respond to an accidental event including the release of petroleum, oils lubricants or any other hazardous material. It will reference the need for personnel training, preventative measures, the response plan and a spill clean-up recourse list. The Contingency and Safety Plan will also detail necessary responses to address fire.

Finally, to ensure that work is carried out with minimal consequences for the environment and as a check on the evaluation that has been undertaken, a number of specific environmental effects monitoring programs will be designed and undertaken. Such programs can include either a direct monitoring of specific VECs or the monitoring of the environmental parameters known to be important to the VECs. Such studies are normally undertaken to address the following objectives:

- to verify predictions and evaluate the effectiveness of mitigation measures;
- to detect undesirable changes in the environment; and
- to improve the understanding of environmental cause and effect relationships.

The following specific programs are proposed and will be further detailed subsequent to release from the environmental assessment process:

i) Ferguson Brook, Vamey Brook and the tributaries of the North River and the sediment and erosion control structures throughout the site should be regularly monitored throughout construction until the disturbed sites have been stabilized; and
ii) the turbine locations should be monitored for bird and bat species due to collision with the turbine blades for a period of two years subsequent to Project start up.

EC and CWS will be consulted in the development of the necessary protocols and the results will be provided to interested regulating agencies.

Chapter 8 Conclusions

This environmental assessment was conducted to determine the potential environmental effects of the construction, operation and decommissioning of a proposed wind farm at Nuttby Mountain in the Cobequid Mountain Region of Colchester County to satisfy the requirements of *CEAA* and the *Nova Scotia Environment Act.* Potential environmental effects from Project related malfunctions and accidents were also considered. The Proponent conducted an Open House in the Project area and consulted extensively both with and through the auspices of the local municipality and with local individuals. In October 2007, the Proponent met with representatives of a number federal and provincial departments to discuss the project and review the environmental work that was being undertaken. The Proponent has committed to keep all interested parties informed of Project progress and to respond to all reasonable questions posed.

The proposed project is located on approximately 11 km^2 of land on Nuttby Mountain to the west of Route 311 and approximately 3 to 4 km to the north of the village of Nuttby. The Proponent plans to construct up to 18 wind turbines to generate more than 100,000,000 kW/hr of electricity annually which would be fed into the NSI transmission grid. To facilitate the development the Proponent has entered into lease agreements with the owners of the four land parcels involved. The land in the area of the turbines is actively logged. This use plus the harvesting of certain areas for blueberries and the use of the area for recreational activities will continue.

Fieldwork has demonstrated that there will be negligible impacts on the identified physical and biophysical VECS and on the identified socio-economic factors evaluated. The nearest occupied residence that is occupied year round, for example, is more than 1,000 m distant form the closest wind turbine which is reflective of the suitability of the site. There will be negligible impacts attributable to noise, lighting or visibility, on the surrounding communities. Indeed, the introduction of an environmentally sound project to the area appears to have widespread local support. The site's attributes include its elevation, the wind regime and, as stated, its separation from the nearest occupied dwellings. From the technical and environmental evaluations that have been undertaken, it is an ideal location for a wind farm.

The environmental assessment considered biophysical and socio-economic factors. In addition to an extensive search of the literature and pertinent data bases, the study team consulted widely with regulatory agencies and acknowledged experts in pertinent disciplines. A number of specific field programs were executed; these included field work with respect to birds, vegetation, wetlands and streams, archaeology and a review of the adjacent communications towers; Membertou Geomatics also conducted a Mi'kmak Ecological Knowledge Study which is included in its entirety as Appendix C. Eighteen VECs or socio-economic issues were subject to analysis. The significance of the residual effects, i.e., after mitigation has been applied, is predicted for each of the identified VECs and socio-economic issues and the potential for the Project to interact cumulatively with other projects and activities taking place in the area was factored into the evaluation.

Subject to adherence to all pertinent regulations and the application of appropriate mitigative measures, the conclusion of this environmental assessment is that no significant adverse residual environmental effects are likely as a result of the Project. The generation of electricity from a renewable energy source in this fashion is in accordance with both Federal and Provincial government articulated strategies and would contribute to a reduction of greenhouse gases as required by Canada's ratification of the Kyoto Protocol.

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Appendix A
Tabulated Results of the Plant Inventory

Appendix B
Archaeological Research Permits

Appendix C
Mi'kmaq Ecological Knowledge Study

Appendix D
Photographs of the Radio Towers Adjacent the Project Site

Appendix E
Open House Materials

Appendix F
Predicted Noise Contours